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22,075	197	654	140	4750	365	7635	510	10,520	661	12,720	788	14,707	425
		701	206	4753	375	7671	701	10,522	204	12,743	365	14,752	960
		702	205	4834	355	7728	215	10,532	94	12,750	428	14,824	237
1907.		721	201	4848	420	7813	538	10,535	715	12,781	740	14,841	92
		726	208	4861	261	7823	795	10,557	256	12,787	740	14,852	877
12,747	97	741	31	4897	383	7841	510	10,588	194	12,787	239	14,853	877
14,285	95	759	362	4929	367	7920	95	10,590	302	12,799	432	14,859	665
17,743	22	774	307	4936	108	7921	544	10,609	510	12,811	472	14,867	360
20,266	105	829	196	4956	83	7923	28	10,625	647	12,812	424	14,926	482
20,267	106	839	237	4992	423	7972	520	10,649	471	12,825	527	14,933	1255
21,356	25	858	201	5011	784	8014	513	10,731	100	12,856	359	14,937	107
22,434	204	913	146	5040	197	8068	41	10,755	361	12,877	614	14,942	647
23,901	26	966	196	5069	194	8142	137	10,771	653	12,913	652	14,954	837
24,025	221	1253	610	5133	670	8168	94	10,781	724	12,955	82	14,971	876
24,283	26	1265	202	5187	416	8186	359	10,854	511	12,962	1143	15,000	884
24,847	203	1339	244	5214	529	8208	510	10,891	648	12,980	794	15,008	698
25,131	14	1409	358	5223	529	8228	663	10,892	649	13,020	472	15,009	432
25,202	28	1455	234	5224	15	8268	373	10,901	514	13,057	85	15,015	202
25,222	36	1470	248	5244	527	8279	379	10,922	88	13,120	798	15,019	873
25,393	36	1582	247	5404	160	8302	202	10,951	241	13,134	315	15,031	990
25,513	17	1608	139	5415	83	8307	524	10,959	695	13,135	1059	15,038	943
25,514	17	1677	222	5484	198	8358	676	11,008	314	13,146	528	15,042	83
25,657	16	1682	42	5485	86	8381	18	11,031	31	13,179	709	15,050	914
25,669	97	1689	259	5502	370	8393	202	11,088	645	13,207	659	15,100	940
26,018	41	1761	206	5515	428	8425	208	11,121	251	13,226	833	15,122	328
26,189	141	1822	85	5582	305	8426	937	11,142	1042	13,252	1157	15,176	661
26,275	17	1842	204	5641	491	8514	442	11,248	745	13,257	148	15,178	196
26,276	17	1884	377	5685	373	8524	592	11,259	315	13,360	356	15,189	78
26,383	26	1921	148	5773	97	8530	198	11,314	363	13,366	1140	15,192	481
26,414	20	1935	204	5830	15	8531	517	11,321	204	13,440	93	15,196	26
26,581	156	2023	41	5841	427	8534	660	11,388	691	13,458	992	15,239	884
26,582	214	2029	365	5868	210	8620	519	11,457	382	13,476	786	15,267	17
26,583	156	2122	252	5944	78	8623	355	11,522	712	13,492	144	15,273	78
26,584	131	2231	244	5963	439	8699	256	11,557	974	13,499	199	15,306	913
26,664	81	2240	16	5969	416	8708	257	11,597	675	13,502	528	15,339	992
26,811	86	2314	261	5999	485	8722	540	11,598	660	13,513	839	15,352	472
26,821	194	2414	243	6029	209	8726	520	11,638	378	13,528	255	15,355	791
26,823	43	2479	528	6036	416	8729	83	11,644	616	13,563	16	15,391	981
26,829	208	2655	237	6047	358	8768	90	11,684	95	13,588	1185	15,463	596
26,910	17	2720	197	6148	839	8821	520	11,688	359	13,632	794	15,466	532
26,949	90	2721	304	6191	466	8904	208	11,698	383	13,655	489	15,474	903
26,981	599	2787	319	6204	466	8926	302	11,710	16	13,666	148	15,490	28
27,006	201	2815	299	6223	466	8959	442	11,762	26	13,671	715	15,552	957
27,017	416	2905	23	6253	355	9002	623	11,834	519	13,675	133	15,554	365
27,018	427	2914	300	6277	851	9003	382	11,845	731	13,715	841	15,556	426
27,019	77	3112	319	6300	472	9031	380	11,861	708	13,734	840	15,570	539
27,020	427	3166	377	6304	482	9044	675	11,865	310	13,753	466	15,573	854
27,142	204	3189	16	6347	243	9059	382	11,866	651	13,760	653	15,625	245
27,187	18	3221	43	6396	436	9096	532	11,867	421	13,768	844	15,628	986
27,282	207	3255	366	6438	215	9107	108	11,878	198	13,776	784	15,645	944
27,314	220	3373	239	6449	220	9112	1605	11,904	1100	13,789	698	15,657	162
27,335	420	3394	314	6444	489	9150	627	11,949	665	13,790	519	15,683	1239
27,463	139	3428	259	6449	425	9239	260	11,950	791	13,792	835	15,792	840
27,501	141	3429	311	6495	81	9275	110	11,996	715	13,811	104	15,831	785
27,506	203	3452	311	6511	479	9283	590	12,042	659	13,822	206	15,854	957
27,559	95	3572	431	6532	20	9293	619	12,051	712	13,828	359	15,916	816
27,735	108	3651	314	6558	311	9377	593	12,067	18	13,890	544	15,921	540
27,830	96	3652	314	6552	194	9383	1140	12,076	590	13,896	472	15,931	742
27,932	140	3659	374	6561	314	9384	514	12,077	784	13,941	24	15,956	1045
28,049	132	3683	94	6575	593	9432	470	12,167	933	13,964	840	15,962	369
28,079	130	3685	310	6584	251	9579	363	12,188	222	13,994	905	15,997	935
28,117	147	3740	366	6641	670	9651	653	12,212	1091	14,014	828	16,027	788
28,147	248	3750	161	6794	92	9652	671	12,253	240	14,093	660	16,034	645
28,159	484	3751	137	6888	481	9663	533	12,258	530	14,110	647	16,047	356
28,191	26	3816	364	6893	422	9665	216	12,312	701	14,126	892	16,056	798
28,290	83	3837	377	6919	474	9680	107	12,317	888	14,143	880	16,092	933
28,356	77	3892	365	6966	1187	9693	675	12,322	370	14,165	787	16,093	146
28,365	484	3904	365	6970	201	9695	611	12,323	660	14,167	1080	16,104	958
28,387	83	3940	374	6971	222	9726	677	12,324	729	14,169	879	16,114	491
28,407	130	4123	312	7052	235	9758	663	12,341	383	14,249	903	16,128	742
28,415	383	4142	370	7087	491	9762	96	12,342	370	14,256	437	16,157	931
28,682	158	4266	515	7105	83	9763	96	12,383	207	14,292	512	16,207	239
28,692	81	4295	88	7201	653	9855	543	12,403	714	14,336	857	16,327	1323
		4390	381	7211	206	9886	105	12,405	815	14,337	423	16,329	979
		4423	18	7224	430	9891	514	12,408	248	14,338	430	16,333	1027
1908.		4424	369	7227	530	9951	35	12,416	471	14,349	974	16,372	305
90	134	4484	803	7230	523	9956	32	12,446	787	14,399	889	16,376	523
92	144	4491	234	7319	259	9982	671	12,452	315	14,405	876	16,397	1000
117	162	4492	196	7345	701	10,043	663	12,455	792	14,408	220	16,405	647
202	19	4515	365	7403	509	10,110	142	12,472	673	14,411	357	16,428	372
287	153	4529	360	7418	305	10,181	90	12,494	799	14,483	877	16,429	1194
390	22	4536	102	7429	528	10,201	665	12,516	104	14,511	880	16,448	973
412	95	4540	78	7430	812	10,277	317	12,517	98	14,558	876	16,456	939
433	207	4579	367	7552	88	10,298	652	12,534	798	14,593	519	16,520	664
444	201	4586	652	7575	470	10,316	652	12,565	784	14,604	514	16,521	370
490	206	4624	422	7580	535	10,378	481	12,634	248	14,609	1045	16,528	152
492	30	4644	247	7584	428	10,387	651	12,641	714	14,619	711	16,542	988
569	153	4657	95	7605	472	10,412	305	12,642	714	14,623	802	16,552	943
585	207	4712	383	7613	543	10,422	648	12,672	810	14,692	328	16,557	978
		4744	372	7620	109	10,442	514	12,711	489	14,693	510	16,599	222

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16,610	972	18,355	957	20,381	929	22,851	1240	24,845	1316	28,011	853	2853	917
16,614	514	18,356	1149	20,393	1088	22,852	1189	24,846	1316	28,012	1327	2918	517
16,617	1081	18,402	1306	20,400	139	22,854	1251	24,859	871	28,081	608	2938	1143
16,623	514	18,434	310	20,406	939	22,869	1262	24,893	876	28,149	880	3021	442
16,642	430	18,482	1088	20,424	714	22,893	1051	25,024	714	28,291	1240	3074	1309
16,659	137	18,493	1157	20,484	1157	22,918	1255	25,035	1045	28,219	948	3139	796
16,689	979	18,513	1047	20,529	1148	23,007	1045	25,042	601	28,233	1117	3171	1117
16,690	708	18,523	427	20,574	162	23,010	1038	25,183	380	28,272	304	3188	1126
16,692	934	18,596	481	20,591	324	23,026	471	25,193	1268	28,276	661	3189	937
16,737	945	18,600	541	20,616	1101	23,039	210	25,213	416	28,290	1257	3196	880
16,743	879	18,616	532	20,649	1161	23,068	609	25,216	1306	28,319	693	3407	971
16,792	931	18,636	356	20,686	196	23,071	208	25,300	590	28,365	698	3546	984
16,806	943	18,653	801	20,709	697	23,143	1104	25,311	469	28,462	1079	3559	1250
16,807	315	18,672	1080	20,743	1122	23,171	1247	25,312	935	28,520	1024	3599	800
16,817	971	18,680	528	20,787	1125	23,175	235	25,318	419	28,538	544	3601	1327
16,820	986	18,729	933	20,788	1143	23,183	670	25,323	300	28,549	658	3602	506
16,881	695	18,730	130	20,802	651	23,186	1263	25,435	1077			3612	1059
16,885	661	18,738	245	20,896	615	23,189	1185	25,441	1312			3623	987
16,895	987	18,744	1105	20,902	799	23,190	842	25,443	593			3704	820
16,903	939	18,750	259	20,909	260	23,192	1270	25,535	794			3732	1091
16,971	1051	18,775	1063	20,915	1188	23,193	990	25,551	1083			3758	975
16,972	943	18,829	1065	20,920	1117	23,204	1150	25,620	799			3788	1023
16,982	904	18,831	828	20,921	1114	23,281	645	25,637	1037			3883	1061
16,987	849	18,956	416	20,971	491	23,330	442	25,643	807			3937	1328
17,054	660	19,035	660	20,972	360	23,349	933	25,644	617			3951	647
17,083	1031	19,118	360	20,978	901	23,429	482	25,726	946			4104	934
17,103	693	19,140	532	21,004	943	23,461	310	25,736	1188			4123	1239
17,113	209	19,148	657	21,068	1159	23,497	840	25,797	1249			4128	854
17,115	97	19,157	880	21,095	1114	23,529	1316	25,804	1143			4130	804
17,132	673	19,158	880	21,096	881	23,594	1295	25,813	1312			4122	1219
17,139	491	19,163	607	21,097	1224	23,627	1212	25,816	1030			4212	1167
17,156	303	19,212	1159	21,191	1194	23,668	1101	25,829	939			4321	1223
17,220	1006	19,216	472	21,239	485	23,698	663	25,833	476			4325	1186
17,229	714	19,263	1206	21,243	371	23,720	929	25,854	647			4488	1151
17,244	1000	19,264	1080	21,249	972	23,721	936	25,881	785			4494	1055
17,246	889	19,265	96	21,255	424	23,725	241	25,901	1036			4553	1145
17,267	701	19,276	936	21,260	885	23,726	831	25,934	1063			4584	1099
17,279	1059	19,297	676	21,280	702	23,765	850	25,958	670			4592	895
17,281	207	19,302	1197	21,285	87	23,779	988	25,965	794			4604	1267
17,325	787	19,310	202	21,389	490	23,806	237	26,013	599			4626	1194
17,331	528	19,311	83	21,441	210	23,889	1314	26,027	516			4683	1085
17,340	989	19,334	1065	21,452	195	23,917	673	26,075	1325			4684	501
17,350	527	19,347	464	21,470	15	23,930	988	26,121	1151			4702	1027
17,352	650	19,348	849	21,474	1113	23,947	541	26,133	992			4819	884
17,356	939	19,356	660	21,479	1126	23,958	428	26,155	1152			4859	975
17,367	479	19,363	788	21,489	593	23,968	425	26,228	1306			4860	931
17,432	1003	19,369	205	21,536	1193	23,972	936	26,248	1308			4872	1314
17,433	1063	19,380	798	21,566	374	23,981	1141	26,257	1313			4956	1094
17,438	481	19,402	1068	21,582	484	23,988	984	26,259	992			4973	973
17,498	517	19,437	1116	21,585	1030	23,990	1200	26,284	711			5087	716
17,500	971	19,455	539	21,590	666	24,007	1143	26,285	1315			5206	1239
17,520	982	19,511	1094	21,593	1260	24,008	529	26,356	988			5250	1114
17,524	1023	19,525	1035	21,621	1194	24,072	490	26,366	1091			5260	931
17,589	474	19,528	1032	21,623	645	24,110	597	26,400	1122			5293	1206
17,596	360	19,564	829	21,630	1263	24,131	1271	26,478	977			5382	1246
17,603	1116	19,585	527	21,660	1187	24,139	990	26,521	987			5400	1057
17,608	1035	19,641	791	21,687	1207	24,141	1213	26,581	734			5571	913
17,610	600	19,656	522	21,741	97	24,209	1081	26,593	535			5672	931
17,611	1045	19,659	197	21,763	1188	24,237	663	26,616	936			5675	1122
17,618	197	19,667	1141	21,800	1243	24,239	1160	26,619	998			5676	1323
17,620	415	19,668	1112	21,820	491	24,242	992	26,643	1212			5709	843
17,621	717	19,726	379	21,822	802	24,244	608	26,714	210			5768	1027
17,644	1060	19,738	939	21,829	519	24,264	708	26,726	1079			5773	1062
17,647	1026	19,793	238	21,839	260	24,325	244	26,829	724			5786	1191
17,653	519	19,827	23	21,840	627	24,328	1077	26,843	842			5790	1218
17,670	317	19,833	318	21,872	1240	24,332	1125	26,851	1143			5802	933
17,672	1060	19,847	1117	21,911	933	24,345	845	26,857	1147			5821	1316
17,673	1031	19,882	798	21,921	943	24,355	988	27,000	1250			5821	982
17,713	88	19,902	212	21,959	529	24,356	988	27,024	945			5859	1122
17,734	357	19,928	503	22,029	490	24,425	903	27,025	1141			5908	984
17,756	715	19,939	1117	22,033	931	24,428	960	27,038	913			6013	850
17,759	540	19,960	1034	22,082	1204	24,430	1219	27,045	876			6014	939
17,810	906	19,988	252	22,085	854	24,467	1047	27,090	720			6086	1310
17,867	996	20,003	421	22,092	987	24,503	840	27,095	671			6087	807
17,888	1052	20,014	645	22,097	791	24,528	1367	27,096	843			6088	944
17,956	1052	20,045	1159	22,118	1186	24,590	1316	27,144	693			6115	1314
17,957	1052	20,050	746	22,122	468	24,594	1206	27,218	379			6163	1186
17,958	842	20,086	956	22,132	544	24,597	1317	27,245	465			6167	1188
17,961	842	20,094	361	22,150	1239	24,600	1121	27,270	1268			6178	1059
17,967	858	20,102	1087	22,221	909	24,601	933	27,271	1161			6270	879
17,976	884	20,102	1087	22,236	1206	24,604	832	27,272	539			6272	832
17,978	1026	20,111	544	22,337	1143	24,605	933	27,302	1126			6276	840
18,023	698	20,171	657	22,368	212	24,627	1319	27,341	973			6300	1200
18,031	1094	20,173	1103	22,412	1204	24,679	1117	27,466	1077			6307	1218
18,047	745	20,198	139	22,420	1163	24,685	527	27,473	465			6415	981
18,048	1051	20,199	310	22,434	1199	24,718	984	27,551	1240			6429	943
18,049	960	20,200	653	22,441	373	24,742	960	27,567	1321			6466	1031
18,107	651	20,214	544	22,455	661	24,750	41	27,686	961			6560	1314
18,110	81	20,244	1117	22,524	1161	24,803	1240	27,742	936			6728	1121
18,115	1046	20,279	162	22,549	472	24,809	851	27,747	517			6760	540
18,129	873	20,302	1149	22,555	817	24,810	1122	27,800	882			6831	1082
18,199	1101	20,303	1149	22,613	310	24,813	740	27,841	1308			6845	593
18,237	537	20,316	1121	22,690	936	24,821	522	27,878	794</				

No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.
1909.		1909.		1909.		1909.		1909.		1909.		1909.	
7092	1241	8131	1268	8842	1316	9946	1059	11,471	1323	12,958	1113	15,855	1161
7094	674	8154	975	8876	1038	9992	1007	11,625	1030	13,091	1315	15,996	1198
7197	711	8164	971	8920	1026	10,071	1023	11,700	1246	13,328	1223	15,997	1129
7302	844	8194	1047	8945	1271	10,187	1121	11,890	930	13,859	1100	16,291	1211
7507	1249	8272	987	8976	1312	10,230	1026	11,924	1154	13,912	1269	16,837	1268
7396	800	8283	1027	8982	1319	10,666	1191	11,988	1113	14,315	1192	17,116	1162
7495	1249	8421	814	9145	1033	10,936	1190	12,010	1026	14,497	1327	17,546	1029
7617	1312	8443	715	9147	1114	11,123	1034	12,059	1193	14,760	1194	17,834	1274
7619	1247	8447	1265	9370	950	11,147	1064	12,250	1321	14,947	1116	18,201	1268
7633	1314	8593	1323	9381	1132	11,166	945	12,371	1190	15,088	976	18,773	1268
7780	930	8621	1240	9383	995	11,263	1314	12,482	1207	15,093	1216	19,804	1321
7839	1130	8674	1319	9394	1200	11,277	1217	12,506	916	15,105	1205	20,140	1307
7849	1126	8768	1119	9441	1259	11,300	1052	12,565	1316	15,164	1251	20,312	1246
7905	697	8834	1255	9853	983	11,353	1161	12,587	1250	15,194	1144	20,728	1246
7931	1310	8835	1256	9929	1315	11,364	1190	12,739	1023	15,341	1311	21,032	1314

LIST OF JOURNALS ABSTRACTED, WITH ABBREVIATIONS USED, AND ADDRESSES OF PUBLISHERS.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
Agricultural Ledger	Agric. Ledger	Reporter on Economic Products to the Government of India, Calcutta. Michaelerstrasse 25, Vienna XVIII/1.
Allgemeine Zeitschrift für Bierbrauerei und Malzfabrikation ..	Allgem. Z. Bierbrau. u. Malzfabr. ..	The Johns Hopkins Press, Baltimore, Md., U.S.A.
American Chemical Journal ..	Amer. Chem. J. ..	Simpkin, Marshall, Hamilton, Kent, and Co., Ltd., 10, James Street, Haymarket, London, S.W.
Analyst	Analyst	C. F. Winter'sche Verlagshandlung, Leipsig, Germany.
Annalen der Chemie	Annalen	M. Crinon, 45, Rue Turenne, Paris, 3 ^e . 16, Place Vendôme, Paris.
Annales de Chimie Analytique ..	Ann. Chim. Analyt. ..	Selbstverlag des Deutschen Apotheker-Vereins, Berlin, Germany.
Annales des Falsifications ..	Ann. Falsific. ..	R. Friedländer und Sohn, Karlstrasse 11, Berlin, N.W., 6, Germany.
Archiv der Pharmazie	Arch. Pharm.	Verlag von Gebr. Bornträger, Berlin, W. 35, Schöneberger Ufer 12A, Germany.
Berichte der Deutschen Chemischen Gesellschaft	Ber.	O. Leiner, Königstrasse, 26n, Leipsig, Germany.
Berichte der Deutschen Pharmazeutischen Gesellschaft ..	Ber. deuts. Pharm. Ges. ..	Bio-chemical Dept., The University, Liverpool.
Biedermann's Zentralblatt für Agricultur Chemie	Biedermann's Zentr. ..	Verlag von J. Springer, Berlin, N. 24, Monbijouplatz 3.
Bio-chemical Journal	Bio-chem. J.	Messrs. Wyman and Sons, Fetter Lane, London, E.C.
Biochemische Zeitschrift	Biochem. Zeits.	F. W. Lyon, Eastcheap Buildings, Eastcheap, London, E.C.
Board of Trade Journal	Bd. of Trade J.	44, Bishopsgate Without, London, E.C.
Brewers' Journal	Brewers' J.	M. le Trésorier, 156, Boulevard Magenta, Paris, 10 ^e , France.
British and Colonial Druggist ..	Brit. and Col. Drug. ..	M. J. Wauters, Palais du Midi (Galerie du Travail, 7), Brussels.
Bulletin de l'Association Chimique de Sucre et de Distillerie ..	Bull. Assoc. Chim. Sucr. ..	Masson et Cie., 120, Boulevard Saint-Germain (6 ^e), Paris.
Bulletin de la Société Chimique de Belgique ..	Bull. Soc. Chim. Belg. ..	51, Rue de Clichy, Paris, 9 ^e .
Bulletin de la Société Chimique de France ..	Bull. Soc. Chim.	Rue de l'Hôpital Militaire 114 et 116, Lille, France.
Bulletin de la Société Française de Photographie ..	Bull. Soc. Franç. Phot. ..	Berger-Levrault et Cie., 5, Rue des Beaux-Arts, Paris.
Bulletin de la Société Industrielle du Nord de la France ..	Bull. Soc. Ind. Nord	Secrétariat, Rue de Rennes 44, Paris, France.
Bulletin de la Société Industrielle de Mulhouse ..	Bull. Soc. Ind. Mulhouse ..	Director of the College of Agriculture, Tokyo Imperial University, Japan.
Bulletin de la Société d'Encouragement pour l'Industrie Nationale ..	Bull. Soc. d'Encour.	A. D. Gillard fils, 49, Rue des Vinaigriers, Paris, X.
Bulletin of the College of Agriculture, Tokyo Imperial University, Japan ..	Bull. Coll. Agric. Tokyo ..	Oxford Court, Cannon Street, London, E.C.
Le Caoutchouc et le Gutta-Percha ..	Caoutchouc et Gutta-Percha ..	E. J. Davey, 16, Newcastle Street, Farringdon Street, London, E.C.
Chamber of Commerce Journal	Ch. Comm. J.	Davis Bros., Danes Inn House, 265, Strand, London, W.C.
Chemical News	Chem. News	Dr. G. Krause, Cöthen, Anhalt, Germany.
Chemical Trade Journal	Chem. Trade J.	Weidmann'sche Buchhandlung, Zimmerstrasse 94, Berlin, S.W., Germany.
Chemiker-Zeitung	Chem.-Zeit.	Dr. Maschke, Wallenstein und Co., G.m.b.H., Catherinestrasse 16, Hamburg, Germany.
Chemische Industrie	Chem. Ind.	R. Friedländer und Sohn, Karlstrasse 11, Berlin, N.W., 6, Germany.
Chemische Revue über die Fett- und Harz-Industrie	Chem. Rev. Fett-Ind. ..	42, Cannon Street, London, E.C.
Chemisches Zentralblatt	Chem. Zentr.	K. Schorlemmer, Huttenstrasse 7, Worms am Rhein, Germany.
Chemist and Druggist	Chem. and Drug.	Imprimerie Gauthier-Villars, Quai des Grands Augustins 55, Paris.
Collegium	Collegium	
Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences ..	Comptes rend.	

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
Comptes-Rendus des Travaux de Laboratoire de Carlsberg Deutsche Zuckerindustrie ..	Comptes-rend. Trav. Lab. Carlsberg Deuts. Zuckerind. ..	H. Hagerup, Copenhagen. Verlag der Gesellschaft, Die Deuts. Zuckerindustrie, Berlin.
Electrician	Electrician	G. Tucker, Salisbury Court, Fleet Street, London, E.C.
Engineer	Engineer	S. White, 33, Norfolk Street, London, W.C.
Engineering	Engineering	C. R. Johnson, 35 and 36, Bedford Street, Strand, London, W.C.
Engineering and Mining Journal Färber-Zeitung	Eng. and Min. J. .. Färber-Zeit.	505, Pearl Street, New York City. Julius Springer, Monbijou-Platz 3, Berlin, N., Germany.
Foreign Office Annual Series (Cons. Reports)	F. O. Ann. Series ..	Wyman and Sons, Fetter Lane, London, E.C.
Gazzetta Chimica Italiana ..	Gazz. chim. ital. ..	La Direzione della "Gazzetta Chimica," Via Panis- perna, 89, Rome.
Gerber	Gerber	VI $\frac{1}{2}$ Gumpendorferstrasse 89, Wien, Austria.
Glückauf	Glückauf	Selbst-Verlag des Vereins für die bergbaulichen Interessen in Oberbergamtsbezirk, Dortmund, Essen (Ruhr), Germany.
Gummi-Zeitung	Gummi-Zeit.	Geschäftsstelle der "Gummi-Zeitung," Charlotten- strasse 6, Berlin, S.W. 68, Germany
Hopper-Seyler's Zeitschrift für Physiologische Chemie	Z. physiol. Chem. ..	Verlag von K. J. Trübner, Strassburg, Germany.
Imperial Institute Journal and Bulletin	Imp. Inst. J. or Bull. Imp. Inst.	Imperial Institute, London, S.W.
India-Rubber Journal	India-rubber J. ..	Maclaren and Sons, 37 and 38, Shoe Lane, London, E.C.
International Sugar Journal ..	Int. Sugar J... ..	N. Rodger, Office of "The Sugar Cane," Mossburn Buildings, Altrincham, Manchester.
Journal of Agricultural Science..	J. Agric. Sci... ..	University Press, Cambridge.
Journal of the American Chemical Society	J. Amer. Chem. Soc.	Dr. E. G. Love, 108, West 55th Street, New York City.
Journal of the American Leather Chemists' Association	J. Amer. Leather Chem. Assoc.	American Leather Chemists' Assoc., Easton, Pa., U.S.A.
Journal of Biological Chemistry..	J. Biol. Chem. ..	2427-9, York Road, Baltimore, Md., U.S.A.
Journal of the Chemical Society of London, Transactions and Proceedings	Chem. Soc. Trans. or Chem. Soc. Proc.	Gurney and Jackson, 10, Paternoster Row, London, E.C.
Journal of the Chemical, Metallur- gical, and Mining Society of South Africa	J. Chem. Met. Soc., S. Africa	F. Rowland, 5 and 8, Corporation Buildings, Rissik Street, Johannesburg.
Journal de Chimie Physique ..	J. Chim. Phys. ..	Gauthier-Villars, 55, Quai des Grands Augustins, Paris.
Journal of the College of Science, Imperial University of Tokyo, Japan	J. Coll. Science, Tokyo	Director of the College of Science, Tokyo Imperial University, Japan.
Journal of the Franklin Institute	J. Franklin Inst. ..	The Actuary, The Franklin Institute, Philadelphia, Pa., U.S.A.
Journal für Gasbeleuchtung und Wasserversorgung	J. Gasbeleucht. ..	R. Oldenbourg, Glückstrasse 8, München, Germany.
Journal of Gas Lighting	J. Gas Lighting ..	W. King, 11, Bolt Court, Fleet Street, London, E.C.
Journal of Industrial and Engineer- ing Chemistry	J. Ind. Eng. Chem... ..	C. L. Parsons, New Hampshire College, Durham, N.H., U.S.A.
Journal of the Institute of Brewing	J. Inst. Brewing ..	Harrison and Sons, 45, Pall Mall, London, W.
Journal of the Institution of Me- chanical Engineers	J. Inst. Mech. Eng. ..	Storey's Gate, Westminster, S.W.
Journal of the Russian Physical- chemical Society	J. Russ. phys.-chem. Soc.	Laboratoire de Chimie, Université Imperiale, St. Petersbourg, Russia.
Journal of Physical Chemistry ..	J. Phys. Chem. ..	W. D. Bancroft, Ithaca, N.Y., U.S.A.
Journal de Pharmacie et de Chimie	J. Pharm. Chim. ..	Imprimerie F. Levé, Rue Casette 17, Paris.
Journal für praktische Chemie ..	J. prakt. Chem. ..	J. A. Barth, Rossplatz 17, Leipzig, Germany.
Journal of the Society of Arts ..	J. Soc. Arts	G. Bell and Sons, York House, Portugal Street, London, W.C.
Journal of the Society of Dyers and Colourists	J. Soc. Dyers and Col.	E. T. Holdsworth, 10, Merton Road, Bradford, Yorks.
Leather	Leather	Leather Trades Publishing Co., 207A, Borough High Street, London, S.E.
L'Industria Chimica	L'Ind. Chimica ..	Associazione Chimica Industriale, Via Roma 28 (Galleria Nazionale Scale A), Turin, Italy.
Mémoriale des Poudres et Salpêtres	Mém. Poudres et Sal- pêtres	Gauthier-Villars, 55, Quai des Grands Augustins, Paris.
Metallurgical and Chemical Engi- neering	Metall. and Chem. Eng.	Electrochemical Publishing Co., 114-118, Liberty Street, New York City, U.S.A.
Metallurgie	Metallurgie	W. Knapp, Halle a. S., Germany.
Mining Magazine	Mining Mag.	819, Salisbury House, London, E.C.
Mining World	Mining World ..	Monadnock Building, Chicago, Ill., U.S.A.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
Mittheilungen aus dem königlichen Materialprüfungsamt zu Gross-Lichterfelde West	Mitt. k. Materialprüf.	Julius Springer, Mombijou-Platz 3, Berlin, N. Germany.
Mittheilungen aus der Centralstelle für wissenschaftlich-technische Untersuchungen	Mitt. Centralst. Wiss.-techn. Unters.	Prof. Dr. W. Will, Neu-Babelsberg, bei Berlin, Germany.
Mittheilungen des technischen Gewerbemuseums in Wien	Mitt. techn. Gew. Museums	IX/1, Hörlgasse 5, Wien, Austria.
Monatshefte für Chemie der kaiserlichen Akademie der Wissenschaften, Wien	Monatsh. . . .	K. Gerold's Sohn, Barbaragasse 2, Wien, I, Austria.
Moniteur Scientifique	Monit. Scient. . . .	Dr. G. Quesneville, 12, rue de Buci, Faubourg St. Germain, Paris.
Oil, Paint, and Drug Reporter..	Oil, Paint, and Drug Rep.	100, William Street, New York City, U.S.A.
Paper Making	Paper Making	5, Ludgate Circus Buildings, London, E.C.
Papier-Fabrikant	Papierfabr. . . .	Otto Eisner Verlagsges., Berlin, S., 42.
Papier-Zeitung	Papier-Zeit. . . .	C. Hofmann, Potsdamer Strasse 134, Berlin, W. 9, Germany.
Petroleum	Petroleum	Verlag für Fachliteratur, Motzstrasse 63, Berlin, W. 30.
Pharmaceutical Journal	Pharm. J. . . .	Pharmaceutical Soc. of Great Britain, 72, Great Russell Street, London, W.C.
Philippine Journal of Science . .	Philippine J. Sci. . .	Bureau of Science, Manila, Philippine Islands.
Philosophical Magazine and Journal of Science	Phil. Mag. . . .	Taylor and Francis, Red Lion Court, Fleet Street, London, E.C.
Photographic Journal	Phot. J. . . .	The Secretary, Royal Photographic Society, 66, Russell Square, London, W.C.
Proceedings of the American Electrochemical Society . .	Proc. Amer. Electrochem. Soc.	39, South Tenth Street, Philadelphia, Pa., U.S.A.
Proceedings of the American Institute of Mining Engineers, and also Bulletin	Proc. Amer. Inst. Min. Eng.; Bull. Amer. Inst. Min. Eng.	S.W. Corner of Seventh and Cherry Streets, Philadelphia, Pa., U.S.A.
Proceedings of the Engineers' Society of Western Pennsylvania	Proc. Eng. Soc. W. Pa.	410, Penn Avenue, Pittsburgh, Pa., U.S.A.
Proceedings of the Faraday Society	Proc. Faraday Soc. . .	The Secretary, 82, Victoria Street, Westminster, London, S.W.
Proceedings of the Institution of Civil Engineers	Proc. Inst. Civ. Eng.	The Secretary, Great George Street, London, S.W.
Proceedings of the Institution of Mining and Metallurgy	Proc. Inst. Min. and Met.	Salisbury House, London, E.C.
Proceedings of the Royal Society	Roy. Soc. Proc. . .	Harrison and Sons, 45, St. Martin's Lane, London, W.C.
Recueil des Travaux Chimiques de Pays-Bas	Rec. Trav. Chim. Pays-Bas.	A. W. Sijthoff, Leiden, Holland.
Revue Générale des Matières Colorantes	Rev. Gen. Mat. Col. . .	L. Lefèvre, 64, Chaussée d'Antin (IX ^e), Paris, France.
School of Mines Quarterly . . .	Sch. Mines Quart. . .	T. H. Harrington, Columbia University, New York.
Science Abstracts	Science Abst. . . .	E. and F. N. Spon, Ltd., 57, Haymarket, London, S.W.
Scientific American	Scient. Amer. . . .	361, Broadway, New York City, U.S.A.
Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften	Sitzungsber. Kgl. Preuss. Akad. Wiss.	Verlag der Königl. Akademie der Wissenschaften, Berlin.
Sprechsaal	Sprechsaal	Verlag von Müller und Schmidt, Coburg, Germany.
Stahl und Eisen	Stahl u. Eisen . . .	A. Bagel, Jacobistrasse 5, Düsseldorf, Germany.
Tonindustrie-Zeitung	Tonind.-Zeit. . . .	Dreysestrasse 4, Berlin, N.W. 21, Germany.
Transactions of the American Ceramic Society	Trans. Amer. Ceram. Soc.	The Secretary, Columbus, Ohio, U.S.A.
Transactions of the Australian Institute of Mining Engineers	Tr. Austral. Inst. Min. Eng.	57-59, Swanston Street, Melbourne, Victoria, Australia.
Transactions of the English Ceramic Society	Trans. Engl. Ceram. Soc.	Victoria Institute, Tunstall, Staffordshire.
Transactions of the Institute of Metals	Trans. Inst. Metals . .	Institute of Metals, Caxton House, Westminster, London, S.W.
Transactions of the Mining Institute of Scotland	Tr. Min. Inst. Scot.	Andrew Reid and Co., Ltd., Newcastle-on-Tyne and London.
Transactions of the North of England Institute of Mining and Metallurgy	Tr. N. Eng. Inst. Min. and Met.	Newcastle-on-Tyne.
Tropenpflanzer	Tropenpflanzer . . .	Unter den Linden 43, Berlin N.W., Germany.
Wochenblatt für Papierfabrikation	Wochenbl. Papierfabr.	Güntter-Staib in Biebrach a. d. Riss, Württemberg, Germany.
Zeitschrift der allgemeine Oesterreichische Apotheker-Verein	Z. Allgem. Oesterr. Apoth.-Ver.	Spitalgasse 31, Vienna IX/2, Austria.
Zeitschrift der analytischen Chemie	Z. anal. Chem. . . .	C. W. Kreidel's Verlag, Wiesbaden, Germany.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
Zeitschrift für angewandte Chemie	Z. angew. Chem. ..	Julius Springer, Monbijou-Platz 3, Berlin, N., Germany.
Zeitschrift der anorganischen Chemie	Z. anorg. Chem. ..	Verlag von L. Voss, Leipzig, Germany
Zeitschrift für Chemie und Industrie der Kolloide	Z. Chem. Ind. Kolloide	Verlag von T. Steinkopff, Dresden A. 21, Germany.
Zeitschrift des Vereins der deutschen Zucker-Industrie	Z. Ver. deut. Zuckerind	Vereins-Direktorium, Kleistsstrasse 32, Berlin, W., 62, Germany.
Zeitschrift für das gesammte Brauwesen	Z. ges. Brauw. ..	R. Oldenbourg, Glückstrasse 8, München, Germany.
Zeitschrift für das gesammte Schiess- und Sprengstoffwesen	Z. ges. Schiess- u Sprengstoffw.	J. F. Lehmann, Paul Heysestrasse 26, München, Germany.
Zeitschrift für Elektrochemie und angewandte physikalische Chemie	Z. Elektrochem. ..	W. Knapp, Mühlweg 19, Halle a.S., Germany.
Zeitschrift für Farben-Industrie	Z. Farben-Ind. ..	Verlag für Textil-Industrie, Sigmundstrasse 3, Berlin, W. 10, Germany.
Zeitschrift für öffentliche Chemie	Z. öffentl. Chem. ..	A. Kell's Buchhandlung, Marktstrasse 19, Plauen i. V., Germany.
Zeitschrift für physikalische Chemie	Z. physik. Chem. ..	W. Engelmann, Mittelstrasse 2, Leipzig, Germany.
Zeitschrift für Riech- und Geschmackstoffe	Z. Riech- und Geschmackst.	Hygienische Verlag, Marienstrasse 23, Leipzig, Germany.
Zeitschrift für Spiritusindustrie..	Z. Spiritusind. ..	P. Parey, Hedemannstrasse 10, Berlin, S.W., Germany.
Zeitschrift für Untersuchung der Nahrungs- und Genußmittel..	Z. Unters. Nahr. u. Genussm.	Julius Springer, Monbijou-Platz 3, Berlin, N., Germany.
Zeitschrift für Zuckerindustrie in Böhmen	Z. Zuckerind. Böhm.	Die Administration, Heinrichsgasse 27, Prag, Bohemia.
West Indian Bulletin	West Ind. Bull. ..	Imperial Dept. of Agriculture, Barbados, W.I.
Wochenschrift für Brauerei ..	Woch. f. Brau. ..	P. Parey, Hedemannstrasse 10, Berlin, S.W., Germany.

ERRATA, 1909.

Issue.	Page.	Column.	Line from Top.	Line from Bottom	Errata.
No. 8—April 30	405	1	10	..	For "Sulphate" read "Sulphide."
" "	429	1	18	..	For "Bayard" read "Bagard."
No. 9—May 15	484	2	..	23	For "Tocum" read "Yocum."
No. 10—May 31	505	1	..	22	Add "See this J., 1903, 1103."
" "	507	1	23	..	" " See this J., 1906, 199."
" "	"	1	27	..	" " See this J., 1906, 1176."
" "	"	2	..	40	" " See this J., 1903, 1368."
No. 11—June 15	580	1	2	..	For "vendu" read "vendus."
" "	617	1	..	25	For "dihydroxy" read "trihydroxy."
No. 12—June 30	639	1	Foot note		For "37, 1158" read "38, 1158," and add "See this J., 1905, 326, 432."
" "	642	1	..	7	For "7902" read "4903."
" "	662	1	First abstract in Class XII.		For "turkey" read "duck" throughout.
No. 14—July 31	763	2	2	..	After "150°" insert "200°."
" "	763	2	Bottom line of table		For "above 372" read "above 572."
No. 16—Aug. 16	916	2	Title of patent		After "12,506" insert "of 1909; date of application."
No. 17—Sept. 15	934	1	29	..	For "air" read "hair."
" "	937	2	..	4	After "3189" insert "of 1909; date of application."
" "	948	1	1	..	This line should read "glyceroll, 12.47; alanine, 1.6; proline, 10.4; leucine, 4.2."
" "	948	1	3	..	For "oxyproline" read "oxyproline."
No. 18—Sept. 30	971	2	..	37	For "Willan" read "Wilbur."
No. 20—Oct. 30	1082	1	30	..	For "85°-87°" read "64°-65°C."
No. 21—Nov. 15	1127	1	..	24	For "Wienand" read "Winand."
" "	1136	2	..	10	For "1906" read "1909."
No. 23—Dec. 15	1233	2	Sixth line of Table IV.		For "4.47" read "6.47."
" "	1239	2	..	19	For "Diamond" read "Diamand."
" "	1241	2	7	..	For "930" read "830."
No. 24—Dec. 31	1297	2	39	..	For "1855" read "1734."

Journal of the Society of Chemical Industry.

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JANUARY 15, 1909.

No. 1, Vol. XXVIII.

The Society of Chemical Industry.

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THE VISCOSITY OF INDIA-RUBBER AND INDIA-RUBBER SOLUTIONS: WITH SPECIAL REFERENCE TO ITS BEARING ON THE STRENGTH OR "NERVE" OF CRUDE RUBBER.*

BY DR. P. SCHIDROWITZ AND H. A. GOLDSBROUGH.

1.—PRELIMINARY COMMUNICATION.

(a) *Introductory*.—The present communication is a record of some preliminary experiments which were undertaken with a view (1) to studying the viscosity of india-rubber solutions; (2) to ascertaining whether there is any correlation between the viscosity of india-rubber (studied in solution) and its strength or "nerve" generally, and what the nature of such correlation may be; (3) to devising, in the event of the experiments under (2) resulting affirmatively, a method for the measurement of india-rubber "nerve" either wholly or partly by means of viscosity estimations.

Our preliminary experiments in this direction have so far proved satisfactory, inasmuch as they appear to indicate that there is a connection between the condition of the soluble rubber substance (as measured by the viscosity of its solution) on the one hand, and the "nerve" of the original crude rubber on the other hand.

We did not anticipate that the results which we might obtain by physical measurements on solutions of rubber could bear a direct relationship to the total "nerve" of the original crude rubber, because it appears to be beyond reasonable doubt that the "nerve" is at least partly due to the mechanical structure or texture, if we may so call it, of the material. It follows, therefore, and we believe that this has not been pointed out by any previous observer, that there are at least two main groups of factors to which the qualities summarised by the term "nerve" are due, namely that which we will, for convenience, call "mechanical" or "structural" "nerve," and that which may be termed "physical" or "chemical" "nerve."

(b) *The Viscosity of India-rubber Solutions*.—We have not been able in the literature of the subject to find any record of any determinations of an exact nature of the viscosity of india-rubber solutions. The instrument employed by us was an Ostwald capillary double bulb viscometer (Fig. 1) of the approximate dimensions:—Total height of apparatus, 24 cm. Capacity of Bulb A, 11 c.c. Capacity of Bulb B, 10 c.c. Length of capillary, 4.5 cm. Bore of capillary (approx.), 1 mm.

In the experiments made so far we have employed only one solvent, namely pure benzene, and the solutions examined have been of a relatively dilute nature, containing, as a maximum 1 to 1.5 per cent. of the solute. The standard temperature at which the experiments were conducted was 20° C.

The rubber solutions were prepared by weighing a definite quantity of rubber (generally one gm.) cut into very small pieces and exposing these to the action, at the required temperature, of a measured volume of solvent. After solution had taken place the sometimes bright, but occasionally turbid solutions were filtered through a plug of glass wool in order to remove mechanical impurities. In our earlier experiments in the cases in which solution appeared to be practically complete, the concentration of the solution was calculated from the quantity of rubber and solvent originally employed.† In our later experi-

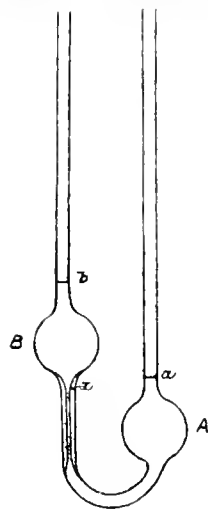


FIG. 1.

ments—and this is the method which we now always employ—the actual quantity of rubber in solution was estimated by evaporating a known volume of the filtered liquid and weighing the residue. In the experiments conducted at the ordinary temperature of the laboratory the samples together with the solvent were placed in glass bottles, protected from the action of light and shaken (as little as possible) at regular intervals and in a regular manner.*

Series 1.—The rubbers examined consisted of six samples of *Funtumia elastica* (Nos. 1–5 and 7); three samples of *Hevea Braziliensis* from Eastern Plantations (Nos. 8, 9, and 10), and a sample of "Fine hard Para" (*Hevea E.* from Brazil).

The *Funtumia* samples 1–5 consisted of somewhat dark, but clear, corrugated sheets which appeared to be strong and normal in character. No. 1 was perhaps rather weaker than the others. No. 7 was a thin light brown sheet rubber, obviously of a somewhat abnormal character. None of the samples were "indigenous" rubbers; that is to say, they had all been prepared from fresh latex under skilled European superintendence. We are indebted for these samples to the Mabira Forest Company of Uganda. The general analytical figures, on analysis, were as follows:—

TABLE I.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 7.
Moisture	per cent. 0.50	per cent. 0.72	per cent. 0.61	per cent. 0.36	per cent. 0.34	per cent. 1.74
Resin .	7.59	7.41	7.69	8.18	9.60	6.79
Ash . .	0.41	0.66	0.43	0.52	0.64	1.22

Judging by our previous experience of *Funtumia* rubbers these figures are fairly normal, excepting that the resin in No. 5 is rather high, and in No. 7 rather low. The latter sample also contained a rather high percentage of ash. The three samples 8–10 were plantation *Hevea* "crêpes" (from Ceylon or Malaya) obtained on the London market. No. 8 was a greyish yellow, No. 9 of a light yellow, and No. 10 of a very pale cream colour. They were practically dry. The sample of "Fine hard Para" employed as a control—inasmuch as this variety of rubber is the standard of industrial quality—was of considerable age, and therefore, perhaps, not quite so satisfactory as a fresher sample might have been, but the reasons for

* Taken as read.

† It is possible that, for this reason, some of our earlier figures may be rather too low.

* Full details of the method of work, the limits and influence of temperature, &c., are reserved for a future communication.

using this particular specimen were (1) that it was practically dry, (2) that it had dried naturally, (3) that the dimensions of the clear, translucent layers were such as to make the cutting of test strips for the mechanical tests (*cf. infra*) a practical possibility. The amount of resin in the sample was rather high, namely, 3.46 per cent.

The following table shows the results of the viscosity determinations carried out with the rubbers described above.

TABLE II.

No. or mark.	Nature of rubber.	Concentration of benzene solution per cent.	Relative viscosity (benzene = 1).
1	<i>Euntamia elastica</i> (Corrugated sheet)	1.0	19.1
		0.5	5.3
		0.25	2.2
2	" "	1.0	35.3
		0.5	7.6
		0.25	2.7
3	" "	1.0	27.3
		0.5	6.1
		0.25	2.5
4	" "	1.0	37.0
		0.5	7.2
		0.25	2.7
5	" "	1.0	37.6
		0.5	7.8
		0.25	2.9
7	(sheet)	1.0	16.6
		0.5	2.9
		0.25	1.6
8	Plantation <i>Hevea</i> (crepe)	1.0	6.7
		0.5	2.7
		0.25	1.6
9	" "	1.0	9.3
		0.5	3.3
		0.25	1.6
10	" "	1.0	9.1
		0.5	3.1
		0.25	1.7
Fine hard Para	Brazilian <i>Hevea</i>	1.2	40.6
"	" "	1.0 (calculated)	26.2
"	" "	0.55	7.1
"	" "	0.24	1.7

Of considerable interest in the above table are the very low figures shown by the plantation *Hevea* specimens as compared with the Brazilian *Hevea* and the *Euntamia* specimens. Graphically represented (Fig. 2) the results are still more striking. No. 7, which was known to be of a somewhat abnormal character, gives an abnormal curve.

The flat nature of the curves shown by Nos. 8–10 as compared with the other rubbers induced us to make an attempt to ascertain the comparative strengths of these typical samples by some direct physical method. If the rubbers had been in homogeneous sheet form, this would have been a comparatively easy matter, but as it is obviously impossible to cut strips for tension experiments from corrugated sheet or "crepe," some other expedient had to be adopted.

The method employed by us was to dip strips of "quantitative" filter paper 60 by 10 mm. into 1 per cent. benzene solutions of the rubbers, to allow the strips to dry and then to ascertain the breaking strain. The figures obtained were as follows, the results denote grams and in each case represents the mean of a number of determinations:—

No.	Breaking strain.
Paper alone (undipped).....	700
Rubber No. 1.....	950
" No. 8.....	860
" No. 10.....	860

The results, naturally, can only be regarded as a rough approximation, but they serve to indicate that there is a connection between the viscosity curves and the strength of the rubbers in question. The increased strength imparted by the relatively viscous rubber No. 1 to the paper compared with that imparted by the rubbers of low viscosity (8 and 10) is roughly as 25 : 16.

Further confirmation of the connection between viscosity and strength in these particular samples was afforded by considerations of a purely empirical, though to some extent of a highly practical nature. In brief, Nos. 8–10 were decidedly brittle or "short," whereas the other rubbers gave satisfactory indications in response to the crude but by no means useless "hand-pulling" test.

Nature of the viscosity curves.—It will be observed, on referring to Fig. 2, that beyond a certain viscosity, the

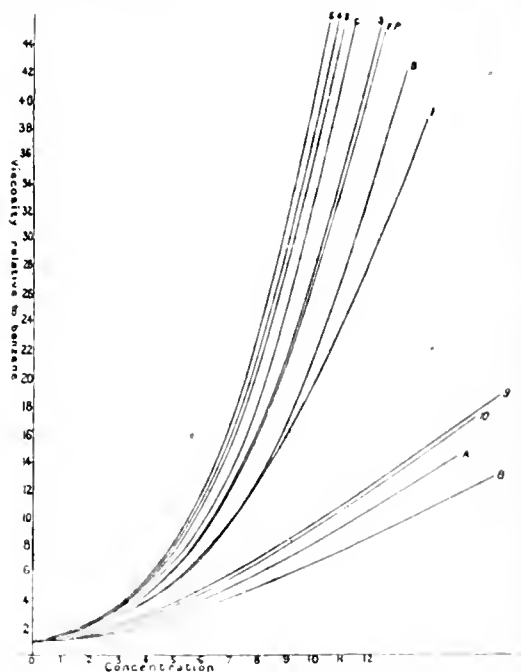


FIG. 2.

curves become straight lines. This was confirmed by subsequent experiments. If, for the sake of convenience, the point at which the curve becomes a straight line, is termed the *critical point*, it follows that for all readings above the critical point, the viscosity is directly proportional to the concentration. If it were found, on producing the part of the curve above the critical point downwards, that all the straight lines thus produced met in a common point, it would follow, taking the viscosity of the rubber itself as equal to that of a 100 per cent. solution, that the viscosities of different rubbers would be inversely proportional to the concentration of the solutions at a fixed viscosity above the critical point and *vice versa*. This, however, is not the case, and the conclusion which, we think, is of some importance, is that although for any given rubber the viscosity of a solution (naturally at a fixed temperature) is proportional to the concentration at any given point above the critical point, yet the viscosity of the rubber itself cannot be ascertained by reference to such a point, and consequently the viscosities of two rubbers cannot be compared by ascertaining the viscosities of their solutions at a fixed concentration.

In order to compare different rubbers in regard to their viscosity we took two points (above the critical point) on each curve, and, inserting the values successively in the linear equation, $y = mx + c$, (where x = concentration and y = viscosity), obtained m and c . By inserting m and c in the equation where $x = 100$, we obtained y , the viscosity of a 100 per cent. solution—i.e., of the rubber.

The error involved in this method of calculating viscosity is, we think, small, provided that the concentration of the solution examined is ascertained with accuracy. Assuming that the concentration is in the neighbourhood of 1 per cent., at least 50 c.c. of the solution should be taken for the determination of the quantity of the rubber contained.

The values calculated by this method for Nos. 1–5 and “Fine Para” were as follows:—

No.	Viscosity (benzene = 1.0).
1	4966
2	8946
3	7551
4	9343
5	9940
Fine Para	7253
8	1000 (approx.)
9	1400 ..
10	1400 ..

It is obvious from the curve why the values for Nos. 8, 9, and 10 could not be calculated. It is probable that if we had been in a position to obtain readings at higher concentrations this might have been done. With regard to these three rubbers, we were not satisfied that we had reached the critical point, and we were unfortunately not in a position to determine the viscosities at higher concentrations. In any case it is quite obvious that the values for these three specimens must be very low.

Second series.—This series consisted of three rubbers concerning which the origin, nature, and age of the trees (at the time of tapping), were accurately known. In addition, the specimens were all in sheet form, and ordinary tension experiments could therefore be applied and the results compared with the viscosity numbers and the “practical” opinion concerning their quality.

With regard to the “nerve” or strength of these rubbers judged by the ordinary method of pulling by hand, the remarks were made that A was rather lacking in strength, B was fairly strong, and C was very strong.

Viscosity experiments.—The numbers obtained with specimens A, B, and C were as follows:—

TABLE III.

Mark.	Ceylon <i>Hevea</i> rubber.	Concentration of benzene solution per cent.	Relative viscosity of solution (benzene = 1).
	Age of tree, years.	per cent.	
A	8	0.86	6.6
		0.43	2.6
		0.21	1.5
B	6–13	1.00	21.4
		0.50	5.2
		0.25	2.2
C	30	1.00	32.3
		0.50	6.8
		0.25	2.5

The results obtained are shown graphically in Fig. 2. The most interesting feature of the figure is the very flat nature of curve A as compared with B and C.

By calculation (*cf. supra*) viscosity values for the actual rubbers (*i.e.*, of 100 per cent. solutions) were obtained as follows:—

Mark.	Viscosity of rubber (benzene = 1).
A	1250 (approx.)
B	6653
C	8843

Tension experiments.—Strips of a cross-sectional area as nearly as possible 40 sq. mm. and sufficiently long to

allow a distance of 30 mm. between grips, were cut for rubbers A, B and C, and for comparative purposes also from the sample of “Fine Para” referred to above. The strips were then broken in a vertical, direct pull machine,* the breaking strain and elongation at break being observed. The units taken were: for the breaking strain, grams per sq. mm. of cross-sectional area; for the elongation, the original length of the strip between lines drawn between the grips. Each figure represents the average of a number of determinations. A second series of experiments was made with similar strips in order to determine the minimum weight per unit of cross-sectional area which would, under certain conditions, cause a permanent distension of the material. The figure so obtained we call the “co-efficient of resiliency,” although possibly a better term might be “limit of elasticity.”

The results of the tension experiments will be found below in Table IV. We have added the details concerning the nature, &c., of the rubbers and also the viscosity figures, so that a comprehensive view of the whole results in regard to Series II. may be obtained.

TABLE IV.

Mark.	<i>Hevea</i> rubber.	Elongation at break	Break ing strain,†	Co- efficient of resi- liency,‡	Vis- cosity (benzene = 1).
A	Ceylon, from 8 year old trees, weak.	4.5	58	21.6	1000 (approx.)
B	Ceylon, from 6–13 year old trees, fairly strong.	8.0	52	24	6653
C	Ceylon, from a 30 year old tree, very strong.	9.75	218	57	8843
Fine Para	Brazilian, fair, but old specimen.	10.0	406	75	7253

† Grms. per sq. mm. of cross-sectional area.

The general superiority of C and the Brazilian specimen over A and B is obvious. The inferiority of B is not so marked, however, in regard to viscosity as with respect to the other factors, and we suggest that it is possible that we have here a case where a rubber is relatively weak as regards its mechanical structure, but fairly satisfactory with respect to the chemical or physical structure of its mass. It will be noticed also, that whereas C is inferior to the Brazilian specimen with regard to breaking strain and resilience, that its viscosity is superior to that of the latter. We think that in the case of the Brazilian product there is not the slightest doubt that a considerable proportion of its mechanical strength is due to purely mechanical causes, and that comparing it with C, the viscosity figures are probably a better criterion of the relative “nerve” of the actual rubber substance of the two specimens than the tension results.

Another point of interest is that the specimen A, which is inferior to B in every other respect, shows a rather higher figure for breaking strain. We think the explanation of this point is not far to seek. This specimen (A) contained a good deal of insoluble matter, and experience has led us to know that the presence of a certain type of insoluble matter in rubbers indicates that they have gained somewhat in toughness at the cost of elasticity and resilience. In such cases the breaking strain may be comparatively high, but the elongation and resilience are always low. We have referred above to “a certain type” of insoluble matter, because it appears to us that it is necessary to differentiate between the insoluble matter present in old or exposed rubbers which is probably an oxydation or hydration product,‡ or a mixture of both,

* We may add—although this does not apply to the experiments here recorded—that we have in our most recent work discarded, for general work, tension apparatus of the ordinary “grip” type, as we have found that more accurate and rapid results may be obtained with the new Schopper apparatus, in which a ring shaped test body (obtained by double punching) working over revolving rollers is subjected to vertical tension by means of hydraulic power.

‡ Weber, “The Chemistry of India-Rubber,” pp. 7–12, and Spiller, J. Chem. Soc., 1865, 44.

and the insoluble matter present in the fresh "hard cure" Brazilian *Hevea*, which according to Spence* consists mainly or largely of fibrous proteid substance. The insoluble matter to which we have referred in connection with sample A shows the characteristics of the former and not of the latter variety. We may also call attention to the fact that the viscosity figures for A, B, and C are in accord with "practical opinion" regarding the relative strength of these three specimens. At the same time, we do not wish, before having accumulated further data, to lay any undue stress on the fact, nor should we be justified in concluding at all positively that the differences observable are due primarily to the relative ages of the trees from which these rubbers were obtained. It is an undoubted fact that the method of coagulation† plays an important part in connection with the question of "nerve," and that variations in the quality of latices obtained from trees of the same species may be due to other causes than that of age.

Meeting held at Burlington House on Monday, Dec. 7, 1908.

DR. LEWKOWITZ IN THE CHAIR.

THE STRUCTURE OF CRUDE INDIA-RUBBER.

BY PHILIP SCHIDROWITZ, PH.D.

Preliminary Note.

According to W. B. Hardy‡, "common black india-rubber" in sections cut with the freezing microtome displays the structure common to many organic gels, namely, that of an open net or fine open sponge. Now, the ordinary "black india-rubber" of commerce is vulcanised rubber, and it is therefore a little difficult to know whether Hardy referred to ordinary black vulcanised rubber or to some particular variety of black crude (i.e., unvulcanised) rubber.

Apart from this "open net" structure, which may or may not be an attribute of the crude variety¶, it has been assumed that the main substance of ordinary crude, dry india-rubber is a structureless mass§, and that after coagulation has taken place, and certainly after the coagulated rubber has become dry, that the original globular condition of the rubber particles as seen in the latex disappears; indeed, there has been a serious discussion as to whether the globules in the latex were actually rubber or some substance which, at the moment of coagulation, polymerises into the rubber hydrocarbon.¶ after the globules containing it have first burst their envelopes and discharged their contents. I have found from observations made on two different species, namely, *Hevea Brasiliensis* and *Funtumia elastica* :—

* *Loc. cit.*

† Schidrowitz and Kaye, *India-Rubber Journal*, 23rd Sept., 1907, and V. Henri, *loc. cit.*

‡ *J. of Physiology*, 24, 169.

§ I have not been able to observe "net" structure in films of crude rubber obtained either (a) by squeegeeing on to a slide solid rubber softened with a solvent; (b) by evaporating off the solvent from a benzene solution; (c) or by coagulating a film of latex between a slide and cover glass; but it is possible that microtome cut sections might show the structure referred to. If, however, a film, obtained by evaporating off a few drops of a 1 per cent. benzene "solution" on a slide, is subjected to the action of a dilute solution of sulphur chloride in benzene (1:100) for a few seconds, I have found that (after removing excess of the reagent by means of acetone, and subsequent drying, a pronounced net structure is formed. If the treatment with sulphur chloride is continued for some minutes, the net structure becomes much more pronounced and presents a really remarkable appearance. Whether this net formation is an essential or an accessory feature of the process of "cold curing"—as vulcanisation with solutions of sulphur chloride is termed technically—or of vulcanisation in general, is a matter well worth investigation, and I propose to do so in the future.

¶ Cf. Weber, "The Chemistry of India-Rubber," p. 17, and D. Spence, *Inst. Comm. Research in the Tropics*, J., No. 13, 1907. Weber, *Ber.*, 1903, 36, 3108—3115; *Gummi-Zeit.*, 19, 161—164; A. W. de Jong and W. R. Tromp de Haas, *Ber.*, 1904, 3298—3301; Each and Chwolson, *Gummi-Zeit.*, 19, 165—166, &c.

(1) That if a thin preparation* of transparent dry rubber is examined under the microscope with magnifications of about 900 and upwards, it is seen to contain very numerous globules, similar in appearance and size to the globules present in the latex.

(2) That if such dry rubber is dissolved in benzene (cf. preceding communication) and examined in solutions of 1 to 5 per cent. strength with reflected light by means of the Leitz dark ground illumination and parabolic condenser, that is to say, on the principle of the ultra-microscopic method, the "solutions" are seen to contain numerous globular particles, these again being similar to those present in the latex.

(3) That if a drop of such a benzene "solution" is allowed to evaporate on a slide, the resultant film presents much the same appearance as a drop of diluted and dried latex, or of a drop of diluted latex coagulated by suitable means, the only difference being that the reticulated structure is not visible to any marked extent. The globular particles are, however, visible in large numbers in every case.

(4) That if a drop of diluted (*funtumia*) latex is coagulated by means of heat between two cover-glasses, the reticulation is seen to consist of branches of more or less structureless matter in which chains of and single globules are enmeshed in large number.

In connection with the films obtained by squeegeeing or from "solutions," those which were quite transparent showed the globules less distinctly than those which were slightly opaque. When, however, such a transparent film is touched or irritated with a glass rod or otherwise, the portions touched become less transparent, and at the same time the globules appear much more sharply defined. When a clear film, showing the globular structure somewhat imperfectly, is treated with a dilute sulphur chloride solution, the resultant preparation, in addition to showing very pronounced "net" structure, exhibits the globules distinctly. Such preparations are slightly opaque. It is possible that the clear film is an approximation to a solid solution of the globules, the opaque film to an irreversible gel.

In conclusion, then, it appears that the globules are not destroyed by coagulation of the latex, but that they continue to exist in the dry rubber and are not removed even by "solution" in benzene.

I take this opportunity of expressing my thanks to Messrs. Leitz for placing at my disposal some of the special optical instruments necessary for this work.

* Note.—The methods employed for obtaining preparations were:—(1) Squeegeeing a thin (hand cut) section on to a slide after softening with chloroform; (2) evaporation of a few drops of a benzene solution, so forming a film; (3) a homogeneous strip was punched from a very thin transparent sheet. This strip was then drawn out until very thin, and a part fixed, while under tension, on to a slide by means of shellac.

Newcastle Section.

Meeting held at Armstrong College on Thursday, Dec. 10, 1908.

MR. C. J. POTTER IN THE CHAIR.

CHEMICAL CHANGES IN PORTLAND CEMENT CONCRETE, AND THE ACTION OF SEA WATER THEREON.

BY CHARLES J. POTTER.

Some years ago the failure of the Portland cement concrete in a dock was brought to my notice; the work had stood well in the sea water for two or three years after completion, after which the walls commenced to show signs of failure, the concrete turning quite soft in places and showing great expansion, and this serious action went on so rapidly that reconstruction was necessary. This failure and several others of a similar nature induced me to make experiments to try and find out the cause with the hope that I would be able to discover some method of prevention.

I commenced my experiments by moulding small blocks of concrete made with three parts of sand to one part of cement, and after these were set, I immersed one of each in strong solutions of the various salts which are found in sea water; I soon found that the magnesium salts were the cause of the mischief, and that the quarter per cent. of magnesium sulphate found in sea water was the most active, as blocks in a strong solution burst up in a few weeks. The magnesium chloride had a tendency to soften the blocks but without showing any expansion. Calcium sulphate had a softening action, but it was slow as compared with magnesium salts.

Since I commenced these experiments, Mr. J. Pattinson, Dr. Michale Chatelier, and several other experts have written articles on this subject, and there can now be no doubt that the damage is caused by the magnesium salts in the sea water acting on the feebly combined lime and alumina in the cement concrete and forming calcium sulphate and alumina compounds, which on taking up water of crystallisation do the bursting of the concrete.

We may take it that Portland cement concrete is composed of cement, sand, gravel or small stones, and larger stones. I term the mixture of sand and cement the mortar of the concrete, and if in this mortar the proportion of sand to cement is too high, then the cement will be unable to fill up all the interstices of the sand, and this mortar when set will be porous; also if this mortar is unable to fill up all the spaces between the stones then the concrete will be open.

In the case of the dock failures which I have referred to, the mortar in the concrete was 4 sand to 1 cement, and the concrete was rather open. Mortar of this proportion is very porous, so with each rise and fall of the tide fresh doses of magnesium sulphate would be brought in contact with the cement, which no doubt accounts for the rapid destruction of these works.

Within the last few years these failures have not been so common, as engineers appear to be doing their utmost to get their cement mortar tight, and this is just a matter of experiment with the class of sand that is being used. A few open spaces in the concrete are of much less importance than porous mortar.

In making concrete it is most important that the cement and sand should be thoroughly mixed, and there can be no doubt that mechanical concrete mixers are a great safeguard as compared with the old method of hand mixing. If any mistakes are made in the proportions of cement used the chances are that it will not be too much cement that is added.

If the above precautions are carefully carried out the action of the sea water on the concrete should be reduced to surface action only; but there appears to me to be a danger in this surface action and it may be only a matter of time for mischief to begin to show even in the most carefully constructed works. The sea water will not miss chances of finding out weak places.

My method of guarding against this danger was to add something to the cement clinker while grinding it, which would, after the concrete is set, get a firm enough hold of the lime in the cement to prevent the magnesium salts in the sea water from acting on it. I tried various materials in various proportions, such as burnt slints, clinkers, slag, burnt fire clay, pozzuolana, trass, and burnt red brick clay. I got the most promising results from the last and found that the temperature of calcination was a most important feature. After numerous experiments I came to the conclusion that the addition of six parts by weight of calcined clay to ten parts of cement gave the best all round results for practical work. Very thorough and intimate mixing and fine grinding were absolutely necessary.

Now let me refer to the results of my tests of Portland cement as against this red clay cement, or red cement as I call it. The Portland tests are the average of many different brands of best quality cement, a number of them from the Thames and Medway. The red cement tests are the average of a number of samples and maximum and minimum in both cases varied but little from the general average.

The test briquettes were all put into water (salt or

fresh) 24 hours after moulding, and remained in the tanks until they were tested. The fresh water tank was emptied and re-filled every three months. The salt water tank was filled with water taken from the River Tyne at high tide, which is equal to sea water, and as a number of briquettes soon precipitated the small quantity of magnesia found in salt water this tank was emptied and re-filled once a month. Both Portland and red cement tests were treated in exactly the same way.

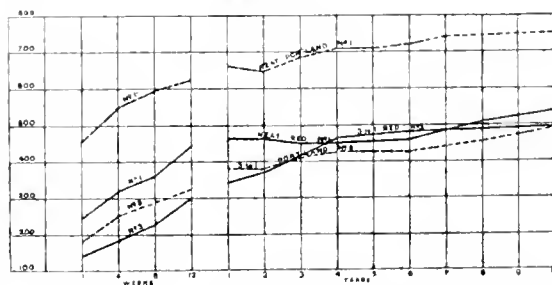
A second series of salt water tests was placed 24 hours after moulding in a perforated box half way between high and low tide in the River Tyne. These tests were started four years later than the tank tests, so they only go up to six years.

A third series of tests was placed in salt water to which had been added ten per cent. of magnesium sulphate; this solution is about 40 times stronger than sea water. It is a very severe test, as it gives results at a few weeks which may take as many years to show in salt water. This test was of great assistance to me in carrying out these experiments.

The diagrams give on the vertical scale the average breaking strain in lb. per square inch, and the horizontal scale gives the age of the briquettes when broken, commencing at one week and going on up to 10 years. The breaking area of all the briquettes on the diagrams was one square inch, but some of the tests were also carried on in duplicate with $1\frac{1}{2} \times 1\frac{1}{2}$ briquettes = 2½ square inches, but strange to say these larger briquettes did not appear to have any appreciable effect on the results. All the sand used in these tests was standard cement testing sand which all passed through 20×20 and stopped on 30×30 sieves. Proportions of sand to cement were all taken by weight.

Diagram No. 1 shows neat Portland cement as against neat red cement in fresh water. The Portland (dotted line) commences at 435 lb. per square inch at one week and goes on steadily improving up to ten years, and this points to the Portland cement selected for these experiments being of thoroughly good quality for fresh water work. The neat red cement (full line) only stands 230 lb. at one week but goes on improving steadily up to 540 lb. at ten years. So neat Portland is stronger than neat red at all these dates in fresh water.

DIAGRAM NOS. 1 AND 3.



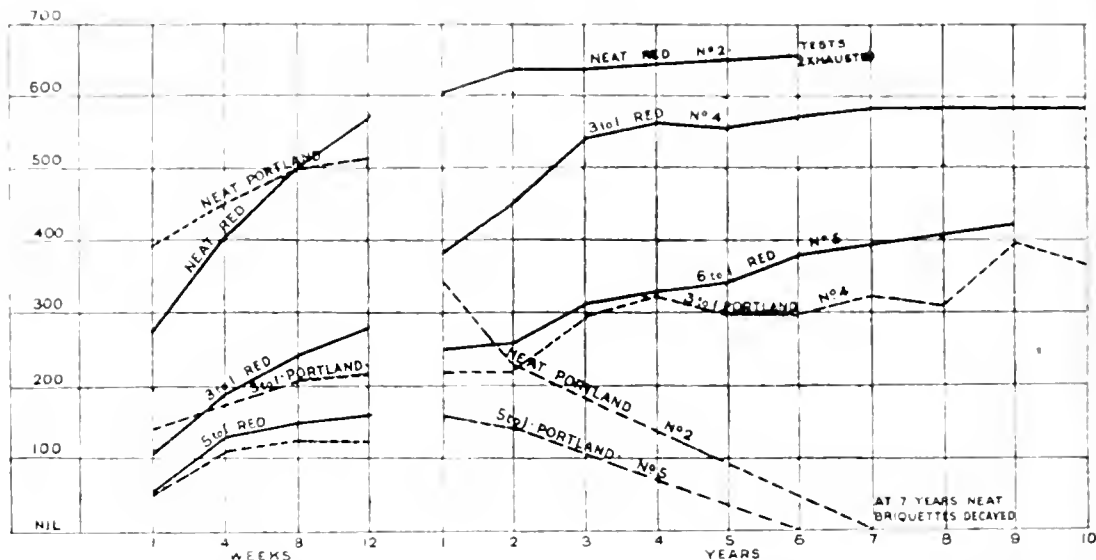
No. 2 Diagram shows neat Portland against neat red in salt water tank. The Portland commences at 400 lb. one week, reaches 500 lb. at twelve weeks, after which it goes gradually back to nil at five years. Most of these bricks showed surface blisters at or before one year, followed by great expansion and bursting up at later dates; the fractures showed signs of internal strain as they were so very uneven. The fracture colour was a dirty green, quite different from the fresh water bricks, and when dried these fractures showed a dirty white colour due to precipitated magnesia within the briquettes.

The salt reds start at 280 lb. at one week, come up to the Portland at eight weeks, reach 640 at two years, and go on improving a little up to six years, when no more tests were left.

No. 3 Diagram shows Portland 3 to 1, and red 3 to 1 in fresh water. For the first twelve weeks, the reds are a little below the Portlands, after which they are practically equal, each 500 lb. at ten years.

No. 4 Diagram gives 3 to 1 Portland and red in salt water tank. Here we have the Portland a little above the

DIAGRAMS NOS. 2, 4, and 5.



red for three weeks, after which the Portland finishes at ten years a little under 400 lb., as against the red 580 lb.

Diagram 10 gives Nos. 1 to 4 on one sheet so that they may more easily be compared. On this diagram the salt tests are full lines and the fresh are dotted.

The red tests are all higher in salt water than in fresh, and the Portland are all lower in salt than in fresh. This points to the red liking the salt water better than the fresh and just the reverse with the Portland.

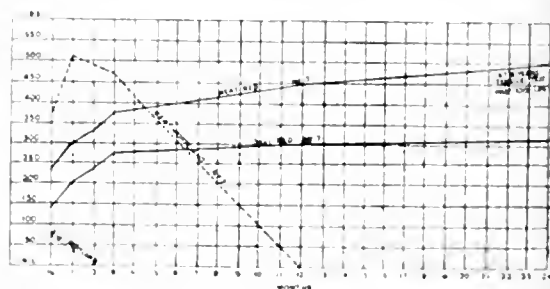
The next diagram, No. 5, shows 5 of sand to 1 cement in salt water tank. These briquettes are very porous and, when lifted out of the tank, a considerable amount of water filters out from them. The Portland stands 60 lb. at one week, goes up to 160 at one year and falls back to *nil* between five and six years; the red commences much the same as Portland, but reaches 250 at one year and goes on improving up to nine years, when the tests were exhausted.

No. 6 Diagram gives the sea water tests when the briquettes were placed in the perforated box in the river, halfway between high and low tide. This appears to be a much more severe test to the Portland than leaving them in the sea water tank, as the 3 to 1 Portlands com-

menced to fall at two years and go steadily down up to six years, but the red stands 320 at one year and goes up to 460 at six years. Portland, 5 to 1, shows *nil* at five years as against red 360 at six. There are more of this series left, but they are not yet due to test at seven years. I have had these tests independently carried out up to three years by Mr. Faija, and his tests give very similar comparative results to mine, but his results were all higher than mine, owing I believe to using a little less water in the moulding of the briquettes and hammering into the moulds, which was not usual ten years ago.

No. 7 Diagram shows tests of briquettes which, 24 hours after moulding, were immersed in a tank of sea water to which had been added 10 per cent. of magnesium sulphate. The vertical lines on this diagram represent months. The neat Portland goes up to over 500 at one month but goes rapidly back to *nil* at one year. The

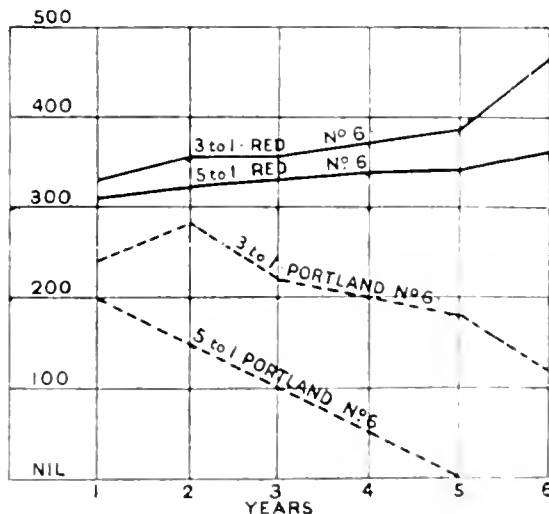
DIAGRAM NO. 7.



red as usual neat commences low at 250, but goes on improving up to two years. One of these briquettes has recently been tested; at eight years it stood 1015 lb., but there were signs of damage to the outer surface of this briquette, only giving about 1 16th in. all round. At the bottom of the diagram the 3 to 1 solution tests are shown—*nil* at eight weeks for the Portland, but the red reaches 260 at 12 weeks and finishes the two years over 300. Some large blocks 4 ft. by 12 in. by 6 in. were placed in the river ten years ago; the 5 to 1 Portland went to pieces in four to five years. 3 to 1 showed signs of damage at about eight years and is getting bad now, but the 5 and 3 to 1 reds are still both quite sound.

All these tests show better results with red cement in salt water than in fresh, and I am unable to account for this. Portland cement contains over 60 per cent. of lime; red under 40; so there is much less lime in red

DIAGRAM NO. 6.



than in Portland for the sea water to act upon, and the high long date red tests point to the silica in the calcined clay combining with the lime.

A 1 to 1 mixture of cement and calcined clay equal to only 30 per cent. of lime, gave high tests at long dates, but the early date tests were too low for practical work. As already mentioned, fine grinding for red is necessary, but extremely fine grinding did not appear to improve the tests. All these tests show a very large proportion of surface to volume, as the briquettes are very small and the larger blocks last referred to stood longer in the river than the 1 inch by 1 inch briquettes did. In the case of a thick dock or quay wall, the proportion of surface to volume is very small, and my tests can have no relation to the probable life of these massive walls, assuming of course that they are not porous and open. But in the case of ferro-concrete piles, which are frequently 18 in. and sometimes only 15 in. square, the proportion of surface to volume is very large and all my tests point to extra danger in this class of work.

If concrete shows white slimy matter (which is magnesia) coming out, then mischief is going on inside. If a chipping from a wall shows the dirty green colour, this points to surface action.

I next wish to refer to the action of carbon dioxide on Portland cement concrete; my attention was drawn to this in the following way:—I had occasion to fix some perforated tiles in a malt kiln which would have to stand a temperature of over 200 F., and decided to try a mortar of 3 sand to 1 of very fine cement. The fumes passing through the tiles and coming in contact with the cement were from an open coke fire burning with an excess of air, and so contained an ample supply of carbon dioxide. Some months after these tiles were fixed a few of them were broken through an accident, and I then noticed how very hard this cement mortar was. I had this examined and found that it contained no combined water, but a very large quantity of carbon dioxide. Set cement generally takes up some 10 per cent. of combined water at early dates, more or less according to the fineness of grinding, so all this water must have been replaced by carbon dioxide. To carry this further I made up a number of 3 to 1 briquettes and after a few days in water took them out and placed them in a box charged with pure carbon dioxide. The briquettes rapidly warmed, gave off water and created a partial vacuum in the box. For the first few hours the carbon dioxide could not be passed fast enough into the box to satisfy the demand. The tests of these were about double the average tests of wet briquettes of the same age, and only a trace of combined water was left in them after being six months in this box. This points to the chemical combination of lime, silica, alumina, and water in set cement being very feeble, and perhaps accounts for the magnesia in sea water being so easily able to act upon the lime.

Carbonating makes cement lighter in colour; it cannot get more than 1/16th inch into neat cement, but it filters its way into 3 and 5 to 1 mixtures, and it is interesting to examine the fracture of briquettes that have been so treated, as a glance tells how far the action has gone in. I carried these experiments further by putting some of the carbonated briquettes into the strong solution already referred to.

Diagram No. 8 gives the results of these tests, both Portland and red, all 3 sand to 1 cement.

DIAGRAM No. 8.

Carbon dioxide and solution tests.

- 1st Series.—Remaining in carbon dioxide up to breaking period.
2nd Series.—Remaining in carbon dioxide for 9 days then immersed in sea-water solution until breaking period.
3rd Series.—Remaining in carbon dioxide for 12 months then immersed in sea-water solution until breaking period.
4th Series.—Remaining in an ordinary dry atmosphere (test house) for 12 months then immersed in sea-water solution until breaking.
5th Series.—Remaining in a perfectly dry enclosed atmosphere (lime-dried) for 12 months then immersed in sea-water solution until breaking.

Table of tensile tests of above.

Results in lbs. per sq. inch when tested at three years from date of making.

3 to 1 tests.	1st series.	2nd series.	3rd series.	4th series.	5th series.
Portland	719	415	910	760	nil
Red	750	690	1120	840	360

1st series: Kept in carbon dioxide for three years, then treated. These tests are very high. 2nd series: Only nine days in carbon dioxide box, then up to three years in solution. 3rd series: Twelve months in carbon dioxide, then two years in solution. Thoroughly carbonated. 4th series: Twelve months in ordinary dry air test room, then two years in solution. Gas burning in the test room would make the carbon dioxide a little higher than in the atmosphere, but these were not thoroughly carbonated. 5th series: One year in a sealed box with burnt lime in it to take up all the water and carbon dioxide, then put into solution. The Portland went wrong in a very few weeks, but the red stood quite a nice test at the three years. These first four tests all point to Portland cement being absolutely proof against the action of sea water if thoroughly carbonated. No. 4 series points to the advantage of keeping cement concrete blocks used so much for pier work, and ferro-concrete piles, as long as possible in the air before putting them into sea water. In the case of dry docks, the construction of which generally occupies over a year, it may be that the effect of the carbon dioxide in the air on the walls is a most important factor in assisting them to resist the action of the sea water to which they will afterwards be subjected.

No. 9 diagram gives some results of tests after being in the malt kiln. These are also interesting, but I am inclined to think that the sulphur coming from the burning coke did some mischief to the tests up to three years.

DIAGRAM No. 9.

Malt kiln tests.

TEST BRIQUETTES when 24 hours old were put into an enclosed atmosphere over a coke fire and afterwards tested.

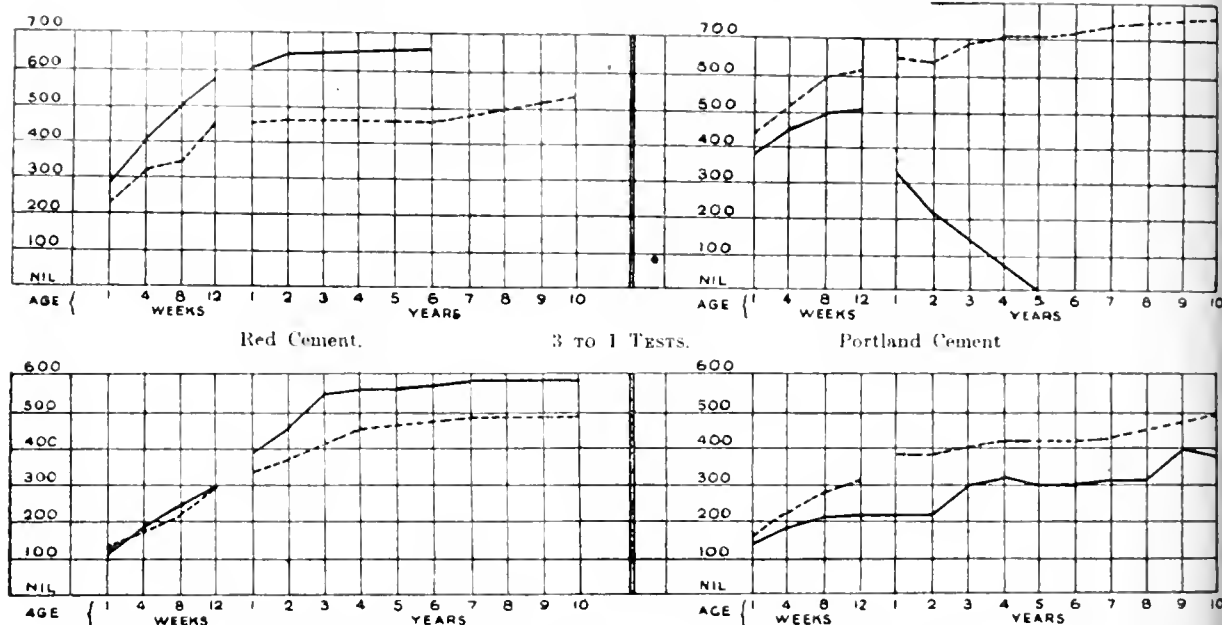
3 to 1.			5 to 1.			
Age of briquettes in weeks.		years.	Age of briquettes in weeks.		years.	
4	2	3	4	1	2	3
337	470	528	175	185	360	300

OTHER BRIQUETTES taken out of atmosphere at stated periods, kept in solution, and then broken as follows:—

Weeks in malt-kiln atmosphere.	3 to 1.			5 to 1.		
	Years in solution.			Years in solution.		
	1	2	3	1	2	3
4 weeks	—	487	505	120	—	—
8 "	—	565	660	—	—	—
12 "	—	900	—	147	150	150
52 "	640	720	575	—	—	—

I can carry these tests on to much longer dates, in particular those in the salt water box in the river, but it appears to me that they have gone on long enough to prove without doubt that the addition of the calcined clay is a most valuable safeguard against the action of sea water in concrete, the long date sand tests all being so high and the 5 to 1 porous briquettes all standing so well both in salt water and in strong solution.

DIAGRAM NO. 10
Comparative Tensile Tests Red and Portland in Salt and Fresh Water.
 Salt Tests— Fresh Tests—
 Red Cement NEAT TESTS. Portland Cement.



Portland cement appears to need a lot of carbon dioxide to make it safe. Red can take a little, but can quite well do without it. Over five thousand tons of red cement have already been used in various works in both sea and fresh water, and the results have been very satisfactory. When mixed with water this concrete is more plastic and sticky than Portland and appears to answer better for under water work. As a substitute for lime mortar for setting bricks it is liked, and the colour of the walls is pleasing to the eye.

Red cement reduces the cost of concrete work, and if it is going to lengthen the life of important and costly marine works, then my time and that of my staff which has been devoted to this subject, will not have been wasted.

It is necessary for me to state that my firm have protected this improvement in order to guard them against unintentional infringement.

DISCUSSION.

Professor HENRY LOUIS asked whether the author had made any analyses of the cements before and after exposure to the action of sea water; the great resistance of the "red cement" suggested that the lime was very rapidly converted into an insoluble silicate. He thought that valuable information might be obtained by a study of the micro-structure of the concrete, and asked if Mr. Potter had any information on this point. He also asked whether any compression tests of the briquettes had been made.

Dr. DUNN considered the Chairman's paper of great interest from a scientific as well as a technical point of view. The deterioration of cement by sea water, when that occurred, had been clearly shown to be due to the reaction upon it of the magnesium salts in the water. His partner, Mr. John Pattinson, had analysed in 1887 a number of samples from the Aberdeen graving dock, which, opened in 1885, was only a couple of years afterwards in a very bad condition through bulging and expansion of the outer walls and consequent leakage. While the briquettes made from the original cement contained on the average 53 per cent. of lime and under 1 per cent. of magnesia, the cement from the deteriorated concrete showed in no case more than 45, and in one as little as 17 per cent. of

lime, while the magnesia was always more than 4, and rose as high as 22 per cent. Direct experiments in which sea water was made to percolate through briquettes of cement and sand also showed that, while in the briquette the lime was diminished and the magnesia increased by the operation, the lime-content of the water was increased and its magnesia-content diminished. The lime in the cement obviously behaved towards these magnesium salts as though it were present as caustic lime; and in order to render the cement inert to sea water it clearly seemed necessary to convert the lime into some other form of combination. This Mr. Potter seemed to have accomplished, both by his carbonating experiments, and in the production of his "red cement," where no doubt the formation of a complex silicate had proceeded. It would be interesting to know whether Mr. Potter had made analyses of his samples, and if so whether these analyses indicated the formation of such compounds as are suggested.

Mr. POTTER in reply said that no chemical analysis had been made of the briquettes after they had been tested. With regard to compression tests, a series was now being carried out, but they had not matured sufficiently to be of any immediate value. Ten years ago compression tests were very unusual and were not as reliable as they were at present.

Scottish Section.

Meeting held at Glasgow on Tuesday, December 8th, 1908.

MR. D. J. PLAYFAIR IN THE CHAIR.

THE ESTIMATION OF SULPHIDE IN ALKALI CYANIDE.

BY THOMAS EWAN, M.Sc., Ph.D.

Several different methods of estimating the small quantities of sulphide which are usually present in potassium and sodium cyanides have been used, which do not always give concordant results. The following

notes contain the results of experiments which have been made from time to time during the past five years in order to discover the nature and magnitude of the errors of the different methods.

In the method which has been in use in the laboratory of the Cassel Cyanide Company for many years, 10 grms. of the powdered cyanide are dissolved in a small volume of water and a solution of lead nitrate is run in from a burette until a drop of the liquid when brought into contact with a drop of the lead nitrate solution, on blotting paper, no longer gives a brown stain. The end point is quite distinct and, provided the test is always carried out in the same way, the results are very concordant. They depend, however, very much on the quantity and quality of the water used to dissolve the cyanide. The following tests, which were all made with the same sample, show this clearly.

TABLE I.

Apparent percentage of potassium sulphide.			
C.c. of water to 10 grms. cyanide.	Unboiled water.	Boiled water cooled in air.	Boiled water cooled in coal gas.
10	0.036	0.0355	—
20	0.029	0.033	0.0355
40	0.025	—	—
50	—	—	0.0275
60	0.0185	—	—
80	0.006	—	—

With 120 c.c. of unboiled water the first few drops of lead nitrate solution gave a brown coloration, which disappeared again before the titration could be finished.

The apparent percentage of potassium sulphide is calculated on the assumptions that the whole of the lead used is present in the precipitate and that the precipitate contains lead and sulphur in the ratio required by the formula, PbS . The first assumption appears to be justified, because a solution in which a titration has been made gives (after filtration) no coloration when sodium sulphide is added to it. The second was tested by collecting and analysing a considerable quantity of the precipitate formed under the conditions of the test; the atomic ratio of sulphur and lead in it was found to be 1:1.008. In another experiment in which a 0.13 per cent. solution of pure sodium sulphide was titrated with lead nitrate the precipitate had exactly the same composition.

From these results it is clear that the sulphide is partly oxidised by oxygen present in the water or taken up during the titration, and that the quantity found, even with the smallest quantity of water, is less than that contained in the solid cyanide. I have attempted to estimate the necessary correction in three different ways.

(a) Solutions containing a known quantity of sulphide were made by adding measured quantities of a solution of sodium sulphide (containing the equivalent of 0.00568 gm. of potassium sulphide per c.c.) to solutions of 10 grms. of pure, sulphur-free sodium cyanide in 15 c.c. of ordinary tap water. Titration with a solution containing 6 grms. of lead nitrate per litre gave the following results:—

TABLE II.

Potass. sulphide added.	Potass. sulphide found.	Difference.
grms. 0.00284	grms. 0.0022	per cent. 23
0.00568	0.00454	20
0.00852	0.0068	20

The solution of sodium sulphide was, of course, tested just before using it, and the titrations with lead nitrate made as quickly as possible, that is in 3½ to 4 minutes.

The effect of making up all the solutions with water which had been well boiled and then cooled out of contact with air and which were only exposed to air during the titration was then tried.

III.

Two titrations of a solution of sodium sulphide (1.29 grms. per litre) gave 1.11 and 1.13 grms. The mean is 1.12 per cent. too low.

Three other tests in which 10 grms. of pure sodium cyanide were dissolved in 25 or 50 c.c. of this solution before titration gave 1.18 and 1.20 grms. (25 c.c.) and 1.13 grms. (50 c.c.). The mean is here 9.3 per cent. too low.

The reaction which takes place between sulphide and oxygen in presence of cyanide is $K_2S + KCN + H_2O + O = 2KOH + KSCN$ (compare Chief Inspector of Alkali Works, 42nd Report, 1905, p. 31), and therefore the 0.15 mgrm. of oxygen contained in 15 c.c. of water saturated with air at 15° can oxidise 1.05 mgrm. of potassium sulphide. The deficits of sulphide in the experiments of Table II. are 0.64, 1.14 and 1.7 mgrms. respectively, and, since the strong cyanide solutions used contain considerably less dissolved oxygen than an equal volume of water, it is evident that atmospheric oxygen must be taken up during the titration, and for this reason the error is not eliminated by the use of boiled solutions but merely diminished. This is seen to be the case in the experiments under III., which also show that the presence of cyanide hardly affects the amount of oxidation.

(b) The effect of the time required for the titration and of the quantity of water employed were studied more carefully, 1 c.c. of the lead nitrate solution used was equivalent to 1 mgr. K_2S .

In Table IV. the time which elapsed from adding the water to the cyanide to beginning the titration is given under "Dissolving"; 15 c.c. of tap water at 12° and 10 grms. of a sample of sodium cyanide were used in each case.

TABLE IV.

Dissolving (minutes).	Titration (minutes).	C.c. lead nitrate used.	Loss per minute.
2	3.5	1.03	0.0015
10	4	1.01	
63.5	3.5	0.93	0.00025
97.8	4	0.70	

In the next set the cyanide was first dissolved (10 grms. in 15 c.c.), some lead nitrate was then added, and the mixture allowed to stand for some time before finishing the titration.

TABLE V.

Dissolving (minutes).	Initial c.c. lead nitrate added.	Minutes in presence of lead.	Total c.c. lead nitrate used.	Loss per minute.
2	—	3.5	1.03	0.016
1.5	0.52	13	0.87	
2.5	0.52	24	0.70	0.015
2	0.52	48	0.61	0.0037
2.5	0.20	966	< 0.20	

In the last test no sulphide was left in the solution and the brown colour produced by the lead nitrate added had almost disappeared. It will be noticed that the initial rate of oxidation is increased about tenfold by the addition of lead nitrate.

A further set of tests was made to determine the effect of the quantity of water used, the time required for each operation being noted.

TABLE VI

C.c. of water.	Dissolving (minutes).	Titration (minutes).	C.c. lead nitrate used.	Loss per c.c. water.
15	2	4	0.9	0.91
15	1.5	4	0.92	
17.5	2	3	0.97	
17.5	1.5	4	0.96	0.97
25	2.5	4	0.87	
35	1.5	3.5	0.75	
50	2.5	2.5	< 0.55	0.012

In the last test the colour of the lead sulphide disappeared before the titration could be finished. That the test with 17.5 c.c. of water gives a higher result than those made with 15 c.c. is due to the latter quantity being insufficient to dissolve the cyanide at the low temperature used.

These results show that small variations in the time required to dissolve the sample do not appreciably affect the result; variations in the time of titration are more important, but, since the greater part of the lead solution can always be run in quickly, the time required is always approximately the same. The results of Table VI. show that, under the conditions of the test, 1 c.c. of water oxidises sulphide equivalent to 0.012 c.c. of the lead nitrate solution; if the quantity of water could have been reduced to zero, therefore, 1.18 c.c. of lead solution would have been used and the two first results are 23 per cent. and 18 per cent. too low respectively.

(c) An estimation of the sulphide in a sample of cyanide was made under conditions which exclude the possibility of oxidation. Twenty grms. of sodium cyanide were dissolved in a 0.2 per cent. solution of lead nitrate through which hydrogen had been passed until it was quite free from dissolved oxygen; the resulting precipitate of lead sulphide and basic lead cyanide was filtered off on a Gooch crucible and washed with the lead nitrate solution, the whole of the operations being carried out in an atmosphere of hydrogen. The precipitate was then oxidised and the sulphur in it weighed as barium sulphate. In this way the sample was found to contain sulphide equal to 0.046 per cent. of potassium sulphide. A direct titration made by dissolving 10 grms. of the cyanide in 15 c.c. of ordinary unboiled water and titrating as quickly as possible with lead nitrate (6 grms. per litre) gave 0.034 per cent. of potassium sulphide. The deficiency is here 26 per cent. of the sulphide actually present.

The three methods of ascertaining the error of the test agree, therefore, in showing it to be from 18 per cent. to 26 per cent. of the sulphide present when it is carried out in the following way:—10 grms. of the powdered cyanide are stirred quickly with 15 c.c. of ordinary water breaking up any lumps with a glass rod, any small undissolved residue usually goes into solution during the titration; the lead nitrate solution is then run in quickly so long as it produces a visible increase of colour, after this it is added gradually, the solution being tested by placing drops of it in contact with drops of the lead nitrate solution absorbed by thick blotting paper. The result is corrected by multiplying it by 1.25 or, more simply, by using a lead nitrate solution containing 2.4 grms. per litre and taking 1 c.c. of it as equivalent to 0.01 per cent. of potassium sulphide in the cyanide.

In this form a complete test can be made in about 10 minutes, and the results are accurate to 2 or 3 units in the third place of decimals, which is quite sufficient for all practical purposes.

Colorimetric methods.—In one modification of this method a solution of sodium plumbite, made by dissolving 60 grms. of lead acetate and 90 grms. of caustic soda in 1 litre of water, is added to the sulphide solution to be tested and the colour matched by adding a standard solution of lead nitrate to a solution containing an excess of sulphuretted hydrogen or of sodium sulphide, the two solutions being placed in cylinders of the same diameter filled to the same depth in the usual way. The assumption made is that when the depth of colour of the two solutions is the same they will contain the same quantity of lead sulphide. This is by no means the case. For

example, solutions containing sodium sulphide equivalent to 0.0006 gram. of potassium sulphide were treated with 2, 5, 10, and 20 c.c. of the alkaline lead solution and the colour matched by adding a solution of lead nitrate (0.15 gram. per litre) to a solution containing 0.015 gram. of sodium sulphide (total volume in each case=60 c.c.). The quantities of the lead nitrate solution required were 15.1, 11.8, 12.4, and 10.4 c.c. respectively. Again, solutions containing 10 grms. of potassium cyanide and 0.0015 gram. of potassium sulphide were treated with 50 c.c. and 5 c.c. of the alkaline lead solution and matched against a solution containing sulphuretted hydrogen equivalent to 0.425 gram. of potassium sulphide. The quantities of lead nitrate solution required were 15.1 c.c. in the one case, and 21.0 c.c. in the other. The quantity of sulphuretted hydrogen or of sodium sulphide used in the comparison solution also affects the result, for example, solutions containing 0.0006 gram. of potassium sulphide and 1 c.c. of the alkaline lead solution in 60 c.c. were matched against solutions containing 0.015, 0.03, and 0.075 gram. of sodium sulphide; 14.8, 12.4, and 10.9 c.c. of the lead nitrate solution were required in the three cases. The difference is not so large when different quantities of sulphuretted hydrogen are used, but it is in the same direction. Finally, the depth of colour is not the same in solutions of sodium sulphide and of sulphuretted hydrogen, two solutions containing sulphide equivalent to 0.033 gram. of potassium sulphide, were prepared: the one contained sulphuretted hydrogen, the other sodium sulphide; 10 c.c. of the lead nitrate solution added to the first gave the same depth of colour as 13 c.c. added to the second.

In all these experiments the solutions were made up just before use with water which had been boiled and cooled out of contact with air. It follows that the depth of colour of the lead sulphide is affected by the nature and quantity of the other constituents of the solution. Comparisons of colour are only possible so long as the lead sulphide remains colloidal. Linder and Pieton's work on colloidal arsenic sulphide (*J. Chem. Soc.*, 1895, 63, and 1905, 1914) suggests that the colloidal lead sulphide consists of complex molecular aggregates $n(\text{MPhS.H.S})$, in which the hydrogen is replaceable by metals. The colour would then depend on the values of n , m , and on the nature of the sulphide combined with the lead sulphide, which would, in their turn, depend on the nature of the substances present in the solution. Hence a reliable colorimetric estimation can only be made when the two solutions have the same composition. This condition is fulfilled in the ingenious method described by G. W. Williams (*J. Chem. Metall. and Min. Soc., S. Africa*, 1905, 6, 170; this *J.*, 1906, 137). Two equal quantities of the cyanide are dissolved in boiled water, the sulphide is removed from one of them by shaking with lead carbonate and filtering, the same quantity of alkaline lead solution is then added to each and the colour matched by adding a standard solution of sodium sulphide. Another advantage of the method is that atmospheric oxygen acts approximately equally on the two solutions, and therefore the error due to this source is eliminated to a great extent.

A sample of potassium cyanide tested by this method gave 0.0309 and 0.0296 per cent. of potassium sulphide, whereas the direct titration method described above gave 0.0246 and 0.0240 per cent. of potassium sulphide, or, after correction by multiplying by 1.25, 0.0307 and 0.0300 per cent. of potassium sulphide. The sample used in the experiments of Table VI. gave 0.013 per cent. of potassium sulphide by Williams' method, 0.012 per cent. of potassium sulphide by direct titration. The agreement is as good as could be desired.

A few experiments were made with the method described by W. Feld (this *J.*, 1903, 1068), in which the sulphide solution is distilled with excess of magnesium chloride in a current of carbon dioxide, the sulphuretted hydrogen evolved being absorbed in a known quantity of iodine solution acidified with hydrochloric acid. The apparatus used was that previously described (this *J.*, 1904, 244) with the addition of a set of potash bulbs containing iodine solution and a second I-tube containing a little $N/10$ sodium thiosulphate. In order to see whether any oxidation of sulphide takes place in the distillation,

a solution of sodium sulphide was (I.) precipitated with pure zinc chloride and the sulphur in the filtrate estimated, after oxidation, as barium sulphate. II. Another portion of the solution was run into a boiling solution of magnesium chloride and boiled until free from sulphuretted hydrogen, the residual sulphur being estimated as barium sulphate; (III.), a third portion was treated in the same way after adding a solution of 10 grms. of pure crystallised $\text{NaCN} \cdot 2\text{H}_2\text{O}$ in boiled water to it. The results were:—

Sodium sulphide used.	Residual sulphur calculated as sodium sulphide.		
	I.	II.	III.
grm.	grm.	grm.	grm.
0.162	0.0013	0.0024	0.0037
0.013	0.0005	0.0002	0.0001

It appears, therefore, that the sulphuretted hydrogen can be expelled quantitatively, and provided that a sufficiently long train of absorbing vessels is used it is easy to absorb it in the iodine solution. For example, in one test 0.0736 grm. of sodium sulphide was distilled and 0.0740 grm. found from the iodine used.

SUMMARY.

Of the three methods discussed the direct titration of sulphide by means of lead nitrate is the most rapid and simple; suitably corrected it is sufficiently accurate (for quantities of potassium sulphide under 0.1 per cent.). G. W. Williams' modification of the colorimetric method is more accurate, but it is slower, owing to the necessity of using boiled water and checking the strength of the standard sodium sulphide solution at frequent intervals. (A solution containing 2 grms. of potassium sulphide per litre, for example, lost 28 per cent. in 18 hours.) W. Feld's method is the most accurate, but it is far too slow for works' purposes, and it can only be used by a skilled operator.

I have pleasure in acknowledging Mr. Thomas Napier's skilful assistance in some of the analytical work. I am also indebted to the directors of the Cassel Cyanide Company, Ltd., for permission to publish the results.

Yorkshire Section.

Meeting held at Leeds on Monday, November 9, 1908.

MR. WALTER M. GARDNER IN THE CHAIR.

SOME CHEMICAL ASPECTS OF THE TEXTILE INDUSTRIES.

BY W. M. GARDNER.

Abstract of Chairman's Address.

In a great variety of manufactures the raw material is converted into the finished product by processes which in their essence are mechanical or chemical. More usually both mechanical and chemical operations are involved, and the two are frequently so intimately blended that the processes cannot be defined as either chemical or mechanical. For example, the manufacture of soap must be classed as a chemical industry, but the conversion of esparto grass into paper is chiefly based on mechanical treatment though involving some chemical processes, while the mechanical engineer is concerned almost exclusively with mechanical operations, though in many directions he is bound to make incidental incursions into chemical science.

The manufacture of a textile fabric is another case in which both chemical and mechanical operations are usually involved, though what may be termed the fundamental operations are mechanical. In the carding or combing and spinning processes the raw fibrous material is transformed into a coherent thread and by subsequent more

or less complex interlacings of individual threads, the woven fabric is produced. Since natural fibrous raw materials are available, a piece of cloth may thus be produced without the intervention of any chemical process whatever, and in attempting to show the great field which exists for industrial chemistry in connection with textile manufactures, one cannot be charged with selecting an industry to which chemical manipulation is fundamental.

I have selected the textile trade partly for this reason, but mainly because it is the one of which I have the most intimate chemical knowledge, and my object is to make some contribution to the discussion of the most interesting points which have been very prominently raised in recent addresses.

Much has been heard during the last few years about the decadent condition of the British chemical industries, and it has to be admitted that many notable examples can be adduced in which chemical trades, originated in this country, have been almost entirely lost to us. This has been frequently dealt with, and its causes analysed by those much more competent than I am, and my only reason for again mentioning a fact which we all deplore is to express the opinion that undue prominence given to our failures is very apt to depreciate the value of the great amount of energetic and successful work which has been and is being done in other directions.

In discussing this matter it is obviously necessary to define what is meant by the chemical industries, and this may be conveniently done by a reference to the subjects dealt with in our JOURNAL, and I claim that much misrepresentation has arisen from want of care in using this term. Surely "the shadow of the cypress" does not rest on the whole of the great industries officially recognised by this Society as chemical industries, and even as regards the minor industry (from the chemical point of view) of textile manufacture, it is easy to show that an enormous expansion of the chemical side has taken place in recent years and that an ever increasing number of well-trained chemists is in demand.

In his most interesting and valuable Presidential Address to the Chemical Society in 1907, Prof. Meldola made an eloquent and well reasoned appeal for increased facilities to be provided for the carrying out of research work in chemistry at the many Technical Colleges and Polytechnics which are provided with well-equipped laboratories. Speaking as he was to the representatives of pure chemistry, Prof. Meldola obviously had in view chemical research as distinct from technical research, and he emphasises the necessity of a training in research and the development of the research spirit which is all important in the working out of new processes.

In regard to many branches of the textile industries it is very satisfactory to be able to say that in several of the larger Technical Colleges much work in the nature of technical research is carried out by the advanced students and is often followed up by investigation for improving or cheapening processes when the students obtain positions in works. In this way both staff and students are being kept in intimate contact with the industries concerned.

In connection with this question of research work it may be interesting to record that at any rate some of the local education authorities who are now mainly responsible for the Technical Colleges, are realising the responsibility resting upon these Institutions to add their quota to the sum of knowledge; and in the Institution over which I have the honour to preside (the Bradford Technical College) a highly qualified lecturer has recently been appointed specifically to devote his time to chemical research.

Turning now to a short review of the chemical industry of textile manufactures, it may be fairly claimed that the chemist has made some remarkable contribution both as regards the actual provision of raw materials, the production of new decorative effects, and in imparting new and valuable properties to fabrics.

In the matter of raw material one textile fibre, artificial silk, is of purely chemical origin. It is invariably made from cellulose as a raw material, this being brought into solution in various ways and subsequently regenerated in the form of fine filaments. Chardonnnet's original

process (1889) was to convert cellulose into the tri- and tetra-nitrate, which was dissolved in alcohol-ether; the solution was then forced through very fine orifices into a heated chamber, which volatilised the solvent. The filaments were then "denitrated" in various ways.

The great defects of artificial silk as a textile raw material have been its low strength, its poor covering power, and the difficulty found in its manipulation, but these defects have now been largely eliminated.

The chemist has also enriched the textile industries by the production of what is practically a second new fibre by the invention of the "lustreing" of cotton by mercerisation. This process, which imparts to cotton very much the appearance of silk, was initiated and developed in this country. The dyeing properties of the mercerised cotton also differ materially from those of ordinary cotton.

Other chemical treatments of the various textile fibres are employed for producing special effects or special properties. For example, by different treatments the dyeing properties of fibres may be entirely altered. In response to the offer of a prize of £10, Messrs. C. F. Cross and Briggs submitted a process by which cotton may be made to resist (that is, will not dye with) direct colours such as the benzidine dyes. The process consists in treating the cotton with acetic anhydride, acetyl chloride, and zinc chloride, and the acetylated cellulose has quite peculiar and valuable properties in several directions. The discovery of this process has no doubt been of considerable service to the patentees as well as to the trade generally, and this example may serve to illustrate the nature and value of chemical research of a technical nature as applied to the textile industries and incidentally the value of bringing the trade problems to the notice of chemists by means of journal publication.

Other directions in which chemical treatment of fibres has been of great value are the production of unshrinkable wool fabrics and unflammable cotton materials, both of which have been the subject of a great amount of technical research before success was attained.

Wool washing is the process of removing from wool fibre the natural grease with which it is encrusted. This is done by emulsifying the grease by means of a solution of soap and alkaline carbonate. The process gives rise to very large volumes of waste liquors which contain much free and combined fat. If these liquors are run into the sewers in considerable quantity they greatly complicate the work of the sewage engineer, as in fact is the case in Bradford, where about £12,000 per annum

is expended for sulphuric acid with which to separate the fatty matter from the sewage.

The recovered fat has a value of about £5 10s. to £6 per ton and about 40 tons per week is recovered from the Bradford sewage. In the larger wool-washing works, the suds are treated before running to waste, and the grease converted into soap, lubricating oil, and lanolin. In one works in Bradford (not the largest) as much as 50 tons of grease per month is recovered, its value being £9 to £10 per ton. This is a particular case of the large chemical question of the treatment of effluents, in which direction much investigation is proceeding and which is one of the important features of the work of a chemist in textile works.

Leaving aside the chemical work involved in such processes in textile manufacture as bleaching, dyeing, printing, etc., which is too extensive a subject to be touched upon, reference may finally be made to one most important branch of the work of a chemist in any textile works, viz., the investigation of defects which may arise at any stage of manufacture.

The work involved in such investigations is often of great interest and of very wide scope. It frequently happens that any solution of the difficulty is impossible in the absence of an acquaintance with the whole range of operations—mechanical as well as chemical—through which the material has passed. It is in fact research work of no mean order and the carrying out of such work by advanced students is the most valuable kind of training. From its very nature much of the work is unsuitable for publication and commercial considerations usually prohibit publication in any case. It appears to me, however, that in carrying out technical research of this character, works chemists and Technical Colleges are fulfilling their truest function. In the case of teaching institutions it provides for the all important necessity of keeping in close touch with the industries they serve.

If it were possible to give publicity to investigations of this character, I feel sure that criticisms of the small amount of original work carried out in Technical Colleges would not be so severe.

I have attempted to show that even in apparently remote directions, such as the textile trade, there is a wide scope for chemical research and abundant opportunity for the employment of well trained (if specially trained, chemists. Chemistry is permeating the textile industry and the outlook for the future of this great industry is very hopeful, even from the chemical student's point of view.

Journal and Patent Literature.

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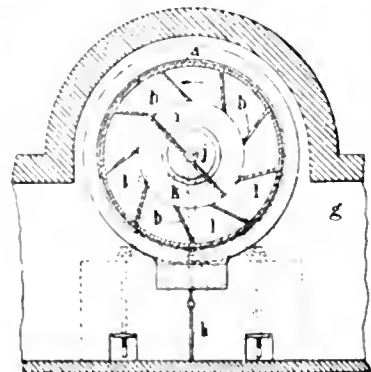
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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Dryer: A mechanical rotary or revolving — for removing and expelling moisture from megass, sawdust, sand, and particles of various substances. L. Jones, London. Eng. Pat. 25,131, Nov. 13, 1907.

A DRUM, *a*, provided with vanes, *b*, forming compartments, *l*, is rotated in a flue, *a*, through which the heating medium is transmitted. By means of a damper, *h*, the volume of heating medium passing round the drum may be regulated. The material to be dried is fed through an opening in the end of the drum on to a distributor-plate, *i*, which can be rotated about the axis, *j*, by the external lever, *k*. When charging, the distributor is fixed in the inclined position shown, and the material falls into the compartments, *l*, as they pass below its lower edge. When half the compartments are charged the feeding is stopped, and the rotation continued. As each compartment attains



the highest position, its contents are dropped on to the distributor, *i*, and are conducted into the compartment

opposite. When the drying is complete, the distributor, *i*, is turned into the horizontal position and the contents of the compartments are successively dropped on to the plate, *i*, from which they are removed; the plate, *i*, is then turned into a sloping position again and the drum is recharged without stopping its rotation.—W. H. C.

Filtering machines. G. Ridgway, Kalgoorlie, W. Australia. Eng. Pat. 5830, March 16, 1908.

The claim is for improvements in the filter described in Eng. Pat. 11,623 of 1906 (this J., 1906, 989). A number of groups of filter-frames, formed of perforated pipes bent into a U-shaped frame, which is covered with filter-cloth and kept distended by coir matting placed in the interior, are supported by chains from a circular framework, which is rotated on rollers and rails above an annular tank. The latter is divided into four compartments which serve respectively for the pulp to be filtered, the washing liquid, and as a drying and a discharge chamber. The ends of the U-shaped pipes of each group of filters are connected by flexible tubes to the radial arms of a central hollow shaft or chamber, so that the frames are successively connected automatically to a vacuum pump and to a supply of compressed air. The frames pass slowly through the pulp which is kept agitated in the trough, and the liquid is sucked through by the vacuum, leaving the solids as a cake on the surface of the filter-cloth. As the groups of frames approach the partitions, they are lifted over them by an arrangement of quadrants and rollers and again lowered into the next compartment. After washing and drying, the vacuum is automatically cut off, and compressed air is admitted into the interior of the frames as they pass through the discharge compartment. At the same time a supply of water from the central shaft is admitted to a chamber at the top of each frame and flows down the surface of the cloth on each side, and the latter is also sprayed with water on both sides from a number of jets; this causes the cake of solid matter to peel off, and the frames are ready to pass into the pulp collecting again.—W. H. C.

Pressure-filter. C. W. Merrill, Lead, S.D. U.S. Pat. 905,341, Dec. 1, 1908.

The claim is for a filter-press provided with direct inlet and outlet pipes to the chambers, so arranged that when the outlet pipe is open, a supply of cleansing medium is introduced into the chambers under pressure, to drive out the solid matter.—W. H. C.

Pumps; Centrifugal —. Allgem. Elektrizitäts-Ges., Berlin. Eng. Pat. 21,470, Oct 10, 1908. Under Int. Conv., Jan. 30, 1908. Addition to Eng. Pat. 14,439 of 1907, dated June 25, 1906.

In order to increase the pressure on the entrained fluid and at the same time to diminish the friction on the entraining fluid, the channels in the stationary conducting ring are constructed with converging walls for a portion of their length and with parallel walls for the remainder of their length. In order to entrap more of the entrained fluid, the passages are combined in pairs so as to have a common inlet.—W. H. C.

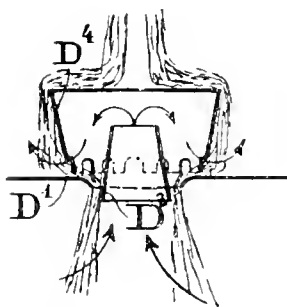
Crystalline substances; Method of recovering — from liquor and drying the same. E. Ordway, New York. U.S. Pat. 905,568, Dec. 1, 1908.

The liquor is concentrated in a vacuum evaporator and is circulated along with the separated crystals through a closed collecting tank. The crystals are retained in the tank by a perforated plate or shelf, and the liquor returns to the evaporator. When the collecting tank is sufficiently filled with crystals, the inflow of liquor is stopped and the liquor in the tank is drained back into the evaporator. Connection with the evaporator is then closed and the crystals are dried in the collecting tank, before removal, by passing a current of heated drying medium through the tank.—W. H. C.

Evaporators; Continuous single or multiple effect —. E. Jolicard. Fr. Pat. 392,616, Sept. 30, 1907.

The evaporating tubes may be vertical or inclined, and rotating metallic brushes, scrapers, or flexible plates, are provided inside the tubes for stirring the liquid to be treated, or the powder produced. The application of such evaporators or parts thereof, is claimed for the pasteurisation or sterilisation, heating, cooling, concentration, and desiccation of liquids.—C. J. G.

Still. E. Flick. Fr. Pat. 392,674, July 18, 1908.



The plates, *D*₁, of the column surmounting the still are provided with holes, each of which has a suitably shaped cover, *D*₄, and a steam inlet, *D*₃. The liquid trickles over the outside of *D*₄, as shown by the arrows, the ascending steam being thus forced through the ring of liquid between *D*₃ and *D*₁. The application of the apparatus to the manufacture of formic acid is described.

—C. J. G.

Separating solid particles from a fluid or from each other; Apparatus for —. K. and A. Wärd, Stockholm. Eng. Pat. 5224, March 7, 1908.

SEE Fr. Pat. 388,103 of 1908; this J., 1908, 886.—T. F. B.

Hydro-extractor. H. Diamanti and N. Beuf, Beaulieu, France. U.S. Pat. 905,297, Dec. 1, 1908.

SEE Eng. Pat. 14,764 of 1907; this J., 1908, 72.—T. F. B.

Drying; Centrifugal machine for —. A. J. Ericsson, Assignor to Aktiebolaget Separator, Stockholm. U.S. Pat. 905,860, Dec. 8, 1908.

SEE Eng. Pat. 16,003 of 1906; this J., 1906, 1136.—T. F. B.

Evaporator or heater; Vacuum —. J. E. and F. M. Dunn, Santiago, Cuba. U.S. Pat. 906,517, Dec. 15, 1908.

SEE Fr. Pat. 384,264 of 1907; this J., 1908, 435.—T. F. B.

Evaporator. O. Faller, Basle, Switzerland. U.S. Pat. 907,109, Dec. 15, 1908.

SEE Eng. Pat. 24,737 of 1905; this J., 1906, 682.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Coals; Philippine —. A. J. Cox. Eng. and Min. J., 1908, 86, 1058–1059.

RESULTS are given of the investigations made by the Bureau of Science, Manila, on the quality of Philippine coals. The coals occur abundantly on Batan Island, Cebu, Polillo, and elsewhere, and show a remarkable uniformity throughout. They resemble in appearance a bituminous coal, but have a rather lower calorific value, are entirely non-caking, and form no clinker. They contain from 35 to 46 per cent. of volatile combustible matter and 2.5 to 6 per cent. of ash. They are a little inferior to the Australian and Japanese coals at present imported, but will be able to compete successfully with them when the cost of inland transport has been reduced. The author considers that the coals obtained from nearer the surface are chiefly suitable for use in gas producers, and the deeper deposits for steam raising, though, owing to their non-caking properties, it may be advisable to mix a small proportion of a caking coal with them. Tables of analyses, etc., are given.—F. R.

Anthracite producer practice; Notes on —, G. S. Stone, J. Industrial and Eng. Chem., 1909, 1, 11-13.

NOTES of experiments, made under working conditions of an anthracite producer gas-plant connected with a spelter furnace, are given. The useful effect of producer gas is shown to depend on the steam supplied to the producer, the thermal capacity of the gas, and the composition and thermal capacity of the waste gases at the furnace temperature, as well as on the calorific power of the gas. It was found that the useful effect in the spelter furnace varied almost directly as the percentage of carbon monoxide in the producer-gas and not as the calorific power of the gas nor as the net heating power under furnace conditions. A table is given with the analyses of the gases, and the heat balance of the furnace, for each experiment. —J. H. J.

Safety explosives; Tests with —, Beyling, See XXII.

PATENTS.

Fuel, artificial; Treatment of coal for the production of —, F. V. Hadlow, Buxted, Eng. Pat. 3189, Feb. 13, 1908.

ARTIFICIAL fuel is produced by mixing coal in a pulverised condition with an alkali silicate solution and a solution produced by adding lime to an aqueous solution of sugar, and water in sufficient proportion to ensure that the product shall be hard, waterproof, and free from smoke and dust when burned. —E. C.

Briquetting carbonaceous materials; Method of —, W. T. Griffin, Limoges, France; J. E. Blake, I. S. Graves, and C. H. Clarke, executors of W. T. Griffin, U.S. Pat. 905, 693, Dec. 1, 1908.

THE carbonaceous materials are first heated until the water and lighter hydrocarbons are driven off and the material has assumed a semi-plastic condition, but is not coked. It is then slightly cooled and compressed into briquettes. If two different kinds of material are used, one of which contains a larger proportion of bituminous matter than the other, they are separately heated to different temperatures and when one of them is in the semi-plastic condition, they are mixed together and briquetted. —W. H. C.

Fuel, artificial; Manufacture of —, The Calor Co., Ltd, Fr. Pat. 393,218, Aug. 11, 1908, Under Int. Conv., Feb. 6, 1908.

BRIQUETTES are prepared from powdered coal, lignite, etc., with the aid of chlorinated liquid hydrocarbons as binding agent. The binding agent is prepared by treating suitable liquid hydrocarbons, e.g., coal tar, with bleaching powder, with or without subsequent addition of lime, or with sulphur chloride or chlorine gas, with subsequent addition of lime. —A. S.

Alcohol; Dehydrated, for use in motor-cars and boats and other internal combustion engines and for lighting and heating, J. Novel, First Addition, dated July 25, 1908, to Fr. Pat. 380,310, July 27, 1907 (this J., 1908, 14).

ALCOHOL is distilled in presence of acid (e.g., 20 per cent. of sulphuric acid), to which may be added ether or acetone as carburising agents. —F. C.

Gas; Manufacture of — from tar, oil, and similar substances, F. G. L. Rincker and L. Wolter, Fr. Pat. 393,114, July 28, 1908.

THE essential feature of the invention, is the introduction of steam into the gas generator, after the introduction of the combustible materials on to a bed of glowing fuel therein, whereby the proportion of nitrogen in the gas is diminished and a richer gas, containing hydrogen, is obtained. The fuel (tar, oil, etc.) and steam are introduced at the upper end, and the gas is withdrawn from the lower end of the generator. —F. C.

Gases; Purifying and cooling hot —, Soc. Anon. des Hauts Fourneaux, Forges et Aciéries de Pompey, Fr. Pat. 392,758, Oct. 5, 1907.

HOT gases, especially those from blast-furnaces, are passed through an apparatus consisting of a number of vertical tubes, enclosed by concentric jackets. The gases pass through the jackets and outside the tubes, through which air is continuously passing in a direction opposite to that of the gases. Entrained moisture is thus condensed, and this in turn assists in the deposition of dust suspended in the gases. —C. J. G.

Incandescent gas mantles; Manufacture of —, J. T. Robin, Streatham, from S. Salomon, Hamburg, Germany, Eng. Pat. 25,657, Nov. 19, 1907.

THE collodionised mantle is dipped in a solution similar to the impregnating solution used in the earlier stages of its manufacture, for example, a 25 to 50 per cent. solution of thorium nitrate containing a small percentage of cerium nitrate. When the mantle so treated is burnt off, the nitrates in the coating are converted into oxides; the coating mends any fractures which may have been formed during handling or transport. —A. T. L.

Arc lamp electrode, H. S. Hatfield and F. M. Lewis, Brighton, England, U.S. Pat. 904,532, Nov. 24, 1908.

AN electrode for enclosed arc lamps is composed of carbon, calcium fluoride, and carborundum. The addition of the fluoride and carborundum improves the steadiness of the light. The relative proportions of the calcium fluoride and carborundum are as 8:5. —A. T. L.

Retort for the distillation of coal; Vertical —, H. W. Woodall, Wimborne, and A. M. Duckham, Parkstone, Assignors to Isbell-Porter Co., Newark, N.J., U.S. Pat. 906,597, Dec. 15, 1908.

SEE Eng. Pat. 24,695 of 1906; this J., 1907, 1271. —T. F. B.

Gas producing apparatus, G. Marconnet, Paris, U.S. Pat. 906,441, Dec. 8, 1908.

SEE Fr. Pat. 370,301 of 1906; this J., 1907, 310. —T. F. B.

Gas; Process and apparatus for the production of —, W. H. Frost, Fr. Pat. 393,044, Aug. 8, 1908.

SEE U.S. Pats. 900,010 and 900,011 of 1908; this J., 1908, 1052. —T. F. B.

Blast furnace, generator, and other gases; Centrifugal apparatus for purifying —, A. J. Dudgeon, London, From Soc. Anon. John Cockerill, Seraing, Belgium, Eng. Pat. 13,563, June 25, 1908.

SEE Fr. Pat. 391,201 of 1908; this J., 1908, 1104. —T. F. B.

Incandescent mantles; Method of producing —, British Cerofirm Co., Ltd., London, From Cerofirm Ges., Berlin, Eng. Pat. 2210, Jan. 31, 1908.

SEE Fr. Pat. 386,549 of 1908; this J., 1908, 742. —T. F. B.

[Metallic filaments] *Plastic mass from tungsten compounds; Manufacture of a —*, Siemens and Halske A.-G., Berlin, Eng. Pat. 11,710, May 29, 1908, Under Int. Conv., Aug. 3, 1907, Addition to Eng. Pat. 16,489 of 1907.

SEE Second Addition to Fr. Pat. 378,743 of 1907; this J., 1908, 1104. —T. F. B.

Metallic filaments; Method of removing carbon from —, W. von Bolton, Charlottenburg, Assignor to Siemens and Halske A.-G., Berlin, U.S. Pat. 905,402, Dec. 1, 1908.

SEE Eng. Pat. 11,524 of 1908; this J., 1908, 849. —T. F. B.

Arc-light electrode, B. Monasch, Berlin, Assignor to General Electric Co., New York, U.S. Pat. 905,557, Dec. 1, 1908.

SEE Eng. Pat. 20,330 of 1905; this J., 1906, 747. —T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Benzine [petroleum spirit]; Commercial —. M. Rakusin, Caoutchouc et Gutta-Percha. 1908. 5. 2504—2512.

THE author describes briefly the manufacture, properties, applications, and methods of storing and transporting commercial benzine.

Viscosity numbers (Engler) and flashing and burning points in oil mixtures; A comparison of the calculated and determined —. H. C. Sherman, T. T. Gray, and H. A. Hammerschlag. J. Industrial and Eng. Chem., 1909, 1, 13—17.

It was found that in mixtures of two petroleum lubricating oils, or of one petroleum oil with a fatty or sperm oil, the Engler viscosity numbers and the flashing and burning points were always lower than those calculated from the percentages of the constituents, assuming those properties to be additive like the specific gravity. The difference between the calculated and observed results, increased with the difference in properties of the two constituents. In some cases the difference between the two results was greatest in the case of the mixture containing equal amounts of the two constituents, but in general the difference was greatest when the mixture contained the least amounts of the lighter or low-test oil.—J. H. J.

Methyl alcohol; Dehydration of commercial —. J. Gyr. See XX.

PATENTS.

Tar; Distillation of —. T. Wilton, Beckton, and G. Wilton, London. Eng. Pat. 26,910, Dec. 5, 1907.

TAR is freed from water, before distillation in pot stills, by heating to about 130° C. under a pressure of 30 lb. per sq. in., and then reducing the pressure so that the water is liberated as steam without liberating the main volatile constituents of the tar. The process is carried out by forcing the tar through a heated coil, from which it is delivered in a thin stream into a chamber at a lower pressure. The steam and vapour are condensed to recover the light oils, and the tar is fed into the stills.

—A. T. L.

Peat; Combustion of — for the manufacture of ammonium sulphate. E. Dromain. Fr. Pat. 392,979, Oct. 12, 1907.

FLUES, such as simple trenches covered with iron plates, are constructed in the peat-bog itself or its immediate vicinity, and in these the peat is burned. The flues extend to the ammonia-recovery plant, and artificial draught may be necessary if the distance be great; they are packed with "dry" peat overlaid by wet peat. —F. SOON.

Rust-preventing and lubricating agent [from mineral oils]; Preparation of a —. F. W. Klever, Ger. Pat. 204,906, April 4, 1906. Addition to Ger. Pat. 174,906 (see Eng. Pat. 27,254 of 1905; this J., 1907, 86.)

By means of the alkali salts of the fatty acids of castor, hemp, palm, rape, cottonseed, sesame, or olive oils or of resin acids, and alcohols of high boiling point, emulsions can be prepared from petroleum illuminating oils or any other mineral oils of higher density, by the process described in the main patent.—A. S.

Petroleum and other liquids capable of volatilisation; Rectification and fractional separation of crude —. E. Guillaume, Paris. Eng. Pat. 15,267, July 18, 1908. SEE Fr. Pat. 390,119 of 1907; this J., 1908, 1013.—T. F. B.

Powders, tablets, etc., completely soluble in water; Preparation of — containing substances originally insoluble. Fr. Pat. 392,478. See XX.

IV.—COLOURING MATTERS AND DYESTUFFS.

PATENTS.

Halogen indigo derivatives; Manufacture of —. O. Imray, London. From Farbwerke vorm. Meister, Lucius, and Brüning, Hoechst a/Main, Germany. Eng. Pats. 25,513, Nov. 18, 1907, and 26,276, Nov. 27, 1907.

By treating dihalogen-indigos with an excess of bromine in the cold or whilst gently heating, greenish-black, highly brominated products are formed, which, when treated with hydrogen bromide or agents capable of eliminating bromine, become blue, yielding dyestuffs which dye greener and clearer shades than the parent dyestuffs. Example: If dibromo-indigo be stirred with 4 times its weight of bromine, a greenish-black product is formed. On heating 10 parts of this product with 10 parts of sodium hydrosulphite of 80 per cent. strength while suspended in water to which sodium carbonate or ammonia has been added, a grey-greenish leuco-product is formed which may be filtered and stirred with water or molasses to form a commercial paste.—P. F. C.

Brominated, halogenised indigos; Manufacture of highly —. O. Imray, London. From Farbwerke vorm. Meister, Lucius, and Brüning, Hoechst a/Main, Germany. Eng. Pats. 25,514, Nov. 18, 1907, and 26,275, Nov. 27, 1907.

By stirring dibromo-indigo with concentrated sulphuric acid, whereby the sulphate of dibromo-indigo is formed, and then treating the mixture with an excess of bromine at the ordinary temperature or while gently heating, products are obtained, which, on pouring into an ice bisulphite solution become blue and yield highly brominated indigo. The resulting dyestuff dissolves in concentrated sulphuric acid with a blue colour and dyes in the vat a clearer and greener blue than that obtained with dibromo-indigo. A similar product is obtained by using a dichloro-indigo or a chlorobromo-indigo as the starting point. Example: One part of dibromo-indigo is slowly introduced, with stirring, into 4 parts of concentrated sulphuric acid of 66 B. After standing for some time, 1.5 parts of bromine are added to the cooled and well stirred mixture. The temperature is next raised to about 45° C. for some hours. Stirring is continued for a time at the ordinary temperature and the whole mixture is then poured on to a mixture of ice and bisulphite, filtered, and washed. These highly brominated products may also be made directly from indigo by stirring it at as low a temperature as possible with concentrated sulphuric acid of about 85—99 per cent. and then brominating with an excess of bromine, first in the cold and finally while gently heating.—P. F. C.

Pentabromo-indigo; Manufacture of —. Farbwerke vorm. Meister, Lucius, and Brüning. Fr. Pat. 392,638, June 29, 1908.

PENTABROMO-INDIGO can be prepared by heating indigo or one of its bromine derivatives with an excess of bromine, preferably in the presence of a halogen carrier and with or without the addition of sulphuric acid. Example 1: 21 parts of dibromo-indigo are added to 180 parts of bromine in which 1–2 parts of iodine are dissolved, the temperature being kept low during the mixing. The mixture is then heated for some hours at 80° C. under pressure. The excess of bromine is next removed and the product is heated with a solution of sodium bisulphite, filtered, and washed with warm water. Example 2: 42 parts of dibromo-indigo are stirred with 252 parts of sulphuric acid of 66 B. 150 parts of bromine, in which 2 parts of iodine are dissolved, are then added to the well-cooled mixture and the whole is heated to a temperature of 70–80° C. for some hours in an apparatus provided with a reflux condenser. The excess of bromine is next removed and the residue is poured on to a mixture of ice and bisulphite, filtered and washed. The pentabromo-

indigo obtained by these methods dyes shades which are greener than those obtained with the parent dyestuff, especially when viewed in artificial light.—P. F. C.

Indigo White; Process of transforming — and its substituted products into bromo-derivatives containing bromine which is readily eliminated, and manufacture of bromine substitution products from these derivatives. Farb. vorm. Meister, Lucius, and Brüning, Fr. Pat. 393,279, Aug. 13, 1908. Under Int. Conv., Aug. 30, 1907.

WHEN Indigo White or its mono- or di-halogen or dimethyl substitution derivatives are treated with bromine in the presence or absence of a solvent and the mixture heated, greenish-black compounds are obtained containing a large amount of bromine, of which a part can readily be eliminated by heating the substances in a current of air, or in a suitable liquid, or by treatment with bisulphites, etc. In this way dyestuffs are produced with a high content of bromine and dyeing cotton in the vat in clear blue shades. Example 1: 100 parts of bromine are added to a mixture of 26 parts of Indigo White and a small quantity of carbon tetrachloride, and the whole is then digested for some time at 60–120° C., preferably under a slight pressure. A catalyst such as iodine may also be added. The product is freed from excess of bromine by adding carbon tetrachloride and is immediately converted into the new dyestuff by boiling this mixture with sodium bisulphite equal to ten times the weight of the black intermediate product. The dyestuff gives greenish-blue shades on cotton. Example 2: Dibromo-indigo White is treated in the same way and yields a dyestuff similar to that produced from the unsubstituted compound.—J. C. C.

Indigo compounds; Manufacture of new — P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4123, Feb. 27, 1908.

New tri- and tetra-bromo-derivatives of Indigo are obtained by treating Indigo or chloro-derivatives of Indigo with bromine in the presence of concentrated sulphuric acid. The new dyestuffs are greener and more soluble in organic solvents than those described in Eng. Pats. 5122 and 10,326 of 1907 (this J., 1908, 71 and 156). Example: 10 parts of finely powdered Indigo are mixed with 250 parts of well cooled concentrated sulphuric acid, 20 parts of bromine are gradually added, and after two hours the mixture is slowly heated to 40° C. and kept at that temperature for 12 hours. On pouring into water, tetrabromindigo separates. For the preparation of tribromindigo, 14 parts of bromine are used, the mixture being heated to 30° C. for 3 hours. The shades produced by both derivatives are similar, but the dyeings from tribromindigo turn white with concentrated nitric acid, whilst those from tetrabromindigo resist the action of the acid fairly well.—J. C. C.

Galloyanines; Manufacture of condensation products of — with ammonia. Farbwerke vorm. L. DuRand, Huguenin, und Co., Hünningen, Germany. Eng. Pat. 12,067, June 3, 1908. Under Int. Conv., June 3, 1907. Addition to Eng. Pat. 15,138 of 1907 (see Fr. Pat. 378,923; this J., 1907, 1194).

CONDENSATION products of galloyanines with ammonia are obtained by heating a galloyanine derived from gallanic acid with ammonia in the presence of an aromatic nitrohydrocarbon. Example: A mixture of 60 litres of alcohol, 30 kilos. of a galloyanine derived from gallanic acid, such as the condensation product from nitrosodiethylamine and gallanic acid, and 5 kilos. of dinitrobenzene are heated with 100 litres of an alcoholic solution of ammonia containing 15 kilos. of ammonia in an autoclave to 110–130° C., until a sample dissolves in sulphuric acid to a brown solution. The excess of ammonia and part of the alcohol are distilled off, the mass cooled, filtered, washed with alcohol, and dried. The product is best applied in the form of its leuco-derivative. The dyestuffs obtained in this way dye chrome-mordanted wool in greenish-blue tints.—J. C. C.

Triaminobenzene derivatives and dyestuffs of the Safranine series; Production of —. Badische Anilin und Soda Fabrik. Fr. Pat. 392,890, Aug. 11, 1908. Under Int. Conv., Dec. 19, 1907, and Jan. 1, 1908.

DERIVATIVES of 1:2:4-triaminobenzene-5-sulphonic acid of the type, $\text{SO}_3\text{H}\cdot\text{C}_6\text{H}_2(\text{NR}_1)_2(\text{NR}_2\text{R}_3)$ (R_1 = a simple or substituted acyl, alkyl, or aryl radical, R_2 and R_3 = hydrogen atoms or simple or substituted identical or different, acyl, alkyl, or aryl radicals) by treating 1-nitro-2:4-dichlorobenzene-5-sulphonic acid with the corresponding amines and reducing the nitro-group. The two chlorine atoms can be replaced by different amines because the atom in the ortho position to the nitro-group is first attacked and the other chlorine atom is only removed by prolonging the action or employing a higher temperature. By condensing these acids with a simple or substituted aromatic monoamine (with a free para-position), indamines are formed which on oxidation furnish the corresponding safranines, and if the acids are heated with $\beta\beta$ -hydroxynaphthoquinoneimines of the type, $\text{O}:\text{C}_{10}\text{H}_5(\text{OH})\text{NR}_1$, corresponding naphthosafranines are produced. The dyestuffs obtained in this way vary from red to greenish-blue and are suitable for dyeing wool and silk. Examples are given describing the preparation and condensation of 1-amino-2:4-dianilinobenzene-5-sulphonic acid with ethylbenzylanilinesulphonic acid, phenyl-1:6- (or 1:7) naphthylaminesulphonic acid, 2-hydroxy-1:4-naphthoquinoneanil-4', -6- and 8-sulphonic acids, and 2-hydroxy-1:4-naphthoquinone-4'-aminoanil-3'-sulphonic acid, of 1-amino-2-sulphamino-4-*p*-acetylaminonaphthobenzene-5-sulphonic acid with ethylbenzylanilinesulphonic acid and diethylmetanilic acid, of 1:4-diamino-2-anilinobenzene-5-sulphonic acid with ethylbenzylanilinesulphonic acid and 2-hydroxy-1:4-naphthoquinoneanil-4'-sulphonic acid, and of 1-amino-2-sulphamino-4-anilinobenzene-5-sulphonic acid with diethylmetanilic acid.—J. C. C.

Monoazo-dyestuff; Manufacture of a — capable of being applied as a bluish-red pigment. K. Merz, Fr. Pat. 392,914, Aug. 3, 1908; Under Int. Conv., Aug. 3, 1907.

THE monoazo-dyestuff prepared by combining diazotised 2-naphthylamine-8-sulphonic acid with 2-naphthol-3-carboxylic acid in alkaline solution gives, when transformed into the barium or calcium salt, a bluish-red or Bordeaux pigment respectively, which is very fast to light and possesses good covering power.—J. C. C.

Colouring matters of the anthracene series; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 27,187, Dec. 9, 1907.

SEE Fr. Pat. 381,471 of 1907; this J., 1908, 422.—T. F. B.

Anthracene dyestuff and process of making same. O. Bally, Mannheim, and H. Wolff, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 906,367, Dec. 8, 1908.

SEE Addition of Oct. 1, 1906, to Fr. Pat. 349,531 of 1904; this J., 1907, 251.—T. F. B.

Thioindigo dyestuffs; Manufacture of new products from —. O. Imray, London. From Farbwerke vorm. Meister, Lucius, and Brüning, Höchst on Main, Germany. Eng. Pat. 8381, April 15, 1908.

SEE U.S. Pat. 898,738 of 1908; this J., 1908, 1015.—T. F. B.

Indigo white preparations suitable for fermentation vats; Manufacture of —. A. Schmidt, Assignor to Farbwerke vorm. Meister, Lucius, and Brüning, Höchst on Main, Germany. U.S. Pat. 906,307, Dec. 8, 1908.

SEE Eng. Pat. 4647 of 1905; this J., 1906, 174.—T. F. B.

o-Orymonazo dyestuff and process of making same. W. Herzberg and O. Spengler, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 906,421, Dec. 8, 1908.

SEE Eng. Pat. 26,416 of 1906; this J., 1907, 1273.—T. F. B.

Monazo dyestuff; Yellow — W. Herzberg, Berlin, and H. Oster, Charlottenburg, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 906,422, Dec. 8, 1908. SEE Ger. Pat. 202,016 of 1907; this J., 1908, 1147.—T. F. B.

Sulphide dyestuffs; Process for the production of new — Act.-Ges. f. Anilinfabr. Fr. Pat. 393,187, Oct. 18, 1907. SEE Eng. Pat. 22,967 of 1907; this J., 1908, 1055.—T. F. B.

Pigments; Production of colouring matters suitable for Fr. Pat. 392,859. See XIII.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Artificial silk industry; Progress of the — W. P. Dreaper and J. G. Davis. J. Soc. Dyers and Col., 1908, 24, 294—297.

THE world's output of artificial silk is now about 5,000 tons per annum. In 1906 it was 8 tons per day as against 14 tons per day at present. Two new companies have been registered in this country to produce artificial silk, "Thiele" and "Glanzstoff" artificial silks respectively. The English output is estimated at 270 tons per annum. Both the Thiele and Glanzstoff processes dispense with the use of gun cotton and its solvents. It appears that the profits on the manufacture of nitrocellulose-silk have decreased, whilst those of companies working other processes have mostly increased, and in spite of its brilliance the gun cotton product is apparently being slowly displaced by those prepared directly from cotton. There is nothing to show that the acetocellulose product has been brought within the range of commercial production. It appears to have the defect that the fibre tends to crystallise, with consequent breaking of the filament. The viscose factory at Coventry has made substantial progress and the use of the product is increasing. It is supplied in sizes of 120 deniers and upwards; as now manufactured it does not become yellow on keeping, and an extended output is contemplated. There will probably be a steady growth of the industry during the next few years, and the production of yarns down to 30 deniers by the "Thiele" process will be commercially possible. During the past year the defects of decreased strength and elasticity on wetting have been favourably modified, whilst the brightness of the product is as great as previously. The individual fibres of boiled-off Thiele silk of 22 deniers are as fine as those of the natural product.

—E. F.

Chroming of wool. C. Gavard. Färber-Zeit., 1908, 19, 345—357.

COMPARATIVE experiments with ten different chrome dyestuffs showed that good results are obtained by using much smaller proportions of bichromate for mordanting or for after-chroming than are recommended in the recipes supplied by the makers of the dyestuffs. In general it is advantageous to use formic acid in place of tartar in mordanting, and also to add formic acid to the bichromate solution used for after-chroming. The detailed results of the author are given in a series of tables.—A. S.

Dyeing and cleaning [textile fabrics]; Recent improvements in — F. J. Farrell. J. Soc. Dyers and Col., 1908, 24, 289—294.

THE process of dry cleaning consists in treating the articles to be cleaned with benzine or solvent naphtha, with the addition of "benzine soaps," in a cylindrical washing machine. "Benzine soaps" are almost anhydrous metallic oleates. The articles are then rinsed in benzine or solvent naphtha free from soap, centrifuged, and dried in a steam-heated chamber. In order to avoid loss of the volatile solvent and danger of fire, many devices have been proposed for conducting all these operations in a closed circuit, but this has only been done with success during the last few years. Fire risks in dry cleaning establishments have greatly decreased owing to

the adoption of precautions, among which are:—The general use of soluble oleates except in the final rinsings; these convert the benzine into an electrical conductor and so prevent sparks due to friction; the earthing of all machines, the employment of appliances to prevent flames from passing down pipes to the storage tanks, the fitting of readily fusible units in the chains holding the counter-balance weights of machine lids, so rendering the latter self-shutting in case of fire, and the use of asbestos blankets to extinguish small fires. The use of closed circuits is better for employees, as the toxic effects of benzine vapour are thus avoided. In the wet cleaning process, amylolytic enzymes have largely come into use for removing the old dressing from fabrics. These extracts, of which "Diasol" is a typical preparation, convert the starch into sugar and also have a distinct solvent action on other impurities, so that much less soap is required than would otherwise be the case. Many of the soluble starches now on the market avoid the necessity of starching twice to obtain the required degree of stiffness for very stiff goods. In modern methods of preparing soluble starch a minimum of acid (sulphuric is said to be best) is used, and is not removed, though it may be neutralised by the addition of borax, alkali acetate, or alkali. The electrolytic production of hypochlorite on the small scale from salt solutions is now practically utilised. The cost of available chlorine need not exceed one-third of a penny per gallon of liquor containing 3 grms. of available chlorine per litre. Sodium perborate has also been recently introduced, and may supersede hydrogen peroxide, which is expensive and unstable. The perborate is used as a bleaching agent in the same way as hydrogen peroxide. The stable hydrosulphites are useful in wet cleaning, especially for flannels. Titanous chloride is useful in clearing coloured goods (e.g., fabrics with coloured embroidery) in which the colour has bled into the white. A superfatted sulphonated castor oil soap ("Tetrapol"), mixed with carbon tetrachloride, is said to have a high efficiency as a solvent of grease and does not affect the most delicate colours. It does not form insoluble calcium soaps, and can therefore be used with hard water. In dyeing, the increase in the range of direct cotton colours yielding uniform shades on cotton, wool and silk, has proved of much service, as have also the many improved methods of stripping, such as the use of stable hydrosulphites. Nitric acid and chromic acid, which were formerly used for stripping woollen goods, left a yellow or yellowish-brown ground. By the use of hydrosulphites, a pale ground is obtained on which almost any shade can be dyed. Stiffening agents are often necessary, which will give the required finish to the lining and at the same time will not affect the colour of the face fabric. Starch shows up on wool; and gelatin, though in some cases the only satisfactory dressing, is expensive, and may often be replaced by "Feculose," which is an acetylated starch product. Formic acid is of use in garment-dyeing owing to the increased penetration obtained with it. It is now as cheap as the less satisfactory acetic acid.—E. F.

Alkali-cellulose; Constitution of — O. Miller. See XIX.

PATENTS.

Soda-lye; Process and apparatus for removing — by means of steam from fabrics saturated with said lye for purposes of mercerisation. O. Venter, Chemnitz, Germany. Eng. Pat. 202, Jan. 3, 1908. Addition to Eng. Pat. 45,352 of 1907 (this J., 1907, 1275).

THE fabric is sprinkled with a dilute soda-lye coming from that compartment of the washing machine which contains the strongest washings, and is subsequently exposed to the action of steam as described in the main patent.

—P. F. C.

Dyeing fabrics in the open width; Apparatus for — A. Duverger and A. Renion. Fr. Pat. 392,693, July 25, 1908.

INSIDE an apparatus for dyeing fabrics in the open width, and below the working level of the dye-liquor, a tube is arranged which is connected with an aspirator and is provided with an opening or a number of openings of

variable size. These openings are so arranged that when the fabric is travelling through the dye-liquor from one roller to another, dye-liquor is aspirated through the cloth into the interior of the tube, this liquor being eventually returned into the vat. In this way thorough penetration of the fabric by the dye-liquor is ensured.—P. F. C.

Ketting process by pectic aerobic microbes in a gas current; Industrial microbiological vegetal —, G. Rossi, Portici, Italy. Eng. Pat. 6532, March 24, 1908.

SEE Fr. Pat. 388,651 of 1908; this J., 1908, 977.—T. F. B.

Retting and ungumming of all textile plants; Process for chemically —, A. Blachon and J. Peretmère, Paris. U.S. Pat. 905,639, Dec. 1, 1908.

SEE Eng. Pat. 16,142 of 1906; this J., 1907, 819.—T. F. B.

Dyeing cotton and other vegetable fibres with Alizarin Red and other alizarin dyes. A. Koblichke, Reichenbach, Silesia. Eng. Pat. 26,414, Nov. 29, 1907.

SEE Fr. Pat. 384,079 of 1907; this J., 1908, 445.—T. F. B.

Tin paste residues; Conversion of — into stannic chloride. Fr. Pat. 392,615. See VII.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Absolute sulphuric acid; its preparation from sulphur trioxide and water; its specific electric conductivity and that of more dilute acid. [Determination of the strength of strong sulphuric acid.] D. M. Lichty, J. Amer. Chem. Soc., 1908, 30, 1834—1846.

By repeated distillation over phosphoric oxide in an apparatus previously exhausted to about 30 mm., sulphur trioxide has been prepared pure and with a permanently low melting point (unpolymerised). From this pure trioxide and water, weighed in sealed bulbs and cautiously mixed in stoichiometrical proportions, absolute sulphuric acid (H_2SO_4) has been obtained. The specific electric conductivity of this acid at 25°C. is 0.01041 reciprocal ohm, and the conductivity is raised by the addition of water or of the fuming acid, even in traces. Measurement of the specific conductivity is found to be the most accurate way of determining the strength of pure acid containing not more than 5 per cent. of water, and a table of conductivities is given. By the addition of water or fuming acid to absolute sulphuric acid, its freezing point (10.43—10.45°C.) is depressed.—E. SORX.

Sodium bicarbonate; Dissociation of —, Soury. Compt. rend., 1908, 147, 1296—1299.

As the dissociation of sodium bicarbonate, not only carbon dioxide but also water is evolved; and as there are therefore three constituents concerned, there must be four phases if the system is to have but one degree of freedom, or show a fixed tension of dissociation at a fixed temperature. The author mixed 27.54 grms. of the dry bicarbonate (which if completely dissociated would evolve 3660 c.c. of carbon dioxide at 0°C. and 760 mm.) with 5.4 grms. of water, and heated to 100°C. The tension, 1600 mm., went down gradually as carbon dioxide was removed, till when 260 c.c. had been removed it reached 800 mm., at which it remained till about 1800 c.c. had been removed; then it fell again to 650 mm. when 2560 c.c. had been removed and was constant up to the removal of 3210 c.c. According to the author, the figures point to the formation of $3\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{CO}_3 \cdot 4\text{H}_2\text{O}$, which at first dissolves in the water, but begins to crystallise from the saturated solution and form a second solid phase when the period of constant tension begins. Complete conversion into this, and disappearance of the bicarbonate, occurs when 1830 c.c. of carbon dioxide have been evolved, and this agrees with the position of the end of the period of constant tension. Normal carbonate is now formed, and when this in turn saturates the water present, and forms a second solid phase, the second period of constancy begins. (J. T. D.)

Ammonia; Synthesis of — by means of peat. H. Wolterreck. Compt. rend., 1908, 147, 1402—1403.

The author has continued his investigations on the synthesis of ammonia by means of peat. The results are shown in the following table; in the first three experiments, 50 grms. of peat were employed, and in each of the last two, the residue from the preceding experiment, after taking 2 grms. for the determination of nitrogen, and making up to 50 grms. with fresh peat. Each experiment extended over four hours at 450°C., air saturated with water vapour at 80°C. being passed through at the rate of 14 litres per hour.

	1.	2.	3.	4.	5.
Dry peat taken	36.4	36.4	36.4	39.9	41.6
Dry peat consumed	21.4	21.2	21.4	19.0	15.0
Ammonia produced	0.571	0.561	0.560	0.587	0.471
Total nitrogen in peat taken	0.820	0.820	0.820	0.995	1.047
Nitrogen in residue	0.410	0.419	0.415	0.572	0.731
Nitrogen in ammonia produced	0.470	0.462	0.461	0.483	0.388
Total nitrogen recovered	0.880	0.881	0.876	1.055	1.119
Excess of nitrogen recovered over that present in peat	0.060	0.061	0.056	0.060	0.072

It will be noted that the residue contains a considerably larger percentage of nitrogen than the original peat; if however the treatment be continued for 6 hours instead of 4 hours, the percentage of nitrogen in the residue is less than in the original peat. The author is endeavouring to ascertain the manner in which the nitrogen is accumulated in the peat during the earlier stages of the process. (A. S.)

Colloidal barium sulphate. E. Feilmann. Trans. Faraday Soc., Dec., 1908. (Advance proof.)

Barium chloride solution is added to an aqueous solution of sodium sulphate and alkali-casein. The colloidal barium sulphate is precipitated from the mixture with acetic acid, washed by decantation with distilled water, and redissolved in very dilute alkali. The solution so obtained may be evaporated to dryness, and then yields a translucent, horny solid, soluble in water. Thus on adding to 230 c.c. of alkali-casein solution, first 200 c.c. of a solution containing 14.2 grms. of anhydrous sodium sulphate, and then, with stirring, 100 c.c. of a solution containing 24.5 grms. of barium chloride crystals, a thick creamy liquid was obtained which, when treated as described above, yielded a soluble dry product containing 56.7 per cent. of barium sulphate.—E. F.

Sulphur dichloride; Action of —, on metalloids and metals. P. Nicolardot. Compt. rend., 1908, 147, 1304—1306.

Among the non-metals, sulphur and selenium dissolve readily in sulphur chloride even in the cold. White phosphorus also dissolves, without effervescence, whilst red phosphorus, which also dissolves, causes a lively effervescence. Arsenic is but slightly attacked, and the action ceases without the substance being dissolved, but antimony dissolves readily. Carbon, silicon, and boron are quite unaffected. Among the metals, only tin, aluminium, mercury, and iron are attacked. In the case of iron, ferrous sulphide and chloride are both formed, in proportions depending on the quantity of sulphur chloride present, but no ferric chloride is produced in any case. (J. T. D.)

Chlorazide, NaCl . F. Raschig. Ber., 1908, 41, 4194—4195.

On mixing together solutions of molecular proportions of sodium azide, N_3Na , and sodium hypochlorite, no reaction takes place, but if the mixture be acidified, even with a weak acid such as acetic acid or boric acid, it becomes yellow, and a colourless gas, having an odour resembling that of hypochlorous acid, is evolved. This gas explodes violently in contact with a flame or a glowing splinter; it sometimes also explodes spontaneously, shattering the containing vessel, even when not exposed to intense light. It is somewhat soluble in water; it is also absorbed

by sodium hydroxide solution, and the resulting solution liberates iodine from an acidified solution of potassium iodide. In this reaction 1 mol. of hydrogen chloride and 1 mol. of hydrogen azide are formed for every 2 atoms of iodine liberated, hence it is concluded that the explosive gas is chlorazide, N_3Cl . When the gas is absorbed in sodium hydroxide solution, sodium azide and sodium hypochlorite are formed, for the resulting solution gives with silver nitrate, first a greyish-white precipitate of silver azide and then a black precipitate, probably basic silver hypochlorite, similar to that given by an alkaline solution of sodium hypochlorite.—A. S.

Sodium nitrate statistics, Shipments, consumption, stocks, and prices, from 1906 to 1908. W. Montgomery and Co., London. Dec. 31, 1908. [T.R.]

	1906.	1907.	1908.
Shipments from South American Ports to all parts for the six months ending Dec. 31st.	Tons 991,000	887,000	1,029,000
Ditto do. for the twelve months ending 31st Dec.	" 1,700,000	1,626,000	1,993,000
Alloat for Europe on 31st Dec.	" 543,000	493,000	510,000

Stocks in U.K. Ports:—

	1906.	1907.	1908.
Liverpool	Tons 7,500	7,200	23,500
London	" 2,400	1,700	3,400
Out Ports	" 7,100	5,100	20,100

Stocks in Continental Ports on 31st Dec.	Tons 173,000	188,000	354,000
Consumption in U.K. for the six months ending Dec. 31st	" 37,000	37,000	42,000
Do. in Continent do.	" 283,000	270,000	309,000
Do. in U.K. for the twelve months	" 108,000	112,000	104,000
Do. in Continent do.	" 1,135,000	1,140,000	1,272,000
Do. in United States do.	" 355,000	350,000	309,000
Do. in other Countries do.	" 38,000	56,000	45,000
Do. in the World do.	" 1,636,000	1,658,000	1,730,000
Visible supply on 31st Dec. (including the quantity alloat for Europe and Stocks in U.K. and Continent)	" 733,000	695,000	911,000
Price on 31st Dec.	per cwt. 11/1½	11/3	9/7½

PATENTS.

Ammonia; Manufacture of —. F. W. Frerichs, St. Louis, Mo. U.S. Pat. 905,415, Dec. 1, 1908.

AMMONIA and volatile ammonium compounds, obtained by the distillation of ammoniacal liquors, are combined with acid ammonium sulphate, and the normal sulphate, thus formed, is heated so as to give ammonia again and acid ammonium sulphate or ammonium pyrosulphate to be re-used in the process. When ammonium sulphate contains nitrogenous and other organic carbon compounds, it may be purified by heating the impure salt in a blast of air to such a temperature that the volatile carbon compounds are volatilised or oxidised and the nitrogenous compounds are converted into ammonium sulphate by reacting with the sulphuric acid of the ammonium salt.—F. SODX.

Alumina and silica; Composition [refractory matter containing] —. F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 906,339, Dec. 8, 1908.

THE patent is for a homogeneous product obtained by fusing a mixture of alumina and silica, containing more than 5 and less than 35 per cent. of the latter (*i.e.*, less than the proportion present in the compound, $Al_2O_3 \cdot SiO_2$) and substantially free from basic impurities; it is characterised by great hardness and toughness, and is very refractory.—F. SODX.

Acetates, especially sodium acetate; Electro-chemical manufacture of —. C. H. Jacob. First Addition, dated Sept. 27, 1907, to Fr. Pat. 383,595, Jan. 12, 1907 (this J., 1908, 341).

ALCOHOLIC liquors produced by the saccharification and fermentation of starchy or other substances, are, prior to distillation, electrochemically oxidised to acetic acid

by means of a catalytic agent at a temperature of 40° C., as described in the main patent.—F. R.

Chlorates; Purification of —. R. Gartenmeister. Fr. Pat. 392,604, July 24, 1908. Under Int. Conv., June 27, 1908.

CHLORATES manufactured electro-chemically are contaminated by an impurity which renders their use dangerous (this J., 1908, 806). By prolonged boiling with about the calculated amount of sufficiently dilute hydrochloric acid, this impurity is destroyed, no appreciable quantity of chlorate being decomposed. The chlorine compounds formed may be removed by long boiling, or more rapidly by adding a little alcohol or other suitable reducing agent.—F. SODX.

Tin paste residues; Conversion of — into stannic chloride. A. E. Nicolle. Fr. Pat. 392,615, July 24, 1908. Under Int. Conv., July 6, 1908.

THE tin paste obtained as a residue in dye works may be converted directly into stannic chloride by treating the moist paste with excess of hydrochloric acid (15–20 per cent. above the calculated quantity), concentrating to 45° B., and heating the liquid, which must still contain the same excess of acid, for 6 hours in an autoclave at 5–6 atmospheres pressure. Any organic matter is next destroyed by chlorine, and the tin necessary to convert the excess of acid, in the presence of chlorine or other oxidiser, into stannic chloride is added. If grease be present, the solution should be filtered before concentrating, and any considerable proportion of iron should be removed by means of ferrocyanide.—F. SODX.

Stannic oxide; Preparation of —. H. Müblinghaus. Fr. Pats. 392,805 and 392,806, July 30, 1908.

MATERIAL containing tin, such as dross, waste tin, or ores, is heated in a small blast furnace or other furnace with a large excess of coke, the materials being introduced in alternate layers and chalk or dolomite added to raise the fusion point. A permanent zone of coke collects in the lower part of the furnace, in passing through which reduction of the molten material is completed; the liberated tin is oxidised by a blast of hot air, the oxide being carried out at the top of the furnace with the blast. A more complete yield is obtained, however, if the oxide formed does not pass through the upper layers of material, and, for this purpose, the fusion may be carried out in a separate furnace, any suitable substance being added to bring the melting point to about 1300–1500° C., and the molten material is then run into the main furnace which is charged with coke and supplied with a blast of hot air, preferably under pressure. The last traces of tin, down to 0.18 per cent., may be recovered as oxide by this arrangement.

—F. SODX.

Copper sulphate; Manufacture of —. P. C. J. Coste, Fr. Pat. 392,617, Jan. 14, 1908.

THE invention relates to an arrangement of apparatus for the manufacture of copper sulphate from crude copper oxide and sulphuric acid. In the reacting vessel the acid and sifted oxide are heated and agitated by the injection of superheated steam and air. The supersaturated solution of sulphate is run out to crystallise, and the mother liquor is heated by contact with the pipe in which any escaping acid vapours are condensed; it is then filtered and returned to the reacting vessel. The insoluble matter is run out from the latter at intervals and washed by treatment with water and steam. Gravitation is utilised as far as possible in transferring material from one part of the apparatus to another, and the waste heat is used for preheating the raw materials. — F. SODX.

Hydrosulphides of the alkaline-earth metals; Manufacture of —. S. Coulier. Fr. Pat. 392,671, July 16, 1908.

THE hydrosulphides of the alkaline-earth metals may be prepared by treating the corresponding oxides, hydroxides, or sulphides with ammonium sulphide or with hydrogen sulphide in the presence of ammonia, the liberated ammonia being subsequently removed and used again. Solutions strong enough to crystallise may be obtained in this way. Contact with air should be avoided. — F. SODX.

Alkali and other silicates; Manufacture of — [in the electric furnace]. Soc. Electrometallurgique de Saint-Béron. Fr. Pats. 392,945 and 392,946, Aug. 3, 1908.

CLAIM is made for the use of an electric furnace in the manufacture of alkali silicates, and for the products thus obtained, which are of exceptional purity and of definite composition. Simple or mixed silicates of the type M_2SiO_3 or $M_2Si_2O_7$ may be prepared by the process in a crystalline state. Sulphates and bisulphates are converted into silicates by fusion with silicious matter in the electric furnace, without the customary addition of carbon; the acid vapours liberated may be utilised for the manufacture of sulphuric acid. — F. SODX.

Potassium ferrocyanide; Manufacture of — from sodium ferrocyanide and potassium chloride. C. Petri. Fr. Pat. 393,003, Aug. 6, 1908. Under Int. Conv., Aug. 7, 1907.

SODIUM ferrocyanide is dissolved in such a quantity of water that the solution will further dissolve, on boiling about 1·7 times the quantity of potassium chloride required to react with the ferrocyanide. After solution of the two salts, the liquid is allowed to cool, when about 70 per cent. of the ferrocyanide is deposited as the potassium salt in marketable form. From the mother liquor, on cooling to -10° to -20° C., a further 18–20 per cent. of the potassium ferrocyanide is obtained, which requires one crystallisation to free it from potassium chloride. By dissolving more potassium chloride in the new mother liquor, another 4–6 per cent. of potassium ferrocyanide, mixed with chloride, are deposited, and the residual ferrocyanide may be recovered from solution by precipitation as the double salt of calcium and potassium. The first yield of crystals may be increased to 75 per cent. by effecting the solution under pressure, at a temperature above 100° C., which allows a larger proportion of potassium chloride to be used for saturating the liquid. The method is claimed to remove the difficulty hitherto experienced in converting sodium ferrocyanide into the potassium salt by means of potassium chloride (this J., 1898, 98, 103). — F. SODX.

Moist chlorine; Process of dehydrating —. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 905,602, Dec. 1, 1908.

MOIST chlorine, contained in a mixture of gases, is refrigerated in a series of chambers, so that "chlorine hydrate" is deposited and the excess of chlorine and other gases pass out of the chambers. Some of the chambers are then disconnected from the system and the contents treated for the liquefaction of the hydrate and the separation of the chlorine and water. — F. SODX.

Silicon; Preparation of —. F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 906,338, Dec. 8, 1908.

ORES, such as aluminium silicate, containing aluminium and silicon, and substantially free from iron compounds and "basic metalliferous materials," are mixed with sufficient carbon to reduce the silicon only to the elementary form. The mixture is heated electrically to a temperature sufficient to bring about reduction and to fuse the alumina, which is then separated from the silicon. — F. SODX.

Hydrogen; Preparation of — by the decomposition of water. P. Mauriceau-Beaupré. Fr. Pat. 392,725, July 27, 1908.

PURE hydrogen is conveniently and cheaply prepared by the action of water on a mixture of pure aluminium filings with 1–2 per cent. of mercuric chloride and 0·5–1 per cent. of potassium cyanide. The mixture must be kept quite dry. To prepare hydrogen, it is treated with an equal weight of water, which causes considerable rise of temperature in a few seconds, and then water is added regularly, so as to keep the temperature at about 70° C. An advantage of the process is that neither the reacting substances nor their products have any corrosive action. Pure aluminium hydroxide is obtained as a by-product. — F. SODX.

Stannic chloride; Process for producing —. The Columbia Process Co. Fr. Pat. 392,618, March 12, 1908. SEE U.S. Pat. 884,756 of 1908; this J., 1908, 749. — T. F. B.

Red oxide of iron and zinc sulphate; Process for preparing —. C. Evans. Fr. Pat. 392,623, May 13, 1908. Under Int. Conv., May 15, 1907.

SEE Eng. Pat. 11,338 of 1907; this J., 1908, 684. — T. F. B.

Peat; Combustion of — for the manufacture of ammonium sulphate. Fr. Pat. 392,979. See III.

Gases; Process and apparatus for effecting chemical action in, and for chemically combining —. U.S. Pats. 904,070–904,073. See XIA.

Carbides [of calcium, etc.]; Process of smelting metallic compounds, and producing —. U.S. Pat. 904,991. See XIA.

Nitrogen oxides; Production of — [from air]. Fr. Pat. 392,670. See XIA.

Ammonia and volatile fatty acids; Process of fermentation to obtain — from organic nitrogenous substances. Eng. Pat. 9951. See XVII.

VIII.—GLASS, POTTERY, AND ENAMELS.

PATENTS.

Metallisation of vitreous, porcelain, earthenware and the like surfaces so that metal or metallic alloy may be electro-litically deposited upon such surfaces. Q. Marino. Eng. Pat. 17,743, Aug. 3, 1907.

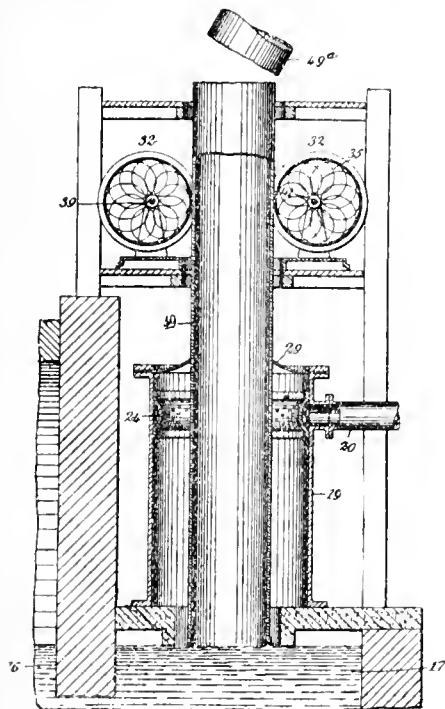
THE grey substance containing finely-divided silver produced by adding cuprous oxide to a solution of silver nitrate is dissolved in hydrofluoric acid, and the solution so obtained is applied to the roughened surfaces to be treated. While still wet the surface is dusted with a mixture of metals, such as copper and zinc, or with one metal only, such as zinc, in a finely-divided state. The silver and copper are thus reduced from the solution and form a thin film over the surface, on which the metal or metallic alloy may be deposited. — O. F. H.

Glass articles; Fire glazing or finishing of —. M. Cummins and C. W. Schwenzfeier, Manchester. Eng. Pat. 390, Jan. 7, 1908.

GLASS articles are fire-glazed and finished by exposing them, mounted in carriers, to the action of an electric arc generated between two carbon rods, inclined so that the

are is at the top. The carbon rods are balanced by a weight, which is coupled to the movable core of a vertical electro-magnet, so that the carbon rods are brought together when the current is switched off, and separated when the current is started. The carbon rods may be mounted on a centrally or excentrically revolving frame, according to the articles to be finished.—A. G. L.

Window glass machines: Continuous draw vacuum—
H. D. Hershey, Latrobe, U.S.A. Eng. Pat. 19,827,
Sept. 21, 1908.



A NUMBER of cylinders of glass, 49, are drawn continuously vertically upwards from the clearing tank, 17, of a glass furnace, 16. Each cylinder is started by a bait attached to a drawing cylinder, which is subsequently detached. The lower part of each cylinder is surrounded by a metal casing, 19, supplied with an asbestos cover, 29, held tightly against the cylinder. The air within this casing and around the cylinder is continuously exhausted by means of a blower, through the pipe, 20, and the perforated ring, 24. Air under atmospheric pressure is at the same time admitted to the interior of the cylinder from above. The weight of each cylinder is supported, and the cylinder is pushed upwards, by four friction wheels, 32 (two only shown), which are coupled to one shaft by three gear-wheels and pinions so as to revolve simultaneously. The metal rim, 35, of each wheel is covered with asbestos and shaped so as to fit the cylinder; the rim is supported on the hub, 39, by a number of metal rings, 41, set at slightly different angles, so as to allow the rim to assume an excentric position with regard to its shaft. In this way the wheels are made to tightly engage cylinders of different sizes. Sections of the cylinders, 49a, are severed from time to time and rolled into window glass in the usual way.—A. G. L.

Mirroring glass or like surfaces: Process of—
C. H. von Hoessle, Assignor to Chem. Fabr. von Heyden A.-G.,
Radebeul, Germany. U.S. Pat. 906,229, Dec. 8, 1908.
SEE Fr. Pat. 392,243 of 1908; this J., 1908, 1204.—T. F. B.

Metallisation of glass, porcelain, ceramic, and analogous surfaces, to permit the electrolytic deposition of a metal or alloy on these surfaces. Q. Marino and E. J. Richardson.
Fr. Pat. 392,916, Aug. 3, 1908.

SEE Eng. Pat. 17,743 of 1907; preceding.—T. F. B.

Glass; Apparatus for drawing—
Window Glass Machine Co. Fr. Pat. 393,005, Aug. 6, 1908.

SEE Eng. Pat. 15,670 of 1908; this J., 1908, 1062.—T. F. B.

Glass; Apparatus for drawing—
Window Glass Machine Co. Fr. Pat. 393,006, Aug. 6, 1908.

SEE Eng. Pat. 15,669 of 1908; this J., 1908, 982.—T. F. B.

Kilns: Gas-fired—[for bricks, pottery, etc.]. Eng. Pat.
2905. See IX.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Portland cement: Free lime in—
A. H. White. J. Industrial and Eng. Chem., 1909, 1, 5—11.

THE author describes a microscopic test for free lime in Portland cement, based on the formation of crystalline calcium phenolate which has a characteristic appearance when examined in polarised light. The reagent used consists of 5 grms. of crystallised phenol dissolved in 5 c.c. of nitrobenzene, with the addition of two drops of water. The test is made by placing 2 or 3 mgrms. of the finely powdered cement on a slide, adding a drop of the reagent, pressing down with a cover glass, and placing at once under the microscope with crossed nicols at a magnification of about 80. Cement is only feebly refracting, but within a few minutes, if any free lime be present, brilliant points begin to show, which develop in 15 minutes into clusters of radiating needles; at the end of 2 hours, the needles may be 0.1 mm. long. The formation of crystals of phenol is prevented by the moisture present in the reagent and absorbed from the air as the solvent on the slide evaporates. Calcium hydroxide responds to the test as well as calcium oxide, but no other substance has been found to do so. Phenolphthalein may be added to the reagent, when pink spots appear round the particles of lime, but in this case magnesia also will react. Comparison of this test with the boiling test showed good agreement, the microscope test being the more delicate. Cements which do not give the crystals within an hour, contain no more than a trace of free lime. Experiments with this test on unsound cements showed the cause of the unsoundness to be presence of free lime, due in most instances to coarse grinding of the raw materials.—J. H. J.

Cement: Influence of electrolytes on the setting time of—
Rohland. Stahl u. Eisen, 1908, 28, 1815—1819.

THE author shows that the action of electrolytes on the setting-time of slag-cement is, qualitatively at least, the same as on that of Portland cement. Thus, sodium chloride, added in small quantity, has no action on either cement; sodium carbonate causes an acceleration; calcium chloride, added in small quantity, delays setting, but added in large amounts, accelerates it. Sodium sulphate, potassium bichromate, and borax delay the setting of both cements, but a larger proportion of sodium sulphate is necessary to affect slag cement than Portland cement. Dissolved electrolytes have a greater influence than the solid salts; the difference in the action is especially marked with the less soluble salts, e.g., borax.

—A. G. L.

PATENTS.

Kilns: Gas-fired—[for bricks, pottery, etc.]. G. Feun
and C. F. Priest, Dudley. Eng. Pat. 2905, Feb. 10, 1908.

THE kiln is heated by means of gas delivered from a series of small gas-producers which take the place of the usual "fire-holes." A steam main encircles the kiln, and branch pipes extend downwards from the main, one into each gas-producer. Each branch pipe consists of independent upper and lower parts, with an air-gap between; the steam in passing from the upper to the lower part, draws in air, and the mixture of air and steam is delivered below the grate of the producer. The air supply for the combustion of the gas from the producers is preheated

by passing (by natural draught) through zig-zag flues, in the inner lining of the kiln. One of these air-flues is provided for each gas-producer, and the gas-exit pipe of the latter passes through the lower part of the corresponding air-flue. The gas and heated air mingle in a passage between the lining of the kiln and the flash-wall, and thence pass into the interior of the kiln.—A. S.

Artificial stone; Manufacture of ——. C. A. P. Turner. Minneapolis, U.S.A. Eng. Pat. 13,941, July 1, 1908.

THE sand to be used for making moulds for artificial stone is treated with a saturated solution of sodium chloride, and is preferably also mixed with 20 per cent. of marl. The surface of the sand mould is sprayed with soap solution, whilst alum solution is added to the liquid stone composition. Potassium chloride or calcium chloride may be used instead of sodium chloride. —A. G. L.

Wood; Apparatus for use in treating ——. S. S. Williams. Providence, R.I. U.S. Pat. 904,589, Nov. 24, 1908.

THE apparatus consists of a closed chamber provided with an air-tight door in one side. Within the chamber are placed steam coils, which are rigidly held against the sides and top, so as to strengthen the latter; these steam pipes are provided with valves which can be operated from outside the chamber, and which admit steam to the inside of the latter. Below the chamber, and communicating with it by two valved pipes, are placed two tanks, a larger one for fresh treating liquid, and a smaller one for used liquid from the chamber. Means are also provided for exhausting the chamber, so as to cause the liquid from the larger tank to rise into it, as well as means by which the liquid purified in the smaller tank is returned to the larger one.—A. G. L.

Refractory material for furnaces and crucibles. W. Rippey. Alleghenny, Pa. U.S. Pat. 905,295, Dec. 8, 1908.

SAND, cement, and water are moulded and heated until incipient fusion of the sand takes place.—A. G. L.

Silicates; New application of metallic ——. to the maintenance of roads. Soc. Electrométallurgique de Saint-Béron and A. Jouve. Fr. Pat. 393,135, Aug. 3, 1908.

ROADS, especially of macadam, wood blocks, or concrete, are sprinkled with a solution of soluble metallic silicates, to which fluorides or fluosilicates may be added, for the purpose of alloying dust.—A. G. L.

Gypsum; Apparatus for burning — in pieces and in powder. J. H. Monbeig. Fr. Pat. 393,226, Oct. 19, 1907.

(1). HOT gases, generated in two separate fire-places, pass through two openings into a large chamber containing the gypsum to be burnt. Large pieces of the gypsum are arranged at the bottom of the chamber, close to the two openings, so as to form two passages which the gases traverse, smaller pieces of gypsum, and powder, being placed on top of these large pieces. The chamber is emptied from time to time by means of trucks running on rails which pass through a large opening into the chamber. (2). Gypsum is continuously burnt in a long kiln of semi-circular section, which is given a reciprocating movement about its long axis. This kiln is placed partly above a fire-grate, partly above the flue leading the gases from the latter to the chimney. The kiln is charged from a hopper (which is above the fire-grate end of the kiln) and discharged through a shoot at the other end. The fixed walls of the furnace are curved inwards towards the movable kiln where they touch the latter, so as to allow the kiln to oscillate without permitting air to enter the furnace.—A. G. L.

Blast-furnace slag; Treatment of — for production of hydraulic cement. B. Grau, Kratzwieck, Germany. U.S. Pat. 905,813, Dec. 1, 1908.

A JET of steam charged with lime is blown against a stream of liquid slag issuing from a furnace, with sufficient force to disintegrate the slag. The mass then falls a sufficient distance and cools gradually, after which it is ground.—A. G. L.

Cement and the like; Drying apparatus for ——. Bühler Frères. Fr. Pat. 392,743, July 27, 1908. Under Int. Conv., Aug. 31, 1907.

THE apparatus consists of two tunnels placed side by side, through which hot gases are drawn into a moisture-collecting chamber by means of a fan, etc., the cement, clay, etc., to be dried being placed in the tunnels. The valves operating the doors at each end of the tunnels are connected with the dampers regulating the admission and exit of the hot gases by means of a system of pulleys and cables in such a way, that the opening of either door of one of the tunnels simultaneously closes the dampers between this tunnel and the moisture-collecting chamber, and also the dampers regulating the hot gas supply to this tunnel, so that the working of the other tunnel is not interrupted, and cold air is not sucked into the first tunnel.—A. G. L.

Hydraulic binding agents containing aluminates and silicates; Improvement of — by addition of barium salts. Königshofer Zement Fabr., A.-G., Ger. Pat. 204,700, May 15, 1907. Addition to Ger. Pat. 204,699.

FOR the improvement of hydraulic cements prepared from blast-furnace slag and similar materials, an addition of barium carbonate was proposed in the main patent (see Fr. Pat. 370,939 of 1906; this J., 1907, 257). It has now been found that other compounds which react to yield insoluble sulphates, e.g., compounds of lead, strontium, and the like, may be used in place of barium carbonate.—A. S.

Cement; Process for making ——. H. Colloseus. Fr. Pat. 392,734, July 27, 1908.

SEE Eng. Pat. 25,795 of 1907; this J., 1908, 841.—T. F. B.

Plaster, cement, or similar materials; Process for mixing — with water. Sackett Plaster Board Co. Fr. Pat. 392,830, March 31, 1908.

SEE Eng. Pat. 7091 of 1908; this J., 1908, 751.—T. F. B.

Cement, hydraulic lime, and dry mortar mixtures; Process for protecting — against moisture during storage. J. Junge. Fr. Pat. 392,817, July 31, 1908.

SEE Ger. Pat. 195,603 of 1907; this J., 1908, 449.—T. F. B.

Alumina and silica; Composition [refractory material] containing ——. U.S. Pat. 906,339. See VII.

Aluminium ores; Process of smelting — and method of treating aluminium silicate. U.S. Pat. 906,172 and 906,173. See X.

X.—METALS AND METALLURGY.

Patio [silver extraction] process; The ——. C. P. Duarte. J. Chem. Met. and Min. Soc., S. Africa, 1908, 9, 105—110.

THE author describes in detail the patio process of silver extraction, which has altered but little since the 16th century, but which will probably have to give place to cyaniding. He discusses at some length, the various theories of the chemical reactions that take place, and gives as his opinion that the sodium chloride reacts with the copper sulphate of the "magistral" to form copper chloride, which then chloridises the silver sulphide. The silver chloride is reduced by the mercury to the metallic state and becomes amalgamated, calcium being formed at the same time by the liberated chlorine.—F. R.

Aluminium; Analysis of powdered ——. E. Kohn. Abstr. Compt. rend., 1908, 147, 1293—1296.

ALL aluminium powder contains a notable proportion of oxide. The author has determined the metallic aluminium in a carefully prepared sample, both by combustion of the hydrogen evolved on dissolving in acid, and weighing the water produced, and also by dissolving in ferric sulphate solution at 100° C., and titrating the ferrous salt formed; the average of many concordant determinations was 92.95 per cent. Complete analysis

of another sample gave the following percentage results:—Metallic aluminium, 92.499; silicon, 0.418; silica, 0.259; iron, 0.613; nitrogen, 0.152; carbon, 0.310; sodium, 0.006; aluminium insol. in acid, 0.024; alumina, by difference, 5.719. A check determination of the total aluminium agreed with the result calculated from the above analysis.—J. T. D.

Silico-thermal experiments. P. Askenasy and C. Ponnaz. Z. Elektrochem., 1908, 14, 810—811.

If with a finely-powdered mixture of barium peroxide and silicon, reaction be started as in Goldschmidt's aluminothermic process, it proceeds with such violence that the material is entirely expelled from the crucible, but it may be moderated by using coarser raw materials. With 50 parts of the peroxide to 4 parts of 90 per cent. silicon, the reaction product was a silicate, which was completely volatilised. On increasing the proportion of silicon to 15 parts, a silicide containing 30 per cent. of barium was obtained. This decomposed water with evolution of hydrogen, and hydrochloric acid with production of hydrogen silicide. This silico-thermal process can be used for melting iron, copper, etc., and for the reduction of oxides such as chromium oxide. The silicon may be replaced by ferrosilicon or titanium silicide, Ti_2Si_3 . At the present time, 90 per cent. silicon costs about 80 Pf. per kilo.—A. S.

Alloys of sodium and potassium; New method of formation of —. G. F. Jaubert. Ber., 1908, 41, 4116—4120.

By the action of sodium on potassium hydroxide or of potassium on sodium hydroxide, liquid alloys of the two metals, containing up to nearly 80 per cent. of potassium are obtained. The reaction is effected in a crucible under a layer of paraffin wax, or *in vacuo*, and according to the temperature and to the proportions of the reacting substances, the products contain from 62.9 to 77.2 per cent. of potassium, corresponding to the formulae, NaK and NaK_2 ; the yields are almost theoretical. The alloy, NaK_2 , is prepared on a commercial scale at Clavaux (Isère), France, by heating together sodium and anhydrous potassium hydroxide to 350° C. in an iron autoclave.—A. S.

Cobalt and its alloys with antimony; Action of antimony trichloride on —. F. Duclleuz. Compt. rend., 1908, 147, 1048—1050.

COBALT decomposes antimony trichloride above 600° C., giving cobalt chloride and an alloy of cobalt and antimony. By passing antimony chloride vapour over powdered cobalt below 1200° C., until the composition of the alloy remains constant, the non-magnetic compound, $CoSb$, is obtained; by the further action of the chloride this compound is decomposed, antimony being deposited and cobalt chloride formed, and above 1450° C. antimony is lost by volatilisation. Above 1200° C. the alloy formed contains less antimony and is attracted by a magnet. The alloys of cobalt and antimony have also been prepared directly in an atmosphere of hydrogen; incandescence takes place when a mixture of the powdered substances is heated to 500° C. The compounds, $CoSb$ (m. pt. about 1200° C.) and $CoSb_2$ (m. pt. about 700° C., with decomposition), have been obtained in this way. They are crystalline powders which, on heating, react vigorously with oxygen, sulphur, and chlorine, are readily attacked by nitric acid, but are scarcely affected by hydrochloric acid, and only slowly by fusion with alkalis or alkali carbonates. Alloys containing more than 67.04 per cent. of antimony are rapidly converted at 1200° C., in a stream of hydrogen or antimony chloride vapour, into the compound, $CoSb$.—F. Soub.

Ferrosilicon; Poisonous effects of vapours from —. "Times," Dec. 22, 1908. [T.R.]

At the inquest on the bodies of five Russian emigrants on the steamer "Ashton," which carried nine tons of ferrosilicon from Antwerp to Grimsby, it was stated that the ferrosilicon contained carbon, arsenic, and phosphorus, and that, in presence of moist air, it generated the hydrides of arsenic and phosphorus and also acetylene and hydro-

gen. The quantity of ferrosilicon carried would generate 110 cu. ft. of the gases in 24 hours. The material was carried in barrels in the hold, immediately below the emigrants' berths, a hatchway connecting the places; the hold was stated to be dry.

Solder used for tinned goods; Limit of lead in — for importation into Uruguay. Board of Trade J., Dec. 31, 1908. [T.R.]

SINCE JAN. 1, 1909, the importation into Uruguay of preserves in tins, which are closed with solder containing more than 5 per cent. of lead, has been prohibited. The Uruguayan Government has consented to exempt from this regulation all British tinned goods shipped to Uruguay before Dec. 31, 1908.

PATENTS.

Steel alloys; Manufacture of —. J. R. Crawford, Bushey, Herts. Eng. Pat. 21,356, Sept. 26, 1907.

STEEL alloys are obtained by adding the alloying metal in the form of carbide or ferro-carbide to the steel, most of the carbon of the carbide being eliminated by oxidation. In certain cases, however, the alloying metal is preferably added as nitride, the nitrogen escaping as gas. The formation of blow-holes may be prevented by the addition of aluminium, etc. Suitable nitrides are formed by titanium, lithium, tantalum, vanadium, and uranium.

—A. G. L.

(1). *Metallurgical process* (2). *Manganese and ferro-manganese; Process of making —.* A. G. Betts, Troy, N.Y. U.S. Pats. 905,280 and 905,281, Dec. 1, 1908.

(1). METALS are obtained from molten slags by the addition of silicon or a silicon alloy to the latter. (2). A slag containing iron and manganese is treated with sufficient silicon to reduce the iron, after which manganese is reduced by the addition of a further quantity of silicon.

—A. G. L.

Converter; Regulation of the temperature and reactions in the —. Ges. f. Linde's Eismaschinen A.-G. Ger. Pat. 204,407, July 17, 1907.

THE regulation is effected by varying the oxygen-content of the air blast. Supplies of oxygen and nitrogen are provided so that either of these gases, alone or mixed with air, can be blown into the converter as desired. For example, if it be desired to shorten the duration of blowing, so that larger quantities of pig-iron can be treated, or a larger proportion of scrap used, oxygen is added to the air blast. If it be desired to lower the temperature in the converter, or to prevent excessive oxidation of the iron, nitrogen is added to the blast.—A. S.

Furnace for the cementation of objects of iron, steel, or steel alloys by means of compressed gases. Soc. Anon. Italiana Gio. Ansaldo Armstrong and Co. Fr. Pat. 392,960, Aug. 5, 1908.

THE furnace is intended for the cementation of iron or steel objects, by means of gases such as hydrocarbons, carbon monoxide, etc., at high pressures and temperatures. The cementation chamber enclosed within the furnace is hermetically sealed, with the exception of inlet and outlet tubes for the gases. By means of tuyères, the pressure within the exterior furnace is maintained sensibly equal to that within the chamber, a valve being provided for the gas outlet at the top.—C. A. W.

Iron; Manufacture of malleable — from cast iron rich in both silica and phosphorus. O. Massenez. Fr. Pat. 393,325, July 21, 1908.

THE process is adapted to cast irons containing more than 1 per cent. of silica and phosphorus respectively, and has the advantage of giving a slag very rich in the latter element. The metal is oxidised in a converter with basic lining, lime and iron oxide being added in such proportions that the resulting slags are of too acidic a nature to combine with any appreciable amount of phosphoric acid. The silicon having been completely oxidised, the

very liquid slag is run off, and lime, in amount equal to two-thirds that required to form the tetrabasic phosphate, added. The process is then continued until the greater part of the phosphorus has been oxidised, the metal being afterwards transferred to a furnace with basic hearth, where the dephosphorisation is completed in the presence of basic oxides. In order to prevent the solidification of the metal in its passage from the converter, it is advisable to add a small amount of carbon before the transference. In any case, the metal is finally deoxidised and recarburised in the usual way. —C. A. W.

Zinc; Separation of — from its ores and compounds. W. Hommel and H. L. Sulman, London. Eng. Pat. 23,901, Oct. 29, 1907.

The invention constitutes an improvement on Eng. Pat. 21,672 of 1906 (this J., 1907, 1144). If the zinc ore used is deficient in sulphur, iron pyrites or other material rich in sulphur is added to it, and the whole roasted, the sulphur dioxide given off being pumped under pressure into closed vessels containing water. The roasted ore is then strongly heated, so as to volatilise zinc oxide, which is condensed in a series of chambers. The impure zinc oxide, containing lead, etc., from the chambers nearest the furnace, is next treated in closed vessels under pressure with the solution of sulphur dioxide obtained as above. The solution of zinc bisulphite obtained is separated from the insoluble lead compounds, etc., and normal zinc sulphide is precipitated, by treating the solution with pure zinc oxide from the chambers furthest from the furnace, by exposing it in a vacuum, or by a combination of both methods. The zinc sulphite obtained is finally calcined to zinc oxide. —A. G. L.

Acid metallic solutions; Treatment of — for the extraction of metals [zinc]. P. D'Alton-Shée, Fr. Pat. 392,867, Oct. 8, 1907.

THE process may be applied to the separation of zinc from other metals in a solution, such as that obtained by the action of acid on a roasted blende. The solution having been previously filtered, is mixed with a small quantity of sodium hypochlorite, in order to oxidise any iron, chromium, or manganese, which are afterwards precipitated by the addition of zinc oxide or hydroxide to the hot solution. The zinc is finally precipitated by the addition of ammonia, not in excess, according to the reaction: $3\text{ZnSO}_4 + 4\text{NH}_4\text{OH} = (\text{NH}_4)_2\text{SO}_4 + (\text{NH}_4)_2\text{SO}_4 \cdot \text{ZnSO}_4 + 2\text{Zn}(\text{OH})_2$, the double sulphate being quite insoluble in the excess of ammonium salt. —C. A. W.

Aluminium; Welding or melting objects of —. M. U. Schoop. Eng. Pat. 24,283, Nov. 2, 1907. Under Int. Conv., Oct. 5, 1907.

FLUORIDES such as calcium fluoride, potassium fluoride, or boron fluoride are added to the flux of alkali chlorides described in Eng. Pat. 24,096 of 1907 (see Fr. Pat. 374,089; this J., 1907, 828). —O. F. H.

Aluminium ores; Process of smelting —, and method of treating aluminium silicate. F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pats. 906,172 and 906,173, Dec. 8, 1908.

ALUMINIUM silicate is mixed with carbon and with a base metalliferous material, the amount of carbon being sufficient to reduce only the whole or a part of the silica present, but none of the alumina, and the quantity of base metalliferous material being such as "to form a disintegrating alloy with the reduced silicon." The mixture is electrically heated so as to fuse the alumina or mixture of alumina and silica, and to reduce the silicon and cause it to combine with the base metal. The mass is allowed to cool and to disintegrate, after which the alumina or alumina-silica, which is claimed to possess great hardness and abrasive properties, is separated from the alloy of silicon. Alternatively, the addition of base metalliferous material may be omitted, in which case one of the products obtained is silicon. —A. G. L.

Aluminium and other metals; Solder for —. C. G. Carroll and W. H. Adams, Fayetteville, Ark. U.S. Pat. 906,383, Dec. 8, 1908.

THE solder consists of calcium and tin or other material possessing sufficient affinity for aluminium and other metals it is desired to join. The function of the calcium in the solder is to reduce the oxide on the surface of the aluminium or other metal. —A. G. L.

Refuse tin ware; Method of and apparatus for cleansing articles of — and for the recovery of solder therefrom. J. W. Evans, Cargo Fleet, Yorks. Eng. Pat. 26,383, Nov. 29, 1907.

THE refuse tin ware is delivered by means of a hopper to one end of a revolving perforated cylinder provided with a spiral worm, by means of which the articles are tumbled forward through the cylinder until they fall, freed from tin, into a receptacle placed at the other end, from which they are discharged at intervals by opening a slide. At this end, beyond the receptacle, is placed a fire-grate, from which reducing gases pass into the cylinder, heating it to a dull red heat. The walls of the cylinder are perforated, and it is completely enclosed within an outer brick chamber. Below the cylinder is placed a tank of water, into which melted tin, solder, iron oxide, and dirt fall through the perforations. By means of inlet and outlet pipes set at the surface of the water in the tank, a constant flow of water is maintained through the latter so as to wash away the dirt. The tin, etc., is from time to time raked out of the tank through an opening near the bottom; it is dried and the iron oxide separated magnetically. —A. G. L.

Ore separating processes. M. Ruthenburg, Lockport, U.S.A. Eng. Pat. 28,191, Dec. 21, 1907.

THE process is applicable to ores and concentrates, e.g., "Elmore concentrates," which cannot be separated by gravitation in water because they are not wetted by it. It consists in separating the separate components by gravitation in a liquid hydrocarbon, e.g., the lighter petroleum distillates, which "wets" the minerals, and dissolves the heavy oil if "Elmore concentrates" are used. —A. G. L.

Concentration of pulverised ore; Apparatus for the —. J. Guinea, Viscaya, Spain. Eng. Pat. 11,762, May 30, 1908.

THE apparatus consists of an inclined table of trapezoidal form, provided with an ore-charging receptacle at the upper corner of the wider part, and a watering pipe along the upper edge. Longitudinal grooves are formed in the surface of the table in its wider portions. The table is given a combined reciprocating and rising and falling movement, in such a way that it descends whilst it advances, and rises on returning. This movement is effected by supporting the table from the middle of a series of bent double-armed levers linked together at their lower ends; the upper ends of the levers are keyed to oscillating shafts, operated from an eccentric disc by means of a connecting rod coupled to an oscillating crank on one of the shafts. —A. G. L.

Metalliferous ores; Process of treating —. F. R. Carpenter, Assignor to The American Iron and Steel Alloys Co., Denver, Colo. U.S. Pat. 904,838, Nov. 24, 1908.

ORES are treated without the use of a flux and without producing a slag, by feeding them on to the top of a molten bath of specific gravity intermediate between that of the metallic constituents of the ore and that of the gangue. —A. G. L.

Annealing furnaces. J. and R. Edwards, Morriston, Wales. Eng. Pat. 15,196, July 17, 1908.

IN addition to the usual bridge of a reverberatory annealing furnace, a second inverted bridge is provided beyond the first. This second bridge extends from the top of the furnace to the bottom, but is made solid only in its upper portion, the lower part being provided with a number of perforations, through which the flame passes, being thereby evenly distributed in the annealing chamber. —A. G. L.

Copper and process for purifying, casting, and alloying the same. A. J. Rossi, Assignor to The Titanium Alloy Manufacturing Co., New York. U.S. Pat. 905,232, Dec. 1, 1908.

MOLTEN copper is purified by the addition of titanium or a titanic compound. The resulting metal, containing not more than a trace of titanium, is also claimed.—A. G. L.

Furnaces; Metallurgical —. L. S. Hughes. Fr. Pat. 392,991, Aug. 6, 1908.

THE furnace is intended for the treatment of pulverised ores, and consists essentially of an upright, cylindrical body of thin sheet iron, with a conical bottom, in which apertures are provided for the admission of air. The gas inlets are arranged on an annular tube surrounding the furnace, just above the conical bottom, and are inclined, so that an ascending flame is produced within the combustion chamber. The ore, fed through a hopper at the side, falls in a thin stream on to a jet of air ascending from the bottom, and is so forced up into the hot zone of the furnace, where it mixes with the flames from the burners. By maintaining a strong current of air through the furnace, the heated products are quickly carried away, so that the temperature within the chamber is never sufficient to fuse the oxidised ore. The powdered material, carried away with the gases, is finally deposited in chambers connected with the conduit. The ash and heavier impurities are separated within the furnace proper, and can be removed through apertures at the bottom.—C. A. W.

Magnesium and its alloys; Melting and casting of — without formation of dross. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 393,080, July 11, 1908.

By adding the metal in only small quantities at a time, the mass in the crucible is never allowed to become completely liquid. In this way the temperature never greatly exceeds the melting point of the metal, and the formation of the oxide and nitride is prevented. Before casting, and in order to obtain the necessary fluidity, the vessel containing the pasty mass is quickly agitated after removal from the fire.—C. A. W.

Ingot; Process for forming —. J. T. Jones. Fr. Pat. 392,629, June 6, 1908.

SEE U.S. Pat. 890,235 of 1908; this J., 1908, 814.—T. F. B.

Iron and steel; Process for making —. J. T. Jones. Fr. Pat. 392,630, June 6, 1908.

SEE U.S. Pats. 890,234, 890,235, 891,704, and 891,705; this J., 1908, 814 and 815.—T. F. B.

Zinc; Process of extracting —. E. H. Shortman. Bloxwich, Assignor to The New Delaville Spelter Co., Ltd., Spring Hill. U.S. Pat. 905,753, Dec. 1, 1908.

SEE Eng. Pats. 7223 and 7223A of 1907; this J., 1908, 450.—T. F. B.

Ore; Apparatus for the magnetic separation of —. G. Gröndal, Djursholm, Sweden. U.S. Pat. 905,815, Dec. 1, 1908.

SEE Addition to Fr. Pat. 340,858 of 1904; this J., 1907, 699.—T. F. B.

Thermic mixtures; Manufacture of —. H. Goldschmidt, Assignor to Th. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 906,009, Dec. 8, 1908.

SEE Fr. Pat. 361,197 of 1905; this J., 1906, 593.—T. F. B.

Magnesium and alloys thereof; Preparing — for casting. P. Rakowicz, Griesheim, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. U.S. Pat. 906,820, Dec. 15, 1908.

SEE Fr. Pat. 393,080 of 1908; preceding.—T. F. B.

Alloy. W. Rübel, Hamburg, Germany. U.S. Pat. 906,937, Dec. 15, 1908.

SEE Fr. Pat. 381,091 of 1907; this J., 1908, 128.—T. F. B.

Furnaces for melting metals, glass, etc., and also for roasting or calcining ores, saltlake, and other substances. L. Le B. Mount and W. H. Pflüger. Fr. Pat. 393,258, Aug. 13, 1908. Under Int. Conv., Aug. 14, 1907.

SEE Eng. Pat. 18,417 of 1907; this J., 1908, 739.—T. F. B.

Rust-preventing and lubricating agent [from mineral oils]. Ger. Pat. 204,906. See III.

Blast-furnace slag; Treatment of — for production of hydraulic cement. U.S. Pat. 905,813. See IX.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A).—ELECTRO-CHEMISTRY.

Silundum, a new product of the electric furnace. F. Bölling. Chem.-Zeit., 1908, 32, 1104—1105.

SILUNDUM, a silicide of carbon, is obtained by heating carbon in an atmosphere of silicon vapour, i.e. by heating carbon with carborundum, to which sand may be added, or with a mixture of sand and carbon, at a temperature of 1700°—1800° C. [Silundum appears to be intermediate between carbon and carborundum]. Carbon articles can, if desired, be converted into silundum on one side, or in places only. The electrical conductivity of silundum is considerably less than that of carbon; it varies, together with the hardness, according to the carbon used and the length of heating in silicon vapour. A rod, 800 mm. in length and 6 mm. in diameter, will carry a current of 4000 watts permanently, and of 8000 watts temporarily. The material is stable in air up to high temperatures; at 1750°—1800° C. silicon vapour is given off and at once oxidised. Molten metals, especially iron, destroy it rapidly; consequently crucibles, etc., should be converted into silundum only on the outside. Silundum cannot be used for making filaments for incandescent electric lamps, on account of the deposition of brown silicon on the glass. The chief use of the new material appears to be as a permanent resistance material for high temperature work.—A. G. L.

Carbon dioxide; Decomposition of — by the silent electric discharge. A. Holt, jun. Chem. Soc. Proc., 1908, 24, 271.

CARBON dioxide, which had been carefully dried by phosphoric oxide, was found to be decomposed to an amount which increased as the pressure of the gas diminished. About 48 per cent. decomposition was obtained under 30 mm. pressure, and about 3 per cent. decomposition under 700 mm. pressure. The amount of decomposition was found to vary with the degree of dryness of the gas, the intensity of the discharge, and the form of ozoniser employed, but in all cases diminished pressure gave greater decomposition. Moist carbon dioxide was found to decompose to a larger extent as the pressure of the gas increased, ranging from 3 per cent. decomposition under 50 mm. pressure to about 14 per cent. under 700 mm. pressure. The weaker the discharge the less gas was decomposed at all pressures. Comparison of these results with those obtained when moist and dry carbon dioxide is decomposed by ultra-violet light, or induction sparks, leads to the conclusion that the silent discharge at low pressures acts chemically, mainly like ultra-violet light, whilst as the pressure of the gas increases, it behaves more and more as though it consisted of actual sparks.

Electrolytic and electrothermal industries; Influence of cheap electricity on —. E. A. Ashcroft. Faraday Soc., Dec., 1908. [Advance proof].

Nickel; Electrolytic determination of —. A. Schumann. See XXIII.

Rotating anode; Use of the — in electrolytic separations. [Determination of calcium]. M. E. Holmes. See XXIII.

PATENTS.

Ozonising liquids; Apparatus for —. F. Barbary. Eng. Pat. 25,202, Nov. 13, 1907. Under Int. Conv., Nov. 29, 1906.

THE apparatus consists of a series of concentric glass vessels, the central one of which is closed by a glass stopper fitted with glass tubes closed at their lower ends and projecting into the vessel. Metallic pins are fitted into the glass tubes and connected with one of the poles of a powerful induction coil. The liquid is introduced into the central vessel by means of a tube in the stopper, and passes from one vessel to another by holes in opposite sides of successive vessels. The outer vessel stands on pointed pins attached to an insulated metal plate which is connected to the second pole of the induction coil, and at the bottom of this vessel is a funnel-shaped opening connected with a receiver in which a vacuum is created.—O. F. H.

Ozone; Method of producing and utilising —. H. N. Potter, New Rochelle, N.Y., Assignor to Cooper Hewitt Electric Co., New York. U.S. Pat. 905,361, Dec. 1, 1908.

THE method of producing and utilising ozone, consists in passing an electric current between electrodes placed inside a container pervious to ozonising radiation, preventing a dissipation of the ozone by suitable means, and conducting it to a required point.—F. R.

Ozone generator. J. J. E. Donzal. First addition, dated May 26, 1908, to Fr. Pat. 391,368, May 4, 1908 (this J., 1908, 1211).

THE apparatus consists of a central tubular electrode perforated by a large number of holes provided with conically arranged pointed projections, a dielectric composed of a large number of capillary tubes placed at a distance of about 0.5 mm. from the central electrode, an exterior spiral electrode holding together the bundle of capillary tubes, and means for drawing air through the central electrode.—O. F. H.

Electrolysis of liquids; Process for the —. J. Billiter, Aschersleben, Germany. U.S. Pat. 903,951, Nov. 17, 1908.

THE liquid is fed into the upper of two superposed chambers separated by a diaphragm. The electrolyte is heated at or about the level of the electrodes in the upper chamber, and the gases generated are withdrawn by suction from the lower chamber beneath the diaphragm.—O. F. H.

Gases; Process and apparatus for effecting chemical action in —. D. R. Lovejoy, Niagara Falls, N.Y., Assignor to W. E. F. Bradley, New York. U.S. Pats. 904,070 and 904,073, Nov. 17, 1908.

THE mixture of gases is subjected to the influence of a radio-active body and to the action of the electric arc, which is successively formed, elongated, and broken. The apparatus consists of a chamber in which are placed two sets of relatively movable electrodes, by means of which arcs may be successively formed, elongated, and broken. Means are provided for introducing the gases into the chamber, and for subjecting them to the influence of a radio-active body.—O. F. H.

Gases; Apparatus and process for chemically combining —. D. R. Lovejoy, Niagara Falls, N.Y., Assignor to W. E. F. Bradley, New York, N.Y. U.S. Pats. 904,071 and 904,072, Nov. 17, 1908.

THE apparatus consists of a chamber in which electrodes are so mounted that arcs may be rapidly formed between them, elongated, and broken. Means are provided for refrigerating the gases on their way to the chamber, and for liquefying or solidifying the gases. The gases, such as nitrogen and oxygen, are subjected to the action of electric arcs, thus successively formed, elongated and broken, and the products, such as nitrous oxide, are removed by cooling to the liquid or solid state.—O. F. H.

Carbides [of calcium, etc.]; Process of smelting metallic compounds and producing —. E. F. Price, Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 904,991, Nov. 24, 1908.

A CALCIUM compound reducible by carbon is directly heated by allowing it to fall through a heated atmosphere. The heat unabsorbed in this process is used to "indirectly" heat carbon. The two materials are then mixed and further heated electrically.—A. G. L.

Electrode. A. G. Davis, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 905,666, Dec. 1, 1908.

IN the electrical treatment of gases, electrodes composed of iron chemically combined with another element, e.g., magnetic oxide of iron, are used for the production of long arcs.—F. R.

Galvanic element. C. F. G. A. Heil. Fr. Pat. 392,429, July 1, 1908. Under Int. Conv., April 10, 1908.

THE claims are for a depolariser consisting of mercury sulphate, mixed with a convenient proportion of graphite and mercury oxide, and an electrolyte consisting of a solution of magnesium and potassium sulphates.—O. F. H.

Electrolyte for a depolarising galvanic element containing compounds of mercury. C. F. G. A. Heil. Fr. Pat. 392,430, July 1, 1908. Under Int. Conv., June 12, 1908.

THE electrolyte consists of an aqueous solution of acetates of metals, particularly potassium acetate.—O. F. H.

Electric resistance furnace; High pressure —. J. Josselin. Fr. Pat. 392,465, July 18, 1908.

THE furnace, which is intended to be used for the manufacture of diamond and for other purposes, consists of a strong, hollow steel cylinder and is heated by means of a carbon resistance of convenient form placed between the electrodes. Tin solder is used as a seal for the cover and for the electrode carrier, both of which are water-cooled. A pump is used for forcing gases under great pressures into the interior of the furnace.—O. F. H.

Nitrogen oxides; Production of — [from air]. F. Haber and A. Koenig. Fr. Pat. 392,670, July 13, 1908. Under Int. Conv., July 24, 1907.

OXIDES of nitrogen are produced by passing air, under reduced pressure, through a narrow cylindrical vessel in which an electric arc is maintained in such a manner that it fills or nearly fills the vessel. An excessively high temperature is avoided by having the walls of the vessel suitably cooled. Gas containing 9.5 to 10 per cent. of oxides of nitrogen is stated to be easily obtained.—F. R.

Electric furnaces. H. Nathusius, and Westdents, Thomas-phosphatwerke, Berlin. Eng. Pat. 7923, April 9, 1908. Addition to Eng. Pat. 7188, April 1, 1908.

SEE Addition of March 30, 1908, to Fr. Pat. 388,668 of 1907; this J., 1908, 1026.—T. F. B.

Compounds of oxygen and nitrogen; Production of —. F. Haber and A. Koenig, Karlsruhe, Germany. Eng. Pat. 15,490, July 21, 1908. Under Int. Conv., July 24, 1907.

SEE Fr. Pat. 392,670 of 1908; preceding.—T. F. B.

Voltaic arcs; Method of striking —. A. J. Petersson, Alby, Sweden. U.S. Pat. 905,572, Dec. 1, 1908.

SEE Fr. Pat. 359,113 of 1905; this J., 1906, 321.—T. F. B.

Arc lamp electrode. U.S. Pat. 904,532. See II.

Acetates, especially sodium acetate; Electro-chemical oxidation of —. Addition to Fr. Pat. 383,595. See VII.

Alkali and other silicates; Manufacture of — [in the electric furnace]. Fr. Pats. 392,945 and 392,946. See VII.

Glass articles; Fire-glazing or finishing of —. Eng. Pat. 390. See VIII.

(B.)—ELECTRO-METALLURGY.

PATENTS.

Coating metallic articles with zinc; Electrolyte for —.
C. Bianco. Fr. Pat. 392,317, July 15, 1908. Under
Int. Conv., July 16, 1907.

THE electrolyte consists of a solution of sulphates and acetates of zinc, iron, aluminium, and an alkali metal such as sodium.—O. F. H.

Fat.	Sp. gr.	M. pt.	Acid value.	Saponification value.	Iodine value.	Helmer value.	Reichert-Meissl value.	Acetyl value.	True acetyl value.	Fatty acids.		
										M. pt.	Mean molec. weight.	Iodine value.
Extracted with ether	0.884	36-37	91.1	227.4	24.3	92.76	0.2	15.1	11.2	39	244.6	25.95
" petroleum spirit ...	0.973	37-38	97.2	234.6	12.3	91.45	4.2	18.2	9.81	39-40	238.5	13.6

Alloy; New metallic — and method of manufacture.
A. Jouve. Fr. Pat. 392,924, Aug. 1, 1908.

THE alloy is composed principally of magnesium and silicon, with or without other metals, and is prepared by reducing magnesium oxide, or any other suitable compound of magnesium, by carbon in the electric furnace, in the presence of a silicious material.—C. A. W.

Zinc-plating; Electrolytic solution for —. C. Bianco, New York. U.S. Pat. 905,785, Dec. 1, 1908.

SEE Fr. Pat. 392,317 of 1908; preceding.—T. F. B.

Metallisation of vitreous, porcelain, earthenware and the like surfaces so that metal or metallic alloy may be electrolytically deposited thereon. Eng. Pat. 17,743. See VIII.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Ergot oil, lycopodium oil, and arcea nut fat; Characteristics of —. A. Rathje. Arch. Pharm., 1908, 246, 692-706.

Ergot oil, obtained from *Scelus cornutum*, is a dark brown oil which thickens a little on cooling. It has a somewhat pungent taste and a not very characteristic odour. The following values were obtained with three samples:—Sp. gr. (one sample), 0.9250; refractometer reading (one sample), 1.4685; acid value, 11.31, 11.46; saponification value, 178.4 to 180.2; iodine value, 73.4 to 74.5; Helmer value, 95.84 to 96.6; Reichert-Meissl value, 0.61 to 0.67; acetyl value, 27.43 to 31.38; unsaponifiable matter (one sample), 0.36; mineral matter, 0.2 per cent.; and alkaloids, 0.6 per cent. *Fatty acids* (average of two samples), neutralisation value, 183.0; mean molecular weight, 307; iodine value, 77.2; and m. pt. (one sample) 38°-39° C. The fatty acids, it was concluded, comprised 68 per cent. of oleic acid, 22 per cent. of hydroxyoleic acid, and 5 per cent. of palmitic acid.

Lycopodium oil is a bright yellowish-green oil, which may be obtained by extracting the spores of lycopodium with chloroform. A yield of 49.2 per cent. was thus obtained of a product which gave the following values:—Sp. gr., 0.93617; refractometer reading, 1.4671; acid value, 18.6; saponification value, 195.0; iodine value, 81.0; Helmer value, 88.0; Reichert-Meissl value, 7.3; acetyl value, 53.8; (true acetyl value, 44.1); glycerol, 7.8 per cent.; unsaponifiable matter, 0.43 per cent.; and mineral matter, 0.03 per cent. *Fatty acids*, m. pt., 39°-40° C.; neutralisation value, 202.0; mean molecular weight, 278.0; and iodine value, 91.8. The fatty acids were found to have the following composition calculated upon the oil:—Lycopodium acid (dihydroxystearic acid) 3.2; lycopodic acid, 81.0; stearic acid, 1.13; palmitic acid, 0.85; and myristic acid, 2.0 per cent. The lycopodic acid separated by treatment of the lead salts of the fatty acids with benzol was a yellow liquid with an iodine value of 98.7,

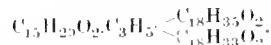
and a molecular equivalent of 256.8 (theory for an acid of formula, $C_{16}H_{30}O_2=254$).

Arcea nut fat:—The substance obtained by extracting the nut with ether was a reddish-brown fat with an odour recalling that of nutmeg, whereas that obtained by extraction with petroleum spirit was yellowish-white and nearly odourless. Both fats were solid at the ordinary temperature. On analysis they gave the following results:—

Both fats contained about 5 per cent. of glycerol, 1 per cent. of unsaponifiable matter, and 0.02 to 0.03 per cent. of mineral matter. The fatty acids had the following composition respectively:—Stearic acid, 2.25 and 3.3; palmitic acid, 3.1 and 2.47; myristic acid, 21.0 and 24.7; lauric acid, 43.65 and 53.3; capric acid, 1.0; and oleic acid, 29.0 and 14.5 per cent.—C. A. M.

Japanese fish oil; Solid constituents of —. H. Okada. Chem.-Zeit., 1908, 32, 1199-1201.

THE oil examined was derived from various species of herring. It was completely soluble in 30 times its volume of a mixture of 40 parts of ether and 60 parts of alcohol. On adding to 100 c.c. of this solution the same volume of 95 per cent. alcohol, and cooling the liquid to -10° C., a white flocculent precipitate (m. pt. 30°-33° C.) was obtained, and from this was finally isolated by successive treatments with the mixture of ether and alcohol, an apparently homogeneous substance melting at 34° to 35° C. This had a saponification value of 195.9; an iodine value of 29.7; and a refractometer reading of 1.4545 at 41°-42° C. The liberated fatty acids were fractionated by the lead-ether method, and found to contain oleic acid and solid fatty acids, which from the results of fractional precipitation corresponded to a mixture of stearic and isocetic acids. The solid substance isolated from the oil thus corresponded to a mixed glyceride with the formula,



which has a theoretical iodine value of 29.5 and saponification value of 195.2.—C. A. M.

Waxes of the Coniferae; a new group of natural compounds.
J. Bougault and L. Bourdier. Compt. rend., 1908, 147, 1311-1314.

THE authors have isolated from the leaves of several species of Coniferae (juniper, pine, thuja, etc.), a series of crystalline waxes constituting a hitherto unrecognised group of chemical substances. The isolation of these waxes was based on their solubility in hot, and insolubility in cold 90 per cent. alcohol; their purification which is effected by various organic solvents is a very laborious process. The wax of *Juniperus sabina*, m. pt. 73°-78° C., was resolved into fractions melting at 68°, 72°, 76° and 82° C., which are not necessarily single substances but are all of the same type. All these bodies are of acid character; when the acid is neutralised by alcoholic potash, they are soluble in hot water, but the solution forms a soap-like jelly on cooling. The waxes also possess a free alcoholic group capable of acetylation. They are also esters, having a saponification value of about 230, but the whole of the products of hydrolysis are acids, no purely alcoholic compounds, such as glycerol, etc., being formed. When the alcoholic solution of the saponified wax is neutralised and treated with barium chloride, the whole of the organic matter is precipitated as barium derivatives insoluble in benzene or

cold ether. Consequently the waxes are esters of alcoholic acids, in which the carboxyl group of one molecule is esterified with the alcoholic hydroxyl of another molecule of the same or a similar acid. In this way complex chains are formed, similar to the polypeptide chains studied by Fischer; the authors propose the name of *etholides* for these new waxes. It is probable that the number of simple hydroxy-acids taking part in the synthesis of the various etholides is not very large, and that the different etholides differ mainly in respect of the number of associated molecules and their order in the chains. The authors have isolated two of these component hydroxy-acids:—a *hydroxypalmitic acid*, m. pt. 95° C., present in all these waxes, which they call *juniperic acid*, and a hydroxylauric acid, called *sabianic acid*, m. pt. 82° C., found so far only in the fraction of the wax of *J. sabina* melting at 82° C.—J. F. B.

Soap; Hydrolysis of —, F. W. F. Ross, Chem. Trade J., 1908, 43, 540–541.

THE author states that the effect of hydrolysis has received scant attention in attempts to determine the value of toilet soaps with respect to their action on the skin. It is stated that the liability to and rate of hydrolysis of a given soap does not depend upon the percentage of combined alkali, the proportion of water in the solid soap, or whether the soap is super-fatted or not, but is governed by the nature of the fats used in its preparation. Tests for toilet soaps are described based on the use of a 1 per cent. solution of phenolphthalein in absolute alcohol. Comparative tests are made on the soap under examination and a neutral standard soap, and the results are given in terms of the time required to obtain a pink colour with the phenolphthalein solution diluted with a known quantity of water, or the relative amounts of water which have to be added to the phenolphthalein solution in order to obtain, in the same time, tints of the same depth on the standard soap and on the soap under examination. —A. S.

Lavender oil; Adulteration of — with the esters of fatty acids of coconut oil, T. Delphin, See XX.

PATENTS.

Cod-liver oil emulsion; Apparatus for the manufacture of —, S. A. Sheard, Leeds, Eng. Pat. 492, Jan. 8, 1908.

THE apparatus consists of a hollow drum mounted horizontally in adjustable bearings, and within which, on a central shaft, are mounted a number of perforated blades. The drum and the blades are capable of being rotated in opposite directions. The oil and flavouring essences are run continuously into the drum, which is also charged continuously, through the hollow end of the central shaft, with the requisite amount of "mucilage" or like material, from reservoirs mounted above the drum, means being provided for regulating and checking the feeding of the different materials. —E. W. L.

Oil; Apparatus for decolorising, bleaching, and thickening —, See Noury et Van Der Lande, Fr. Pat. 392,793, July 30, 1908.

THE patent relates to the process of decolorising, bleaching, and thickening oils by subjecting them to the action of heat and of air under pressure in an apparatus provided with an agitator. The apparatus consists of a jacketed cylindrical vessel, divided by transverse partitions into compartments, which communicate with one another alternately at the centre and at the circumference. Alternate partitions are fixed to a central shaft and rotate with it. On the upper and lower sides of the partitions a series of projecting wings or blades, of trapezoidal shape, are mounted, whereby a thorough agitation and mixing of the oil and air are effected. —A. S.

Soap and process of making soap, C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co., N.J. U.S. Pat. 904,520, Nov. 24, 1908.

ABOUT 300 parts of commercial oleic acid are sprayed upon about 500 parts of a fixed alkali such as soda ash;

the mixture is then stirred and heated at a temperature of 250° F. until combination has taken place, when the resulting soap is cooled and ground. The mixing, stirring, and heating are carried out as a continuous process.

—W. P. S.

Polyglycerins from glycerin; Process for preparing —, C. Claessen, Fr. Pat. 392,881, Aug. 1, 1908.

SEE Ger. Pat. 198,768 of 1907; this J., 1908, 833. —T. F. B.

Glycerin; Application of the highly viscous liquids obtained by the separation of water from — by heating, C. Claessen, Fr. Pat. 393,341, Aug. 1, 1908.

SEE Ger. Pat. 198,711 of 1907; this J., 1908, 803. —T. F. B.

Soaps containing peroxide; Process for making —, P. Beiersdorf and Co., Fr. Pat. 392,955, Aug. 5, 1908. Under Int. Conv., Aug. 29, 1907.

SEE Eng. Pat. 16,823 of 1908; this J., 1908, 1028. —T. F. B.

Resins, wax, gums, fats, oils, &c.; Treatment of — with chlorine, Eng. Pat. 741, See XIII B.

Elastic and plastic material; Manufacture of —, Fr. Pat. 392,669, See XIII C.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

Lead chromate ["chrome yellow"] and its change of colour, K. Jablczynski, Chem. Ind., 1908, 31, 731–733.

FRESHLY-PRECIPITATED lead chromate gradually changes in colour from light yellow to orange, and in practice a certain proportion of lead sulphate is precipitated with the chromate in order to prevent this change from taking place (see this J., 1891, 709; 1899, 843). The author has found that when lead chromate is precipitated in presence of excess of normal lead acetate, the yellow precipitate does not change in colour when left in contact with the solution, nor even when boiled with the latter, but if separated and washed with water or with acetic acid, it then gradually acquires an orange tint. If the precipitation be effected in presence of excess of basic lead acetate, the colour of the precipitate changes gradually (or immediately on boiling) from golden yellow to red; this change is attributed by the author to the separation of water from the basic lead chromate, $Pb_2(OH)_2CrO_4$, first precipitated, with formation of the compound, $O \left\langle \begin{smallmatrix} Pb \\ Pb \end{smallmatrix} \right\rangle CrO_4$ ("chrome red," Chinese or Persian red).

THE prevention of the change of colour of normal lead chromate ("chrome yellow") in the experiments described above was evidently due to the presence of excess of lead acetate. Further experiments showed that the change is also prevented by as little as 10 per cent. of lead sulphate; barium sulphate and lead phosphate do not prevent the change; lead oxalate causes reduction of the "chrome yellow." According to the author the change of colour is due to the hydrolysis of the lead chromate, which is not completely insoluble in water. The dissolved portion yields in solution lead ions and chromate ions: $PbCrO_4 \rightleftharpoons Pb^{++} + CrO_4^{--}$. By the union of the lead ions and the hydroxyl ions of the water, the basic ions, $PbOH^+$, are formed, and these combine with chromate ions to produce basic lead chromate, $Pb_2(OH)_2CrO_4$ (the parent substance of "chrome red"). If a soluble lead salt be present, it yields lead ions in solution, and these diminish the degree of dissociation of the lead chromate and thus limit the reactions mentioned. Lead acetate, being easily soluble, can be washed out of the lead chromate precipitate, and the change of colour can then take place. Lead phosphate is practically insoluble and thus incapable of preventing the change. Lead sulphate is sufficiently soluble to prevent the change of colour, but not soluble enough to be removed by washing. —A. S.

PATENTS.

Pigments; Production of colouring matters suitable for —. Badische Anilin und Soda Fabrik. Fr. Pat. 392,859. July 31, 1908. Under Int. Conv., April 2, 1908.

INDANTHRENE BLUE and other similar dyestuffs are obtained in a state very suitable for their use as pigments by reducing them with carbohydrates in alkaline solution. Example: 1000 kilos. of Indanthrene Blue RS are mixed with 9000 litres of water, and a mixture of 900 kilos. of caustic soda (40° B.) and 500 kilos. of glucose added. The whole is boiled for $\frac{1}{2}$ –1 hour, filtered, and washed. If, before the filtration a little colouring matter has passed into solution, air is bubbled through to precipitate it.

—J. C. C.

Lake colours; Process of making —. F. M. Winter, Fährbrücke, Germany. U.S. Pat. 905,264, Dec. 1, 1908.

SEE Fr. Pat. 385,484 of 1907; this J., 1908, 633.—T. F. B.

Monazo-dyestuff; Manufacture of a — capable of being applied as a bluish-red pigment. Fr. Pat. 392,914. See IV.

(B.)—RESINS, VARNISHES.

Turpentine oil as a by-product in the manufacture of wood-pulp by the sulphate process. P. Klason. See XIX.

PATENTS.

Resins, wax, gums, fats, oils or similar substances; Treatment of — with chlorine. The Electrolytic Alkali Co., Ltd., Middlewich, Cheshire. C. C. Connor, Belfast, and J. W. Stubbs, Middlewich. Eng. Pat. 741, Jan. 13, 1908.

IN order to moderate the violence of the reaction between gaseous chlorine and the substances enumerated in the title, these substances are dissolved in carbon tetrachloride and the gas passed through the solution. The progress of the reaction is indicated by the rise of temperature, and the reaction is complete when the temperature begins to fall. When an oxidised product is desired, water is added to the solution before passing in chlorine. The free acid is finally neutralised with alkali and the carbon tetrachloride distilled off, the chlorinated or oxidised product remaining behind.—E. W. L.

Varnish and manufacture thereof. F. R. Suter, Assignor to New Process Varnish Co., New York. U.S. Pat. 905,384, Dec. 1, 1908.

MOLASSES is boiled until most of the water is expelled, and is then introduced, under pressure, into a mass of melted resin, below the surface of the latter. The mixture is agitated, and then "a distillate of asphalt diluted with a suitable vehicle" is added.—A. S.

Varnish and paint with a base composed of derivatives of pimaric acid; Manufacture of —. Darrasse Frères and L. Dupont. Fr. Pat. 392,668, July 11, 1908.

CRUDE resinous exudations containing pimaric acid are filter-pressed, and the resulting cake, which is said to consist of almost pure pimaric acid, is dissolved in alkali. From the solution, metallic pimarates are obtained by precipitation with soluble salts of the respective metals. These metallic pimarates are dissolved in suitable solvents and utilised as substitutes for resins in the production of varnish and paints.—A. S.

Siccative; Process for producing a —. J. Pilgram, Cologne, Germany. Eng. Pat. 11,031, May 21, 1908.

SEE Fr. Pat. 390,804 of 1908; this J., 1908, 1122.—T. F. B.

Resinous products capable of replacing natural resins; Process for the manufacture of —. L. Grognot, Assignor to Les Produits Chimiques de Croissy, Paris. U.S. Pat. 906,219, Dec. 8, 1908.

SEE Fr. Pat. 390,713 of 1907; this J., 1908, 1122.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Rubber from Manihot Glaziovii, and cultivation of the latter at Hawaii. Zimmermann. Der Pflanze, 1908, 4, 265; Gummi-Zeit., 1908, 23, 315.

THE tapping of the trees is effected by removing the hard layer of cork, and then making a series of vertical cuts; at the base the vertical cuts are connected by sloping ones. The duration of the flow of latex, usually from 2 to 5 minutes, may be increased by the usual "drip" method, the effect being greatest (30–40 minutes) when dilute (0.033 per cent.) ammonia is used. The collected latex is neutralised with dilute sulphuric acid, allowed to stand for half an hour, then mixed with a boiling concentrated solution of ammonium sulphate, heated up to, but not above 77° C., and allowed to stand. The rubber is removed from the surface, well washed, and kneaded to improve its mechanical properties; it is then dried either *in vacuo* or in a drying chamber, with or without simultaneous smoking. By tapping on the herring-bone system the yield obtained was poor, but it is believed that on the vertical system an annual yield of 2–4 kilos. per tree of 15 to 20 cm. diameter could be obtained. In January, 1908, there were about 360,000 *Manihot Glaziovii* trees and 20,000 *Hevea* and *Castillon* trees in Hawaii.—E. W. L.

Rubber latex; Studies on —. V. Henri. Caoutchouc et Gutta-Percha, 1908, 5, 2405. (See also this J., 1906, 940; 1907, 264.)

THE Brownian movement of the globules of *Hevea brasiliensis* latex has been followed cinematographically, and the effect of coagulating and other reagents upon it studied. The latex was diluted until only about 20 globules were visible in the field of the microscope, and the movement of each one of these could be accurately recorded, by taking photographs at intervals of 1/20th sec. with an exposure of 1/320th sec. The following displacements were found to occur in 1/20th sec. under the conditions named:—in the pure latex, 0.62 μ ; in presence of alkali, 0.31 μ ; in presence of acid, 0.07 μ . As the acidity increased, the globules could be seen to range themselves in chains, forming a network. The author again points to the distinction between "agglutination," as produced in *Hevea* latex by alkalis and salts of bivalent and trivalent metals, and "coagulation," as brought about by acids, alcohol, acetone, and certain salts. The former process is a reversible one, the latex being restored to its original condition by vigorous agitation, or by dilution with water; "coagulation" is not reversible.—E. W. L.

Rubber of Forsteronia floribunda from Jamaica. Bull. Imp. Inst., 1908, 6, 259–260.

A SAMPLE of the rubber of *Forsteronia floribunda*, a plant which is stated to grow profusely in the limestone district of Jamaica, was found to possess satisfactory physical properties; it had a strong odour of creosote. The rubber had the composition:—moisture, 10.8; caoutchouc, 79.3; resin, 6.3; protein, 1.4; insoluble matter, 2.2; ash, 1.26 per cent. It was valued at 2s. 4d. per lb., compared with fine hard Para rubber at 3s. 5d. per lb. —A. S.

Rubber cultivation in British Guiana. Board of Trade J., Dec. 24, 1908. [T.R.]

ACCORDING to the report on British Guiana for 1907–8, recently issued by the Colonial Office (Annual Reports, No. 589), 4000 acres of land on the banks of the Aruka and Kaituma rivers have been leased to a corporation for rubber cultivation, and further developments in this direction are pending. The output of balata for the year 1907–8 was 973,269 lb., as against 634,242 lb. in 1906. The quantity of rubber produced was also greater, 6873 lb. having been gathered as against 2563 lb. in the preceding year. The price of balata was fairly maintained, whilst that of rubber fell. Licences for the collection of balata were previously limited to three years, but in response to a general demand for a longer period they are now being issued for 15 years, and 164 more licences were taken out in 1907–8 than in the previous year.

PATENTS.

Rubber solution; Process for vulcanising — Degen and Kuth, Düren, Germany. Eng. Pat. 9956, May 7, 1908. Under Int. Conv., May 14, 1907.

A SOLUTION of vulcanised rubber is said to be obtained by mixing together solutions of rubber and of iodine in suitable solvents. For example, a solution of 0.4 gram. of iodine in 100 grms. of carbon tetrachloride is added in the cold to a solution of 4 grms. of Para rubber in 100 grms. of carbon tetrachloride. The solution loses its stickiness and viscosity on standing, and can be filtered and sterilised. This solution of vulcanised rubber is said to be very useful for surgical purposes for covering the surface of the skin.—E. W. L.

Elastic and plastic material; Manufacture of — Rütgerswerke-A.-G. Fr. Pat. 392,669, July 15, 1908.

IS the process of solidifying oils by means of air, oxygen, sulphur, or substances yielding oxygen or sulphur, claim is made for incorporating naphthalene with the mass just before the operation is finished.—A. S.

Rubber solution; Process for vulcanising a — H. Scherpe, Assignor to Degen and Kuth, Düren, Germany. U.S. Pat. 906,366, Dec. 8, 1908.

SEE Eng. Pat. 9956 of 1908; preceding.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tannic and gallic acids; The action of reducing agents on — W. M. Gardner and H. H. Hodgson. Chem. Soc. Proc., 1908, 24, 272—273.

THE object of the work was to devise a rapid and accurate method for the estimation of tannic and gallic acids, and it was thought that a quantitative yield of benzoic acid might be obtained on reduction. Among the reducing agents tried were: zinc, sodium, magnesium, aluminium, sodium hyposulphite, and hydriodic acid; experiments being made in most cases under acid, alkaline, and neutral conditions. The general results were that tannic and gallic acids are little affected by neutral or acid reducing agents, but that they react readily in alkaline solution. In no case, however, was a quantitative yield of benzoic acid obtained, and this was shown to be due to the slow destruction of benzoic acid by alkaline reducing agents.

Phenols; Action of iodine on — and a modified process for the determination of tannic acid. W. M. Gardner and H. H. Hodgson. Chem. Soc. Proc., 1908, 24, 273—274.

THE authors have shown (see preceding abstract) that tannic acid in alkaline solution rapidly reacts with reducing agents, and, based on this observation, a quick and accurate method for the estimation of tannic acid has been developed. The process is carried out as follows: To an aqueous solution of tannic acid, standard iodine solution is added in excess. Aqueous sodium hydroxide is then added drop by drop until the colour due to the iodine disappears, "after which concentrated hydrochloric acid is added in sufficient excess to precipitate the unabsorbed iodine," the amount of which is estimated by standard sodium thiosulphate. Two estimations are necessary in the case of commercial tannins. Firstly, that of the total iodine absorbed, and secondly, that of the iodine absorbed after removing the tannic acid from the solution by precipitation with gelatin; the difference giving the iodine absorbed by the tannic acid. Previous work by Messenger and Voitaum (this J., 1890, 1970), F. Musset (Chem. News, 1885, 51, 42), and A. Moulade (J. Pharm. Chim., 1905, 22, 153) on somewhat similar lines has been repeated, and it has been further shown that the process is available for the estimation of many phenols, for example, phenol, catechol, quinol, salicylic acid, pyrogallol, and gallic acid, in addition to tannic acid. With these substances, the amount of iodine absorbed is in direct ratio to the number of hydroxyl groups present, one hydroxyl group requiring one molecule of iodine; but with other phenols the reaction, although

quantitative, is empirical. The presence of other groups, such as NO_2 , NH_2 , OCH_3 , as well as the position of the hydroxyl groups in the benzene nucleus, was found to have a determining influence on the course of the reaction. Following Wijs's investigations on the action of Hübl's solution, the authors think that the active substance is the hypiodite formed, but they are further investigating this assumption.

XV.—MANURES, &c.

Artificial fertilisers in Russia. Board of Trade J., Dec. 31, 1908, [T.R.]

THE imports of artificial fertilisers into Russia have shown an upward tendency for several years, the figures for the last two years being 413,558 pounds and 509,622 pounds, respectively. They consisted chiefly of sodium nitrate, kainite, superphosphate, and Thomas phosphate. Of the total quantity imported in 1907, 84,283 pounds came from the United Kingdom, 99,204 pounds from Belgium, and 326,124 pounds from Germany. It was composed of 118,061 pounds of sodium nitrate, 177,391 pounds of kainite, 39,672 pounds of superphosphate, and 183,487 pounds of Thomas phosphate, the first three all from Germany and the last from the United Kingdom and Belgium. (1 pound = 36.112 lb.)

XVI.—SUGAR, STARCH, GUM, &c.

Beet; Optically active non-sugar substances of the — E. Herles. Z. Zuckerind. Böhmen, 1908, 33, 176—182.

DURING the present season the beetroots worked up in numerous factories have shown a considerable amount of the so-called "undetermined losses" in conjunction with an apparently richer sugar content of the roots, thus confirming the author's conclusion (this J., 1908, 1168) that there is frequently present in beetroots a dextro-rotatory non-sugar substance which is destroyed by the action of lime at a high temperature. Against the contention of Weissberg that the effect observed is due to a precipitation of sugar as calcium or lead saccharate, he replies that solutions of pure sucrose, treated under the same conditions as the juice, with lime and normal lead acetate, do not show any alteration of polarisation, and that a comparison of the direct polarisation with the sugar found by the Clerget inversion method indicates a difference of 0.30 per cent. of sugar between diffusion juice and second saturation juice. —L. J. DE W.

Reducing sugars; Precipitation of — with basic lead acetate. A. H. Bryan. Internat. Sugar J., 1908, 10, 602—605.

IN order to determine the effect of different precipitants on reducing sugars, solutions of dextrose and levulose were prepared, using 5 grms. of sugar and 1 gram. each of magnesium sulphate and ammonium tartrate. To 50 c.c. of the sugar solution the precipitant was added and the volume made up to 100 c.c. After filtering, the excess of lead was removed with potassium oxalate and the sugar determined by Allihn's method. Normal lead acetate removed practically no reducing sugar; basic lead acetate, however, whether in solution or dry, and basic lead nitrate solution removed very large quantities of both dextrose and levulose, the latter sugar always in much larger amounts. In view of the manifest error involved, the American Association of Official Agricultural Chemists (Bulletin 107, Revised, Bureau of Chemistry, U.S.A.) have discontinued the use of basic lead acetate, and at the present time only the normal lead acetate solution is used. The effect of different lead salts upon the polarisation of mixed solutions of sucrose, dextrose, and levulose in the presence of optically inactive compounds precipitable by lead also showed that reducing sugars were carried down with the precipitate.—L. J. DE W.

Molasses; Viscosity of cane sugar — H. C. Prinsen-Geerlings. Internat. Sugar J., 1908, 10, 584—592.

THE concentration and temperature are considered to be the principal factors governing the viscosity of the molasses

in a massecuite; the content of gum, the decomposition products of reducing sugar and other deposits, and the presence of fine grains of sugar being only of secondary importance. From a manufacturer's point of view the molasses should be as little viscous as possible, so that it may be easily separated from the crystals without much washing in the centrifugals, since the object aimed at is to obtain the maximum of sugar in the crystallised form. The molasses should therefore be made as liquid as possible compatible with the keeping of its minimum sugar content. This may be accomplished by taking care not to drive the concentration of the last massecuites too far, or, in case they have become too much concentrated, to dilute them with dilute molasses. A water content of last massecuites (boiled to grain), after the dilution, of 10 per cent. (equivalent to 96° Brix) and a water content of the molasses drained off from it of 20 per cent. (equivalent to 85° Brix) are the most favourable ones for the best desaccharification and the lowest viscosity. The cooling must not be pushed further than 45° C. and the temperature should remain preferably a couple of degrees over that figure. The increase of viscosity occasioned by the secondary factors enumerated above can be avoided by well conducted clarification, settling, filtering, boiling, and cooling processes.—L. J. DE W.

PATENTS.

Diffusion process and installation avoiding mixture of the [sugar] juice extracted with the juice in circulation and the macerating juice. J. C. Grière. Fr. Pat. 392,323. July 15, 1908. Under Int. Conv., Oct. 3, 1907.

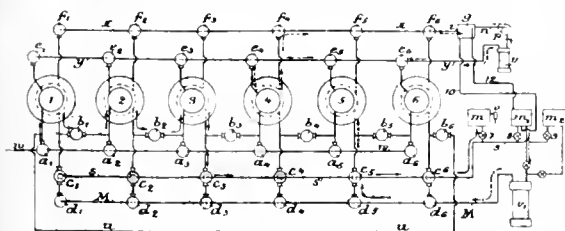


FIG. 1.

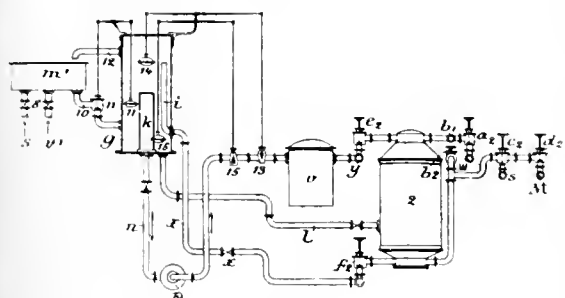


FIG. 2.

In this diffusion process a more concentrated and hotter juice than usual is drawn off, and macerating is commenced with a weaker juice, drawn from the second preceding diffuser, the temperature of the weak juice being regulated independently of the diffusion and of the circulation, so that an energetic exhaustion of the fresh chips is obtained, the duration of diffusion is shortened, and the battery may be made smaller. Water enters the upper part of diffuser, 1 (Fig. 1), by the water main, *w*, and valve, *a*₁; the juice leaves at the lower part of this diffuser, passes through *b*₁, into diffuser, 2, and thence by the valve, *b*₂, into diffuser, 3, then through *c*₃ into the juice main, *s*, and through valve, 7, into the measuring tank, *m*. This concentrated juice is subsequently drawn off. Meantime the chips are heated in diffuser, 4, by the circulation of juice, the juice passing from the lower part of the diffuser through the valve, *f*₄, and main, *x*, into the overflow receiver, *g*, from which it passes to the pump, *p*, which forces it through the heater, *e*, the main, *y*, and

valve, *e*₁, into the upper part of diffuser, 4. The macerating of the fresh chips has been simultaneously commenced in diffuser, 5. The weak juice in receiver, *m*₁, obtained from a previous operation in diffuser, 2, passes through the temperature regulator, *r*₁, the main, *M*, and valve, *d*₅, enters the lower part of diffuser, 5, and rises in it. By the interposition of the temperature regulator it is possible to effect macerating at any desired temperature independently of the temperature of the juice of the battery, as the juice passing through may be heated by steam or cooled by diffusion water or cold circulation juice. As soon as the necessary quantity of juice is collected in the measuring tank, *m*, the valve, 7, is closed and 9 opened, and the weaker juice is collected in the macerating-juice tank, *m*₂, ready for the macerating operation in diffuser, 6. The receivers, *m*₁ and *m*₂, are used alternately, in order to regulate more conveniently the duration of macerating and of the circulation of the juice. The overflow tank, *g*, (Fig. 2), which is open to the atmosphere, has a pipe, *i*, fitted inside, rising to a certain height in *g*, and connected with the main, *x*. This pipe serves to secure a definite and constant column of juice, thus producing a counter pressure in the diffuser in circulation and preventing any irregular packing together of the chips. The quantity of juice in circulation as well as the height of the juice in the receiver, *g*, are immaterial in this respect. The main, *n*, which leads from the bottom of the receiver to the pump, *p*, is connected inside *g* to a perforated pipe, *k*, to separate any pulp present in the juice. The pulp is run off occasionally by the main, *l*, into one of the diffusers. The receiver, *g*, is in communication with the macerating-juice receivers by the main, 10, which is closed by the float-valve, 11. When the level falls to the float, 11, juice passes from the receiver, *m*₁, into *g*. This happens when, owing to the output of the pump, the same quantity is not sent to the receiver, when the pulp is emptied from *g*, or when a heater is emptied. The pipe, 12, serves to run off juice into *m*₁, or *m*₂, when the level rises too high in *g*. In order to further prevent any chance of the receiver, *g*, overflowing, the float-valve, 13, is interposed in the main leading from the pump to the heater. This valve is connected to the float, 14, which closes the valve and stops the circulation when the level rises too high. To prevent air from entering the pipe, *n*, which might occur on commencing operations, the float-valve, 15, is arranged to stop the circulation when the level falls too far. The receiver, *g*, is only of small dimensions since it serves principally to secure a column of juice of uniform height to give a counter-pressure in the diffuser.

—L. J. DE W.

Sugar; Apparatus for the manufacture of —. Raffinerie Moderne (Procédé Natta). Fr. Pat. 392,540, July 22, 1908.

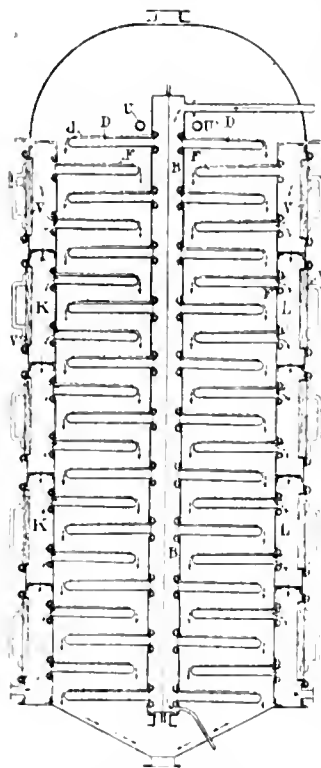
The vacuum pan contains a central, vertical, rotary shaft around which are arranged, one above the other, a number of circular hollow shelves heated internally by a main steam conduit. Two types of shelves are placed alternately, one type fitting close to the shell at its outer periphery and leaving an annular space around the central shaft, and the other type fitting close to the shaft and leaving an annular space around the outer periphery of the shelf. Thus the syrup, distributed on the top shelf by means of a perforated pipe, flows from one shelf to another in a radially zig-zag course towards the bottom of the pan. The rotary shaft carries scraper-arms which sweep the circular shelves and cause the transference of the grainy syrup from one shelf to the next. The massecuite collects below the system of shelves in the lower part of the pan and is kept in agitation by the shaft until the boiling is finished.—J. F. B.

Green refinery syrups; Apparatus for concentrating and boiling —. Raffinerie Moderne (Procédé Natta). Fr. Pat. 392,541, July 22, 1908.

The steam evolved from the boiling of juices and syrups is conducted into the steam chamber of a concentrating apparatus constructed on the same principle as that described in Fr. Pat. 392,539 (see above), and is thus

caused to heat the interior of two alternate series of hollow shelves over which a cascade of the refinery syrup is allowed to run.—J. F. B.

Sugar juices and refinery syrups; Apparatus for concentration of — in vacuo. Raffinerie Moderne (Procédé Natta). Fr. Pat. 392,539, July 22, 1908.



The apparatus consists of a rectangular shell with a domed top connected with a vacuum pump. Inside, arranged in duplicate series (one shown in fig.), are: a central divided steam conduit, B, and side steam conduits, K and L. Connected with the side and central conduits, alternately, are a number of hollow shelves, D, F, heated internally, and arranged one above the other at a slight incline, so that juice entering at U, U', will fall from shelf to shelf, boiling under the action of the vacuum and becoming progressively concentrated until it reaches the bottom. The juice is kept on the shelves, in layers not exceeding 1 cm. deep, by slightly raised border-strips, d. The doors, V, V', V'', give access to all parts of the apparatus. In order to prevent caramelisation, hydrosulphite, glycerol, or "oil" may be injected

tion, hydrosulphite, glycerol, or "oil" may be injected to the lower shelves.—J. F. B.

Carbohydrates soluble; Process for rendering —. A. Boidin, Seclin, France, Assignor to Soc. Anon. Anwerp, Antwerp, Belgium. U.S. Pat. 906,188, Dec. 8, 1908. SEE Fr. Pat. 335,366 of 1903; this J., 1904, 197.—T. F. B.

Dryer; Mechanical rotary or revolving — for removing water from mequass, etc. Eng. Pat. 25,131. See I.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt extract; Increase in the yield of — by previous doughing-in of the grist. C. Bleisch. Z. ges. Brauw., 1908, 31, 633—636.

IN Bavaria it was formerly very common to allow the malt grist to lie in dough for some time before the mashing proper was proceeded with, but no numerical expression of the benefit thereby produced in the yield of extract was to be found till recent work of van Hest showed that an increase of at least 2 per cent. was obtained. The subject has been investigated at Weihenstephan, where malts have been mashed on this principle and the yield of extract compared with that obtained in the ordinary way. In laboratory experiments the finely ground malt was doughed-in at 50° F. and allowed to stand 14 hours at the ordinary temperature, after which it was mashed in the customary way. In nine experiments the yield was increased from 0.47 to 1.79 per cent., with an average of 1.3 per cent. On the large scale such comparative mashes are difficult to obtain owing to the difficulty of securing exactly similar grists and extractions

of the goods. Finally three duplicate mashes were secured and in them the yield was increased by 1.85, 0.57, and 1.35 per cent. respectively by the previous doughing-in of the malt. The author has always considered that loss of extract can only be due to unconverted starch left in the grains, or to soluble matter not properly washed out of them. The unconverted matter in the grains usually varies from 0.3 to 0.8 per cent. of the malt and cannot reach the value, 2.0 per cent., given by van Hest for the increase to be obtained. The grains from the large-scale mashes were therefore examined and it was found that a gain of only 0.2 per cent. could be accounted for by increased conversion. The soluble protein and ash were then estimated in comparative mashes and in each case were found to be increased by the doughing-in operation. The author concludes that the increase in extract obtainable by the modified mashing process is illusory and only in small part due to better extraction of the goods, but is chiefly to be referred to increased solution of protein and ash, together with, possibly, an altered saccharification of the starch.—R. L. S.

Yeast cell-juice; Action of colloidal ferric hydroxide on —. F. Resenschek. Biochem. Zeits., 1908, 15, 1—11.

It has been observed that when yeast cell-juice is subjected to the action of an electric current, the liquid around the cathode acquires a stronger fermentative power than the liquid near the anode. This suggests that the fermentative enzyme is a colloid which should be precipitated by colloids of opposite function, e.g., ferric hydroxide. When a dialysed sol of ferric hydroxide, containing 26 grms. of the hydroxide per litre, was mixed with an equal volume of cell-juice, a red-brown flocculent precipitate was formed containing the whole of the iron together with some of the proteins of the juice. This precipitate was separated by means of the centrifuge, and was examined comparatively with the juice from which it had been obtained. The precipitate itself was devoid of fermentative power, but possessed stimulating properties identical with those of the co-ferment discovered by Harden and Young (this J., 1906, 490, 1111); it likewise contained phosphoric acid. The juice from which the precipitate had been removed, when compared with some original juice, showed a decreased fermentative power, corresponding with the removal of some of its co-enzyme, but in the course of 3—4 days' fermentation, it was capable of recuperating this loss, and the final fermentative result was practically the same. When the precipitate produced by acetone in the treated juice was compared with the acetone precipitate from the original juice, the loss of fermentative power was permanent and no recuperation took place. The ferric hydroxide precipitate and the co-enzyme precipitated from boiled cell-juice were proved to be reciprocally interchangeable and their identity is established. The co-enzyme does not exist in the precipitate in combination as ferric phosphate, nor is it merely carried down mechanically, since it cannot be removed from the precipitate by thorough washing; probably the two colloids form an adsorption compound of an intermediate degree of stability.—J. F. B.

Alcoholic fermentation; Influence of stannous chloride and other mineral salts on —. G. Gimel. Compt. rend., 1908, 147, 1324—1326.

IT is known that, in addition to the recognised nutrient elements, there are certain special mineral salts, the presence of which in traces may exert a favourable influence on the growth of micro-organisms. For instance in Raulin's culture medium, the addition of traces of zinc salts stimulates the growth of *Aspergillus niger*. Similarly Kayser and Marchand found that the presence of 5—10 parts of manganese sulphate per 10,000 parts of liquid had a favourable effect on alcoholic fermentation. The author has now studied the effect of a large number of metallic salts on cultures of yeast; two of the salts, viz.: bismuth subnitrate and stannous chloride gave positive results. The addition of 1 part of stannous chloride per 10,000 of must, was found to increase the yield of alcohol by about 4 per cent., whereas 10 times that quantity of manganese sulphate only increased the yield by 2—3.

per cent. Stannous chloride accelerates the revivification of the yeast which is sown in the must, and cultures taken from the yeast so produced retain a similar property for a certain length of time. Stannous chloride also has a partial decolorising action on the must, particularly in the case of molasses, which appears to be favourable to the development and activity of the yeast.—J. F. B.

Molasses rum in Japan. K. Saito. Cent. Bakt., 1908, 675; Z. Spiritusind., 1908, 31, 565.

THE inhabitants of the Japanese island of Bonin prepare an alcoholic drink by the spontaneous fermentation of sugar-cane molasses, at a moderate dilution, in casks in a warm room. Fermentation sets in after a few days, with the formation of a white frothy "head," and the liquor is finally distilled. The spirit is a colourless rum with a slightly acid flavour. Analysis showed: sp. gr., 0.9543; alcohol, 38.54 per cent. by volume; acid (as acetic acid), 0.174 per cent. Acetic acid and furfural were present, as well as traces of fusel oil. From the molasses wash, the author isolated a species of yeast, which when grown in "koji" decoction or molasses wort, forms a delicate white film which readily falls to the bottom. The yeast occurs as roundish or oval cells of 6–10 μ diameter; these form at temperatures of 18°–30° C. 1–4 spores, which multiply by budding. This yeast is probably *Pichia californica*; it produces no fermentation in beer wort; it does not ferment sucrose, but only dextrose and laevulose; a vigorous surface growth, however, occurs on sucrose media. It produces 4.8 per cent. of alcohol in "koji" decoction, but only 2.4 per cent. in molasses wort, since it ferments only the monose sugars present; it is capable of growth in presence of 20 per cent. (by volume) of alcohol in "koji" decoction containing 50 per cent. of dextrose.—J. F. B.

Guaiacum reaction; Contribution to the knowledge of the —. C. L. Alsberg. See XXIII.

Denatured alcohol; Formula for making chloral hydrate in the United States. Oil, Paint, and Drug Rep., Dec. 7, 1908. [T.R.]

THE U.S. Commissioner of Internal Revenue has approved the following formula for specially denatured alcohol to be used in the manufacture of chloral hydrate:—

Formula 17.—To 100 gallons of ethyl alcohol add 0.05 gallon (6½ fluid ounces) of animal oil.

The animal oil must conform to the following specifications:—

The colour shall be a deep brown.

Boiling point.—When 100 c.c. of the animal oil are subjected to distillation in the same manner as prescribed for the determination of wood alcohol in Section 26, Part I, of the regulations, not more than 5 c.c. should distil over below 90° C., and not less than 50 c.c. at 180° C.

Pyrrol reaction.—2.5 c.c. of a 1 per cent. solution of the animal oil in 90 per cent. alcohol are diluted to 100 c.c. with alcohol. A splinter of pine wood, previously moistened with concentrated hydrochloric acid, is dipped into 10 c.c. of this solution, containing 0.025 per cent. of animal oil. After a few minutes the splinter should show a distinct red coloration.

Reaction with mercuric chloride.—5 c.c. of the 1 per cent. solution of the animal oil in 90 per cent. alcohol, when treated with 5 c.c. of a 2 per cent. solution of mercuric chloride in alcohol, should give immediately a voluminous flocculent precipitate. Five c.c. of the 0.025 solution of the animal oil, when treated with 5 c.c. of the 2 per cent. solution of mercuric chloride, should show at once a distinct turbidity.

PATENTS.

Malt; Preparation of a product capable of being preserved in good condition from green —. A. Weickmann. Ger. Pat. 203,944, June 26, 1906.

FINELY-DIVIDED green malt is mixed to a dough-like mass with a solution prepared from vegetable or animal

substances and containing mineral salts. The solution may be prepared by dissolving peptones, amides, etc., in a 2–6 per cent. solution of an alkali phosphate, nitrate, or sulphate, until the liquid has a density of 10°–30° Balling. It is stated that by this process the enzymic activity of the malt is not injured, and that the product can be preserved for months without suffering any depreciation in value.—A. S.

Ammonia and volatile fatty acids: Process of fermentation to obtain — from organic nitrogenous substances. J. Effront. Brussels. Eng. Pat. 9951, May 7, 1908. (Compare this J., 1908, 241, 953.)

THIS process of obtaining ammonia and volatile fatty acids, particularly from distiller's and yeast wastes, wastes from the manufacture of sugar, foul waters from wool scouring operations, or turf containing large proportions of nitrogen, consists in decomposing these materials by fermentation produced by yeast or moulds. Under this treatment, glycocoll is resolved into ammonia and acetic acid, and aspartic acid into ammonia and propionic acid. These fermentative decompositions are favoured by maintaining the fermenting liquid alkaline to an extent corresponding with 2.5–4 grms. of potassium carbonate per litre, by the presence of 30–50 grms. of aluminium sulphate or of a corresponding amount of other aluminium salt per hectolitre, or of calcium superphosphate.—T. H. P.

Beverages: Process of making fermented —. M. Wallerstein. New York. U.S. Pat. 905,029, Nov. 24, 1908.

A "RAW mash" is treated with malt at a temperature of 60°–65° C., in the presence of an excess of dissolved calcium sulphate. The conversion of the starchy constituents is then completed at a temperature above 74° C., and the product is diluted by the addition of malt mash to reduce the quantity of calcium sulphate to the desired proportion.—W. P. S.

Peat; Treatment of — for the production of alcohol. Sec. anon. Origo. Ger. Pat. 204,058, March 27, 1907.

THE essential feature of the invention consists in heating the peat at a high temperature, in an autoclave, with the acid fermented liquor from a previous operation. In starting the process, 400 kilos. of dry peat are treated with a mixture of 22 hectolitres of water and 24 kilos. of sulphuric acid of 53° B. Steam is forced in at the bottom of the autoclave and a pressure of 3 atmospheres is maintained for about 40 mins. The mass is then removed from the autoclave, treated with calcium carbonate, and cooled to 35° C. the neutralised mixture should contain about 3 grms. of free acid per litre. It is fermented by means of yeasts obtained from berries growing on peat moors. In succeeding operations, the sulphuric acid is replaced by an equal quantity of the acid fermented liquor. In the treatment in the autoclave it is necessary to open a cock to allow the air to escape, and this air, carrying with it steam, alcohol vapour, and volatile aromatic substances, is led to a condenser or dephlegmating column.—A. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(1.)—FOODS.

Phosphorus; Quantity and distribution of — in some foodstuffs. W. Heubner and M. Reeb. Arch. exp. Pathol. u. Pharmak., 1908, Supplementband. Schmiedeberg-Festschrift, 265–272. Chem. Zentr., 1908, 2, 1918.

THE amount of dry substance in the different materials was determined by first drying at 85° C., then finely powdering, and afterwards drying *in vacuo* over sulphuric acid. In a portion of the dry substance the total

phosphorus was determined by Neumann's alkalimetric method (Z. physiol. Chem., 37, 115) as modified by Von Wendt (Skand. Arch. Physiol., 17, 211) and Gregersen (Z. physiol. Chem., 53, 453). Another portion was extracted with 95 per cent. alcohol, the alcohol distilled off from the extract, and the phosphorus in the residue determined, i.e., the portion present as leathin-like compounds. The residue left after extraction with alcohol was dried, weighed, boiled with water, filtered, washed, and the phosphorus (as nuclein substances or phosphor-protein) determined in the dried residue. The phosphorus present as phosphate in the aqueous solution was precipitated with magnesia mixture, and after filtering, the phosphorus present as soluble esters (chiefly phytin, inositol-phosphoric acid) was determined. The results obtained are shown in the following table:

	Percentage of dry substance.	Percentage of phosphorus in the dry substance.					
		Total.		As phosphatide.	As soluble phosphate.	As soluble ester.	As nuclein and phosphor-protein.
		Determined.	By addition.				
Horseflesh.....	26.0	0.74	0.73	0.15	0.44	0.04	0.10
Cow's milk.....	12.6	0.84	0.80	0.05	0.25	0.05	0.45
White of egg.....	12.6	0.12	0.11	0	0.02	0.02	0.07
Bread.....	70.1	0.14	0.13	0.01	0.05	0	0.07
Rice.....	87.8	0.11	0.11	0.005	0.005	—	0.10
Bran.....	98.8	1.47	1.29	0.02	0.25	0.35	0.67
Carrots.....	13.6	0.40	0.38	0.03	0.20	0.11	0.04
Sugar beets.....	14.6	0.19	0.19	0.04	0.08	0.05	0.02
Green cabbage.....	12.3	0.48	—	0.07	0.22	(0.09)	0.10
White cabbage.....	8.3	0.31	—	0.06	0.14	(0.07)	0.04

—A. S.

Milk intended for analysis; Disadvantages of potassium bichromate as a preservative for —. A. Monvoisin. Compt. rend., 1908, 147, 1403—1404.

ACCORDING to the French law of Aug. 1, 1905, potassium bichromate is added (0.25 gm. per 250 c.c.) as a preservative to samples of milk taken for analysis. Grélot (J. Pharm. Chim., 1907) has already shown that such addition interferes with the determination of the acidity, cryoscopic point, and refractive index of the milk, and probably also with the detection of formaldehyde. The author has found that Storch's test with *p*-phenylenediamine for the detection of hydrogen peroxide and for distinguishing whether a milk has been heated or not, is also rendered useless by the addition of potassium bichromate, since in presence of this salt, pure fresh milk gives a blue coloration with *p*-phenylenediamine. (See also this J., 1908, 242).—A. S.

Dutch lard. C. Arragon. Chem.-Zeit., 1908, 32, 1227.

THE author draws attention to the presence on the market of Dutch lards which on examination give figures similar to those yielded by lard adulterated with beef tallow. These lards are prepared by pressing, with the aid of moderate heat, a portion of the so-called lard oil being thereby separated from the fat. Four samples gave the following figures:—Sp. gr. at 100° C., 0.8575—0.8588; refractometer reading at 40° C., 47.5—48.7; iodine value, 48.9—54.3; saponification value, 194.5—195.5. In view of these results the author emphasises the necessity of supplementing the usual methods of analysis by the microscopic examination of crystals of the fat, which is capable of detecting the presence of 10 per cent. of beef fat in lard.—A. S.

Caffeine; A source of error in the determination of — by Juckenack and Hilger's method. K. Lendrich and R. Mordfield. Z. Untersuch. Nahr. Genussm., 1908, 16, 647—658.

EXPERIMENTS to determine the cause of the low yields of caffeine obtained by the method of Juckenack and Hilger (this J., 1897, 567) showed that if the coffee was

completely dry, repeated extraction did not remove the whole of the alkaloid. In the authors' opinion this is to be attributed to adsorption of the caffeine by the divided material, and to the adsorption compound being only broken up with difficulty by chloroform or carbon tetrachloride when the substance is completely dry. To obviate this error, the filtered decoction treated as in Juckenack and Hilger's method is evaporated with sand or fragments of filter paper of about the same size, and the dry residue rendered moist by exposure in a vessel containing steam, and repeatedly extracted with carbon tetrachloride. The method may also be used for the determination of caffeine in roasted coffee, but it is necessary to calculate the proportion of alkaloid from a determination of the nitrogen in the impure residue obtained.—C. A. M.

PATENTS.

Milk; Process and apparatus for keeping — sound. T. G. Mollinger and A. Rompies, Nieuwer Amstel, Holland. Eng. Pat. 25,393, Nov. 15, 1907.

THE milk is first heated in a closed vessel to a temperature of 75° C., and is then pumped through a coil surrounded by a steam-jacket, by which it is heated to a temperature of from 150° to 160° C. It is next cooled to 90°—100° C., and delivered at this temperature, from a collecting tank into bottles or other receptacles. The bottles while being filled are arranged under a hood, and the necks are pressed against the end of the pipe discharging the milk. Caps placed over the necks of the bottles hermetically close the latter while the contents are still at a temperature near 100° C.—W. P. S.

Fruit juices and extracts; Preparation of concentrated —. O. Volz. Ger. Pat. 204,603, April 12, 1907. Addition to Ger. Pat. 184,760.

THE extract is freed from aromatic substances by the process described in the main patent, then concentrated, freed from pectin substances by treatment with several successive quantities of alcohol, and finally after distilling off the alcohol, and again concentrating, re-united with the aromatic substances.—A. S.

Cascien; Preparation of —. E. Soncini, Assignor to Soc. di Esportazione Polenghi Lombardo, Milan, Italy. U.S. Pat. 905,943, Dec. 8, 1908.

SEE Fr. Pat. 375,123 of 1907; this J., 1907, 887.—T. F. B.

(B).—SANITATION; WATER PURIFICATION.

PATENT.

Water; Method of purifying waste — [by electrolysis]. W. Rumin, Kharkoff, Russia. Eng. Pat. 25,222, Nov. 13, 1907.

THE water or effluent coming from septic tanks or biological filters is conducted to a tank in which electrodes are immersed; these electrodes have the form of a grating

or netting of porous material. On passing a current of electricity through the water, the substances in suspension are coagulated and precipitated on the bottom of the tank. (Reference is directed to Eng. Pats. 10,094 and 14,182 of 1903; 14,003 and 17,532 of 1904; 9002 and 25,940 of 1906; this J., 1903, 878, 1142; 1904, 947; 1906, 1114; 1907, 836.)—W. P. S.

(C).—DISINFECTANTS.

PATENT.

Insecticidal gas; Process of producing —. H. V. Walker, New York. U.S. Pat. 905,609, Dec. 1, 1908.

A MONOHYDROXY-DERIVATIVE of an aromatic hydrocarbon containing from six to ten atoms of carbon, and possessing insecticidal properties when in a state of vapour, is mixed with quicklime, and with a reagent which in solution has a greater affinity for lime than the hydroxy-derivative, and then water is added to combine with the quicklime. The proportions of quicklime and water are so adjusted that the heat evolved is sufficient to vaporise the hydroxy-derivative.—A. S.

XIX.—PAPER, PASTEBOARD, &c.

Sulphate cellulose mills; Volatile by-products of —. H. Bergström and O. Fagerlind. *Papier-Zeit.*, 1908, 33, 3779.

IN a wood-pulp mill working the sulphate process, with a maximum pressure in the digesters of 10 atmospheres, the following quantities of by-products were condensed from the vapours discharged from the digesters in the course of manufacture:—Oil of turpentine, 8 kilos. from pine wood, 1 kilo. from spruce wood; methyl alcohol, 5 kilos.; methylmercaptan, 1 kilo.; dimethyl sulphide, 3 kilos.; dimethyl disulphide, 0.1 kilo.; ammonia, 0.2 kilo., all quantities being calculated per ton of finished cellulose. The presence of hydrogen sulphide, carbon dioxide, and acetone was also observed, as well as that of two bodies, not isolated, to which the peculiar difficulty experienced in clarifying the oil of turpentine of this origin, is to be attributed. It should, however, be noted that the digester-gases are not the only source of nuisance in a sulphate pulp mill; equally noxious gases are discharged, in perhaps larger quantities, from the soda-recovery plant.—J. F. B.

Turpentine oil as a by-product in the manufacture of wood-pulp by the sulphate process. P. Klason. *Papier-Zeit.*, 1908, 33, 3779—3780.

THE quantity of turpentine oil obtained as a by-product in the manufacture of wood-pulp by the sulphate process is about 5 kilos. per ton of wood (*Pinus sylvestris*), but it is of low quality owing to the presence of noxious sulphur impurities. Comparatively few of the sulphate pulp mills recover this turpentine at the present time, but since one of the first steps towards the suppression of the nuisance caused by these mills, consists in condensing the volatile by-products (see this J., 1908, 1219) more attention will probably be paid to their utilisation. The fraction of the crude oil distilling below 100° C. consists chiefly of dimethyl sulphide; this may be freed from traces of mercaptan and trimethylamine by agitation with lead acetate. The fraction distilling between 100° and 150° C. contains dimethyl disulphide. This body does not exist originally in the vapours discharged from the digesters, but is produced by the oxidation of methylmercaptan under the peroxidising influence of the turpentine in presence of air. As a rule, these two fractions do not amount to more than 5 per cent. of the crude oil. The turpentine oil, when distilled in a current of steam, leaves a brownish residue of polyterpenes. The major portion of the purified oil, consisting mainly of pinene, distils between 155° and 158° C. and has a sp. gr. of 0.8601. In spite of the removal of the sulphides in the fractions of low

boiling point, the resulting oil of turpentine has an objectionable secondary odour, which cannot be removed by fractionation and which is particularly noticeable when the oil is used in paints. In some cases this odour may be eliminated by treating the oil with 4 per cent. of its weight of 50 per cent. sulphuric acid, but frequently this treatment fails. The sulphur compounds are more soluble in the turpentine than in the acid, so that a limit is soon reached in the efficacy of the treatment. If the oil contain only dimethyl sulphide it may be deodorised, but if dimethyl disulphide be present its odour cannot be eliminated completely. Dimethyl disulphide boils at 117° C., only about 40° C. lower than the oil of turpentine itself, so that its elimination by fractional distillation is difficult. Moreover, its odour is more disgusting, more permanent, and very much more poisonous than those of the ordinary sulphide and of the mercaptan. The solution of the difficulty lies in the fact that the disulphide is a secondary product of the oxidation of the mercaptan, and is not originally present in the oil. If, then, the purification of the turpentine oil be undertaken immediately after its production, the disulphide is not formed, and a finer quality of turpentine oil is obtained than when the crude oil has been stored for some time.—J. F. B.

Alkali-cellulose; The constitution of —. O. Miller. *Ber.*, 1908, 41, 4297—4304.

THE author criticises a paper by Vieweg on this subject (this J., 1908, 1081), in which he communicates some re-determinations, made by Haupt, of the absorption of sodium hydroxide from its solutions by cellulose, which he contends support his previous conclusion as to the existence of Gladstone's compound, $C_{12}H_{10}O_{10}Na$. Vieweg, the author states, has overlooked the fact that Haupt's numbers differ considerably from the relationships previously recorded (this J., 1907, 1157). The author has calculated these numbers so as to show that, except for very low and very high concentrations of sodium hydroxide, when secondary effects come into play, the ratio of the concentrations of the alkali in the solid and liquid phases respectively is approximately a constant. This fact supports the present author's view that alkali-cellulose is a solid solution. It would appear from Haupt's results that there is no horizontal portion in the absorption-concentration curve starting at 16 per cent. of sodium hydroxide, but that the curve rises steadily until a concentration of 20—24 per cent. is reached. At this point it falls somewhat, and this fall is due to decompositions which take place in the solid phase. These decompositions have been studied by the author, who has shown that they are dependent on the time of contact. With regard to the influence of sodium chloride on the distribution of the hydroxide between the two phases, it would appear that the molecular weight of the hydroxide in the cellulose is greater than in the aqueous chloride solution.—J. F. B.

Peat; Contribution to the study of the humic substances of —. L. Roger and E. Vulquin. *Compt. rend.*, 1908, 147, 1404—1406.

THE humic substances were obtained by treating fibres of peat wadding ("Fovate de tourbe") with a 10 per cent. solution of sodium hydroxide, precipitating the solution with hydrochloric acid, washing the precipitate free from hydrochloric acid, and drying on glass plates at a low temperature. Analysis showed that the conversion of vegetable matter into peat is accompanied by an accumulation of nitrogen and carbon in the product. The humic substances contain neither pentosans nor hexosans, but the alcoholic function of the celluloses from which they are derived is not destroyed, since an acetyl derivative (yielding 30 per cent. of acetic acid) and a derivative (containing 20 per cent. of sulphur) analogous to cellulose thiocarbonate, can be prepared. On fusion with alkali the humic substances yield protocatechuic acid, whilst on hydrolysis with alkali or sulphuric acid and on destructive distillation, they yield products containing acetic acid; they absorb halogens. They possess acid properties, combining with alkalis to form soluble products; they can also combine with a considerable quantity of ammonia; these acid properties are destroyed by oxidation.—A. S.

PATENTS.

Fibres for papermaking; Process for treatment [digestion] of —. Soc. Anon. des Papeteries de Galas. Fr. Pat. 392,486, July 20, 1908.

THE digestion of fibrous materials for conversion into paper pulp, which must be carried out under high pressure, is generally effected at a temperature corresponding with that of water boiling at that pressure. According to this invention, the injurious action of the chemicals at such high temperatures is avoided by creating the necessary pressure mechanically, whilst the temperature of the digesting liquor is not allowed to rise above 100° C. The apparatus consists of a rotary digester of the usual type, an external heating coil, and a pump in circuit with the coil and digester. The fresh-liquor cistern is connected with the circuit by a three-way cock. The digester is first charged with liquor, fresh liquor is then pumped from the cistern through the heating coil and into the digester until the desired pressure is attained. Finally digestion is continued under this pressure by pumping the liquor from the digester, through the coil, and back into the digester at a different point. The resulting fibres, after washing, may be partially bleached by acidifying with sulphuric acid.—J. F. B.

Paper; Manufacture of — impermeable to water and untearable. Soc. anon. des Papeteries de Galas. Fr. Pat. 392,489, July 20, 1908.

UNSIZE paper, prepared preferably of long fibres, is passed through a cold solution of caoutchouc or gutta-percha, and then dried in a stove in a current of hot air. Such paper is claimed to be impermeable to water and untearable and not to change in dimensions when wetted.—J. F. B.

Paper pulp; Economical production of —. C. Badoil. Fr. Pat. 392,750, July 27, 1908.

PLANTS such as the asphodel are boiled with water once or several times in succession, being pressed after each treatment, in order to recover such substances as glucose, gum, etc., and are then boiled under pressure with a small proportion of "soda."—A. S.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Strychnine and brucine; Iodine derivatives of —. J. Buraczewski and T. Kozniowski. Anz. Akad. Wiss. Krakau, 1908, 644—649. Chem. Zentr., 1908, 2, 1872.

BY the action of a solution of iodine in carbon bisulphide on solutions of the alkaloids in hot 96 per cent. alcohol, almost quantitative yields of di-iodo-derivatives of strychnine and brucine were obtained. *Di-iodostrychnine* forms small scarlet crystals; it melts at 196—197° C., is almost insoluble in water, aqueous alkali and the usual organic solvents, and is not altered on heating to 165° C. *Di-iodobrucine* forms small silky crystals of a cinnamon-colour; it melts at 222.5° C., is somewhat hygroscopic, and has properties similar to those of the corresponding strychnine compound. Both compounds are decomposed by alcoholic alkali, with regeneration of the alkaloids. On prolonged boiling with alcohol, the compounds are partially decomposed, with separation of compounds containing larger proportions of iodine, that from the strychnine derivative melting at 253—254° C., and that from the brucine derivative at 251°—252° C.—A. S.

Hordenine sulphate; Therapeutic value of —. J. Sabrazès and G. Guérive. Compt. rend., 1908, 147, 1076—1079.

HORDENINE (this J., 1906, 133) is *p*-oxyphenylethyldimethylamine. The sulphate crystallises in needles and has a slightly bitter taste; its aqueous solution may be

sterilised at 120° C. It gives no precipitate with the tannins of vegetable infusions, and forms brown crystals in contact with iodine. One mgrm. per kilo. has a tonic action on the heart, but toxic doses (1—2 grms. per kilo.) produce the reverse effect by suspending the activity of the pneumogastric nerve. Although not acting with the energy of digitalis, sparteine, or strophanthus, hordenine has the advantage of being much less toxic. It has been found valuable in cases of typhoid, dysentery, enteritis, etc.—F. SODX.

Kola nut. L. Bernezau. Ber. deutsch. pharm. Ges., 1908, 18, 468—491.

THE first portion of this paper deals with the varieties of kola grown in different parts of Africa, and the means of transport to the markets. The kola fruit, after gathering, is stored in a sheltered place, when the outer shell splits open owing to fermentation, and the seeds can be removed. The seeds may be extracted with alcohol or sodium phosphate solution and the liquid or paste extract exported. The nuts, or rather seeds, can be preserved in hermetically sealed glass jars or tin boxes, which must be heated to 100° C. Peat dust makes a good packing for the seeds. The author claims priority for the method of sterilising the seeds described by A. Goris (this J., 1908, 996). "Kola red" was prepared from the seeds of *Cola acuminata* obtained from the Cameroons. The freshly-gathered fruit was allowed to stand for a few days and the seeds removed and crushed. They were mixed with sodium phosphate solution, allowed to stand overnight, and heated for 4 hours under pressure. The liquid extract was evaporated to a paste and extracted with dilute alcohol containing a little hydrochloric acid. The alcohol was distilled off, the residue taken up with water, and shaken with ether. The aqueous portion left a ruby-red substance on evaporation. This substance when heated with water loses its colour and forms phloroglucinol.—F. SODX.

Cyanogenetic glucosides [phaseolunatin]; Transformation of — during germination. L. Guignard. Compt. rend., 1908, 147, 1023—1028.

IN order to obtain evidence as to whether the cyanogenetic glucosides function as reserve material, the author has followed the transformation of phaseolunatin (linamarin) during germination of the beans of *Phaseolus lunatus*. When kept in the dark, these beans lose about one-fourth of their glucoside during the period of germination proper (a fortnight) and about one-third in a month, as measured by the amount of hydrocyanic acid obtainable; in the plants exposed to the light, this loss is more than counterbalanced, after the first ten days, by the synthesis of hydrocyanic acid effected in the leaves under the influence of chlorophyll. No evidence has been obtained that hydrocyanic acid is liberated during germination by the action of the enzyme present.—F. SODX.

Lavender oil; Adulteration of — with the esters of fatty acids of cocoanut oil. T. Delphin. Svensk. farm. Tidskrift, 1908, [22]; Pharm. Zeit., 1908, 53, 984.

THE presence of the esters of the fatty acids of cocoanut oil has been detected in a specimen of adulterated lavender oil. Owing to the high saponification value of these esters, the addition of a relatively small amount would materially increase the ester value of lavender oil of poor quality.—J. O. B.

Lemon oil. Schimmel's Rep. Noy. 1908, 60—65.

IT is pointed out that the solubility test of the Japanese Pharmacopœia (1 vol. of oil to form a clear solution with about 7 parts of 90—91.2 per cent. alcohol), whilst quite useless for detecting adulteration, would in many cases lead to the rejection of oils of the best quality.—A. S.

Lemon grass oil. Watt and Tempany. West. Ind. Bull., 9, 265; Pharm. J., 1908, Dec. 26, 840.

THIS oil, commonly known as oil of verbena, obtained from *Cynopogon citratus*, is known to vary in its solubility in

alcohol. It appears from the statements made by the authors that the West Indian oil is objected to on account of its imperfect solubility in alcohol. When first distilled, it is miscible with 95 per cent. alcohol up to one and a half times the volume of oil, but a further addition of oil causes turbidity. It has been found that, immediately upon distillation, West Indian lemon-grass oil is completely soluble in 95 per cent. alcohol without turbidity, but in a few days it loses this property, and will not give clear mixtures if the volume of alcohol be increased beyond about twice the volume of oil. This is now considered to be probably due to the polymerisation of some hydrocarbon, possibly myrcene. The Indian oil of the grass, *Cymbopogon flexuosus*, cultivated on the East Indian coast, near Cochin, does not possess this drawback, the oil being completely soluble in alcohol, and having a higher citral content than the West Indian oil. This grass is now under cultivation in the Leeward Islands at the botanic stations, so that in course of time a soluble oil may be produced in the West Indies, if the price obtainable, which is very low at present, offers encouragement for the cultivation of the grass.

Lemon-grass oil; [Determination of citral in —.] Schimmel's Rep., Nov., 1908, 80—84.

In the determination of citral in lemon-grass oil, where sodium bisulphite is used, this combines also with the

Oil of Thuja plicata (red cedar). I. W. Brandel and A. H. Dewey. Pharm. Review, 1908, 26, 248. Schimmel's Rep., Nov., 1908, 117—118.

In connection with the question of the utilisation of the waste products obtained in the clearing of large tracts of land in the north-west of the United States, the authors examined the oil from the red cedar. On distillation with steam, the leaves and twigs of the tree yielded 0.18—1.4 per cent. of a bright yellow oil having a slightly pungent, camphor-like odour, and possessing the following characters:—Sp. gr. at 25° C., 0.9305; $\alpha_D = -6.9$ at 25° C. in a 100 mm. tube; acid value, 0.518; saponification value, 5.7; ester value after acetylation, 6.2. The oil was miscible in all proportions with 70 per cent. alcohol. On distillation, more than 75 per cent. of the oil passed over between 190° and 203° C.; all the fractions were dextrorotatory. The oil contained about 3 per cent. of terpenes, among which pinene was identified, and also thujone, fenchone, and bornyl ester or esters. (See also Blasdale, this J., 1907, 635.)—A. S.

Savin oil; Detection of —. A. Beythien and P. Atenstädt. Z. Untersuch. Nahr. Genussm., 1908, 16, 677—679.

THE characters of savin, juniper wood, and juniper berry oils are given in the following table:—

Oil.	Sp. gr. at 15° C.	Specific rotation $[\alpha]_D$	Butyro-refractometer reading at 25° C.	Iodine value.	Saponification value.	Boiling point (not constant).
Savin	0.9137	+50	70.00	232.21	120.30	°C. above 165 (begins at 170)
Juniper wood	0.8727	+7.3	71.20	313.80	313.80	partially below 165 (begins at 155)
Juniper berry	0.8571	+5.95	64.00	329.44	329.44	below 165 (the largest portion between 155 and 165)

other aldehydes present in the oil and also with a part of the methylheptenone. Hence the bisulphite method gives results higher by from 2 to 5.5 per cent. than when normal sodium sulphite is used. Since lemon-grass oil is purchased on the basis of its citral-content, the method used to determine this should always be stated.—A. S.

Bergamot oil. Schimmel's Rep., Nov., 1908, 58—60

ACCORDING to the Japanese Pharmacopœia, 1 vol. of bergamot oil when mixed with 1.5—2 vols. of a mixture of 80 c.c. of alcohol and 10 c.c. of water at 20° C., should yield a clear solution, which may become turbid, but from which no oily drops should separate. It is pointed out that authentic oils of the best quality are frequently met with, which will fail to pass this test.—A. S.

Oil of dill herb. Schimmel's Rep., Nov., 1908, 19—50.

THE dextro-rotatory oil had a greenish-blue colour, and was soluble in 3.4 vols. of 90 per cent. (by vol.) alcohol. It had the sp. gr. 0.9062 at 15° C., and $n_D^{20} = 1.49185$. On distillation at 4 mm. pressure, 75 per cent. of the oil passed over between 45° and 60° C., and 20 per cent. between 130° and 132° C.; the lower-boiling fraction had the sp. gr. 0.8528 at 15° C., and optical rotation, $\alpha_D = +68.17^\circ$ in a 100 mm. tube. The oil contains *d*- α -phellandrene, terpinene, (and possibly also dipentene or limonene), earvone, and dill apiol, together with a blue substance identical with that which is the cause of the blue colour of some other essential oils such as camomile oil. When the oil is allowed to stand for a long time, clear long prisms, m. pt. 40°—44° C., separate from it; these are probably crystals of dill isapiol.—A. S.

The differences in the sp. gr. and on fractional distillation and the high saponification value and specific rotation are thus the best means for the detection of savin oil in the other oils. The specific rotation will also afford information in the case of conifer oil or turpentine oils being present, since with the exception of certain American turpentine oils, these are either optically inactive or levorotatory. The most reliable test of all, however, is the characteristic odour, and comparative tests have shown that it is possible in this way to detect as little as 0.1 per cent. of savin oil in mixtures of the two juniper oils. The odour is rendered most pronounced by diluting the oil with water and then heating it.—C. A. M.

Oil of maali resin. Schimmel's Rep., Nov., 1908, 137—139.

MAALI resin, a soft, elemi-like resin from Samoa, when distilled with steam, yielded 16.08 per cent. of a bright green semi-solid oil soluble in about 1 vol. of 90 per cent., or 3 vols. of 80 per cent. alcohol. The oil melted between 65° and 80° C. and had the optical rotation, $\alpha_D = +7.15^\circ$ in a 100 mm. tube; saponification value, 3.3; ester value after acetylation, 46.6. The solid portion of the oil yielded a new sesquiterpene alcohol, $C_{15}H_{26}O$, which when purified by crystallisation from 70 per cent. alcohol or petroleum ether, was obtained in silky needles, m. pt. 105° C., $[\alpha]_D = +18.33^\circ$; b. pt., about 260° C., ester value after acetylation, 16.0. When heated with dehydrating agents, this yielded the corresponding sesquiterpene, sp. gr. 0.9190 at 15° C., $[\alpha]_D = +131.99^\circ$, $n_D^{20} = 1.52252$, b. pt. 270.8—271° C. (754 mm.). The liquid portion of the oil apparently consisted of a solution of the solid sesquiterpene alcohol in a levorotatory sesquiterpene. The sesquiterpene alcohol yielded with chromic acid an addition compound, $(C_{15}H_{24}O)_2CrO_3$,

which melted at 111 C., was soluble in most organic solvents, and was immediately decomposed by water. Other sesquiterpene alcohols also formed addition compounds with chromic acid.—A. S.

Camphor substitutes: *Analysis of camphorated oil for* —, F. W. Richardson and W. Walton, *Analyst*, 1908, **33**, 463—466.

NATURAL camphor can be determined in camphorated oil by direct polarimetry (see Leonard and Smith, this J., 1900, 861). "The reading given in a 100-mm. tube in a Schmidt and Haensch instrument, multiplied by 0.69, gives the percentage of camphor in camphorated oil on the volume. This figure divided by 0.926—the sp. gr. of the oil at 15.5 C.—gives grms. of camphor in 100 grms. of the oil." Synthetic camphor was found to have a molecular weight of 150.6 (theory for camphor, 152.016), and to agree with ordinary camphor in all other respects, except that it is optically inactive. For the analysis of oils containing such substitutes, 10 grms. of the sample are heated in a 2-oz. retort in an oil-bath at 200 C., a current of carbon dioxide being meanwhile passed through the retort. The delivery tube of the retort is connected with a weighed 4 oz. Woulfe's bottle, which is placed in ice, and a small spiral glass condenser of known weight is fitted by means of a cork into the other opening of the bottle. The bulk of camphors present will condense in crystals in the delivery tube of the retort, and the portion of the tube may subsequently be cut off with a file and weighed. The sublimate is then dissolved off the glass by means of carbon tetrachloride, and its weight found by again weighing the dried portion of the retort. Any additional volatile products will be in the Woulfe's bottle and spiral condenser, and the increase in weight of these gives their quantity. These portions are also dissolved in carbon tetrachloride and added to the original solution. The whole solution is then weighed, and aliquot portions taken for the determination of the sp. gr. and iodine value, and for polymerisation with sulphuric acid. For the last-named test about half the solution is treated little by little with a third of its volume of sulphuric acid (sp. gr. 1.81), and the whole then thoroughly mixed, cooled if necessary, and allowed to stand for 5 minutes. The side tube of the flask containing the solution is then connected with a Liebig's condenser, the outlet of which is connected with an 8 oz. separator, and a current of steam is passed through the apparatus until the separator is nearly full. The condenser tube is rinsed out with some of the carbon tetrachloride drawn from the lower layer in the separator, and subsequently with fresh solvent, and the united carbon tetrachloride solutions are transferred to a flask and weighed. About 35 per cent. of the camphors are unaltered by the treatment with sulphuric acid and distil, whilst turpentine and essential oil of camphor are polymerised to such an extent that no optically active substance subsequently passes over. The amount of total camphors may be calculated from the change in the specific gravity and refractive index of the carbon tetrachloride solution, whilst the natural camphor is found by multiplying the polarimetric reading in a 200 mm. tube by 0.22385 and dividing the product by 0.95. If the solution is optically inactive, natural camphor is absent. In calculating results from the iodine value it is assumed that the normal value of natural camphor is 5, that of artificial camphor 7, that of essential oil of camphor 180, and that of oil of turpentine 370. Essential oil of camphor, when present to any notable extent, may be detected by the odour emitted on heating the solution. The olive oil freed from the volatile constituents by being heated at 200 C. in a current of carbon dioxide is not changed as regards its physical characteristics and iodine value, and the constants due to the oil itself may thus be eliminated from the values obtained with the original camphorated oil. The proportion of turpentine or oil of camphor may be calculated from the iodine value, when the amounts of natural and synthetic camphor are known. The accuracy of this method is shown by test analyses of mixtures of olive oil with various proportions of the four other substances.—C. A. M.

l-Pinene: *Action of piperidine on the nitrosochloride of* —, P. Golubew, J. Russ. Phys.-Chem. Ges., 1908, **40**, 1015—1018. *Chem. Zentr.*, 1908, **2**, 1865—1866.

A CUSTOMARY method for the identification of pinene consists in the preparation of its nitrosochloride and the compound of the latter with piperidine. Wallach has previously shown (*Annalen*, **245**, 251) that the reaction between *d*-pinene-nitrosochloride and piperidine proceeds in two directions, and the author finds that this is also the case with the nitrosochloride of *l*-pinene (obtained from the oil of the Siberian fir). Ten grms. of *l*-pinene-nitrosochloride (m. pt. 103—104 C.) were mixed with an equal weight of piperidine and 30 c.c. of alcohol, and the mixture boiled and then treated with water. The precipitate was dissolved in glacial acetic acid, and water added until a crystalline precipitate separated; this consisted of nitrosopinene (m. pt. 134—135 C.). From the filtrate *l*-pinenitropiperidide, $C_{10}H_{16}NO.NC_5H_{10}$, was precipitated by ammonia and purified by crystallising from ether; it melted at 118—119 C. The relative yields of *l*-nitrosopinene and *l*-pinenitropiperidide were 35.5 and 54.9 per cent. respectively. From French oil of turpentine a yield of 39.8 per cent. of *l*-nitrosopinene was obtained.—A. S.

Iodine derivative [iodopeptide]: *New* —, A. Cecchini, *Giorn. Farm. Chim.*, 1908, **57**, 441—444. *Chem. Zentr.*, 1908, **2**, 1891.

BY the action of iodine (in the nascent condition) on a peptonised albumin solution (10:100), the author obtained a new iodine preparation, *iodopeptide*, containing from 1.75 to 3.48 per cent. of iodine. The new product is a pale yellow liquid, apparently a colloidal solution. It is stated to be useful in tuberculous diseases.—A. S.

Methyl alcohol: *Dehydration of commercial* —, J. Cyr, *Ber.*, 1908, **41**, 4322—4327.

STARTING from a commercially pure methyl alcohol, free from acetone, the anhydrous alcohol may be prepared by first boiling for a long time with quicklime, then allowing the liquid to stand for some weeks over ignited potassium carbonate, and finally distilling several times in presence of metallic calcium. During these manipulations the alcohol must be protected from moist air by a tube filled with calcium chloride or phosphorus pentoxide. In the first distillation, 10 grms. of metallic calcium turnings are used for 1 litre of alcohol; the liquid is digested near the boiling point for some time before distillation takes place. In the subsequent distillations smaller quantities of calcium are taken, since, as the alcohol becomes nearly anhydrous, it tends to react very vigorously with the calcium, with considerable evolution of heat. Three or four distillations from calcium are sufficient to give anhydrous alcohol. The condition of the alcohol may be ascertained by determining its esterification velocity with phenyl-acetic acid in presence of hydrogen chloride. The elimination of the moisture is accompanied by a rise in the esterification constant until the alcohol is anhydrous. The presence of 0.125 per cent. of moisture was found to lower the esterification constant by 13 per cent., whereas its influence on the sp. gr. was only 0.055 per cent. The sp. gr. at 15°/15° C. of anhydrous methyl alcohol is 0.79647; its boiling point is 64.56° C.—J. F. B.

Urano-uranic oxide, and a standard of radio-activity. H. N. McCoy and G. C. Ashman. *Amer. J. Sci.*, 1908, **26**, 521—530.

URANO-URANIC oxide, U_2O_5 , may be obtained in a pure condition by heating any higher or lower oxide to constant weight at about 700° C. Uniform films of this oxide, 7 cm. in diameter and weighing 0.6—0.8 gm., have been found to exhibit very definite and constant α -ray activity. These films are easily reproduced and are sufficiently thick to have the maximum α -ray activity; they are, therefore, recommended as standards. From the results

of measuring, in absolute units, the α -ray saturation current for such a standard film, the total ionisation current for 1 grm. of uranium, in an infinitely thin film, has been calculated to be 4.61×10^{-10} amp. The α -ray activity of radium (free from its products) is 1.29×10^6 times that of an equal weight of uranium.—F. SODN.

Thorium; Chlorides and oxychlorides of —. E. Chauvenet. *Compt. rend.*, 1908, **147**, 1046—1048.

ANHYDROUS thorium tetrachloride is best prepared from thoria by heating in a very slow stream of phosgene. The chloride sublimes as prismatic needles which absorb water readily from the air, without changing in appearance. The crystals, when heated in a stream of phosgene, sublime as a very hygroscopic white powder of the same composition. An aqueous solution of the chloride, on evaporation, gives the hydrate, $\text{ThCl}_4 \cdot 7\text{H}_2\text{O}$. Thorium chloride is readily oxidised, for on heating the above hydrate in a stream of dry hydrogen chloride at 120° — 160° C. till of constant weight, the compound, $\text{ThO}(\text{HCl})_2 \cdot \text{H}_2\text{O}$, is obtained, and at 250° C. the compound, ThOCl_2 .—F. SODN.

Thorium chloride; Preparation of —. C. Matignon. *Compt. rend.*, 1908, **147**, 1292—1293.

DELÉPINE and the author proposed to prepare thorium chloride by the action on thoria at a high temperature of a mixture of carbon monoxide and chlorine; Chauvenet proposed to substitute carbonyl chloride for this mixture, and Delépine and the author suggested, later, a mixture of chlorine and carbon tetrachloride. The action of chlorine and sulphur dichloride, however, is preferable to any of these processes, as it occurs at a lower temperature, so that glass tubes can be used, and oxychloride is not formed to the same extent. Quite recently, the author has tried the chlorides of phosphorus, but the results are not so good as with sulphur chloride. The extraordinary hygroscopicity of thorium chloride is due to impurities; the pure chloride, though it is hygroscopic, can nevertheless be manipulated in the air quite safely. Its heat of solution (1 molecule in 2700 of water) was found to be 53.8 calories.—J. T. D.

Tannic and gallic acids; Action of reducing agents on —.

Phenols; Action of iodine on — and a modified process for the determination of tannic acid. W. M. Gardner and H. H. Hodgson. See XIV.

PATENTS.

Secretions from organic tissues; Process for obtaining —. E. Hoenicke, Dresden, Germany. Eng. Pat. 26,918, Nov. 23, 1907. Under Int. Conv., Nov. 30, 1906.

THE sodium chloride solution containing the secretion (see Eng. Pat. 27,023 of 1907; this J., 1908, 1084) is either filtered through a Berkefeld or other fine-grained filter, which allows the contents of the vesicle to pass through but retains the cellular albumin, or is dialysed through a suitable membrane such as parchment paper. Or the tissue to be treated may be introduced into a finely porous filter or enclosed in a casing of a suitable membrane placed in a solution of common salt, in order to carry out the filtration or dialysis simultaneously with the maceration.—T. H. P.

Secretions from organic tissues; Process for obtaining —. E. Hoenicke, Dresden, Germany. Eng. Pat. 24,750 of 1908; date of application, Nov. 23, 1907.

THE liquid containing the secretion (see Eng. Pat. 27,023 of 1907; this J., 1908, 1084) is submitted to dialysis through a suitable animal membrane, such as thin intestine, by which the colloidal cellular albumin is retained and so separated from the diffusible secretions.—T. H. P.

Cyclic carbonates of halogen derivatives of ethyl- and propyl-3,4-dihydroxybenzene. H. S. Wellcome, London, and G. Barger, Herne Hill. Eng. Pat., 2023, Jan. 29, 1908.

WHEN 3,4-methylenedioxy styrene is treated with chlorine at 0° C., a dichloride is formed, which boils at 153° — 160° C. at 12 mm. This is changed by aqueous acetone into

the corresponding chlorhydrin, which melts at 95° C. When either of these substances is treated with phosphorus pentachloride, distilled, and the product mixed with anhydrous formic acid, the cyclic carbonate of α -3,4-dihydroxyphenyl- α -3-dichloroethane, $\text{O} : \text{C} : \text{O}_2 : \text{C}_6\text{H}_3 \cdot \text{CHCl} \cdot \text{CH}_2\text{Cl}$, is obtained. This carbonate forms a thick oil boiling at 182° C. at 8 mm. Starting from isosafrolchloride and using an analogous process, the cyclic carbonate of α -3,4-dihydroxyphenyl- α -3-dichloropropane, $\text{O} : \text{C} : \text{O}_2 : \text{C}_6\text{H}_3 \cdot \text{CHCl} \cdot \text{CHCl} \cdot \text{CH}_3$, is produced. This substance boils at 192° C. at 9 mm.—F. SODN.

Therapeutic compound [Hydroxyquinoline salicylate]; New —. H. S. Wellcome and A. G. Bates, London, and F. G. P. Reinfry, Dartford. Eng. Pat. 8068, April 11, 1908.

ONE molecular proportion of salicylic acid in alcohol is added to one molecular proportion of 8-hydroxyquinoline also dissolved in alcohol. On evaporation, crystals of 8-hydroxyquinoline salicylate, $\text{C}_{16}\text{H}_{13}\text{O}_4\text{N}$, separate, which melt at 114° — 115° C. after crystallising from acetone.—F. SODN.

Radio-active mass. S. Loewenthal, Braunschweig, and K. Lüer, Charlottenburg, Assignors to Radiogen Ges.m.b.H., Charlottenburg, Germany. U.S. Pat. 907,066, Dec. 15, 1908.

A BLOCK of kieselguhr containing incorporated radio-active substances is enclosed in a cover of kieselguhr, and the whole is arranged in a reservoir so as to close the outlet opening of the latter. Any fluid drawn off from the reservoir has therefore to pass through the radio-active block.—A. S.

Borneols and isoborneols or their esters from pinene; Process for preparing —. G. Austerweil. Fr. Pat. 392,159, June 15, 1908. Under Int. Conv., May 13, 1908.

PINENE is heated under pressure in an autoclave with an aromatic polysubstituted acid, which is insoluble or slightly soluble in water, to a temperature 10° or 20° above the boiling point of the mixture: the air in the autoclave is replaced by carbon dioxide or other inert gas, which is forced in until a suitable pressure is attained. Addition of a small quantity of the anhydride or chloride of the acid accelerates the reaction. The excess of acid is removed from the resulting product by filtration, and the limonene separated from the oily portion by steam distillation: the residue, which consists of esters of borneol and isoborneol, may then be saponified.—T. F. B.

Camphor; Manufacture of artificial —. G. A. Le Roy. Fr. Pat. 392,182, Sept. 17, 1907.

TURPENTINE oil is treated with a halogen at a low temperature (e.g., -25° C.), until an increase of 25 to 50 per cent. of its weight is obtained. The product is mixed with one-eighth to one-fifth of its weight of sodium hydroxide, the temperature meanwhile being kept low, when it is said to be converted into camphor.—T. F. B.

Isobornyl esters from pinene hydrohalides; Process for preparing —. L. Weitz. Fr. Pat. 392,247, July 11, 1908. Under Int. Conv., July 12, 1907.

PINENE hydrohalides are converted into isobornyl esters by heating with organic acids in presence of metallic zinc: camphene is formed during the process, and combines with the acid, forming an isobornyl ester. It is stated that the yields are 20 to 30 per cent. higher than when organic zinc salts are used for the purpose. The following is an example of the process:—172 kilos. of pinene hydrochloride and 350 kilos. of glacial acetic acid are heated to 90° — 95° C., and 40 to 45 kilos. of zinc foil are added: evolution of hydrogen continues quietly for about 20 hours, after which the excess of acetic acid is removed by distillation under reduced pressure, and the isobornylacetate is washed.—T. F. B.

Powders, tablets, etc., completely soluble in water; Preparation of — containing substances originally insoluble. L. J. Barillet. Fr. Pat. 392,478, July 20, 1908.

ESSENTIAL oils, tar oils, etc., are mixed with a sulpho-ricinoleate and about 20 times their weight of lactose; the resulting products are said to be soluble in water.

T. F. B.

Bromisovaleric acid ester of isobornol; Manufacture of the —. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering. Eng. Pat. 1682, Jan. 24, 1908.

SEE Fr. Pat. 389,327 of 1908; this J., 1908, 999. T. F. B.

Oxyquinolin salts; Process of making neutral —. L. Ostermann, Hamburg, Germany. U.S. Pat. 906,918, Dec. 15, 1908.

SEE Eng. Pat. 11,725 of 1906; this J., 1906, 908. T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Compressed powder, nitroglycerin and ammonium nitrate explosives; Experiments with — in the Royal Coal-mines, Schwalbach (Saar). Glückauf, 1908, 44, 1566—1571.

EXPERIMENTS were made as to the relative cost and coal-getting power of compressed powder compared with the following explosives: *Roburite* No. 3; ammonium nitrate (55), trinitrotoluene (12), flour (6), magnesium carbonate (5), sodium chloride (7), ammonium chloride (5), potassium nitrate (9.5), and potassium permanganate (0.5 parts). *Wittenberger Wetterdynamite*: nitroglycerin (25), potassium nitrate (34), rye meal (38.5), wood meal (1), barium nitrate (1), and sodium carbonate (0.5 parts), *Carbonite* No. 1: nitroglycerin (25), sodium nitrate (30.5), wheat flour (39.5), and potassium bichromate (5.0 parts).

The following table gives the comparative results.

Conditions of mining.	Consumption of explosives in grams per ton of coal produced.			Taking compressed powder as unity.	
	Compressed powder, grams.	Other explosives.	grams.	Consumption.	Cost.
With undercut	149	Carbonite	36	0.64	0.87
	117	Wetterdynamite	98	0.83	1.14
	180.5	Roburite	128.8	0.69	1.24
With breaking-in shots	190	Wetterdynamite	51	0.27	0.37
Without undercut or breaking-in shots	149	Carbonite	137	0.42	1.25
	86.5	Wetterdynamite	79.0	0.46	1.31
	84	Roburite	87	1.03	1.85

—G. W. McD.

p-Aminophenylarsinic acid; Acyl derivative of —. P. Ehrlich and A. Bertheim, Frankfurt, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Main, Germany. U.S. Pat. 907,016, Dec. 15, 1908.

SEE Eng. Pat. 17,619 of 1907; this J., 1908, 892. T. F. B.

Diaminobenzic acid alkamine ester. A. Einhorn, Munich, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Main, Germany. U.S. Pat. 907,017, Dec. 15, 1908.

SEE Eng. Pat. 18,942 of 1907; this J., 1908, 958. T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Photographic plates; Product for "reversing" ordinary or colour —. R. Chaboseau. Fr. Pat. 392,528, July 21, 1908.

THE claim is for a "reversing" solution for negatives containing a soluble permanganate, bichromate, etc., an alkali bisulphate, and an alum. T. F. B.

Photographic emulsion. J. T. Gateau, Aix-en-Provence, France. U.S. Pat. 905,306, Dec. 1, 1908.

SEE Fr. Pat. 380,188 of 1907; this J., 1908, 38. T. F. B.

Multicolour screens for producing photographs in natural colours; Process for preparing —. J. Szecsenik. Fr. Pat. 393,249, Aug. 12, 1908. Under Int. Conv., Aug. 14, 1907.

SEE Eng. Pat. 17,065 of 1908; this J., 1908, 1178. T. F. B.

Safety explosives; Tests with —. Beyling. Glückauf, 1908, 44, 1717—1721.

THESE tests were carried out in the testing station at Gelsenkirchen, where the principle has always prevailed that explosives should be subjected to as rigorous tests as possible. Hitherto air containing 8 to 9 per cent. of fire-damp was used, and 2 litres of fine coal dust were added just before firing. Under these conditions coal dust appeared to exert no special influence on the result of the tests. In 1907 it was found however that coal dust is more readily ignited by quite a number of explosives than the most sensitive fire-damp mixture (see Beyling, Glückauf, 1907, Nos. 36 and 37), and further, that certain other explosives ignite a fire-damp mixture more readily than a fire-damp mixture containing coal dust. Tests have been carried on since, and it was found that all explosives ignite either coal dust or a gas mixture more readily than a combination of the two. This is explained by the fact that any addition of coal dust to the most sensitive mixture of air and fire-damp immediately reduces the amount of oxygen available for the combustion of the fire-damp, and so renders the whole less sensitive. It was therefore decided to make fresh tests for the whole range of safety explosives on this principle. The work is not yet complete, but the results of the tests on some explosives belonging to the gelatin-dynamite and ammonium nitrate groups (largely used in mines on account of their efficiency) are published in tabular form. The shots were fired from a mortar of 55 mm. diameter into air containing 8 to 9 per cent. of fire-damp. The cartridges were of 35 mm. diameter and no stemming was used. Not more than 150 grms. of any of the explosives tested could be fired without causing ignition, while in most cases 50 grms. sufficed. On the other hand, the maximum capacity of the mortar (600—800 grms. according to the density of the explosive) fired into coal dust did not cause ignition. Recently, "Kohlencarbonit," "Wittenberger Wetterdynamit," and "Ammoncarbonit" were tested. The two former are said to be almost identical in composition, and quantities of 650 grms. (the maximum capacity of the mortar) were found to be safe both in fire-damp, and in coal dust. "Ammoncarbonit" ignited, it is stated, in fire-damp when

500 grms. were used, but was safe with 450 grms., whilst in coal dust the values were given as 300 grms. and 250 grms. respectively.—C. J. G.

White Phosphorus Matches Prohibition Act, 1908. [8 Edw. 7. Ch. 42.]

THE following is the text of the above Act to prohibit the manufacture, sale, and importation of matches made with white phosphorus, and for other purposes in connection therewith, dated Dec. 21, 1908:—

1.—(1) It shall not be lawful for any person to use white phosphorus in the manufacture of matches, and any factory in which white phosphorus is so used shall be deemed to be a factory not kept in conformity with the Factory and Workshop Act, 1901, and that Act shall apply accordingly.

(2) The occupier of any factory in which the manufacture of matches is carried on shall allow an inspector under the Factory and Workshop Act, 1901, at any time to take for analysis sufficient samples of any material in use or mixed for use, and, if he refuses to do so, shall be guilty of obstructing the inspector in the execution of his duties under that Act:

Provided that the occupier may, at the time when the sample is taken, and on providing the necessary appliances, require the inspector to divide the sample so taken into two parts and to mark, seal, and deliver to him one part.

2. It shall not be lawful for any person to sell or to offer or expose for sale or to have in his possession for the purposes of sale any matches made with white phosphorus, and, if any person contravenes the provisions of this section, he may on complaint to a court of summary jurisdiction be ordered to forfeit any such matches in his possession, and any matches so forfeited shall be destroyed or otherwise dealt with as the court may think fit, but this provision shall not come into operation as respects any retail dealer until the first day of January, nineteen hundred and eleven.

3. It shall not be lawful to import into the United Kingdom matches made with white phosphorus, and matches so made shall be included amongst the goods enumerated and described in the table of prohibitions and restrictions contained in section forty-two of the Customs Consolidation Act, 1876.

4.—(1) Any person who is manufacturing or proposing to manufacture matches by way of trade may present a petition to the Board of Trade, praying for the grant of a compulsory licence to use any process patented at the passing of this Act for the manufacture of matches without white phosphorus, other than matches intended to strike only on a surface specially prepared for the purpose.

(2) The Board of Trade, after considering any representations that may be made by the patentee as defined by the Patents and Designs Act, 1907, and any person claiming an interest in the patent as exclusive licensee or otherwise, and, after consultation with the Secretary of State, may order the patentee to grant a licence to the petitioner on such terms as the Board may think just. The provisions of the Board of Trade Arbitrations, &c., Act, 1874, shall apply to proceedings under this section as if this Act were a special Act within the meaning of that Act.

(3) An order of the Board directing the grant of a licence under this section shall, without prejudice to any other method of enforcement, operate as if it were embodied in a deed granting a licence and made between the petitioner and the patentee and such other persons claiming an interest in the patent as aforesaid.

5.—(1) This Act may be cited as the White Phosphorus Matches Prohibition Act, 1908, and shall, except as otherwise expressly provided, come into operation on the first day of January nineteen hundred and ten.

(2) For the purposes of this Act the expression "white phosphorus" means the substance usually known as white or yellow phosphorus.

Chlorazide, N₂Cl. F. Raschig. See VII.

PATENTS.

Explosives; Manufacture of —. South African Maganite Explosives Synd. Ltd., and H. C. L. Bloxam, Cape Town. Eng. Pat. 26,823, Dec. 4, 1907.

The process claimed is an improvement on that described in Eng. Pat. 3005 of 1906 (this J., 1906, 868), and consists in fusing ammonium nitrate, allowing it to solidify, grinding it and mixing it with dinitrobenzene, the mixture being heated to a temperature a little above the melting point of dinitrobenzene.—A. S.

Phosphorus compounds and kindling or priming compositions; Process for making readily inflammable —, and compositions resulting therefrom. R. Gartenmeister, Elberfeld, Germany. Eng. Pat. 3221, Feb. 13, 1908.

SEE Fr. Pat. 386,988 of 1908: this J., 1908, 837.—T. F. B.

Explosive; Safety —. N. Ceipek, Vienna. U.S. Pat. 907,007, Dec. 15, 1908.

SEE Eng. Pat. 7838 of 1907; this J., 1907, 1296.—T. F. B.

Explosive composed of trinitrotoluene and oxygenated compounds, especially for filling shells and torpedoes; Manufacture of an —. A. and W. Allendorf, and J. Rudeloff. Fr. Pat. 392,994, Aug. 6, 1908.

SEE Ger. Pat. 201,306 of 1906; this J., 1908, 1178.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

Nickel; Electrolytic determination of —. A. Schumann. Z. angew. Chem., 1908, 21, 2579—2583.

PARALLEL experiments showed that a gauze cathode is preferable to a dish or cone cathode in the electrolytic determination of nickel. Good results were obtained by electrolysing solutions of nickel-ammonium sulphate in presence of ammonia, ammonium carbonate, or sodium pyrophosphate and ammonium carbonate, with all three cathodes; with solutions of nickel-ammonium sulphate containing boric acid, good results were obtained with a dish or gauze cathode, but not with a cone cathode; solutions of the same salt to which oxalic acid was added gave very high values, due to the deposition of carbon, both at the ordinary temperature and at 60–70° C.; in presence of citric acid, solutions of nickel-ammonium sulphate, electrolysed at 60–70° C., gave low results, although carbon was deposited; from solutions of the same salt containing free sulphuric acid or hydrochloric acid, firmly adherent deposits were obtained, the results, however, being useless for quantitative work. Solutions of nickel chloride to which ammonia was added gave good results with the dish and gauze cathodes, but not with the cone cathode, unless ammonium sulphate was added as well. Solutions of nickel nitrate also gave good results if a large excess of ammonia and a considerable quantity of ammonium sulphate, or ammonium sulphate and ammonium nitrate, were added, and the electrodes were kept sufficiently far apart.—A. G. L.

Rotating anode; Use of the — in electrolytic separations. [Determination of cadmium.] M. E. Holmes. J. Amer. Chem. Soc., 1908, 30, 1865—1874.

SATISFACTORY separations can be made with the rotating anode, using low currents (0.3–1 amp.), and in much less time than is required with stationary electrodes. Cadmium has been separated from aluminium, chromium, cobalt, nickel, zinc, and magnesium in the presence of sulphuric acid, from manganese in the presence of formic acid, and from aluminium and magnesium in the presence of ammonium acetate and acetic acid, precipitation being complete in about 45 minutes. Attempts to separate cadmium from iron proved unsuccessful (compare this J., 1904, 1115).—F. SOHN.

ORGANIC—QUALITATIVE.

Guaiacum reaction; *Contribution to the knowledge of the* ——. C. L. Alsberg. *Arch. exp. Pathol. u. Pharmak.*, 1908, Supplementband. Schmiedeberg-Festschrift, 39—53. *Chem. Zentr.*, 1908, 2, 1955.

THE author has found that the blue coloration of guaiacum tincture in presence of hydrogen peroxide is produced by many chlorides, including alkali chlorides, but not by sulphates or nitrates. In certain cases metal ions (iron, copper, etc.) act catalytically in producing the coloration. The guaiacum-hydrogen peroxide reaction is thus not a trustworthy means for the detection of oxydases or peroxydases.—A. S.

Savin oil; *Detection of* ——. A. Beythien and P. Atenstädt. *See XX.*

ORGANIC—QUANTITATIVE.

Sodium peroxide; *Use of* — in organic analysis. H. Pringsheim. *Ber.*, 1908, 41, 1267—1271. (Compare this J., 1905, 943.)

THE author cites a number of well-agreeing analyses in support of his contention that Virgin's recent statement (*Arkiv. kemi. Geol.*, 1908, 3, 112) that oxidation with sodium peroxide is not suitable for the estimation of halogens in organic compounds cannot be upheld. The following is an improved method of carrying out the analysis: The substance is mixed in an iron crucible with the requisite amount of sodium peroxide, fused, and mixed with an iron nail inserted through a hole in the crucible lid by means of crucible tongs. Substances containing 75 per cent. and more of carbon, hydrogen, and sulphur require 18 times, and those with 50—75 per cent. of these elements 16 times their weight of sodium peroxide. Those containing 25—50 per cent. of these elements are mixed with half, and those with less are mixed with an equal weight of a substance containing much carbon and hydrogen, for example, sugar, and then with 16 times in the former case and 18 times in the latter, their weight of sodium peroxide. After cooling, the crucible is transferred to a dish containing water reaching to about three-quarters of the height of the crucible and covered with a watch-glass; the mass dissolves gradually. (a) Sulphur is estimated by acidifying with hydrochloric acid, filtering, and adding barium chloride. (b) Halogens are determined by adding 3 c.c. of a saturated solution of sodium sulphite or bisulphite (to reduce any halogen oxy-acids formed), then dilute sulphuric acid until any iron precipitate is dissolved, heating to expel sulphur dioxide, and adding first 3 c.c. of concentrated nitric acid, and then silver nitrate. The silver halide is weighed in a Gooch crucible. (c) Arsenic and phosphorus are best estimated by using a silver crucible; the solution is acidified with hydrochloric acid, filtered, ammonia added, and precipitation effected with magnesia mixture.—J. C. C.

Tannic and gallic acids; *Action of reducing agents on* ——. *Phenols*; *Action of iodine on* —— and a modified process for the determination of tannic acid. W. M. Gardner and H. H. Hodgson. *See XIV.*

Reducing sugars; *Precipitation of* — with basic lead acetate. A. H. Bryan. *See XVI.*

Milk intended for analysis; *Disadvantages of potassium bichromate as a preservative for* ——. A. Mouvoisin. *See XVIII.A.*

Caffeine; *A source of error in the determination of* — by Juckenack and Hilger's method. K. Lendrich and R. Mordfeld. *See XVIII.A.*

Lemon-grass oil [; *Determination of citral in* ——.] *See XX.*

Camphor substitutes; *Analysis of camphorated oil for* ——. F. W. Richardson and W. Walton. *See XX.*

New Books.

SOME ELECTRO-CHEMICAL CENTRES. A Report to the Electors of the Gartside Scholarships. By J. N. PRING, M.Sc. Sherratt and Hughes, the University Press, Manchester. 1908. Price 1s. 6d.

THE report is based chiefly on information acquired during visits to several European countries, to the United States, and Canada, including British Columbia, during the years 1907 and 1908.

Six volume, containing 136 pages of subject-matter, and an alphabetical index. The subject-matter is classified as follows:—I. Cost of power production. II. Niagara Falls. III. The copper refineries of New Jersey. IV. Canadian water powers and electro-chemical centres. V. Electric smelting of iron ores, and steel production. VI. Ozone and water purification. VII. Gold and silver refining. VIII. Electrical manufacture of carbon bisulphide. IX. Electro-chemical industries in the Alps, France, and Belgium. X. The electrical fixation of atmospheric nitrogen. XI. Power centres and electro-chemical works in Great Britain.

SPRECHSAAL-KALENDER, FÜR DIE KERAMISCHEN, GLAS- UND VERWANDTEN INDUSTRIEN. 1909. I. Jahrgang. Herausgegeben von Dr. J. KOERNER, Müller und Schmidt, Verlag des Sprechsaal, Coburg. 1908. Price M.250.

THE first appearance of this Kalender. It is of pocket-book size, bound in waterproof cloth, and contains a calendar, blank pages headed for the months of the year, and each day of the month, besides 38 blank pages for miscellaneous entries. The technological portion which follows, fills 116 pages, devoted to all subjects likely to be of service to the ceramic, glass, and allied industries, to students of the subject, or to the practical chemist.

STATISTICAL ABSTRACT FOR FOREIGN COUNTRIES IN EACH YEAR FROM 1896 TO 1905 6, WITH SOME PROVINCIAL FIGURES FOR 1907. Thirty-fourth Number. [Cd. 4265.] Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 7d.

THIS abstract gives particulars regarding trade, navigation, agriculture, railways, telegraph and telephone systems, finance, mineral production, &c., of the principal foreign countries for a series of years. This number of the abstract deals mainly with the years 1896 to 1906, but in the case of Germany, France, and the United States, it has been possible to include some particulars of the foreign trade of these countries for the year 1907. Four new tables summarising the trade of the principal commercial countries with the United Kingdom have also been included.

STATISTICAL ABSTRACT FOR THE SEVERAL BRITISH COLONIES, POSSESSIONS AND PROTECTORATES IN EACH YEAR FROM 1893 TO 1907. Forty-fifth Number. [Cd. 4115.] Wyman and Sons, Fetter Lane, London, E.C. Price 2s.

THIS publication contains the principal official data regarding the trade, shipping, agriculture, production, revenue, expenditure, &c., &c., of the various British Colonies, Possessions, and Protectorates, as well as an abstract of the rates of import duty levied in the various Colonies on the principal articles of trade.

COLONIAL IMPORT DUTIES, 1908. RETURN RELATING TO THE RATES OF IMPORT DUTIES LEVIED UPON THE PRINCIPAL AND OTHER ARTICLES IMPORTED INTO THE BRITISH COLONIES, POSSESSIONS, AND PROTECTORATES. [Cd. 4383.] Wyman and Sons, Fetter Lane, London, E.C. Price 3s.

THIS RETURN shows the duties in force, so far as notified to the Board of Trade, at the date of preparation of the Return, viz., November, 1908.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 27,061. Perks. Moving valuable vapours or gases from machinery. Dec. 14.
 27,089. Donlton and Morson. Hand pump pressure filter.* Dec. 14.
 27,245. Norma Compagnie, and Kirner. Pyrometers.* Dec. 15.
 27,466. Hallett. Separating air or other gases from liquids.* Dec. 17.
 27,473. Panling. Simultaneously distilling and concentrating liquid mixtures.* Dec. 17.
 27,551. Snowden. Kilns.* Dec. 18.
 27,675. Schmatolla. Furnaces, kilns, etc. [Addition to No. 1168 of 1908.]* Dec. 19.
 27,767. Arbuckle and Osborne. *See under X.*
 27,939. Jones. Centrifugal machines for separating liquids from solid substances. Dec. 23.
 28,201. Dempster and Sons, Ltd., and Toogood. Vertical retorts. Dec. 28.
 28,295. Webb. Apparatus for filtering liquid. Dec. 28.
 28,549. Schmatolla. Kilns for burning limestone, dolomite, &c. Dec. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

- 27,947 (1907). Black, Lennox, and Lennox. Apparatus for cleaning or washing smoke and for inducing draught. Dec. 23.
 28,079 (1907). Oxley and Crossley. Recovery and subsequent utilisation of the waste heat of kilns, ovens, etc. Dec. 31.
 28,356 (1907). Williamson. Centrifugal drying machines. Dec. 23.
 4540 (1908). Hawes. Obtaining dry products from liquids and semi-liquids. Dec. 23.
 7920 (1908). Peat. *See under X.*
 20,400 (1908). Arbuckle and Osborne. Rotary filtering apparatus. Dec. 31.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 27,144. Kroll and Saklatwalla. Production of pure and thin filaments for illuminating purposes. [Ger. Appl., Dec. 13, 1907.]* Dec. 14.
 27,755. Zdanowich. Incandescent mantles. Dec. 21.
 27,763. Kokotek, Knaster, and Offord. Bodies for incandescent lighting. Dec. 21.

- 27,841. Chandler. Apparatus for gas purification. Dec. 22.
 27,896. Paterson. Hydrocarbon gas production. Dec. 22.
 27,899. Lewis. Arc lamp electrodes. Dec. 22.
 27,920. Nehmer. Incandescent gas mantles. Dec. 23.
 28,032. Schmatolla. Gas producer. Dec. 24.
 28,053. Mason's Gas Power Co., Ltd., and others. Production of gas from bituminous fuel in gas producers. Dec. 24.
 28,054. Mason's Gas Power Co., Ltd., and others. Production of recoverable ammonia in the manufacture of producer gas. Dec. 24.
 28,179. Marshall. Manufacture of artificial fuel. Dec. 24.
 28,201. Dempster and Sons, Ltd., and Toogood. *See under I.*
 28,349. Rindom. Gas retorts. [App. in Denmark, July 16, 1908.]* Dec. 29.
 28,435. Laigle. Incandescent gas and electric filaments. [Swiss Appl., Jan. 10, 1908.]* Dec. 30.
 28,462. Neilson. *See under III.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 28,049 (1907). Fieschi. Coke furnaces. Dec. 31.
 28,290 (1907). Von Bauer. Coke ovens for the recovery of by-products. Dec. 23.
 28,602 (1907). White. Distillation of coal for producing smokeless fuel. Dec. 23.
 4956 (1908). Planchon. Manufacture of incandescent bodies for electric lamps. Dec. 23.
 7105 (1908). Junquera. Gas generators. Dec. 23.
 12,955 (1908). Hammond and Cash. Manufacture of gas. Dec. 23.
 15,042 (1908). Lake (Trump). Gas producers. Dec. 23.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATION.

- 28,462. Neilson. Purification of and recovery of tar and other substances from blast furnace, producer, and like gases.* Dec. 31.

COMPLETE SPECIFICATION ACCEPTED.

- 7920 (1908). Peat. *See under X.*

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

- 27,095. Knoll and Co. Phenolphthalein compounds. [Ger. Appl., Dec. 21, 1907.]* Dec. 14.
 27,098. Newton (Bayer and Co.). Manufacture of anthracene derivatives and their employment in dyeing and printing. Dec. 14.
 27,747. Imray. (Soc. Chem. Ind. in Basle). Manufacture of brominated indigos.* Dec. 21.
 28,272. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matter.* Dec. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

- 5485 (1908). Newton (Bayer and Co.). Manufacture of sulphur dyestuffs. Dec. 23.
 7552 (1908). Holliday and Sons, and others. *See under V.*
 9107 (1908). Imray (Meister, Lucius, und Brüning). Separation of *o*- and *p*-chlorobenzaldehyde. Dec. 23.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

- 27,098. Newton (Bayer und Co.). *See under IV.*
 27,225. Levene and Harris. Rendering fabrics and other articles non-inflammable. Dec. 15.
 27,676. Pfel. Process for obtaining textile fibres.* Dec. 19.
 27,742. Newton (Bayer und Co.) Printing with brominated indigo. Dec. 21.
 27,928. Calico Printers' Assoc., and Hewit. Calico printing. Dec. 23.
 28,042. Hardman and Edmondson. Bleaching cotton or other vegetable fibres in the raw state or in yarns or fabrics. Dec. 24.
 28,056. Ryhance. Reducing the inflammability of textile fabrics. Dec. 24.
 28,149. Lecoœur. Manufacture of threads and filaments of cellulose. Dec. 24.
 28,163. Malcolmson (De Lamarre). Treatment of megass and other vegetable fibre. Dec. 24.

COMPLETE SPECIFICATIONS ACCEPTED.

- 3751 (1908). Johnson (Badische Anilin und Soda Fabrik). Production of reserve effects on fabrics in dyeing with sulphur colouring matters. Dec. 31.
 4295 (1908). Shaw, and Whitfield Velvet and Cord Dyeing Co. Dye jiggers or dyeing apparatus. Dec. 23.
 7552 (1908). Holliday and Sons, Turner, and Dean. Direct cotton dyestuff preparation for dyeing. Dec. 23.
 13,897 (1908). Drews. Extraction of fibre from leaves and other vegetable matter. Dec. 23.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

- 27,252. Rigby. Production of granulated or coarse-grained salt. Dec. 15.
 27,302. Carulla. Manufacture of ammonia salts from ferrous liquors. Dec. 16.
 27,587. Rollin, and Hedworth Barium Co. Manufacture of barium compounds. Dec. 18.
 27,592. Flamand. Dividing air into its elements by fractional distillation. [Fr. Appl., Sept. 18, 1908. Addition to No. 26,720 of 1908.]* Dec. 18.
 27,597. Morrison. Treatment and preservation of calcium carbide. Dec. 18.
 27,774. Rüber. Production of phosphate precipitates. [Appl. in Norway, Nov. 6, 1908.]* Dec. 21.
 27,878. Erlenbach. Manufacture of ammonium sulphate. [Ger. Appl., Jan. 10, 1908.]* Dec. 22.
 27,905. Woltereck, and The Sulphate of Ammonia Co., Ltd. Production of ammonia from peat. Dec. 22.
 28,054. Mason's Gas Power Co., Ltd., and others. *See under II.*
 28,074. Dewrance and Williams. Manufacture of alkaline cyanides. Dec. 24.
 28,112. Behrens. Separating carbonic acid from carbonic acid containing gas mixtures.* Dec. 24.
 28,549. Schmatolla. *See under I.*
 28,565. Jensen (Spitz). Production of pure oxide of tin. Dec. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

- 14,285 (1907). Cowper-Coles. *See under XI.*
 27,463 (1907). Alexander, McClelland, and Lange. Unstable solutions. Dec. 23.
 27,932 (1907). Wack. Manganese salt for oxidation purposes. Dec. 31.

1608 (1908). Percy and Byrom. Obtaining hydrocyanic acid from waste gases. Dec. 23.

5573 (1908). Goldschmidt. *See under X.*

8768 (1908). Dieffenbach and Moldenhauer. Transformation of hydrocyanic acid into oxynitrogen compounds. Dec. 23.

10,181 (1908). Newton (Bayer und Co.). Manufacture of hydrosulphites. Dec. 23.

20,198 (1908). Willeox (Badische Anilin und Soda Fabrik). Manufacture of solid hydrosulphites. Dec. 31.

VIII.—GLASS, POTTERY, AND ENAMELS.

COMPLETE SPECIFICATIONS ACCEPTED.

- 26,189 (1907). Meakin, Ltd., and Jackson. Ovens and kilns for drying or firing ceramic wares. Dec. 31.
 6794 (1908). Gayed. Recovering china clay or china stone from decomposed granite and separating the clay, mica, and quartz. Dec. 23.
 14,841 (1908). Chem. Fabr. von Heyden. Silvering glass or other surfaces. Dec. 23.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

- 27,055. Marchetti and Marchetti. Building materials. Dec. 14.
 27,640. Bost. Manufacture of heat insulating materials. Dec. 19.
 27,902. Von Medvedsky. Production of a fireproof concrete compound. [Comprised in No. 16,118, July 29, 1908.]* Dec. 22.

COMPLETE SPECIFICATIONS ACCEPTED.

- 13,440 (1908). Poths. Rotary kilns for burning cement. Dec. 23.
 17,119 (1908). Solomon and Austin. Compound for rendering waterproof cements and mortars. Dec. 23.

X.—METALS AND METALLURGY.

APPLICATIONS.

- 27,163. Crosley. Mineral slime-concentrating machines. Dec. 15.
 27,221. Wheatley. Metal alloy and its production. Dec. 15.
 27,353. Bloxam (Cie. des Forges de Chatillon). Pickling metals. Dec. 16.
 27,452. Stoker. Extraction of metals from their ores. Dec. 17.
 27,464. Rees, Davey, and Martin. Extraction of metals from ores. Dec. 17.
 27,498. Williams. Manufacture of wrought iron. Dec. 18.
 27,767. Arbuckle and Osborne. Separating crushed ore products or other comminuted solid matter from liquid. Dec. 21.
 27,838. Brown, Turner, and Turner. Alloying sterling silver. Dec. 22.
 27,910. De Ferranti. Coating metal articles. Dec. 22.
 28,003. Soc. Anon. Le Néo Métallurgie. Manufacture of commercially pure manganese. [Fr. Appl., Jan. 22, 1908.]* Dec. 23.
 28,081. Kurz. Manufacture of leaf metal, particularly leaf gold.* Dec. 24.
 28,172 to 28,175. Sulman, Picard, and Ballot. Concentration of ores. Dec. 24.
 28,508. Stewart. Treatment of alloys of tin and copper to separate the metals. Dec. 31.

28,509. Stewart. Treatment of alloys of tin and silver to separate the metals. Dec. 31.

28,551. Jensen (Spitz). Separating tin or other metal from waste metal, alloys, &c. Dec. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

21,638 (1907). Martin. Treatment of iron or steel to prevent rust or corrosion. Dec. 23.

92 (1908). Plathner and Dorn. Coating of metals. Dec. 31.

5573 (1908). Goldschmidt. Manufacture of alloys of silicon. Dec. 23.

7211 (1908). Strange, Pim, and Matthews. Recovery of gold by the cyanide process, and other chemical processes wherein zinc is employed. Dec. 31.

7920 (1908). Peat. Apparatus for subjecting ores, shale, &c., to the action of heat in a continuous manner. Dec. 23.

8168 (1908). Messier. Basic Bessemer process. Dec. 23.

13,492 (1908). Imbert. Extraction of zinc from ores by the precipitation process. Dec. 31.

13,666 (1908). Lévy. Removing the electrolytic nickel or other metallic coating of metallic surfaces. Dec. 31.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATION.

28,147. Gibbs. Electrolytic cells. [Comprised in No. 27,830, Dec. 17, 1907.]* Dec. 24.

COMPLETE SPECIFICATIONS ACCEPTED.

14,285 (1907). Cowper-Coles. Electric hydrogen and oxygen generators. Dec. 23.

13,666 (1908). Lévy. *See under X.*

19,265 (1908). Marsh. Electric furnaces. Dec. 23.

21,741 (1908). Keller. Electric furnaces. Dec. 23.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

27,065. Farr. Polishing or other waxes. Dec. 14.

27,083. Buchanan. Manufacture of soap. Dec. 11.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

COMPLETE SPECIFICATION ACCEPTED.

12,517 (1908). Liebreich. Manufacture and application of oil paints. Dec. 23.

(C.)—INDIA-RUBBER.

APPLICATIONS.

27,090. Price. Preparing rubber for preservation and transportation.* Dec. 14.

27,328 Hayley (Northway). Obtaining india-rubber or caoutchouc from rubber producing machines.* Dec. 16.

27,496. Pybus and Pybus. Manufacture of rubber substitutes. Dec. 18.

27,567. Capelle. Recovery and regeneration of india-rubber, &c.* Dec. 18.

27,688. Wallace and Reynaud. Manufacture of elastic products similar to india-rubber. [Fr. Appl. Dec. 20, 1907.]* Dec. 19.

27,914. Gottschalk, Barr, and Dawson. Synthetic production of india-rubber. Dec. 22.

27,915 to 27,917. Lilley and Dawson. Synthetic production of india-rubber. Dec. 22.

28,159. Immisch. Manufacture of ebonite and vulcanite. [Comprised in No. 28,365, Dec. 24, 1907.]* Dec. 21.

28,450. Blum. Manufacture of artificial Para rubber. Dec. 30.

COMPLETE SPECIFICATION ACCEPTED.

10,731 (1908). Torrini, Hoffmann, and Benoit. Manufacture of a substitute for hard vulcanised rubber or ebonite. Dec. 23.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c. APPLICATION.

28,219. Buffum and Carter. Preparation of waterproof leather board. [U.S. Appl. Jan. 2, 1908.]* Dec. 28.

XVI.—SUGAR, STARCH, GUM, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

20,266 (1907). Hutchinson, and United Railway and Trading Co. *See under XIX.*

569 (1908). Greenwood. Manufacture of gum tragacanth. Dec. 31.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATION.

27,956. Breker. Production of brewers' wort. [Addition to No. 25,356 of 1907.]* Dec. 23.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

27,080. Hogarth. Treatment of air or gases for use in conditioning or improving cereals. Dec. 14.

27,218. Wesener. Apparatus for preparing gaseous mixtures for treating flour, &c. [U.S. Appl. May 14, 1908.]* Dec. 15.

27,520. Hogarth. Treatment of cereals and other alimentary substances. [Addition to No. 5155 of 1908.]* Dec. 18.

28,223. Jensen. Pasteurising or sterilising liquids.* Dec. 28.

28,241. Anyon. Treating fresh or spent hops for edible and dietetic purposes. Dec. 28.

28,507. Bloxam (Thomas). Conditioning flour. Dec. 31.

COMPLETE SPECIFICATION ACCEPTED.

8279 (1908). Snelling. Manufacture of margarine. Dec. 31.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

27,226. Ozonair, Ltd., and Joseph. Sterilisation of water by ozone or other gaseous agent. Dec. 15.

28,052. Heenan and Leask. Treatment of sewage. Dec. 24.

28,562. Guy. Bacteria beds and substances for use as bacteria medium. Dec. 31.

(C.)—DISINFECTANTS.

COMPLETE SPECIFICATION ACCEPTED.

9886 (1908). Schneider. Manufacture of disinfectants. Dec. 23.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

27,123. Claviez. Manufacture of a material like paper.* Dec. 14.

27,573. Luck. Treatment of flax straw or the like for the production of cellulose. Dec. 18.

28,149. Lecoqur. *See under V.*

28,538. Ratignier, and Pervillac et Cie. Manufacture of pellicles and films. [Fr. Appl., Jan. 4, 1908.]* Dec. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

20,266 (1907). Hutchinson, and United Railway and Trading Co. Treatment of bagasse. Dec. 23.

20,267 (1907). Hutchinson, and United Railway and Trading Co. Manufacture of paper and material therefor. Dec. 23.

7629 (1908). Lehner. Colouring celluloid, especially for coloured screens for photography. Dec. 23.

XX.—FINE CHEMICALS, ALKALOIDS,
ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

27,096. Knoll und Co. Manufacture of condensation mixtures from phenols and aldehydes. [Ger. Appl., July 3, 1908.]* Dec. 14.

28,011. Richter. Preparation of iodide of lecithin and bromide of lecithin.* Dec. 23.

28,434. Marks (Koch). Manufacture of ferro-albumen preparations.* Dec. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

27,735 (1907). Boult (Radiogen Ges.). Radio-active preparations. Dec. 23.

4936 (1908). Newton (Bayer und Co.). Manufacture of santalol ethers. Dec. 23.

5404 (1908). Tompkins, and Clayton Aniline Co. Manufacture of dihalogen-acetyl chloride and dihalogen-acetic acid and derivatives thereof. Dec. 31.

XXI.—PHOTOGRAPHIC MATERIALS AND
PROCESSES.

APPLICATIONS.

27,233. Mansell and Mansell. Production and reproduction of bleached images. Dec. 15.

27,686. Soc. Anon. La Photographie des Couleurs, Sury, and Bastyns. Preparation of solutions used in the bichromate gelatine process for photographic printing.* Dec. 19.

27,687. Soc. Anon. La Photographie des Couleurs, Sury, and Bastyns. Printing on paper of photographs in colour.* Dec. 19.

27,957. Lucas. Treatment of photographic sensitised gelatin films or gelatino-bromide prints for reproducing any photographic image. Dec. 23.

COMPLETE SPECIFICATIONS ACCEPTED.

7629 (1908). Lehner. *See under XIX.*

15,657 (1908). Jeannot and Bremner. Photographic toning and fixing solutions. Dec. 31.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

27,286. Kilburn (Rickmers). Explosives. Dec. 15.

28,012. Harris. Explosives. Dec. 23.

28,544. Andersen. Explosives.* Dec. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

117 (1908). Carré. Matches. Dec. 31.

20,279 (1908). Bawden. Explosives. Dec. 23.

20,574 (1908). Farris and Jex. Blasting powder Dec. 31.

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DR. MILTON L. HERSEY IN THE CHAIR.

CHEMISTRY IN ITS RELATION TO FOOD.

BY PROF. J. F. SNELL.

The sum of human knowledge on the differences between foods, and the physiological effects of these differences is still small and imperfect, and the wise man is he who is modest enough to admit the limitations of his own share of this knowledge; open minded enough to give fair consideration to rational argument, keen enough to discriminate between sound knowledge and irrational dogmatism, and strong-willed enough to shape his policy to fit the best knowledge available to him.

Though it has its physical and biological aspects it must be admitted, I think, that the diet problem is to a very great extent a chemical one. Digestion is accomplished by chemical processes, and the examination of a given commodity to determine its suitability for consumption as food must include a chemical analysis as well as a search for injurious organisms, parasitic or bacterial.

The directions in which chemistry is being applied to nutrition problems are more various than perhaps the average man realises. I wish briefly to refer to the following:

1. The determination of the relative values of foods, from the nutrition standpoint.
2. The elucidation of the processes of digestion.
3. The problem of hygienic preservation of food.
4. The detection of adulterants.

The processes of digestion are, as I have said, essentially chemical processes. The constituents of foods are: water, mineral salts, organic acids and their salts, carbohydrates, fats, and proteins.

(1) Water constitutes a large proportion of our diet. It is excreted unchanged, but the chemical processes involved in the digestion of the other nutrients are in general hydrolytic processes; in other words, digestion consists in reactions of the other nutrients with water, and it is only in the subsequent physiologico-chemical reactions, such as respiration, that the water is again liberated as such.

(2) Mineral salts. These are closely associated with the proteids, but their functions are only imperfectly understood. Like the water, the mineral salts of the diet are excreted as such, and as a diet containing a sufficient quantity of the organic nutrients is pretty certain to contain an abundant supply of the essential mineral substances, with the single exception of common salt, it is not often of practical importance to determine the quantities of mineral salts in foods; nevertheless, there are interesting questions connected with the functions of the mineral salts. Such salts are undoubtedly essential constituents of the living cell. Though our present methods of analysis do not enable us to determine just what the relationship of the mineral salts to the organic constituents is, there can be little doubt that it is an intimate one.

Forster, experimenting with dogs and pigeons with food as poor as possible in mineral substances, observed such a very marked disturbance of the functions of the organs, particularly the muscles and nerves, that death resulted in actually a shorter time than under complete starvation. Bunge, suspecting that Forster's result might be due rather to the lack of an alkali to neutralise the sulphuric and phosphoric acids formed by the oxidation of the proteids, made similar experiments with mice, and although he found that the mice lived twice as long on a diet consisting of casein, milk-fat, cane-sugar, and

sodium carbonate as on one consisting of the same foods without the sodium carbonate, he also made the remarkable observation that the life of the mice was not further prolonged by the addition of all the mineral substances of milk to the above diet, which it will have been noticed contained the organic constituents of milk, with the exception that cane-sugar was substituted for milk-sugar. A possible explanation of this result is that proteins and salts separately cannot take the place of compounds of proteins with salts. Rohmann has obtained better results than Bunge with a more varied artificial diet, having succeeded in maintaining mice on a mixture of casein, white of egg, vitellin, starch, margarine, and salts, and even in bringing up a second generation of mice on the same diet, with the addition of malt. But even with this more varied diet, which includes some foods (e.g., white of egg and malt) which are not ash-free, the mice were not normal, the second generation being undersized and incapable of producing living young.

There can be little doubt, therefore, that the mineral constituents of food are intimately associated with the organic nutrients, and very little doubt that the proteins are the particular class of nutrients with which they are combined. But as to the nature and significance of the combinations of salts and proteins we are as yet very much in the dark.

Certain tissue elements are richer in one mineral body, and others in another. Potassium compounds, for instance, occur chiefly in the form elements, sodium compounds chiefly in the fluids of the organism. For the proper functioning of the animal body, it appears to be necessary to preserve a certain balance between the sodium and potassium, and also a certain balance between the chlorides and the salts of other acids.

Bunge maintains that the specific function of the common salt, which appears to be a necessity in the diet of herbivora and of certain races and classes of men, is to supply sodium to balance the potassium, and chlorine to balance the sulphuric and phosphoric acids, supplied in excess by a vegetable diet, and cites in favour of his theory the fact that carnivora do not require salt, and that men whose diet consists largely of animal foods require less salt than those whose diet is vegetable, especially if composed largely of vegetables rich in potash, such as potatoes.

Passing over for the present the organic acids and their salts, which may be regarded as intermediate in character, we come to the three great classes of organic nutrients—carbohydrates, fats, and proteins. These are the food substances which undergo the most profound changes in the animal organism, being converted by the digestive processes into forms in which they can be absorbed into the blood or lymph, subsequently transformed into living protoplasm or stored as glycogen or as fatty tissue, and ultimately oxidised to water, carbon dioxide, and simple nitrogenous compounds, such as urea, in which simple forms they are excreted. The heat which maintains the body at its normal temperature, and the mechanical energy of muscular work are derived from the oxidation of these nutrients, and it is upon its content of the nutrients of these classes that the so-called "nutritive value" of a food is based. In one sense the nutritive value of a food is measured by the quantity of energy yielded by its oxidation in the body. A less ambiguous term for nutritive value in this sense is *fuel value*. To estimate the fuel value of a food it is therefore necessary and sufficient to determine first what proportion of the given food is actually digested and absorbed, and second, what is the heat of combustion of the food. It is here assumed that the energy yielded by the gradual oxidation characterising physiological processes is the same as that yielded by the rapid oxidation of the same food in a calorimeter; in other words, that the law of conservation of energy holds in animate as well as in inanimate nature. That this assumption is correct is indicated by the results of all the experiments made to decide the question, and

particularly by those of Atwater and his associates in a large number of experiments in which foods were on the one hand burned in a bomb calorimeter and on the other hand supplied to human subjects confined for periods of several days in a dehydrate calorimeter, provided with appliances for the collection and analysis of the respiratory products. The solid and liquid excreta were likewise collected, analysed and burned in the bomb calorimeter. Complicated as such experiments are, involving the co-operation of numerous observers and a considerable amount of apparatus—mechanical, electrical, and chemical—continued practice enabled the investigators to reduce the experimental error to less than 1 per cent., and it was found that the law of conservation of energy held strictly true up to this limit of error.

Assuming, then, the validity of the law of conservation of energy, the energy value of the food can be determined by burning a weighed portion of the food in a bomb calorimeter, and also burning in the calorimeter the excreta produced in a digestion experiment on a diet composed of the food under investigation, together with foods whose energy value has previously been determined in a similar manner.

Results somewhat less precise, but sufficiently accurate for most practical purposes are obtained by determining chemically the proportions of carbohydrates, fats, and proteins in the food, and deriving the energy values of the food by use of average figures for both the heats of combustion and the digestibilities of the nutrients of the three classes. In the case of proteins allowance has, of course, to be made for the fact that while the products of combustion in the calorimeter are water, carbon dioxide, and free nitrogen, the products of physiological oxidation are water, carbon dioxide, and the nitrogenous compounds excreted by the kidneys, chief among which is urea. It is convenient to combine the two factors—digestibility and heat of combustion—into a single value for each class of nutrients. These values are known as the "fuel values" of the nutrients, and the figures in common use are:

For Protein	1860 Cal. per lb.
" Carbohydrates	the same.
" Fats	4220 Cal. per lb.

Proteins and carbohydrates, as these figures indicate, have about equal value as heat and energy producers, while one pound of fat is the equal of about two and a quarter pounds of protein or starch.

As the term "fuel value" implies, the food has so far been regarded as bearing the same relationship to the organism that fuel bears to a furnace and engine; the food merely supplying heat and the mechanical energy that sets up and keeps the engine in motion. This analogy is useful but by no means adequate. The relationship of food to a living organism is infinitely more complex than that of fuel to the engine. One obvious difference is, that in addition to supplying heat and energy to the organism the food must provide for the continual renewal of the tissues of the organism, and in the case of young organisms, for the production of new tissue. It must serve for construction material as well as for fuel. This fact naturally complicates the estimation of the relative values of foods. For whereas all classes of nutrients may serve as fuel, proteins alone can serve as the essential construction material of cellular tissue. Consequently a fair comparison of the nutritive values of foods cannot be based on their mere fuel values. The content of protein must also be considered. Obviously no man or animal could live on a diet which did not include protein, however rich it might be in energy value. And this brings us face to face with the much controverted question: "How much protein should the diet include?"

The older dietary standards of Voit, Playfair, Atwater, &c., were based upon observations of the food actually consumed by persons in the various callings and circumstances of life. They thus assumed that the average usage of the race in respect to the total quantity of food and to the quantity of protein consumed is the best usage possible; in other words, that the average wisdom of the race is in respect to this important question the highest wisdom. Dietary standards derived in this manner by the different authorities do not differ greatly from each other,

and for purposes of discussion we may confine our attention to one of them. Voit's standard for a man of 70 kilos. (154 lb.) body weight, performing a moderate amount of muscular work, was 118 grms. of protein, 500 grms. of carbohydrates and 56 grms. of fat. The total fuel value of this dietary is 3055 cal. Per kilo. of body weight, it amounts to 43 calories of energy and 1.68 grms. of protein, of which about 1.50 grms. would be actually digested. Chittenden has of recent years called boldly into question the validity of the assumption that the average usage of the race in the matter of food consumption is correct. He maintains that the average diet, and consequently also the dietary standards based upon it, contains from two to three times as much protein as it is necessary or even wise to consume. For a man of this same body weight of 154 lb., doing the same moderate amount of work he would allow 60 grms. of protein (0.85 gm. per kilo. of body weight) or just about half that contained in the older diet standards. To give a clearer idea of what this means, I may say that 60 grms. of protein are contained in half a pound of fresh lean beef or in three-quarters of a lb. of halibut steak or in nine eggs. Of course a man adopting this dietary standard would have to use less than these quantities of meat or fish or eggs per day, because the other portions of his diet would provide part of the protein.

Chittenden would not increase this allowance of protein even for a man doing severe muscular work. He would make up the additional food necessary to such a man by an increase of the carbohydrates and fats of the diet. As to the total fuel value of the diet, he recommends a quantity just a little lower than the older dietaries—2800 calories as against the 3055 for the man at moderate work—a decrease of about 7 per cent. Chittenden's advocacy of a reduction of protein in the diet is based upon personal experience and observation, and upon the results of scientific experiments made in Yale University—some by himself, some by his colleagues. The original purpose of the experiments was to determine whether the body could maintain itself for a period of several months on a diet as low or almost as low in protein as the minimum quantity which has been found sufficient in experiments of a few days to maintain nitrogen equilibrium, i.e., to prevent a continual loss of nitrogen from the body. In experiments of six to nine months' duration upon himself and other men of his class—University professors and instructors—he found that the body could be kept in nitrogen equilibrium on a diet containing only $\frac{1}{2}$ to $\frac{2}{3}$ as much protein as Voit's standard calls for. In his own case he found his health actually improved by the change of diet, being now free from minor ailments such as headaches, which formerly caused inconvenience and discomfort, and being able to work longer without fatigue. Three years after the close of the experiments, he wrote that he was still continuing the low nitrogen diet.

Eight University athletes, formerly accustomed to a diet much higher in protein than the old standards prescribe for men doing moderate muscular work, reduced their protein to 55 grms. per day without detriment to body-weight, health, physical strength, or muscular tone. The nitrogen was gradually diminished during three months and maintained at the low level for two months longer. Twenty soldiers were maintained five months upon a diet with the same low protein content of about 55 grms. These men had daily exercises in a gymnasium, and gymnasium tests showed that at the end of the experiment they had all increased greatly in strength. The average strength of eleven of the soldiers at the beginning of the experiment was 2790, and at the end of the experiment 5100 in terms of the gymnasium tests. This remarkable increase in strength was probably due in some part to practice, for at the beginning of the experiment they were untrained, but it at least indicates that there was no failure of strength on account of the diet. The eight trained athletes showed at the beginning of their experiment a total strength test about equal to that of the soldiers at the end of theirs, but the athletes likewise gained in strength upon the low protein diet. Their initial total strength averaged 4911, their final 6612. The effect of diet on endurance was studied in a five months' experiment by Prof. Irving Fisher of Yale, nine University students serving as subjects. The men were allowed

to select their diet at will, but were to give preference to non-proteid foods, and to practise that thorough mastication of food, recommended by Mr. Horace Fletcher. At the close of the experiment the diet had fallen off about 25 per cent. in total fuel value, about 40 per cent. in total protein and over 80 per cent. in flesh foods. Six simple gymnastic endurance tests were made at the beginning, middle, and end of the experiment. We may take the first of these tests as an example. One subject could rise on his toes 300 times at the beginning of the five months' experiment, 400 times at the middle and 500 times at the end. The results with the other subjects were as follows:

	1.	2.	3.	4.	5.	6.	7.	8.	9.
Beginning	300	1007	333	69	127	1482	702	900	1263
Middle ...	400	1265	2620	65	400	—	831	1500	—
End	500	1061	3000	85	1500	1800	1263	1800	3350

Similar results were obtained with the other tests, subject 2 being the only one who did not show an improvement in practically every test.

In order that it may fulfil its functions then, the average diet must furnish a certain minimum amount of energy and a certain minimum amount of protein, the former at least (if not also the latter) varying with the muscular activity as well as with the size of the consumer. It is no doubt true also that an excessive amount of food reduces the efficiency of the body, and if Chittenden's views are correct, an excessive proportion of protein, even in a diet of correct fuel value, also tends to diminish the efficiency.

But the absolute physiological value of a food is not dependent solely upon its fuel value and its content of proteins, carbohydrates, and fats. Judged by fuel value and protein, eggs have a high nutritive value, but to those few individuals in whom they cause digestive disturbances their practical food value is evidently less than nothing. Fruits, on the other hand, supply very little fuel value and practically no protein to a diet, yet they are of great value in keeping the organs of digestion in good condition. Their virtue is believed to reside in the organic acids and salts contained in them, though probably the flavouring matters are not without influence. Dogs do not thrive on a purely vegetable diet, even if adequate in fuel value and protein content. They require that the best portion of their proteins shall be furnished in the form of flesh. So far as the speaker is aware, but little work has been done in the examination of foods for compounds of pharmacodynamic importance, but from many well-known facts such as those just cited it would appear that such compounds may play a very important part in the processes of digestion.

In the study of the chemistry of digestion, important advances have been made of recent years, but much still remains to be learned. The processes are chiefly hydrolyses—the splitting of complex carbohydrates into simpler carbohydrates; the splitting of proteins into simpler proteins, and possibly into amino acids; and the splitting of fats into glycerin and free fatty acids. All of these processes are promoted or accelerated by the influence of enzymes, secreted by the various glands connected with the alimentary canal. As to the chemical nature of the enzymes there is still much doubt, but they are believed to be themselves protein bodies. Each enzyme acts only in a medium of suitable reaction. For example, ptyalin, the starch splitting enzyme of the saliva, acts only in a neutral or alkaline medium, and the protein splitting enzyme of the gastric juice, pepsin, only in an acid medium. The most important work of digestion is done in the small intestine, into which the liver and pancreas discharge their secretions, the latter furnishing a separate ferment for each class of nutrients—trypsin for proteins, amylase for starch, invertin for sugar, and steapsin for fats.

But not only are the digestive enzymes chemical compounds, the products of chemical reactions and catalytic promoters of other chemical reactions, but the very co-ordination and regulation of the secretion of these enzymes is accomplished very largely by chemical means. It is true that the timely secretion of saliva and of gastric

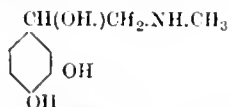
juice, immediately food is ingested, are brought about through the instrumentality of the nervous system, but it has been demonstrated that the co-ordination of the secretion of the pancreatic juice with the arrival of food in the duodenum is quite independent of the nervous system, and it seems probable that the same is true of the inter-relation of some of the other chemical processes. Starling and Bayless divided all the nerves going to a loop of the small intestine; thus placing it in complete nervous isolation from the remainder of the digestive system. Yet when acid was introduced into this isolated loop it was found that a flow of pancreatic juice invariably resulted. From the mucous membrane of the duodenum and upper part of the small intestine they obtained in alcoholic solution and also in aqueous solution a substance which injected into the veins of animals evoked a copious supply of pancreatic juice. This substance, to which they give the name of secretin, appears to be secreted in the cells of the intestinal walls under the stimulation of the acid of the chyme, and to be carried by the blood to the pancreas, where it stimulates the secretion of the alkaline pancreatic juice, which, entering the duodenum, eventually neutralises the acid of the chyme, whereupon the formation of secretin ceases, until the arrival of another portion of chyme. In parallel with this pancreatic secretin, there has also been discovered in Starling's laboratory a gastric secretin. This substance secreted in the pyloric division of the stomach, which contains no oxyntic cells, causes a fresh flow of acid from the cells of the fundus or cardiac division of the stomach some 2 or 3 hours after the food is ingested.

These secretins then serve as chemical messengers from one part of the digestive system to another. Other substances of similar function play a part in physiological chemistry, and to the general class Starling applies the term hormones (from *ὁρμῶν*, I arouse).

He points out that in the simplest organisms, such as bacteria and protozoa, the only adaptations into the mechanism of which we can gain any clear insight are accomplished by chemical means, and that in the lower metazoa, such as the sponges, the co-ordination of the different cells is still wholly determined by chemical means, there being no trace of a central nervous system. The nervous system was evolved to permit of the more rapid adaptations demanded of higher organisms, but where speed is of no special advantage, the more primitive means of adaptation is still employed. The inter-relation of the hormones and the nervous system may be compared to that of the mail and the telegraph in the business world. As a means of communication in primitive communities the mail suffices. More highly organised communities demand a more rapid means of communication, and this the electric telegraph supplies. But the mail system is not abolished when the telegraph is introduced. Where speed is not essential the mail is still employed. Similarly, when in the course of animal evolution rapid communication between the organs became necessary, and a nervous system appeared to supply the means of this rapid communication; the older and slower communication by chemical means was continued where rapidity of adaptation was not essential. So in the processes of digestion we find the nervous system employed only where promptness of response is important. When food is introduced into the mouth, telegraphic messages are despatched by way of the nervous system to the salivary glands and to the stomach, and an immediate response is obtained in the secretion of saliva and gastric juice. But in the later stages of digestion, there being no such occasion for haste, messages are despatched from organ to organ by mail or messenger service, that is to say, by the hormones. Chemically, the hormones appear to be comparatively simple compounds, much simpler than the proteins and enzymes. The actual composition of any of those concerned in digestion has not been determined, but it is known that they are readily soluble in water and in alcohol, that they are not destroyed by heating to the boiling point of water, and that they are readily diffusible. The composition of two hormones employed in other physiological work than that of digestion is known and both of these are simple compounds. The two are carbonic acid,

which is produced in the muscles and stimulates the action of the respiratory organs, and adrenalin, which is secreted in the suprarenal glands and acts upon the sympathetic nervous system.

Adrenalin is a derivative of pyrocatechin, having the formula



In the direction of food preservation there still remains much for the chemist to do. The public is disposed to look with suspicion upon all the newer chemical preservatives, and no doubt a good deal of conservatism in this direction is justifiable. No new chemical should be employed as a preservative until its physiological effects have been thoroughly investigated. On the other hand, indiscriminate condemnation of chemical methods of food preservation is to be deprecated. Certain chemical preservatives, such as salt, saltpetre, and the creosote of smoke have been used for centuries, and are still used daily without question. If experience has proved these efficient and harmless it is not reasonable to suppose that some of the newer preservatives may be equally efficient and equally harmless?

In the preface to their book, "Preservatives in Food" (1906), Drs. Thresh and Porter say: "A careful study of all that has been written on this subject at home and abroad, and of inquiries made of medical practitioners, leads one to the conclusion that the dangers arising from the use of preservatives have been greatly exaggerated. It is impossible to say definitely that a single case of illness has ever been conclusively traced to the preservatives used in any article of food or drink. Preservatives have been used from time immemorial, and it would certainly be strange if with the advance of scientific knowledge better preservatives could not be discovered than those which were originally discovered by uncivilised or semi-civilised man; yet the old preservatives are permitted without question although some of them are more deleterious if not taken in moderate quantities than their modern substitutes. Many articles of food contain small quantities of proximate constituents of a poisonous character, yet no outcry is ever raised for parliamentary interference with their use, whereas if minute traces of far less potent substances are introduced for the purpose of preventing decomposition, with the consequent formation of decidedly poisonous products, prosecutions at once follow."

The active agents in the decomposition of foods are bacteria, yeasts, and moulds. Their activity is due in some instances, and possibly in all, to the enzymes which they secrete. The bacteria, either by virtue of their enzymes, or in some other manner incidental to their life processes, produce chemical changes in the food, resulting in deterioration and often in the production of very poisonous substances—ptomaines and toxins.

Preservatives are substances which either destroy the bacteria or other micro-organisms or inhibit the chemical reactions which these micro-organisms promote. One of the arguments urged against chemical preservatives is that a substance which inhibits the activity of the enzymes of the micro-organisms will *ipso facto* inhibit the activity of the digestive ferments, and so interfere with the digestion of the food. This is not necessarily the case. According to Dr. Frank Billings, of Rush Medical School, the hydrochloric acid of the stomach acts as an antiseptic, protecting the body against micro-organisms entering the stomach. Hydrochloric acid also inhibits the activity of ptyalin, the starch splitting ferment of the saliva; but far from interfering with digestion, it is an essential ingredient of gastric juices, and greatly increases the activity of the gastric ferment, pepsin. Similarly taurocholic acid, according to several investigators, is nearly as powerful an antiseptic as salicylic acid or phenol. But although it inhibits the action of the putrefying bacteria, it evidently exercises no injurious effect on the enzymes of the pancreatic juice, for taurocholic acid is a constituent of the bile, and in normal digestion is always present in the duodenum along with the pancreatic ferments

The actual observations which have been made upon the influence of such substances as borax, boric acid, and salicylic acid on the action of the digestive ferments singly have shown that the same preservative may interfere with or retard the action of one ferment, while it favours and accelerates the action of another.

It is clear then that no general condemnation of chemical preservatives—on the mere ground that they are preservatives—is valid. Each substance must rather be judged separately upon its own record. The majority of the substances used as preservatives have, when taken in sufficient quantities, decided pharmacodynamic effects. In normal health these effects are, as a rule, undesirable, and in many cases positively injurious. In pathological conditions of the body, some of them may be beneficial, others much more injurious than in normal health. It is therefore of importance to the physician to know what preservatives are contained in the foods consumed by his patients, and almost the only point concerning chemical preservatives upon which all authorities appear to be at one is the right of the consumer and of his physician to know exactly what preservatives the food contains. Laws requiring that the label should state the nature and quantity of preservative used may therefore fairly be demanded. How much farther the laws should go is a much more difficult question, and one which cannot be adequately discussed in this paper. Some attention, however, may well be given to the curious argument appearing in the Bulletin describing Dr. Wiley's experiments with salicylic acid, and repeated in his recently published book "Foods and their Adulterations"—an argument which, to his mind, wholly refutes the claim that chemical preservatives may be harmless, if the quantities taken are sufficiently small. In his own words: "The principle which is laid down is that a substance which is injurious to health when added to foods, if not a natural constituent thereof or if not added for condimental purposes, does not lose its power of injury to health because it is diluted or given in small quantities."

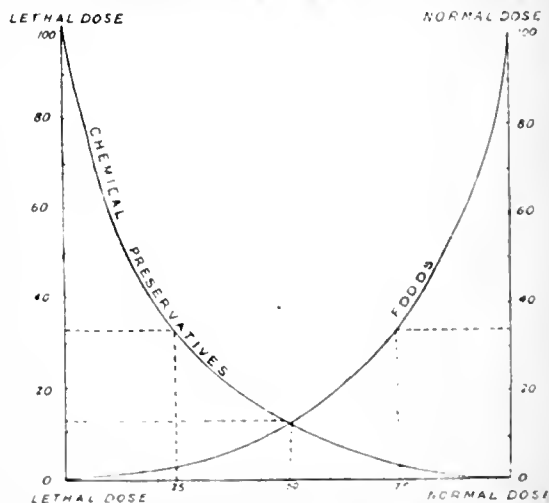


FIG. 1.—"Graphic chart, representing the comparative influences of foods and preservatives."—Wiley.

The argument consists in references to the accompanying diagram (Fig. 1), which shows two curves—one for foods the other for chemical preservatives, each running from the normal dose to the lethal dose. The normal dose of the foods is defined as that quantity of food which maintains a healthy adult body in equilibrium. It is arbitrarily represented on the diagram by 100. The lethal dose of food is stated to be zero. The normal dose of preservatives is assumed as zero, apparently on the ground that they are not natural constituents of foods. The lethal dose is that required to produce death, and is represented on the diagram by 100. The argument is so obscure that I find it necessary to quote the author's words: "If you add a very minute quantity of a chemical preservative, the curve representing it varies so slightly from the

horizontal base as to be impossible of measurement by ordinary means. If we follow along to the number 75, on the horizontal base, we see the deviation of the curve is sufficiently great to measure. At 50 it is still greater, at 25 still greater, while at the left of the basic line it is a maximum, extending from 0 to 100 or the lethal dose. It is easy to show by mathematical data that no matter how small the quantity of an injurious substance or preservative is, it will still produce an injurious effect, which may be infinitely small if the dose be infinitely small. It follows then as a mathematical demonstration, that any quantity of an injurious substance added to a food product must of necessity be injurious, provided it is of the nature of a drug, and the body is in a perfectly normal healthy condition."

The flaws in this so-called "mathematical demonstration" are so numerous and so obvious that one marvels that any scientific man should allow it to go forth under his name. In the first place, it is not clearly stated what the co-ordinates of the diagram are intended to represent. But since the ordinates are stated to represent quantities of preservatives one is obliged to assume that measurements along the axis of abscissæ represent degrees of injury to health—in spite of the author's intimation that injurious effects are to be measured in terms of deviation from the horizontal line. If, then, the form of the curve for preservatives be correct, the diagram would indicate that a very little preservative may produce considerable injury. But absolutely no evidence is offered that the form of the curve is that shown in the diagram. If it should happen to be that of the curve A B in Fig. 2, the

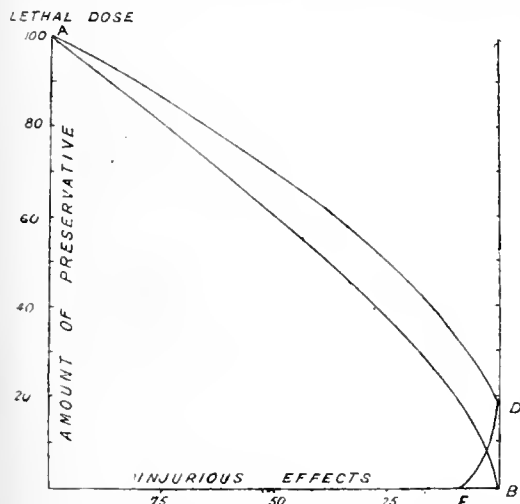


FIG. 2.—Injurious effects of preservatives possible alternatives to Wiley's curve.

addition of a small quantity of preservative would produce only an infinitesimal injury, and the matter would only become important when a certain dose of preservative was taken. In the case of many substances normally present in food the curve would obviously have the form A D E (Fig. 2), according to which the presence of either less or more than a certain quantity of the substance is injurious. It is evident that the curve for foods in Fig. 1 must have this form, since an excess of food is certainly injurious; and it is by no means clear that the same principle may not apply to some of the substances used as preservatives; that is to say, it is not clear that a preservative which in large quantities is injurious to health may not, if present in smaller quantity, be positively beneficial. Dr. Wiley's abolition of all substances naturally present in foods, and also of all substances added for condimental purposes—from the application of his "mathematical demonstration" is rather ludicrous. Why should such a mathematical principle, applying to drugs in general, fail to apply when the drug is one naturally present in the food or when it is characterised by a decided flavour? Moreover, the admission of such

exceptions to his principle would logically lead to the exclusion of the very substance in connection with whose effects the argument is advanced, for salicylic acid has been shown to occur in wines in small quantities, and to be a natural constituent of strawberries, raspberries, blackberries, currants, plums, cherries, apricots, crab-apples, and oranges.

To avoid possible misunderstanding, it may be well to explain that I am not advocating the indiscriminate use of chemical preservatives, but merely protesting against their indiscriminate condemnation. Each one must be judged upon its merits. The use of some may then be absolutely prohibited; that of others permitted for special purposes, and in quantities to be limited by law or governmental regulation, and to be clearly stated on labels.

In regard to the remaining application of chemistry to the food problem—the detection of adulterants, artificial colouring matters, &c., I can do no more than refer to the excellent service rendered the public of Canada by the Laboratory of the Inland Revenue Department—a service contributing not merely to the protection of the consumer but also to the promotion of business honesty.

London Section.

Meeting held at Burlington House on Monday, January 4th, 1909.

DR. J. LEWKOWITSCH IN THE CHAIR.

CINCHONAMINE AND CERTAIN OTHER RARE ALKALOIDS.

BY B. F. HOWARD, F.I.C. AND O. CHICK.

In December, 1905, the first of the present authors and F. Perry read a paper before this Society on "The Salts of the Alkaloid Cinchonamine" (this Journal, 1905, 24, 1281), in which it was pointed out that cinchonamine nitrate is exceedingly insoluble, and it was mentioned that use had been made of this peculiarity for the purpose of determining nitrates gravimetrically.

Since then the present authors have been engaged on further investigations into the nature of this alkaloid and also the alkaloids quinine, euprepine, concusconine, and cinchonine. The first part of the paper is devoted to ascertaining the extent to which qualitative tests for and quantitative estimations of nitrates can be effected by utilising the insolubility of cinchonamine nitrate. The most recently published work on this subject appears to be a paper by Arnaud in the *Annales de Chimie et de Physique*, in 1890. He states that he has used the method with satisfactory results for the estimation of nitrates in vegetable tissues, and he has also utilised it in detecting small quantities of nitric acid in effluents and mineral waters.

PART I.—The use of cinchonamine hydrochloride as a reagent for analytical purposes.

The method was first tested by the estimation of potassium nitrate in a solution of known strength, 3 grms. being made up to 300 c.c. so that 1 c.c. contained 0.01 grm. of potassium nitrate. A roughly standard solution of cinchonamine hydrochloride was prepared, 1 c.c. containing approximately 0.025 grm. of the salt, and the solution was rendered distinctly acid with hydrochloric acid, as the nitrate is least soluble in acidified solutions. It was found extremely difficult to obtain an exact balance in the volume of wash water to be used; if the crystallised cinchonamine nitrate was washed until the washings were quite free from chloride, some of the salt was dissolved and the result obtained was low; on the other hand, there was considerable risk, unless the crystal was very thoroughly washed, of including some chloride and obtaining a high result. The first four experiments failed apparently from this latter cause.

The same potassium nitrate solution, analysed by means of the nitrometer, gave the following percentages:—95, 100, 97.6, 97.6, or an average of 97.55.

In the following four estimations by the cinchonamine nitrate, the washing was continued until the filtrate gave no cloudiness with silver nitrate or nitric acid (showing absence of cinchonamine hydrochloride).

The following percentages were obtained:—98.1, 95.3, 90.3, 99.5, or an average of 97.3.

Arnaud's analysis of potassium nitrate by this method gave an average result of 98.31 per cent. The factor used for the conversion of cinchonamine nitrate into

101
359 or 0.2813.

It will be seen that this last series of results, although somewhat lower than the calculated amount, only differed from the nitrometer results by 0.24 per cent. Quite satisfactory results can be obtained if the following points are observed:—(1) A large excess of the cinchonamine solution is necessary to ensure complete precipitation; as much of the solution should be added as contains 0.6 gm. of cinchonamine hydrochloride for every 0.1 gm. of potassium nitrate to be precipitated. (2) An excess of hydrochloric acid should be added on mixing the solutions. (3) The mixture should be allowed at least twelve hours to crystallise fully. (4) Not more than about 100 c.c. of wash water should be allowed for every gram of the precipitated nitrate to be washed.

Estimation of nitrate in bismuth subnitrate.—The method cannot be applied with any degree of accuracy to this estimation on account of the unavoidable precipitation of bismuth with the cinchonamine nitrate, and the consequent loss of nitrate occurring in washing out this trace of bismuth.

The estimation of nitrate in quinine nitrate.—0.5 gm. of quinine nitrate was dissolved in 25 c.c. of hot water, 50 c.c. of the cinchonamine hydrochloride added, the mixture allowed to cool and crystallise, filtered, washed, dried, and weighed on tared filter papers. The factor used for converting cinchonamine nitrate into quinine nitrate was 405:359. Four experiments gave the following percentages: 101.9, 97.2, 100.6, and 99.0, or an average of 99.7 per cent.

In this case the method was quite satisfactory, and, moreover, by many of the recognised methods considerable difficulties would be experienced.

Mixtures of nitric and acetic acid.—A dilute solution of nitric acid containing 5 grms. of HNO_3 per litre was prepared, and mixed with different quantities of glacial acetic acid, and the cinchonamine hydrochloride solution added to precipitate the nitric acid. In each experiment 85 c.c. of the cinchonamine solution and 5 c.c. of the nitric acid solution was used and the procedure exactly as above. Four experiments gave the following percentages: 98.4, 99.6, 98.4, and 99.7, or an average of 99.03 per cent.

The presence of acetic acid did not appear to affect the solubility of the cinchonamine nitrate in any way, as although the results are somewhat low, this error is no more than one would expect from the previous estimations.

Detection of small quantities of nitric acid in the presence of glacial acetic acid.—Investigations were made with a view to ascertaining the limit of the precipitation of cinchonamine nitrate used as a qualitative test. Nitric acid and glacial acetic acid were mixed in various proportions, and the amount of nitric acid in the mixture gradually diminished until a proportion of one part in 500 of glacial acetic acid was reached. At this point the precipitate of cinchonamine nitrate obtained was only just perceptible, and this was regarded as the limit of the test. A mixture of one part of nitric acid in 1000 of acetic acid gave no indication whatever. This qualitative test was found to be far more delicate with nitric acid alone than when mixed with another acid as above. A strong precipitate was obtained on adding the cinchonamine hydrochloride solution to a nitric acid solution of 1 in 1000, while with a solution of 1 in 100,000 a perceptible crystallisation was obtained and it was found that this was the extreme limit of the test.

Estimation of nitrate in urea nitrate.—0.5 gm. of urea nitrate was dissolved in hot water and 85 c.c. of cinchonamine hydrochloride solution added, and the nitrate

allowed to crystallise and settle. Filtered, washed, dried, and weighed. Four experiments gave the following percentages: 99.5, 100.5, 99.8, 99.5, or an average of 99.82.

The above results appeared to be fairly satisfactory and it was evidently an easy method for performing an estimation which would be a difficult one by many of the recognised processes.

Quinine nitrate and quinine bismur carbamide.—The qualitative test was applied to detect varying quantities of quinine nitrate in quinine bismur carbamide, but owing to the solubility of cinchonamine nitrate in the liquor, for quantitative purposes the test proved useless.

Summary.—This method of estimating nitrates has been found to be very useful in many cases where by other methods considerable difficulty would be experienced. It was found to be quite as accurate but slower than the nitrometer method and distinctly easier of application, and it may be employed for the estimation of all nitrates, except those of the metals which give insoluble chlorides or oxychlorides. Although the cinchonamine hydrochloride is expensive as a reagent, there need be practically no loss, as all the precipitated nitrate can be recovered. It undoubtedly is a method well worthy of the notice of analysts who have to perform long and tedious experiments, to arrive at the estimation of nitrate radicles in the presence of other nitrogenous radicles of a complicated nature, for want of a practicable insoluble nitrate.

There are so many excellent qualitative tests for small quantities of nitrates that the authors would hardly venture to put it forward as a substitute for any of those in use, but here again it might be of use in cases where for any reason any of the well known tests are masked.

PART. II.—*Constitution of cinchonamine and certain other rare alkaloids.*

The only information that could be obtained in the previous investigations on the salts of this alkaloid, with regard to its constitution, was the fact that it is always found to act as a monad radicle in combination with acids, forming one salt only with halogen acids and both the normal and acid salts with sulphuric acid. The empirical formula has been determined by both Arnaud and Hesse, whose results agree very closely, to be $\text{C}_{19}\text{H}_{24}\text{N}_2\text{O}$, that of cinchonine, which has been absolutely established, being $\text{C}_{19}\text{H}_{22}\text{N}_2\text{O}$.

Raoult's freezing-point method was found to be useless for determining the molecular weight of cinchonamine, as well as of certain other alkaloids, as no satisfactory solvent could be found. The platinum-chloride method, however, was found to give very satisfactory results, the molecular weights found being 287 and 297, that calculated for $\text{C}_{19}\text{H}_{24}\text{N}_2\text{O}$ being 296. This formula can be said, therefore, to have been confirmed.

The specific rotation of cinchonamine was determined by dissolving 1 gm. of cinchonamine in alcohol, and diluting to 50 c.c., the rotation being read in a 2 d.cm. tube. The average reading was $+4^\circ 48'$, and the specific rotation, $[\alpha]_D = 120^\circ$, which agrees very closely with the value, $[\alpha]_D = +121^\circ$ given by Léger.

It was next ascertained by Zeisel's method that no methoxyl group was present in cinchonamine. The estimation was carried on as described in Meyer's "Determination of Radicles in Carbon Compounds," pp. 33—38. The potash bulbs in the first experiments were filled with red phosphorus suspended in water, but it was found that the silver iodide precipitate obtained was always dark coloured, and the precipitate on gentle heating smelt of phosphorus; so the bulbs were filled instead, in the after experiments, with a solution consisting of one part of arsenious oxide, one part of potassium carbonate, and twenty parts of water. With the bulbs so filled, the silver iodide precipitate was white, and was much more satisfactory to work with. A blank determination and an examination of quinine sulphate (the latter showing 1.016 methoxy groups per molecule) established the accuracy of the method.

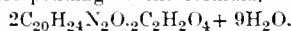
Quinineine.—This alkaloid was prepared by Pasteur's method. 2 oz. of quinine bisulphate were placed in a flask in an oil bath, kept at 130°C ; $\frac{1}{2}$ oz. of water was

added, just to melt down, and then 5 c.c. of 13 per cent. sulphuric acid. The flask was stirred gently, and kept at the above temperature for four hours. The contents were then in a thick gummy state, becoming hardened on cooling. The mass was dissolved in dilute sulphuric acid, and precipitated into ether with caustic soda. The ether was evaporated off, leaving the gummy amorphous alkaloid, quinine. It was ascertained that this contained no unchanged quinine, and it was then crystallised as acid tartrate. This salt was then recrystallised. All efforts to obtain the alkaloid in a crystalline form were unsuccessful, an amorphous resinous mass being obtained in all cases. Although Hesse claims to have prepared several salts of quinine, viz., two sulphates, the hydriodide, and thiocyanate, the present authors were quite unable to obtain any other salts than the bitartrate, oxalate, and the platinochloride. With an impure alkaloid, not freed from the last traces of quinidine, which was obtained previously, several crystalline salts were apparently obtained, but these proved on examination to be merely the usual quinidine salts, and this may possibly be the cause of Hesse obtaining the crystalline salts mentioned above.

The molecular weight, determined from the platinum salt in the usual way, was found to be 328.2 (calculated for $C_{20}H_{24}N_2O_2$, = 324), and the specific rotation in chloroform solution, $[\alpha]_D^{20} = +38^\circ.40'$. This result agrees very well with that obtained by David Howard, $+39^\circ$.

The percentage of tartaric acid in the recrystallised bitartrate was determined (a) as calcium tartrate; (b) by Chapman's bismuth tartrate method (this J., 1907, 645). The percentages of tartaric acid in quinine tartrate found were (a) 26.76 per cent.; (b) 27.44 per cent., 26.90 per cent. The percentage of moisture was 12.4 per cent. Allowing for this moisture, and calculating on the formula $C_{20}H_{24}N_2O_2 \cdot C_4H_6O_6$, the theoretical result would be 27.73 per cent., which agrees fairly closely with the figures obtained experimentally.

Another portion of the tartrate was again passed through ether, and the alkaloid obtained. On neutralising this with oxalic acid, a crystallised quinine oxalate was obtained, corresponding to the formula,



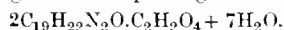
In order to ascertain whether an acid oxalate of quinine existed, a portion of the above oxalate was dissolved and treated with a good excess of oxalic acid. No quinine bioxalate was obtained, even after evaporation and freezing, and there is no evidence that such a salt exists.

The presence of methoxyl groups was investigated by Zeisel's method. As the alkaloid could not be obtained in a crystalline form, the tartrate was used and very concordant results obtained, two estimations giving 0.992 and 0.997 methoxyl groups per molecule. From this it was concluded that quinine contained one methoxyl group, and was represented by the formula,



Cinchonine.—This alkaloid was prepared by a similar method mentioned by Pasteur. Cinchonine sulphate was treated with dilute sulphuric acid in the proportion of one molecule of sulphuric acid to one molecule of the salt. This mixture was treated exactly as described above in the preparation of quinine. The alkaloid was crystallised as acid tartrate, and this on recrystallisation gave figures agreeing closely with those calculated for $C_{19}H_{22}N_2O \cdot C_4H_6O_6 + H_2O$.

A portion of this tartrate was put through ether, the alkaloid obtained, and this treated with enough oxalic acid to neutralise. On analysis the oxalate salt so obtained gave figures corresponding to the formula,



The specific rotation, $[\alpha]_D^{20} = +47^\circ.13'$, was determined on the alkaloid extracted from a portion of the tartrate, and agrees very well with the figure given by David Howard, namely, 48° .

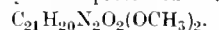
Concusconine.—The alkaloid, concusconine, is mentioned by Léger as having been extracted by Hesse from the bark of the *Remijia Purdieana*. The method he used was to extract the alkaloids from the bark with alcohol, and

to purify the concusconine according to the process mentioned below. The only salt mentioned is the sulphate, having the formula, $(C_{22}H_{26}N_2O_4)H_2SO_4$. The sample experimented with in this research was a small quantity obtained by G. E. Shaw in 1899, from the residues of cinchonamine. His method of obtaining it was on the lines described by M. Hesse. Some crude precipitated cinchonamine nitrate was boiled with acetone. The acetone extract was distilled, and the non-volatile residue shaken into ether with sodium carbonate solution. The alkaloid was washed out with sulphuric acid and then precipitated with sodium carbonate, washed, dried, and dissolved in hot alcohol. The alcoholic extract was treated with sulphuric acid, and a sulphate obtained. (The mother liquor of this was tested with hydrochloric acid for presence of chairamine and with potassium thiocyanate for presence of couchairamine, but no indication of the presence of either of these alkaloids was obtained.) This crude sulphate was purified by a series of recrystallisations from spirit. The amount of this alkaloid on which to work was so very small that no investigation could be made as to the salts which could be prepared in a crystalline state.

The molecular weight, determined by the platinochloride method, was found to be 398.8; that calculated for $C_{23}H_{26}N_2O_4$ is 394.

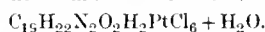
The specific rotation on the dry alkaloid was found to be $[\alpha]_D^{20} +19^\circ.34'$, and on the undried alkaloid, containing 1.4 per cent. of water, $20^\circ.16'$. Léger gives $+40^\circ.8'$, and it was very unfortunate that the authors were unable, for lack of material, to further investigate this difference.

The examination of concusconine for methoxy groups, was performed as described above, with the result that 1.936 methoxyl groups per molecule were found. From this we conclude that this alkaloid contains two methoxyl groups, and may be represented as,

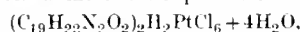


Cupreine.—Cupreine is an alkaloid occurring in the bark of the *Remijia Pedunculata*, which was chiefly remarkable in the past as being the only bark which contained quinine and the other usual alkaloids, but not cinchonidine. For many years it has ceased to be a commercial bark, and is now almost unobtainable, and consequently the supply of cupreine is now very limited.

The platinochloride of cupreine was prepared by dissolving cupreine sulphate in dilute hydrochloric acid, and adding excess of platinum chloride solution. The yellowish amorphous precipitate was then thoroughly washed free from all impurities, with spirit, and allowed to dry. This salt was found to contain 2.50 per cent., or one molecule of moisture, and 26.44 per cent. of platinum. The formula is therefore,



Léger describes a more basic platinochloride

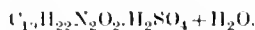


but the above salt was the only one obtained under various conditions.

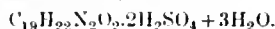
Cupreine sulphate is said to crystallise with six molecules of water. Two samples of the commercial salt were tested for moisture, and found to contain 2.0 per cent. and 1.4 per cent. of water respectively, which does not account for even one molecule of water. These two samples were then recrystallised from water, the crystals being laid out to air-dry for about a day, when they were just hand-dry. The moisture estimations on these two samples came out at 0.8 per cent. and 0.6 per cent. of water. This seems to indicate that there is no water of crystallisation in the basic sulphate. A third lot recrystallised, air-dried, gave only 1.46 per cent. of water after four days' drying. It was found almost impossible to estimate the alkaloid in these salts with any degree of accuracy, owing to the alkaloid being soluble in alkalis, and not very soluble in ether, chloroform, etc. An estimation of the sulphate on the dry salt gave 13.69 per cent. of sulphuric acid, against 13.65 per cent. calculated for $(C_{19}H_{22}N_2O_2)_2H_2SO_4$.

The bisulphate was prepared by dissolving 6.48 grms. of basic sulphate in 15.6 c.c. of normal sulphuric acid,

evaporating to a small volume, and then allowing to crystallise. It crystallises in short thick yellow prisms. The moisture estimated in three different lots of crystals was respectively:—4.02 per cent., 4.08 per cent., and 4.20 per cent. of water. Calculated for one molecule of water, 4.22 per cent. Oudemans states that the neutral sulphate contains two molecules of water, while Hesse only found one molecule. The above results confirm Hesse's statement. 0.9598 gram. of dry salt gave 0.5170 gram. barium sulphate, which corresponds to 23.98 per cent. of sulphuric acid in the dry salt. Calculated, 24.02 per cent. The formula is therefore,



It was tried first to prepare cupreine tetra-sulphate by dissolving 3.21 grms. of neutral sulphate in 23.4 c.c. of normal sulphuric acid, but on evaporating a little, and leaving to crystallise, crystals came out which looked very much like the neutral sulphate, and on analysis, they proved to be so. A second lot was prepared, more concentrated, and with excess of sulphuric acid. This set to a solid mass of silky short needles. These were filtered, washed with a little dilute sulphuric acid, and dried over sulphuric acid in a vacuum. These crystals were rather difficult to dry, but some, given a very little wash with distilled water, dried more readily, but even these felt a little damp to the touch after two days. 1 gram. of salt lost 0.0988 gram. of moisture on drying, which corresponds to three molecules of water of crystallisation (calculated 9.64 per cent. of water). The percentage of sulphuric acid found was 38.63 per cent. The formula is, therefore,

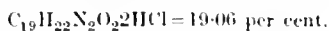


This salt deliquesces on exposure to air.

Cupreine hydrochloride is prepared by dissolving the alkaloid in the calculated amount of hydrochloric acid (10 c.c. normal acid for each 3.1 grms. of alkaloid taken). It crystallised in small needles, coloured slightly brown. The salt contained 5.04 per cent. (1 mol.) of water, and 10.44 per cent. of hydrochloric acid on the dry salt. The formula is, therefore,



Cupreine bi-hydrochloride was prepared by dissolving the alkaloid in normal hydrochloric acid (using 20 c.c. for each 3.1 grms. of alkaloid taken), concentrating down to a small volume, and allowing to crystallise. The crystals obtained were small prisms, coloured slightly yellow. Two lots of crystals contained no water of crystallisation, and 19.09 per cent. of hydrochloric acid. Calculated for



The specific rotation of cupreine in alcohol solution was found to be $[\alpha]_D = 163^\circ 45'$. This is fairly close to the value given by Leger, viz., $-175^\circ 5'$.

The molecular weight of cupreine, ascertained by the platino-chloride method, was 314.4. This determination confirmed the formula, $C_{19}H_{22}N_2O_2$, which requires a molecular weight of 310.

This alkaloid was examined by Zeisel's method for methoxyl groups. Two experiments were performed, and in each case only a minute trace of silver iodide was obtained, so it was concluded that cupreine contains no methoxyl group.

The following table shows the results obtained compared with the four best known cinchona alkaloids:—

DISCUSSION.

The CHAIRMAN said that those who had worked on optically active substances would remember that in early times these alkaloids were the only ones which were used in resolving racemic compounds into their optically active antipodes. Mr. Howard naturally applied the base for the determination of the nitric acid, and he should like to hear how the method compared in accuracy with the employment of "nitron," which gave practically an insoluble salt with nitric acid.

Mr. DAVID HOWARD said the exact relation of the methoxy group to the active constituents of the alkaloids was a very interesting question, and he should have expected to find cupreine running in couples with quinine, which it so curiously resembled, that practically the one ready distinction between them was that the former was soluble in caustic alkali whilst quinine was not. In fact it seemed all but quinine, but not quite. The *remigias* were a puzzle to botanists, because although they had no business to contain quinine they did. The same group also gave cinchonamine and concusconine. Unfortunately the cultivation of bark was now carried to such perfection that it did not pay to bring bark over from South America, so that they did not now get the interesting curiosities they would like to. Quinine will give three sulphates, but it was extraordinarily difficult to get the double acid sulphate. A good many years ago he worked a little on these acid salts because it was the first thing which threw a light on the double ammonium in the quinine molecule. There was a possibility of four salts; but only three could be obtained readily, viz., what the French called the neutral sulphate and we called the bi-sulphate, the basic or normal, and the ordinary sulphate of commerce. If only the two could be obtained it implied a very different composition to where there was the double molecule or the linking molecule which quinine showed, whether in the ethyl compounds or in the salts.

Mr. A. C. CHAPMAN asked how cinchonamine compared with "nitron," both in respect of cost and of efficiency. The price of "nitron" was, he believed, about 10s. an ounce, but probably the cinchonamine would be more expensive. Assuming the cinchonamine nitrate to be as insoluble as the nitrate of "nitron," did the former possess any advantages over the latter? Had the authors, for example, made any experiments to ascertain whether iodides or other substances which interfered with the direct application of the "nitron" method could be disregarded when using cinchonamine? Mr. Howard had not told them in what solvents the rotatory powers of the alkaloids were determined, but, doubtless that information would be found in the paper. It was, of course, of the utmost importance that full information should be given, both on this point and also in regard to the concentration of the solutions worked with.

Mr. C. F. CROSS asked whether it had been ascertained that there was reaction between the ethereal or alcoholic nitrates, and cinchonamine salts, and if so, whether the conditions for the reaction had been arrived at?

Dr. MORGAN asked whether cinchonamine gave a precipitate with nitrous acid as well as with nitric acid?

Mr. GRANT HOOVER asked whether this cinchonamine nitrate was soluble in alcohol? He took it from the remark made that it was important to limit the amount of wash water, that it was soluble in water, and he should

Alkaloid.	Specific rotation. $[\alpha]_D$	Methoxyl group.	Molecular weight found.	Molecular weight calculated.	Formula.
CINCHONINE	+ 226°30'	None	—	294	$C_{19}H_{21}N_2(OH)$
CINCHONIDINE	- 70°	None	—	294	Do.
Cinchonineae	+ 47°13'	None	—	294	$C_{19}H_{22}N_2O$
Cinchonamine	+ 120°	None	292	296	$C_{19}H_{24}N_2O$
Cupreine	- 163°45'	None	314.4	310	$C_{19}H_{22}N_2O_2$
QUININE	- 145°12'	1 group	—	312	$C_{19}H_{20}N_2(OH)(OCH_3)$
QUINIDINE	+ 236°48'	1 group	—	312	Do.
Quinine	+ 38°40'	1 group	328.2	324	$C_{19}H_{21}N_2O(OCH_3)$
Concusconine	+ 20°(?)	2 groups	398.8	394	$C_{21}H_{26}N_2O_2(OCH_3)_2$

like to know whether the possibility of washing in alcohol had been duly considered.

Mr. F. H. CARR asked whether the presence of excessive amounts of inorganic salts influenced the precipitation of these nitrates and also whether Mr. David Howard's remark with regard to the double acid sulphate had ever been substantiated to the extent of publishing a definite analysis of the substance? He was quite aware there was much evidence of its existence, but he had not been able to produce it in a tangible form.

Mr. B. F. HOWARD, in reply, said the solvent used for the specific rotatory power was absolute alcohol. He had not ascertained how the use of cinchonamine nitrate compared practically with the "nitron" method. The present price of cinchonamine hydrochloride was about 30s. an ounce. With regard to the salts which were obtained with a sample of impure quinine, they had not attempted to apply the method to ethereal nitrates. He regretted to say he had not tried it, but there was no reason why it should not work. They had not tried the estimation in the presence of nitrites. The particular cases in which they had used the method were compounds which were difficult to analyse by other methods. Other cases which occurred to them afterwards they would certainly investigate further. The method was found to be applicable with ordinary inorganic nitrates except those which formed oxy-salts or oxychlorides, such as bismuth. In such cases, owing to the precipitation of the metallic salt along with the cinchonamine nitrate, the method could not be satisfactorily applied.

The CHAIRMAN asked why alcohol was chosen as the solvent instead of chloroform?

Mr. DAVID HOWARD said the greater number of published results on the cinchona alkaloids were made with alcohol, and that was probably the reason why the authors of this paper adopted the same method.

Meeting held at Burlington House on Monday, January 4th, 1909.

DR. J. LEWKOWITSCH IN THE CHAIR.

REACTIONS BETWEEN FIBRES AND DYES.

BY W. P. DREAPER, F.I.C., F.C.S., AND A. WILSON, M.Sc.

In a previous communication (this J., 1907, 667), we have pointed out that the equilibrium established between



in a desolution system is displaced as indicated by increasing the temperature of dyeing. We now deal with another variation in dyeing caused by the presence of fibre material.

Dyes of varying constitution have been suitably applied to various fibres and their relative colour reactions noted, more particularly with reagents of an acid nature. Colour changes take place when mineral acids are added to almost all dyes. These experiments for convenience have been chiefly confined to those dyes which react with weak solutions of dyes in this manner, and are known as "indicators."

Methyl Orange on silk.—Samples of silk were dyed with 1 per cent. of this dye in neutral solution, at the boil, washed and dried. The silk was then immersed in sulphuric acid of varying concentration, the ratio of acid to fibre being kept constant and equal to 2:1 in every case. This large excess of acid reduces any secondary action between the fibre and acid in its influence on the strength of solution to a minimum. The following results were obtained:—

Methyl Orange on Silk.

Strength of acid solution.	Colour change.	
	Fibre.	Solution.
N/10	Pink	Deep pink.
N/25	Pink in 20 secs.	Deep pink.
N/50	Orange in 30 secs.	Pink.
N/75	Yellow orange	Pink.
N/100	Do.	Pink.

These observations were made immediately, and at the end of 12 hours, they were the same in both cases. A slight change in colour from the yellow shade (as originally dyed) in the case of the N/50 and N/75 solutions was probably due to the pink colour of the solutions they were saturated with, as when removed from the solution, hydroextracted and compared with a dyed silk sample moistened with distilled water, the shades were identical.

The above solutions, containing the samples, were then raised in temperature to 100° C. Part of the dye was rapidly transferred from the silk to the solution, but no further change in the shade of the remaining dye on the fibre could be detected.

Reversibility of action.—The silk from the N/10 solution was transferred to the N/100 one; the colour immediately changed to the shade of the silk sample immersed directly in that solution. Treatment with distilled water immediately restored the original shade of the dyed silk. Previous treatment at the boil with dilute acid of the silk before dyeing gave similar results. For example, a sample of silk was boiled in N/10 acid for 30 minutes, rinsed and dyed in an acid solution of Methyl Orange (red solution). The shade obtained on dyeing was a bright orange. This indicated that any acid absorbed by the fibre will not influence the shade of the dyed silk, and that even from an acid solution the silk dyes orange.

Methyl Orange on wool.—Samples of wool were dyed, under similar conditions, to the same shade as on the silk ones. The ratio of colour change was found to be practically the same as on silk, but that action took longer to complete, and the dye did not transfer itself to the solution to the same extent. The reversibility of colour change is as complete as with silk, subject to the time factor being extended. Wool transferred from N/10 acid to N/75 changed from pink to orange, but several minutes were required to complete the reaction and establish the normal result. With silk the change is almost instantaneous. Five minutes were required also to regain the normal orange shade as dyed with distilled water. Mere dilution will not give this same effect in the absence of the fibre material with this dye.

Benzopurpurine 4B on silk.—Dyed at the boil with 1 per cent. dye in neutral solution. Ratio of acid to fibre, 4:1.

Strength of sulphuric acid.	At 15° C.	Same at 100° C.
N/25	No change	No change.
N/10	Slightly bluer	Red shade restored.
N/5	Red violet	Do. partly.
N/1	Blue black	Violet.

**Reversibility of action.*—This took longer than with Methyl Orange (on the same fibre), and was complete in two hours. After 12 hours in distilled water the red shade was completely restored. In aqueous solution N/25 acid changed the colour to brown, and silk dyed in this, dyed the same shade, but rather redder. Boiling did not alter the shade of the solution.

Benzopurpurine 4B on cotton.—Dyed a similar shade in neutral solution. The effect of varying the concentration of the sulphuric acid solution was as follows:—

Benzopurpurine 4B on cotton.

Strength of sulphuric acid.	Acid/fibre.	Result on fibre.	Do. after 12 hours.
N/10	4/1	Blue	Black.
N/25	2/1	Red violet, dark	Blue.
N/50	2/1	Red violet	Navy blue.
N/100	1/1	Red violet	Chocolate.
N/500	1/1	Bluer shade	Red violet.
N/1000	1/1	Slightly bluer	Blue red.
N/5000	1/1	No change	Slightly bluer.

These figures indicate that the colour change is more pronounced than in the case of the animal fibres. A

* It is not yet known whether this restoration of colour at 100° C. is generally present with the "direct" dyes on animal fibres.

further trial indicated that with the *N* 5000 solution the colour change after 12 hours immersion was equal to that in the solution itself.

Influence of temperature.—On boiling the above samples, they all became bluer in tone. In this respect the change is in the opposite direction to that noticed with the same dye on animal fibres. This fact clearly establishes differences in the nature of the adsorption in these two cases.

Reversibility of action.—The *N*/10 sample transferred to the *N* 1000 solution slowly changed to red, but even after 48 hours standing a slight difference could be noticed between the *N* 10 and *N* 1000 samples. These figures, therefore, indicate that the relative attraction of the dye and cotton is less, and of a different order to that of dye on silk or wool. That the relative time changes do not merely indicate relative rates of diffusion of the acid in or out of the fibre substance is sufficiently evident from the rapidity of the colour changes in the reverse action on silk, and the direct action in the case of cotton. Immersion of the acid treated cotton samples in distilled water completely restored their original colour.

Benzopurpurine 4B on mercerised cotton.—The following results were obtained. Ratio of acid to fibre = 4 : 1.

Strength of acid.	Colour change.
<i>N</i> /10	Inst. change deep chocolate.
<i>N</i> /1000	Bluish after 1 hour.
<i>N</i> /5000	1 hour no change; 12 hours bluer.

Samples of ordinary cotton immersed at the same time showed similar results; but if anything, the mercerised cotton reacted in a shorter period. These results are interesting in view of the stated increased affinity of mercerised cotton for direct dyes.

Reversibility of action.—As with the cotton samples, but in a shorter time. A similar result with distilled water.

Benzopurpurine 4B on artificial silk (hydrocellulose).—*N*/5000 sulphuric acid. Distinct change after 5 minutes. *N*/10,000 sulphuric acid. Distinctly bluer after 12 hours.

The reverse actions were more rapid than with cotton, as in the case of mercerised cotton. Both these products are in a hydrated state.

Benzopurpurine 4B on wool.—Acid to fibre = 4 : 1.

Sulphuric acid solution.	Shade at 15° C.	Same, heated to 100° C.
<i>N</i> /5	Violet	Claret red.
<i>N</i> /10	Red violet	Red.
<i>N</i> /25	Claret red	Red.
<i>N</i> /50	No change	No change.

Effect of temperature.—Same as with silk. Red colour restored at the boil. Wool from a *N*/10 solution when treated at the boil recovered in shade to that of the *N* 50 one, immersed cold.

Reversibility of action.—This takes place as with silk, but, as in the case of Methyl Orange, the time taken is much longer with wool, in this case about ten times.

Litmus on silk.—Dyed in neutral solution at the boil. Effect of varying concentration of acid (sulphuric).

Silk dyed with litmus.

Strength of sulphuric acid.	Colour change on fibre.	Colour of solution.
<i>N</i> /25	Turns pink instantly	Pink instantly.
<i>N</i> /50	Turns pink in 10 secs.	Do.
<i>N</i> /100	Do. in 15 secs.	Do.
<i>N</i> /1000	Do. in 20 secs.	Do.
<i>N</i> /5000	Do. in 30 secs.	Do.
<i>N</i> /10,000	Do. in 1 minute	Do.

It was impossible to observe any difference between these samples in respect of shade. This was the same as that of the solution.

Influence of organic acids.—Silk, wool, and cotton, dyed

with Benzopurpurine 4B, gave the following results with *N*/10 acetic acid. No change with silk and wool. On cotton the shade was bluer and about equal to that obtained with *N*/50 sulphuric acid. With *N*/1 acetic acid, shade on cotton still bluer, and equal to that obtained with *N*/25 sulphuric acid. Silk and wool very slight change in colour. With Methyl Orange. On silk *N*/10 and *N*/1 acetic acid give no change. The ordinary 60 per cent. acid slowly changed the colour, while *N*/10 acetic produced a deep pink with this dye in aqueous solution. Tartaric acid reacts in a similar way.

Influence of salts on colour change.—The normal action of these bodies in cotton dyeing is specific. They increase the amount of dye adsorbed by the fibre. The following results show that the action of acids is correspondingly and in some unknown manner influenced by the bodies. Cotton samples dyed with the 4B compound were immersed in 100 c.c. of 10 per cent. solution of sodium sulphate (cryst.). Under these circumstances it required 20 c.c. of *N* 1 sulphuric acid to produce a shade equal to that produced by 1 c.c. of the same acid in 100 c.c. water. On wool and silk a similar but less pronounced result was obtained, 13 c.c. and 16 c.c. respectively of *N*/1 acid being required to produce the same shade as produced by 20 c.c. of acid added to 100 c.c. of the salt solution. With Methyl Orange corresponding results were obtained with wool and silk, wool requiring 12 c.c. and silk 15 c.c. respectively under that same conditions, as against 20 c.c. of acid in distilled water. It is remarkable that under these circumstances no further change takes place in the resulting shade on boiling, as in the absence of the salt. Experiments made with hydrochloric acid in the place of sulphuric acid indicate that similar results are obtained, showing that these results are not due to the formation on the acid sodium salt. The results with hydrochloric acid and sodium sulphate are as follows. Cotton, wool, and silk dyed with Benzopurpurine 4B, and silk and wool dyed with Methyl Orange were placed in 100 c.c. of 10 per cent. solution of sodium sulphate, plus 20 c.c. of hydrochloric acid as a standard. Similar samples were placed in 100 c.c. of water and hydrochloric acid run in until the shades were identical in the two cases.

Fibre.	Dye.	Hydrochloric acid required to equal shade in standard salt solution.
Cotton	Benzopurp. 4B.	3 c.c.
Wool	Do.	15 c.c.
Silk	Do.	16 c.c.
Wool	Meth. Orange	13 c.c.
Silk	Do.	15 c.c.

These results indicate that the restraining action of salts is present with different acids, but is not so great in the case of animal fibres. The relative action of salts in dyeing seems to correspond with these figures in its "driving on" power. This action was not noticed in solutions of the dyes. It will be remembered that one of us (Dreaper, this J., 1907, 866) has shown that solutions of such dyes lose more of their dye in the presence of soluble salts when allowed to percolate through a column of sand, than when these salts are absent. As these salts exert no restraining action on the colour changes in aqueous solution, and as the same addition increases the adsorption when mineral substances like sand replace the fibre, the action is one in which the dye must enter into closer sympathy with the fibre mass, in addition to the increased amount of dye adsorbed, as the result of any change in the solution state of the dye.

Other reactions.—The blue colour produced by acting on the 4B dye on wool is immediately changed back to red in a 10 per cent. solution of sodium sulphate. Sodium chloride behaves in a similar way to the sulphate. Sodium bisulphate "blues" cotton dyed with the 4B dye, and the colour is not restored by the further addition of the normal salt to the solution.

Basic dyes.—Similar results are obtained with basic dyes, but in this case concentrated sulphuric acid was added to 25 c.c. of the solution containing the dyed sample to produce the colour change. Wool dyed with Safranine and immersed in a solution of equal dye concentration to

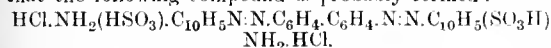
that used in dyeing (0.1 gram. per litre.) gave the following reactions:—

Sulphuric acid (98%) added.	Shade of solution.	Shade of fibre.
1 c.c.	Violet	Red violet.
2 c.c.	Blue violet	Red violet.
3 c.c.	Blue violet	Violet.
6.5 c.c.	Blue	Blue violet.

Further additions of acid increased the colour change, but the solution changed more than the fibre in all cases. At 25 c.c. addition, the dye had practically all left the fibre, so the experiment was stopped at this point, the further change on the fibre from blue to green not being possible under these conditions. It may be that the blue compound has relatively small affinity for the silk, as compared with the original dye, or the dye may be associated with the acid instead of the fibre substance, and under the conditions of the experiment diffuse out of the fibre into the solution. Trials are in progress with acid colours under these conditions and in other directions, including the relative action with inorganic adsorbents.

Conclusions.—These experiments indicate that dyes like Methyl Orange and Benzopurpurine 4B are present on the fibre in a state which can hardly be defined, in terms of these colour reactions, as an indefinite one. The disturbance of the equilibrium established between the latter dye and animal fibres by variation in temperatures is also evidence in the same direction. The reversible nature of these reactions indicated a state of equilibrium as indicated. The reactions are dependent on the concentration of the acid solutions, not the ratio of acid to dye or fibre, in the case of animal fibres. With cellulose their actions follow fairly closely those of solutions. The action of salts seems to be altogether abnormal in the presence of fibre substance and dyes. This and the fact that a time factor has to be introduced in the reverse action with cotton indicates that there is some affinity between the cellulose and the dye, but that in terms of the colour changes it is of a different order to that with the animal ones. The case of litmus is, again, of a different order. The reactions between organic acids and dyes on fibres is interesting and will be followed up. It is not known whether their action is in the ratio of their activities.

In an attempt to prepare the colour acid of Methyl Orange for these experiments by decomposing the colour salt with acid, it was found that on thorough washing, the free colour acid is *orange*, and not *pink* in colour, and that the pink colour only develops in excess of acid. It is already known that unstable hydrogen chloride compounds are formed with Congo Red, which in the same way are decomposed by washing with water, and that the following compound is probably formed:—



(Schimankky. Mitt. Technol. Gewerbe-Mus., Wien. 1900, 39—40.)

Linder (this J., 1908, 485) has also suggested that association compounds are formed between acids and Metanil Yellow. The fact now established that these compounds are decomposed on dyeing, as indicated by the colour changes recorded, and that only in strong acid solutions is an equilibrium established between the dye + fibre \rightleftharpoons dye + acid, aq., is a further proof of the close relationship existing between dye and fibre. Assuming the compound with Methyl Orange, $\text{NaSO}_3.\text{C}_6\text{H}_4.\text{N}:\text{N}.\text{C}_6\text{H}_4.\text{N}(\text{CH}_3)_2$, fibre, the combination between dye and fibre is probably brought about through the $\text{N}(\text{CH}_3)_2$ group and not by the SO_3Na one, if the acid when in excess is associated with the former group. It is possible to argue that the silk (or wool) substance is associated with the dye through this group, and not through the sulphonic acid one, for silk dyes out a violet Methyl Orange solution *orange*; and the resistance of the dye on the fibre to the action of acids indicates that the group responsible for the colour change is already associated with the fibre substance. It is not even necessary to assume from these experiments that in all cases the SO_3Na group is decomposed.

Also the equilibrium established between dye + fibre \rightleftharpoons dye + acid aq., may be displaced in either direction by increased temperature according to the fibre present, as shown.

Influence of temperature on action of acids. (Benzopurpurine 4B.) Shade red.

Fibre.	Strength acid.	At 15° C.	Same heated to 100° C.
Silk ...	N/10	Charet red	Red.
Wool ...	N/25	Charet red	Red.
Cotton ...	N/25	Red violet (dark)	Blue.

In the obscure reaction of assistants in dyeing, and more particularly in the case of acids, and assuming the presence of the above associated compounds, there is evidence that these compounds are adsorbed more easily than the dye itself, even if they are decomposed in the process. The need of an excess of acid in dyeing over that necessary to set free the colour acid may be indicated in this way.

To sum up, the evidence brought forward in a series of papers dealing with dyeing reactions, apart from the work of other investigators, is as follows. The abnormal reactions of ingrain colours, and the refusal of some developers to react in the presence of animal fibres (Dreaper, this J., 1894, 96), the variation in desolution effects due to dyeing conditions (Dreaper and Wilson, this J., 1906, 375); the abnormal reaction between picric acid and fibres under a vacuum (Dreaper and Stokes, J. Soc. Dyers and Col., 1909, 10), when taken in conjunction with the present results, confirm the extreme complexity of the reactions involved in dyeing, and to a certain extent indicate their nature.

Surface concentration, as predicted by one of us (Dreaper, this J., 1905, 223), does take place from dye solutions, complete extractions taking place from these when they slowly percolate through a column of sand (Dreaper, this J., 1907, 866). There is no reason why a similar concentration should not take place in the fibre area. It is equally clear, however, that in some cases the above results do not agree with the view, that the dye is present in a mere state of colloid slime, held mechanically in the fibre area. If these reactions are the normal ones of reacting colloids in pseudo-solutions they throw further light on the behaviour of these little understood compounds.

The above reactions with Methyl Orange are also of interest from the point of the use of these dyes as indicators. The fact that the silk or wool samples turned pink do not change back to orange on drying is also interesting.

DISCUSSION.

Mr. J. W. LOYBOND asked if the authors noticed any difference in the change of character in the solution, not corresponding, but having a relation to the changes of the fibre in No. 1 diagram, and in No. 2 diagram. In the action of Benzopurpurine 4B on silk he noticed in the third line there was a change from one colour division of the spectrum to the other, namely, that the colour was transferred from the blue side of the violet to the red and then back again to the blue accompanied apparently by a considerable loss of colour. This was so unusual that it suggested the possibility of a change in character quite different from the first change. Then in the other diagram, had it been noticed whether there was any change in colour depth in the fibre or in the solution having relation to the difference of time?

Mr. C. F. CROSS asked whether it was a fair interpretation of results to take them as consistent with the view that the dyeing result was analogous to a double salt formation, modified by interactions of the active groups of dyestuff and fibre substances?

Dr. G. T. MORGAN said that the experiments showed that it was unsafe to assume that either a mechanical, physical, or chemical theory alone was sufficient for all the facts of experience. They had, in the speaker's opinion, demonstrated not merely that the animal fibres could fix successively acid and dye,

but could hold these reagents apart in the molecules of the final complex compounds formed within the material. Even in the case of cellulose, the most inert of the three fibres examined, there was evidence of chemical combination. The acetylcellulose exhibited at the last meeting of the Society by Mr. Cross might be mentioned in this connection, for this material, although retaining the physical structure of the original cotton, nevertheless had but little affinity for the substantive colours which dye ordinary cotton directly. A chemical alteration of the substance, namely, the replacement of hydroxyl by acetoxy, leads, in this instance, to a marked difference in the behaviour of the fibre towards the dye.

Mr. J. F. BRIGGS agreed with Dr. Morgan that in investigating a dyestuff account ought to be taken not only of its constitution, but of that of the substance dyed, and the effect that any particular liquid might have. Some of the cellulose esters would dye in alcoholic solutions, but would not take the dye from an aqueous solution, and that showed that the liquid played a chemical part just as much as the fibre or the dye itself. These tables seemed to show that the fibres acted as a sort of insoluble alkali or base, and in connection with that, Ditz had recently pointed out that an insoluble acid produced no change in an aqueous solution of Methyl Orange, but that on adding sodium chloride to the Methyl Orange, the presence of the salt developed the acid reaction of the insoluble acid. He suggested that Mr. Dreaper's observations on the effect of sodium sulphate seemed to indicate that the salt made the insoluble alkalinity of the fibres more pronounced, *i.e.*, it required more acid to produce the colour changes with sodium sulphate than without it, and this might be described as a similar but converse action to that observed by Ditz with insoluble acids.

Mr. CLAYTON BEADLE said one point brought out in this paper was that dyestuffs established a sort of equilibrium between the solution and the substance to be dyed. In regard to cellulose, it appeared to him that taking an aqueous solution, the cellulose altered its affinity towards dyestuffs depending on the amount of water or the hydration the cellulose underwent. Mercerised cellulose took up a considerable amount of water. If this was dried after removal of the alkali it became dehydrated and on placing the mercerised cellulose again in water it did not take up so much as before drying. He had noticed that the affinity towards dyestuffs was greater in proportion to the amount of hydration of the cellulose, and there are many instances showing that the activity of cellulose towards dyestuffs was largely determined by the amount of its hydration.

Dr. H. P. SEYENS asked if Mr. Dreaper had examined the salts of any of these solutions by the spectrum. He believed an examination of the absorption spectrum would throw a great deal of light upon the coloured changes, especially when the colour ran from one end of the spectrum to the other.

Dr. E. FEILMANN said one rather interesting fact was brought out in this paper to which perhaps not sufficient attention had been directed hitherto, owing partly to technical considerations; namely, that dyeing was essentially a time phenomenon. They probably all had their own views on these matters, and those who were rather inclined to emphasise the colloidal nature of the phenomenon knew that in all colloidal changes the question of time, and in fact the whole previous history of the reacting substance, was one of very great importance. One aspect of the paper struck him as interesting, *viz.*, whether the colour changes might not be partly due to an alteration in the size of the particles of the dyestuff both in the fibre and in the dye-bath. If to an ordinary pseudo-solution of an inorganic substance very small amounts of acid were added with a certain amount of the electrolyte coagulation was not necessarily complete, but the small discrete particles became larger, and by suitably reducing the concentration of the electrolyte, in a good many cases the particles became smaller again; they seemed to disintegrate. In such cases, with a comparatively coarse pseudo-solution such as could be obtained with finely divided metals, a distinct change was noticeable in the apparent shade of the solution. It was possible that some

such changes might go on and alter the colour of the fibre and the solution to an appreciable extent.

Mr. DREAPER said it was impossible to deal fully with the many questions which had been raised. In the colour changes dealt with in these experiments, they had been unable to deal fully with the question as to their nature. This would be his reply to the question with regard to the absorption spectrum. He could hardly answer Mr. Cross's question in a few sentences, but he thought there might be some double salt union, as suggested. The relative colour changes which took place on fibre and in the solution in these experiments might be taken to support such a view. He agreed with Dr. Morgan in thinking that there must be a blending of all three ways of explaining the nature of dyeing. The case of acetylcellulose resisting the dyeing action, he believed the action was due to its water-resisting properties. Mr. Briggs' remarks about alcoholic solutions were certainly interesting and some very curious results had been obtained generally by dyeing in different solutions besides water. As to the time phenomenon the retarding action was more pronounced in the case of wool than in silk, and was hardly present at all in cotton, but as to exactly what these results meant in terms of colloidal activity, he would hardly like to speculate on the evidence before them.

Meeting held at Burlington House, on Monday, January 4th, 1909.

DR. J. LEWKOWITSCH IN THE CHAIR.

A PHYSICO-CHEMICAL METHOD FOR COMPARING THE ANTISEPTIC VALUE OF DISINFECTANTS.

BY S. B. SCHRYVER, D.S.C., PH.D., AND R. LESSING, PH.D.

Various methods have been proposed for determining the antiseptic value of the numerous products, proprietary and others, which have in recent years been employed for the purposes of disinfection. The best known, perhaps, are the "thread method" of Koch, the "garnet method" of Krönig and Paul, and the method which has been extensively employed in this country, of Rideal and Walker. A general account of these has been recently given in a valuable work by Miss Harriet Chick, (1) who has investigated in some detail the laws of disinfection.

In the Rideal-Walker method, definite small amounts of broth-culture of the same species and age are added to a constant volume of a disinfectant solution. A series of trials are made with varying concentrations of the disinfectant to be tested, and of pure phenol under similar conditions, and the relative concentrations necessary to complete germicidal action within equal periods of time are thereby determined. The ratio of the reciprocals of these concentrations was termed by Rideal and Walker the "carbolic acid co-efficient," and was regarded by them as the standard of disinfecting power. Various objections have been made to this method, chiefly on the ground that the actual test for disinfection is carried out in the absence of organic matter other than that present in the disinfectant and the minute amount introduced by the bacterial culture, and the conditions of the trial are not, therefore, entirely analogous to those under which antiseptics are ordinarily employed. Somerville and Walker have endeavoured to remedy this defect by carrying out the disinfecting test in the presence of known quantities of added organic matter, such as protein and starch, and have in some cases obtained widely different numbers for the carbolic acid coefficient.

The addition of organic matter can act in different ways with different disinfectants. In some cases, as, for example, in that of permanganate, the disinfectant can be directly destroyed by acting as an oxidiser to the organic matter; in other cases, again, the disinfectant can be dissolved by the organic matter and thus removed from solution and its sphere of activity, an action which is conceivable when disinfection is carried out in the presence of fats by substances soluble in organic solvents. A still more complicated case is that where adsorption of the disinfectant by the organic matter takes place, a process which probably accounts for the behaviour of certain antiseptics recently investigated by Ehrlich

and Bechhold (2). In all such cases the addition of organic matter would considerably lower the carboic acid coefficient. Nor need such a lowering of the coefficient always indicate a diminished practical value. It is not impossible, for example, that the disinfectant might be adsorbed by solid matter: if the latter were the material required to be disinfected, it would, after the separation from the surrounding liquid matter, contain a higher percentage of the disinfectant than the latter, in which case a lowering of the carboic acid coefficient by the addition of organic matter should denote an increased practical efficiency.

One more action of organic matter deserves consideration. Many of the more recently introduced disinfectants are emulsions, and it is generally admitted that their efficiency depends to a great extent on the degree of emulsification, for the addition of organic matter might either accelerate or inhibit the rate of de-emulsification and thus, by a purely physical method, either decrease or increase the practical value.

Enough has been said to indicate the great complexity of the problem due to the introduction of organic matter, and as the mere germicidal value as indicated by the various methods already mentioned is regarded as an insufficient test of the practical efficiency of an antiseptic, the authors have ventured to suggest that a new method, described in the following pages, may throw some further light on this vexed question.

Principle of the method.—The rate of chemical change produced in a substrate by bacterial infection may be regarded as a measure of the vigour of the growth. By introducing substances inimical to the bacteria, the rate of growth may be inhibited or even entirely impeded. The principle of the method herein described depends essentially upon the measurement of inhibition produced when varying quantities of an antiseptic are added to an infected medium, and comparing these quantities with the amounts of phenol or any other standard disinfectant which will produce the same result.

Of the chemical changes produced by bacteria, those of protein degradation or conversion of dextrose into lactic acid both lend themselves to chemical measurement. A measurement of the rate of putrefactive change in a gelatin-peptone substrate has been already carried out by one of the authors of this paper (Schryver, Report No. 1, Inspector of Foods' Department, Local Government Board). In this case a meat essence was infected with putrefying liver, and the nitrogen determined in the filtrate from the precipitate produced by adding a given volume of tannic acid mixture to a given volume of the medium removed from the main bulk after different intervals of incubation. This purely chemical method involves a relatively large amount of labour and is impracticable, when it is necessary to measure the rate of change which takes place in different concentrations of an antiseptic, owing to the large number of analyses involved. Fortunately, the chemical change in the case of protein degradation at any rate, closely responds to certain changes in the physical properties which can be readily and accurately measured, and in the following investigations the electrolytic conductivity has been taken as the index of chemical change. This physical property has already been employed for studying protein changes, notably by Sjöqvist,⁽³⁾ Oker-Blom,⁽⁴⁾ and Bayliss,⁽⁵⁾ the last-named of whom studied by this method the chemical dynamics of tryptic digestion.

The medium used in the following experiments has been either gelatin-peptone or sodium caseinogen-peptone mixture containing about 5 per cent. of gelatin or sodium caseinogenate (*i.e.*, caseinogen dissolved in the requisite amount of sodium hydroxide) and 1 per cent. Witte's peptone. In all cases a mixed infection by faeces has been employed. Such an infection was found to produce a much more rapid change in the substrate than is produced by the inoculation with a pure strain, probably owing to the fact that the action of the different species is specific, some degrading the protein to albumoses or proteoses, others acting only on these latter bodies, and others again only on amino-acids, as shown by Nawiasky⁽⁶⁾. A similar method of infection has also been employed by M. Wynter Blyth⁽⁷⁾.

Apparatus.—The ordinary method as described in text-books was employed. The only part of the apparatus which requires any special mention is that of the electrodes of which a sketch is appended (Fig. 1). They consist

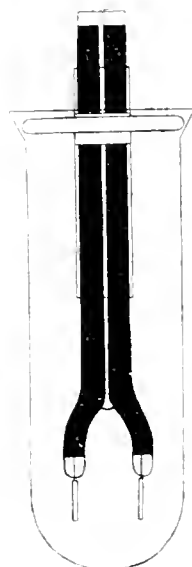


FIG. 1.

of platinum plates coated with platinum black, made of fairly stiff pieces of metal 10 mm. square and placed 20 mm. apart. These were fused into glass tubes of the shape indicated which were filled with mercury into which the wires connecting the electrodes with the remainder of the apparatus could be placed. The tubes were fitted by means of india-rubber into a glass collar which, resting on the rim of the test tube containing the liquid the conductivity of which was to be measured, enabled the electrodes to be adjusted in a convenient position. One pair of electrodes constructed in this manner could be used for an unlimited number of determinations, as they could be readily moved from one test tube to another. The test tubes employed measured 30 by 95 mm., and were placed for the purpose of the determinations in a constant temperature bath heated to 37° C. Throughout this research all the readings were taken at this temperature. An expensive resistance box is not required; when electrodes of the character and size described are employed and the solutions infected contain 5 per cent. gelatin or caseinogenate and 1 per cent. peptone a single coil of approximately 100 ohms will serve quite well as a counterbalancing resistance. This was used in all the experiments described, the initial resistance of the liquids varying generally only between 100 and 200 ohms.

The relationship between electrolytic conductivity and protein degradation.—This relationship has already been determined by Bayliss in his investigations on the action of trypsin on caseinogen, where he found that the curves representing the conductivity of the caseinogen solution in different stages of digestion and the nitrogen in the filtrate from the tannic acid precipitation were very similar in form. The following experiment gives a typical example of a putrefactive change, in which both the conductivity of the solution and the nitrogen in the tannic acid filtrate were determined.

A sterile solution containing 5 grms. of gelatin and 1 gm. of peptone in 100 c.c. of liquid was infected with faeces, and incubated at 37° C. It was thoroughly shaken up during the earlier period of incubation to ensure uniform infection throughout the fluid. At the commencement of incubation and at successive periods of 24 hours 10 c.c. of the mixture were pipetted out and weighed and then diluted to 100 c.c. the weighing bottle was

washed out with 10 c.c. of water and 40 c.c. of tannic acid mixture was then added.*

The whole was then made up to 200 c.c. and filtered, and the nitrogen determined in 150 c.c. of the filtrate. The results are indicated in Table I., and Fig. 11.

TABLE I.

Time of incubation.	Mg. nitrogen in filtrate.	Resistance in Ohms.	Conductivity in Gemmos.
Beginning	11.3	156.6	6.39
1 day	13.0	125.7	7.96
2 days	10.3	55.0	18.18
3 days	43.9	39.0	25.64
4 days	56.0	30.0	33.33
6 days	89.3	18.3	56.64

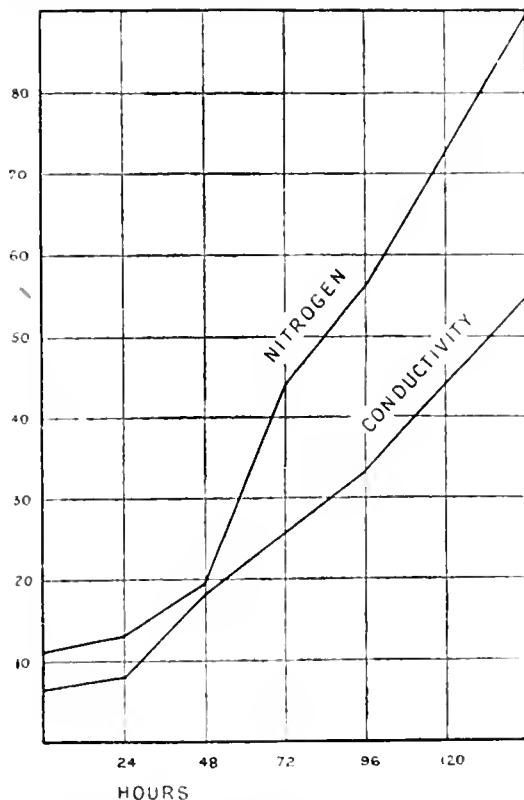


FIG. 2.

The effect of the antiseptic on the rate of change.—The following experiment was carried out to determine the influence of varying quantities of antiseptic on the form of the conductivity curve. A solution of 5 per cent. gelatin and 1 per cent. peptone was infected in bulk with faeces and warmed for a short time at 37° C. with repeated shaking to ensure uniform infection. Portions of 90 c.c. of the infected liquid were placed in six sterile flasks to which were added respectively 10, 5, 2, 1, and 0.5 c.c. of a 5 per cent. phenol solution which had been standardised by the Messinger-Vortmann method; to the sixth flask no disinfectant at all was added. In all cases the total bulk of the fluid was made up to 100 c.c. with sterilised water. All the portions were incubated at 37° C. and quantities of about 15 c.c. were taken out at intervals and their conductivity determined. They were placed in series in the test tubes already described in the constant temperature bath, the sample from the portion containing no disinfectant being at one end of the series and that containing the most disinfectant being at the other. Sufficient time must be allowed for the electrodes to

* Tannic acid 100 grms., sodium acetate 25 grms., sodium chloride 75 grms., glacial acetic acid 50 grms., water 1000 grms.

attain the full temperature of the surrounding liquid, 10 to 15 minutes is generally required in the case of the first tube. They do not cool much when moved to the following tubes. Some of the slight discrepancies in the tables are due to the fact that sufficient time was not allowed for the electrodes to reach the requisite temperature.

The results of these experiments are recorded in Table II.

TABLE II.

Per cent. phenol.	Beginning.	28.5 hrs.	44 hrs.	53 hrs.	69 hrs.	77 hrs.	93 hrs.
0.00 ...	220	150.0	54.2	37.9	30.0	28.5	26.0
0.025 ...	220	170.3	103.7	52.0	33.0	—	33.0
0.05 ...	220	184.9	180.1	91.2	62.3	61.0	40.0
0.10 ...	220	220	218.0	198.5	210.0	220	—
0.25 ...	220	—	—	No change	—	—	—
0.50 ...	220	—	—	No change	—	—	—

Influence of varying concentration of phenols on gelatin-peptone mixture. Numbers indicate resistance in Ohms.

From this table it will be seen that no putrefaction takes place within four days, where the concentration of the phenol reaches 0.1 per cent. A concentration of 0.05 per cent. is however insufficient to altogether stop putrefaction within this period, although it considerably impedes it. The results are graphically plotted in Fig. 3.

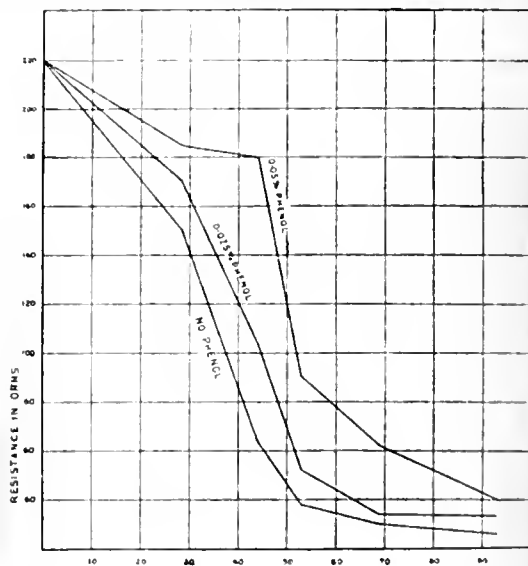


FIG. 3.

The actual bridge readings are appended in this table (Table III.) to denote the magnitude of the measured change.

TABLE III.

Per cent. phenol.	Beginning.	28.5 hrs.	44 hrs.	53 hrs.	69 hrs.	77 hrs.	93 hrs.
0.00 ...	68.3	60.0	39.1	27.5	23.0	22.2	20.6
0.025 ...	68.3	63.0	50.9	34.2	28.3	27.3	24.8
0.05 ...	68.3	64.9	64.3	47.7	38.4	38.1	25.5
0.10 ...	68.3	67.9	67.5	67.5	66.2	67.9	67.0

Bridge-readings corresponding to resistances in Table II.

The influence of the activity of the infecting growth on the rate of change.—In the above experiments the substrate was directly infected with fresh faeces. In the following, 100 c.c. of the gelatin-peptone mixture was infected with fresh faeces. The conductivity of the solution was determined at definite intervals in different stages of the change, at which 1 c.c. of the mixture was removed by

a sterile pipette and used to inoculate fresh quantities, each of 100 c.c., of a similar gelatin-peptone solution. The rate of change was then determined in each of these sub-cultures. Furthermore, when the determinations indicated a rapid change in the conductivity of the originally infected liquid (*i.e.*, after 40 hours' incubation) fresh portions, each of 100 c.c., were reinfected from it with respectively 1, 3, and 5 c.c. of liquid, in order to determine the influence of the volume of the infecting fluid upon the rate of change.

TABLE IV.

A. Original infection.			
1.	Subinfection with	1 c.c. of A.	before incubation.
2.	"	"	" after 16 hours' incubation.
3.	"	1 c.c.	" 24 "
4.	"	1 c.c.	" 40 "
5.	"	3 c.c.	" 40 "
6.	"	5 c.c.	" 40 "
7.	"	1 c.c.	" 64 "
8.	"	1 c.c.	" 88 "

No. of infection.	24 Feb. 6 p.m.	25 Feb. 10 a.m.	25 Feb. 6 p.m.	26 Feb. 10 a.m.	26 Feb. 6 p.m.	27 Feb. 10 a.m.	27 Feb. 5.30 p.m.	28 Feb. 10 a.m.	26 Feb. 6 p.m.	29 Feb. 10 a.m.	2 Mar. 10 a.m.
A.....	155.4	139.2	118.8	61.5	49.5	42.8	39.1	31.6	32.4	25.8	19.2
1.....	155.4	154.5	147.5	43.8	28.3	25.1	23.1	21.2	29.1	18.5	19.0
2.....		150.0	150.0	138.1	130.9	116.4	107.0	102.6	89.7	79.2	61.8
3.....			150.0	140.9	130.9	109.2	98.4	85.9	80.2	66.9	46.8
4.....				159.7	151.9	59.5	39.8	35.3	29.5	26.6	19.7
5.....				148.7	138.6	56.2	41.2	37.0	33.3	29.9	22.8
6.....				140.9	125.7	44.1	40.8	37.0	32.4	29.3	21.8
7.....						152.2	143.9	73.9	45.3	35.3	21.2
8.....								153.2	135.2	58.7	21.5

Influence of age of culture on rate of change, when making sub-cultures. Resistances in Ohms.

From the above table it will be noticed that if the sub-infections be made from the original infected liquid after a short time of incubation, and during the period in which only slow changes are taking place, the sub-infected liquid will only change with comparative slowness, more slowly, in fact, than the original infection. If on the other hand, the sub-infection be made from the original during a period of rapid change, the sub-infected liquid will also undergo a very rapid change. Moreover, a period of maximum rate of change appears to be reached, for sub-infections made during the period of very rapid change, showed that the rate of degradation in the sub-infected liquid was practically independent

of the amount of substance used for the purpose of inoculation. Thus, in experiments 4, 5, and 6, 1, 3, and 5 c.c. respectively of the originally infected liquid were used for the purposes of the sub-culture. In all cases the change of conductivity of the sub-infected liquid took place at practically the same rate. A somewhat similar result has been obtained by Adrian Brown by a purely biological method, in investigating the rate of growth of yeast cells. He has shown here that a maximum rate of growth can be attained which cannot be surpassed by using larger numbers of cells for inoculation of the medium. A few of the above results are plotted on the accompanying curve. (Fig. 4.)

An experiment was also made to determine whether the results are due to bacterial growth with the consequent production of endogenous enzymes or to exogenous excreted enzymes, which latter could act even after the death of the bacteria. For this purpose, some of the original growth was incubated for about 40 hours. It

was then filtered into a sterile flask through a sterilised Berkefeld filter. The conductivity of the filtrate was then determined, and it was then incubated for several days. It showed no change of conductivity during this period, the resistance remaining constant the whole time. Neither did a Mett gelatin tube, when placed in the liquid, undergo any change. These experiments indicate the absence of any exogenous proteolytic enzyme in the liquid. Several experiments similar to the above, both with gelatin and caseinogen media have been carried out, which yielded substantially the same results. These indicate that by means of the method interesting data as to the life history of bacteria might be obtained. It is also suggested that a subinfection made at the period when the maximum rate of change is produced might

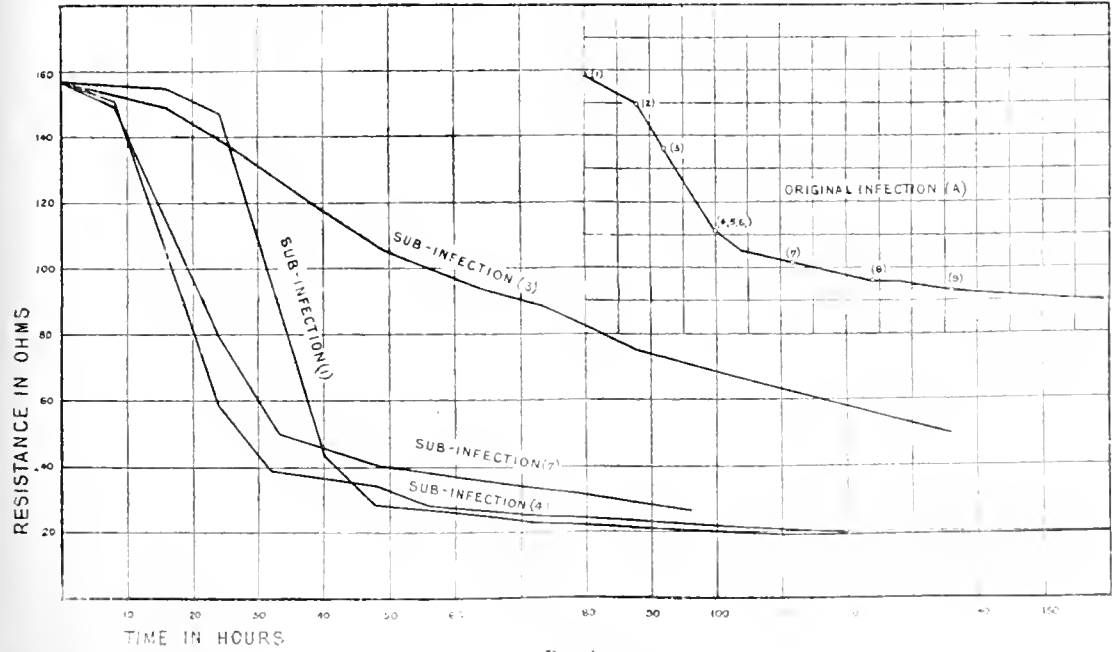


FIG. 4.

be conveniently employed for testing the efficiency of antiseptics.

Comparison of disinfectants.—In the following experiments, six different disinfectants were employed, viz., mercuric chloride, formaldehyde, and phenol, and three proprietary disinfectants A, B, and C. Altogether four series of experiments were carried out with these disinfectants, two with the gelatin-peptone mixture and two with sodium caseinogen-peptone mixture. In Series I, small quantities of the media were emulsified

mercuric chloride practically no change had taken place in the conductivity, even in the most dilute solution of disinfectant. Phenol was the weakest, disinfectant A, was appreciably more effective, whereas B, and C, were more effective than A, C being the most efficient of all. In the accompanying curve, the relative amounts of disinfectant are plotted as abscissae and the differences between the initial and final resistances as ordinates. The relative efficiencies are thereby indicated at a glance. The actual results are recorded in Table V.

TABLE V.

SERIES I.	Gelatin					Caseinogen				
	Without antiseptics. Initial resistance, 177. Final resistance, 34.6.					Without antiseptics. Initial Resistance, 150.6. Final resistance, 37.5.				
	5 %	2.5 %	1 %	0.5 %	0.25 %	5 %	2.5 %	1 %	0.5 %	0.25 %
Mercuric chloride	129.3 145.7	132.5 141.5	112.7 141.5	163.2 145.1	159.7	82.8 102.0	88.7 111.4	103.6 132.0	112.7	112.7
Formaldehyde ..	186.5 184.1	171.0	161.8	155.8	159.7	225.7 217.5	166.7 172.5	132.5 153.2	115.5	20.9(?)
Phenol.....	166.7 170.3	81.8	50.8	40.2	20.5	110.5 142.1	117.4	59.0	49.7	31.7
A.....	156.4 161.8	156.4	73.9	41.4	33.7	108.3 132.5	115.0	74.5	73.3	43.4
B.....	155.8 176.2	161.1	131.5	99.2	100.0	117.4 144.5	112.7	83.1	34.2	31.0
C.....	159.7 169.4	158.4	156.1	109.6	98.8	117.4 138.6	115.0	104.1	75.4	32.8
SERIES II.										
Mercuric chloride	126.7	123.7	132.0	147.5	151.0	87.6	106.2	116.0	132.5	123.2
Formaldehyde ..	166.7	151.3	148.1	143.9	143.9	202.1	159.7	138.1	134.2	143.9
Phenol.....	147.5	66.7	19.5	19.5	19.5	123.7	47.0	26.4	20.2	20.2
A.....	132.0	139.2	31.0	22.4	20.7	131.5	101.2	26.6	21.2	19.2
B.....	145.7	137.0	109.6	79.5	43.9	128.8	124.7	32.8	20.5	22.1
C.....	145.7	138.1	118.8	71.5	70.9	128.3	130.0	71.5	32.1	21.6

with a small amount of human faeces, and the emulsion filtered through a platinum sieve to separate the coarser particles. The filtrate was added to a large quantity of the medium with which the emulsion was made. The whole was then incubated for a short time with constant shaking, so as to obtain a homogeneous mixture, and quantities of 20 c.c. were pipetted out into sterile vessels. The pipette used for this purpose was connected through rubber tubing by means of a two-way tap, with a vacuum pump or with the outer air, in both cases through a sterile plug of cotton wool. In each series five mixtures were made with five different quantities of the antiseptics, viz., with 5, 2, 1, 0.5 and 0.25 c.c. of a 2.5 per cent. solution of each disinfectant and 20 c.c. of infected medium. In every case the total bulk of the liquid was made up to 25 c.c. with sterile water. The degree of putrefaction was consequently determined in mixtures containing 0.5, 0.2, 0.1, 0.05 and 0.025 per cent. of each disinfectant.

In Series II, the experiments were exactly similar to those in Series I, with the exception that, instead of infecting the medium directly with faeces, it was inoculated with some of the same medium which had already undergone considerable putrefaction. Thus, the gelatin-peptone mixture (6 per cent. gelatin, 1.5 per cent. peptone) with original resistance 151.9 ohms, was infected with faeces and allowed to putrefy for 48 hours. Its resistance had then sunk to 34.6 Ohms. A caseinogen-peptone mixture (6.0 per cent. caseinogen, 1.5 per cent. peptone) with original resistance 130.0 ohms was allowed to putrefy for the same time also after faecal contamination. Its resistance was also lowered to 34.6 ohms. Small quantities of the former putrefying mixture were added to a large quantity of gelatin-peptone solution (6.0 per cent. gelatin, 1.5 per cent. peptone) and small quantities of the latter were added to large quantities of the caseinogen-peptone solution (6.0 per cent. caseinogen, 1.5 per cent. peptone). In Series I, the tests for disinfecting value were carried out in slowly putrefying medium and in Series II, in a rapidly putrefying medium. After five days' incubation the resistance in each experiment was determined. In all four sets, substantially the same results were obtained. In the case of formaldehyde and

Comparison of influence of different antiseptics on amount of putrefactive change after 5 days' incubation of mixtures. Resistances in Ohms. Italicised figures represent the initial resistances, when determined, before incubation of mixtures.

Caseinogen solutions undergo a small change on incubation, even in the absence of putrefaction; the alteration in conductivity, is, however, small, when compared with the changes produced by putrefaction, and can be readily controlled by carrying out a blank experiment in the presence of toluol. For this reason, the gelatin-peptone mixture is to be preferred when testing the efficiency of antiseptics. In this latter medium, the changes are small. It will be noticed that, as would be expected, the addition of mercuric chloride diminishes the resistance of the substrate; formalin, on the other hand, increases it, owing probably, to its capacity to enter into chemical combination with amino-derivatives. The disinfectants themselves, also exert sometimes small changes when present in large quantities, owing to their acid or basic characters. In no case however can such changes be mistaken for a putrefactive alteration.

Conclusions.—Many problems with regard to bacterial growth and disinfection are suggested by the above recorded experiments and the present communication must be regarded as of a preliminary nature.

The factors concerned in the process of disinfection are so complex that the authors have for the present avoided the use of the word "standardisation" in their description of the suggested methods. Nor have they attempted, so far, to express any numerical relationship when comparing the antiseptic value of the different disinfectants examined. There are however various methods by means of which such a relationship might be fixed: the most feasible would be to determine the relative quantities of the disinfectant which are just necessary to entirely inhibit putrefaction during a given interval. Thus on reference to Fig. 5 it would be noticed that no change was produced in the substrate when phenol was in the concentration of 5 parts per mille, although a considerable amount took place when

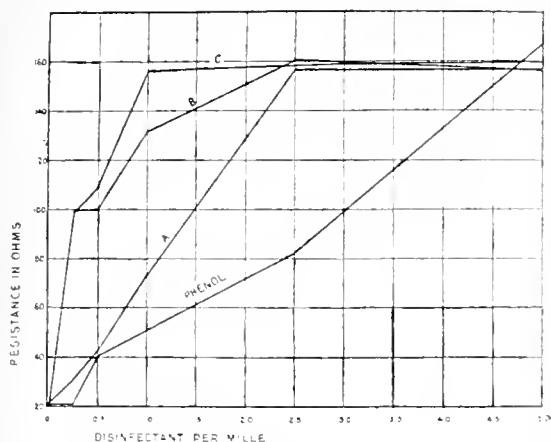


FIG. 5.

2.5 parts per mille were present. The amount necessary for total inhibition lies somewhere between these limits. In disinfectant C, these limits lie between 1.0 and 0.5 parts per mille. By taking a larger number of dilutions these limits can be considerably narrowed and the relative amounts just necessary to inhibit putrefaction within a given time ascertained. It is proposed to continue the investigations on this subject.

The method suggested has many advantages, notably the small amount of time and labour involved and the simplicity of manipulation. It is furthermore adaptable to a large number of conditions, varying substrates and disinfectants in different physical forms, such as powders, emulsions or organic solvents. It is hoped that this wide range of applicability will render the method acceptable to those engaged in the examination of antiseptics.

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DISCUSSION.

The CHAIRMAN said that the authors had only applied themselves to proteids. He should have liked to hear something with regard to the fate of the fats, as he had occasion to study somewhat extensively the constitution of sewage fats. It was well known that the neutral fats were hydrolysed by the bacteria in the sewage into free fatty acids and glycerol. The fatty matter of the sewage fats contained considerable quantities of coprosterol which seemed to be the degradation product to which both cholesterol and phytosterol are broken down in the alimentary canal.

Dr. S. DREYFUS asked if the authors had made any comparative tests as to this method and that of Rideal and Walker, and how had the results compared? It seemed to him at first sight that this method of measuring resistance was a little complicated, but he might change his opinion when he became better acquainted with it.

Dr. SOMMERVILLE said an interesting point arose as to whether or not the enzymes of the lower bowel continued their action, when separated from the bacteria which produced them; or whether there might not be such a quantity of enzymes in the ordinary intestinal contents as some were disposed to believe. He had been engaged on the bacteriology of the lower intestinal tract for some years, and he thought no section of modern medicine was fuller of interest to the chemist, to the physiologist, to the pathologist, and to the practising physician. They owed a great deal to Dr. Herter of Columbia University for the work he had done on the flora of the upper and lower intestinal tracts, and if it should prove true that there was a physiological sup-

pression of enzymes in the lower tract he would consider that Drs. Schryver and Lessing had thrown light on an interesting subject.

Dr. S. RIDEAL said the authors proposed to test the antiseptic value of a chemical substance by the amount of chemical change after bacterial infection brought about in its presence as compared with the change in its absence; in other words, it was a method which was eminently applicable to the determination of the behaviour of preservatives—of antiseptics as distinguished from germicides or disinfectants—and would throw light on the changes which took place, for example, when food was kept under different circumstances. That class of work could be measured by this method provided the resistance changes were comparable one with another. But they had not sufficient data at present, as the authors would admit, to ascertain, for example, whether their solution—3 per cent. gelatin and 1 per cent. peptone—had a uniform resistance, or the variation of experimental error in the resistance of such a solution when it had undergone no change at the blood heat temperature. The viscosity of glue or gelatin solutions of equal percentage composition varied considerably, and he thought the same would be true of conductivity. The changes which took place went over a long period, before you got the curve shown, and they would like to know more about the breaks in the curve, which evidently took place from day to day. For example, small quantities of salt introduced into the solution with the disinfectant to be tested would influence the original conductivity of the solution and also the shape of the curve during the period under observation. All these factors had to be considered before one could venture to put forward this as a practical method for testing disinfectants. One would think it would be better to measure the amount of change by some chemical method rather than a physical method, and he had always felt a doubt in his own mind as to what a difference in the conductivity of a solution actually meant. It was all very well to say it meant the breaking down of a mixture, but the peptone was already broken down to start with, and that had increased the conductivity of the medium initially. He supposed the peptone was introduced in order to enable the gelatin to conduct electricity to start with. Then again they took faeces of unknown origin, containing a number of organisms of different kinds, and had shown that the sequence in the breaking down of the gelatin through the albumenoses and amino acids was brought about by a variety of organisms, working one after the other, some symbiotically, but most of them by sequence; and it was therefore very difficult to ensure that a given sample of faeces contained the right proportion of organisms to degrade the gelatin and peptone in the way suggested. The absence of enzymes was very astonishing, in the ordinary liquefaction of gelatin by *B. liquefaciens*, *fluorescens*, and by *B. prodigiosus*, he had found an enzyme was produced (Rideal and Orchard, Analyst, 1897). The method associated with his own name and Mr. Walker's had never been put forward as one for determining the way in which a disinfectant was going to do its work, but simply as a way of enabling the manufacturer and the purchaser to see that they were getting an article according to sample—a commercial method which would enable buyer and seller to judge whether the article was according to specification. In every case, the way in which a disinfectant, after it had been sold, was going to be used, its strength, and whether it was to be used in the presence of organic matter or not, and whether for sterilising water or for disinfecting solid faeces, containing fat or urine or liquid faeces like cholera stools in which there was no fat, or the fat was already emulsified—all that had to be judged by the medical officer in charge of the public health of the district or house or patient. Every case was different, and must be judged locally by the expert in charge. He believed it was impossible for any single test to be devised which would meet all cases of practical disinfection.

Dr. BOUSFIELD said the question of standardising disinfectants was essentially a twofold one. Speaking as a bacteriologist, he had no hesitation in saying that

the academical test and the practical test were essentially different things, and in his opinion the two could never be satisfactorily brought together. It was one thing to do as Rideal and Walker had done, devise a method which gave a certain result in the presence of a small definite quantity of organic matter, and quite another thing to take a pure culture and determine what effect could be produced upon that. Then again that depended upon the question of the resistance of the particular organism you were disinfecting. He had himself within the last few days obtained results which completely astonished him, after nearly twenty years' work on this matter. He failed to kill a sporing organism with a 1 per cent. solution of one of the most powerful disinfectants on the market; whereas he obtained a very considerable effect, though not complete, on those same organisms by the use of one of the permanganates. He was a strong advocate of permanganates, because he believed the nascent oxygen had a selective action that it broke up more easily and attacked more readily the highly complex protoplasm of the bacteria than the comparatively lower organised compounds such as some of those referred to with reference to the decomposition of proteins which were found associated with bacteria. He had found in disinfecting London sewage that it was possible to sterilise it completely by adding permanganate in the proportion of 1 per 1,000, which was not the case with any other disinfectant with which he was acquainted, although there was an enormous amount of organic matter present. The permanganate answered the purpose equally well in the testing under more favourable circumstances as far as they were concerned of pure cultures simply suspended in water. How far this method would help in bridging over the great gap between the academical and practical test of disinfectants he was not able to say, but it seemed to him, knowing nothing but what he had heard, that the difficulties in the way of carrying it out with anything like accuracy would be considerable. First of all in the comparison of the disinfectants one would have to ascertain first whether or no they were electrolytes, and if so what their conductive powers might be. As far as he could see it was hopeless to attempt to compare by that method perchloride of mercury with phenol, one being a true electrolyte and the other not an electrolyte at all. After all, he did not see from what the author had said that he was going to tell them what they wanted to know, namely, how long it would take to sterilise or kill a given organism under given conditions.

Mr. W. C. T. GARDNER said this paper was of undoubted interest, but to his mind it fell short in one point. It did not definitely show the distinct germicidal action of the various disinfectants, but rather dealt with their inhibitory effect, similar to the well-known method which was in vogue at present. He could not understand why, in that method, a bacillus of low resistance, the *B. typhosus*, was chosen as the particular germ for experiment. Would it not have been better to have selected a germ which was more difficult to kill? It was incomprehensible that the agents at present in use, such as formaldehyde or substances containing 50 per cent. of cresols, which were known to be of undoubted germicidal value showed a very low co-efficient. He would like to have these substances worked out by the authors' method and to compare their results with those published by Dr. Rideal.

Mr. O. A. ELIAS drew attention to recent investigations in Germany by Proskauer, Seligmann, and Hans Schneider. These authors affirmed that all absolute results which might be claimed with respect to the disinfecting powers of any preparation were valueless unless distinction were drawn between inhibitory and actual germicidal effect. The main point with these observers was to combat the chief error committed in testing disinfectants, according to the Rideal-Walker method. Dr. Schneider emphasised the necessity of washing out or neutralising any property that might be present likely to hinder the development of growth before finally determining the real value of the antiseptic. This would avoid the confusion that frequently arose between disinfecting action and retardation of development, which in many instances, especially in

the case of a large number of disinfectants containing tar oils, gave rise to the most anomalous results. As regards formaldehyde disinfecting compounds, Seligmann and Schneider pointed out how the retarding action on development might be removed, and observed that a reliable result in regard to the disinfecting action was only obtained by using partially dry test material, and removing the adherent disinfectants by rinsing with dilute ammonia before conveying it into the culture medium. If formaldehyde compounds were compared according to the direct method with carbolic acid, cresol soaps, or such preparations as lysol, there would be better results on the side of formaldehyde. Whereas in reality this was an error, which should be rectified by eliminating its power of retardation; for after 24 to 48 hours cresol soap and carbolic acid, according to the strength of the solution, would show a distinct germicidal action, whilst the formaldehyde under these circumstances only checked the development of the germs, and growth would set in as a rule after the third or fourth day.

The remarks made as to the test of formaldehyde compounds applied in a far greater degree to compounds containing tar oils, and here the authors mention several well-known preparations said to have a very high carbolic co-efficiency, whereas in the case of these substances the true disinfecting test can only be determined by acting on partially dried material carefully rinsed in appropriate fluids, say $\frac{1}{4}$ to $\frac{1}{2}$ per cent. alkaline solutions to wash out the disinfectant before transferring to the culture medium. Whilst a co-efficiency of 15 and more was ascribed to some of the coal-tar products now on the market in England, Seligmann and Schneider point out that these are in reality considerably less powerful than carbolic acid itself.

Mr. JULIAN L. BAKER said it occurred to him when looking at the curves that the difference in the strengths of the organisms might be possibly due to some of varying proteolytic activities being crowded out. The authors took from the original culture sub-cultures at certain intervals and according to the length of time between the first and the last sub-culture so the change of the putrefactive strength altered.

Dr. H. P. STEVENS said he understood the authors did not bring this forward as giving a method for standardising disinfectants, but supposing they developed it in that direction, it appeared to him they would not have to contend with some of the difficulties referred to in reviewing the objections to the Rideal-Walker method, owing to the presence of organic matter; in applying this (the authors') method, there was organic matter in the form of gelatin and peptone.

Mr. J. F. BRIGGS said this method was complicated by the action of an antiseptic on the substratum, and an alkaline antiseptic might have a different rate of effect on the substratum from that of an acid disinfectant quite independently of the bacteria; a mercurial disinfectant would precipitate the substratum altogether and be apparently perfectly efficient. The action of the antiseptic ought to be measured on the bacteria, not on the substratum. That seemed to him a fault of this method.

Mr. C. T. KINCZETT sent the following observations:—

The experiments made by Drs. S. B. Schryver and R. Lessing are very interesting from several points of view and somewhat novel in character, but whether the process be preferable or not to the so-called Rideal-Walker method, it at any rate shares in common with that method its other great limitations and is valueless for determining real disinfecting values. What it does determine is the retarding influence of such antiseptics as may be tested, in so far as they are chemically amenable to the test, in respect of the process of putrefaction as carried on under the particular conditions which are observed. Similarly, the Rideal-Walker method serves to determine the relative germicidal strengths of coal-tar disinfectants under the particular conditions that are observed in conducting the test, but neither process reproduces the conditions under which disinfection has to be carried out in practice and both methods are obviously incapable (and therefore absolutely useless for the purpose) of determining the value of many other preparations, well known to be possessed of great disinfectant properties,

but having different chemical characters to those of coal-tar disinfectants, such, for example, as chlorine preparations, sulphurous anhydride, hydrogen peroxide, formaldehyde, the manganates and the permanganates.

I think there is an objection to the use of faeces for admixture with the gelatin and protein medium, considering that faeces must vary enormously in composition, not only as regards its organic constituents, but with respect also to the organisms with which it is impregnated. This latter consideration doubtless has chiefly to do with the varying incidents of putrefaction of the several mixtures tested by the authors, for in all probability the action of the aerobic organisms has to be either completed, nullified or destroyed before the anaerobic germs can get full play.

Dr. LESSING replied that he could not agree with the argument that this method was a purely academical one. This impression might have been given by the nature of their paper which was more intended to show the scientific principle of the method than discuss its applicability. He thought that it had a stronger claim for practical value than methods working with minute quantities of bacterial growth in an excess of the disinfectant solution, by reason of this ratio being here reversed and imitating more closely the conditions prevailing in the practice of disinfection where there was never any question of acting on the naked germ. Previous methods, such as the Rideal-Walker test, which was an excellent one for the comparative control of preparations of the same type, could only yield a pharmacological factor, and it was agreed on all sides that in the presence even of traces of foreign matter no reliable results could be obtained. With regard to the medium chosen it was, of course, impossible to imitate in any test the conditions of all possible cases; it was too complex a problem to be compressed into one formula or numerical value. They selected the protein medium as a very suitable means of following up the change, but had no doubt that other media, such as those suggested by the Chairman, could be employed under proper precautions. He thought they had given ample proof that the change was due to bacterial action and that it was not brought about by exogenous enzymes. The presence of salt in the medium or the addition of saline disinfectants could only show a different initial conductivity but it would not interfere with the difference in conductivity after putrefaction. For this reason the method was not restricted to coal-tar preparations. These had only been shown in the curves as they had been given considerable prominence of late. The high antiseptic value of formaldehyde, which as Mr. Wynter Blyth pointed out, did not show up in other tests, was very marked by this method. In reply to Dr. Rideal's remarks he pointed out that in most cases where economic efficiency was required, *i.e.*, where preparations are used in great quantity, antiseptics was all that could be desired. There could not be any question of sterilisation in the treatment of drains, floors, stables, public conveniences and places where the bulk of disinfectants went to. On the other hand, where absolute sterilisation was necessary as in surgery, the economic efficiency of the preparation to be used was of minor importance. With regard to the bacteria employed, they had tried pure cultures at first, but found that these did not produce a very rapid change, possibly due to the degeneration of the strains. Under symbiotic conditions the bacteria acted more vigorously and being more resistant allowed a better judgment of the real value of the disinfectant. However, the principle of the method did not imply the use of faeces for infecting purposes and any conditions under which a similar degradation of the medium took place, were acceptable. With regard to the crowding out of the bacteria mentioned by Mr. Baker, this was quite likely, and he thought that whatever the latent period was due to, the method afforded a good means of ascertaining it, and incidentally the age of the culture.

The paper was only of a preliminary nature and the authors would be fully recompensed for their labours if the method would be found useful for the determinations of the antiseptic, if not the germicidal value of disinfectants or preservatives.

Dr. LESSING wrote, in reply to Mr. Kingzett: As I have pointed out in the discussion, our method is not restricted to coal-tar emulsions, but can be applied to such substances as quoted by Mr. Kingzett. As to the use of faeces for infection these have been found to answer the purpose; their employment, however, does not constitute an integral part of the test, but the method can obviously be worked with any other pure or mixed infection which produces degradation in the substrate.

The question of aerobic and anaerobic action has been considered by us and it is quite possible to grow under either condition and then put the cultures to test. This method will thus allow a convenient differentiation between the action of these two types of organisms.

ERRATA.

CELLULOSE AND CHEMICAL INDUSTRY. By C. E. Cross and E. J. Bevan, (this J., Dec. 31, 1908, pp. 1187-1193). Page 1189, column 1, line 10, for "provision" read "prevision," and line 50, for "natural silk" read "artificial silk."

New York Section.

Meeting held at Chemists' Club on October 23, 1908.

THE USE OF PRESERVATIVES IN FOODS.

At this meeting an important discussion took place as to whether chemical preservatives in food are detrimental to health.

Dr. H. W. WILEY, in condemning the use of preservatives in food, dealt with the subject under the following heads:—

(a) Since preservatives have no food value, their addition to articles intended for human consumption is unjustifiable from every point of view.

(b) The addition of preservatives to food substances causes injury to health, though not necessarily immediate injury, as for instance in the case of benzoic acid.

(c) It is illegal, under the Food and Drugs Act, to add preservatives even to specific articles of food which are, by their nature, restricted in consumption.

(d) There is no necessity to add preservatives to food; their use in milk is universally condemned, and ketchup, preserves, pickles, canned meats, and unfermented grape juice, are instances of perishable products which are to be found on the market free from preservatives.

(e) No benefit in the price of food results from using preservatives; inferior materials can certainly be rendered edible by their use, but usually the preserved products possess much lower food value than the pure article.

Mr. READ GORDON pointed out that salting, smoking, pickling, and preserving with sugar or spirit were permitted by law, and yet were considered by many to be quite as injurious, as if not more so, than benzoic or salicylic acids. These acids were found in natural food products, and, when added to foods under proper safeguards, caused no greater retardation of digestive processes than the salt ordinarily taken with food.

Dr. E. E. SMITH dealt with the use of sulphites as preservatives, and criticised the evidence brought forward to show that their use was injurious. He contended, on the other hand, that the evidence went to show that they corrected rather than produced albuminuria; that they did not in any way reduce the number of red corpuscles in the blood; that their oxidation in the body tended to raise the temperature of the blood; and that they had no predominating influence on sulphur metabolism.

Mr. SEBASTIAN MCLELLER argued that, from the commercial point of view, preservatives were unnecessary, and showed that canned or bottled foods, containing no preservatives, were more profitable to the purchaser than the cheap, preserved articles, which were usually made from unsound materials, and were generally of low strength; and gave illustrations of brands of apple butter, baked beans, and tomato ketchup. He also drew attention to the unnecessary and harmful practice of adding alum to pickles.

Mr. HARRIS contended that it was necessary to use preservatives in articles of food in which the bases of ptomaine poisoning were liable to develop.

Mr. L. S. DOW urged the exclusion of preservatives from all pickles, preserves, jellies, tomato products, mince meat, etc.; there was no necessity for their use in a properly conducted cannery using pure fresh materials.

Mr. HARGOOD described the working up of low-grade tomato pulp in preparing ketchup, and pointed out the necessity for using preservatives for this class of product.

Mr. A. W. BITTING described the canning of shrimps without preservatives. The shrimps are kept on ice, washed, boiled in salt water, and canned.

Dr. WILEY replied to the criticisms on his paper.

A letter was read from Dr. E. GUDENAN, arguing that the use of preservatives might be defended on the ground that the system was capable of accommodating itself to poison. He instanced a case in which strychnine had been given in doses increasing from 0.02 grain to 0.1 grain, this latter dose being given for about 500 days; at first the urine gave a strong reaction for strychnine, but later on showed only the faintest traces, even on the full amount voided daily; the patient exhibited no effects of the cumulative action of the poison. In another case, the blood serum of a man who worked continuously in an atmosphere charged with starch dust, had a powerful hydrolysing action on raw starch, and a third case showed that the effect of nitrates was neutralised by accommodation of the system.

Nottingham Section.

Meeting held at Nottingham on Wednesday, December 16, 1908.

MR. S. J. PENTECOST IN THE CHAIR.

THE VOLUMETRIC DETERMINATION OF PHOSPHORIC ACID, MONO-ALKALI, AND DI-ALKALI PHOSPHATES.

BY JOHN M. WILKIE, B.Sc., A.I.C.

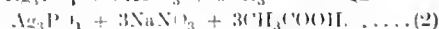
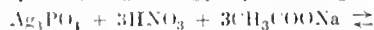
The principal methods for the determination of phosphoric acid are the ammonium-magnesium phosphate method and the molybdate method—the former is nearly always gravimetric though volumetric modifications are occasionally employed, the latter lends itself better to volumetric adaptation, Pemberton's process being perhaps the best known. In addition, the uranium volumetric method is also somewhat largely used in technical work, but suffers from many disadvantages, amongst which may be mentioned lack of sharpness in the end point, necessity for standardising on a pure specimen of the substance to be tested, and non-concordant results by the unpractised worker. As I wish to draw special attention to a volumetric method, I shall briefly describe some of the less known volumetric methods.

The lead method involves precipitation as lead phosphate, filtration, and determination of the excess of lead volumetrically in the filtrate. Maly's method involves precipitation as barium phosphate and titration of the liberated acid in presence of phenolphthalein or preferably corallin. The end point is not well marked and the titration must be conducted at boiling temperature. Calcium chloride has also been used (*cf.* Kohn, *Chem. Zeit.*, 1908, 718). Perrot precipitates silver phosphate in the presence of acetic acid and determines the residual silver after filtration by means of a standard sodium chloride solution. (*cf.* this J., 1888, 311.) Holle- mann determined phosphoric acid by conversion to the

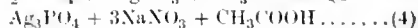
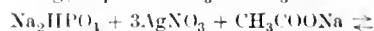
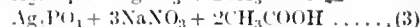
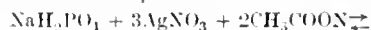
disodium salt, precipitation as silver phosphate in the presence of sodium acetate, and determination of residual silver by Vollhard's method (*cf.* this J., 1894, 763, 843).

The main features of any good volumetric process may be enumerated thus:—(a) *Accuracy*—that is consistent and reliable results obtainable only by a reaction which is strictly molecular. (b) *Speed*—The only methods which can lay any special claims to speed are those of Holle- mann and Perrot, and the obsolete method of Maly.

The method I wish to introduce complies with the above requirements. Consider the following equations.



Silver phosphate is readily soluble in mineral acids and also in phosphoric acid, so that on adding silver nitrate to phosphoric acid solutions no precipitation occurs, increasing precipitation taking place as the free acid is neutralised. Silver phosphate is practically insoluble in very dilute acetic acid, as assumed by Holle- mann. It occurred to me that a simple and accurate determination could be effected by precipitating the silver phosphate in presence of excess of sodium acetate and then titrating directly the acetic acid produced in accordance with equation (2) above. Rough experiment seemed to confirm this conjecture so completely that I decided to investigate the matter, and at the same time to extend the method to mono- and bi- basic orthophosphates in accordance with the equations.



Preliminary experiments were carried out with a solution of orthophosphoric acid the strength of which, as deduced from its specific gravity, did not agree well with the figure obtained on titration with $N/10$ barium hydroxide in presence of phenolphthalein.

I might here remark that though direct titration with alkali hydroxide or alkaline earth hydroxide gives good approximations to the actual content of phosphoric acid solutions the point of neutrality indicated by phenolphthalein does not strictly agree with the equation,



The acid referred to above was submitted to careful qualitative examination and found to be free from phosphorous, meta- and pyro-phosphoric acids. The only impurities present were minute amounts of iron and sodium. The real phosphoric acid content was carefully determined both by the ammonium magnesium phosphate method, weighing as magnesium pyrophosphate, the excellent modification of B. Schmitz being followed (*Zeits. anal. Chemie*, 1906, 512), and also by weighing as lead phosphate, proceeding in the usual manner by adding the phosphoric acid to excess of pure lead oxide in presence of nitric acid, evaporating, and igniting to constant weight at low red heat. The results obtained by the first method were 15.17 grms. of phosphoric acid per 100 c.c. (mean of 3 closely concordant results), and by the second method, 15.18 grms. per 100 c.c. The correct strength was taken as 15.17 per cent. w/v.; obviously the lead oxide method returns as phosphoric acid all non-volatile impurities. After various trials the following conditions were found to answer admirably. The equivalent of 0.5 c.c. of the phosphoric acid referred to was transferred to a stoppered cylinder, 26 c.c. of $N/10$ silver nitrate solution was added (no precipitate forms in the absence of chloride), and then 25 c.c. $N/5$ sodium acetate solution; the whole was diluted to about 100 c.c., shaken vigorously, and the acetic acid produced titrated with $N/10$ barium hydroxide solution (*cf.* addendum), adding a few drops of phenolphthalein as indicator. The end point is sharp and easy of recognition. In this connection I prefer the ordinary stoppered cylinders for the titration as the change is particularly distinct, though of course any suitable vessel may be used.

For the 0.5 c.c. of the phosphoric acid solution 23.24 c.c. of barium hydroxide solution were required (the actual figures being 23.23, 23.26, 23.22, 23.25, 23.23 c.c. $N/10$) corresponding to 15.19 grms. of phosphoric acid per 100 c.c.

The close agreement with theory (15.17) is very satisfactory. In the later experiments the precaution was always taken of freeing the acid from carbon dioxide—this was done by boiling in Jena glass vessels for a few minutes, cooling, and then transferring to the cylinder, using the sodium acetate solution for rinsing purposes. In the case of the free acid this precaution is scarcely necessary, but with the alkali phosphates it is absolutely essential. All water used must be freed from carbon dioxide.

Disodium orthophosphate, $\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$. The salt used was of a high degree of purity the only impurity present in determinable amount being sulphuric acid; chloride was absent. The crystals were somewhat damp. A solution containing 35.83 grms. per litre was prepared, this solution being decinormal for the hydrogen ion and three times that strength for the phosphoric acid ion. 15 c.c. of this solution was transferred to a small Jena flask, 15 c.c. of $N/10$ sulphuric acid added, and the whole boiled for five minutes to expel carbon dioxide. After rapidly cooling the flask contents were transferred to a stoppered cylinder containing 50 c.c. of $N/10$ silver nitrate solution, the flask being rinsed with 30 c.c. of $N/5$ sodium acetate solution and water; after well shaking the acetic acid produced was titrated as already described, an allowance being made for the sulphuric acid added.

The following results were obtained—given as percentage of $\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$ in the salt: ammonium magnesium phosphate method (Schmitz), 96.84 per cent.; sodium metaphosphate method (evaporation and ignition), 96.98 per cent.; volumetric method, 97.03 and 97.07 per cent. The agreement is again good.

Monosodium orthophosphate, $\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$. The salt used was in the form of colourless damp crystals and was free from chloride. As with the disodium salt sulphate was present but in smaller amount.

The results obtained with the mono sodium salt were as follows in percentages of NaH_2PO_4 in the salt, the treatment being exactly as for the disodium salt save that in experiment (2) no sulphuric acid was added. Ammonium magnesium phosphate method (Schmitz), 77.28 per cent.; volumetric method, (1) 78.20 (2) 78.33 per cent. (Theory for the $\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$ requires 76.92 per cent.)

The high results obtained by the volumetric method are in all probability due to the presence of free phosphoric acid. This conjecture received confirmation when an attempt was made to determine phosphoric acid as sodium metaphosphate; low results were consistently obtained, no constant weight being obtainable at a bright red heat. In one experiment the first weighing corresponded to 76.92 per cent., and after 30 minutes further ignition this had fallen to 76.28 per cent.

It will be seen that the method as given for mono- and di-sodium phosphates fails in the presence of sodium carbonate. This not unlikely impurity can be readily detected and approximately estimated by slightly modifying the method already given. In the preliminary boiling with sulphuric acid any carbonates present will be converted into sulphates, thus using up some of the acid added, and so low results will be obtained; the full acidity corresponding to the phosphoric acid actually present will not be shown, but the silver consumed in the absence of halogens, etc., will correspond to the actual phosphoric acid content.

Modified method in presence of carbonates. The determination of acetic acid is carried out exactly as already described except that the titration is performed in a 150 c.c. calibrated flask. After noting the alkali consumed, 1 c.c. of normal sulphuric acid is added, the volume is adjusted to 150 c.c. and the contents well mixed. After an hour or so, the flask contents are filtered and the residual silver determined by Volhard's process on 100 c.c. of the filtrate. The results so obtained in all cases have been slightly high, but in the absence of carbonate, the results obtained by the alkali and silver titrations closely agree.

In the modified process alkali chlorides will obviously vitiate the silver, but not the baryta determination; as already mentioned under phosphoric acid, their presence is readily detected in the determination itself when a precipitate of silver chloride will be produced before the sodium acetate is added. This also holds true for the mono-sodium salt, but not for the disodium salt, unless a larger volume of sulphuric acid be added. In any case they can be readily determined by Volhard's method, and a correction applied.

Within limits the exact amount of silver nitrate added is immaterial, but with excessive silver the end point is obscured by precipitated silver hydroxide which does not completely redissolve. The quantities given have been found to work well, and of course the silver solution is not of necessity truly decinormal or even of known value unless carbonates are to be determined.

The author is at present extending the process to calcium phosphates.

The silver nitrate solutions used, when largely diluted, were neutral to phenolphthalein. The sodium acetate was the ordinary trihydrated salt: it was neutral to phenolphthalein.

The author desires to express his indebtedness to Messrs. Boots, Ltd., for the use of their laboratory, in which the work was carried out.

ADDENDUM.

In determining the factor of an approximately decinormal baryta solution the importance of freeing the acid used as standard from carbon dioxide cannot be too strictly insisted on. In the author's opinion this is a point that is often overlooked; his practice is to use $N/10$ sulphuric acid for the purpose, boiling for a few minutes, cooling, and then proceeding as usual; the precipitated barium sulphate does not in any way mask the end point.

Baryta solutions often cause grave inconvenience by crystallizing in the burette owing to changing temperature—an effect specially noticeable in the winter months. This source of trouble and annoyance can be completely eliminated by using a mixed alkaline earth hydroxide solution. A saturated calcium hydroxide solution is prepared and the requisite amount of barium hydroxide, dissolved in a limited amount of boiling water, is then added. After standing a day the solution is decanted and is ready for use.

Scottish Section.

Meeting held at Glasgow on Tuesday, December 8th, 1908.

MR. D. J. PLAYFAIR IN THE CHAIR.

THE VALUE OF THE POLENSKE TEST IN THE ANALYSIS OF OILS AND FATS.

BY R. R. TATLOCK AND R. T. THOMSON.

This method of analysis was introduced by Polenske, whose object was to detect coconut oil, and if present, to determine its proportion, in butter. This was the primary intention, but it has also been attempted to utilise it, in conjunction with other constants, for the detection of animal fat, such as beef fat or lard, in butter. It is with these two points, and with a reference to the application of the method to other oils and fats that we shall deal in this paper. The method of procedure, and the precise form of apparatus employed, were exactly as described in Vol. II., page 853, of Lewkowitsch's book on Oils and Fats. Of course we had in view, and were in agreement with Lewkowitsch's dictum "that it is absolutely necessary to follow the process in all its minutest details, in order to obtain concordant results." There is one detail, however, which has not been generally referred to, and that is the exact amount, and the condition

as regards fineness, of the pumice employed in the process. In Lewkowitsch's volume it is stated that "some powdered pumice" is added, but Harris ("Analyst," Vol. XXXI., page 358) adopts 0.1 gm. as being nearly the amount recommended by Polenske, which was a quantity sufficient to cover the point of a pocket-knife blade. The results Harris gives are only with "three pieces of pumice-stone about 1.5 c.m." and "0.1 gm. of powdered pumice-stone," but still we have no idea of the degree of fineness of the powdered pumice. In the following table are stated results of two butters for insoluble volatile acids which we have obtained with pumice of varying degrees of fineness, and when employed in different quantities:—

Insoluble volatile acids.		
	Butter A.	Butter B.
With two small lumps pumice	2.0	not done
" 0.1 gm. of No. 1 pumice powder	2.3	3.7
" 0.1 gm. of No. 2 pumice powder	2.5	4.1
" 0.5 gm. " " "	2.75	4.4
" 1.0 gm. " " "	2.9	not done.

The No. 1 pumice powder referred to above was ground so as to pass through a sieve with 100 meshes and remain on one with 400 meshes to the square inch, while No. 2 pumice powder was treated in the same way with sieves having 2500 and 3600 meshes, respectively, to the square inch. The soluble volatile acids were practically the same in each experiment, being 29 for butter A and 31 for butter B. In all further tests we have adopted 0.1 gm. of No. 2 pumice powder, as that is quite sufficient to prevent priming, and results can be obtained within 0.1 of each other. In our opinion, however, it is inadvisable to depend upon getting results closer than 0.2 to the truth, as there is a danger of obtaining higher results when the filtration of the alcohol takes longer than usual. Thus an exposure of five minutes may account for 0.1 c.c. of decinormal alkali. Taking everything into consideration, it is apparent that the Polenske method requires delicate handling, and above all it is necessary not to be dogmatic with regard to the bearing of slight differences from the maximum or minimum of insoluble volatile acids found in oils or fats.

Various observers have given the results of their examination of butters by the Polenske method, and have endeavoured to trace a more or less close relationship between the soluble and insoluble volatile acids, but we have not been so fortunate as Polenske himself, for example. That no close relationship existed was plain from the analysis of several hundreds of samples received mainly from sanitary inspectors, but in addition we examined 24 samples, of which 21 were extracted by ourselves from milks from different districts, including the counties of Aberdeen, Dumbarton, Perth, Lanark, and Ayr, while the other three were butters from reliable sources. In order to show the variations in this comparatively small number of butter fats, we may quote the following:—

TABLE I.

showing the variable nature of the relationship between the soluble and insoluble volatile acids in genuine butter fat.

	Soluble volatile acids.	Insoluble volatile acids.
Butter fat No. 1	30.0	2.1
do. No. 2	27.1	2.1
do. No. 3	25.2	2.1
do. No. 4	29.5	2.3
do. No. 5	29.4	4.2
do. No. 6	26.0	1.0
do. No. 7	26.5	2.3

It is scarcely necessary to do more than quote these, the variation being so striking, and especially so as they represent about one-third of the samples tested. It must

also be particularly borne in mind that these are good average specimens of butter fat, as five or six samples of milk (which were undoubtedly mixed milks to begin with) were mixed together for extraction of the fat. The other samples showed very considerable variations, but not so great as those quoted above. The general results are given in

TABLE II.

Number of samples.	Variations in soluble volatile acids.	Average soluble volatile acids.	Variations in insoluble volatile acids.	Average insoluble volatile acids.
6	30 — 32.4	30.9	2.1 — 2.2	2.7
10	28.1 — 30.7	28.8	1.8 — 4.2	2.6
5	26.0 — 27.1	26.6	1.0 — 2.3	1.9
3	24.1 — 25.2	24.9	1.2 — 2.1	1.7

The average for the 24 samples was 28.5 of soluble and 2.4 of insoluble volatile acids.

We shall now deal with the effect of various proportions of cocoanut oil on the Polenske test for butter, the results of our experiments being stated in

TABLE III.

	Soluble volatile acids.	Insoluble volatile acids.
Butter alone	28.1	1.8
Cocoanut oil alone	7.5	18.0
Butter with 5% cocoanut oil ..	27.4	2.4
do. 10% do.	26.2	3.2
do. 20% do.	24.4	4.2
do. 30% do.	22.5	5.7
do. 40% do.	20.9	7.4

The cocoanut oil used in the above trials was extracted in the laboratory from the cocoanut, so that its genuineness is undoubted, and the same oil has been employed in the trials of which the results are recorded later. It is apparent from these results that the possibility of the detection of even 10 per cent. of cocoanut oil in a butter by the Polenske method is very doubtful. One of the genuine butters, extracted from milk in our laboratory, gave 29.4 of soluble and no less than 4.2 of insoluble volatile acids, and, reasoning from analogy, it is most probable that butter fats having about 25 of soluble and 3.5 of insoluble volatile acids may occur in that class of butter. In this connection it ought to be noted that comparatively few butters with low soluble volatile acids have been examined by the Polenske method, so that before giving a final decision on this matter, a much larger number of such butters ought to be analysed. Among the genuine butters we have one showing 25.2 of soluble and 2.1 of insoluble acids, which, on Polenske's original figures, might be regarded as containing at least 10 per cent. of cocoanut oil.

If we now examine the results recorded in Table III., we shall find that the soluble volatile acids in the mixtures are higher, and the insoluble volatile acids lower, than the average of those given by the butter and cocoanut oil separately. Take for example the mixture containing 20 per cent. of cocoanut oil. If we calculate simply on the basis of the butter and cocoanut oil results, we find that the average for soluble and insoluble volatile acids is 24.0 and 5.0 respectively, but the actual results are 24.4 and 4.2, and the same holds good for the other mixtures. It is evident, however, that this is not a true average, as the mixture operated upon was 4 grms. of butter and 1 gm. of cocoanut oil, and it is therefore necessary to know what these quantities will give separately. In making these tests the full quantity (20 grms.) of glycerin was employed, but the amount of caustic soda used was proportionate to the quantity of fat saponified. When the full amount (2 c.c.) of the caustic soda solution required for 5 grms. was employed for 1 gm. of the fat, the mixture

would not clear up, so that the point of complete saponification could not be determined satisfactorily. The following Table (IV.) gives the results obtained:—

TABLE IV.

	Soluble volatile acids.	Insoluble volatile acids.
4 grms. butter fat	22.6	1.7
1 gm. cocoanut oil	4.4	9.1
Mixture of 4 grms. butter with 1 gm. cocoanut oil	24.4	4.2

It will be here observed that there is a deficiency in the soluble volatile acids of 2.6 and in the insoluble of no less than 6.6, and this is most probably due to the retention of the less volatile acids by the non-volatile acids. Another point which calls for remark is with regard to the very high proportion, namely 4.4, of soluble volatile acids obtained from 1 gm. of cocoanut oil as compared with 7.5 from 5 grms. of the same oil. In order to throw some light on this apparent discrepancy, we saponified 1 gm. of butter and 1 gm. of cocoanut oil, respectively, distilled off the usual 110 c.c. which was titrated in the ordinary way, then added 110 c.c. of water to the distilling flask, distilled off 110 c.c. again, and repeated this four times, with the results given in Table V.

TABLE V.

	1 gm. butter.		1 gm. cocoanut oil.	
	Soluble volatile acids.	Insoluble volatile acids.	Soluble volatile acids.	Insoluble volatile acids.
1st distillation ...	6.2	1.0	4.4	9.1
2nd " ...	.6	.8	.7	5.6
3rd " ...	.2	.6	.2	4.3
4th " ...	.1	.6	.15	3.0
5th " ...	.05	.5	.10	2.7
6th " ...	.05	.5	.05	2.3

If we add together all the soluble volatile acids data 7.2 is obtained, and this is equal to 36 for total soluble volatile acids in 5 grms. As the 5 gm. quantity actually gave 28.1, it is plain that there is practically no discrepancy between the results, when the nature of the method is taken into account. With the 1 gm. of cocoanut oil the figure is 5.6, which is equal to 28 in 5 grms., whereas the actual figure from the latter quantity is only 7.5. This difference cannot be accounted for by the proportion of soluble volatile acids in the residual mixture in the distilling flask when 5 grms. are operated upon, but is manifestly due to the fact that the insoluble volatile acids are only insoluble under the conditions of the process. If these so-called insoluble volatile acids are not quite insoluble, but in reality slightly soluble, then the higher soluble volatile acids in the 1 gm. quantity are accounted for. That this is the case is proved by an experiment made with 5 grms. in the usual way, diluting the 110 c.c. distillate to 550 c.c. with water, shaking thoroughly, filtering and titrating 500 c.c. of the filtrate. Treated in this way the soluble volatile acids were 12 c.c. and the insoluble 1.37 c.c., and although this does not account for the whole difference in the soluble volatile acids, it clearly shows that the so-called insoluble volatile acids are not quite insoluble in water. If the distillate, after dilution, had been heated to boiling and then cooled it is certain that considerably more of the acids would have been dissolved, but it was not necessary to pursue the matter further.

A series of trials was next made with margarine containing various percentages of cocoanut oil, which was the same as was employed in the mixtures with butter, and the following results were obtained:—

TABLE VI.

	Soluble volatile acids.	Insoluble volatile acids.
Margarine alone .....	.4	.5
do. with 5% cocoanut oil	1.4	.7
do. do. 10% do.	2.2	1.3
do. do. 20% do.	3.9	2.6
do. do. 30% do.	5.0	3.9
do. do. 40% do.	5.8	5.7
do. do. 50% do.	6.5	7.6

Taking, as before, the margarine containing 20 per cent. of cocoanut oil, it is apparent that the soluble volatile acids are 0.8, and the insoluble volatile acids, 6.9, lower than would be expected from the mixture, thus showing, as in the case of butter, that these acids are retained to the extent stated, by the non-volatile fatty acids. Identical results were obtained with olive oil and beef fat when mixed with the cocoanut oil, after allowing for the slight differences in the composition of the two former oils. This shows that the almost liquid fatty acids of olive oil have quite as great an effect as the more solid fatty acids of beef fat, in retaining the volatile acids.

The question now arises as to the value which is to be attached to the Polenske numbers for the detection and determination of cocoanut oil in butter and in margarine. It must be admitted without qualification that the Polenske test is purely empirical, and it is hedged round by so many conditions that extreme caution must be exercised before coming to a decision as to the presence of cocoanut oil in a butter. It is all very well, as some analysts have done, to show what small proportions can be detected on the condition that one knows the exact composition of the butter which has been mixed with cocoanut oil. But unfortunately for the analyst, he is not in a position to know this, and therefore the Polenske test simply brings him, in some cases, to the doubtful point. This occurs, as far as our experience goes, when there is found a ratio of 9 of insoluble volatile acids to 100 of soluble volatile acids. In such cases resort must be had to the phytosteryl acetate test, and if this proves the presence of a vegetable oil, the probability will then be that it is cocoanut oil, although certainty is out of reach. Where a positive result is obtained, it will probably be safe to regard any excess of insoluble volatile acids as being due to cocoanut oil, and to state always the minimum proportions that may be present. We may add that so far as our trials have gone, we cannot place any reliance on the methods of detecting cocoanut oil which are dependent on silver, copper or baryta values.

As regards the detection and estimation of cocoanut oil in margarine, the Polenske number appears to be quite reliable within limits of say 5 per cent. Basing our calculations on the figures given in Table VI., we have tested margarines of known composition, and obtained results within 3 per cent. of the truth, where there was 35 per cent. of cocoanut oil present. In this connection there is a danger of the analyst reporting a margarine, say on a soluble volatile acids of 6.4, as containing 16 per cent. of butter, if he only determined the soluble volatile acids which seems to be all that he is legally required to do. In a sample of margarine tested by ourselves, the soluble volatile acids were 6.2, and the insoluble 6.6, but this we reported as genuine, as practically the whole of the former was due to cocoanut oil and not to butter. This is a pitfall which analysts must avoid, as they may otherwise wrongly accuse manufacturers of margarine of an infringement of the Sale of Food and Drugs Act, 1899.

As already stated, it has been attempted to utilise the Polenske number as a factor for the determination of animal fat, such as beef fat or lard, in butter. But for this purpose two principles must be established beyond doubt, and these are (1) that a greater proportion of insoluble volatile acids, as compared with the soluble acids, is to be found in butters when the latter acids are high than when they are low, and (2) that the other constants are so affected as to throw them out of their usual relationship to each other. The first of these propositions is founded upon insufficient data, and in our experience facts are

entirely against it, as is shown by the figures already referred to. It may be said that Butter No. 5 in Table I. does not support our contention, but this is an exceptional case, and its composition is probably due to the cow which produced it having been fed partly on cocoanut cake or meal. In fact, the only butters we have found to give such results were from the milk of cows which we had fed in this way, by a farmer, for experimental purposes. It is therefore to be expected that butters having low soluble volatile acids, say about 25, will have a corresponding proportion of the insoluble variety, if the cows received cocoanut meal as a portion of their food. The first proposition therefore remains unproved, or rather is practically disproved, and without it the second proposition is of little account. It is not necessary to enter into an elaborate argument on this point, but we may just put on record the following analysis of a genuine Scotch butter, which, according to the two propositions referred to, would be regarded as containing animal fat:—

Soluble volatile acids	25.2
Insoluble volatile acids	2.1
Saponification value	227.2
Zeiss at 40° C.	43.7
Specific gravity at 100° F.	0.9113
Iodine value	42.71

It is sometimes inconvenient, as occasionally in cheese analysis, to obtain 5 grms. for the determination of the volatile acids, and it is therefore of interest to know the relationship between the results with this and smaller quantities of butter. With this object in view, tests were made with 1, 2.5 and 5 grms., respectively, of two samples of butter, the results being embodied in:—

TABLE VII.

	Soluble volatile acids.	Insoluble volatile acids.
5 grms. No. 1 butter fat	32.4	2.7
2.5 grms. do. do.	16.7	2.4
1 grm. do. do.	7.3	1.8
5 grms. No. 2 butter fat	28.1	1.8
2.5 grms. do. do.	14.7	1.5
1 grm. do. do.	6.2	1.1

These results show that the soluble volatile acids for 5 grms. of butter fat may be obtained approximately by multiplying the result from 2.5 grms. by 1.92, and that from 1 grm. by 4.5. Similarly the insoluble volatile acids for 5 grms. may be approximately obtained by multiplying the result from 2.5 grms. by 1.16, and that from 1 grm. by 1.6.

We have also been making trials with regard to the application of the Polenske test to other oils and fats, so far without finding it of any positive value, but we intend going further into the matter. In the meantime we append the results obtained with several oils and fats:—

TABLE VIII.

	Soluble volatile acids.	Insoluble volatile acids.
Beef fat	35	3
Lard	35	4
Cottonseed oil	4	4
Olive oil	2	2
Arachis oil	4	35
Cod liver oil	5	4
Dogfish liver oil	3	9
Porpoise oil	81.4	1.4
Japan wax	3.6	9

Yorkshire Section.

Meeting held at Leeds on Monday, December 14th, 1908.

PROF. W. M. GARDNER, M.Sc., IN THE CHAIR.

THE FIFTH REPORT OF THE ROYAL COMMISSION ON SEWAGE DISPOSAL.

BY JOHN T. THOMPSON, M.Sc.

After ten years of deliberation the Commissioners have issued this Report, which deals chiefly with the relative merits of the methods available for the purification of the sewage of towns.

As a result of this delay in publication, the Report is very important as an official confirmation of facts that have been known for some years amongst those working on the sewage problem, but it contains little recent investigation. During the last two or three years, authorities who were compelled to carry out schemes may have spent considerable sums of public money, for example, on storm filters, whilst the Royal Commission held back information showing that these were costly and inefficient. At the same time one must bear in mind the difficulty of the task which the Commissioners have successfully carried out, namely, the collecting of a large mass of evidence and collating with it observations and experiments of their own. They have interpreted their terms of reference wisely and in broad outline the conclusions they have arrived at are excellent, consequently they deserve the gratitude of all engineers and chemists who are responsible for the sewage disposal and general sanitation of our towns. Some of the experiments and methods by which these conclusions were arrived at are open to criticism; the general arrangement of the Report is also somewhat confusing. There is very scanty reference to work done in other countries on this subject.

The following paragraph is noteworthy, and reveals the main principle underlying the whole report:—

"We are satisfied that it is practicable to purify the sewage of towns to any degree required, either by land treatment or by artificial filters, and that there is no essential difference between the two processes, for in each case the purification, so far as it is not mechanical, is chiefly effected by means of micro-organisms. The two main questions, therefore, to be considered in the case of a town proposing to adopt a system of sewage purification are, first, what degree of purification is required in the circumstances of that town and of the river or stream into which its liquid refuse is to be discharged; and, second, how the degree of purification required can, in the particular case, be most economically obtained."

The Commissioners realise that local circumstances vary to such an extent that "the necessary control cannot be provided by direct enactment which could be enforced by the ordinary courts," therefore, statutory provisions in regard to questions of pollution and public health must be of an elastic character. This important principle will be received with general satisfaction.

The Report will be extremely useful in the hands of those who have intimate expert knowledge of all the varied local factors which enter into the question of the sewage treatment of any place, but the danger of misuse by the inexperienced cannot be too strongly emphasised, for it may lead to an increase of the waste of public money which is continually going on, especially in small communities, by the employment of architects and surveyors who have no personal experience of sewage disposal.

PART I.—PRELIMINARY PROCESSES.

Par. 21.—Dr. McGowan's formula for "strength of sewage" seems too empirical, but as Appendix IV. is not yet available one cannot judge how it has been arrived at. It is significant that the Report says that "no statement can be made as to its precise accuracy."

Par. 24.—"Screening" might have been dealt with more fully. It is essential, not only where the sewage has to be pumped, but also where it is necessary to press the sludge.

Par. 29.—With reference to the use of sedimentation tanks in parallel, where the tanks are narrow and adjacent, there is the additional advantage of a short sludge culvert, or better still, the sludge pump may have a suction pipe in each tank, thus avoiding the cost of a culvert and the objectionable manual labour often necessary with tanks in series, where the fall is insufficient.

Par. 50.—The statements about septic tank treatment are in harmony with the usual practice; it is interesting to learn that if septic effluent is treated in settling tanks with "2 to 3 grains of lime per gallon, the suspended solids are reduced from 8 to 5 parts per 100,000, a considerably larger quantity of the liquor can be purified per cubic yard of filter, and the offensive character of the septic tank liquor is largely destroyed." It is a quaint idea to express the amount of precipitant in the time-honoured British unit when suspended solids, etc., are throughout expressed in parts per 100,000.

The advice given about the choice of tank treatment is sound, but considerable knowledge of local conditions are essential to use it successfully.

PART II.—ARTIFICIAL FILTERS.

Pars. 92—98.—Elaborate detailed suggestions are here made as to the volume of liquid which can be treated on contact and percolating beds, taking into account the size of material used in the filters and the amount of suspended solids in the effluent from the preliminary processes. For treating well clarified liquids on contact beds of fine material, 4 to 6 fillings per day are recommended for dry weather, but surely this does not allow sufficient time for proper drainage and aeration of the beds; such statements cannot be based on practical experience with contact beds. When the Report goes on to state, "that the rates of filtration that we give could generally be doubled in wet weather," it reaches the verge of absurdity, for it is almost impossible to fill a contact bed 8 to 12 times per day without serious damage to the bed and the quality of the effluent. Such statements are misleading and tend to encourage the provision of inadequate areas of filters, which would be perpetually overworked. The mass of evidence given before the Commission points to 3 fillings per day in dry weather, increased to 5 or 6 fillings for short periods during storm, as the highest rate at which contact beds can be efficiently worked.

Par. 99.—The remarks on the action of contact beds are important and suggest the need of further investigation. Perhaps more emphasis might have been put upon the value of the period when the bed is standing empty.

Pars. 111—118.—There are eight causes of the loss of capacity of contact beds mentioned, the most important are the disintegration and consolidation of the medium, which can be largely avoided by using durable material graded to an even size; inefficient sub-drainage and overwork; if these causes of decrease are guarded against, the other minor ones will have little effect when a clarified liquid is treated.

The important subject of percolating beds occupies a considerable portion of the Report. Unfortunately the experiments described under this head are open to criticism because of the small size of the beds used and the comparatively short periods over which the observations extended.

Par. 135.—At Horfield a deep bed containing 284 cube yards of medium is compared with a shallow one containing only 27.56 cube yards.

Par. 136.—The Ilford beds had a content of 24 and 12 cube yards respectively, and in both these experiments the distribution was faulty through the use of Stoddart's trays.

Par. 147.—Worse still, at Dorking much time and care was expended on tests carried out with beds with contents of 5 and 10 cube yards. Extreme caution should be used in drawing inferences from experiments carried out on such a small scale.

Par. 149—152.—The experiments with salt solutions are of some academic interest, but do not accurately represent the passage of sewage impurities through a bed.

Par. 153.—These observations lead to the conclusions that, assuming good distribution, a given quantity of coarse material will give about the same result whether arranged as a deep or shallow bed, but in the case of fine materials it is more advantageous to construct a shallow bed.

Par. 159.—The remarks on the most convenient arrangement of percolating beds are of practical utility. An area of percolating beds should be so arranged that portions of it may be put out of work without interfering with the general plant. As side aeration is not necessary for percolating beds, the arrangement of a works would depend chiefly on the configuration of the site and the form of distribution employed; all moving distributors have economic limits, but with fixed forms, such as nozzles, perforated pipes, etc., "there would appear in principle to be no limit to the size."

Par. 161.—It is desirable to be able to form some idea of the relative cost of the various methods of sewage disposal, but the estimates given in the Report do not appear to justify the labour expended on them. They are unfair to contact bed installations for the following reasons:—

(1.) Assuming ample fall, no allowance is made for excavating in the case of the 9 feet percolating beds, but for double contact beds, each 3 feet deep, excavation is charged for the secondary bed.

(2.) To compare fairly in the cost of flooring with the contact beds, the percolating beds should have been 6 feet deep—a much more usual depth than 9 feet, especially where pumping is not employed.

(3.) At large works, anyhow, the cost of labour in a contact bed system would not be double that required for a percolating system.

(4.) £5,700 per acre is an excessive cost for contact beds; the Manchester beds only cost about half that amount. This expensive construction of course tells in favour of percolating beds, for a much smaller area of beds is required in this case.

Par. 168.—The figures for the total constructional cost of the two systems of beds are quite inexplicable, for in some cases this total is less and sometimes several thousands more than the sum of the principal items given.

Par. 177.—Under these circumstances, little value can be attached to the conclusion that on this basis the treatment of tank effluent on "percolating beds costs only about two-thirds as much as purification by double contact beds," although one is convinced that from the standpoint of total annual cost and efficiency the use of percolating beds is the better of the two methods.

Par. 190.—The summary of Part II. shows that where the size of material and depth of bed are arranged to give maximum efficiency, the superiority of percolating beds rests on (1) their ability to treat nearly twice the volume of tank liquor; (2) their ability to readily cope with variations in flow; and (3) the fact that they produce better aerated, and apart from suspended solids, more uniform effluents than contact beds; at Leeds the effluents from percolating beds were generally better nitrated also.

On the other hand, where an offensive tank liquor is being treated, they are liable to produce more smell nuisance, and also more likely to swarm with flies than contact beds. These conclusions have been confirmed at many works.

PART III.—LAND TREATMENT.

This subject has been fully dealt with in previous reports and needs no comment at this juncture, save that the Commissioners very wisely emphasise the fact that sewage farms should be under the best available management, and agricultural results should be quite secondary to the production of a good effluent.

PART IV.—SLUDGE.

The sludge question is, in the majority of towns, the most difficult part of sewage disposal. The Report contains much valuable information, collected from many sources, and one would have liked to have had the subject still further amplified, for it is the chief source of the troubles to which sewage works managers are heir to.

Par. 248.—Little is yet known about the burning or destructive distillation of sludge cake, but the method promises to become a feasible one, if the Mond principle could be applied to sludge cake so as to produce power gas and ammonium salts.

Pars. 253—262.—The experiments on the manurial value of sludge are interesting, but are unsatisfactory, as experiments with manures on one-twentieth of an acre plots and in flower pots for one year always must be. They are of no value to those who are endeavouring to dispose of large quantities of sludge cake to farmers who are willing to pay carriage on it. The fact that the nitrogen and phosphoric acid in cake is in a much less available form than in sulphate of ammonia and superphosphates, should have been the starting point of the experiments and not the conclusion arrived at. It is well known that cake must be put on the land in autumn or early winter to get the best results; it has not time to weather if applied at the same time as quick acting artificial manures in spring.

If the Commission had collected information about the best conditions for applying cake to different crops from districts like Glasgow, where 30,000 to 40,000 tons per year are sent out for agricultural purposes, and where farmers have had experience with this manure for years, the result would have been of great utility to those who wish to dispose of large quantities of sludge cake in this manner.

PART V.—GENERAL.

The treatment of storm water is dealt with in a very satisfactory way. It is a great advantage to have clear official recommendations on a branch of sewage purification which, in the past, has either been entirely neglected or else the provision made for storm water has failed to accomplish much.

Par. 287.—The following paragraph is important:—“In the present state of knowledge, we consider that any regulations in regard to the amount of storm sewage to be treated, and the method of treatment, should be of a tentative character, and that, as regards storm overflows, each place must, to a great extent, be dealt with according to local circumstances. The general principle which should be followed is, we consider, that each local authority should so arrange its sewerage system as to prevent impurified sewage from passing into the river or stream to an extent likely to cause nuisance.”

Again, the Report makes it clear that “the difficulty of dealing with storm water lies, not so much in the actual quantity flowing off an area as the result of rain, as in the rate at which it flows off.”

Storm water is usually most polluted when at its maximum flow, hence the usual overflows on the sewer line, allow the foulest sewage to flow direct into the river during heavy rain.

Par. 295.—The Commissioners consider that the present Local Government Board regulations should be modified, for the special storm filters required therein are found to be costly and inefficient, also the provisions respecting the volumes to be treated are not elastic enough.

Instead of these regulations they recommend as a general rule:—

(1.) Special stand-by tanks of a volume equal to about a quarter of the dry weather flow, kept empty to receive the storm water above about three times the dry weather flow, which should be treated fully in the ordinary tanks and filters worked expansively.

(2.) That any overflow at the works should only be made from these special tanks.

(3.) That no special storm filters should be provided, but that the area of ordinary filters should be enlarged to provide for the filtration of the whole volume requiring such treatment.

(4.) The Rivers Boards or County Councils, as the case may be, shall have power to decide the volume of storm water to be treated, size of stand-by tanks, etc., the Local Authority having a right of appeal to the Central Authority.

If this sound advice is carried into practice it will be a great gain to all concerned. Of course the Com-

missioners recognise that it is impracticable to dispense with the existing forms of storm overflow entirely; for instance, to make the main overflow from the stand-by tanks in cases where the outfall sewer delivers at about river level, would be prohibitively expensive, for it would entail a large spare pumping plant which would only be required on very few days in the year.

Par. 282.—In discussing the choice of a method of sewage treatment, it is made clear that this should depend primarily on local conditions and therefore only guiding considerations are indicated in a general way. The intimate knowledge of these local conditions, which is of such importance to the success of a scheme, can only be attained by prolonged observation and experiment by trained officials: research of this kind cannot be hurried, for some of the most important difficulties in sewage disposal only develop after a method of treatment has been in operation for some years. For example, during the first twelve months a contact bed may give far more brilliant results than a percolating bed, whereas by the end of four years the verdict might be reversed.

The unsuccessful character of many works treating the sewage from small communities, is largely due to the absence of such primary knowledge.

Unless good cheap land, suitably situated, is available, land treatment is not recommended. The results which may be expected from the various processes treating sewages of different strengths are summarised in three tables facing page 202.

This is the first official recognition of the important principle of the expensive use of artificial filters, therefore the rate of filtration given in these tables might have been more clearly defined without compromising the spirit of the Report, which is to avoid fixed legal enactment. For example, this could easily have been done by working out the case of, say, a town with a mean dry weather flow of 1,000,000 gallons per day of average sewage (Class II.), where it is proposed to use continuous flow precipitation tanks and coarse percolating beds 6 feet deep.

From Table II. we gather that “Rate of filtration” per cube per day = 150 gallons, then the maximum rate in storm times = $150 \times 2 = 300$ gallons. Assuming that this town is required to treat three times the mean dry weather flow of storm water completely, then mean dry weather rate of filtration per cube yard per day = $\frac{300}{3} = 100$ gallons, therefore 10,000 cube yards of medium or approximately 1 acre of beds would be required.

Hence it would appear that the term “Rate of filtration” used throughout this Report is merely a figure which may be doubled to get the maximum rate in storm time and only corresponds with the mean dry weather rate in the special case where two volumes of storm water must be treated.

Par. 293.—The Commissioners say, “we think it may be taken that it is practicable to filter three times the mean dry weather flow, and while there are few or no data to show that this is the right amount for which filtration is required, we doubt whether, as a general rule, the filtration of any larger amount will be found to be necessary to prevent nuisance.”

If they had only taken steps to make certain that it will be unnecessary to treat more than three times the mean dry weather flow, it would have avoided much confusion. Then the mean dry weather rate could have been used throughout for expressing the volumes treated on beds, supplemented by the statement that the beds may be used expansively up to a maximum of three times this rate in storm times if it were necessary to treat three dilutions completely. Such a basis would have still been elastic enough to cover the variations in local factors, and would have added a definition to the conception which would have appealed more forcibly to the practical mind, than the basis used in the Report.

Although it is possible that the rates of treatment given in the tables may be attainable when the whole area of beds are at their maximum efficiency, it is doubtful whether such high rates could be maintained in actual practice, especially with a contact bed system. There seems to be little margin allowed for breakdowns or the washing and renewal of material.

Par. 303.—With regard to standards to be applied to sewage effluents, the investigation is still incomplete.

The harm caused by allowing insufficiently purified sewage to flow into streams is summarised under the following heads:—

(1.) De-aeration of the river and consequent injury to fish life.

(2.) Putrefaction of organic matter to such an extent as to cause nuisance.

(3.) Production of sewage fungus and other objectionable growths.

(4.) Accumulation of suspended matter in the river bed or behind weirs.

(5.) Discharge of substances either in solution or suspension which are poisonous to fish or live stock drinking from the stream.

(6.) Discoloration of the river.

(7.) Discharge of intestinal bacteria.

The extent of the purification necessary to avoid the occurrence of all these evil results must vary with the particular circumstances of the town and water course concerned.

Par. 311.—As the Rivers Pollution Prevention Act of 1876 takes no account of this fact, the Commissioners feel strongly that the law should be altered in this sense.

Par. 316.—The recommendations on this subject are of the greatest significance:—

(1.) The Central Authority should determine the tests to be used as standards, and in the first instance prescribes one standard for all non-tidal waters; then the Rivers Boards or County Councils, as the case may be, shall be authorised to raise or lower that standard as local circumstances require, subject to appeal to the Central Authority.

(2.) No action shall be allowed for damages alleged to be due to the discharge of an effluent which complies with the standard fixed for the water into which it discharges, but complaint shall be made to the Central Authority, which shall fix a different standard, if circumstances require it.

Action may be brought in the ordinary courts for alleged damage caused by the discharge of an effluent which does not comply with the standard.

(3.) The Central Authority should have power to suspend the operation of any standard to allow time for construction of works, etc., which justify such suspension.

Par. 320.—A perusal of the replies to questions relating to standards for sewage effluents given in Appendix VII., shows that there is a general consensus of opinion that the mere estimation of the amount of organic matter in an effluent by means of the ordinary water analysis tests is not a reliable index of the effect of the effluent on the stream into which it is discharged; to judge of this a knowledge of the stage of oxidation to which that organic matter has arrived must be obtained. It would be desirable to do this by estimating the total amount of dissolved oxygen that an effluent could absorb during complete oxidation, but unfortunately this process is slow and would occupy two months. Consequently it is necessary to devise some simple, rapid test based on this biological process which is not likely to give conflicting results with different analysts.

Par. 322.—For general guidance the Commission provisionally state that an effluent should not contain more than 3 parts per 100,000 of suspended matter and should absorb less than certain specified weights of dissolved oxygen in 1, 2, and 5 days.

The Commission specify that the suspended matter should be removed before this "aeration" test is applied, but their reason for this is not apparent. To form an opinion of the effect of an effluent on the stream receiving it, the test should certainly be applied to the effluent as a whole. Moreover in its present form this test seems too complex to be useful as a legal standard, and their final pronouncement on this difficult point will be awaited with interest.

The attention of chemists should be drawn to the account of Dr. Adeney's interesting and laborious research on the "Course and Nature of the Fermentative Changes in Natural and Polluted Waters, as indicated

by the Composition of the Dissolved Gases," published in Appendix VII. Amongst other important results it is demonstrated that the fermentation of substances under aerobic conditions by the organisms usually present in water, takes place progressively in two distinct stages, (1) that in which the organic substances are completely broken down, the carbon and nitrogen being largely converted into carbon dioxide and ammonia, a little organic matter remaining as such, but in an altered form; (2) that in which ammonia is oxidised to nitrous or nitric acid or both; during this stage some of the organic matter remaining from (1) may be further oxidised to carbon dioxide and possibly also to nitric acid.

This research is an important step towards ascertaining the nature of the complex changes which take place during the aerobic purification of sewage. As a result of his experience, Dr. Adeney (Appendix VII., page 5) suggests a series of standard tests based on the ratio of dissolved oxygen to dissolved atmospheric nitrogen remaining in aerated mixtures of tap water and effluent, after standing 24 hours at 60° F. These standards are perhaps too elaborate for practical purposes, yet every-thing points to the adoption of some modification of the "aeration" test, together with a limit to the amount of suspended solids, as the ultimate standards for sewage effluents.

Par. 356.—The whole of the recommendations of the Royal Commission centre around the creation of a new Central Administrative Authority, with the local Rivers Board as a first tribunal.

Much difference of opinion has been expressed on this point, but in theory, at least, the proposal should give general satisfaction; for it seems eminently desirable that the vital questions indicated should be dealt with in a comprehensive manner. For instance, it is very essential that the water supplies of this country should be protected, and utilised to the best advantage for the benefit of our dense population.

Our past experience of Government Departments is not encouraging, yet if this new Authority were so constituted that it would break away from old traditions, and carry out its work on broad, progressive lines so as to lead, not hinder, those who are working out the many details of the vital problem of sanitation, it would be a great boon to our national life.

DISCUSSION.

Prof. W. M. GARDNER said that he gathered that on the whole the Report was a very satisfactory one. It appeared probable that improvements were not likely in the future to bear so much on fundamental points as on details.

Dr. G. J. FOWLER appreciated Mr. Thompson's difficulty in summarising the Report, as he himself had made several attempts to do the same. He was pleased Mr. Thompson did not depreciate contact beds. The confusing figures given in the Report with regard to them could probably be explained by making an allowance in the later fillings for water held up in the pores of the beds, this causing decreased capacity. He agreed that these beds could not be used for more than six fillings per day. On the whole he agreed to the recommendations of the Report, though not to the grounds for them. With regard to costs, the endeavour to give definite estimates had resulted in a series of figures of little practical value. These tables should be taken simply as indications of the lines on which estimates should be made, since there was great variation in different places. The estimates given might unfortunately be used to support individual ideas. He thought more general principles should have been embodied in the Report, since the limits of success in several directions were now known. For instance, in dealing with sludge, the difficulty was not in getting it out of the sewage. Much depended on its nature. Sludge from percolating filters was dried more easily than chemically treated sludge, because grease was removed by oxidation in the biological processes. Sludge from percolating filters had not been tried in the agricultural experiments quoted. Sludge cake from chemical treatment disintegrated very slowly. It might pay to wash filter beds, since chemical

treatment increased in cost far more than the efficiency of the resulting purification. He thought a properly regulated Central Authority might do much good, not only in consolidating and guiding the work of individuals, but also in controlling the sources of water supply, and preventing their monopoly by a few large towns.

Dr. H. MACLEAN WILSON advised those who meant to read the Report to cut out about two-thirds of it which dealt with detailed matter on first reading, so as to avoid confusion resulting from mixing this up with the main body of the Report. There were important omissions on the subjects of screening, comparative results of treatment of the same sewage by different methods, and the nature and amount of chemicals to be used in precipitation. The suggestions for standardising sewage were, on the one hand, impracticable, and on the other hand, too empirical and artificial. The formula proposed was evidently not a good one if it had to be varied for different sewages. The question of suspended matter from percolating filters had only been indirectly mentioned. The removal of this matter should not be neglected, since it contained a considerable proportion of polluting matter. It often accounted for as much as fifty per cent. of the oxygen absorbed figure. The question of storm water was not treated in the best way. He was sure the stand-by tanks suggested were better than storm filters, but what was to become of their contents after the storms? With regard to fine and coarse material for percolating filters, he feared filters of fine material were certain to become blocked. He agreed with Dr. Fowler about washing the percolating filters, but did not see how this would work with fine material. He thought the old standard required, viz., that every sanitary authority and manufacturer should use the best available means for purification of sewage and refuse, was the most satisfactory. Any arbitrary fixed standard would put those who had to fix it in a very awkward position, and any variable standards for different localities would leave them still more at a loss as to what to advise.

Mr. G. A. HART thought the Report might be a very dangerous weapon if used indiscriminately in the hands of those without technical knowledge of sewage purification. The Local Government Board had hitherto adjudicated upon such schemes and such an authority must be largely influenced by general considerations and questions of precedent. He regarded the Report as laying down the basis for guidance in prospective legislation. The general recommendations of the Report were good, especially so the expansive volumetric basis for those works constructed for the filtration for storm water, and the consolidation of views with regard to percolation filters. So far no such recognition had been given to those works and only the experience of a few particular places had supported them.

Mr. W. McD. MACKEY was interested to hear lime was now used without slaking, and asked if it would not be more under control if in the ground condition.

Mr. T. FAIRLEY was pleased to hear that the general opinion was that the recommendations were good, but thought it a defect that so little reference to the experience of other countries was supplied.

Dr. H. T. CALVERT would have liked to hear the general opinion on the proposed standards. The suggested formula seemed very empirical and he hoped the Appendix still to be published would justify its use. It seemed a pity that England, which had done so much to solve the fundamental problems of sewage purification, should now be so backward in filling in the details, thus leaving other countries to get ahead of us in this respect.

THE TANNAGE OF SOLE LEATHER WITH MIMOSA BARK.

BY H. G. BENNETT.

(See this J., Dec. 31, 1908, pp. 1193-1195.)

DISCUSSION.

Mr. W. B. HILL said he had tried experiments with mimosa bark without the use of salts but obtained a

product which was too soft. It would be interesting to know what percentage weight of leather was obtained by this process.

Mr. A. G. PERKIN asked what views Mr. Bennett held as to the chemical nature of the astringent tannins. Catechol was probably a constituent of mimosa bark tannin and could condense to form phlobaphenes. It seemed to him that in the extraction of the bark with water the pure tannins were first obtained in solution and the part which was extracted with difficulty consisted of the phlobaphenes which had been formed in the plant itself.

A MEMBER inquired whether it was not now recognised that the tannins from galls were not glucosides as was formerly supposed?

Mr. H. G. BENNETT, in reply, said that although mimosa bark gave leathers which remained soft to the end of the tanning, the drying caused the product to become wonderfully firm. Mimosa bark tannin had now been known for some time, and was a staple tanning material in Australia and the Cape. The acacia had been successfully transplanted to Natal, and was now exported to Great Britain, and was of increasing importance to British tanners. Most of the astringent tannins were catechol tannins, but some catechol tannins, e.g., gambier, were very mellow. Astringency was, however, probably connected with the chemical constitution. Mimosa bark gave "reds" or phlobaphenes but the leather obtained was not so dark as that from quebracho. A good deal of doubt existed even yet as to the constitution of gall-nut tannin. He thought catechol tannins were not glucosides because the amount of sugar naturally associated with mimosa bark was very small and these tannins possessed no souring properties. On the whole the best results were obtained by using a combination of catechol and pyrogallol tannins.

Obituary.

THOMAS WARDLE.

SIR THOMAS WARDLE, one of the greatest authorities of the day on sericulture and all branches of silk manufacture, was born at Leek, in Staffordshire, on January 26th, 1831. He was educated at the local grammar school and at Macclesfield, and entered commercial life at an early age. Having taken up business as a silk-dyer and finisher, he extended his operations to silk and calico-printing. Thomas Wardle was the first to discover a satisfactory process for dyeing the wild tussur silk of India. At the request of the King (then Prince of Wales) specimens of the early results of his efforts in this direction were placed in the Indian Section of the Paris Exhibition of 1878. They were afterwards removed to the South Kensington Museum. They included the first piece of plush made from tussur silk, from which was originated the now considerable Yorkshire industry of "seal cloth," an imitation of sealskin, chiefly prepared from the waste of tussur silk. For several years a "Wardle Collection" of bleached and dyed Indian silks was on exhibition at Lyons; there Thomas Wardle came into close association with the leaders of the silk industry in France. He acted as a juror at the International Paris Exhibition of 1878-9, and was made a Chevalier of the Legion of Honour. He was an original member of the Society of Chemical Industry, and a member of Council (1905-1908). He was also a President of the Society of Dyers and Colourists. At the instance of Sir George Birdwood, who had been the first to call attention to the great possibilities of the commercial utilization of Indian tussur, the Secretary of State for India sent Thomas Wardle out in 1885 to report on sericulture in Bengal, and to collect typical silks from various parts of the country for the then approaching

Colonial and Indian Exhibition at Earl's Court. Several other visits to India subsequently followed, succeeded by reports and advice, which did much to improve methods and to advance the growth of this branch of Indian trade. His most conspicuous service there was the revival of the industry in the Valley of Kashmir. Innumerable difficulties were overcome and a moribund industry was placed upon a footing of prosperity. The whole story is told by Sir Thos. Wardle in his "Kashmir and Its New Silk Industry" (1904). At the Royal Jubilee

Exhibition, Manchester, 1887, he was made Chairman of the Silk Section, when he brought together a magnificent collection, and drew up an exceptionally fine illustrated handbook for his Section. He received the distinction of knighthood in 1897, and was made honorary expert on silk of the Imperial Institute. Sir Thomas Wardle was President of the Silk Association of Great Britain and Ireland, and Hon. Secretary of the Ladies' National Silk Association. He died on Sunday, Jan. 3, 1909, at his residence, Leek, Staffordshire.

Journal and Patent Literature.

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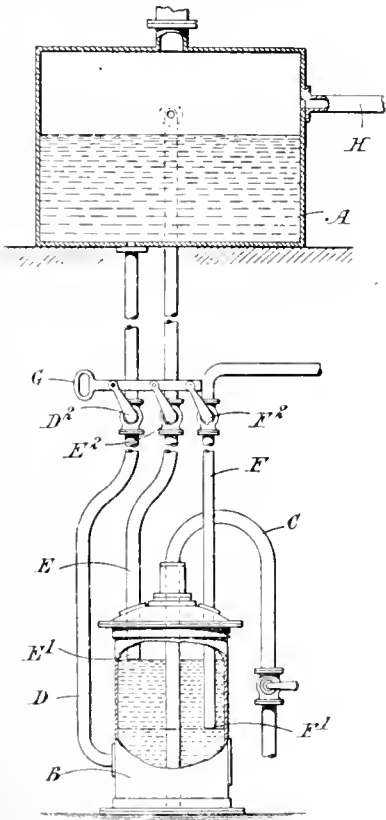
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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Dissolving gases in liquids; Apparatus for—W. Hommel and The Metals Extraction Corporation Ltd., London. Eng. Pat. 27,019, Dec. 6, 1907.



THE invention is particularly applicable to the solution of sulphurous acid in water and to the delivery of predetermined quantities of the solution. The solution vessel, B, is connected with a water supply tank, A, fixed

at a definite height above it, by the pipes, D, E. It is also provided with a gas supply pipe, C, and a solution delivery pipe, F. The three pipes, D, E, F, have valves, D², E², F², all of which are connected to the lever, G, so that they can be operated simultaneously, the valves, D², E², being open when F² is closed and *vice versa*. The apparatus is operated in the following manner. The valves, D², E², being opened, and F² closed, a quantity of water flows from the tank, A, into the vessel, B, until it is filled to the level of the lower end, E¹, of the pipe, E. Sulphurous acid or any other desired gas is then pumped under pressure through the pipe, C, and dissolves in the water, any excess escaping through the pipe, E, which is momentarily unsealed. The valves are then reversed and the solution is forced out by the pressure of the gas through the pipe, F, until the level falls below the end, F¹, of the pipe, F. The quantity of liquid delivered at each operation is regulated by adjusting the depth to which the pipe, F, dips into the liquid in B. If desired, some gas may be passed into the tank, A, through the pipe, H, in order to partially saturate the water and shorten the time necessary to obtain the solution in the vessel, B.—W. H. C.

Centrifugal drying machine. R. Williamson, Motherwell. Eng. Pat. 28,356, Dec. 24, 1907.

THE elastic buffer which supports the spindle of the machine or its collar, is constructed of two or more rings of rubber or other suitable elastic material, separated by loose distance pieces. The object is to obtain a better control of the gyratory motion of the spindle.—W. H. C.

Centrifugal apparatus for separating solids from liquids. Aktiebolaget Separator. Fr. Pat. 392,702, July 25, 1908. Under Int. Conv., July 27, 1907.

THE patent relates to improvements in apparatus of the type described in previous patents (see this J., 1904, 895; 1905, 1162; 1906, 9). One or more of the vanes are allowed to project outside the outer plates of the centrifugal separator disc, in order to protect the other vanes from injury, and to minimise wear and tear on the latter. Protecting pieces may be suitably attached to these projecting vanes in order to facilitate renewal when worn.—C. J. G.

Centrifugal dryer. F. J. H. Bromham. Fr. Pat. 393,415, Aug. 17, 1908.

THE claim is for a centrifugal machine having a horizontal axis, from which the dried material can be intermittently or continuously withdrawn by a pipe, the end of which is provided with scrapers and which is moved vertically

and also horizontally parallel to the axis of the machine. The material to be dried is delivered by a worm-wheel on to an adjustable inclined plate which directs it on to the perforated periphery of the centrifugal drum.—W. H. C.

Dry products from liquids and semi-liquids; Obtaining —, D. M. A. G. Hawes, London. Eng. Pat. 4549, Feb. 28, 1908.

THE claim is for improvements in the apparatus described in Eng. Pat. 1479 of 1906 (this J., 1907, 110), and in application for Eng. Pat. 17,323 of 1907. Two or more perforated rotating chambers are arranged within one outer casing, or the chambers may be constructed of sheet metal, not perforated, and have only their upper ends enclosed in a casing, into which the current of hot air for drying is delivered. The powder resulting from the operation is removed from the bottom of the chambers by a screw-conveyor and from the air scrubbers by brushes or flexible flaps, which are kept in flexible contact with the walls by the centrifugal force resulting from the rotation of the chambers. The rotary chambers may also be constructed of a pear-shape with the apex uppermost.—W. H. C.

Dryer. J. W. Biles, Louisville, Ky. U.S. Pat. 907,219, Dec. 22, 1908.

A ROTARY drying drum has a "heat-conduit" arranged concentrically within and adapted to be rotated. The "heat-conduit" is provided with projections or shelves upon its periphery. The angles at which the shelves project, can be adjusted, and the material which is fed into one end of the drum is lifted by projections from the latter and dropped on to the projections on the conduit, from which after a short interval it again falls back on to the bottom of the drum. It is in this way alternately lifted and dropped, being at the same time moved forward towards the other end of the drum, from which it is discharged.—W. H. C.

Dryer [for paper, etc.]. M. E. Dejonge. Fr. Pat. 393,199, Aug. 11, 1908.

THE claim is for the construction of the casing of the drying chamber of incombustible and heat insulating materials. The casing has an iron frame covered by shutters formed of sheets of asbestos held between metallic gauze or perforated metal sheets.—W. H. C.

Drying apparatus. A. von Dehn. Fr. Pat. 393,273, Aug. 13, 1908.

THE apparatus consists of a horizontal jacketed drum provided with a longitudinal shaft, passing through stuffing-boxes at either end and rotated by suitable gearing. The shaft carries a coil, to the extremities of each whorl of which, agitator plates are fixed. Steam is passed through hollow journals into the coil, and heated air or gas is passed through both the drum and the jacket, which latter has partitions to force the gas to take a tortuous path. When the greater part of the liquid has been evaporated, the current of gas passing through the drum itself is stopped, and a vacuum is created within the drum to complete the desiccation, the passage of gas through the jacket and of steam through the coil being continued.—W. H. C.

Filter-press frames. E. Feix, Tüppelsgrün, Bohemia. Eng. Pat. 5944, March 17, 1908.

THE claim is for a method of securing the rubber packing by which the joints between the metallic (tin for beer filtration) plates or frames of the press are made tight. The packing, which has a dovetail section, is inserted into a rectangular groove formed near the edge of the plate. The outer wall of the groove is then pressed inwards by a roller, so that the rubber packing is gripped tightly.—W. H. C.

Earthenware cocks and pipes. M. Henss, Nied on the Maine, Germany. Eng. Pat. 15,189, July 17, 1908. Under Int. Conv., Jan. 11, 1908.

A LAYER of wire-netting is placed over or around the earthenware pipe or cock and a protecting casing of lead or other suitable metal is cast around the netting so as to surround the cock or pipe. The wire-netting serves to strengthen the metal casing.—W. H. C.

Temperature fluctuations; Apparatus for indicating —, J. E. Hedin, Lidköping, Sweden. Eng. Pat. 15,273, July 18, 1908.

TWO spiral wires, tubes, or bands which alter their shape when heated or cooled, are rigidly fixed at their inner ends to adjustable pins, by which the instrument can be set, and have their outer ends free. They are formed of dissimilar metals having different coefficients of expansion. One spiral is enclosed in a heat-insulating cover and the other is freely exposed to the influence of the temperature it is desired to indicate. Each spiral is connected by a conducting wire to an electrical indicating device, such as a bell, and carries a contact piece at its outer, free end. On expansion of the coils taking place, the contacts touch, the circuit is closed, and the bell or other device indicates that the predetermined temperature, for which the instrument was set, has been reached.—W. H. C.

Kiln. W. Ward, Mitchell, Ind. U.S. Pat. 906,174, Dec. 8, 1908.

THE air-supply for the kiln is preheated by aspirating it, by means of an injector, through a series of arched flues over the grate.—W. H. C.

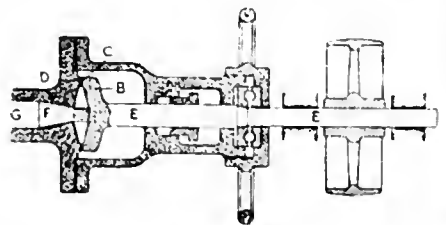
Calclner. C. De Jonge and W. Nevers, Grand Rapids, Mich. U.S. Pat. 907,575, Dec. 22, 1908.

TWO vertical concentric tubes are connected at their ends by annular heads. The diameter of the inner tube is reduced in its lower part; this tube is provided with an interior ledge at a distance from its ends; on this ledge is supported a diaphragm. In the upper part of the inner tube is placed an agitator. Flues extend into the lower part of the inner tube, and pass through the upper annular head to an annular breeching. The inner tube is provided with a cover, through which pass an outlet pipe and a pipe communicating with a blower.—A. G. L.

Fume-condensing apparatus. L. C. Laurent, Denver, Colo. U.S. Pat. 907,379, Dec. 22, 1908.

THE furnace is connected to the chimney or stack by a flue which slopes downwards from the stack to the furnace. Liquid is sprayed into the flue by a number of jets, the orifices of which are turned towards the stack so that the draught may not be impeded. A gutter formed on the bottom of the flue collects the liquid and guides it into a number of outlet pipes passing through the bottom of the flue.—W. H. C.

Emulsions; Preparation of —, W. G. Schroeder. Ger. Pats. 204,061 and 204,062, July 26, 1907.

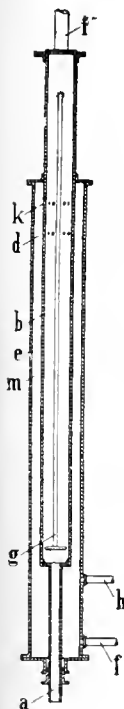


(1). THE process consists in preparing the emulsion in a series of mixing vessels connected only by narrow tubes. The mixing vessels are jacketed, and each is provided with an agitator, the rate of rotation of these agitators decreasing

regularly from the first vessel to the last of the series. The mixing vessels are arranged step-wise one above the other, the components of the emulsion being introduced continuously into the top vessel, and the emulsion drawn off from the bottom one. (2). An apparatus for the preparation of emulsions is shown in the figure. A rapidly rotating shaft, *E*, carries the block, *b*, which has an annular grinding surface, *c*, bearing against a fixed annular grinding surface, *n*. In the space between the two grinding surfaces is a turbine, *f*, which is fixed to *n*. The liquid to be emulsified enters at *g*, and is forced under high pressure, between the two surfaces, *b* and *c*, the emulsion being then withdrawn from the arrangement.—A. S.

Distilling, evaporating, heating, or cooling liquids. O. Brücke, Fr. Pat. 392,986, Aug. 6, 1908.

The apparatus consists of two concentric tubes, *b*, *e*; the liquid to be treated enters by the pipe, *a*, flows upwards through the inner tube, *b*, overflows through the holes, *d*, into the annular space, *m*, and trickles down the outer surface of the tube, *b*, in a thin film, finally escaping through *f*. The gaseous treating medium enters partly through *g*, flowing in the same direction as the liquid through *b*, and partly through *h*, flowing in the opposite direction to that of the liquid through *m*. The gaseous medium along with any vapour given off passes from *m*, through the perforations, *k*, and escapes along with that from the inner tube, *b*, through the pipe, *i*. If desired a heating or cooling jacket may be interposed between the two tubes and the gas given off in each may be collected separately.—W. H. C.



II.—FUEL, GAS, AND LIGHT.

Peat for industrial and metallurgical purposes. E. Nystrom, J. Canadian Min. Inst., 1907, 11, 231—235.

AIR-DRIED machine-made peat is said to have a fuel efficiency equal to 55 per cent. of that of ordinary coal, but the cost of handling and transporting so bulky a material, and the readiness with which it absorbs moisture, greatly decreases its value. Suction producer gas may be produced from peat containing up to 45 per cent. of moisture, though it is recommended that for this purpose the moisture should not exceed 30 per cent. Some retort-made peat coke manufactured in Germany and Russia (see this J., 1907, 1270) is said to compare favourably with charcoal for blast-furnace and other metallurgical purposes. Three tons of air-dried peat are required to produce one ton of coke, and the non-condensable gases are utilised for heating the retorts. A new method of manufacturing peat fuel consists in reducing the peat to a pulp, and without drying, subjecting it, under a pressure of 5—10 atmospheres, to a temperature of 150—175 °C. The carbonised material is then filter-pressed, dried, and briquetted. The fuel has a calorific value approaching that of ordinary coal and does not absorb moisture.—F. R.

Coke-oven gas; Utilisation of —. E. Cuvelette, Soc. Ing. Civ. de France, Proc.-verb., 1908, 243—245.

THE successful application of blast-furnace gases in gas-engines points to a similar utilisation of coke-oven gas.

In modern regenerative by-product ovens about 40—50 per cent. of the gas generated is available. It must be passed through purifiers to remove tar, sulphur, and cyanogen compounds before it can be used in engines. Thus purified, it is very rich in hydrogen (50—60 per cent.). Up to the present, engines using this gas have been installed on the Continent to a total of about 40,000 H.P., mostly of the double tandem type; the largest yield 1200—1500 H.P. Careful trials in the Cockerill works have shown that 1 kilowatt at the terminals is yielded by a consumption of 1 cb.m. of gas of 4000 calories per cb.m., whilst 2½ cb.m. of the same gas are required to generate the same energy by means of boilers and turbines.—J. T. D.

Water-gas production in vertical retorts; Economy of —. B. Strache, J. Gasbeleucht., 1909, 52, 12; E. Körting and Geipert, *ibid.*, 13.

(1). STRACHE criticises the conclusion of Körting and Geipert that it is economical to introduce steam into vertical retorts towards the end of gasification (see this J., 1908, 1143). From the results obtained in water-gas producers, it is argued that if 80 per cent. of the steam is decomposed, the yield of water-gas in a vertical retort would not exceed 5.1 cb.m.; the actual yield of 36.5 cb.m. is only realised by passing steam through the retort for 1½ hours, and probably 90 or 95 per cent. of the steam is not decomposed. (2). Körting and Geipert state that actual measurements show that in the vertical retorts, 0.568 kilo. of steam is used per cb.m. of water-gas formed, as against 1 kilo. in a water-gas plant. It is pointed out that Strache takes no account of the greater depth of the bed of hot coke in a vertical retort, nor of the external heating of the retorts during the introduction of steam.—A. T. L.

Thorium. C. Baskerville. See X.

Water gas, suction gas, and other gases in factories; Memorandum as to the use of —. Factory Department, Home Office, Dec., 1908. Form 827. [T.R.]

Carbonic oxide poisoning.—In recent years there has been great extension of the manufacture and use of water gas and other gases of a similar nature (suction gas*, Dowson gas, Mond gas, power gas, producer gas, blast furnace gas, &c.) for driving gas engines, heating furnaces and boilers in factories, welding, soldering, and many other industrial purposes. The particular danger associated with all these gases is that of poisoning by carbon monoxide, which is also a constituent of ordinary coal gas; but whereas the proportion in coal gas varies from 4 to 12 per cent., in carburetted water gas it reaches 30 per cent., and in uncarburetted water gas 50 per cent. The other gases named above usually contain from 10 to 25 per cent.

The use of these gases was the subject of an inquiry in 1899 by a Departmental Committee, who recommended in their Report† that the manufacture and distribution for heating and lighting purposes of any poisonous gas which does not contain a distinct and pungent smell should be prohibited, and that regulations should be made limiting the proportion of carbonic oxide. In recent Acts authorising companies and local authorities to manufacture and supply Mond or similar gas for motive or heating purposes it is required (1) that the gas shall be strongly scented; and (2) either that the proportion of carbonic oxide in the gas shall be limited to 11 per cent., or the Secretary of State may impose regulations to protect against the risk of poisoning. It is made the duty of the Inspectors of Factories to enforce these provisions as regards factories and workshops in which the gas is used.

The Annual Reports of the Factory Department during the last eight years show a steadily increasing number of

* The name is derived from the fact that every suction stroke of the gas engine draws the vapour (previously heated) into the generator, with which the engine communicates directly without interposition of a gasholder.

† Report of Water Gas Committee, 1899, on the Manufacture and Use of Gases containing a large proportion of Carbonic Oxide. C. 9164. Wyman & Sons, Ltd., Fetter Lane, E.C. Price, 1s. 2d. by post 1s. 6d.

reported cases of poisoning by carbonic oxide on manufacturing premises. Thus in the five years 1899 to 1903 there are references to 51 cases (17 fatal), in the two years 1904 and 1905 to 57 (18 fatal), and in the two years 1906 and 1907 to 136 (14 fatal). The lessened mortality is due possibly to better knowledge of the methods of resuscitation. This list does not include the slight cases of partial unconsciousness of which there is mention, entailing only a few hours' absence from work. These casualties were traced to several causes, among which may be mentioned:—(1) leakage from joints or taps in engines, or in pipes and flues conveying gas; (2) gradual escape of gas into a small engine-room, weigh-cabin, office, or the syphon-pit of the Dowson apparatus; (3) cleaning and repairing of engines and of tanks, scrubbers, or blast furnace flues, before a sufficient time had been allowed for the gas to escape; (4) inefficient disconnection from the blast furnace of the flue during cleaning; (5) charging cupola furnaces at raised platforms; (6) percolation of gas, through several yards of soil, from underground flues; (7) conveyance by the wind of gas escaping from defective reservoirs, or of waste gas allowed to blow off unburnt, through ventilators and open windows into workrooms at some distance from the generating plant; (8) incomplete combustion of gas in defective gas ironing machines; (9) ignorance of danger and of the earliest symptoms produced; (10) inodorous nature of the gas; (11) working alone; (12) lack of rescue appliances.

More particularly in connection with suction gas plants the constantly recurring cases of poisoning are evidence of the care necessary in installation and working. Accidents have happened by reason of faulty situation in cellars, or in places inadequately ventilated. They emphasise the desirability of posting up in the engine-house a cautionary notice (such as is now issued by some manufacturers of gas engines) with the necessary routine instructions, *e.g.*—

(1.) *Starting*.—The main stop valve must be shut and the chimney valve opened; otherwise gas will escape into the room, owing to the pressure set up by the starting fan.

(2.) *Stopping*.—As soon as the stop valve of the engine is shut, the chimney valve must at once be opened, so as to allow the gas to escape into the open air.

(3.) *Charging with coal*.—The head must never be placed immediately above the hopper.

(4.) *Testing*.—All air must be drawn out of the washers and pipe before any light is applied so as to avoid an explosion, and the cock must always be closed between tests.

(5.) *Cleaning and repairing*.—After the fire is quite out, air must be blown through by the fan, and the generator doors opened; and the plant must then be left for several hours *before any cleaning is done*. Cleaning should be done by daylight; and no fire, naked light, or smoking must be allowed near the plant.

Other special precautions may need to be mentioned in the notice; thus where one of a range of boilers fired by waste blast furnace gas has to be disconnected for internal sealing and flue cleaning, disconnection should be complete, either by a running joint or a short piece of pipe which can be removed—preferably a flange pipe; and while anyone is inside the boiler, a man should keep watch outside.

Carbonic oxide poisoning may occur in other ways apart from the manufacture or use of the particular gases named. Thus danger of this kind may arise in laundries from the use of gas irons, and in workrooms from defective gas fittings (especially absence of stop-pins indicating the cutting off of gas) and from gas stoves not provided with chimneys or flues for carrying off the products of combustion. The absence of a chimney in a room greatly increases the risk. Carbonic oxide is found also in lime kilns, cement works, and where braziers and coke fires are used in confined spaces.

Preventive measures.—The precautionary measures to be considered must vary somewhat according to the manner in which the gas is manufactured and used in different works, but the following are of general application:—

(1.) The structural conditions should be such as not to entail unnecessary risk; thus—

(a) The suction or other gas engine should not be in a confined space or in a basement or sunk room, but in a room or shed properly lighted and adequately ventilated (by special openings and by a fan where practicable) to the outer air, and either without doors or with doors cut away at the top or bottom.

(b) The air intake for the engine should be from the open air, and not from the engine house itself. The same observation applies to the silencer or air-box, if any.

(c) The vent pipe through which the gas main to the engine is cleared of air, or any similar vent pipe, should never end inside a building, but always outside, and at least six feet from the ground.

(d) The openings giving access to any part of the gas circuit should be few, and in positions as safe as possible, and opened only in cases of real need, and by responsible persons.

(2.) A competent person should be made responsible for inspecting at stated short intervals all valves and connections, to see that there is no leakage; and for keeping a signed and dated record of such inspection.

(3.) A notice, mounted on a board, should be affixed in the engine room or gas-plant house, as recommended above.

(4.) No person should be allowed single-handed to execute work in a place where exposure to the poisonous gas is to be anticipated.

(5.) No workman should enter, or approach when opened, the holder or other part of the gas circuit until the gas has been well flushed out by fresh air.

(6.) A cylinder of compressed oxygen, fitted with lever key, nipple and union, and rubber gas-tubing with mouthpiece, should be kept in constant readiness. The apparatus should be in charge of not less than two persons* instructed in its use. At least once a month it should be examined by them, when the condition of the mouthpiece and of the rubber tubing should be observed. If the rubber becomes hard and dry, warm water will restore the pliability.

(7.) Ropes should be provided for rescue purposes, and the place where they are to be found stated on the notice (par. 8). Where dangerous work is foreseen, special rescue appliances should be supplied, such as those now kept in many chemical works and coal mines; they supply the rescuer with air or a mixture of oxygen and air, so that he does not breathe the poisonous gas.

(8.) Further notices should be affixed in the works, explaining the deadly nature of the gas, the symptoms of poisoning, and the means of rescue and "first aid."

(9.) The workmen should be practised in rescue drill, including the use of the appliances provided. They should be further instructed by a medical man in artificial breathing and administration of oxygen. They should be especially warned of the danger of exposing a "gassed" person to cold.

(10.) Men in charge of any engine worked by poisonous gas, or of any apparatus in which such gas is stored, or otherwise exposed to risk of inhaling it, should be free from any disease of the heart and lungs. Employers would do well to cause such persons to be medically examined and certified.

Additional precautions will be required, according to the character of the works. Thus the Associated Portland Cement Manufacturers, Ltd., have adopted the following notice, in addition to instructions somewhat similar to those given here:—

Regular inspection of kilns must be made on opening after being burnt off to see that they are safe for men to

* It should be their duty to gauge the cylinders (by means of a pressure gauge), whenever it has been used and see that they are adequately charged for future use.

work in. Under normal conditions the kiln is partly and sometimes entirely drawn before the chamber is cool enough to enter to clear for reloading, and inspection must cover safety, not only as to heat but as to gases. The eye in front of kiln and back eye of chamber must be opened when drawing is commenced, and entrance to chamber must be made cautiously. Should there be the slightest indication of gas, a paper torch must be thrown into the kiln and seen to burn out properly before work therein is commenced. If after several attempts it is clearly shown that a paper torch will not burn freely, the men must not be allowed to enter, and the matter must be at once reported to the manager. This applies more particularly where there is a kiln burning next to one that is being drawn, but in any case the dampers of the kiln being drawn must be down tight, and precautions taken generally to see that fumes from a burning kiln on the same flue cannot get back into a kiln in which men are at work, and this applies not only to the work of clearing or drawing, but to repair or any kind of work done in or about kilns.

In case of a kiln which has lain cold for a long period, all the above-named precautions must be observed, and, in addition, before men enter the pan or chamber, the drawing eye of the kiln must be opened, and thoroughly freed below so that the air may pass into the charge. Employees are especially warned against adopting the means employed by many persons ignorant of the first principles of resuscitation, viz., placing men on their faces with mouth over a hole in the ground. All such means are strictly forbidden. The administration of stimulants in any form is most dangerous, and is also strictly forbidden.

In towns where the public gas supply is largely charged with water gas, attention to gas fittings in factories and workshops becomes a matter of increased moment.

Respirators of the usual type designed to protect the wearer against inhalation of dust are of no avail as a protection against carbonic oxide poisoning.

The symptoms of carbonic oxide poisoning begin with throbbing of the blood vessels of the head, giddiness, palpitation of the heart, and weakness of the limbs. These become greatly aggravated after any exertion. Owing to their insidious onset and the cumulative effect of the gas the weakness of the limbs may come on without attracting notice, so that the person affected is unable to make good his escape.

Headache, anæmia, and defective nutrition may result from the long continued breathing of the gas in amount too small to produce immediate effects. Such symptoms may be caused by defective gas fittings in workrooms.

Remedies.—The appropriate remedies for poisoning by carbonic oxide are—fresh air, artificial breathing, administration of oxygen, and the application of warmth. They should be applied without any delay, and hence the importance of competent "first aid."

PATENTS.

Briquettes; Manufacture of — from coal, peat, and moor coal. J. Buss and C. Fohr. First Addition, dated Aug. 7, 1908 (under Int. Conv., Aug. 10, 1907) to Fr. Pat. 372,744, Dec. 17, 1906 (this J., 1907, 520).

THE process described in the main patent may be applied to the manufacture of briquettes from combustible materials which have previously been subjected to distillation, e.g., coke. Improvements are also claimed in the means for introducing steam into the mixing chamber, and a special scraper with curved arms is provided for expelling the mass from the lower end of the chamber.—A. S.

Briquettes; Binding agent [from sulphite-cellulose lyes] for the manufacture of —. Gewerkschaft Eduard. Fr. Pat. 392,898, Aug. 3, 1908. Under Int. Conv., March 11, 1908.

THE concentrated lye is converted into a gelatinous mass by heating with an acid, such as sulphuric acid, or with suitable salts, such as aluminium sulphate, and the product is mixed with an inert material such as coal dust,

infusorial earth, etc., to form a mass capable of being moulded. Tar or asphaltum may be added to the lye before the treatment with the acid or salt.—A. S.

Smokeless fuel; Distillation of coal for the production of a —. W. C. White, Sidecup. Eng. Pat. 28,692, Dec. 31, 1907.

BITUMINOUS coal, preferably small, is sprayed, before or after it is charged into retorts with a mixture in water of equal proportions of sodium chloride, sodium carbonate, and calcium chloride, the quantity of the mixture used being such as to contain about 2½ lb. of the salts per ton of coal. The coal is heated in retorts for 4 to 6 hours at a temperature not exceeding 450° C., a low pressure being maintained by a vacuum pump, until about half of the gas in the coal has been distilled. The fuel is suitable for domestic purposes.—A. T. L.

Coke quenching apparatus. Akt.-Ges. für Kohlendestillation, Gelsenkirchen-Buhlme, Germany. Eng. Pat. 18,110, Aug. 28, 1908. Under Int. Conv., Oct. 21, 1907.

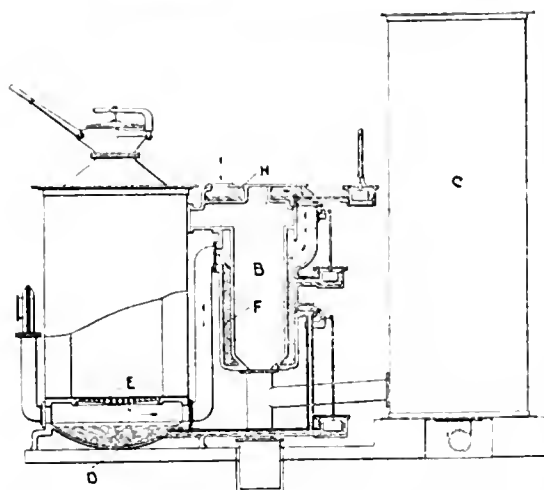
THE apparatus, which is suitable for use with horizontal ovens, comprises two water-chambers, which, when brought into position before the oven, form continuations of the side walls of the retorts. The inner face of each water-chamber is perforated and the coke is sprayed with water as it passes between the chambers. The apparatus is mounted on wheels which run in rails of U-section sunk in the ground, and in order to present a smooth surface for the passage of the coke, the lower tie-bars connecting the water-chambers are bent so as to fill the channel rails in front of the retort. The space between the inner ends of the water-chambers and the face of the oven is closed by iron doors hinged to the water-chambers and secured to the tie-bars of the oven from the outside by wedges.—A. T. L.

Producer gas; Apparatus for the manufacture of —. L. C. Barker, Colchester. Eng. Pat. 26,644, Dec. 2, 1907.

THE object of the invention is to ensure that the body of the fuel through which the steam and air passes in the producer shall always be in a proper state of incandescence. The air and steam enter the producer through an opening the width of which is regulated by a damper; the width of the opening so formed, regulates the depth of the mass of incandescent fuel, as the air and steam traverse the producer horizontally and escape into a flue on the other side. The hearth of the producer is hollow and contains water which is vaporised, the steam so formed being either allowed to pass into the exit flue and mix with the escaping gas, thus assisting the deposition of tar in the scrubber, or being mixed with the incoming blast of air and steam. When the apparatus is supplying producer gas for a gas engine, the use of a vaporiser is also claimed, in which the water to be vaporised is admitted to an annular vaporising space surrounding the exhaust pipe of the engine, the flow being regulated by a valve in such a manner that water is admitted to the vaporiser each time the cylinder charge is exhausted.—E. F.

Gas producers. E. Jones, Perry Bar, and Kynoch, Ltd., Birmingham. Eng. Pat. 6495, Mar. 24, 1908.

THE object of the invention is to provide a float feed arrangement for automatically controlling the supply of water to the vaporiser of suction gas producers. The water is contained in three vessels, H, F, and D, and flows from one to the other in the order named, the flow in each case being regulated by a valve controlled by a float. The vessel, H, is a shallow pan, the bottom of which is formed by the top of the vaporiser. The air passes over this pan on its way to the producer, as indicated by the arrows. The producer-gas passes through the inner tube, B, of the vaporiser on its way to the scrubber, C. The second vessel holding water is formed by the outer tube of the vaporiser. From this it flows to the



third vessel, D, which is under the ash-pit, ensuring that the air which enters through the fire-grate, E, is charged with a large quantity of water-vapour. The amount of water in each of the three containing vessels is controlled automatically by the level of the water in it. Sometimes only the first and second controlling apparatus is used.—E. F.

Gas; Manufacture of —, and apparatus therefor. J. Hammond, Eastbourne, and J. Cash, Hove. Eng. Pat. 12,955, June 17, 1908.

THE process consists in the combustion of the outer surface of a mass of coal, accompanied by the destructive distillation of the internal mass, and the intermittent formation of water-gas from the coke produced. The apparatus is of the producer type. The coal is forced up a vertical conduit to the centre of a rotating annular stepped grate at the base of the producer-chamber. The walls of the producer-chamber are formed with vertical ribs or channels to facilitate the passage of air over the outer surface of the mass of coal. Above the producer-chamber is a fuel-chamber surrounded by an annular regenerator. The producer is provided with steam and air inlets below the grate. The working with twin producers is as follows: Both producers are blown with air until the outer parts of the mass of coal are carbonised. The products of combustion pass through the regenerators, and thence through the water-gas carburettor and superheater, or to a stack-pipe, and the gases distilled from the mass of coal, are drawn by exhausters through the fuel-chambers and are passed through the scrubbers. The air-blast is next stopped, and one of the producers is blown with steam. The outlet from the regenerator being closed, the steam is forced through the incandescent coke into the mass of fuel, and through the fuel-chamber; the gases then pass through the regenerator of the other producer, and through the fuel-chamber to the carburettor and superheater. The steam-blow is made in each producer in turn. Steam is used in excess, so that considerable quantities of ammonia and tar are obtained as by-products.—A. T. L.

Gas; Process of producing —. C. J. Greenstreet, Alton. Ill. U.S. Pat. 906,793, Dec. 15, 1908.

LIMESTONE or other mineral carbonate, and a carbonaceous substance are heated in a retort, and steam is injected during the heating. The carbonaceous substance may be the waste from the distillation of crude petroleum, and the illuminating and heating values of the gas may be increased by injecting oil with the steam.—A. T. L.

Gas producer. J. Maly, Dresden, Germany. U.S. Pat. 906,812, Dec. 15, 1908.

THE base of a gas producer is formed by a revolving annular water trough. A pyramidal grate is mounted

centrally in the water trough and revolves with it, the apex of the grate being eccentric to the axis of rotation. The interior of the grate is divided, by horizontal partitions, into a number of compartments with independent steam and air supplies. The uppermost compartment is provided with a perforated vertical partition, so that more steam is delivered at one side of the upper chamber than at the other.—A. T. L.

Gas; Apparatus for producing —. F. E. Fink, Cortland, Ohio. U.S. Pat. 907,110, Dec. 15, 1908.

A COKEING chamber is arranged above a producer chamber and connected thereto by a vertical neck, and a water-seal is arranged below the producer chamber. A vertical shaft with radial arms extends through the two chambers and the neck, and is rotated to stir the fuel. Air inlets are provided near the base of the coking chamber, and the tar and by-products are drawn off from the upper part of the coking chamber by a steam-jet. The tarry gases are delivered, with air if desired, through a series of conical deflectors, into the centre of the lower part of the producer chamber. Gas outlets are provided in the upper parts of the coking and producer chambers, and the gases from each chamber may be led away separately or through a single main.—A. T. L.

Gas producer. A. Bouvier. First Addition, dated July 30, 1908, to Fr. Pat. 376,201, March 28, 1907.

THE low-grade gas from a producer is passed through a combined washer, scrubber, and dryer as described in the main patent. This portion of the apparatus consists essentially of a well containing water, into which the gas is delivered, surmounted by a chamber in which horizontal turbine- or fan-wheels, mounted on a central vertical shaft, are caused to rotate by the suction of the gas-engine. On the upper portion of the shaft a series of perforated plates are mounted in order to retain the moisture carried by the gas. Owing to the jets of water playing on the fan-wheels and the deposition of tar and dust on them, it is difficult to obtain uniform rotation by means of the suction of the gas-engine alone. According to the present addition, therefore, a horizontal water-wheel is fixed on the shaft above the fan-wheels, and is caused to rotate by jets of water introduced tangentially, the water then falling and serving to wash the gas.—A. S.

Retort furnaces; Vertical — for the manufacture of illuminating gas. C. Bolz. Fr. Pat. 393,081, July 11, 1908.

A NUMBER of vertical retorts are fixed in rows in a chamber through which the heating gases pass in an upward zigzag path formed by horizontal baffles. A gas-producer is arranged beneath each retort-chamber, and regenerators above the level of the operating platform and between adjacent retort-chambers in the length of the furnace. The producer gas and the hot air from the regenerators are admitted to each retort-chamber at both sides, through apertures opposite to the spaces between the rows of retorts; or in an alternative construction, the heating gases are admitted to the retort-chamber through apertures in a central flue running between two rows of retorts, the apertures being opposite to the spaces between the retorts. The heating gases pass from the retort-chambers to the regenerators, and finally escape through short shafts built directly above the regenerators. The retort-chambers and the superstructure are supported on columns independently of the lower part of the structure. The arrangement of the regenerators between the retort-chambers, instead of below them, enables a water-gas generator to be placed beneath each retort-chamber, and the hot coke from the retorts can be discharged directly into the water-gas generator; a conveyor is also placed between the gas producers and the water-gas generators. In charging the retorts, the coal is discharged from a hopper on to an inclined surface, so that the larger pieces rebound and are thrown towards the sides of the retort and afford a free passage for the gases formed during the distillation.—A. T. L.

Oil-gas; Apparatus for the production of ——. P. Suckow and Comp. Inhaber R. Meyer. Ger. Pat. 202,579, June 5, 1907.

THE retorts in which the oil-gas is produced, are heated externally at the bottom. They are of rectangular cross-section and are narrower at the bottom than at the top. The bottom edges of the retort are rounded, and along the middle of the floor of the retort there is a projection of triangular prismatic form jutting into the gas-producing space.—A. S.

Washer-scrubbers for the purification of cool- and other gases. Kirkham, Hulett and Chandler, Ltd., and S. Hersey. London. Eng. Pat. 28,387, Dec. 24, 1907.

THE patent relates to washer-scrubbers comprising a series of compartments in which washing devices, such as sets of parallel discs, are rotated. The washing devices in each pair of adjacent chambers, are mounted on a central hollow boss, which extends through the dividing wall between the compartments. The gases entering the first compartment of the scrubber through an opening in the casing, pass through the washing device from the circumference towards the centre of the discs, and then through the hollow boss to the centre of the washing device in the next compartment. A packing ring is provided to prevent the passage of gas from one compartment to the next outside the hollow boss. The washing discs are built up of bundles of sector-shaped plates held in position by bolts, and the plates in each bundle are connected together by an independent bolt near the outer edge, by means of which the bundles of plates can be lifted out through manholes in the casing of the scrubber.—A. T. L.

Coal gas or water gas; Methods of scrubbing, cooling, or otherwise treating ——. J. S. McIlhenny, Washington, U.S.A. Eng. Pat. 8729, April 21, 1908.

CONDENSERS or coolers and scrubbers are arranged alternately in a series, and the gas is passed through in the opposite direction to the cooling medium. The condensers successively increase in size, and the scrubbers decrease, from the end at which the gas enters. The speed of the gas is thus successively diminished in its passage through the condensers and increased in its passage through the scrubbers. The speed of the cooling medium may be successively increased in its passage through the condensers. The condensers and scrubbers are so connected that the cooling medium may be used for scrubbing the gas after it has been employed in its particular stage of the cooling.—A. S.

Incandescent bodies for electric lamps; Manufacture of ——. F. J. Planchon, Paris. Eng. Pat. 4956, Mar. 4, 1908.

AN aqueous or alkaline solution of a carbohydrate is mixed with an alkaline solution of an oxygenated compound of tungsten or molybdenum, such as tungstic acid, and the mixture is poured into dilute acid. A compound of tungstic acid and the carbohydrate is precipitated, which contains from 68 per cent. of tungstic acid if gum arabic be used, or up to 72 or 76 per cent. if cellulose be used. This compound, either alone or mixed with its components or with other substances, is formed into a plastic mass with water or with alkali, and made into filaments in the usual manner.—A. T. L.

Incandescent electric lamps, heaters, and the like; Incandescent or heating bodies containing or consisting of zirconium for ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, New York. Eng. Pat. 5415, Mar. 10, 1908.

FILAMENTS or other conductors are made from zirconium oxalate with just sufficient finely-divided carbon to effect reduction to metallic zirconium on heating to the necessary temperature, without leaving any residual carbon. No binding material is necessary since the zirconium

oxalate itself forms a tenacious paste, which can be squirted. It may be prepared by the precipitation of hot zirconium nitrate solution with ammonium oxalate, and has a smooth, even, gelatinous texture, resembling that of starch paste. The heat treatment necessary for the reduction, may be carried out in an inert atmosphere or in a vacuum, and the furnace described in Eng. Pat. 29,809 of 1904 (this J., 1905, 976) may be used, though it is better to replace the graphite heater there described by one made of tungsten. The method may also be applied to the production of conductors consisting of alloys of zirconium with other metals. The use of finely-divided reducing agents other than carbon, is also claimed.—E. F.

Electric incandescence bodies of tungsten; Manufacture of ——. Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 19,311, Sept. 14, 1908. Under Int. Conv., Sept. 26, 1907.

NICKEL tungstate is reduced, for example by heating in hydrogen, and the resulting ductile alloy or mixture of tungsten and nickel is heated to volatilise the nickel. In carrying out the process, nickel tungstate is mixed with tungsten powder, or with a reducible compound such as tungstic acid, or with colloidal tungsten compounds such as are described in Eng. Pats. 11,716 and 16,489 of 1907, and the Second Addition to Fr. Pat. 378,743 (this J., 1907, 1192; 1908, 496, 1104), and the mixture is formed into rods or filaments. The mixture should contain nickel and tungsten in proportions which will give an alloy containing 5 to 20 per cent., and preferably 12 per cent., of nickel. A rod 0.6 mm. thick would be heated in a current of hydrogen at 1650° C. for 50 seconds, but the best working conditions are different in different cases. After reduction, the filaments are subjected to a drawing and rolling process, and then heated electrically in a vacuum.—A. T. L.

Coke ovens for the recovery of by-products. T. von Bauer, Berlin. Eng. Pat. 28,290, Dec. 23, 1907.

SEE Fr. Pat. 330,720 of 1908; this J., 1908, 1103.—T. F. B.

Gas generators. B. Junquera, Oviedo, Spain. Eng. Pat. 7105, March 31, 1908. Under Int. Conv., June 26, 1907.

SEE Fr. Pat. 379,246 of 1907; this J., 1907, 1192.—T. F. B.

Gas producers. W. E. Lake, London. From E. N. Trump, Syracuse, N.Y., U.S.A. Eng. Pat. 15,042, July 15, 1908.

SEE U.S. Pat. 893,114 of 1908; this J., 1908, 848.—T. F. B.

Gas; Process of making illuminating ——. International Gas Development Co. Fr. Pat. 393,379, Aug. 14, 1908.

SEE U.S. Pat. 896,795 of 1908; this J., 1908, 931.—T. F. B.

Incandescence bodies of metallic tungsten; Manufacture of ——. Siemens und Halske A.-G. Fr. Pat. 393,644, Aug. 25, 1908. Under Int. Conv., Sept. 26, 1907.

SEE Eng. Pat. 19,311 of 1908; preceding.—T. F. B.

Analysis of gases [products of combustion]; Apparatus for the ——. U.S. Pat. 906,687. See XXXII.

Nitrogen; Process for preparing pure ——. from combustion gases. Ger. Pat. 204,882. See VII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum; New colour-reaction of ——. C. Arragon. Chem.-Zeit., 1909, 33, 20—21.

AMERICAN petroleum, when shaken vigorously with an equal volume of nitric acid (free from nitrous acid), of

sp. gr. 1.4, becomes coloured bright violet, whilst the acid turns yellow. Austrian, Bohemian, Galician, or Russian petroleum when similarly treated is coloured yellow, and the acid becomes brown. Mixtures of American oil with the other oils strike the violet colour in the first instance, but after a few seconds this vanishes and the yellow colour appears and remains. In this way, for example, 10 per cent. of Austrian oil can be detected in admixture with American oil.—J. T. D.

Mineral lubricating oils; New values in the analysis of —, R. Kissling. Chem. Rev. Fett- u. Harz-Ind., 1909, 16, 3—5.

In a previous communication (this J., 1908, 1053) the author described a method of testing the behaviour of machine oils under conditions of continual heating, such as they would encounter in, e.g., turbines. The examples given before included only one kind of heavy Russian machine oil, and the following results are therefore quoted:—

Russian machine oils.	Sp. gr. at 15° C.	Viscosity (Engler).	Flashing point ° C.	Ignition point ° C.	Before heating.		After heating.		Total of Tar- forming and coke- forming values.
					Tar value.		Tar- forming value.	Coke- forming value.	
Cylinder oil, Nobel 00.....	0.912	13.00 at 50° C.	240	280	0.168	0.468	0.355	0.823	
Do.....	0.913	14.00 at 50° C.	240	280	0.266	0.501	0.484	0.985	
Heavy machine oil, Nobel C.....	0.909	7.00 at 50° C.	215	240	0.239	0.458	0.782	1.240	
Spindle oil.....	0.892	6.80 at 25° C.	175	200	0.213	0.474	0.753	1.227	

From these figures it appears that as regards the amount of tar they contain and their tar-forming and coke-forming values, Russian lubricating oils are inferior to Pennsylvania, but better than Texas oils.—C. A. M.

Paraffin oil; Note on the iodine value of —, J. Dreyfus. J. Amer. Leather Chem. Assoc., 1908, 3, 394.

To obtain constant results fully 80 per cent. of the amount of the Hanus iodine solution added, should be in excess, and at least 8 hours should be given for the absorption of the iodine. The Hübl-Waller method is of no use.

—H. G. B.

Colloidal solutions of calcium soaps in heavy mineral oils. Holde. See XII.

PATENTS.

Ammonia from gas-liquor; Apparatus for separating —, Berlin-Anhaltische Maschinenbau A.-G. Ger. Pat. 204,858, Jan. 12, 1907.

THE patent relates to a process for utilising the heat of the gases from the gas-retort furnace for distilling ammonia from the gas-liquor. The ammonia still is mounted above the flue through which the furnace-gases pass on their way to the chimney. The lowest compartment of the ammonia still is divided into upper and lower sections, connected by vertical tubes passing through the upper bend of an inverted U-shaped pipe, the limbs of which open into the furnace-gas flue below. The furnace-gases pass through this pipe and serve to distil off the ammonia, and a movable damper is provided in the flue between the two limbs of the inverted U-shaped pipe, so that the proportion of the gases passing through this pipe can be regulated as desired.—A. S.

Sodium compound of indene; Process for preparing —, Ges. f. Teerverwerthung. Ger. Pat. 205,465, Feb. 12, 1908.

A compound of indene with sodium is obtained by the action of sodium amide, or sodium in presence of dry ammonia, on indene or hydrocarbon mixtures containing indene. For example, 500 kilos. of coal tar distillate,

b. pt. 175—185° C., freed from phenols and bases, are heated with 40 kilos. of sodium amide, with agitation, for 1½ hours at 100—105° C.; when cool, the supernatant layer of hydrocarbons is removed, and the sodium compound of indene is recovered from the hydrocarbons in which it is in solution by heating at 110°—130° C. under a pressure of 20—30 mm.—T. F. B.

Decomposition of indifferent chemical substances (mineral oils, etc.) and the transformation of their elements into products of technical value; Process and apparatus for the —, J. Tanne and G. Oberländer. Fr. Pat. 393,047, Aug. 8, 1908.

THE material, (mineral oil), to be treated is placed in a closed tank provided with a vertical extension at the top, closed by a movable cover. A coil formed of conducting material and covered with asbestos or other similar non-conducting body is suspended in the liquid. That portion of the coil which is immersed, has a large number of very fine perforations. The coil is isolated from the tank itself

by porcelain rings and is heated by passing a current of electricity through it, the temperature being controlled by thermometers in contact with the projecting ends of the coil. Air, chlorine, or any other suitable gas is passed into the coil at each end, from pipes connected to the coil by insulating rings, and after becoming heated passes through the perforations. The liquid in the tank is absorbed by the porous covering of the coil, and the gas passing through the latter is forced into intimate contact with the absorbed liquid. The result of this forced intimate contact is stated to be the elimination of hydrogen and the formation of bodies like solid paraffin and ozokerite. —W. H. C.

Hydrocarbon oils and similar substances; Process for converting — into light oil or petrol. J. Noad and E. J. Townsend. Fr. Pat. 393,433, Aug. 18, 1908. Under Int. Conv., June 27, 1908.

THE vapour of the oil, mixed with steam, is brought into contact with a large surface of iron heated to redness in the absence of air, the resulting vapours are condensed, and the light oil separated by distillation. The light oil is suitable for use in internal-combustion engines. The residues from the distillation are again submitted to the process. The process may be carried out by leading the oil and water, in about equal quantities, in continuous streams into one end of a chamber packed with iron turnings and heated to about 480° C. The fixed gases formed during the process may be used to heat the chamber. The iron appears to act as a catalytic agent, and there is no deposit of carbon.—A. T. L.

Petroleum and its distillates; Apparatus for ionising —, D. Martini, London. U.S. Pat. 908,297, Dec. 29, 1908.

SEE Eng. Pat. 16,432 of 1907; this J., 1908, 890.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Trisazo-dyestuffs from resorcinol. F. Muhlert. Z. angew. Chem., 1908, 21, 2611—2612. (Compare Paul, this J., 1908, 1013.)

TRISAZO-DYESTUFFS can be prepared from resorcinol by treating it with three molecules of a diazo-compound,

or by the action of one molecule of a diazo-compound on a resorcinol disazo-dyestuff. The dyestuff from resorcinol and three molecules of diazobenzenesulphonic acid is easily soluble and gives brownish-orange shades on chrome-mordanted wool, which are, however, not fast to milling. The pale brown dyestuff produced by using three molecules of diazotised naphthionic acid is very soluble and that from three molecules of diazotised Safranine is a very soluble blue compound giving on tannin-mordanted cotton, tints which are redder than Indoin Blue but not so fast to light.—J. C. C.

Dyestuffs in solution; Capillary rise of —. L. Pelet-Jolivet and C. Jess. *Z. Chem. Ind. Kolloide*, 1908, 3, 275—280.

STRIPS of filter-paper, 8 cm. wide and 30 cm. long, were immersed to a depth of 15 mm. in 50 c.c. of dyestuff solution and the height to which both the dyestuff and the water rose in 3 hours was noted. Tables are given showing the results for many commercial dyestuffs, both alone and in the presence of varying quantities of electrolytes. It was found that the acid wool dyestuffs were characterised by a large rise of 100 to 200 mm. The basic and direct cotton dyestuffs showed small rises of 8 to 105 mm. The phthalein dyestuffs gave a medium rise of 60 to 150 mm. It thus appears that the stronger the adsorption by the cellulose, the smaller the rise. In the case of those dyestuffs which are not adsorbed, the rise is comparatively independent of the concentration of the solution, whilst the adsorbed dyestuffs rise to a greater extent from stronger solutions. An exception to this rule is found in the case of specially viscous adsorbed colours such as Carbazol Yellow, and is probably due to the pores of the paper being stopped up. Dyestuffs of the same class vary considerably in behaviour, and the capillary rise decreases with increasing molecular weight; in the case of the basic dyestuffs and Rhodamines, it increases with decreasing basicity. Those dyestuffs the solutions of which show colloidal characters under the ultramicroscope show the smallest capillary rise. In the case of Methylene Blue the rise of both dyestuff and water is increased by hydrochloric acid, which retards dyeing, and decreased by sodium hydroxide, which promotes it. In the case of Crystal Ponceau, addition of hydrochloric acid, which promotes fixation on the fibre, decreases the capillary rise, but this is not lessened by the addition of sodium hydroxide, sodium sulphate, or sodium phosphate, which is contrary to what might be expected. Experiments were also made on the capillary rise in strips of linen, silk, and wool. Linen was found to behave in a similar manner to filter-paper or cotton, though it shows less affinity than these for direct cotton colours. Wool and silk show much more adsorptive power than the vegetable fibres.—E. F.

PATENTS.

Anthracene derivatives; Manufacture of —. P. A. Newton, London. From Farbenfabrik vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1822, Jan. 27, 1908.

HALOGEN substituted anthraquinones can be obtained by treating anthraquinonesulphonic acids with halogens or compounds capable of splitting off halogens. The sulphonic acid groups are replaced by halogen atoms. Starting from anthraquinonedisulphonic acids the process proceeds in steps, the hitherto unknown halogen substituted monosulphonic acids being first produced. Example—A current of chlorine is passed into a mixture, heated to 100° C., of 20 parts of the potassium salt of anthraquinone-1-sulphonic acid, 1500 parts of water, and 60 parts of hydrochloric acid (20° B.). The mixture is filtered and the precipitate washed and dried.—P. F. C.

Flavopurpurin; Process for preparing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 205,097, Dec. 12, 1907.

ANTHRAFLAVIC acid or salts of anthraquinone-2,6-disulphonic acid are converted into flavopurpurin by heating

with a large excess of moderately concentrated (30—50 per cent.) alkali hydroxide solutions, at temperatures of about 200° C., with or without addition of oxidising agents. The temperature need not be carried above 200° C. if the amount of alkali hydroxide is at least 25 times the amount of anthraflavic acid used, or at least 12 times that of the anthraquinonedisulphonate.—T. F. B.

Sulphurised vat dyestuffs of the anthracene series; Manufacture of —. O. Imray, London. From Soc. of Chemical Industry, Basle, Switzerland. Eng. Pat. 13,057, June 18, 1908.

By heating an amino-, alkylamino-, arylamino-, acylamino- or nitro-derivative of 2-methylantraquinone or a substitution product of such a derivative, with sulphur at a comparatively high temperature, new sulphurised products are obtained which are insoluble in alkali sulphide, but can be made into a vat with the aid of alkali hydrosulphite solution; the vats thus obtained dye cotton directly without a mordant in grey, yellowish-brown, and violet shades of excellent fastness. Example:—A mixture of 60 parts of sulphur with 20 parts of 1-amino-2-methylantraquinone is heated to 240—280° C., until the evolution of hydrogen sulphide has ceased. The cooled mass is finely powdered and the excess of sulphur is extracted with carbon bisulphide or sodium sulphide solution. The purified dyestuff yields a brown vat with hydrosulphite from which cotton is dyed intense brown tints.—P. F. C.

Leuco-1,4-diaryldihydrazinoanthraquinones or their oxidation products; Preparation of —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 204,411, Aug. 9, 1907.

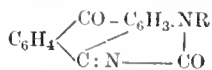
EQUAL parts of leucoquinizarin and phenylhydrazine are heated at 100° C., under a reflux condenser, in presence of alcohol or other solvent, for one hour, or until the leuco-compound has disappeared. Leuco-1,4-diphenylhydrazinoanthraquinone is thus obtained, and is purified by crystallisation. Analogous compounds are obtained from leuco-tri- and -tetrahydroxyanthraquinones, and also by using arylhydrazinesulphonic acids. Reddish-brown dyestuffs are obtained by passing air into caustic alkali solutions of the condensation products.—T. F. B.

4-Amino-2-nitrobenzoic acid; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 204,884, July 2, 1907.

2,4-DINITROBENZOIC acid may be reduced to 4-amino-2-nitrobenzoic acid by means of alkali sulphide, the presence of alkali or substances with alkaline reaction being avoided. 21.2 parts of the dinitrobenzoic acid are introduced into a solution of 33 parts of sodium sulphide in 40 times its weight of water at 60° C.; the mixture is heated at 90° C. for three hours, when the solution is rendered feebly acid. The new aminonitrobenzoic acid, mixed with sulphur, is precipitated, and is purified by crystallisation from water; it melts at 234—235° C. with decomposition, and forms an easily soluble diazo compound.—T. F. B.

Anthrapyrimidones; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 205,035, Nov. 5, 1907.

By condensation of urethanes with α -aminoanthraquinones or α -alkylaminoanthraquinones, with the aid of heat, and preferably in presence of zinc chloride or other condensing agent, anthrapyrimidones of the general formula,



are formed. They possess both feeble acid and feeble basic properties, and are either applicable as dyestuffs or for the preparation of dyestuffs.—T. F. B.

Dyestuffs of the anthracene series; Process for preparing blue —, Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 205,006, Nov. 30, 1907.

DYESTUFFS which dye wool from acid baths in pure blue shades, fast to alkalis, are obtained by heating leucoquinizarin-5-sulphonic acid with two molecular proportions of monoalkylamines; the resulting products are 1,4-di-monoalkylaminoanthraquinone-5-sulphonic acids. —T. F. B.

α -Isatinanilide or its homologues and sulphurous acid; Preparation of compounds of —, C. Stephan and A. Rahtjen. Ger. Pat. 204,478, Oct. 2, 1907.

COMPOUNDS of α -isatinanilide or its homologues with sulphurous acid are obtained (1) by adding a dilute acid solution of α -isatinanilide or a dilute acid suspension of its salts to a solution of sulphurous acid, a bisulphite, or thiosulphate; (2) by passing sulphur dioxide into the libite solution or suspension of the anilide. The quantity of sulphurous acid used in each case should be equivalent to that of the α -isatinanilide. —T. F. B.

α -Isatinanilide and its homologues; Manufacture of compounds of — by means of sulphurous acid. — C. Stephan and A. Rahtjen. Fr. Pat. 393,085, July 16, 1908. Under Int. Conv., Oct. 1, 1907.

SEE Ger. Pat. 204,478 of 1907; preceding. —T. F. B.

Trisazo dyestuffs and their dycings; Process for preparing green —, L. Cassella und Co. Ger. Pat. 204,707, Nov. 12, 1907.

GREEN trisazo dyestuffs are obtained by combining the intermediate product from tetrazodiphenyl and salicylic or *o*-cresotinic acid, in acid solution, with 1,8-amino-naphthol-4,6-disulphonic acid, the disazo dyestuffs thus obtained being combined with diazo compounds either in substance or on the fibre, in alkaline solution. The dycings obtained are intense in shade, and fast to washing and light. —T. F. B.

Trisazo dyestuffs; Manufacture of —, R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfurt on Maine, Germany. Eng. Pat. 26,811, Dec. 4, 1907.

SEE Ger. Pat. 204,707 of 1907; preceding. —T. F. B.

**p*-Phenylenediamine; Process for preparing* —, Act.-Ges. f. Anilinfabr. Ger. Pat. 201,848, Feb. 14, 1908. Addition to Ger. Pat. 202,170, Dec. 7, 1907 (see this J., 1908, 1147).

p-CHLOROANILINE is converted into *p*-phenylenediamine by heating it with aqueous ammonia in presence of copper salts; the ammonia and excess of *p*-chloroaniline are removed by means of steam, and the residue is evaporated to the crystallising point; any remaining *p*-chloroaniline is extracted from the product by means of petroleum spirit. —T. F. B.

**p*-Phenylenediaminemonosulphonic acid; Process for preparing* —, Act.-Ges. f. Anilinfabr. Ger. Pat. 204,972, Jan. 24, 1908. Addition to Ger. Pat. 202,564, Nov. 15, 1907, (see this J., 1908, 1147).

p-CHLOROANILINE-*m*-SULPHONIC acid is converted into *p*-phenylenediaminesulphonic acid by heating under pressure with ammonia in presence of copper salts. —T. F. B.

Vat dyestuffs containing sulphur; Process for preparing —, Badische Anilin und Soda Fabrik. Ger. Pat. 205,002, Nov. 3, 1906.

Dihalogen derivatives of 3-ketodihydro-(1)-thionaphthene are obtained by the action of halogens on 3-oxy-(1)-thionaphthene or its homologues or derivatives; these combine with 3-oxy-(1)-thionaphthene, indoxyl, halogenated indoxyls, or the homologues or derivatives of these

compounds, to form vat-dyeing (indigoid) dyestuffs. The dyestuff from 2-dihydro-3-ketodihydrothionaphthene and 3-oxy-(1)-thionaphthene is not included in the claim, being more readily obtained by heating the product resulting from the action of halogens on oxythionaphthene. —T. F. B.

1,3-Diaminoanthraquinone; Process for preparing derivatives of —, Badische Anilin und Soda Fabrik. Ger. Pat. 205,036, Aug. 14, 1907.

DIAMINO-BENZOYLEN-*benzoic* acid derivatives, in which the amino-groups are in the *meta*-position to one another and to the carbonyl group, are readily converted into 1,3-diaminoanthraquinone derivatives by heating either alone or in presence of acids, such as acetic acid; any derivatives of the diamino-benzoylbenzoic acid which have an *ortho*-position to the carbonyl group free in each nucleus undergo the same change. The preparation of triaminomethyl-anthraquinone, 1,3-diamino-2-methylanthraquinone, and 1,3-diamino-2-methoxyanthraquinone is described in the specification. —T. F. B.

**p*-Aminodiazobenzene and its derivatives; Process for preparing* —, Badische Anilin und Soda Fabrik. Ger. Pat. 205,037, Sept. 24, 1907.

THE diazo derivatives of acetyl-*p*-phenylenediamines or their homologues are converted into *p*-aminodiazobenzene derivatives by heating with dilute mineral acids, the acetyl group being completely removed, for example, after heating for an hour at 70° C. without appreciable decomposition of the diazonium group. 15 parts of acetyl-*p*-phenylenediamine are diazotised by means of 7 parts of sodium nitrite and 30 parts of hydrochloric acid (sp. gr. 1.16), and the solution, after the addition of 30 parts of hydrochloric acid, is heated at 70° C. for one hour. The solution of *p*-aminodiazobenzene chloride thus obtained reacts slowly with azo components, no dyestuff being at first produced, for instance, with an alkaline solution of β -naphtholdisulphonic acid R in the cold; by warming, however, or after long standing, a violet-red dyestuff is obtained. —T. F. B.

Sulphur [sulphide] dyestuffs; Manufacture of new —, P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5485, March 11, 1908.

SEE Fr. Pat. 388,539 of 1908; this J., 1908, 895. —T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Electrolytic bleaching process; Preparation of alkali hypochlorites, and the —, F. J. G. Beltzer. Z. angew. Chem., 1909, 22, 8—14.

IN the production of sodium hypochlorite, salt solutions of 4°—16° B. (sp. gr. 1.029—1.277) are electrolysed, the more concentrated solutions being preferably employed, as the conductivity of the solution increases with the concentration. An amount of electricity corresponding to about 7 kilowatts is required in practice to produce 1 kilo. of available chlorine, and the cost will vary with the source of the power (steam, gas, water) employed in producing the current. Under the most expensive conditions (use of steam power and "brine") the cost of chlorine would be about 0.35 franc, whereas by using water power and sea-water, the cost would be no more than 0.05 franc per kilo. of chlorine. The electrolyser of the Electrolytic Bleaching Co., Ltd. (with platinum electrodes) is shortly described; in this, the salt solution (of carefully regulated concentration and rate of flow) circulates between the electrodes, and the hypochlorite solution passes direct to the bleaching tanks or to reservoirs, as desired. A 15 per cent. salt solution yields a hypochlorite solution

containing 30 grms. of available chlorine per litre and 1170 litres will contain therefore 35 kilos. of available chlorine, or a quantity sufficient to bleach 5000 kilos. of cotton. When the electrolysed solution is to be passed direct to the bleaching tanks, it is convenient to use a salt solution of 1.5 per cent. strength, which yields a hypochlorite liquor containing 3 grms. of available chlorine per litre. In summing up the advantages of the electrolytic over the ordinary bleaching process, the author draws attention to the fact that the electrolytic hypochlorite is neutral in reaction, whereas the solution prepared by mixing solutions of bleaching powder and sodium carbonate (or by saturating caustic soda with chlorine, etc.) is always alkaline; the consequence is that solutions prepared in these latter ways do not give up their chlorine so readily to the material to be bleached, and to get the full effect from them, they have to be warmed or acidified. It has been found that a quantity of electrolytic hypochlorite containing 0.8 grm. of chlorine, is equal to a quantity of ordinary hypochlorite containing 1 grm. of chlorine. In comparison with bleaching powder, it is evident that sodium hypochlorite is much safer and simpler to use, and not only is the bleach whiter and more permanent—not liable to become yellow—but there is no risk of damage from particles of undissolved powder producing intense local action, and the goods remain soft and free from harshness. The author discusses the arrangements required for the electrolytic bleaching of 5000 kilos. of cotton per day of 10 hours, and compares the cost of production of electrolytic chlorine, with that obtainable from ordinary sodium hypochlorite and from bleaching powder.—F. M.

Paranitraniline-red; Formation of —. M. Prud'homme and A. Colin. Rev. Gen. Mat. Col., 1909, 13, 1—3.

THE fact that a solution of diazotised *p*-nitraniline containing acetic acid and sodium acetate gives a bluer and fuller shade of Para-red than one containing only hydrochloric acid has been attributed by Goldschmidt and later by Lichtenstein (this J., 1908, 976) to the difference in the concentration of hydrogen ions in the two cases. This is considered by the present authors to be a statement of fact but not an explanation, and they have therefore carried out experiments on the action of the ions Cl' and $\text{C}_2\text{H}_3\text{O}_2'$ (which are present in the two cases referred to) on the sodium naphtholate. Cotton padded with sodium naphtholate and then dried was dipped into distilled water and into the following solutions: dilute hydrochloric acid, dilute acetic acid, acetic acid and sodium acetate, sodium acetate. The cloth was then developed and the tints of Para-red compared. The following are the conclusions drawn: In the instantaneous formation of Para-red the free acid exerts an action proportional to the ionic concentration and liberates naphthol. If, other things being equal, the ionic concentration attains a suitable value, the amount of naphthol liberated will be slight. The thin layer which it forms on the fibre can exercise a protective action on the sodium naphtholate and prevent it from diffusing. If the ionic concentration is excessive, too large a proportion of naphthol is precipitated and as this combines indifferently with the diazo-compound, the intensity of the red produced is decreased. The diffusion and solution of the sodium naphtholate is important: this is greatest in the presence of pure water and varies with the nature of the acid and of the salts present. These can act directly in hindering the diffusion of the naphtholate, but they can also modify the degree of ionisation of the diazo-salt if they give rise to the same kind of ion when dissolved.—J. C. C.

Indian indigenous dyes; Experiments with — in comparison with synthetic products. U.S. Cons. Reps., Dec., 1908. [T.R.]

MR. E. R. WATSON, connected with the Asiatic Society of Bengal, has been experimenting with dyes, both indigenous and synthetic, and appears to demonstrate the superiority of the former over the latter so fully and clearly that it would seem the contention in favour of the latter would cease. Mr. Watson experimented with ten vegetable dyes,

viz., turmeric, or haldi (*Curcuma longa*); safflower, or kusum (*Carthamus tinctorius*); spanwood, or bakam (*Cesalpinia sappan*); palas (*Butea frondosa*); annatto, Orleans, or lakkam (*Bixa orellana*); majisto (*Rubia cordifolia*); kamala (*Mallotus philippinensis*); singher or harsinghar (*Nyctanthes arbor tristis*); jackwood, jack, or kanthal (*Artocarpus integrifolia*), and lac dye.

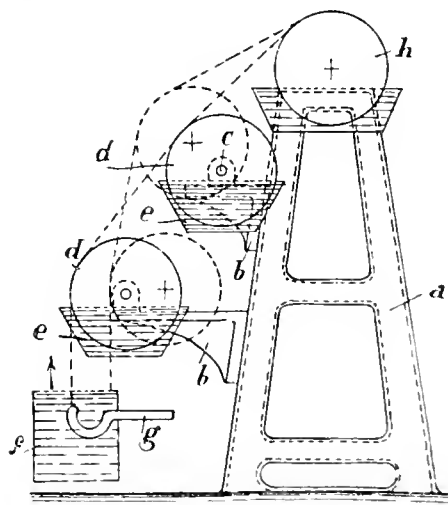
He followed the native methods of dyeing, and had no occasion to resort to any European as opposed to Indian method. He used silk cloth purchased from the Rij-bahi diamond jubilee industrial schools, and his success was greater than in the case of experiments in dyeing cotton fabrics. The conclusions he arrives at are that the indigenous dyes of Bengal are considerably more useful for dyeing on silk than for cotton dyeing, and that the dyeings obtained are frequently considerably faster on silk than on cotton. This, taken in conjunction with the fact that many of the commonly used synthetic dyes do not give fast dyeings on silk, causes the indigenous dyes to compare much more favourably with their synthetic adversaries in this field than was the case in that of cotton dyeing. He says:—

"The shades obtained from bakam on a tannin-iron mordant from majisto, from lac, kamala and jackwood, may be said to exhibit good fastness, since in no respect does any one of these dyeings come lower than III. in the scale. Thus of 10 dyestuffs examined, 3 have yielded dyeings which may be characterised as good average goods. Of the 12 synthetic dyestuffs used for comparison only 4, viz., alizarin, primuline, chrysophenine and magdala red are capable of yielding dyeings which may by the same criterion be similarly characterised."

The author's work would lead him to form a somewhat higher opinion of the value of the kamala as a silk dye than that apparently formed of it by A. G. Perkin (this J., 1895, 460). The dyeings with lac proved to be faster to soaping even than the synthetic dyes which were fastest in this respect. In fact, the general fastness of lac dyeings made it appear to me a matter of surprise that this material has been so completely superseded by synthetic dyes, the more so as it is necessarily obtained as a by-product in the purification of lac, a material for which there is an ever rapidly increasing demand.

PATENTS.

Artificial threads; Treatment of —. P. Follet and G. Ditzler, Verviers, Belgium. Eng. Pat. 21,255, Oct. 8, 1908.



SUPPORTS, *h*, on a frame, *a*, carry spindles, *e*, on which are mounted cylinders, *d*, rotating in troughs, *c*. The spindles, cylinders, and troughs can be moved along the brackets, *b*, so as to occupy the positions indicated in both the full and the dotted lines. The cylinders are rotated by a vari-

able gearing and when in movement carry on their surfaces thin coatings of the liquid contained in the troughs. Below the lower cylinder, *d*, is arranged a receptacle, *f*, into which spinning nozzles, *g*, force a solution of cellulose or other similar substance in an ammoniacal solution of a suitable metallic oxide or salt. The receptacle, *f*, contains a coagulating bath containing 15–20 per cent. of acid. The troughs, *e*, contain similar baths, the proportion of acid in which may decrease from the lower to the higher troughs until the highest contains only water, in which a spool, *h*, rotates, on which the thread is wound. On leaving the nozzle, *g*, the thread passes quickly through the bath contained in the receptacle, *f*, and is therefore only coagulated on its outside. It then passes on to and over the cylinders, *d*, and is thereby submitted to a tension which varies with the angle formed by the thread passing over the different cylinders. By making the cylinders, *d*, rotate at different speeds, the thread can be gradually stretched so long as its interior remains liquid. By this means threads of any desired degree of fineness can be obtained.—P. F. C.

Artificial silk and hair: Process for the preparation of —. A. Lœueur. Fr. Pats. 392,868 and 392,869, Oct. 8, 1907.

CELLULOSE is dissolved in an ammoniacal solution of cupric hydroxide and the resulting solution is forced through a capillary tube into a coagulating bath under constant pressure. The bath is maintained at a temperature of 27–35° C. and consists of a mixture of equal parts of a solution containing 44–49 per cent. of sodium hydroxide and a solution containing 23–28 per cent. of anhydrous sodium carbonate. A rather weaker bath is employed for artificial hair. After spinning, the thread is wound on a bobbin, and plunged into a second coagulating bath containing in solution as much anhydrous sodium carbonate as the first bath but much less sodium hydroxide. The copper and ammonia which remain in the product are eliminated by a passage through a dilute solution of sodium bisulphate to which 1–4 per cent. of free acid has been added. The process is completed by washing, soaping, if necessary, and finally drying the product.—P. F. C.

Dye jiggers or dyeing apparatus. F. Shaw and Whitefield Velvet and Cord Dyeing Co., Ltd., Whitefield, Lancs. Eng. Pat. 4295, Feb. 26, 1908.

THE invention consists in the use in combination with the dye-vat of a displacer arranged inside the vat which displaces the dye liquor over a greater area and consequently subjects the pieces to a longer immersion. If the dye-vat be circular, the displacing roller has a circular cross-section, whilst if the vat be angular, the displacer is of corresponding contour and rollers are arranged at points along its surface. The piece under operation passes from one roller of the jigger, under the displacer, to the other roller. The surface of the displacing device may be fluted to allow the dye-liquor to saturate the material more easily.—P. F. C.

Dyestuff preparations for dyeing: Direct cotton —. Read Holliday and Sons, Ltd., J. Turner, and H. Dean, Huddersfield. Eng. Pat. 7552, April 6, 1908.

By mixing together the free colour acids or acid salts of certain direct cotton dyestuffs, shades are produced which are superior to those obtained by using the dyestuffs as their sodium or ammonium salts. Dyestuffs which are suitable for this purpose, are sulphonated mono-, di-, or tri-beta-naphthylated rosaniline and the blue and violet tetrazo dyestuffs from benzidine, toluidine, diamididine, or other similar para-diamines.—P. F. C.

Variegated colour effects upon fabrics; Process for obtaining —. J. Hindley, Stockport. Eng. Pat. 10,922, May 20, 1908.

THE fabric is laid out and drawn up from its flat position into something approximating to the form of a cone at those places where a variegated colour effect is desired.

Yarn or tape is then tightly tied round each cone in two or more places, so as to produce a "scrumpled" effect and the whole fabric is dyed. The fastenings are then untied retied so as to produce a different "scrumpled" effect, and the fabric is again dyed with a different dyestuff. Before beginning the final dyeing which is to give the ground colour to the whole fabric, that part of the cone which lies between the fastenings is over-wrapped to prevent it from coming in contact with the dye-liquor. A modification of this process consists in knotting the fabric, as described, dyeing it, then re-knotting it one or more times and dyeing it with a different dyestuff each time.—P. F. C.

Dyeing apparatus. J. Friedrichs, Woonsocket, R.I. U.S. Pat. 907,229, Dec. 22, 1908.

EACH of a number of conical holes pierced in the floor of a dye-vat is connected on its under side with an suction pipe leading to a pump and on its upper side with an upright perforated spray tube arranged within a cage having perforated walls. A second pipe leading from the pump is disposed so as to deliver into the upper part of the vat. Means are provided for lifting the cage and spray tube out of the dye-vat.—P. F. C.

Dyeings with sulphide dyestuffs; Treatment of black —. R. vom Hove. Ger. Pat. 204,412, Oct. 9, 1907.

BLACK dyeings on cotton with sulphide dyestuffs may be rendered fast to rubbing and soaping by treating the goods, 12 hours after dyeing, with a hot solution of sodium sulphide.—T. F. B.

Reducing agents; Manufacture of new — and method of printing with their aid. A. Ashworth, Bury. Eng. Pat. 17,734, Aug. 24, 1908.

By acting upon zinc dust with sulphur dioxide in the presence of glycerin or glucose, suitably diluted with water or with a solution of zinc chloride or calcium chloride, a reducing agent is formed which is stable and reduces indigo at low temperatures. Example:—Into a well stirred mixture of 20 parts of zinc dust, 15 parts of glucose, and 20 parts of a solution containing about 45 per cent. of calcium chloride, 29 parts of sulphur dioxide are introduced till the zinc dust has disappeared. The temperature of the mixture is kept at 50–55° C. during the reaction. The product is a thick greyish paste which can be used directly for printing. For this purpose 40 parts of the product, 30 parts of dry British gum, 10 parts of water, and 10 parts of turpentine are mixed, heated to 40° C., cooled, and mixed with 5 parts of sodium bisulphite containing 24 per cent. of sulphur dioxide. This discharge is printed on the goods, which are then dried and passed through a steam ager, supplied with moist steam at a temperature of 102–103° C.—P. F. C.

Green, olive, and brown shades in dyeing and printing; Production of —. H. Schmid. Fr. Pat. 392,891, Aug. 1, 1908. Under Int. Conv., May 4, 1908.

A RANGE of shades can be produced upon the fibre by oxidising the salts of *m*-aminophenols with alkali chlorates and ferrocyanides as in the production of Aniline Black. After the oxidation the fabric is chromed and washed. The shades thus obtained become browner on soaping and yellower by passing them through an alkaline bath. The *m*-aminophenols may be replaced by *m*-aminoresols, or may be mixed with *o*- and *p*-aminophenols.—P. F. C.

Decoration of fabrics; Process for the —. M. Ratignier and H. Pervillae et Cie. Fr. Pat. 393,412, Oct. 25, 1907.

A CYLINDER engraved with a network or other desired design is arranged to rotate underneath a hopper which distributes on to the cylinder a plastic coating of collodion or other similar preparation. After passing this distributor, the surface of the cylinder is brought into contact with a doctor which removes the excess of the plastic preparation. The fabric, which is to be decorated, passes from one

roller to another and during its passage is made to press tightly on the engraved cylinder, which is adjusted so that its peripheral velocity is the same as the velocity with which the fabric travels. During the time of contact, the collodion contained in the engraving of the cylinder is transferred to the fabric. In the case of openwork fabrics it is necessary to provide a backing which can support the design and for this purpose the machine is so arranged that the fabric is pressed against the cylinder by a roller carrying an endless band on to which a layer of flocks has been distributed. Where the plastic preparation comes in contact with the fabric, the flocks adhere and provide a suitable backing to hold the design.—P. F. C.

Scouring of fabrics dyed or printed with vat dyestuffs. Badische Anilin und Soda Fabrik. Fr. Pat. 392,858, July 31, 1908. Under Int. Conv., Mar. 31, 1908.

FABRICS, after being woven, are often cleaned by boiling them with a dilute solution of sodium hydroxide, with or without pressure. This process is injurious to most dyestuffs and in the case of fabrics which have been dyed or printed with vat dyestuffs, the size present in the fabric occasionally reduces the dyestuff and a part of the latter thereupon dissolves in the sodium hydroxide solution and is re-dyed on to another part of the material. It is found that this difficulty can be avoided by adding a small quantity of some easily reducible organic compound to the scouring bath. The salts of the mono- or disulphonic acids of anthraquinone or of nitrobenzene are specially suitable for the purpose.—P. F. C.

Fabrics; Process for rendering certain — impermeable. J. R. Blum. Fr. Pat. 392,870, Oct. 8, 1907.

CELLULOSE is dissolved in acetone, ether, amyl acetate, or other solvent, and the article to be treated is dipped into the solution. On drying, the solvent evaporates, leaving the article completely covered with a thin pellicle of celluloid. This operation is repeated until a coating of the desired thickness has been obtained.—P. F. C.

Dyeing sulphur [sulphide] dyestuffs; Process of —. A. Wöschel, Assignor to Farbwerke vorm. Meister, Lucius, and Brüning, Höchst on Main, Germany. U.S. Pat. 907,937, Dec. 29, 1908.

SEE Eng. Pat. 8631 of 1907; this J., 1908, 559.—T. F. B.

Printing with sulphide dyestuffs with the aid of copper or brass rollers; Process for —. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 393,893, Nov. 9, 1907.

SEE Eng. Pat. 24,978 of 1907; this J., 1908, 332.—T. F. B.

Electrolytic apparatus for the manufacture of bleaching liquors. U.S. Pat. 906,669. See XI.A.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Potassium chlorate; The purity of commercial —. G. Pöndorf. Chem.-Zeit., 1908, 32, 1151—1152. (See this J., 1908, 806, and 1909, 21.)

It was found by Gartenmeister (this J., 1907, 223) that solutions of certain samples of potassium chlorate give an immediate blue coloration when treated with starch, potassium iodide, and dilute sulphuric acid, and he assumed that this was, as a general rule, owing to the presence of chlorites or hypochlorites. The author, however, examined five samples of chlorate, all of which were free from chlorite and hypochlorite, and several of which had been prepared electrochemically. One grm. of each sample was dissolved in 25 c.c. of water, a small crystal of potassium iodide added, a few drops of starch solution and then 0.5 c.c. of dilute sulphuric acid (1:4). A blue coloration appeared after 2½ minutes with the first sample, and immediately with

the other samples. A portion of each was then mixed with some ammonium nitrate and powdered resin, and heated in an oil-bath. The first sample exploded at 127—132° C. Mixtures of other samples exploded at temperatures between 126° C. and 173° C. One sample, of German origin, did not cause an explosion of the mixture when heated to 170° C. It consequently does not follow that a sample of potassium chlorate, which gives an immediate coloration with the iodide test, will be more liable to cause premature explosion or ignition under the conditions named, or in a word, to be more dangerous than one which does not respond to the iodine test. Moreover, an electrochemically prepared chlorate has been used for many years in the Kriewald Powder Factory without any mishap.—F. SIDA.

Chlorates; The "active" substance in —. H. Klopstock. Chem.-Zeit., 1909, 33, 21. (See this J., 1907, 223.)

THE active substance (iodine reaction) in potassium chlorate made at the Aussig works was found to be, not chlorite at all, but potassium bromate. This was formed at the anode from bromide existing as an impurity in the potassium chloride used. Sodium chlorate produced electrolytically did not show any "activity," the sodium chloride used never being contaminated by bromide.—J. T. D.

Sulphur and sulphides; Spontaneous oxidation of —. E. Pollacci. Monit. Scient., 1908, 22, 373—375.

FINELY-DIVIDED sulphur when mixed with water and exposed to the air is oxidised to sulphuric acid, the process being accelerated by movement of the air and by exposure to sunlight. The oxidation is not caused by oxygen nor by neutral hydrogen peroxide, and is not due to decomposition of the water, since it does not take place in an atmosphere of hydrogen. It appears to be caused by the ozone present in the air; ozonised air acts more rapidly than ordinary air. Sulphides, especially when finely divided, are also oxidised by the air, even at temperatures below 30° C., but not directly to sulphates as is generally believed. The oxidation proceeds in two stages, just as with hydrogen sulphide: first sulphur is liberated and the oxide of the metal is formed; secondly, the sulphur is oxidised to sulphuric acid which unites with the oxide, giving the sulphate. There are considerable differences in the rates at which different sulphides are oxidised, but the change is sufficiently marked to be taken into consideration in analytical determinations in which metals or metalloids (bismuth, cadmium, mercury, arsenic) are weighed as sulphides. It is suggested that sulphur might be obtained in considerable quantities by passing natural waters containing hydrogen sulphide through beds of ochreous earth, allowing the iron sulphide formed to oxidise in the air, and recovering the liberated sulphur by distillation or treatment with carbon bisulphide.—A. S.

Graphite; Formation of — by the interaction of magnesium powder and carbonates. H. R. Ellis. Faraday Soc., Dec. 15, 1908. [Advance proof.]

When a mixture of magnesium powder and a carbonate is ignited at one point, interaction proceeds vigorously and a very high temperature is reached. In the author's experiments, in which the carbonates of cadmium, ammonium, magnesium, and the alkaline-earth metals were used, a mixture of graphite and amorphous carbon was found amongst the products. By burning 25 grms. of magnesium powder in a stream of dry carbon dioxide, about 2.5 grms. of carbon, containing 12 per cent. of graphite, were obtained, a very slight amount of carbide being also detected.—F. SODA.

Nitric acid; The electric discharge and the production of —. W. Cramp and B. Hoyle. See XI.A.

Zeolites and similar compounds, their constitution and technical importance for agriculture. R. Gans. See XV.

Sulphuric acid; Determination of — as barium sulphate. E. Ruppin. See XXIII.

Ammonia production of Great Britain in 1908. Bradbury and Hirsch, Liverpool. [T.R.]

THE total production of ammonia from all sources in the United Kingdom, calculated into ammonium sulphate, during 1908 was as follows:—

	1908.	1907.
	Tons.	Tons.
Gas works	161,000	165,000
Iron works	20,000	21,000
Shale works	51,000	51,000
Coke and carbonising works and producer gas.....	79,000	75,500
	314,000	313,000

Of this production England contributed 206,500 tons, Scotland 105,000 tons, and Ireland 2,500 tons. The stock brought forward from 1907 was 15,000, making the supply for 1908, 329,000 tons. The exports during 1908 were 235,000 tons and the home consumption was 83,000 tons, leaving stock to carry forward into 1909, 11,000 tons.

PATENTS.

Sulphuric acid; Removal of sulphurous fumes and their recovery as —. H. Kühne. Fr. Pat. 393,461, Aug. 19, 1908. Under Int. Conv., Aug. 20, 1907.

THE sulphurous fumes mixed with air (or oxygen) and water (or steam or dilute sulphuric acid) are exposed to the action of a source of light rich in ultra-violet or similar rays, such as a mercury vapour lamp enclosed in a quartz globe, the sulphurous acid being thus converted into sulphuric acid. The latter may be either absorbed, condensed, or recovered in the form of metallic sulphates, and it is stated that the conversion is almost complete even when the proportion of sulphurous acid in the fumes is less than 1 per cent. Aqueous solutions of sulphurous acid mixed with air may be treated in the same manner.—C. J. G.

Vapours of volatile acids, especially nitric acid; Apparatus for the condensation and absorption of —. Scherfenberg und Prager. Ger. Pat. 202,500, Feb. 16, 1907.

A COOLING device formed of several upright condensing tubes, is arranged as a reflux condenser directly over the condensing tower. The pipe leading from the tower to the reflux condenser is provided with a rose, so that the ascending vapours are atomised and come into intimate contact with the descending condensed liquid.—A. S.

Alkali hydrosulphite; Preparation of — from zinc hydrosulphite or its double salts and complex compounds. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 203,910, Jan. 28, 1908.

ZINC hydrosulphite and its double salts, such as zinc-sodium hydrosulphite, and complex compounds such as the double compound of zinc hydrosulphite and ammonium chloride, are easily soluble in ammonia. On adding the requisite quantity of a sodium or potassium compound to a concentrated ammoniacal solution of this kind, the corresponding alkali hydrosulphite separates in a few hours as a crystalline mass.—A. S.

Alkali hydrosulphites; Preparation of —. Badische Anilin und Soda Fabrik. Ger. Pat. 201,063, Dec. 12, 1907. Addition to Ger. Pat. 119,676.

A MIXTURE of 145 grms. of caustic soda lye (containing 27.5 per cent. of sodium hydroxide) and 200 c.c. of water is prepared in a vessel from which air is excluded, 40 grms. of zinc dust are added, and then sulphur dioxide is led in until the mixture has gained 96 grms. in weight, the vessel being cooled and shaken during this operation. The

mixture is now allowed to stand for some hours, with frequent agitation, then milk of lime (40 grms. of quicklime and 120 c.c. of water) is added, and after again standing for several hours, with frequent agitation, the concentrated solution of sodium hydrosulphite is separated by suction.—A. S.

Sodium perborate; Preparation of — from sodium metaborate and hydrogen peroxide. C. von Girssewald. Ger. Pat. 201,279, July 20, 1907.

AN aqueous solution of 76.5 parts of borax and 21.6 parts of 90 per cent. sodium hydroxide is mixed with 950 parts of 3 per cent. hydrogen peroxide, and a concentrated solution of sodium chloride is then added until a permanent turbidity is produced, the temperature being kept below 10° C. On placing the mixture in an ice-chest, a yield of 87.5 per cent. of the theoretical quantity of white, nearly chemically pure sodium perborate crystallises out.—A. S.

Potassium sulphide lyes; Decomposition of — with carbonic acid. J. A. Reich. Ger. Pat. 204,526, March 8, 1907.

IS the usual process of decomposing potassium sulphide lyes by carbon dioxide at the ordinary temperature, or with the application of gentle heat, considerable time is required for the decomposition of the sulphide. According to the present patent, it is stated that solutions free from sulphide are quickly obtained if the liquor be strongly cooled during the passage of the carbon dioxide.—A. S.

Ozone; Fixing — in liquids. S. Fraser, London. Eng. Pat. 26,949, Dec. 6, 1907.

THE claim is for fixing ozone in solution by passing it into a liquid containing paraldehyde, $C_6H_{12}O_3$. Fatty, vegetable, mineral, or other substances, and also alcohol, may be added to the paraldehyde solution.—C. J. G.

Nitrogen; Process for preparing pure — from combustion gases. A. Frank and N. Caro. Ger. Pat. 201,882, May 22, 1907.

COMBUSTION gases, e.g., from a gas producer, containing carbon dioxide, carbon monoxide, hydrocarbons, oxygen, and nitrogen, are passed over a heated mixture of a metal and its oxide, e.g., copper and copper oxide; the metal is oxidised by the oxygen, whilst the carbon monoxide and hydrocarbons are oxidised to carbon dioxide by the metallic oxide. In this way a mixture containing only nitrogen and carbon dioxide is obtained, from which the latter is removed by absorption in the usual manner.

—A. S.

Sulphur; Process for obtaining — from metallic sulphides which are decomposed on heating. E. Fleischer. Ger. Pat. 205,017, April 21, 1907.

THE process consists in distilling off a portion of the sulphur from metallic sulphides, such as iron disulphide, and at the same time leading air and steam into the roasting furnace, whereby the residual sulphide is decomposed with formation of sulphur dioxide and hydrogen sulphide. The gases from the furnace, containing excess of steam, are cooled first to a temperature above 100° C. in order to condense the sulphur vapour, and are then further cooled, and if necessary, water added, in order to cause interaction of the sulphur dioxide and hydrogen sulphide with liberation of sulphur.—A. S.

Orygnitrogen compounds; Process for the transformation of hydrocyanic acid into —. O. Dieffenbach and W. Moldenhauer, Darmstadt, Germany. Eng. Pat. 8768, April 22, 1908. Under Int. Conv., April 24, 1907.

SEE Fr. Pat. 389,500 of 1908; this J., 1908, 981.—T. F. B.

Hydrosulphites; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,181, May 11, 1908.

SEE Ger. Pat. 203,846 of 1907; this J., 1908, 1204.—T. F. B.

Nitrite solutions; Process of purifying —. K. Geelmuyden, Notodden. Assignor to Norsk Hydro-Elektrisk Kvaelfabriksselskab. Christiania. U.S. Pat. 907,332. Dec. 22, 1908.

SEE Eng. Pat. 11,415 of 1908; this J., 1908, 1019.—T. F. B.

Pyrites, pyrites waste, and similar materials; Treatment and utilisation of the solutions obtained from —. J. H. Thwaites. Fr. Pat. 393,589, Aug. 21, 1908. Under Int. Conv., Dec. 12, 1907.

SEE Eng. Pat. 27,426 of 1907; this J., 1908, 949.—T. F. B.

Hydrogen and oxygen generators; Electric —. Eng. Pat. 14,285. See XI.4.

Chlorates and perchlorates; Electrolytic preparation of alkali —. Ger. Pat. 205,919. See XI.4.

Persulphates; Preparation of — by electrolysis of bisulphates. Ger. Pats. 205,967 and 205,068. See XI.4.

Sodium persulphate; Preparation of — by electrolysis of sodium bisulphate. Ger. Pat. 205,069. See XI.4.

Oxidising agents, such as hypochlorites, chlorates, etc.; Electrolytic production of —. Ger. Pat. 205,087. See XI.4.

VIII.—GLASS, POTTERY, AND ENAMELS.

Plate-glass; Manufacture of —. H. Knoblauch. Sprechsaal, 1908, 41, 704–706, 719–721.

THERE are three kinds of plate-glass—the cast or moulded, the hand-worked or blown, and the so-called “shock” glass. Cast-glass, once outstripped by every other form of glass, has greatly improved and now holds its own. Plates may be cast up to 25 sq. m. in area. The metal is generally fired in a Siemens regenerative gas-furnace. In composition, it resembles window-glass, but is less fusible. It is made up of 100 parts of sand, 40–43 of sodium sulphate, and 40–45 of calcium carbonate. The pot of melted glass is swung by a crane over the moulds, and the plates of glass are run, as quickly as possible (in order to prevent curling at the edges), into the cooling-oven, which starts at a bright red-heat and cools down gradually. Owing to the uniformity of the cooling, cast-glass cuts easily and straightly. It is then ground between two tables revolving in opposite directions by sand of increasing fineness, and ultimately polished by iron oxide. The plates must be true and upright, and are used for show-windows, business plates, table-tops, and on tombs. While cast-glass is about 5 mm. thick, blown glass can be made from 8–1½ mm. thick. This property enables it to be put to many uses—for working with brass, for ornamental ware, and furniture. For these purposes it is often silvered to act as a mirror. It is made up of 100 parts of sand, 40 of sodium carbonate, and 25 of chalk. The melting is not so complete as with cast-glass. “Shock” glass is not thicker than a well-worked delicate window-glass, and can be conveniently considered in that branch. It is generally silvered for mirrors, and must be quite free from all flaws. It is also used for toy-making and for photographic plates.—H. H. S.

Vitreous enamelling metal or glass; Home Office Regulations for —. Statutory Rules and Orders, 1908, No. 1258, Dec. 18, 1908. [T.R.]

WHEREAS the process of vitreous enamelling of metal or glass has been certified in pursuance of section 79 of the Factory and Workshop Act, 1901, to be dangerous, the Home Secretary has made the following Regulations, and directs that they shall apply to all factories and workshops in which vitreous enamelling of metal or glass is carried on.

Provided that nothing in these Regulations shall apply to—

- (a) the enamelling of jewellery or watches; or
- (b) the manufacture of stained glass; or
- (c) enamelling by means of glazes or colours containing less than 1 per cent. of lead.

These Regulations shall come into force on 1st April, 1909.

Definitions.

In these Regulations—

“Enamelling” means crushing, grinding, sieving, dusting or laying on, brushing or woolling off, spraying, or any other process for the purpose of vitreous covering and decoration of metal or glass;

“Employed” means employed in enamelling;

“Surgeon” means the Certifying Factory Surgeon of the district or a duly qualified medical practitioner appointed by written certificate of the Chief Inspector of Factories, which appointment shall be subject to such conditions as may be specified in that certificate;

“Suspension” means suspension by written certificate in the Health Register, signed by the Surgeon, from employment in any enamelling process.

Duties.

It shall be the duty of the occupier to observe Part I. of these Regulations.

It shall be the duty of all persons employed to observe Part II. of these Regulations.

PART I.—DUTIES OF EMPLOYERS.

1. Every room in which any enamelling process is carried on—

(a) shall contain at least 500 cubic feet of air space for each person employed therein, and in computing this air space no height above 14 feet shall be taken into account;

(b) shall be efficiently lighted, and shall for this purpose have efficient means of lighting, both natural and artificial.

2. In every room in which any enamelling process is carried on—

(a) the floors shall be well and closely laid, and be maintained in good condition;

(b) the floors and benches shall be cleansed daily and kept free of collections of dust.

3. No enamelling process giving rise to dust or spray shall be done save either—

(a) under conditions which secure the absence of dust and spray; or

(b) with an efficient exhaust so arranged as to intercept the dust or spray and prevent it from diffusing into the air of the room.

4. Except in cases where glaze is applied to a heated metallic surface, dusting or laying on, and brushing or woolling off, shall not be done except over a grid with a receptacle beneath to intercept the dust falling through.

5. If firing is done in a room not specially set apart for the purpose, no person shall be employed in any other process within 20 feet from the furnace.

6. Such arrangements shall be made as shall effectually prevent gases generated in the muffle furnaces from entering the workrooms.

7. No child or young person under 16 years of age shall be employed in any enamelling process.

8. A Health Register, containing the names of all persons employed, shall be kept in a form approved by the Chief Inspector of Factories.

9. Every person employed shall be examined by the Surgeon once in every three months (or at such other intervals as may be prescribed in writing by the Chief Inspector of Factories) on a date of which due notice shall be given to all concerned.

10. The Surgeon shall have power of suspension as regards all persons employed, and no person after suspension shall be employed without written sanction from the Surgeon entered in the Health Register.

11. There shall be provided and maintained for the use of all persons employed—

(a) suitable overalls and head-coverings, which shall be collected at the end of every day's work, and be cleaned or renewed at least once every week;

(b) a suitable place, separate from the cloakroom and mealroom, for the storage of the overalls and head-coverings;

(c) a suitable cloakroom for clothing put off during working hours;

(d) a suitable mealroom separate from any room in which enamelling processes are carried on, unless the works are closed during meal hours.

12. There shall be provided and maintained in a cleanly state and in good repair, for the use of all persons employed, a lavatory, under cover, with a sufficient supply of clean towels, renewed daily, and of soap and nail brushes, and with either—

(a) a trough with a smooth impervious surface, fitted with a waste pipe with plug, and of such length as to allow at least two feet for every five such persons, and having a constant supply of warm water from taps or jets above the trough at intervals of not more than two feet; or

(b) at least one lavatory basin for every five such persons, fitted with a waste pipe, and placed in a trough having a waste pipe, and having either a constant supply of hot and cold water or warm water laid on, or (if a constant supply of heated water be not reasonably practicable) a constant supply of cold water laid on and a supply of hot water always at hand when required for use by persons employed.

13. The occupier shall allow any of H.M. Inspectors of Factories to take at any time sufficient samples for analysis of any enamelling material in use or mixed for use.

Provided that the occupier may at the time when the sample is taken, and on providing the necessary appliances, require the Inspector to take, seal and deliver to him a duplicate sample.

No results of any analysis shall be published without the consent of the occupier, except such as may be necessary to prove the presence of lead when there has been infraction of these Regulations.

PART II.—DUTIES OF PERSONS EMPLOYED.

14. Every person employed shall—

(a) present himself at the appointed time for examination by the Surgeon as provided in Regulation 9;

(b) wear the overall and head-covering provided under Regulation 11 (a), and deposit them and clothing put off during working hours, in the places provided under Regulation 11 (b) and (c);

(c) carefully clean the hands before partaking of any food or leaving the premises;

(d) so arrange the hair that it shall be effectually protected from dust by the head-covering.

15. No person employed shall—

(a) after suspension, work in any enamelling process without written sanction from the Surgeon entered in the Health Register;

(b) introduce, keep, prepare, or partake of any food, drink, or tobacco, in any room in which an enamelling process is carried on;

(c) interfere in any way, without the concurrence of the occupier or manager, with the means and appliances provided for the removal of dust or fumes, and for the carrying out of these Regulations.

PATENTS.

Glass: Apparatus for the manufacture of sheets of —. F. L. O. Wadsworth, Assignor to Pressed Prism Plate Glass Co. Morgantown, W. Va. U.S. Pat. 907,656, Dec. 22, 1908.

A SHEET of glass is first formed by passing glass between two rollers. This sheet then passes between a third roller and a table. In the surface of this third roller grooves are formed, which correspond with grooves formed in the table, so that the sheet of glass produced is of unequal thickness.—A. G. L.

Granite: Recovering china clay from decomposed, and china stone from partly decomposed —, and separating the clay from mica and quartz, and the mica from the quartz; applicable also to treating ochre and the like. A. E. Gaved, St. Austell, Cornwall. Eng. Pat. 6794, Mar. 27, 1908.

DECOMPOSED or partly decomposed granite is dried and broken up in a crusher from which it falls into a disintegrator, consisting of a tube in which a shaft provided with blades rotates, and in which it is further broken up. The coarse material falls out of the bottom of this tube, and may be re-treated, whilst the finer materials are carried by means of a current of air through aspirators, in which the materials are forced to pursue a zig-zag course, into grading chambers and finally into a dust-collector. The aspirators are provided with flap-doors, which open from time to time under the weight of the sand which settles on them, whilst the mica and china-clay pass to the grading chambers, in which the mica settles first, the china-clay depositing further on. Grading is assisted by perforated baffle-plates inserted in the grading chambers. A spray of water may be injected into the further end of the chambers to cause the fine china-clay to settle. The materials from the grading chambers may be still further purified by treatment on oscillating sieves of the kind described in Eng. Pat. 27,034 of 1906 (this J., 1907, 1281).—A. G. L.

Kaolin, clay, and ceramic masses prepared therefrom: Process for rendering — plastic. G. Keppeler and A. Spangenberg. Ger. Pat. 201,404, Aug. 29, 1906.

THE process consists in adding tannic acid (or other complex organic acids such as humic acid), combined with alkali or ammonia to the clay or clay mass; or in first imparting to the mass a certain degree of mobility by addition of tannic acid and an excess of alkali, and then partially or completely destroying this mobility by addition of acid. It is stated that the mixtures when dried and burnt at temperatures below 600° C. yield light (sp. gr. 0.5) porous articles.—A. S.

Opaque enamels: Preparation of — by means of cerium compounds. Rickmann and Rappe, G.m.b.H. Ger. Pat. 203,773, June 30, 1907.

IT has been proposed to use the fluoride or silicofluoride of cerium for the production of opaque enamels, but during the melting process the effect of these compounds is partially destroyed; indeed on prolonged heating, the enamel mass dissolves them with production of a clear glaze. According to the present patent, this defect is overcome by replacing the compounds mentioned by cerium oxide or such cerium compounds, e.g., the carbonate, which yield the oxide, or by a mixture of oxides of cerium metals, such as is obtained as a by-product in the manufacture of thorium nitrate.—A. S.

Silvering glass or other surfaces. Chem. Fabr. von Heyden A.-G., Radebeul, Germany. Eng. Pat. 14,841, July 13, 1908. Under Int. Conv., July 18, 1907.

SEE FR. Pat. 392,243 of 1908; this J., 1908, 1204.—T. F. B.

Earthenware cocks and pipes. Eng. Pat. 15,189. See I.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Clays: Action of electrolytes on the colloidal substances of —. Rohland. Sprechsaal, 1909, 42, 1—3.

ALL electrolytes, which on dissociation give rise to hydrogen ions, increase the plasticity of clays, i.e., render them stiffer, if the concentration of the electrolytes is not less than that of a $N/10$ -hydrochloric acid solution.

Conversely, electrolytes, which yield hydroxyl ions, render clays thinner, and thus make them more suitable for pouring, if the concentration is not less than that of a $N/1$ -sodium hydroxide solution. The explanation of these facts is assumed to be that the colloids, hydroxides of iron, aluminium, and silicon, formed by the action of water on clays, possess a negative charge, and are attracted by, and form complex compounds with, the positively charged hydrogen ions, whilst they are repelled by hydroxyl ions. In cases, *e.g.*, with copper sulphate, ammonia, and potash alum, where a concentrated solution has an action the reverse of that shown by a dilute solution of the same electrolyte, it is assumed that the anion acts in the dilute solution, and the cation in the concentrated solution. Clays possess the peculiar property of adsorbing carbonic acid ions completely from solutions of alkali carbonates; phosphoric acid ions are also partially adsorbed. Talc (magnesium silicates) possess the same property, but to a less extent. Hydroxyl ions act most strongly on dark-coloured clays, which contain organic matter, and it has been proposed to render clays more fluid by adding, in addition to alkalis, organic colloids, such as peat and lignite. In selecting clays for casting, the nature of the soluble salts contained in the clays should not be overlooked, since all neutral salts are not so inert as is sodium chloride; magnesium and iron salts, sulphates and carbonates especially exert specific actions.—A. G. L.

Molasses binder [roads]. Rock Products, 8, Sept. 26. Chem. Abstr. (Amer. Chem. Soc.), 1908, 2, 3414. [T.R.]

THE public roads department of the U.S. Department of Agriculture has experimented at Newton, Mass., with molasses as a road binder. The molasses used was the lowest grade from the cane sugar refineries of the Southern and the beet sugar factories of the Western and Northern States. It was nearly as black and thick as tar, and almost as powerful as a binder. Having always been a waste product, it can be bought at a lower price than coal tar and in greater quantities. Samples of this molasses were subjected to laboratory tests. The molasses was blended with oils and lime water, mixed with rock dust, with earth and with sand and subjected to the action of heat and water. It behaved so well and held out such promises for ideal roads that a practical test was decided upon.

PATENTS.

Stone, artificial; Process for the preparation of — from refuse ashes and paper pulp. F. Reinold. Ger. Pat. 204,100, Sept. 20, 1907.

THE ashes are agglomerated by means of a pulp prepared from the organic substances, such as paper, wood, etc., present in the refuse.—A. S.

Cement; Rotary kilns for burning —. F. J. Poths, Hamburg, Germany. Eng. Pat. 13,440, June 24, 1908.

SEE Fr. Pat. 391,698 of 1908; this J., 1908, 1154.—T. F. B.

X.—METALS AND METALLURGY.

Iron ores of Ontario. A. B. Willmott. J. Canadian Min. Inst., 1908, 11, 106—124.

IN 1907, the production of iron ore in Ontario was 200,185 tons, the total mined from 1869 to 1907 being little more than two million tons. The author passes in review the principal areas in Ontario in which iron ores are found, but points out that the prospecting in these regions has been comparatively superficial. More than half of the ore mined is hæmatite, but magnetite, limonite, chalybite, and titaniferous iron ores are also found. As the geological formation in which the vast high-grade Lake Superior iron deposit is situated extends into Ontario, the author considers that similar deposits may be expected there. Up to 1907, over 330 million tons of ore had been produced

from the Lake Superior deposits and it is estimated that on the basis of last year's consumption, they will not last more than fifty years. In discussion, F. Hill maintained that the Mattawin Iron Range was the most important iron deposit in the province, for though the ore was of low grade, it was readily concentrated to a high-grade Bessemer ore with hardly any phosphorus or sulphur. This deposit was known to cover an enormous area and drilling to a depth of 1000 ft. had failed to reach the bottom.—F. R.

Charcoal: the blast furnace fuel for Ontario. R. H. Sweetzer. J. Canadian Min. Inst., 1907, 11, 163—169.

THE fuel cost in Ontario is high on account of the necessity of importing coal or coke, but as there is an abundance of wood, the use of charcoal is advocated. The author claims that the destruction of forests would not seriously affect the province for many years. Charcoal forms a very efficient fuel for the smelting of iron ores, owing to its freedom from sulphur, and, in consequence of its low percentage of ash, both the amount of fuel and flux may be materially reduced. The air blast required is only 65 per cent. of that necessary for a coke furnace, with the result that, in addition to the saving in blowing engines, etc., the quantity of fine dust is reduced, and yield of pig iron increased. The furnaces for the use of charcoal are however comparatively small, and size for size, their output is less, compared with coke. Complete data are given of a furnace running one month on coke and one month on charcoal.—F. R.

Tin; Determination of — in tin-plate. K. Meyer. Z. angew. Chem., 1909, 22, 68—69.

THE method gives concordant results and occupies only 20 minutes. 20—50 grms. of cuttings or small pieces of the tin-plate, freed from dirt and grease, are covered with water, heated to 80 °C., and 1—2½ grms. of sodium peroxide added. After the first vigorous reaction has subsided, another 1 gm. of peroxide is added, the heating being continued so that the solution boils. When reaction has ceased, the residual metal is examined, and if necessary, a further small quantity of sodium peroxide is added and the mixture boiled to dissolve the last traces of tin. The metal is then washed with water, and with alcohol, dried and weighed. If desirable, the tin in the solution may also be determined. Any lead present is dissolved with the tin.—A. S.

Lead and tin alloys; The coefficient of viscous traction of —. A. E. Dunstan. Phil. Mag., 1909, 17, 192—201.

IT is shown that when a wire composed of pure lead, or tin, or alloys of these metals, is stretched beyond its elastic limit, (in these cases this limit is exceeded by a very small load), the rate of extension proceeds quite steadily, and the material undergoes a "viscous flow." From this rate of flow a coefficient of viscous traction may be deduced for any given load. It is further shown that on plotting the corresponding coefficients of viscous traction against the percentage composition of the alloys, a hyperbolic curve is obtained, which indicates that the relative effect of tin on the mobility of lead is very great, whilst that of lead on the mobility of tin, is very small. The maximum divergence from the normal, did these alloys follow the mixture law, is at 2Pb:1Sn. The coefficient of viscous traction is a function of the load, and in some cases is very considerably affected by the load used. This statement is, however, strictly applicable only to those alloys containing less than 10 per cent. of tin.

[Alloys] *Hardness of solid solutions and compounds of metals.* N. Kurnakow and S. Shemtschukhy. J. Russ. Phys.-Chem. Ges., 1908, 40, 1067—1104. Chem. Zentr., 1908, 2, 1990—1992.

FROM a study of the hardness of metallic alloys it is found that the formation of a solid solution is accompanied

by an increase of hardness. The curves representing the hardness of binary alloys may be divided into four main types. (1). When the metals form a continuous series of mixed crystals, the hardness is represented by a continuous curve passing through a maximum; the point of maximum hardness generally corresponds with that of minimum electric conductivity. (2). When the alloys solidify as a mechanical mixture of the two components, the hardness is represented by a straight line; in most cases, however, this form of curve is modified owing to deformation of the crystals of the individual metals. (3). When the two metals form only a limited series of mixed crystals, the curve is a combination of those described under (1) and (2). (4). If the two metals form a definite chemical compound, this may be harder or softer than the component metals, and the curve representing the hardness of the alloys differs accordingly.

—A. S.

Monel Metal. Eng. and Min. J., Dec. 26, 1908. [T.R.]

ATTENTION has been called to this alloy recently by its use in the sheet form in the roof of the new Pennsylvania railroad station in New York. It is laid in the same manner as copper sheets would be, and the sheets are fastened with nails made of the same alloy.

Monel metal is an alloy containing about 70 per cent. of nickel and 30 per cent. of copper. It is smelted and refined directly from nickel-copper matte produced from ores of the Sudbury district in Canada. The furnacing and refining of the matte involves only the removal of impurities and the reduction of the iron which is contained in the matte to a very small proportion, 1.5 per cent. being the maximum. Monel metal has a high tensile strength, the tests showing much higher results than those given by nickel steel. Its hardness makes it more difficult to roll than steel sheets. A special mill will probably be required. The new alloy resists corrosion, takes a fine polish, and possesses many of the qualities of metallic nickel. Perforated sheets for mining screens have been tried, and have been found to wear better than any other metal yet used for the purpose. Notwithstanding the high nickel content, the metal is placed on the market at about 2c. per lb. above the current price of copper. This can be done because the process of separating the nickel from the copper is not required; the alloy, as above stated, being made directly from the nickel-copper matte.

Aluminium, calcium, and magnesium; Heats of combustion of —. F. E. Weston and H. R. Ellis. Faraday Soc., Dec. 15, 1908. [Advance proof.]

THE authors have investigated the reduction of the oxides of aluminium, calcium, and magnesium by each of these metals respectively. Aluminium oxide is reduced by magnesium and by calcium; calcium oxide is easily reduced by magnesium and partially reduced by aluminium; magnesium oxide is slowly reduced by calcium, but not by aluminium. The conclusion is drawn that the heat of combustion of magnesium is slightly greater than that of calcium, and that the latter is greater than the heat of combustion of aluminium.—F. SODDY.

Carborundum [Production of metallic silicides]. L. Baraduc-Muller. Soc. Ing. Civ. de France, Proc. verb., 1908, 245—247.

AFTER a description of the history of the production of carborundum and a résumé of its properties and applications, the author describes the reaction, at temperatures about 1350° C. of carborundum on metallic oxides, expressed by the general equation, $\text{SiC} + \text{MO} = \text{MSi} + \text{CO}$. In this way it is possible to prepare many metallic silicides practically free from carbon. By carrying out this reaction on the surface of a bath of melted steel (or even pig-iron), special ternary or quaternary steels can be produced at a single operation.—J. T. D.

Thorium. C. Baskerville. Eng. and Min. J., 1908, 86, 1241—1242.

THORIUM, though of rare occurrence, is of wide utility in consequence of its use in the manufacture of the

Welsbach incandescence mantle. The chief minerals in which thorium occurs are thorite, aegirite, thorianite, and monazite, most of the commercial thorium being obtained from monazite. It is also found in a greater or less quantity in many other rare minerals, the author giving a statement of the composition of 80 minerals in which it is said to occur, together with a description of the mineralogical qualities and reactions of the most important.—F. R.

Mercury in 1908. Chem. and Druggist, Jan. 15, 1909. [T.R.]

APPENDED are Mr. Alex. S. Pickering's annual statistics:

	Imports.	Exports.	Price.	
			Highest.	Lowest.
			£ s. d.	£ s. d.
1908....	Bottles, 43,605	Bottles, 22,348	8 10 0	7 12 6
1907....	39,448	29,465	8 5 0	6 15 0
1905....	34,034	21,330	7 15 0	7 1 0
1903....	34,886	18,846	8 15 0	8 5 0
1901....	35,341	26,862	9 2 6	8 17 6
1899....	51,696	32,239	9 12 6	7 15 0

Estimated consumption United Kingdom, 13,000 bottles per annum.

Peat for industrial and metallurgical purposes. E. Nystrom. See II.

PATENTS.

Bessemer process; Basic —. L. P. J. A. H. Messier, Lille, France. Eng. Pat. 8168, Apr. 13, 1908.

IN treating pig-iron poor in phosphorus or high in silicon, a portion of the basic slag obtained in a previous operation is added from a slag-mixer to the metal after it has been sufficiently freed from silicon. Lime is then added and the basic process completed as usual. If a cupola furnace is used for melting the pig-iron, the slag may be added in the cupola furnace instead of in the converter.—A. G. L.

Carburising gas [for case-hardening iron and steel]; Preparation of —. A. W. Machlet, Elizabeth, New Jersey, U.S.A. Eng. Pat. 10,532 of 1908; date of application, Nov. 12, 1907.

IN the process of case-hardening iron and steel by means of illuminating gas, as described in Eng. Pat. 25,087 of 1907 (see Fr. Pat. 389,547; this J., 1908, 985), the gas should be diluted with an inert gas. The invention consists in producing a suitable diluted carburising gas by passing an inert gas, such as ammonia, through a body of naphtha.—A. T. L.

Steel; Process of manufacturing —. W. R. Walker, Chicago, Ill. U.S. Pat. 906,757, Dec. 15, 1908.

THE spiegel to be added to the charge of a Bessemer converter, or steel-refining chamber, is made by tapping a spiegel, low in manganese, into a receiving ladle and mixing with it sufficient of a metallic addition rich in manganese, to produce the necessary recarburising material.—F. R.

Ore separators; Centrifugal —. P. F. Peek, Chicago, U.S.A. Eng. Pat. 3683, Feb. 18, 1908.

THE specification relates to modifications of the ore separator described in Eng. Pat. 3682 of 1908 (this J., 1908, 1209). Owing to the strong flow of water over the different zones of the separating channel, there is a tendency for part of the water to flow over, carrying ore particles with it, from one zone to the next adjacent ones. In order to overcome this difficulty, water-partition or bulkhead zones, supplied independently with clean water, are provided between the concentrates-removing zones and the ore-receiving and separating zones.—A. S.

Ores, shale, or other substances; Apparatus for subjecting — to the action of heat in a continuous manner. J. B. Peat, Redcar, Yorks. Eng. Pat. 7920, Apr. 9, 1908.

SOLID or gaseous fuel is burnt in grates or burners placed in a brick combustion chamber in such a way that the flames are forced to take a spiral path through the chamber before entering a central chimney through an opening arranged for the purpose. In doing so, the flames heat a number of separate and easily removable tubes, which extend vertically through the chamber, and through which the material to be heated falls on its way from a chamber above the combustion chamber to another chamber placed below it. From the lower chamber the burnt materials are removed by a conveyor or other device without admitting air. To the upper chamber the unburnt materials are charged from a hopper placed above, also without admitting air. The central brick chimney of the combustion chamber is continued upwards through the upper chamber and the hopper by means of a suspended metal shaft, made tight with asbestos packing, thus allowing for expansion and contraction. In the upper chamber the materials are heated centrally from this chimney after being preheated in the hopper; in the tubes the material is heated from outside. The tubes are provided with internal spiral retarders or ribs, which serve to turn the materials over in their downward passage; the tubes may also be provided with external baffle-plates to take up heat more readily from the flames.

—A. G. L.

Ores; Process of desulphurising —. R. Hübner, New York. U.S. Pat. 906,883, Dec. 15, 1908.

THE ore is placed in an externally heated chamber and the evolved gases withdrawn by suction, the chamber being otherwise closed to prevent the entrance of any material amount of air.—F. R.

Metals; Process of uniting —. E. D. Holley, Forestville, and C. L. Root, Bristol, Conn. Assignors to Bristol Brass Co., Conn. U.S. Pat. 906,627, Dec. 15, 1908.

Two metals are united by coating the surface of one of them with an adherent metallic medium, fusible at a lower temperature than either, and then applying the second metal in a molten condition and allowing it to cool naturally. Iron and copper are united by applying a coat of molten zinc to the surface of the iron and then pouring on the molten copper.—F. R.

Ore concentrating and separating apparatus. F. and H. Dallemagne, Passages, Spain. Eng. Pat. 11,684, May 29, 1908. Under Int. Conv., June 15, 1907.

SEE Fr. Pat. 378,895 of 1907; this J., 1907, 1203.—T. F. B.

Zinc; Apparatus for extracting —. E. H. Shortman, Bloxwich, Assignor to The New Delaville Spelter Co., Ltd., Birmingham. U.S. Pat. 907,416, Dec. 22, 1908.

SEE Eng. Pat. 7223 of 1907; this J., 1908, 450.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A).—ELECTRO-CHEMISTRY.

Nitric acid; The electric discharge and the production of —. W. Cramp and B. Hloye. Paper read before the Institution of Elect. Eng., Nov. 3, 1908.

THE authors discuss the various types of apparatus which have been proposed for the electrical oxidation of atmospheric nitrogen. They conclude that good results are only to be obtained by the use of thin flames with very rapidly moving arc-threads employed to heat suddenly large quantities of air which are as quickly as possible

cooled again. On this basis experiments were made, with a modification of the apparatus suggested by Werner (See U.S. Pats. 777,987—777,991; this J., 1905, 95), in order to ascertain the effect of variations in: (1), the size and form of the nozzle through which the air is delivered; (2), the electric current; (3), the velocity of the air; (4), the length of the spark-gap; (5), the capacity of the circuit. The results show broadly the great importance of adapting spark-gap, current, and air-blast to one another, for changes of yield to the extent of 50 per cent. or more may be obtained by slight variations of any one of these factors. For a given current the maximum yield of acid does not correspond with the maximum concentration of acid, and the value of using a magnetic field to spread out the flame, as in the Birkeland-Eyde process, is hence doubtful. If in the Birkeland-Eyde process, as at present carried on, a very good proportion of the maximum possible yield is being obtained, then direct electrical processes would appear to possess no chance of competing effectively with the calcium cyanamide process of Frank and Caro. Further experiments are needed to ascertain whether much better yields of oxides of nitrogen can be obtained by making use of the most favourable velocity of air and length of spark-gap, the introduction of ozone, the instantaneous cooling of the gaseous products, and subjecting these products to ionisation. A bibliography is appended to the paper. (See also Guye, this J., 1906, 567, and Howles, this J., 1907, 290.)—A. S.

Electrolytic bleaching process; Preparation of alkali hypochlorites, and the —. F. J. G. Beltzer. See V.

PATENTS.

Hydrogen and oxygen generators; Electric —. S. O. Cowper-Coles, London. Eng. Pat. 14,285, Dec. 20, 1907.

THE electrodes consist of metallic sheets provided with tongues, which project downwards at an angle of about 45° with the faces of the sheets. The electrodes are placed in separate collecting boxes or chambers, the liberated gases being guided into these by the inclined tongues of metal which project within openings in the sides of the chambers. A battery of generators may be enclosed in a water jacket, and provided with means for keeping the solution in each cell at a common level.—B. N.

Electrode for use in the purification of water and other liquids. J. M. Murphy, Hammonton, N.J., U.S.A. Eng. Pat. 27,559, Dec. 13, 1907.

THE electrode is composed of from 87 to 93 parts of aluminium and from 7 to 13 parts by weight of magnesium; the alloy is melted, cast into a plate, and the surface of the latter is polished. When in use, two plates are fixed in suitable proximity, and the liquid to be purified is passed between them, while a current of electricity (of about 30 volts and 20 ampères) is passed through the electrodes and liquid.—W. P. S.

Ozone; Apparatus for the production of —. J. Steynis, New York, and H. J. E. Chaumat, Paris. Eng. Pat. 412, Jan. 7, 1908. Under Int. Conv., Jan. 25, 1907.

THE air or oxygen ozonised in this apparatus is previously cooled by adiabatic expansion with external work. The electrodes form two alternated systems of conducting plates, connected in parallel, the electrodes of one polarity being fixed and the others forming a whole which may be displaced in the direction of the movement of the air, so that the amount of the silent discharges may be varied. The insulating blocks which separate the dielectric plates also serve to support the electrodes. The insulating blocks have grooves in which the electrodes are fixed in such a manner that the insulating blocks are outside the zone of the silent discharge.—O. F. H.

Electrical resistances; Manufacture of —. C. Ruzicka, London. Eng. Pat. 4657, Mar. 2, 1908.

THE resistances are made from a mixture of substances, such as coal tar or rosin, which leave behind a carbon-

aceous residue when heated in a neutral or reducing atmosphere, or a vacuum, and mineral substances such as quartz and silicon borate. To this mixture are added one or more metallic salts to act as fluxing or welding agents, the whole being heated to a temperature of at least 1000° C. so as to yield a hard stone-like homogeneous product. For a resistance rod of 1 sq. cm. cross section and 10 cm. long, having a resistance of 10,000 ohms, the following composition is specified—coal tar, 60 parts; quartz, 12; potassium feldspar, 21; and potassium tetraborate, 10 parts. For a resistance rod of the same dimensions to give a resistance of 20,000 ohms, the following composition is specified—rosin, 60 parts; flint, 12; potassium feldspar, 24; boric acid, 10; and turpentine, 30 parts.—O. F. H.

Electrical resistances; Manufacture of —. C. Ruzicka, London. Eng. Pat. 9762, May 5, 1908.

THE resistances are made of a mixture of either an oxide, carbonate, chloride, nitrate, or nitrite of at least one metal of each of the following two groups—(a), copper, iron, and silver; (b), iridium, nickel, palladium, and platinum; together with one or more artificial or natural compounds of silicic or boric acid or both, these compounds possessing a comparatively low melting temperature of less than 1500° C. To this mixture are added one or more natural or artificial minerals having a comparatively high melting temperature of over 1500° C., such as bauxite or alumina. For a resistance rod of 1 sq. cm. cross section, 10 cm. long, and having a resistance of 300 ohms, the following mixture is given—iron oxide, 20 parts; nickel oxide, 33; calcium feldspar, 26; and bauxite, 18 parts. For a resistance rod of similar dimensions having a resistance of 2 ohms, the following mixture is given—iron nitrite, 20 parts; nickel nitrite, 38; calcium feldspar, 26; and bauxite, 18 parts.—O. F. H.

Electrical resistances; Manufacture of —. C. Ruzicka, London. Eng. Pat. 9763, May 5, 1908.

CLAIM is made for the use of metallic salts as fluxing or welding agents in the manufacture of electrical resistances. For a resistance rod of 1 sq. cm. cross section and 10 cm. long, having a resistance of 400 ohms, the following mixture is given: carbonised petroleum residue, 4 parts; potassium feldspar, 34; quartz, 22; coal tar, 4; and boric acid, 6 parts. For a resistance rod of the same dimensions and having a resistance of 60 ohms, the following mixture is given: silicon carbide, 60 parts; potassium feldspar, 24; marble, 12; tar pitch, 3; boric acid, 10; and amyl alcohol, 10 parts.—O. F. H.

[Electrolytic] Precipitating apparatus. J. E. Greenawalt, Denver, Colo. U.S. Pat. 906,011, Dec. 8, 1908.

THE precipitating vessel has a perforated false bottom on which a mass of shavings cut from an alloy of lead and zinc and forming the cathode is supported. A suitable anode contained in a porous jar is suspended just below the surface of the liquid or electrolyte. The liquid to be treated is introduced by a pipe which enters the side of the vessel below the false bottom, passes upwards through the metallic shavings, and overflows through a pipe near the top of the vessel.—W. H. C.

Electrolytic apparatus for the manufacture of bleaching liquors. A. Vogelsang, Dresden, Germany. U.S. Pat. 906,669, Dec. 15, 1908.

THE apparatus consists of a series of compartments, arranged in steps, in which chloride solutions are electrolysed. The walls between the compartments serve as electrodes and the liquid flows through the compartments in succession. The sides of the division walls between the compartments, which are exposed to the air, do not act electrolytically and have tubes arranged near them for cooling the flowing liquor.—J. W. H.

Electric furnace. K. Birkeland, Christiania, Norway. U.S. Pat. 906,682, Dec. 15, 1908.

A TUBULAR electric furnace for the treatment of gases has axial electrodes arranged at a distance apart greater

than that at which the arc may be re-formed. The furnace is surrounded by a field coil, producing a magnetic field parallel to the axis of the electrodes, by which the arc is distorted into a helical form. The air or gas for treatment is admitted at one end of the furnace and exhausted from the other.—J. W. H.

Chlorates and perchlorates; Process and apparatus for the electrolytic preparation of alkali —. F. Silbermann. Ger. Pat. 205,019, Nov. 7, 1907.

IN the electrolytic preparation of chlorates and perchlorates, the electrolyte soon becomes alkaline, and the excess of free alkali has a prejudicial effect on the yield. In order to overcome this defect, a method of working is adopted in which the electrolyte flows continuously through the apparatus at a suitable rate and rinses the surface of the cathode just before leaving the electrolytic vessel. In this way small quantities of free alkali are continuously removed from the system, before they can interact with chlorine formed at the anode. For this purpose, the cathodes are enclosed in open tubes through which the electrolyte flows to the discharge tube, or they are themselves made hollow in order to serve as outlet tubes for the electrolyte.—A. S.

Oxidising agents, such as hypochlorites, chlorates, bromates, etc.; Electrolytic production of —. G. Thiele. Ger. Pat. 205,087, July 11, 1906.

IN the electrolytic preparation of oxidising agents, such as hypochlorites, chlorates, etc., without the use of a diaphragm, it has been proposed to add calcium or chromium compounds to the electrolyte, in order that the oxide or hydroxide of the added metal may form a protecting layer on the cathode, and prevent cathodic reduction of the oxidising agents formed. According to the present patent, high-molecular, non-aromatic, organic sulphur compounds, such as Turkey-red oil or other sulphonated or sulphurised fats or fatty-acids, or soluble soaps prepared from them, are added, along with calcium compounds, such as the chloride or hydroxide, to the electrolyte either before or during electrolysis. It is stated that the organic sulphur compounds increase the protective action of the calcium hydroxide.—A. S.

Persulphates; Process for the preparation of — by electrolysis of bisulphates. Verein. Chem. Werke, A.-G. Ger. Pats. 205,067 and 205,068, April 14, 1907.

INCREASED yields of persulphate are obtained by the addition to the electrolyte of: (1), simple or complex cyanides; (2), salts of cyanic acid, thiocyanic acid, or cyanamide.—A. S.

Sodium persulphate; Process for the preparation of — by electrolysis of sodium bisulphate. Verein. Chem. Werke, A.-G. Ger. Pat. 205,069, June 14, 1907.

IN order to obtain sodium persulphate in a granular form, so that it can be readily separated from the mother-liquor, small quantities of potassium salts, especially salts of cyanogen-compounds, are added to the electrolyte.—A. S.

Electrolytic cells. A. E. Gibbs, Wyandotte, Mich., U.S.A. Eng. Pat. 27,830, Dec. 17, 1907.

SEE U.S. Pat. 871,064 of 1907; this J., 1908, 80.—T. F. B.

Furnaces; Electric —. A. L. Marsh, Lake Bluff, Ill., U.S.A. Eng. Pat. 19,265, Sept. 11, 1908. Under Int. Conv., Sept. 19, 1907.

SEE U.S. Pat. 882,788 of 1908; this J., 1908, 452.—T. F. B.

Ozone; Process and apparatus for the production of —. J. Steynis, New York. U.S. Pats. 906,081 and 906,468, Dec. 8, 1908.

SEE Eng. Pat. 412 of 1908; preceding.—T. F. B.

Sealing a conductor into glass: Method and means of hermetically —. C. O. Bastian and G. Calvert, London. U.S. Pat. 908,378, Dec. 29, 1908.

SEE Eng. Pat. 21,383 of 1905; this J., 1906, 1156.—T. F. B.

Incandescent bodies for electric lamps. Eng. Pat. 4956. See II.

Incandescent electric lamps, heaters, and the like: Incandescing or heating bodies containing zirconium for —. Eng. Pat. 5415. See II.

Electric incandescence bodies of tungsten. Eng. Pat. 19,311. See II.

Glycollic acid: Process for preparing — by electrolytic reduction of oxalic acid. Ger. Pat. 204,787. See XX.

(B.)—ELECTRO-METALLURGY.

PATENTS.

Iron: Electro-deposition of —. S. O. Cowper-Coles, London. Eng. Pat. 12,747, Dec. 2, 1907.

FINELY-DIVIDED iron in the form of cast-iron chilled shot is maintained in suspension in the electrolyte by the following or other suitable means: The electrolyte and shot are withdrawn from the bottom of the depositing vat into a vat at a lower level. The electrolyte passes into a sump from which it is pumped back to the depositing vat, while the shot is elevated by a series of perforated buckets attached to an endless chain and tipped into a hopper on the top of the depositing vat, and thence into the electrolyte. The object of the finely-divided iron is to keep the electrolyte neutral.—O. F. H.

Electrodeposition. L. Hausmann, Berlin. Eng. Pat. 25,669, Nov. 20, 1907. Under Int. Conv., Nov. 23, 1906.

AN anode with metallic surface containing a metal core is used in connection with the process described in Eng. Pat. 14,904 of 1907 (this J., 1908, 232).—O. F. H.

Scrap tin or the like: Receptacles for — for electrolysis. The London Electron Works Co., Ltd., and A. de Back, London. Eng. Pat. 17,115, Aug. 14, 1908.

THE sides, ends, bottom and top, of the receptacle containing the scrap tin to be detinned electrolytically, are made of perforated metallic flat plates, connected together so as to form a perforated vehicle or cage, preferably of rectangular form. One side of the cage is made easily removable for the introduction of the material. The ends project above the top level of the cage, and are connected to a non-insulated electric conductor, or crossbar, the latter being provided with electrical contact studs or bolts, and with a hook for attachment to lifting gear. The studs are connected to a source of current, so that the cage forms the anode.—B. N.

Detinning tin scrap: Apparatus for and method of —. M. Leitch, Springfield, Mass., Assignor to Metal Process Co., New York. U.S. Pats. 906,726 and 907,061, Dec. 15, 1908.

THE apparatus consists of cathode and anode plates, specially arranged in a tank containing an electrolyte such as caustic soda. The tank or the electrodes can be raised or lowered, for the immersion or otherwise of the latter. Pipes are provided for withdrawing the electrolyte at a point below its surface, passing it through a tank where it is heated, and returning it to the detinning tank.—F. R.

Furnaces: Electric —. C. A. Keller, Paris. Eng. Pat. 21,741, Oct. 14, 1908.

THE base or sole of the furnace comprises a bundle of vertical iron bars embedded or countersunk into a setting of suitable fireproof material, such as magnesite, the upper ends of the bars being flush with the upper surface of the material, whilst the lower ends are electrically connected with a horizontal conducting plate. The bars of metal conduct the current when cold, but at higher temperatures

the refractory earth also becomes a partial conductor. "The semi-metal and semi-fireproof block," thus forming the lower electrode, is contained in a surrounding metal frame, which may be water-cooled, and the electrode and metal casing are separated by a refractory brick lining.—B. N.

Silicides of barium, calcium, and strontium: Preparation of — in the electric furnace. T. Goldschmidt, Ger. Pat. 204,567, May 19, 1907.

THE oxide or salts of calcium, barium, or strontium are heated with silicon, in the presence of a flux capable of yielding a friable slag. When calcium chloride is used as raw material, calcium fluoride is a suitable flux. For instance, 15 parts of calcium fluoride, 5–10 parts of calcium chloride, 66½ parts of lime, and 33½ parts of silicon are heated in the electric furnace, and from the product the light grains of the silicide are separated from the friable slag by sifting.—A. S.

Alloys of silicon [silicides]: Manufacture of —. Th. Goldschmidt, Essen on Ruhr, Germany. Eng. Pat. 5773, March 12, 1908. Under Int. Conv., May 18, 1907.

SEE Ger. Pats. 199,193 and 204,567 of 1907; this J., 1908, 948, and above.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Red currant seed oil. R. Krzizan, Chem. Rev. Fett- u. Harz-Ind., 1909, 16, 1–3.

THE air-dried seeds of Italian and Bohemian red currants yielded, on extraction with petroleum spirit, 16.0 and 18.5 per cent. of oil respectively. In each case the oil was of an orange-yellow colour and had an odour resembling that of linseed oil. In the film test the oils dried in 3 to 4 days, yielding an elastic skin, and in Livache's test absorbed 9.24 and 8.78 per cent. of oxygen respectively in 7 days. The oil from the Italian seeds had a high acid value (40.6) possibly due to the presence of a lipolytic enzyme; its sp. gr. was 0.9265 at 15° C., saponification value, 189.9; iodine value, 172.3; Reichert-Meißl value, 1.1. The Bohemian oil, extracted from freshly-separated seeds only showed an acid value of 2.9, but when kept in closed vessels became light yellow, and strongly rancid. It had the sp. gr. 0.9303 at 15° C., saponification value, 186.9; iodine value, 175.9. The Italian oil contained 0.14 per cent. of sulphur, but none was found in the Bohemian oil. The 5 per cent. of solid fatty acids separated from the Italian oil had the sp. gr. 0.9117 at 15° C., iodine value, 178.7; neutralisation value, 196.3; acetyl value, 13.2. They contained stearic and palmitic acids, whilst the liquid fatty acids consisted chiefly of linolic acid with smaller quantities of oleic, linolenic, and (probably) isolinolenic acids. The tetrahydroxystearic acid obtained by the oxidation of the linolic acid melted at 157° to 158° C. instead of the normal m. pt. (173–174° C.), and in this respect resembled the tetrahydroxystearic acid obtained from blackberry seed oil (this J., 1908, 233). The Bohemian oil contained less solid fatty acids than the Italian oil. (See also this J., 1908, 1072).—C. A. M.

Salvadora oleoides fat [khakas oil]. D. Hooper, Agricult. Ledger, 1908, [1], 1–5.

KHAKAS oil is obtained by hot expression from the kernels of the seeds of *Salvadora oleoides*, indigenous to the Punjab, Baluchistan, Sind, and Bombay, where it often forms the greater part of the desert vegetation. The fat occurs in yellowish-white blocks, solid at ordinary Indian temperatures; the odour is slightly rancid. Sp. gr., 0.9084; m. pt., 41° C.; acid value, 11.26; saponification value, 242.36; iodine value, 7.48; Reichert-Meißl value, 1.28; fatty acids, 94.12 per cent.; titer test, 40° C.; acid value of fatty acids, 244.42; iodine value of fatty acids, 8.3. The fat can be easily saponified. It should be useful for candle making, for hard soaps, or for pharmaceutical products. It is used by native Indian dyers as a "resist." Its low iodine value and high saponification

value distinguish it from other Indian fats, such as Malabar tallow, from *Vateria indica*, and kokum butter from *Garcinia indica*. J. O. B.

Oils; Iodine value of —, L. E. Levi and E. V. Mameel. J. Amer. Leather Chem. Assoc., 1908, 3, 386—387.

EXPERIMENTS with cod, olive, sperm, neatfoot, and "tan" oils showed that carbon tetrachloride or pentachloroethane may be substituted for chloroform in the determination of the iodine value of oils by the Hanus method. Carbon tetrachloride is preferred, it being easily obtainable at a comparatively low price. Two methods are given for its purification. (1). Commercial carbon tetrachloride is shaken with a solution of sodium thiosulphate at intervals of half an hour for two hours. The two layers are then separated, and the carbon tetrachloride next shaken with a 5 per cent. solution of caustic soda every 15 minutes for one hour. It is again separated, dried over calcium chloride, and distilled. (2). In the other method of purification the Hanus iodine solution is used instead of the sodium thiosulphate solution. H. G. B.

Unsaturated organic compounds [fats, fatty acids, etc.]; Catalytic oxidation and reduction of —, S. Fokm. J. Russ. Phys.-Chem. Ges., 1908, 40, 276—321. Chem. Zentr., 1908, 2, 1995—1996.

The author has continued his studies on the catalytic oxidation of unsaturated organic compounds (see this J., 1907, 1149). In the oxidation of olein, tung oil, sunflower oil, almond oil, and the fatty acids of linseed oil, using as catalysers ("driers") the oleates of cobalt, manganese, chromium, nickel, barium, lead, and calcium, the compounds of cobalt and manganese gave the best results, whilst those of lead and calcium were the least active. There appears to be no simple relation between the rate of oxidation and the concentration of the catalyser. The rate of oxidation is retarded by moisture, increased by light, doubled by a rise of temperature of 10° C., and greatly accelerated by increasing the pressure of the oxygen from 1 up to about 20 atmospheres.

Further experiments on catalytic reduction are also described (see this J., 1906, 935; 1907, 169, 1149; 1908, 878).—A. S.

Colloidal solutions of calcium soaps in heavy mineral oils. Holde. Z. Chem. Ind. Kolloide, 1908, 3, 270—274.

CERTAIN lubricating greases (known as Stanffer's or Toyote greases) are usually prepared by dissolving a calcium soap in a mineral oil and thoroughly stirring in a little water. Less frequently a saponifiable oil is dissolved in a mineral oil, the solution treated with lime and so much water left in the product that on stirring, the peculiar consistence of these lubricants, resembling that of vaseline or tallow, is obtained. When not mixed with water they are not stable, and the constituents separate out. The water is present in the form of microscopic drops, and when present in the proper quantity, increases the consistence of the product very greatly and raises the dropping point very considerably, in some cases converting a product which is quite liquid at the ordinary temperature into one with a dropping point of 70° C. The point of greatest consistence is characterised by a peculiar cracking noise which is produced on stirring. The turbidity of the mixture is in close relation to the amount of water. The magnitude of the difference between the softening and dropping points (in Ubbelohde's apparatus) is considered to be of great technical importance. It becomes large, if too much oil is used, or if the oil is too thin, or if the conditions under which heat is applied during preparation are unsuitable. On standing, the lubricant becomes more consistent and the softening point gradually rises, though the dropping point remains unaltered. This phenomenon is in the author's opinion connected with the fact that solutions of calcium soaps in mineral oil, to which water has not been added, gradually become non-homogeneous, the calcium soap separating out locally in the form of a jelly. In the finished product the increased viscosity due to the finely-divided water prevents this change from being outwardly noticeable; the product may probably be looked upon as a supercooled colloidal

solution of the calcium soap. Very different results are obtained on preparing the calcium soap by precipitation of an alkali soap with calcium chloride. Under the ultramicroscope, solutions of calcium soaps in heavy mineral oil appear homogeneous, but solutions of precipitated calcium soaps in pure benzene show submicrons. Crystallised paraffin wax shows a light-cone, but few submicrons, except in very strong solutions; in Russian petroleum which is almost free from paraffin wax, scarcely any submicrons could be observed, but they were present in an American petroleum, containing paraffin wax. —E. F.

PATENT.

Sewage, waste-water, etc.; Apparatus for the extraction of grease from —. Fr. Pat. 393,172. See XVIII B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

PATENTS.

White lead pigment; Process for the preparation of —, J. M. Neil, Assignor to J. B. Gregory, Toronto. U.S. Pat. 906,454, Dec. 8, 1908.

A SOLUTION of lead chloride is treated with a sulphate, and the precipitated lead sulphate is washed thoroughly and mixed with a half-molecular proportion of lead chloride. The mixture, having the composition, $2\text{PbSO}_4 + \text{PbCl}_2$, is then treated with a boiling solution of an alkali hydroxide, until the lead chloride is converted into hydroxide. The resulting precipitate, after washing and drying, has the composition, $2\text{PbSO}_4 + \text{Pb(OH)}_2$.—E. W. L.

White pigment with lead sulphate as basis; Manufacture of —, L. S. Hughes. Fr. Pat. 392,990, Aug. 6, 1908.

ORES or other compounds containing lead sulphide are crushed so as to pass a sieve of 24 meshes per cm. The crushed material is fed into the bottom of a vertical sheet-iron furnace where it is projected upwards, by a blast of air, through a zone of oxidising flame. This flame is produced by burning gas with excess of air, the mixture being introduced into the furnace through the jets of a ring burner. The metal walls are protected by the introduction of an upward current of cold air through apertures near the bottom of the furnace. The object of making the furnace entirely of metal, without a fire-resisting lining, is in order to prevent, as far as possible, the superheating of the burning ore, which would result in the fusion of some portions of it, and in the oxidation of the iron sulphide present, thus rendering the sulphate of lead (principally basic sulphate, $\text{Pb}_2\text{S}_2\text{O}_5$) impure. The blast of air, and the fan used to draw off the products of combustion, are regulated so that the unoxidised particles of ore are not carried over. The separation of the pigment from impurities, and from the gases, is effected by gravitation and filtration.—E. W. L.

Paint and varnish; Antirouling —, M. Ulrich, Assignor to Farbenfabrik, vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 906,668, Dec. 15, 1908.

THE varnish or paint consists of dinitro-ortho-cresol associated with suitable solvents.—J. W. H.

Oil paints; Manufacture of — and process of applying same to metal for preventing rusting. E. Liebreich, Berlin. Eng. Pat. 12,517, June 10, 1908.

SEE Fr. Pat. 391,984 of 1908; this J., 1908, 1122.—T. F. B.

Preservative paints. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 393,764, Aug. 4, 1908. Under Int. Conv., Aug. 19, 1907.

SEE U.S. Pat. 906,668 of 1908; preceding.—T. F. B.

(B.)—RESINS, VARNISHES.

PATENT.

Resinous products similar to natural resins: Manufacture of —. Les Prod. chim. de Croissy, Ltd. Fr. Pat. 392,978, Oct. 12, 1907.

A VOLATILE liquid such as benzol, benzine, alcohol, ether, carbon tetrachloride, etc., is used as a means of moderating the heat developed in the preparation of resinous products by the action of phenols upon aldehydes in presence of catalytic agents. The vapours of the volatile solvent—which is added to the other ingredients before the reaction begins—may be condensed, and the liquid be either allowed to flow back into the reaction vessel, or recovered for future use. A form of apparatus is described, the condensing-worm of which can be utilised for either purpose, by the manipulation of cocks.—E. W. L.

(C.)—INDIA-RUBBER, &c.

Cryptostegia grandiflora in South-East Madagascar. H. Jumelle. Caout. et Gutta-Percha, 1908, 5, 2410.

THE analyses summarised in the following table represent the composition of samples of *Cryptostegia grandiflora* rubber from various sources, viz.:—(1). Sample from Madras, flat cake, dark brown outside, light in colour and porous inside, some of the pores containing uncoagulated latex and a brown acid liquid. Soft, but not tacky, elastic and showing good "nerve." Became hard and diminished in strength after some time. (2). Sample from Jalau, irregular leaves, black inside and out, very porous, and containing much bark. Physically greatly inferior to sample (1). (3). Sample from Bombay, lump apparently made up of scraps. Deeply coloured, of medium strength, and containing much impurity. (4). Sample from South-East Madagascar, which the author regards as the native habitat of the lina. Prepared by heating the diluted latex. Brownish-black in colour. Retained its elasticity, "nerve," tensile strength, and freedom from tackiness after two years. When rolled out into thin sheet was of a light colour. (5). This represents a sample of *C. madagascariensis* rubber for comparison. The relatively low resin content of sample (4) should be noted.

	1	2	3	4	5
Moisture	24.7	5.5	3.1	5.0	0.4
Caoutchouc	67.4	79.9	64.3	76.5	88.1
Resin	5.9	8.5	10.1	4.7	10.7
Protein	—	—	7.9	—	—
Ash	—	—	8.2	1.2	0.8
Other impurities	2.0	6.1	5.9	12.6	—
Value in francs per kilo. (Para=14.7)	6.40	4.00	9.60	—	—

—E. W. L.

India-rubber Market, 1908; S. Figgis and Co.'s Annual Review of the —. [T.R.]

Plantation rubber in Ceylon and British Malaya.—The acreage under rubber plantation (partly mixed with other products) is now nearly 500,000 acres.

	1908.	1907.	1906.	1905.
Exported from—	tons.	tons.	tons.	tons.
Ceylon (& India)	350	230	160	70
Malaya, &c. ..	1,450	780	350	75
Tons ..	1,800	1,010	510	145

There has been a further general improvement in preparation, less of inferior and "tacky," much more of fine clean crêpe—some of very good colour realising high prices—

and nice resilient sheet. The variations and advance in prices since early October have resulted in very high "average price" for Plantation during recent months, but, the difference in value compared with fine Para Brazil rubber, lessens with the larger supply of Plantation. Manufacturers have shown a decided preference for sheet, biscuit and crêpe; the latter should not be drawn out too thin or have visible air or steam bubbles in it, some lots of strong thick crêpe sold very well. It has been profitable to planters to wash and clean the rubber thoroughly, and to prepare as large a proportion as possible of good colour—also not to send many qualities or very small lots. Block has not been in favour generally, and unless clean resilient hard quality can be sent, it may be better to ship as crêpe or sheet. It should be packed in good dry condition (excess of resin is much disliked) in strong cases of 1 cwt. to 2 cwt. each. No paper, fullers earth, &c., is to be used.

Different qualities and colours and, where practicable, immature rubber should be kept separate; it is best to send separately dirty barked pieces, and to wash out all the bark in crêpe, block, and sheet. All fine qualities should be loose crêpe, sheet, or biscuit—not run to a mass.

Smoked rubber appears to have greater resiliency and to be more suitable for many purposes than unsmoked. "Smoking" prevents the "proteins" in rubber from decomposition, and generally from "tackiness." All fine rubber from Para is smoked.

India Rubber of all Kinds.

The world's supply in 1908 was about 65,000 tons, against 69,000 tons in 1907, and 65,000 tons in 1906. Consumption was about 67,500 tons.

Of rubber planted there is in the East nearly 500,000 acres—

	1908.	1907.	1906.
	acres.	acres.	acres.
Ceylon	180,000	150,000	100,000
Malaya, Malacca, etc. (containing about 20 million trees, not two million tapped in 1908)	185,000	100,000	90,000
Borneo and New Guinea	10,000	9,000	8,000
Dutch East Indies (60,000 Java, 30,000 Sumatra), &c.	90,000	70,000	25,000
India and Burma	30,000	—	—

Mexico, Nicaragua, and Honduras have plantations but are not increasing—probably by now 20,000 acres planted; also Colombia, Ecuador, Bolivia, and Peru.

India is extending, probably about 30,000 acres planted. Some in Burmah and Mergui: the Philippines (small as yet), Samoa, Hawaii, and beginning in New Guinea and other Islands, Queensland and Seychelles. The West Coast of Africa has plantations, and more progress has been made in the Congo region and German West Africa, also in British East Africa, Uganda, and the West Indies probably 2,000 acres.

Brazil exported in 1908 about 40,000 tons against 41,500 tons in 1907, Manicoba seriously decreased, also Guayule from Mexico, largely used in America and the Continent. Prices of Guayule are very much lower and quality improved; probably 2,000 tons were made.

India Rubber Statistics.

Total imports, &c., of all sorts were:—

	England.		
	Imports.	Deliveries.	Stock, 31st Dec.
	tons.	tons.	tons.
1908....	21,611	23,369	1,510
1907....	22,964	21,317	3,268
1906....	21,269	21,162	1,669
1905....	21,700	21,410	1,562
1904....	19,883	20,035	1,272

	London.		
	Imports, tons.	Deliveries, tons.	Stock, 31st Dec. tons.
1908.....	2,983	3,908	378
1907.....	3,509	3,149	1,003
1906.....	3,604	2,444	691
1905.....	2,126	2,003	531
1904.....	1,932	1,770	408

PATENTS.

Rubber goods; Use of naphthalene and its derivatives in the manufacture of —. Rütgerswerke-Akt. Fr. Pat. 393,186, Aug. 10, 1908.

THE claims are for the use of naphthalene and its derivatives, and of analogous substances, in the manufacture of rubber goods: (1), in place of and in the same manner as vegetable waxes, paraffin wax, ceresin, fats and oils, which are employed in rubber mixings in order to assist the mixing process, and to minimise micro-porosity; (2), in place of the same substances in the treatment of waste rubber in order to bring the latter into a condition in which it can be readily worked up again; (3), in place of benzine, benzol, and similar solvents for spreading purposes. In case (1) only small additions of naphthalene, from about 0.5 to 5.0 per cent., are necessary as a rule; only in extreme cases is an addition of as much as 10 per cent. required. In case (2) 10 per cent. may be regarded as an average proportion of naphthalene. In preparing "doughs" for spreading, either on the spreading-machine, or on the calenders (case 3), the proportion of naphthalene should vary considerably according to the kind of rubber used. Mixings containing balata or guayaquil require, for example, about 25 per cent., whereas a Ceara mixing, heavily loaded, will often require about 80 to 100 per cent. of naphthalene. Fabrics which have been spread with such "doughs" still retain some 3 to 6 per cent. of naphthalene after being kept for some time.—E. W. L.

Ebonite; Manufacture of a substitute for hard vulcanised rubber or —. E. Torrini, M. Hoffmann, and A. Benoit, Courbevoie, France. Eng. Pat. 10,731, Aug. 1, 1908.

HORN or other gelatinous material is powdered, treated with an alkaline solution, dried, treated with a solution of bichromated albumin or gelatin, again dried, moulded under pressure, and then exposed to light so as to render the gelatin insoluble.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning materials; Extraction of —. W. Eitner, Gerber, 1908, 34, 291—293, 305—307, 319—320, 333—334.

THE author points out that the tannin estimated by analysis is not always of practical use in the tannery, and that even with that part of the estimated tannin which is useful, there is a different value for each chemical individual according to its characteristic effect. The effect of increased temperature of extraction is discussed and it is emphasised that although this may bring a greater proportion of the material into solution, it involves also the development, formation, and solution of dark colouring matters and has also a deleterious effect on the easily decomposable tannins. It is the tannins which are soluble with difficulty which are readily decomposed, and which need the high temperature to bring them into solution; it is such tannins, also, which in practice are of little or no use. It is therefore not desirable to push the extraction too far, either by the employment of heat or of extraction in closed vessels under pressure. It is also necessary to consider whether fresh material or "fishings" from the dusters and layers is to be extracted. In the latter case the proportion of ineffective tannins is much greater,

partly because of the free acids which cause a decrease in the solubility of the less soluble tannins and partly because the material has already been leached to some extent, the easily soluble tannins having dissolved in the liquors in which the dusting material was used. Even in fresh material, however, the proportion of useful and useless tannin is not constant, but is variable for the same tanning material as well as for different tanning materials, being largely dependent on whether the tanning material is liable to form the less soluble varieties. The greater this tendency the greater the differences observed between the proportions of the two classes of tannin. These views are borne out by experimental work with the following materials. *Pine bark* with a mean tannin content of 13.5 per cent. was (1), leached for the early stages of sole leather tanning in an open battery of 8 vessels, the last three of which were heated. The spent tan had a mean tannin content of 2.62 per cent., consisting entirely of ineffective tannin insoluble at ordinary temperatures. The same bark (2), similarly leached, except that hot water was poured on to the "tail leach" and no further heating given, gave a mean result of 5.8 per cent. of tannin in its spent tan, which also consisted entirely of useless tannin. Another bark (3), extracted in an open battery of 7 vessels to yield handler liquors, showed 4.06 per cent. of residual tannin after leaching, all of which was soluble with difficulty. Another bark (4), containing only 12 per cent. of tannin, was leached in an open battery of 8 vessels, employing heat, and gave a spent tan with 4.39 per cent. of residual tannin in it. As the most rational process is that by which all the effective tannins are obtained at the minimum of cost and trouble, example (2) is clearly the most efficient. A sample of old bark (5), extracted as in example (4), gave a residue of 6.8 per cent., but this consisted of strongly coloured as well as difficultly soluble substances, illustrating therefore that the quality of the material influences the extent of leaching. *Pine bark "fishings"* (6), containing about 9 per cent. of tannin were leached as in example (3), but with 6 vessels, and yielded a residue of 5.54 per cent. consisting entirely of difficultly soluble tannins. The author concludes that pine bark contains about 5 per cent. of useless tannin, the proportion being greater in old bark and less in young bark. *Oak bark* (containing about 11 per cent. of tannin) was leached by various methods in different factories and yielded the following mean residues of tannin, 2.35, 2.74, 1.67, 2.13, 2.42, and 2.45 per cent. The author concludes, therefore, that the amount of difficultly soluble tannins is small and fairly constant, but that the more easily soluble part is just as easily extracted as that of pine bark. *Quebracho wood* contains about 20 per cent. of not very soluble tannin and is often extracted with heat and under pressure. The author states that about half the total tannin (10 per cent.) is fairly easily extracted, that 8 per cent. is a red tannin soluble above 40° C., and the remaining 2 per cent. is partly soluble in hot water and partly a source of dark resinous bodies. The proportion of these constituents varies considerably with the quality of the wood, and determines whether heat should be used in the extraction. The author obtained the following amounts of residual tannin after extraction:—

Extraction in open vessels.			Extraction in closed vessels under pressure.		
Example 1.	Example 2.	Example 3.	Example 4.	Example 5.	Example 6.
3.35	3.67	3.21	1.56	0.86	1.85
3.52	3.23	3.05	1.36	0.93	2.15
3.73	3.72	3.41	1.73	1.12	2.21
—	3.85	3.11	1.62	1.21	1.56
—	3.72	3.14	1.61	0.80	1.78
—	4.02	—	—	—	—
Mean 3.50	3.70	3.20	1.57	0.90	1.91

The residual tannin of those extracted under pressure contained only resinous bodies, but those extracted in open vessels contained in addition about 1.5 per cent. of the red tannin which is soluble above 40° C. In both cases therefore, the useful tannins are equally well extracted,

Myrobalans may be extracted whole or crushed, and yielded the following results:—

Extraction	Material	Tannin in spent tan.
under pressure	whole fruit	Per cent. 3.54
	crushed fruit	3.66
in open vessels	whole fruit	12.24
	crushed fruit	7.34, 6.72, 8.21, 7.66

The whole fruit is therefore generally employed for extraction under pressure and the crushed fruit for extraction in open vessels. The author considers that a myrobalans spent tan containing 7.5 per cent. of tannin will not yield much more effective tannin. *Mallet bark* yields very similar results, even in tanneries widely separated and with different methods of extraction. A spent tan from West Germany contained 9.42 per cent. of tannin, one from North Germany 9.80 per cent., from North Austria 9.60 per cent., and from Hungary 9.82 per cent. Hence it is concluded that mallet bark has a fairly constant proportion of easily and of difficultly soluble tannins, and that there is a sharp difference between their respective solubilities. The author assumes the presence of 9½ per cent. of ineffective tannin of the same nature as that in other materials. *Knopperrn* and *valonia* are used only as dusting material and are not leached separately, so that there is little evidence upon which to base conclusions, but some experiments with finely ground and specially extracted "fishings" indicate that these materials have about 5.2 and 7.2 per cent. of ineffective tannin respectively. *Divi-divi*, *algarobilla*, and *mimosa* bark have as yet supplied no data. The author also examined the behaviour of mixtures of tanning materials, with the following results, all mixtures being extracted in open vessels by a similar process:—

Mixture.	Tannin residues in spent tan, %	Mean of all experiments.	Calculated mean.
(1) 75 parts pine bark, 25 quebracho.....	4.13, 4.80, 5.19, 4.75, 4.41, 5.22	4.76	4.99
(2) 80 pine bark, 20 oak bark	4.25, 4.72, 4.33, 4.15	4.36	4.90
(3) 60 pine bark, 40 mangrove	8.15, 7.87, 7.76	7.93	7.30
(4) 70 pine bark, 30 mimosa	4.60, 5.01, 4.36, 5.13	4.90	5.05
(5) 50 pine bark, 50 myrobalans	5.91, 5.72	5.80	6.50
(6) 60 pine, 20 quebracho, 10 myrobs., 10 valonia	7.34, 7.87, 7.78, 7.80	7.70	6.70
(7) 60 pine, 20 mangrove, 20 myrobs.	7.23, 6.87, 7.52, 7.10	7.13	6.80
(8) 60 quebracho, 25 mangrove, 15 myrobs.	7.87, 7.32, 8.15, 8.69	7.75	5.72
(9) 60 mallet, 40 myrobs.	8.34, 8.83, 8.82	8.66	9.00

The difference between the experimental and calculated means is not great, and where distinct is readily explained by the insufficient data for the calculation. The author hence concludes that each material behaves the same in mixture as it does when used alone. Further discussion and experiments indicate also that extraction in open vessels is the most efficient and economical.—H. G. B.

Tanning materials; The colour valuation of —. H. C. Reed, J. Amer. Leather Chem. Assoc., 1908, 3, 382—385.

THE author criticises the methods at present in use for the estimation of the colour value of tanning materials, and suggests a new method of determination. The "pelt test," by which a small piece of prepared pelt is considered actually tanned with the material under examination, is useless, owing to the impossibility of obtaining pelt which will yield uniform and consistent results. The skins of the sheep, calf, and cow give varying colour valuations of the same tanning material, and portions of pelt even from the same skin produce irreconcilable results, whatever care is taken in their previous preparation. The "tintometer test," which indicates the relative proportions of red, yellow, and black in a solution of the tanning material, leaves it open to doubt whether these colours are fixed on the leather in the same proportions, and the author considers it not yet proved that there is a sufficient agreement possible between different analysts when this method is used. The author therefore experimented with the first type of method, but with material other than pelt. Cotton

cloth, wool cloth, and a good grade of white broadcloth were employed. Solutions of various tanning extracts were made, of 25 barkometer strength, and the cloth, after thorough wetting, was allowed to steep in the liquors for a definite period. The cloth was then squeezed from the liquor, washed thoroughly with water at the ordinary temperature, and permitted to dry after spreading on a glass plate while still wet. The colour valuations with broadcloth appear to be the most satisfactory, giving uniform and tangible results, and allowing a discrimination between extracts produced from the same crude material. —H. G. B.

"Galalith": A sensitive reaction for —. L. Wolter. Chem.-Zeit., 1909, 33, 11.

"GALALITH" is artificial horn prepared by the action of formaldehyde on casein. Skim milk is treated with caustic alkali or alkali carbonate, the casein is precipitated by addition of acid, pressed, impregnated with formaldehyde, and dried. This product has recently been used for the preparation of imitation tortoise-shell, and it is difficult to detect the imitation from the real material, until it has been in use for a short time. The author has found that treatment with fuming nitric acid affords a ready means of distinguishing "galalith" from tortoise-shell. A cutting of the material is boiled with a few c.c. of fuming nitric acid: "galalith" yields a heavy yellow crystalline powder, insoluble in water and the ordinary organic solvents, whilst tortoise-shell dissolves almost completely with the exception of fine, transparent scales; on adding water to the solution, amorphous flocks slowly separate. —A. S.

PATENTS.

Dressing leather; Process for — with oil by means of a torsion press. W. Marquardt. Fr. Pat. 392,188, July 9, 1908.

THE process consists in the preparation of leather from fresh skins by applying a mixture of tallow and fish oil to

the warmed skins and subjecting them to torsion in a special press. This consists of two beams capable of turning round the axis of an upright and of sliding up and down over this upright. The supports are bound to one another by free bolts disposed in a circle about the upright, between which the rolled up skins are placed and fastened by one extremity in a perforation of the axis of the upright. The skins are continually rolled up round this axis by the rotation of the beams and so tightened and squeezed. For complete conversion into leather it is necessary that the skins should be three times impregnated with fat and compressed in this way.—H. G. B.

Tanning skins; Process for —. C. W. Nance. Fr. Pat. 391,720, June 26, 1908.

THE process aims at making the tannage of skins more efficient by eliminating the oxygen from the tanning liquors before they come in contact with the skins. Tan liquors exposed to oxygen are said to be more prone to gallic fermentation, and to possess less penetrating power than liquors which have been deoxygenated. With this process, therefore, the circulation of the tanning liquor is effected by means of an aspirator, and not by means of pumps. A series of vats are arranged, which receive the skins to be treated, each one being provided with a deoxygenation chamber, and communicating by pipes with the cisterns containing the tan liquor, which are also provided with deoxygenation chambers, and connected by a pipe to the aspiration apparatus. The vats and cisterns are provided with air-tight lids which can be removed or brought into

position by cranks which cause them to slide over rollers. The vats are also fitted with horizontal celluloid stands on which the skins are laid; this ensures that the tan liquors will come in contact with every skin, and avoids also a needless excess of liquor. The skins are treated with deoxidised tan liquors of different strength, the last phase of tannage involving the use of more concentrated tan liquor and of powdered tanning bark, which last is disposed between the stands separating the skins. The skins are submitted to aspiration before admitting the tan liquor. When the tannage is complete, the excess of liquor is removed and the leather may be dried in the apparatus with the assistance of the aspirator.—H. G. B.

Leather, artificial; Manufacture of ——. A. Woonnam, London. From Oesterreichische Privivsin Akt.-Ges., Vienna. Eng. Pat. 4536, Feb. 28, 1908.

FINELY divided or powdered natural leather is distributed over the surface of a foundation of paper, fabric, felt, or the like, which has been coated previously with a suitable adhesive material. When the latter has dried, the layer of leather is subjected to a polishing, scraping, or grinding operation; for this purpose the coated surface may be drawn over rotating emery rollers. The ends of the fibrous coating material are thus removed and a smooth uniform surface is produced. Instead of leather powder, hide powder may be used and the tanning effected after it has been applied to the foundation.—W. P. S.

XV.—MANURES, &c.

Zeolites and similar compounds, their constitution and technical importance for agriculture. R. Gans. *Jahr. K. Preuss. Geol. Landesanst. u. Bergakad.*, Berlin. **26**, 179—211; **27**, 63—94. *Chem. Abs.* (Amer. Chem. Soc.), 1908, **2**, 3216—3217.

THE material soluble in dilute hydrochloric acid, obtained from soils, contains silicates which resemble zeolites, especially chabazite. Zeolites may be divided into two classes:—(1), those which readily exchange their bases on treatment with saline solutions, and (2), those in which the exchange proceeds only slowly. In those of the first class (aluminate-silicate zeolites), the bases are united only to the aluminium, the silicic acid being combined with such groups as $\text{Al}(\text{OH})(\text{ONa})$ or $\text{Al}(\text{ONa})$. In those of the second class (alumina-double-silicate zeolites), on the other hand, the bases are united directly to silicic acid. The zeolitic compounds of arable field soils belong to the aluminate-silicate group. The importance of these compounds in agriculture is discussed. The manufacture of artificial zeolites and their application to the purification of water and of sugar juice and molasses, have been described in this J., 1907, 215, 711, 1251; see also Ger. Pat. 174,097, and Eng. Pat. 8232 of 1907 (this J., 1907, 771, 1091). By passing a solution of a salt through different aluminates-silicates, different salts of the same acid may be prepared by the exchange of bases between the dissolved salt and the aluminate-silicate.—A. S.

Phosphate rock; Analysis of ——. C. F. Hagedorn, C. H. Denipwolf, jun., and F. B. Carpenter. *J. Ind. and Eng. Chem.*, 1909, **1**, 41—44.

THE paper comprises the report of a committee appointed by the National Fertiliser Association (U.S.A.) to examine the various analytical methods for phosphate rock. Four different kinds of phosphate rock were tested, the moisture, phosphoric acid, and oxides of iron and aluminium being determined. The phosphoric acid was determined by the official (U.S.A.) gravimetric method as magnesium-ammonium phosphate, Pemberton's volumetric method (this J., 1894, 176, 667; 1895, 511), the citrate method, and Gladding's method of weighing as ammonium phosphomolybdate. The oxides of iron and aluminium were determined by a modification of Von Guerber's method (this J., 1897, 164), Gladding's method (see J. Amer. Chem. Soc., **13**, 721), the acetate method, Glaser's method (this J., 1890, 111), Jones' method (this J., 1891, 387), and Wyatt's method of precipitating iron and aluminium

phosphates by acetic acid from a slightly ammoniacal solution. Pemberton's method and Gladding's method gave the most concordant results for phosphoric acid, but the committee considers there are not sufficient reasons for substituting either of these for the present official method, and they recommend the latter for referee work. For the determination of the oxides of iron and aluminium, the mineral should be dissolved in hydrochloric acid (1:1), and it is considered that a satisfactory modification of the acetate method would be useful as a standard on account of its simplicity. The work is to be continued in this direction.—A. S.

Superphosphate sacks. *Chem. Trade J.*, Jan. 9, 1909. [T.R.]

GREAT loss is incurred by the loss of superphosphate owing to the destruction of the bags by the free acid in the manure and repeated re-bagging, and the use of double bags to guard against this loss has become a heavy tax upon the farmer. In the annual report of the mines department of Western Australia the results are published of experiments made by the Government analyst during the year to see if a method could be devised to avoid this waste, and bags treated in various ways were submitted to practical test. One bag, which had been treated with a strong solution of red gum kino gave very satisfactory results. It was filled with a very acid superphosphate (which had completely rotted the double bags in which it had been imported) and was stored for six months surrounded and covered by other bags containing the same manure. At the end of six months, the bags by which it was surrounded had rotted and given way in all directions, but the bag treated with kino came out as strong and intact as when it was put into the store. This test was so satisfactory that many of those interested in the superphosphate trade are applying the method of treatment on a large scale, and there is every reason to hope that this simple and inexpensive method of preserving the bags will be effective.

PATENT.

Citrate-soluble phosphate; Preparation of a ——. H. Schroeder. *Ger. Pat.* 203,758, Jan. 17, 1908.

THE crude calcium phosphate is treated by one of the usual methods with a reagent capable of yielding calcium chloride, and then calcium oxide is added in sufficient quantity to convert the calcium chloride into oxychloride ($\text{CaO} \cdot \text{CaCl}_2$). The mixture of calcium oxychloride and citrate-soluble phosphate is a dry non-hygroscopic powder.—A. S.

XVI.—SUGAR, STARCH, GUM, &c.

Cane sugar juice; Relation between added water per cent. on cane and dilution per cent. on normal ——. F. N. Coombes. *Internat. Sugar J.*, 1909, **11**, 11—14.

N. DEER has pointed out that the amount of water used per 100 parts of cane for maceration after dry crushing, will always show a figure considerably greater than that expressing dilution per cent. on normal juice if the admixture of the added water has been complete. The author has found, however, that under laboratory conditions, 100 parts of a megass containing 45 per cent. of fibre, require about 200 parts of water for complete saturation; this corresponds to about 53 per cent. of water on canes containing 12 per cent. of fibre, and more water would be required under practical conditions. It must be remembered too, that the density of the juice expressed, decreases with each dry crushing, the density of the residual juice in the megass being less than that of the expressed juice from the cane. Taking the density of the expressed juice to be 18.2° Brix, and that of the residual juice in the megass to be 17° Brix, the author has shown that if instead of 53, only 26.5 per cent. of water is used for maceration (a more probable amount), then, assuming that half the layer of megass can be saturated thereby, and that it is crushed to 50 per cent. fibre after this maceration, the dilution per cent. on normal juice will

be 27·8, i.e., greater than the maceration water per cent. on cane. Under practical conditions, the dilution would probably be still greater. Similarly, if 13·25 per cent. of water is used for maceration and it is assumed that a quarter of the layer of megass can be saturated, the dilution will be 14·39 per cent. Should the maceration water per cent. of cane ever be higher than the dilution per cent. of juice, the cause might be found in a defective last mill crushing.—L. E.

Sugar in saturation mud; Determination of —. F. Herles. Z. Zuckerind. Böhm., 1909, 33, 254—264. (See also this J., 1908, 1033.)

SOME exception has been taken to the author's method of determining sugar in saturation mud (*loc. cit.*) on the grounds that it involves danger of formation of lead sucrate, that with excess of basic lead acetate, non-sugar may pass into solution, and that (according to Herzfeld) some saturation muds may contain more lime than that allowed for (*ibid.*). The author shows, however, that provided the aqueous sugar solution only contains lead in the form of basic acetate or of basic and normal acetate, no sugar is precipitated in the form of sucrate. He also points out that the amount of non-sugar in saturation mud, soluble in excess of basic lead acetate, is extremely small. As to Herzfeld's objection, the author observes that in the experiments on which this objection was based, the prescribed method was not adhered to, in that insufficient lead acetate was used, and that in some cases, amounts of lime were added to the mud far in excess of those found in practice. As regards some sucrose determinations in calcium sucrate, quoted by Herzfeld, the author points out that his method is not intended for the analysis of such material, though it could be modified to serve this purpose. One hundred c.c. of 20 per cent. solution of lead acetate suffice for 30 grms. of saturation mud containing not more than 4·9 per cent. of lime; if the percentage of lime is greater, the polarisation will be low, but such a condition is easily detected, since the filtrate will be alkaline to phenolphthalein. Should such a case occur, which the author doubts very much, a stronger solution of lead acetate (e.g., 30 per cent., sufficing for an alkalinity of 7·3 per cent.) could be used. Addition of ammonium nitrate and basic lead acetate to saturation mud causes error, since the ammonia set free precipitates lead hydroxide which combines with the sugar; use of ammonium nitrate alone may lead to practical difficulties. The author has also investigated the action of other salts in decomposing the calcium sucrate and fixing the free lime in saturation mud; for this purpose, magnesium chloride, nitrate, or acetate, or aluminium nitrate may be used (zinc nitrate and acetate, and magnesium sulphate are not so satisfactory) together with sufficient lead acetate or nitrate to form a basic salt. Basic lead acetate should not be used in conjunction with magnesium or zinc salts, but may be used together with aluminium nitrate (and probably with other aluminium salts also).

—L. E.

Molasses binder [for roads]. See IX.

Zeolites and similar compounds, their constitution and technical importance for agriculture. R. Gans. See XV.

PATENTS.

Sugar, etc.; Apparatus for boiling —. G. S. Baker. Fr. Pat. 392,948, Aug. 4, 1908. Under Int. Conv., June 1, 1908.

THE patent relates to apparatus of the type in which the sugar juice is heated, *in vacuo*, in a coil disposed in a steam-heated chamber, the coil discharging into a reservoir. The principal object of the invention is the construction of an apparatus which will work continuously, and to provide that the reduced pressure in the apparatus shall not be destroyed when a part of the apparatus is disconnected; the apparatus may also be used as a pressure-boiler. An auxiliary chamber is fixed to the reservoir and is connected with an exhaust pump; a three-way tap allows connection to be made between the coil and the reservoir, or the auxiliary chamber and the pump, and means are provided for making an air-tight joint at the

discharge outlet of the chamber. The exhaust pump is always in connection with the coil and the reservoir by means of a column in which is placed a condenser, so that water and other condensed matters can be readily removed.

—W. P. S.

Woody and vegetable substances; Method for the saccharification of — and the recovery of by-products, etc. E. Bouchaud-Praceiq. Fr. Pat. 393,336, Oct. 22, 1907.

THE material, such as woody matter, sawdust, twigs, etc., is finely divided and heated with dilute sulphuric acid to a temperature of about 140° C., the quantity of actual sulphuric acid added being about 5 per cent. of the weight of the material. The treatment lasts for from two to three hours, after which time the acid liquor is removed and the residue is washed and dried. This residue is next treated with its own weight of concentrated sulphuric acid for 24 hours and the solution is then mixed with the acid liquor first obtained. The solution is divided into two parts, one of which is used for treating a fresh batch of material, whilst the second is neutralised by the addition of calcium carbonate or calcium phosphate (natural phosphate). The calcium sulphate is removed by filtration, and, if phosphate has been used, the addition of a further quantity of calcium carbonate results in the precipitation of calcium phosphate, which is removed. The saccharine solution obtained is employed for the production of alcohol or sugar (glucose), whilst the calcium sulphate is converted into calcium sulphide, and the latter is used for the manufacture of sulphur, sulphurous acid or sulphuric acid. The calcium phosphate recovered can also be utilised.—W. P. S.

Amorphophallus roots and tubers; Process for rendering insoluble the mucilaginous substances contained in —. Mertens und Co., Ges.m.b.H. Fr. Pat. 393,426, Aug. 18, 1908.

THE roots or tubers of amorphophallus plants (*Araceæ*), or the mucilage obtained from them, are treated with a solution of sodium hydroxide. The liquid obtained coagulates on continued stirring, and, if spread over the surface of fabrics, forms a water-tight and air-tight coating on the latter. Alkali carbonates, sodium acetate, and copper-ammonium sulphate may be used in place of sodium hydroxide.—W. P. S.

Sugar; Product producing — and its manufacture and conversion into sugar. G. W. McMullen. Fr. Pat. 393,847, Sept. 1, 1908.

SEE U.S. Pat. 898,592 of 1908; this J., 1908, 1216.—T.F.B.

"Bagasse"; Treatment of —. Eng. Pat. 20,266. See XIX.

Paper and material ["bagasse"] therefor. Eng. Pat. 20,267. See XIX.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt; Decrease of the albumin-content of — on digestion at low temperatures. J. J. van Hest. Z. ges. Brauw., 1908, 31, 645—647.

THE results of the experiments recorded show that whilst the total amount of nitrogen in a malt solution (wort), which has been obtained by digesting the malt for 15 hours at a temperature of 17° C., is about twice as large as that in an undigested extract, the digestion diminishes the amount of albumin and xanthine bases in the solution by approximately one-half. The saccharified digested wort also contains more total nitrogen, less albumin and xanthine bases, and more ammonia than the saccharified undigested wort.—W. P. S.

Diastase and catalase; Adsorption of — by colloidal protein and by normal lead phosphate. A. W. Peters. J. Biol. Chem., 1908, 5, 367—380.

TWO processes for the isolation and purification of diastase and catalase are described. It is possible to purify aqueous extracts of enzyme-containing material from contaminating protein, carbohydrates, and other

matter by the addition of an equal volume of pure acetone. An acetone extract of dried germinated wheat contained only diastase, but the residue possessed catalytic activity. Catalase is thus insoluble in but not destroyed by this reagent. In practice an equal volume of acetone is added to the aqueous enzyme extract and the mixture warmed at 40° C. for a short time. A heavy precipitate formed under these conditions will probably contain most of the enzymes. A 10 per cent. solution of precipitated Witte peptone in 50 per cent. acetone may be applied for the adsorption of diastase and catalase from liquids, these being treated with an equal volume of acetone and 10 c.c. of the peptone suspension. The precipitate containing the adsorbed enzyme is removed by decantation or by means of the centrifuge and can be digested in water when it is desired to test the activity of the adsorbed enzyme. The enzyme is concentrated by this method but becomes associated with the peptone. A lead phosphate suspension, made by precipitating lead acetate with sodium phosphate, likewise precipitates enzyme from aqueous extracts; it has a marked effect in concentrating the enzyme in dilute solutions. Lead phosphate accelerates diastatic action. Appreciable amounts of enzyme can be extracted from the lead phosphate precipitate with water or 50 per cent. glycerin. —E. F. A.

Beer infection [in breweries]: The action of light on —. S. Armstrong. J. Inst. Brewing, 1908, 14, 571–585.

The author describes the case of a brewery in India, which produced porter of excellent quality, but which experienced, over a long period of years, great difficulty in brewing pale ales. The ales almost invariably developed a turbidity and sulphuretted hydrogen "stench," which gradually worked off, leaving the beer flat and sour. It was ultimately noticed that the ale was of good quality only when the time of brewing was accidentally so adjusted that the wort came on the cooler after sunset, and when this was made a regular practice all the previous trouble disappeared. The author's explanation of this phenomenon is that the action of light favoured the development of the spores of air-borne wild yeasts in the wort on the cooler and that the abnormal fermentation was started by these organisms before the pitching yeast could assert its predominance. The author has carried out a number of experiments in the laboratory which tend to confirm the above hypothesis. Working with a darkened chamber affording every opportunity for aerial infection, his experiments led him to conclude that, whereas light has no action on the development of vegetative yeasts, the desiccated resting forms, which are carried in the air, cannot develop without the stimulus of light. The same rule apparently applies to some of the putrefactive and acid-forming bacteria, but the spores of mould fungi, on the other hand, readily develop in the dark. —J. F. B.

Fluorides: Detection of — in beer. J. Flamand. Bull. Soc. Chim. Belg., 1908, 22, 451–453.

The fluoride is precipitated as barium salt from a litre of beer rendered alkaline by addition of ammonia and ammonium carbonate. To assist the deposition of the barium fluoride, an alkali sulphate is added to the beer before addition of the barium chloride. The precipitate is collected, dried (unwashed), and ignited in a platinum crucible. Pure sulphuric acid is added to the crucible, which is immediately covered with a piece of glass coated with paraffin wax through which lines have been drawn. The whole is then placed on the water-bath for one hour, the wax on the glass being kept from melting by covering the upper side with filter paper on which water is constantly dripping. In this way the presence of one mgrm. of ammonium fluoride can be recognised. R. L. S.

PATENTS.

Waste liquors of breweries and distilleries: Process to extract yeast from — to render them suitable for treatment by any process of sewage disposal. W. Hampton, Mortlake. Eng. Pat. 13,811, June 30, 1908.

SAND, sawdust, brewers' or distillers' waste, spent grains, or, preferably, spent or waste hops, are placed in the

revolving cage or hopper of a centrifugal hydro-extractor and forced on to the interior surface of the cage by revolving the latter. The liquor with the yeast in suspension is now fed continuously or intermittently into the cage. The liquor which passes through is fairly free from yeast and is suitable for treatment by a septic, bacterial, or precipitation process of sewage disposal. —T. H. P.

Woody and vegetable substances: Method for the saccharification of — and the recovery of by-products, &c. Fr. Pat. 393,336. See XVI.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

1.) FOODS.

PATENTS.

Milk and process of manufacturing it. J. A. Wülling. Fr. Pat. 393,317, Aug. 6, 1908. Under Int. Conv., Jan. 27, 1908.

MILK-ALBUMIN is dissolved in a solution containing 60 grms. of sodium hydroxide for each kilo. of the albumin. The excess of sodium hydroxide is then removed by dialysis or by neutralisation, and the solution is sterilised. This solution is added to cow's milk to which the requisite quantities of cream, lactose, and water have been previously added, but the quantity of water employed is reduced according to the amount introduced by the solution of albumin. From 3 to 6 grms. of actual albumin are added to each litre of milk. —W. P. S.

Milk for infants: Method for making —. P. Bergell and J. A. Wülling, Berlin. Eng. Pat. 12,516, June 10, 1908.

SEE FR. PAT. 393,347 OF 1908; preceding.—T. F. B.

(B).—SANITATION; WATER PURIFICATION.

Typhoid bacillus: Examination of samples of raw Thames, Lee, and New River water for the presence of the —. A. C. Houston. Metropolitan Water Board. Second Report on Research Work, Oct., 1908. (See also this J., 1908, 873).

THE chief epidemic diseases liable to be water-borne are held to be cholera, typhoid fever, and diarrhoea. With the object of detecting the presence of the typhoid bacillus, eight series of experiments, extending over a period of twelve months, were made with 156 samples of raw river water. The total amount of water dealt with was 29,400 c.c. containing a total of 135,687,500 bacteria capable of growing on gelatin. By cultivation on special media, 7329 colonies were isolated as possible typhoid colonies, but on applying verification tests the whole of these were excluded as not those of the typhoid bacillus. These negative results for a "specific definitely dangerous" pollution fortify a favourable judgment as to the non-specific biological quality of the water. —J. H. J.

PATENTS.

Sterilisation of liquids: Apparatus for the —. H. J. Wessels, Paris. U.S. Pat. 906,975, Dec. 15, 1908.

A VERTICAL cylinder is divided into compartments by a series of plates having capillary perforations. The liquid to be sterilised will not pass through the perforated plates and is maintained at a definite level in each compartment by means of vertical pipes down which the liquid overflows into the next lower compartment. The liquid which overflows is received in a cup surrounded by a cylinder with open ends, by which it is delivered near the perforated plate of the lower compartment. Gas and liquid inlets and outlets are provided at the top and bottom of the vertical cylinder. The gas under slight compression passes through the perforated plates continuously, leaving the apparatus at the top. —J. W. H.

Sewage, waste-water, etc.; Apparatus for the extraction of grease from —. Ges. f. Abwässerklärung m.b.H. Fr. Pat. 333,172, Aug. 10, 1908.

THE apparatus is a kind of trap and consists of a chamber provided with a removable perforated cover; two partitions extend across the chamber but do not reach to the top or bottom, and an inclined cover is placed over the space between these partitions. The sewage, etc., to be freed from fat is passed through the perforated cover on to the inclined plate, which directs it into the space between the outer wall and one of the partitions; passing under the latter, the fatty matter rises and collects in the space between the two partitions, whilst the water flows under the second partition and leaves through an opening at the upper part of the wall of the chamber. The fatty matter is removed as required by raising both the covers, and heavy particles, separating from the sewage, are collected in a removable vessel contained in a well at the bottom of the chamber.—W. P. S.

Air; Composition for purifying —. H. Ryder and L. C. Wilson, Newark on Trent. U.S. Pat. 907,180, Dec. 22, 1908.

SEE Eng. Pat. 1079 of 1907; this J., 1907, 836.—T. F. B.

Stone, artificial; Preparation of — from refuse ashes and paper pulp. Ger. Pat. 204,100. See IX.

Electrode for use in the purification of water, etc. Eng. Pat. 27,559. See XI.A.

Zeolites and similar compounds, their constitution and technical importance for agriculture. R. Gans. See XV.

Waste liquors of breweries and distilleries; Process to extract yeast from — to render them suitable for treatment by any process of sewage disposal. Eng. Pat. 13,811. See XVII.

(C.)—DISINFECTANTS.

Pyretol, the active principle of insect powder [Pyrethrum flowers]. S. Sato. See XX.

PATENT.

Disinfectants; Manufacture of —. H. Schneider, Hamburg, Germany. Eng. Pat. 9886, May 6, 1908. Under Int. Conv., May 8, 1907.

SEE Fr. Pat. 389,872 of 1908; this J., 1908, 1037.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Mineral loading materials for papermaking; Normal characters of —. E. Belani, Papier-Fabrikant, 1908, 6, 2826—2828, 2881—2883, 2941—2945.

THE author describes a photometric method for the estimation of the "whiteness" of opaque minerals, such as kaolin, gypsum, "blanc fixe" or "satin white," suitable for the surface-coating of paper. The mineral is either itself cut into the form of a triangular prism or is spread on the face of a wooden prism, and the amount of light reflected from an electric lamp by the face of the prism on to a movable photometric screen is measured. From the examination of a large number of samples, the author is able to put forward certain values which he regards as normal for various qualities. *Kaolin*.—On suspending in water and passing through a sieve with holes of 0.1 mm., the best English clays, suitable for paper-coating, should leave no residue of sand or mica. Bohemian clays leave 0.1—0.4 per cent. of residue; clays of fair quality for loading in the engine may leave 2—3 per cent. of residue. The loss of moisture at 100° C. is very variable. The author has found for Styrian clays, 0.8—0.9 per cent.; for Bohemian clays, 0.5—5 per cent. for the product from one pit and 7.2—11.2 for that from another; he regards 5 per cent. as a normal maximum for Continental clays. English paper-coating clays contain more moisture, e.g., 12.0—19.8 per cent., but anything over 12 must be regarded as unreasonable. The loss on ignition of the dried clay

is 12 per cent. on the average; there appears to be a connection between the loss on ignition and the "greasy" character of the clay. Some comparative measure of the plasticity of samples of clay is desirable, such as is afforded by sinking a weight into a paste of the clay or by determining the sedimentation-volume, the medium in both cases being 50 per cent. aqueous glycerin. The yield of clay in the paper is about 65 per cent. of the quantity added. *Talc*.—This should be as free as possible from mica, the glittering particles of which may be discerned by spreading a coat of the mineral on a flat surface and examining in a double illumination from two directions. The size of the largest particles of the talc, measured under the microscope, should not exceed 20 μ in diameter. The moisture expelled at 100° C. should not exceed a few units per cent. The loss on ignition was found to be 4.3 per cent. for Styrian and 3.7 per cent. for Pyrenean talcs; 4 per cent. is normal. The amount retained in the paper is about 75 per cent.; in this connection the qualities of low specific gravity (1.6—1.7) are preferable. *Asbestos*.—If microscopic examination show the presence of other forms than thin rodlets, the purity of the sample is to be suspected. The average length of the particles is 80 μ ; the mineral should not be ground too fine. The American product loses 1.3 per cent. of moisture at 100° C.; the loss on ignition ranges from 5 to 7.4 per cent.; normal, 5.5 per cent. The amount retained in the paper is about 70 per cent. *Gypsum*.—The ground native mineral has the form of plates, a maximum diameter of 15 μ being normal. The precipitated mineral occurs as needles, which should not be ground too fine. The loss on ignition of the calcined mineral is 0.5—2.0 per cent.; that of the precipitated is 21 per cent. The amount retained in the paper is about 70 per cent. (calculated as hydrated on anhydrous). *"Blanc fixe"*.—The normal moisture in the paste is 20—25 per cent.; pastes containing up to 50 per cent. are met with but are not normal. *"Satin white"*.—The normal paste contains 34 per cent. of dry mineral.—J. F. B.

Hydrocellulose; Formation of — by means of sulphuric acid. G. Büttner and J. Neuman. Z. angew. Chem., 1908, 21, 2609—2611.

WHEN cellulose is treated with diluted sulphuric acid, of sp. gr. 1.353—1.53, a mixture is formed consisting probably of hydrocellulose and oxycellulose together with unchanged material. Under special conditions (using acid of only 3—4 per cent. strength), however, cellulose hydrates are formed of the general formula, $(C_6H_{10}O_5)_x.H_2O$, (three preparations were obtained in which $x=2, 3$, and 6). Hydrocellulose of this composition, whether $x=2, 3$, or 6, is a white, sandy powder extremely resistant towards acids and alkalis. It is usually not changed by boiling with dilute sulphuric acid, but further experiments are necessary in order to ascertain whether the one stage of hydration may not be changed into another by this treatment. It is dissolved by cold concentrated sulphuric acid or fuming nitric acid, but it is only coloured yellow on boiling with caustic potash or soda. It is also soluble in an ammoniacal solution of copper oxide. When hydrocellulose is treated with acetic anhydride, and concentrated sulphuric acid added, a vigorous reaction ensues and the substance dissolves. On dilution with water an acetyl derivative is precipitated in white to blue opalescent flocks. Hydrocellulose is coloured blue with zinc chloride-iodine reagent or iodine and potassium iodide solution and it reduces Fehling's solution and ammoniacal silver nitrate. Girard's statement that hydrocellulose is readily oxidised even at 50° C. cannot be maintained, for the pure substance remains unchanged at 100° C. If, however, traces of sulphuric acid are present, it is soon decomposed on warming.—J. C. C.

PATENTS.

"Bagasse"; Treatment of — [for obtaining phos]. T. J. Hutchinson, Manchester, and United Railway and Trading Co., London. Eng. Pat. 20,266, Sept. 11, 1907.

"BAGASSE," preferably in a fresh condition, is boiled for about an hour at a temperature not much above 100° C. with a solution containing about 10 per cent. of sodium carbonate calculated on the air-dry weight of the material. Caustic soda or a mixture of the two forms of alkali may

be used if preferred. The operation is better performed in two stages, boiling for half an hour each time with a portion of the prescribed quantity of alkali, and washing the material between the two stages. The most suitable form of digester is one of the "vomiting" type, which causes the liquid to flow through the mass in one direction only without disturbing the fibres. The product of this so-called "mild" treatment will not yet have reached the condition of a "half-stuff"; the fibres are not separated one from another, but the gummy and other impurities of the cane are converted into a soluble form so that they can be eliminated by washing. — J. F. B.

Paper and material therefor ["bagasse"]; *Manufacture of* —. T. J. Hutchinson, Manchester, and United Railway and Trading Co., London. Eng. Pat. 20,267, Sept. 11, 1907.

THE purified "bagasse" fibre, produced by the "mild" treatment described in Eng. Pat. 20,266 of 1907 (see preceding abstract), is subjected to a second and preferably milder treatment of a similar nature, whereby 85–95 per cent. of a paper-making "half-stuff" is obtained from it. In this second treatment the purified "bagasse" fibre is boiled for about one hour under atmospheric pressure with a solution containing 2.5–5 per cent. of caustic soda on the air-dry weight of the material. By this treatment the fibres are sufficiently reduced for conversion into paper pulp by known methods. — J. F. B.

Briquettes; Binding agent for — [from sulphite-cellulose lyes]. Fr. Pat. 392,898. See II.

Dryer [for paper, etc.]. Fr. Pat. 393,199. See I.

Celluloid; Colouring — especially for preparing coloured screens for photography. Eng. Pat. 7629. See XXI.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Strychnine alkaloids, II. A new method for the preparation of sulphonic acids. H. Leuchs and W. Schneider. Ber., 1908, 41, 4393–4395.

STRYCHNINE was mixed with water at 50° C., and sulphur dioxide passed through till the alkaloid was dissolved. Powdered manganese dioxide was then added, and the passage of the gas continued. The liquid was cooled and the crystalline precipitate removed, and recrystallised from water. The substance thus produced is the sulphonic acid of strychnine, $C_{21}H_{22}O_5N_2S$. It crystallises with 4 molecules of water, which are lost on heating to 105° C. It melts with decomposition between 350° C. and 360° C. It crystallises from alcohol and dilute acetic acid in prisms. It is not dissolved by 20 per cent. hydrochloric acid, but dissolves readily in excess of sodium carbonate or hydroxide. A neutral solution when cooled, deposits crystals of the free acid. (See this J., 1908, 640.) — F. SUDS.

Cheiroline, an alkaloid containing sulphur, from wallflower seeds. W. Schneider. Ber., 1908, 41, 4406–4470.

THE name cheiroline is given to the alkaloid found in the extract of the seeds of the wallflower (*Cheiranthus cheiri*). The author finds the alkaloid to have the formula, $C_{29}H_{46}O_2N_2S_2$, his analytical results differing from those of Wagner (this J., 1908, 138). Cheiroline has a neutral reaction, and is optically inactive. When crystallised from ether, it forms handsome colourless prisms melting at 47°–48° C., and is moderately soluble in hot water. The substance dissolves in cold sodium hydroxide solution, and the solution, when acidified, gives off sulphuretted hydrogen and carbon dioxide. The acid solution was found to contain the hydrochloride of a strong base, $C_{29}H_{46}O_2NS.HCl$, which crystallises from absolute alcohol in colourless, prismatic needles melting at 145–146° C. The free base is crystalline but very deliquescent, easily soluble in water, and moderately soluble in cold alcohol. It does not reduce either Fehling's solution or an ammoniacal solution of silver nitrate. The base appears to be a primary one; the methiodide, $C_{29}H_{46}O_2NSI$, melts at 183° C. — F. SUDS.

Alkaloids; New method for the determination of — by means of potassium-mercuric iodide. G. Heikel. Chem.-Zeit., 1908, 32, 1149–1150, 1162–1163, 1186–1187, 1212–1213.

ALKALOIDS in solution are determined by adding excess of Mayer's reagent (N/20 mercuric chloride with potassium iodide), filtering, and finding the amount of mercuric chloride left in the solution by means of standard solutions of potassium cyanide and silver nitrate. A solution of the alkaloid is made containing 0.1 gram. in 10 c.c. Mayer's reagent is then added to 10 c.c. of the alkaloid solution till there is an excess of about 15 c.c. The liquid is diluted to 100 c.c., shaken well, and filtered, 80 c.c. of the filtrate being retained. To this, 10 c.c. of 10 per cent. ammonia are added, and 10 c.c. of N/20 potassium cyanide solution, which precipitates all the mercury. The mixture is acidified, or neutralised, with dilute sulphuric acid and N/20 silver nitrate added till there is a permanent turbidity. From this titration the amount of mercuric chloride actually precipitated by the alkaloid can be ascertained. The method is sufficiently accurate for many ordinary purposes. It can be used for the determination of the amount of alkaloid in tablets, pills, and fluid extracts. A table is given, showing the weight of alkaloid corresponding to 1 c.c. of N/20 Mayer's reagent and the percentage limits of error. — F. SUDS.

Pyretol, the active principle of insect powder [Pyrethrum flowers]. S. Satō. Pharm. Post, 1908, 41, 22.

PYRETOI, the purified active principle of *Pyrethrum* flowers, is an odourless, non-volatile, light yellow, clear, syrupy, resinoid substance; when applied to the tongue it is tasteless, but later it has a numbing effect. It is insoluble in water and in dilute acids; soluble in ether, alcohol, and light petroleum spirit. The fresh solutions are neutral, but gradually become acid; in a month, the acid value amounts to 14.2, and the ester value to 154.3. Pyretol is soluble in hot alkaline solutions and is re-precipitated by acids, but loses its physiological activity by this treatment. It contains no nitrogen. It is extremely toxic to cold-blooded animals, but is practically without action on warm-blooded animals. — J. O. B.

Essential oils; Constituents of —. Carvenene, $C_{10}H_{16}$, and "pure" terpinene. F. W. Semmler. Ber., 1908, 41, 4474–4479.

THE author points out that the physical constants of terpinene as observed by Wallach (this J., 1908, 997), Harries (Ber., 1908, 41, 2516), and himself (Ber., 1907, 40, 2968) do not exactly agree, more especially those relating to the "increments" of the molecular refraction. He has therefore prepared carvenene from carvenone in order to determine its physical constants. Monochlorocarvenene, $C_{10}H_{15}Cl$, was prepared by shaking carvenone dissolved in light petroleum with phosphorus pentachloride, the temperature being kept low throughout. The substance boils at 95–98° C. at 10 mm., has the sp. gr. 0.994 at 20° C., and n_D^{20} 1.51700. The chloride is easily converted into carvenene, $C_{10}H_{16}$, by reduction with sodium and alcohol. The hydrocarbon boils at 61–63° C. at 10 mm., and at 179.5–180.5° C. at 735 mm.; it has the sp. gr. 0.844 at 20° C., and n_D^{20} 1.49100. The author does not think that carvenene and terpinene are identical. He considers that the "merement" in the molecular refraction is an indication of conjugate double bonds in the ring. — F. SUDS.

Camphor; Complete synthesis of —. G. Komppa. Ber., 1908, 41, 4470–4474.

THE fact that Wallach has recently made camphor from β -pinene (this J., 1908, 1130) has led the author to publish his results on the synthesis of camphor from camphoric acid. Racemic camphoric acid, m. pt. 202–203° C., was converted into the anhydride, and reduced with sodium and alcohol to *r*-campholide, $C_{15}H_{24}O_2$, melting at 211.5°–212° C. (corr.). This was converted into cyanocampholide acid by heating in a sealed tube to 230° C. with potassium cyanide. The product was hydrolysed, when *r*-homocamphoric acid, $C_{11}H_{18}O_4$, was produced, which melted at 231°–232° C. (corr.). The homocamphoric acid was treated with twice the equivalent amount of lime, evapo-

rated to dryness with water, and the residue subjected to dry distillation. The substance obtained was purified, and identified as *r*-camphor.—F. SHDN.

dl-Suprarenine: Resolution of synthetic — into its optically-active components. F. Flächer. Z. physiol. Chem., 1908, 58, 189—194.

SYNTHETIC suprarenine (adrenaline, *o*-dihydroxyphenylethanolmethylamine) is, according to Cushman (Pharm. J., 1908, 668), less active physiologically than the levorotatory natural product, probably owing to the dextrorotatory component being inactive. The author has succeeded in resolving the synthetic product into its optically-active components. The substance was moistened with methyl alcohol and dissolved in a hot solution of a molecular proportion of *d*-tartaric acid in methyl alcohol. The alcohol was distilled off from the solution in a vacuum at 35°—40° C., and the residue inoculated with a small crystal of the acid dextrotartrate of natural suprarenine, in order to induce crystallisation. The crystals were dried in a vacuum, triturated with a small quantity of methyl alcohol, filtered, and the residual acid dextrotartrate of *l*-suprarenine washed with methyl alcohol, and recrystallised from 90 per cent. ethyl alcohol or 95 per cent. methyl alcohol until it melted at 149° C. From the mother liquor, the base was separated, and the acid levotartrate of *d*-suprarenine prepared in a similar manner. The optically-active bases separated from their acid tartrates both melted at 211°—212° C. (uncorr.), and yielded non-crystalline oxalates and hydrochlorides. The levorotatory base is identical with natural suprarenine; its optical rotation in hydrochloric acid solution is $[\alpha]_D = -51.4$, and that of the dextrorotatory base, $[\alpha]_D = +51.88$.—A. S.

Suprarenine, synthetic: Action of —. A. R. Cushman. Pharm. J., 1909, 82, 56—57.

THE author has determined the physiological activity of the synthetic dextro- and levo-suprarenine prepared by Flächer (see preceding abstract). It was found that the levo-modification was equal in power to the natural base, and much more active than the dextro-modification, the relative powers being about 12:1. The relative activity of the new commercial synthetic product (*l*-suprarenine) compared with that of the older commercial substance (*dl*-suprarenine) was found to be about 24:13. It is noted incidentally, also, that *l*-hyoscyamine is about 14 times more active physiologically than *d*-hyoscyamine.—A. S.

Carbon suboxide: New method of preparing —. H. Staudinger and St. Bereza. Ber., 1908, 41, 4461—4465.

WHEN malonyl chloride is heated with metallic oxides (especially silver oxide), carbon suboxide is formed, probably through intermediate formation and decomposition of malonic anhydride. Acid chlorides, reacting on silver malonate, also produce carbon suboxide. Much better yields, however, are given by the reaction of zinc on dibromomalonyl chloride in ethereal solution. If ethyl acetate be used as the solvent, the yield is only 40—50 per cent. of the theoretical, against 80 per cent. in the case of ether; but the suboxide formed is much more easily separated from the less volatile ethyl acetate than from ether.—J. T. D.

Hydriodic acid: Method for the extemporaneous preparation of —. G. Heikel. Amer. J. Pharm., 1908, 80, 581—582.

A SOLUTION of ferrous iodide is treated with a slight excess of pure barium carbonate, and the mixture is boiled for 3 to 6 hours, until the addition of ammonia to a portion of the liquid produces only a slight precipitate, which does not diminish on boiling. The mixture is then filtered, the filtrate is allowed to stand for a few hours, and again filtered. It should then be free from iron; if not, it must be boiled again with a little barium carbonate. The solution of barium iodide is then diluted to a definite volume, and the amount of that salt determined in an aliquot part. The exact equivalent of dilute, 10 to 20 per cent., sulphuric acid is then added, to precipitate the barium. To ensure the absence of barium a very

slight excess of sulphuric acid may be used. After removing the barium sulphate, the hydriodic acid solution is concentrated to the desired strength, any iodine liberated during the process being removed by boiling for a few minutes with a small quantity of hypophosphorous acid.—J. O. B.

Hypophosphorous acid: Method for the extemporaneous preparation of —. G. Heikel. Amer. J. Pharm., 1908, 80, 583—584.

THE high price of barium hypophosphite renders it a costly source for the direct preparation of hypophosphorous acid. The acid is more economically obtained as follows: Calcium hypophosphite, in solution, is precipitated with a slight excess of ammonium oxalate; the calcium oxalate is filtered off, and the filtrate boiled with excess of barium carbonate until all ammoniacal odour has disappeared; this should be done with strong solutions, but avoiding evaporation to dryness. The product is treated with a large volume of water and the precipitate is filtered off. The amount of barium in the concentrated filtrate is then determined, and the calculated quantity of dilute sulphuric acid, in slight excess, is added to the hot solution. The precipitated barium sulphate is removed by filtration. Hypophosphorous acid thus obtained should be free from any trace of barium, and contain only a trace of free sulphuric acid.—J. O. B.

Bismuth subsalicylate: Method for the extemporaneous preparation of —. G. Heikel. Amer. J. Pharm., 1908, 80, 584—586.

METALLIC bismuth, or the subnitrate, is dissolved in the smallest possible quantity of nitric acid. Into this solution, a solution of ammonium salicylate is slowly poured, in the proportion of 3 mols. of salicylic acid to one equivalent of bismuth, both solutions being kept cold. At first, free salicylic acid is liberated, and then loosely combines with the bismuth. Ammonium salicylate is then added until no further precipitation occurs. The precipitate is washed twice with cold water, and boiled with successive portions of water until the washings cease to give an acid reaction with litmus paper. The salt is then collected, and dried at a low temperature.—J. O. B.

Cerium and other rare elements: Determination of — in rocks. M. Dittrich. See XXIII.

PATENTS.

Dioxyphenylethanolamines [Dihydroxyphenylethanolamines]; Manufacture of —. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-the-Maine, Germany. Eng. Pat. 9680, May 4, 1908. (Compare this J., 1907, 1028; 1908, 1177.)

By treating dihalogen derivatives of 3:4-methylenedioxytyrol with phosphorus pentachloride, and decomposing the products by means of water, 3:4-dihydroxytyrol-bromohydrin and chlorohydrin are obtained and these react with primary amines or ammonia yielding 3:4-dihydroxyphenylethanolamines.—T. H. P.

p-Aminophenylarsinic acid: Manufacture of homologues of —. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-the-Maine, Germany. Eng. Pat. 14,937, July 14, 1908. Under Int. Conv., July 19, 1907.

THE process consists in heating the arsenate of *o*- or *m*-toluidine or *p*-xylydine with an excess of the base, the compound obtained being amino-*o*-tolylarsinic acid,

$\text{CH}_3\text{C}_6\text{H}_3(\text{NH}_2)\text{AsO}(\text{OH})_2[\text{CH}_3\text{C}_6\text{H}_3(\text{NH}_2)\text{AsO}(\text{OH})_2]_n$ —
1:2:5], m.p. 194—195°, amino-*m*-tolylarsinic acid [1:3:6], m.p. 189°, or amino-*p*-xylylarsinic acid, $\text{NH}_2\text{C}_6\text{H}_4(\text{CH}_3)_2\text{AsO}(\text{OH})_2[\text{CH}_3\text{C}_6\text{H}_3(\text{NH}_2)\text{AsO}(\text{OH})_2]_n$ —
1:4:2:5], m.p. 215° C.—T. H. P.

Acyl derivatives of aminoarylsaric acids: Process of making new —. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 392,857, July 31, 1908. Under Int. Conv., Aug. 19, 1907.

NEW derivatives of arylarsinic acids are obtained by the action of cyanic acid, thiocyanic acid, or their salts or esters on aminoarylsaric acids; thus, by the

action of potassium cyanate and acetic acid on *p*-aminophenylarsinic acid, carbaminophenylarsinic acid, $\text{NH}_2\text{CO.NH.C}_6\text{H}_4\text{AsO}_3\text{H}_2$, is formed.—T. F. B.

Carboxylic acids of acylaminophenyl- and -tolylarsinic acids; Process for preparing —. Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 203,717, Aug. 15, 1907.

HOMOLOGUES of *p*-acylaminophenylarsinic acids, when oxidised, are converted into carboxylic acids of *p*-acylaminophenyl- or -tolylarsinic acids, which are less toxic in their action than the acids which contain no carboxyl group.—T. F. B.

Bornyl oxalate from pinum; Preparation of —. Chem. Fabr. auf Actien vorm. E. Schering. Fr. Pat. 393,175, Aug. 19, 1908. Under Int. Conv., Aug. 24, 1907.

PINENE is heated with anhydrous oxalic acid in the presence of certain anhydrous chlorides, capable of acting as catalysts, with the addition of a diluting agent. For instance, 100 parts of oil of turpentine are dissolved in 200 parts of carbon tetrachloride, and the liquid is heated to 50° C. An intimate mixture of 50 parts of anhydrous oxalic acid and 5 parts of aluminium chloride is then added in small portions at a time. The mass is maintained at a temperature not exceeding 70° C. for two or three hours, and the bornyl oxalate is isolated in the usual manner.—J. F. B.

Camphor from oil of turpentine; Preparation of —. A. Mayer. Fr. Pat. 393,504, Aug. 24, 1908.

THE solid modification of the pinene hydrochloride obtained from oil of turpentine is heated with the oxide of an alkaline-earth metal, in presence of excess of an acid of the fatty series. If an acid of low molecular weight be used, the camphene which is at first produced is esterified, with the formation of the bornyl and isobornyl esters of the acid employed; these must then be saponified. If one of the higher fatty acids be used, camphene is the sole product of the reaction. The camphene, borneol, or isoborneol is then converted into camphor by oxidation in the usual manner.—J. F. B.

Scandium or scandium compounds; Preparation of from minerals. R. J. Meyer. Ger. Pat. 202,523, March 15, 1908.

FOR the separation of scandium from minerals, the residue left after lixiviating the reaction product of the usual fusion process, is neutralised with acid, and treated with such a quantity of oxalic acid or hydrofluoric acid that the scandium is precipitated, whilst iron and manganese remain in solution. The precipitated scandium oxalate may be ignited, the residual oxide dissolved in hydrochloric acid, and scandium reprecipitated with hydrofluoric acid. Example: 100 kilos. of the residual oxides left after lixiviating the reaction product from the fusion of wolframite are dissolved in 250 kilos. of crude hydrochloric acid, and to the filtered solution a concentrated solution of 80 kilos. of oxalic acid is added. The precipitate is collected after 24 hours, washed, dried, and ignited. The residue is dissolved in hydrochloric acid, the solution neutralised with ammonia or magnesia, and treated with hydrofluoric acid until the liquid becomes colourless. After warming, the precipitate is collected, washed, and decomposed with concentrated sulphuric acid. The soluble sulphates are extracted with water, and the scandium precipitated from the solution by an excess of oxalic acid. A yield of 300–400 grms. of scandium oxide of 90–95 per cent. purity is stated to be obtained.—A. S.

Bismuth salt of paraneleic acid; Process for preparing the —. G. Richter. Ger. Pat. 202,955, April 28, 1907.

CALCIUM paraneleinate is decomposed by a soluble, inorganic bismuth salt, in saturated sodium chloride solution; the bismuth paraneleinate thus obtained is said to contain 50 per cent. of bismuth.—T. F. B.

**o*-Nitrobenzonitrile and *o*-nitrobenzamide from *o*-nitrobenzaldehyde; Preparation of —.* Kalle und Co. Ger. Pat. 204,477, Nov. 13, 1907.

ALTHOUGH aldoximes are usually converted into nitriles only in presence of dehydrating agents, *o*-nitrobenzaldehyde is converted into *o*-nitrobenzonitrile by heating in dilute aqueous solution with dilute alkalis (e.g., sodium carbonate, borax, potassium cyanide, etc.). 15 kilos. of *o*-nitrobenzaldehyde are boiled with 0.6 kilo. of potassium cyanide and 150 litres of water under a condenser, for nine hours; on cooling, pure *o*-nitrobenzonitrile crystallises out. If 20 kilos. of the oxime are boiled for nine hours with 1.6 kilos. of crystallised sodium carbonate and 200 litres of water, *o*-nitrobenzamide separates from the solution on cooling.—T. F. B.

Glucose and sodium iodide; Process for preparing a crystalline double compound of —. J. A. Wülling. Ger. Pat. 204,764, March 29, 1907. Addition to Ger. Pat. 196,605, March 16, 1907 (this J., 1908, 471).

THE double compound of glucose and sodium iodide described in the original patent can also be prepared by using, in place of ethyl alcohol, other indifferent solvents, such as methyl alcohol, acetone, etc.—T. F. B.

Glycollic acid; Process for preparing — by electrolytic reduction of oxalic acid. Deuts. Gold- und Silber-Scheide-Anstalt vorm. Rössler. Ger. Pat. 204,787, Dec. 11, 1903. Addition to Ger. Pat. 194,038, Dec. 6, 1903 (see U.S. Pat. 837,083; this J., 1907, 157).

HYDROCHLORIC acid (20 per cent., or sp. gr. 1.1) can be used in place of sulphuric acid as electrolyte for the electrolytic reduction of oxalic acid, carbon being used as anode; otherwise the process is carried out as in the original patent.—T. F. B.

Oxalates; Process for the preparation of — from formates. Elektrolytische Werke Ges.m.b.H. Ger. Pat. 204,895, Oct. 14, 1906.

FORMATES are converted into oxalates by heating in a vacuum at a temperature below 360° C.—A. S.

Allophanic acid santalol ester; Process for preparing —. Verein. Chimmfabr. Zimmer und Co. Ger. Pat. 204,922, Aug. 31, 1907.

THE santalol ester of allophanic acid, which melts at 162° C., is tasteless and odourless, and contains about 72 per cent. of santalol, is obtained by any of the usual methods of making allophanic esters, e.g., by the prolonged action of cyanic acid on santalol in presence of benzene or other solvent, or by the action of urea chloride, phenol carbamate, or phenol allophanate on santalol.—T. F. B.

Radioactive preparations and apparatus for use thereof. A. J. Boulton, London. From Radiogen Ges.m.b.H., Charlottenburg, Germany. Eng. Pat. 27,735, Dec. 16, 1907.

SEE U.S. Pat. 907,066 of 1908; this J., 1909, 41.—T. F. B.

Santalol ethers and intermediate compounds [santalol halides] for use therein; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4930, March 4, 1908.

SEE Ger. Pat. 202,352 and 203,882; this J., 1908, 1177 and 1223.—T. F. B.

Ortho- and para-chlorobenzaldehyde; Process for the separation of —. O. Imray, London. From Farbenwerke vorm. Meister, Lucius, und Brüning, Höchst am Main, Germany. Eng. Pat. 9107, April 27, 1908.

SEE Fr. Pat. 389,750 of 1908; this J., 1908, 1041.—T. F. B.

Camphol esters; Manufacture of —. A. Verley, Paris, E. Urbain and A. Feige, Gentilly, France. U.S. Pat. 907,428, Dec. 22, 1908.

SEE Eng. Pat. 14,549 of 1907; this J., 1907, 1295.—T. F. B.

Cumpher; *Process of oxidising cumpher for the making of* —. A. Verley, Paris, and E. Urbain and A. Feige, Gentilly, France. U.S. Pat. 908,171, Dec. 29, 1908.

SEE Eng. Pat. 14,550 of 1907; this J., 1907, 1163.—T. F. B.

Dialkylbarbituric acids; *Process of manufacturing* —. O. Wolfes, Assignor to L. E. A. W., and C. E. Mreck, Darmstadt, Germany. U.S. Pat. 907,664 and 907,665, Dec. 22, 1908.

SEE Ger. Pat. 170,586 of 1905; this J., 1906, 909.—T. F. B.

Esters of cyclic terpene alcohols; *Process for the manufacture of acid* —. O. Zeitschel, Hamburg, Germany. U.S. Pat. 907,941, Dec. 29, 1908.

SEE Fr. Pat. 379,430 of 1907; this J., 1907, 1253.—T. F. B.

Acetylene tetrachloride; *Manufacture of* —. J. Voigt, Schwanheim on Maine, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. U.S. Pat. 908,051 Dec. 29, 1908.

SEE Fr. Pat. 378,713 of 1907; this J., 1907, 1215.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Colour photography. A new multicolour grating. F. Limmer. Z. angew. Chem., 1909, 22, 14.

THE objection to Lumière's autochromatic plate is its low degree of sensitiveness, due to the opacity of the coating. A new three-colour grating by Szezepanik does not suffer from this defect. He makes use of the observation that colours are able to transfer themselves from one vehicle to another; thus, when a collodion film coloured red with erythrosin, is superimposed upon a colourless gelatin film, the dyestuff transfers itself almost completely from the collodion to the gelatin. In general, it appears that basic dyestuffs have a "preference" for collodion, and acid dyestuffs for gelatin. Szezepanik prepares three solutions of gelatin and colours them with suitable dyestuffs, which have a "preference" for collodion. The solutions are evaporated to dryness and the residues finely powdered; they are mixed, and the mixture dusted over collodion plates which are still somewhat soft. The dyestuffs wander from the gelatin powder in contact with the collodion film, and produce in the latter a mosaic of minute, coloured areas, which correspond to the coloured starch grains of the autochromatic plate. The almost colourless gelatin powder is then washed away. The Szezepanik grating is much more sensitive to light than the autochromatic plate, and yields pictures of greater brightness and brilliancy.—F. M.

Development with pyrogallol; *Correction of over- or under-exposure in* —. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1908, 24, 488—491.

THIS method is based on the variation of the amount of alkali in the developer, as well as the time of development, according to the degree of under- or over-exposure. The following solutions are prepared:—(a). Pyrogallol, 30 grms.; sodium bisulphite solution ("commercial"), 10 c.c.; water, 1000 c.c. (b). Sodium carbonate, 35 grms.; anhydrous sodium sulphite, 75 grms.; potassium bromide, 5 grms.; water, 1000 c.c. 10 c.c. of (a), 20 c.c. of (b), and 90 c.c. of water constitutes the normal developer. In order to increase the time for the first appearance of the image, only 10 c.c. of (b) are used at first; according to the time taken for the image to appear, also having regard to the rapidity of the plate used, further quantities of (a) or (b) are added, these quantities and the total duration of development being found from a table: the time of development for exposures varying between eight times normal or one-fourth normal, is between 12 and 18 minutes.—T. F. B.

Toning-fixing process after fixing [for photographic papers]. R. Namias. Eders Jahrbuch, 1908, 72. Z. angew. Chem., 1909, 22, 28.

SINCE the instability of silver prints, toned in the combined bath containing sulphur, is attributed to the presence of

silver thiosulphate in the bath, it is proposed to immerse the prints, before toning-fixing, in a solution of thiosulphate, preferably containing boric acid.—T. F. B.

Prints on silver chlorocitrate paper, toned and fixed in one operation; *The alteration of* —. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1908, 24, 481—483.

A NUMBER of prints on silver chlorocitrate paper, toned and fixed in the combined bath, were kept in a damp place for seven years; after that time it was found that none of the prints toned and fixed in solutions containing gold salts, whether in presence of lead salts or not, had deteriorated if they had been perfectly washed; prints toned in solutions containing lead salts alone, without gold, as well as prints which had been insufficiently washed, showed marked deterioration. The presence of lead in the finished print appears to have no effect on the stability of the image, but the substitution of tin for lead in the combined bath gave unfavourable results in this respect.—T. F. B.

Photocyanide and photothiocyanate. Lüppo-Cramer. Eders Jahrbuch, 1908, 15. Z. angew. Chem., 1909, 22, 28.

SILVER photocyanide and photothiocyanate were obtained in the same way as the photohalides, *viz.*, silver hydrosols were mixed with hydrosols of silver cyanide or thiocyanate, and the gel precipitated by concentrated sulphuric acid; when purified from free silver by treatment with nitric acid, the photocyanide was obtained as a rose-red and the photothiocyanate as a brick-red body. The former soon became blue-violet when exposed to the light, but the latter was very little altered.—T. F. B.

PATENTS.

Celluloid; *Colouring* —. more especially for use in preparing coloured screens for photography. F. Lehner, Zürich, Switzerland. Eng. Pat. 7629, April 6, 1908.

ALL the dyestuffs hitherto used for colouring transparent celluloid have been soluble in strong alcohol and have possessed the disadvantage of allowing "spreading" of the colour beyond its own limits when used for multicolour screens. According to this invention certain dyestuffs, which are enumerated, are used which are readily soluble in water but as far as possible insoluble in alcohol. The celluloid is milled with alcohol diluted with as much water as possible, and the dyestuffs, either solid or in aqueous solution, are incorporated with the plastic mass. When this is homogeneous it is reduced to films which are then dried very slowly. Finally the films are softened by exposure to the vapour of alcohol and the process of rolling is completed.—J. F. B.

Celluloid films for photography; *Process and apparatus for applying emulsions to* —. Soc. Civile des Pellicules Nouvelles pour Cinématographes et autres usages. Fr. Pat. 393,224, Oct. 19, 1907.

A NUMBER of plates with plane surfaces, mounted on wheels, are joined together to form an endless band, which passes over a vacuum chamber containing water-cooled tubes: each plate is perforated with a number of holes. A band of celluloid is led on to the chain of plates, and is given a velocity equal to that of the plates; just after it passes over the vacuum chamber, where it is held in close contact with the plates, a stream of emulsion is made to flow on to it; it then passes beneath hoods containing cold water, and finally to the drying apparatus.—T. F. B.

Photography of colours; *Trichromatic screen for the* —. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 393,296, Oct. 21, 1907.

A GLASS or other screen is coated with a layer of gelatin, etc., which is then stained with one of the colours to be used; a series of parallel lines, covering about one-third of the surface, is now ruled in a fatty ink on the gelatin, and the exposed dyed gelatin decolorised and stained with a second colour; a second series of lines, perpendicular to the first, and covering one-half of the stained surface exposed, is ruled on the gelatin with ink, and the

decolourisation repeated, the remaining spaces being stained with the third colour. On removing the fatty ink by washing with a suitable solvent, a trichromatic screen is obtained which can at once be coated with a sensitive emulsion.—T. F. B.

Gelatin films coated on either side with collodion; Process for preparing — for photographic and other purposes. O. Moh. Ger. Pat. 204,868, Sept. 8, 1906.

A SMALL quantity (e.g., one per cent.) of a neutral soap, in alcoholic solution, is added to the collodion and gelatin solution for making films by applying successive coatings of collodion, gelatin, and collodion to suitably prepared paper or other temporary support. The films can be readily removed from the support, are quite clear, do not readily crack or ignite, and can easily be coated with a sensitive emulsion.—T. F. B.

Silver salt [photographic] copying papers. Chem. Fabr. auf Actien, vorm. E. Schering, Ger. Pat. 203,373, Jan. 31, 1908.

THE known printing-out papers for producing hard prints, made by addition of ferriyanides, chromates, and chromic acid to the silver salt emulsion, are yellowish in colour, and there is, therefore, a difficulty in judging the correct depth of printing. According to the present invention, white papers giving harsh contrasts are produced by using vanadic acid, vanadates, or complex vanadic acid compounds (e.g., phosphovanadates) in small quantities in preparing the emulsions.—T. F. B.

Silver photographic papers. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 9275, April 29, 1908.

SEE Ger. Pat. 203,373 of 1908; preceding.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Potassium chlorate; Purity of —. G. Ponndorf. See VII.

Chlorates; "Active" substance in —. H. Klopstock. See VII.

PATENTS.

Vacuum drying apparatus for explosives; Safety device for —. E. Passburg. Ger. Pat. 204,381, Feb. 4, 1908.

IN order to preserve the solid walls of the drying chamber in case of an explosion, the doors of the chamber are so fastened that they will freely open when exposed to pressure on the inside, and one or more walls of the chamber or the cover of the chamber are held in place by springs which give way when a certain amount of pressure is developed inside the chamber.—A. S.

Explosive. O. von Schroetter, Kruppamühle, Upper Silesia. U.S. Pat. 908,149, Dec. 29, 1908.

SEE Eng. Pat. 8157 of 1907; this J., 1907, 893.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, &c.

PATENT.

Analysis of gases [products of combustion]; Apparatus for the —. J. A. Caldwell, Montclair, N.J. U.S. Pat. 906,687, Dec. 15, 1908.

THE apparatus comprises a measuring chamber into which a charge of furnace gases is drawn, and absorption and displacement chambers, with means for recording on a card the amount of gas absorbed or the amount left unabsorbed. The measuring chamber is connected to each of a number of furnaces in succession, and the result of the analysis is recorded on a separate card for each furnace. The record cards are carried by a movable holder which automatically brings the next card into position, when the measuring chamber is connected to the next furnace.—A. T. L.

INORGANIC—QUANTITATIVE.

Copper; Effect of — on the results of the Zimmermann-Reinhardt method of titrating iron. K. Schröder. Z. öfentl. Chem., 1908, 14, 477—492.

MINUTE traces of copper have the effect of lowering the result of titrating an iron ore; larger quantities give too high a result, while intermediate quantities may be without effect, through opposite tendencies compensating one another. The cause of the lowered results is "induced" oxidation of the iron, partly by the hydrogen peroxide formed during the autoxidation of the cuprous compounds, partly by the reversible reaction, $\text{CuCl}_2 + \text{FeCl}_2 \rightleftharpoons \text{CuCl} + \text{FeCl}_3$. The speed of these oxidising reactions increases as the acid-concentration is diminished. A copper-content of not more than 0.01 per cent. may be neglected in ordinary work, but if more copper than this is present it should be removed before reducing and titrating the iron. No material containing copper should be used as a standard, and the freedom from copper of all the reagents used, especially of the stannous chloride, should be ascertained.—J. T. D.

Cerium and other rare elements; Determination of —, in rocks. M. Dittrich. Ber., 1908, 41, 4373—4375.

CERIUM is completely precipitated from its salts by oxalic acid or ammonium oxalate; if, however, ferrous salts be present, the precipitate is contaminated by iron. If ferric salts be present in considerable quantity, no precipitate is formed at first by oxalate, and only after considerable excess has been added, and the iron has been converted into the complex ferric oxalate, does further addition of oxalate precipitate the cerium. The precipitate so formed is, however, pure and free from iron. For 0.2 gm. of cerium salt and 15 c.c. of concentrated ferric salt, at least 200 c.c. of saturated ammonium oxalate solution must be used. It is best to precipitate in hot solution, as the precipitate is then denser and better to filter. It should be washed at first with ammonium oxalate solution. The allied metals can be separated from iron (aluminium or chromium) in the same way as cerium.—J. T. D.

Sulphur and sulphides (oxidation). E. Pollacci. See VII.

Tin in tin-plate. K. Meyer. See X.

Phosphate rock. C. F. Hagedorn and others. See XV.

ORGANIC—QUALITATIVE.

Petroleum colour reaction. C. Arragon. See III.

"Galalith"; Reaction for —. L. Wolter. See XIV.

Fluorides in beer. J. Flamand. See XVII.

ORGANIC—QUANTITATIVE.

Paraffin oil; Iodine value of —. I. Dreyfus. See III.

Oils; Iodine value. L. E. Levi and E. V. Manuel. See XII.

Sugar in saturation mud. F. Herles. See XVI.

Alkaldoids; Determination of —. G. Heikel. See XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Silicides of hydrogen. P. Lebeau. Compt. rend., 1909, 148, 43—45.

THE mixture of gases evolved on treating magnesium silicide with hydrochloric acid was submitted to a series of fractionations by means of liquid air (see Moissan and Smiles, this J., 1902, 504). In this way in addition to the gaseous silicides, SiH_4 and Si_2H_6 , small quantities of a liquid and of a solid silicide were obtained. Silicoethane, Si_2H_6 , was obtained in a nearly pure condition; it boils at about -7°C , and is probably quite non-inflammable (spontaneously) in the air when pure. The liquid silicide is probably silicoethylene, Si_2H_4 ; in contact with oxygen it burns with a very bright flame and gives rise to violent explosions.—A. S.

Colloidal suspensions; Behaviour of — with immiscible solvents. W. L. Miller and R. H. McPherson. *J. of Physical Chem.*, 1908, 12, 706—716.

As a rule, attempts to bring about the distribution of a colloid between two immiscible solvents result in the coagulation of the colloid (this *J.*, 1906, 1177). A mixture of chloroform and alcohol (or acetone), however, does not coagulate the hydrosol of arsenious sulphide, although no distribution is observed. If ether or ethyl acetate, on the other hand, be substituted for chloroform, distribution readily occurs, whether the consolute liquid be alcohol, acetone, or propyl alcohol. For example, by mixing a 1 per cent. solution of arsenious acid, ether, alcohol, and hydrogen sulphide solution, in the order given, taking somewhat less alcohol than is necessary to make a homogeneous solution, and then shaking and allowing to stand, two clear yellow layers separate, which may remain for days apparently unchanged. By adding more ether, the volume of the lower layer is diminished and the concentration of the colloid in that layer increased. Colloidal antimony trisulphide also becomes distributed between the two liquid phases in the system, water-ether-alcohol, but a like phenomenon has not been observed with copper sulphide.—F. SODN.

Egg-albumin and acetic acid;] Physico-chemical investigation of the interaction of —. L. Zoja. *Z. Chem. Ind. Kolloide*, 1908, 3, 249—269.

IF acetic acid is added to dialysed albumin solution, the mixture gradually increases in consistence on standing, and finally forms a transparent mass which can no longer be poured out of the test-tube. The presence of salts increases the rapidity with which this occurs. No precipitate is formed, but mixtures containing much acetic acid become slightly opalescent. On warming the jelly dissolves to a perfectly clear solution and gelatinises again on standing. The viscosity of solutions of acetic acid and albumin increases with the time; after any given length of time it increases with the amount of acetic acid originally added, up to a maximum of 7.01 per cent.; it then falls to a minimum at 11.22 per cent. and again rises. The electric conductivity of the mixtures is always higher than that of the corresponding mixture of water and acetic acid only, but the curves are otherwise analogous. The maximum amount of viscosity is only reached after a considerable time, which is never less than 18 to 20 days. Formic acid has a much more rapid and stronger effect than acetic acid, whilst with propionic acid the reverse is the case. The presence of inorganic salts increases the rapidity of reaction, but the maximum viscosity is attained at the same concentration as before. Acetates alone, without free acetic acid, do not effect any increase in the viscosity of albumin solutions.—E. F.

Copper albuminate; Acid and neutral —. G. Bonamartini and M. Lombardi. *Z. physiol. Chem.*, 1908, 58, 165—174.

SOLUTIONS of egg-albumin were treated with varying quantities of copper sulphate solution, with and without addition of varying quantities of potassium hydroxide solution, and the precipitates weighed and analysed. In the absence of potassium hydroxide the precipitates were of practically constant composition, whatever the quantity of copper sulphate added, and contained copper and the sulphuric acid radical (SO_4) in equivalent proportions, the average composition of the precipitate being:—8.07 per cent. of sulphuric acid radical (SO_4); 5.26 per cent. of copper; and 86.67 per cent. of albumin. The amount of the precipitate decreased as the total volume of the reacting liquids increased, and was practically unaffected by the concentration of the copper sulphate when the total volume was unaltered. The authors conclude that under these conditions an "acid compound" is formed, which is considerably soluble in the liquid, and which contains chemically equivalent amounts of copper and sulphuric acid radical (SO_4). When increasing amounts of potassium hydroxide solution are added to mixtures of albumin and copper sulphate solutions, the amount of precipitate formed increases steadily up to the point at which the supernatant liquid is neutral

in reaction. At the same time the amount of copper in the precipitate progressively increases and the amount of sulphuric acid radical (SO_4) decreases. If potassium hydroxide solution is added until the supernatant liquid is neutral in reaction, and the precipitate is washed with distilled water, in which it is then insoluble, the resulting precipitate contains no sulphate, and has the composition:—31.25 per cent. of copper; 68.75 per cent. of albumin. If an excess of alkali is added it is not found possible to filter and collect the resulting precipitates. The authors consider the resulting insoluble compound, free from sulphate, to be a "neutral salt"; it does not froth when shaken up with water, but the acid salt causes frothing when so treated.—E. F.

Peroxydase; New artificial —. E. de Stoecklin. *Comptes rend.*, 1908, 147, 1489—1491. (See also this *J.*, 1908, 185, 474, 772.)

TANNATE of iron, prepared by the interaction of tannin and a ferric salt, acts as a peroxydase capable of transferring oxygen from hydrogen peroxide to a number of compounds, most of which resist the action of all the peroxydases previously known. Thus, alcohol is oxidised to acetaldehyde, and a large number of phenols and phenolic and amino-derivatives readily undergo oxidation. Contrary to what is the case with other peroxydases, tannate of iron acts most readily on monophenols and, in general, on compounds containing only one hydroxyl-group. This peroxydase usually yields oxidation products which resinify, so that its action cannot be compared with that of ferric sulphate and hydrogen peroxide; in the latter case, however, the action seems to be more vigorous than the former. It is interesting to note that this peroxydase attacks tyrosine, for up to the present the peroxydases have been found capable of acting only on compounds which are also oxidised by oxydases of the laccase type and not on tyrosine, which is only attacked by the enzyme tyrosinase; whether the action of the latter on tyrosine yields the same products as that of tannate of iron has not been ascertained.—T. H. P.

Iron and Steel Institute. The Andrew Carnegie Research Scholarship.

A RESEARCH Scholarship or Scholarships, founded by Mr. Andrew Carnegie, will be awarded annually, irrespective of sex or nationality, on the recommendation of the Council of the Iron and Steel Institute, 28, Victoria Street, London, S.W. Candidates, who must be under thirty five years of age, must apply on a special form before the end of February to the Secretary of the Institute.

The object of this scheme of Scholarships is not to facilitate ordinary collegiate studies, but to enable students, who have passed through a college curriculum or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects, with the view of aiding its advance or its application to industry.

The appointment to a Scholarship shall be for one year, but the Council may at their discretion renew the Scholarship for a further period.

THE PATENTS AND DESIGNS ACT, 1907.

American Letters Patent Revoked. *Times*, Jan. 6, 1909.

THE Comptroller-General of Patents, Designs, and Trade Marks (Sir Cornelius Dalton) has given his decision in an application for the revocation of letters patent under the Patents and Designs Act, 1907. The applicants were William T. Thomson and James Knox, and they applied for the revocation of letters patent No. 26,519 of 1896, on the ground that the patented article is not manufactured to an adequate extent in the United Kingdom. The prime object of the invention protected by the patent was to produce a lockstitch sewing machine capable of operating at a high speed upon either thick or thin work.

It appeared from the evidence that the machine as imported had been wholly manufactured in the United States, but that before it was sold in this country a few parts were taken out and in their place others were substituted which were manufactured here. The substituted

parts, however, were very few in number, as compared with the other patented parts of the machine. It further appeared from the evidence that accessories not the subject of the patent were manufactured in this country, and sold in certain cases with the machine. The machine is not patented in Germany, and the applicants for the revocation of the patent were alleged, in the declaration of the managing director of the company who own the patent, to be, or to be about to become, agents for certain manufacturing firms in Germany and elsewhere for whom they desire to sell sewing machines which are made by such firms in accordance with the patent, and, if at present sold in the United Kingdom, would be an infringement of the patent.

In his decision, the Comptroller-General said that the first question which he had to decide was whether the patented article was manufactured to an adequate extent in the United Kingdom. For the purposes of this question the accessories to the machine, which were alleged to be manufactured in this country, must be disregarded; for it was not suggested that any of them formed part of the invention protected by the patent. It seemed to him impossible to contend that the public demand in this country for the patented article was substantially met by the manufacture here of a comparatively small number of substituted parts, which were mere modifications, made to suit the taste and convenience of certain purchasers, for which there would be no demand except for the purpose of using them as parts of the entire machine. The question that next arose was whether the patentees had given satisfactory reasons why the patented article was not manufactured to an adequate extent in the United Kingdom. The company did not themselves manufacture the machines imported from the United States, but employed for the purpose a firm there, whom they considered the best tool manufacturers in the world. It was easy to understand that they had found it more convenient to continue to employ this firm, on whom they felt they could rely, for such refined work as theirs, than to employ a manufacturer in this country to do it for them, or to set up factories here for the purpose. But their own convenience was obviously of itself no satisfactory reason within the meaning of the section for not manufacturing the patented article in the United Kingdom. An attempt had therefore been made to show that it was impossible to make the machine in this country. It was very natural that the patentees and their *employés* should believe that their machine was a better one than anyone else could produce, and that the American firm which had done their work well for 40 years were the best tool manufacturers in the world. But it was manifest that opinions of this kind must be received with considerable hesitation, having regard to the high-class machinery turned out in this country and on the Continent; and that even if they could be substantiated, they would not, of themselves, afford a satisfactory reason for not manufacturing in the United Kingdom. If he were to accept opinions of this kind as a satisfactory reason for failing to manufacture in this country, he doubted whether any American patent for machinery of precision could be revoked on the application of a German applicant; or any German patent for similar machinery on the application of an American applicant, although, as a matter of fact, the machinery might in both cases very well be manufactured in any one of the three countries, if the patentee were not in possession of the monopoly of manufacture. In the present instance, the patentees evidently regarded with some apprehension the importation of the machine by rival manufacturers in Germany, where it was not patented. It was said that if the patent were revoked "the country would be flooded with German and other Continental imitations of their machines," and that the company did not want to see the public put off with machines which they were convinced were very much inferior to this one. He doubted very much whether the protection which, it was suggested, the users of these machines would derive from the continuance of the patent was quite the kind of protection which they themselves desired or required, and whether they would not prefer that the trade should be freed, and that they should have the opportunity of testing the qualities of some of these

much-maligned German sewing machines, which could not be brought into this country so long as the patent remained in force. The patent had rather less than two years more to run in the ordinary course, and, according to the evidence of the managing director of the company, it would be between five and ten years from the present time before the company could be in a position to make the machine completely in this country. On the other hand, it appeared from the evidence of Mr. Knox that a German firm were able to put a similar machine on the market in six months from the time when they started to make it. If the company's evidence was correct, no useful object would apparently be gained, if he were to make an order revoking the patent after a reasonable interval. On the other hand, if Mr. Knox's evidence was correct, it was possible that if he revoked the patent forthwith the patented article might be manufactured in this country before the time when the patent would expire. The power to defer the revocation for a reasonable interval was given for the protection of patentees who of their own accord had taken substantial preliminary steps to comply with the requirements of the Act, but had not had sufficient time to complete their works and actually manufacture the patented article before an application was made to revoke their patent. Here it appeared that the patentees had taken no steps whatever with a view to meeting the requirements of the section, although more than 16 months had elapsed since the passing of the Act. He therefore ordered, subject to an appeal to the Court, that the patent be revoked forthwith, and that the patentees pay to the applicants in respect of the costs of their application the sum of 40 guineas.

New Books.

TECHNOLOGIE ET ANALYSE CHIMIQUES DES HUILES, GRAISSES ET CÈRES. Par le Dr. J. LEWKOWITZKY, M.A. Traduit du Manuscrit, spécialement rédigé pour cette édition par l'Auteur, par EMILE BONSTORF. Tome II. H. Dunot et E. Pinat, Éditeurs, 49, Quai des Grands-Augustins, Paris. 1909. Price 30 frs.

THE appearance of Volume I. of this work (French edition) was noticed in this Journal, 1906, 1010. It contained 546 pages of subject matter and 53 illustrations. The present volume (Vol. II.) brings up the contents to 1416 pages, with 10 illustrations and a sheet of microphotographic engravings. There are two indexes, *viz.*, a botanic index, and a zoologic index. This portion of the work commences with Chapter XIII., which is principally concerned with the extraction and preparation of the raw materials used in the industries of the oils, fats, and waxes; it then proceeds to Chapter XIV., which is occupied with the general technology of the natural oils, fats, and waxes, their methods of purification and preparation, refining, and examination, with a description of the processes for detecting and determining adulterations. The classification proceeds as follows:—A.—OILS AND FATS. Glycerides I. OILS, OR LIQUID FATS. 1. Vegetable oils. (i.) Drying oils. (ii.) Semi-drying oils. (iii.) Non-drying oils. 2. Animal oils. (i.) Oils of marine animals. (ii.) Oils of terrestrial animals. II. FATS, OR SOLID FATTY BODIES. 1. Vegetable fats. 2. Animal fats. (i.) Drying fats. (ii.) Semi-drying fats. (iii.) Non-drying fats. B.—WAXES. 1. Liquid waxes. II. Solid waxes. 1. Vegetable waxes. 2. Animal waxes.

DIE STEARINFABRIKATION. Von BÉLA LACH, Ph.D. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price M.6.40.

8vo volume, containing 176 pages of subject matter, with 79 illustrations. There is an alphabetical index of authors' names, and one of subject matter. The subject matter is classified according to the following scheme:—I. Raw materials for the stearine manufacture. II. Preparing the raw materials. III. The manufacture of oleomargarine. IV. Refuse fat or kitchen fat. V. Bone

fat or grease. VI. Obtaining fish oils. VII. Obtaining fat from animal carcasses. VIII. Preparation of raw materials. IX. Working up fatty matters for stearine. X. Preparation of fatty acids. XI. Description of the distillation apparatus. XII. Distillation under vacuum, etc. XIII. Hydraulic cold press. XIV. Warm pressing of fatty acids. XV. Selection of the pressed stearine. XVI. The elaine: Its filtration, etc. XVII. Analysis of fatty matters. Simple and rapid method for determining the free fatty acids in mixed fats.

INTRODUCTION TO THE RARER ELEMENTS. By PHILIP E. BROWNING, Ph.D. 2nd Edition. John Wiley and Sons, New York, U.S. America. Price \$1.50 net. Chapman and Hall, Limited, London. 1908. Price 6s. 6d. net.

8vo volume, containing 206 pages of subject matter, an engraving representing the typical absorption spectra of the rare earths, and an alphabetical index. Commencing the book, there is also an index to the literature of certain of the rare elements. The groups treated of in the text are the following:—I. The alkalis. II. Beryllium. III. The radio metals. IV. The rare earths. V. Gallium, indium, thallium. VI. Titanium, germanium. VII. Vanadium, niobium, tantalum. VIII. Molybdenum, tungsten, uranium. IX. Selenium, tellurium. X. The platinum metals; Gold. XI. The rare gases of the atmosphere. XII. Technical applications. XIII. Qualitative separation.

ELEMENTARY AGRICULTURAL CHEMISTRY. A Handbook for Junior Agricultural Students and Farmers. By HERBERT INGLE, B.Sc. Chas. Griffin and Company, Ltd., Exeter Street, Strand, London, W.C. 1908. Price 4s. 6d.

SMALL 8vo volume, containing 241 pages of subject matter, six illustrations, and the alphabetical index. The text is classified according to the following plan:—I. Introduction. Outline of chemical theory. II. The atmosphere. III. The soil. IV. Natural waters. V. The plant. VI. Manures. VII. Crops. VIII. The animal body. IX. The feeding of animals. X. The dairy. XI. Disinfectants and antiseptics. Fungicides. Insecticides. Plant poisons.

FIRST PRINCIPLES OF CHEMICAL THEORY. By C. H. MATHEWSON, Ph.D., Instructor in Chemistry and Metallurgy at the Sheffield Scientific School of Yale University. First edition. John Wiley and Sons, New York, U.S. America. 1908. Price \$1.00 net. Chapman and Hall, Ltd., London. Price 4s. 6d. net.

8vo volume, containing 119 pages of subject matter, seven illustrations, and alphabetical index. The subject matter receives the following classification:—I. Leading principles of general inorganic chemistry. II. Natural classification of the elements. III. Determination of molecular weights. IV. Determination of atomic weights. V. Calculation of formulae. VI. Osmotic pressure and related phenomena with special reference to dilute aqueous solutions of acids, bases, and salts. VII. The electrolytic dissociation theory. VIII. The law of chemical mass action. IX. Heterogeneous equilibrium. X. Thermochemistry.

LABORATORY NOTES ON INDUSTRIAL WATER ANALYSIS. A Survey Course for Engineers. By ELLEN H. RICHARDS, Instructor in Sanitary Chemistry, Massachusetts Institute of Technology. First edition. John Wiley and Sons, New York, U.S. America. 1908. Price 50 cents net. Chapman and Hall, Ltd., London. Price 2s. net.

8vo volume, containing 48 pages of subject matter, and an alphabetical index. The text is planned as follows:—PART I. (i.) Introduction. (ii.)—(vii.) Laboratory exercises. PART II. (i.) Standard solutions. (ii.) Computation of hypothetical combinations. (iii.) Percentage composition of salinity in various waters. (iv.) Convenient data and tables. (v.) Useful references.

TONINDUSTRIE KALENDER. 1909. ERSTER THEIL. ZWEITER THEIL. DRITTER THEIL. Verlag der Tonindustrie-Zeitung, Berlin. N.W. 21. Price for all three parts, M.1.50, without postage. Single parts M.1 each.

Erster Teil.—This takes the form of a pocket-book, bound in water-proof cloth, with calendar and blank pages for notes; pencil, etc. Its table of contents refers to all three parts, though each part forms a separate booklet. It contains besides the calendar and note pages, also a couple of pages of data furnished by Seger and Cramer with respect to the Seger cones, and their uses, etc. There is also a sheet with the molecular weights of the most important substances for the clay industry, data as to saturation capacity of the atmosphere for moisture, and mean values of the fusion points of Seger cones.

Zweiter Teil.—This little volume contains 392 pages, and an alphabetical index. There are 147 illustrations. All data and constants are furnished for the clay and earthenware chemist, as regards clays, fuels, etc., also as regards furnaces, mills, and apparatus generally, directions and data are given.

Dritter Teil.—This part is an index or guide to the best books and sources of information for the clay worker and chemist. Classified lists are also given of the best firms where materials, apparatus, and utensils, etc., can be obtained, most likely to be useful to the clay worker, potter, etc.

STATISTICAL TABLES RELATING TO BRITISH COLONIES, POSSESSIONS, AND PROTECTORATES. Part XXXI. 1906. [Cd. 4385.] Price 6s. 2d.

This return, which is prepared annually in the Commercial, Labour and Statistical Department of the Board of Trade, contains much statistical information in regard to British Colonies, Possessions, and Protectorates supplementary to the figures published in the "Statistical Abstract for the British Empire" and the "Statistical Abstract for the Colonies." The present issue, which relates to the year 1906, contains statistics of the population, foreign trade, shipping, finances, agriculture, and other industries of the various Colonies, &c. Among statements appearing for the first time may be mentioned those respecting the number and tonnage of vessels engaged in the foreign and inter-state trade of the Australian Commonwealth during 1906, the number and tonnage of vessels built in the Commonwealth in 1906, the value of Australian inter-state trade in 1904, 1905, and 1906, mineral statistics of the Orange River Colony for each of the years ended 30th June, 1904 to 1906, shipping statistics of the Nyasaland Protectorate for the year ended 31st March, 1907, statistics respecting industrial establishments in Canada, &c., &c.

DIE VERWERTUNG DES KALIS IN INDUSTRIE UND LANDWIRTSCHAFT. Eine wirtschaftliche Studie in vier Abschnitten. Von Dr. PAUL KRISCHE, Göttingen und Stassfurt. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price M.5.70.

8vo volume, containing 181 pages of subject matter with 16 illustrations, and a chart. The subdivisions of the text are as follows:—I. The most important sources of potash. II. Development of the potash industry. III. The industrial valuation of potash. IV. The manual valuation of potash. V. The prospects of the potash industry.

LABORATORIUMSBUCH FÜR TINKTORIAL-CHEMIKER, KOLORISTEN, INGENIEURE, UND TECHNISCHE REISENDE, IN FÄRBEREIE, DRUCKEREIE, FARBEN-, LACK- UND PAPIERFABRIKEN. Von Dr. FRANZ ERBAN. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price M.5.20.

This volume forms one of the publisher's "*Laboratoriumsbücher für die chemische und verwandte Industrie, Bd. IV.*" It contains 109 pages of subject matter, with 21 illustrations. There is no alphabetical index, but a very full and complete table of contents. The subject matter is classified as follows:—I. The laboratories in dye- and print-works. II. The dyeing laboratories and experimental dye-houses of dye-works. III. Concerning the advancement of dye-works chemists and colourists, and their prospects.

FIRE TESTS WITH FIRE EXTINGUISHERS. "Red Books" of the British Fire Prevention Committee. No. 128. ["Red Book" No. 128.] Edited by the Committee. Published at the offices of the Committee, 1, Waterloo Place, Pall Mall, London. 1908. Price 2s. 6d.

Svo pamphlet in stout cardboard cover of red colour, containing 16 pages of subject matter. The objects of the tests were to ascertain the effect of the application of water in small vessels, such as buckets, etc., upon various burning materials both in a room and in the open. There were in this case 12 tests. Illustrations are given. Particulars are given of these experimental tests. They were made in connection with the employment of buckets of water, hand pumps, etc., as in common use.

["Red Book" No. 133.] Price 2s. 6d.

Svo pamphlet similar to the last, and containing 24 pages of subject matter and 11 illustrations. The object of the tests in this case was to ascertain the effect of the application of asbestos cloths, sand, and steam upon petrol and various burning materials, though principally upon burning petrol, and more particularly under conditions met with in processes employed on the premises of dyers and cleaners.

ELEKTROLYTISCHE ZÄHLER. [Monographien über angewandte Elektrochemie Bd. XXXI.] Von Dr. KONRAD NORDEN. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price M.9.00.

Svo volume, containing 161 pages of subject matter with 150 illustrations, and an alphabetical index of names, followed by an index of patents, German, English, and American. The subject is arranged under the following classification:—PART I. A. General facts on galvanometers, specially ammeters. B. Essential practical conditions. C. The electrochemical conditions. PART II. (i), Copper voltameter, (ii.), Zinc voltameter, (iii.), Silver voltameter, (iv.), Mercury voltameter, (v.), Water voltameter. PART III. (i.), Precipitate voltameters, (ii.), Mercury electrometer, (iii.), Hydrogen electrometer.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

55. Iron. Furnaces and kilns. Jan. 1.
146. Ruddle. Collecting, handling, and storing liquors, etc., by means of organic absorbents, for the subsequent recovery of nitrogenous and other compounds therefrom. Jan. 2.

370. Peake. Thermo-electric pyrometers. Jan. 7.
397. Schmatolla. Furnaces, kilns, &c. [Addition to No. 1168 of 1908.] Jan. 7.
654. Cloake. Heating apparatus. Jan. 11.
779. Brücke. Apparatus for distilling, evaporating, heating, or cooling liquids. Jan. 12.
828. Jones. Perforated top cone kiln thermometer. Jan. 13.

916. De Brumo-Austin. Automatic apparatus for dissolving. [Addition to No. 6842 of 1907.] Jan. 14.

1151. Thompson (Badische Maschinenfabr. und Eisen-giesserei vorm. Schell und Neff). Separating substances of different specific gravities. * Jan. 16.

COMPLETE SPECIFICATIONS ACCEPTED.

26,584 (1907). Pampé. Notched columns for distilling and rectifying purposes. Jan. 13.

26,821 (1907). Elmore and Elmore. Apparatus for separating sub-divided solids from a liquid, especially for thickening ore pulp, &c. Jan. 13.

5069 (1908). McNeil and McNeil. Evaporating or concentrating apparatus. Jan. 13.

6552 (1908). Martin. Mixing and pulverising apparatus for liquids. Jan. 20.

7728 (1908). James (Separatorkiebolaget Mundus). Centrifugal separators. Jan. 13.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

71. Robin. Incandescent gas mantles. * Jan. 1.
132. Hornsby and Sons (Tuxham). Suction gas plant. * Jan. 2.

174. Mayer and Fehlmann. Removing carbon bisulphide from gases. * Jan. 4.

218. Walton. Manufacture of filaments for incandescent electric lamps. Jan. 4.

282. Coolidge. Manufacture of refractory electric conductors. [U.S. Appl. Sept. 23, 1908.] * Jan. 5.

321. Weissmann. Illuminating bodies. * Jan. 6.

359. Potter. Filaments for incandescent lamps and heating purposes. Jan. 7.

974. Parker. Discharging vertical retorts for the destructive distillation of coal. [Addition to No. 14,165 of 1908.] Jan. 14.

982. Koppers. Gas and coke oven plant. * Jan. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

829 (1908). Stewart and Stewart. Gas producers. Jan. 20.

2720 (1908). Cie. du Gaz de Lyon. Treatment of gaseous fuels. Jan. 20.

1492 (1908). Blakeley. Producer gas plants. Jan. 20.

5040 (1908). Planchon. Metallic filaments or rods for electric incandescent lamps. Jan. 20.

6251 (1908). Ries. Quenching and discharging coke. Jan. 13.

17,618 (1908). Arsem. Manufacture of refractory conductors. Jan. 13.

20,686 (1908). Bowmer. Gas producers. Jan. 13.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

71. Davies and Vivian. Separation of certain components of certain liquid hydrocarbons. Jan. 1.

COMPLETE SPECIFICATIONS ACCEPTED.

1921 (1908). Backeland. Insoluble condensation products of phenol and formaldehyde. Jan. 13.

13,675 (1908). Noad and Townsend. Production of volatile spirit from hydrocarbon oils, &c. Jan. 13.

IV.—COLOURING MATTERS AND DYE-STUFFS.

APPLICATIONS.

111. Perkin. Manufacture of indigo from the indigo plant. Jan. 2.

339. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Jan. 6.

657. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Jan. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

90 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur. Jan. 13.

5484 (1908). Newton (Bayer und Co.). Manufacture of trisazo dyestuffs. Jan. 20.

8530 (1908). Imray (Soc. Chem. Ind. in Basle). Manufacture of halogenised vat dyestuffs. Jan. 20.

11,878 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters suitable for use in the form of their lakes. Jan. 20.

26,714 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matter suitable for use as a pigment or lake. Jan. 13.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

169. Baumann and Diesser. Process for obtaining silk fibroin, albumen, etc. [Ger. Appl. Sept. 15, 1908. Addition to No. 25,522 of 1908.]* Jan. 4.

270. Cassella and Co. Dyeing union fabrics. [Ger. Appl., Jan. 6, 1908.]* Jan. 5.

271. McNaught. Machinery for scouring and washing wool and other fibrous materials. Jan. 5.

625. Garsedden and Ingram. Automatic skein or hank dyeing machine. Jan. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

27,006 (1907). Scott. Degreasing and cleaning fabrics, yarns, etc. Jan. 13.

858 (1908). Dreaper. Manufacture of threads or filaments from cellulose. Jan. 20.

6979 (1908). Calico Printers' Assoc. and Schofield. Printing textile fabrics. Jan. 20.

8142 (1908). Newton (Bayer and Co.). Printing with the aid of sulphide dyestuffs. Jan. 13.

16,659 (1908). Chaumat. Indigo dyeing. Jan. 13.

19,310 (1908). Imray (Soc. Chem. Ind. in Basle). Producing in printing violet to lilac tints fast to washing and light. Jan. 20.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

52. Firman and Cocksedge. Apparatus for making sulphur and similar acids. Jan. 1.

146. Ruddle. *See under* 1.

351. Weyer. Production of nitric acid.* Jan. 6.

491. Poulson. Manufacture and utilisation of gelatinous silica. Jan. 8.

562. Leese. *See under* IX.

596. Williams. Extraction of sulphur from spent oxide, &c.* Jan. 9.

612. Leese. Preparation of magnesite in impalpable powder, and of calcined magnesite therefrom.* Jan. 11.

711. Herrmann and Co. Packing peroxides of alkalis. [Swiss Appl., Jan. 13, 1908.]* Jan. 11.

794. Bailey and Stevenson. Production of borax from native boron compounds.* Jan. 12.

1148. British Cellulose Synd., and Mertz. Production of a solution of ammoniacal cupric oxide.* Jan. 16.

1150. Gruner. Production of a sodium peroxide compound for washing and bleaching. [Ger. Appl., Feb. 28, 1908.]* Jan. 16.

COMPLETE SPECIFICATIONS ACCEPTED.

22,434 (1907). Tucker. Manufacture of massive boron carbide. Jan. 20.

651 (1908). Naumann. Production of sal-ammoniac by decomposing common salt with ammonium sulphate. Jan. 13.

726 (1908). Jacob. *See under* XI.

3429 (1908). Dyes (Hempel). Manufacture of oxalates. Jan. 20.

19,369 (1908). Eastwick. Treatment of waste hydrated sulphate of lime. Jan. 20.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATION.

1 364. Bousfield. *See under* IX.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

34. Spoor. Hydraulic cement. Jan. 1.

113. Fludder and Fludder. Manufacture of refractory bricks, furnace lining, cement, &c. Jan. 2.

118. Stein. Producing granulated slag from refuse for artificial stone, &c. [Ger. Appl., Feb. 27, 1908.]* Jan. 2.

364. Bousfield. Manufacture of bricks, tiles, pottery, etc. Jan. 7.

562. Southern. Regenerative gas kilns for making lime, cement, &c. Jan. 9.

710. Bourne and Bourne. *See under* X.

COMPLETE SPECIFICATIONS ACCEPTED.

702 (1908). Von Seemen. Manufacture of refractory, ceramic, or abrasive products from bauxite or other aluminous earths. Jan. 20.

1452 (1908). Castéran. Manufacture of artificial wood. Jan. 13.

10,110 (1908). Lake (H. Spackman Engineering Co.). Plastic compositions. Jan. 13.

X—METALS AND METALLURGY.

APPLICATIONS.

269. Crosse. Extracting gold and silver from crushed ore and ore slimes.* Jan. 5.

274. Stobie. Manufacture of iron and steel. Jan. 5.

539 and 531. De Ferranti. Manufacture of material for the blading of turbines and compressors, &c. [Comprised in No. 26,175 of 1907.]* Jan. 8.

653. Hommel. Rotary furnaces for roasting ores, &c. Jan. 11.

710. Bourne and Bourne. Substitutes for metal, wood, &c. Jan. 11.

713. Stobie. Manufacture of high grade steel and iron. Jan. 11.

945. Sulman and Durant. Separation of zinc from its ores or compounds. Jan. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

26,821 (1907). Elmore and Elmore. *See under* 1.

26,829 (1907). Awallow. *See under* XI.

27,282 (1907). Sinding-Larsen. Treatment of titaniferous iron ores. Jan. 20.

433 (1908). Herrenschmidt. Manufacture of aluminium. Jan. 20.

490 (1908). Rudge-Whitworth, Ltd., and Heathcote. Treating iron or steel to prevent rust. Jan. 13.

701 (1908). Sulman. Separation of zinc from its ores or compounds. Jan. 13.

913 (1908). Birkeland. Metallurgical treatment or smelting of ores, &c. Jan. 13.

1761 (1908). Heskett. Continuous extraction of zinc from its sulphide. Jan. 20.

6029 (1908). Bismarckhütte. Refining steel in electric furnaces. Jan. 20.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

285. Bingham. Electric furnaces. Jan. 5.

605. Siemens und Halske A.-G. Electrolysis of aqueous saline solutions. [Ger. Appl., Jan. 15, 1908.]* Jan. 9.

1136. Bradley and Bickerton. Electrolytic cells. Jan. 16.

COMPLETE SPECIFICATIONS ACCEPTED.

26,829 (1907). Awallow. Electrolytic refining of copper. Jan. 13.

726 (1908). Jacob. Electrochemical manufacture of acetates, especially sodium acetate. Jan. 20.

8904 (1908). Bouneau. Electric furnaces. Jan. 20.

13,257 (1908). Helberger. Electric furnaces. Jan. 13.

17,281 (1908). Inubert. Electric furnaces. Jan. 13.

23,071 (1908). British Thomson-Houston Co. (General Electric Co.). Electric furnaces. Jan. 13.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.**APPLICATIONS.**

305. Lloyd, and Harmens Bros. and Co. Manufacture of soap. Jan. 6.
 327. Prout. Liquid soap. Jan. 6.
 501. Wolf and Bohme. Manufacture of soap. Jan. 8.
 691. Egeberg. Purification of oil.* Jan. 11.
 717. Hollingworth. Soap or soap compound. Jan. 12.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.**(B.)—RESINS, VARNISHES.****COMPLETE SPECIFICATION ACCEPTED.**

- 16,528 (1908). Prod. Chimiques de Croissy. Manufacture of resinous substances. Jan. 13.

(C.)—INDIA-RUBBER.**COMPLETE SPECIFICATIONS ACCEPTED.**

- 5868 (1908). Durham. Treatment or preparation of rubber. Jan. 13.
 21,441 (1908). Cockerill. Treatment of india-rubber. Jan. 20.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.**APPLICATIONS.**

14. Hookham. Whalebone substitutes. Jan. 1.
 169. Baumann and Diesser. *See under V.*
 493. Richardson. *See under XIX.*

COMPLETE SPECIFICATION ACCEPTED.

- 287 (1908). Seyewetz and Mennier. Tanning or manufacturing leather. Jan. 13.

XVI.—SUGAR, STARCH, GUM, &c.**APPLICATIONS.**

465. Shaw. Manufacture of sugar. Jan. 7.
 1074. Dautrebandi. Production of beetroot sugar.* Jan. 15.

XVII.—BREWING, WINES, SPIRITS, &c.**APPLICATIONS.**

434. Epstein. Treatment of alcohol. Jan. 7.
 476. Grimshaw and Skurray. Hopping leers. Jan. 8.
 537. Ross. Treatment of beer and like beverages. Jan. 8.
 1113. Hunt. Maturing potable spirits. Jan. 16.
 1117. Davies and Stevenson. Treatment of brewers' raw yeast. Jan. 16.

COMPLETE SPECIFICATIONS ACCEPTED.

- 26,581 (1907). Pampe. Concentrating distillers' wash or slop. Jan. 13.
 26,582 (1907). Pampe. Saccharifying distillers' mash. Jan. 13.
 26,583 (1907). Pampe. Cooking maize and other cereals. Jan. 13.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.**(A.)—FOODS.****APPLICATIONS.**

128. Woosnam (Whetnam). Manufacture of food-stuffs. Jan. 2.
 884. Bakonyi. Manufacture of solid coffee extract. Jan. 13.

COMPLETE SPECIFICATION ACCEPTED.

- 22,137 (1907). Nicholls. Apparatus for testing for moisture in butter and other substances. Jan. 20.

(B.)—SANITATION; WATER PURIFICATION.**APPLICATION.**

767. Morse. Treatment of garbage. Jan. 12.

COMPLETE SPECIFICATION ACCEPTED.

- 9665 (1908). Candy. Purification of water by filtration. Jan. 20.

XIX.—PAPER, PASTEBOARD, &c.**APPLICATIONS.**

376. Parkin and Williams. Manufacture of non-inflammable celluloid. Jan. 7.
 412. Goldsmith. Manufacture of a thermoplastic compound. Jan. 7.
 493. Richardson. Loading agent or sizing ingredient. Jan. 8.

COMPLETE SPECIFICATION ACCEPTED.

- 858 (1908). Dreaper. *See under V.*

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.**APPLICATION.**

314. Wellcome and Pyman. Manufacture of a therapeutic compound. Jan. 6.

COMPLETE SPECIFICATIONS ACCEPTED.

- 27,314 (1907). Lake (Lilly and Co.). Preparation of pharmaceutical compounds. Jan. 20.
 3750 (1908). Schmitz and Co. Manufacture of camphor. Jan. 13.
 6439 (1908). Johnson (Verein, Chininfabr. Zimmer und Co.). Manufacture of pharmaceutical products. Jan. 20.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.**APPLICATIONS.**

50. Duncan. Preparation of plates or films for producing coloured pictures by photography. Jan. 1.
 51. Duncan. Sensitised paper, &c., for colour photography. Jan. 1.
 651. Heard and Boden. Sensitive emulsion for coating plates, papers, fabrics, &c. Jan. 11.
 883. Caster. Sensitised paper.* Jan. 13.
 1154. Weigert-Sterne and Moore. Colour photography. Jan. 16.

XXII.—EXPLOSIVES, MATCHES, &c.**COMPLETE SPECIFICATION ACCEPTED.**

- 16,599 (1908). Rudeloff. Explosives. Jan. 20.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.**COMPLETE SPECIFICATION ACCEPTED.**

- 22,137 (1907). Nicholls. *See under XVIII.4.*

Birmingham Section.

Meeting held at Birmingham on Thursday, December 10th, 1908.

MR. HENRY SILVESTER, B.Sc., F.I.C., IN THE CHAIR.

APPARATUS USED IN RAPID METHODS OF ELECTRO-ANALYSIS. ANALYSIS OF BRASS.

BY T. SLATER PRICE, D.Sc., Ph.D., F.I.C., AND
T. C. HUMPHREYS.

The history of rotating electrodes in electrolytic analysis has lately been a subject of much discussion, various investigators claiming to have been the first to use them. As the result of this discussion we may take it that the idea of the use of a rotating electrode occurred to a number of different investigators at much about the same time; the results of their investigations were first published some time during the year 1903. (Goode and Medway, *Amer. J. Sci.*, 1903, 15, 320; this *J.*, 1903, 823; Exner, *J. Amer. Chem. Soc.*, 1903, 25, 896; this *J.*, 1903, 1150; F. M. Perkin, Paper read before the Faraday Society, June 30, 1903; *Electrochem. and Metall.*, 1903, 3, 22; this *J.*, 1903, 1064.) It should, however, be mentioned that Klobukow (*J. pr. Chem.*, 1886, 33, 473) was probably the first to point out the advantage of stirring the electrolyte during the passage of the current; after first trying rotating the cathode and then the anode, and finally agitating the electrolyte while the electrodes were kept stationary, he came to the conclusion that it was best to rotate the anode. He did not publish any results, however, and it was left for the above-mentioned investigators to be the first in the field. In 1904 further results were published by students working in Classen's laboratory at Aachen (Amberg, *Z. Elektrochem.*, 1904, 10, 385 and 853; Fischer and Boddaert, *ibid.*, 1904, 10, 945), and since that time there have been numerous publications dealing with the same subject, a great number of the investigations having been carried out by students working under E. F. Smith of the University of Pennsylvania. Probably the most important work in this connection which has been published lately is that which has been done by Sand (*Trans. Chem. Soc.*, 1907, 91, 373; 1908, 93, 1572; this *J.*, 1907, 490; 1908, 963).

The apparatus which is used by the different investigators varies considerably; it may be divided into the following classes according to whether the anode, cathode, or electrolyte only is kept in rapid motion:—

1. *Rotating anode*.—(a). Dish cathode and wire or disc anode. (b). Cylindrical cathode and anode of fine gauze. (c). Mercury cathode and wire anode.

2. *Rotating cathode*.—(a). Cylindrical cathode made of platinum gauze. (b). Cathode made of a platinum crucible. (c). Spiral wire cathode.

3. *Electrodes stationary, electrolyte stirred*.—(a). Electrolyte stirred by mechanical means. (b). Electrolyte stirred by electro-magnetic force.

The above classification is not supposed to be complete, nor is every type of apparatus dealt with; it is only intended as a rough guide. We will deal shortly with each of these classes.

1. ROTATING ANODE.

(a). *Dish cathode and wire or disc anode*.—Since one of the commonest forms of apparatus used with stationary electrodes consisted of a dish cathode and a wire anode, it was only natural that attempts should be made to utilise the same apparatus for the purpose of rapid electro-



FIG. 1.

analysis. The diagram (Fig. 1) illustrates such an apparatus as used to a great extent in the laboratories of Smith and Classen.

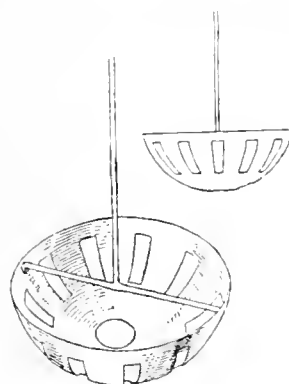


FIG. 2.

Instead of the wire anode a perforated disc anode may be used. This apparatus has been found to give very good results, although our limited experience of it has not been very satisfactory, except in so far as the determination of copper is concerned. It suffers, theoretically, from the disadvantage that the distribution of the current between the anode and the cathode is very uneven, and this may have led Miss Langness (working under Prof. Smith) to devise the anode shown in Fig. 2 (*J. Amer. Chem. Soc.*, 1907, 29, 460; this *J.*, 1907, 644). Its shape conforms to that of the dish cathode, and in its sides are ten slits perpendicular to the edge. Free circulation of the electrolyte is ensured by these openings, and through a circular opening in the bottom of the dish. The anode is so adjusted that it is equidistant from the sides of the cathode, and the electrolyte, during the rotation of the anode, is all contained within the space bounded by the cathode and the outer surface of the anode; there is none within the inner dish. The volume of electrolyte does not exceed 60 c.c., and when the electrodes are properly adjusted there is no splashing and no loss of electrolyte. With this apparatus 0.4884 gm. of copper could be deposited (quantitatively) in 3 minutes, using 10–15 amps. and 8 volts.

(b). *Cylindrical cathode and anode of wire gauze*.—The best apparatus of this kind is that due to Sand. The

FIG. 3a. FIG. 3b. FIG. 3c.

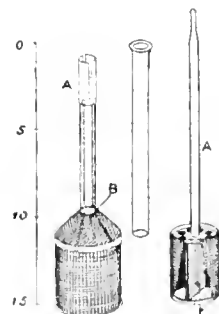


FIG. 3a.—Outer electrode. FIG. 3b.—Glass tube. FIG. 3c.—Inner electrode with part of gauze removed.

FIG. 3.

complete apparatus, as well as the parts, is shown in Figs. 3 and 4. The outer electrode (1a) completely

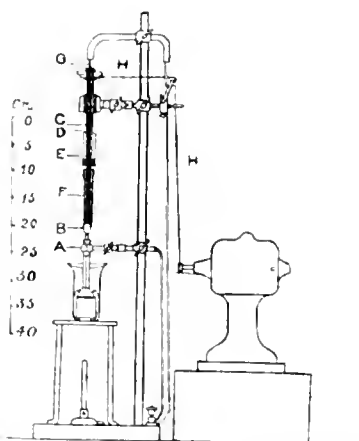


FIG. 4.—A, Clamp to grip outer electrode. B, Chuck to grip inner electrode. C, Glass tube rotating in glass tube D. E, Oil trap on C. F, Thick rubber tube. G, Amalgamated copper wire dipping into mercury contained in C and F. H, Cord made of violin string. I, Pulley made of rubber tube.

FIG. 4.

surrounds the inner rotating electrode (1c) on all sides except the bottom, the two being kept in position relatively to each other by means of the glass tube (1b) which is slipped through the collar, A, and the ring, B, of the outer electrode. It is gripped firmly by the former, but passes loosely through the latter. The hollow platinum-iridium stem, A, of the inner electrode is passed through the glass tube, in which it rotates freely. The inner electrode is designed to produce a maximum amount of rotation of the liquid, and for this purpose has a vertical partition, P. The gauze of the outer electrode almost completely stops the rotation of the liquid. While the electrolyte is therefore rapidly ejected from the centre of the inner electrode by centrifugal force it is continually replaced by liquid drawn in from the top and bottom. As the outer electrode surrounds the inner completely, the lines of flow of the current are contained between the two, and even when strong currents are employed the potential of the electrolyte anywhere outside the outer electrode is practically the same as that of the layer of liquid in immediate contact with it. The space between the two electrodes is about 3 mm. Fig. 4 illustrates the manner in which the electrical connections are made, that to the anode, which is fastened in the chuck, B, being made by means of mercury contained in the glass and rubber tubes, C and F. For details as to dimensions, etc., reference must be made to the original paper (*loc. cit.*). This apparatus has been designed with a view to carrying out separations by the method of graded potential, and it has shown itself eminently adapted for that purpose, although it seems to the authors to be unnecessarily complicated. In his last paper (*Trans. Chem. Soc.*, 1908, 93, 1572; this J., 1908, 963) Sand gives a description of the quantitative estimation and separation of antimony and tin. The method used for the estimation of antimony is a very great step forward, since in all previous methods, with perhaps one exception, (Scheen, *Z. Elektrochem.*, 1908, 14, 257; this J., 1908, 575) the deposited metal has always contained small quantities of occluded electrolyte.

(c) *Mercury cathode and wire anode.*—Although many early investigators had endeavoured to make use of a mercury cathode, the first really successful apparatus was devised by Howard, working in Smith's laboratory. A diagram of the apparatus is shown in Fig. 5. It consists of a small tube or beaker of about 50 c.c. capacity, near or in the bottom of which there is introduced a thin platinum wire, by means of which the current is supplied to the mercury cathode. The anode may be either a per-

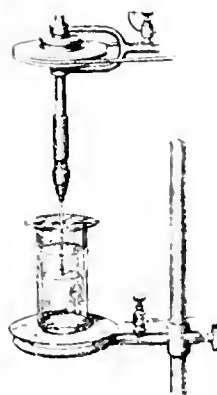


FIG. 5.

forated platinum disc or a spiral of stout platinum wire. Since the amount of platinum is a minimum the apparatus is comparatively cheap, and it also possesses the advantage that it can be readily made with the materials usually at hand in a chemical laboratory. Reference to the literature (*J. Amer. Chem. Soc.*, 1905, 27, 1255 and succeeding volumes) will show that analyses can be conducted very quickly with this apparatus; e.g., 0.3945 gm. of copper was deposited in 4 minutes, using a current of 3.5 amps. at 8.5 volts. It possesses the disadvantage that very great care is necessary in washing the amalgam with water, alcohol, and ether, preparatory to drying, or else small quantities of mercury may be detached and lost. In the case of zinc determinations, as has been shown by one of us (*Price, Trans. Faraday Soc.*, 1907, 3, 88; this J., 1907, 345), there is always a small loss of zinc and mercury during the washing, so that the results are low. This has recently been confirmed by Porter and Frary in a paper read at the 14th General Meeting of the American Electrochemical Society, Oct. 30-31, 1908.

2. ROTATING CATHODE.

(a) *Cylindrical cathode made of gauze.*—One of the best of this type of apparatus is that due to Perkin, and first described by him in a paper read before the Faraday Society (*loc. cit.*). As will be seen from Fig. 6, the anode is in the form of a double circle of stout platinum wire, and has four little baffle plates placed at intervals around it, to prevent the liquid from rotating with the cathode. If the apparatus is to be used for the determination of lead as peroxide the rotating electrode becomes the anode. While dealing with this apparatus it may be as well to once more call attention to the use of a bicycle hub for rotating the electrode. This arrangement, which is a very cheap one, was first described by Price and Judge (*Trans. Faraday Soc.*, 1906, 2, 85), the idea of using a hub for such purposes being suggested to us by Mr. Heathcote, and since that time it has been in continual use and has been found to be perfectly satisfactory. An improved form of hub is shown in Fig. 6A. Instead of the current being conducted to the spindle in the manner shown in Fig. 6, an ordinary terminal is screwed into the barrel of the hub at the oil-hole; the balls are lubricated with a mixture of graphite and oil. If it is desired to obviate the drop in potential across the balls of the hub, so that the apparatus can be used for electrolyses with graded potential, the current is led directly to the spindle by the arrangement shown (in section) at the top of the diagram. A small hole is drilled in the end of the spindle and a platinum wire soldered into it. A small cup is formed where the grooved pulley screws on to the spindle, and into this is fitted, by means of india rubber tubing, or better, by means of red lead or cement, a glass cup. The platinum wire projects up into this glass cup, which is filled with mercury to an appropriate height; the leading wire from the current terminals then dips into the mercury. The electrode is held in position by means of a small chuck, which is screwed into the lower end of the spindle. Another modification



FIG. 6.

Another modification



FIG. 6A.

which was introduced at the same time was the replacement of the beaker which is generally used to hold the electrolyte by a tap funnel. This is of great advantage for washing the deposited metal without stopping the current or removing the electrode from position, and is infinitely to be preferred to the usual method of siphoning off the electrolyte while at the same time distilled water is run into the beaker containing the electrodes. Care should be taken that the tap of the funnel fits tightly and does not become loose during the electrolysis. Of course, the funnel cannot be used with stationary electrodes or electrolyte, as some of the solution would remain in the neck of the funnel and escape electrolysis.

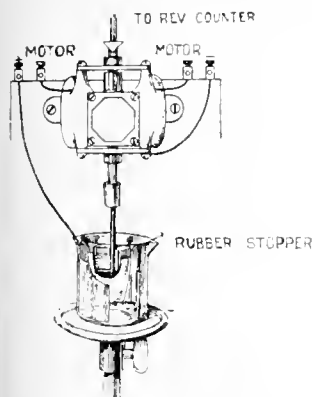


FIG. 7.

(b) *Cathode made of a platinum crucible.*

—This was the apparatus used by Gooch and Medway (Amer. J. Sci., 1903, 15, 320; this J., 1903, 823), and is sufficiently explained by Fig. 7. To secure electrical connection between the crucible and the shaft of the motor a narrow strip of sheet platinum is soldered to the shaft and then bent upwards along the sides of the stopper, thus putting the shaft in contact with the

inside of the crucible when the latter is pressed over the stopper.

(c) *Spiral wire cathode.*—This apparatus was described by Perkin (Trans. Faraday Soc., 1906, 2, 91; this J., 1906, 609), and is mentioned here because it is simple to make and not very expensive in platinum. The cathode consists simply of a spiral of platinum wire, the total active area of which is about 23 sq. cm.

3. ELECTRODES STATIONARY. ELECTROLYTE STIRRED.

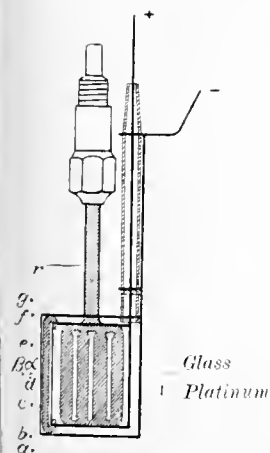


FIG. 8.

(a) *Electrolyte stirred by mechanical means.*—A very convenient apparatus of this kind, and one which can be used for separations by graded potential, is due to A. Fischer (Z. Elektrochem., 1907, 13, 469). Fig. 8. The two electrodes are concentric cylinders of wire gauze; they are fixed in position and kept from touching each other by three glass rods which are fastened to the inner electrode (one only is shown in the diagram). The electrolyte is stirred by a glass stirrer of appropriate shape.

(b) *Electrolyte stirred by electro-magnetic means.*—A most ingenious apparatus of this kind is due to Frary

(Z. Elektrochem., 1907, 13, 308; J. Amer. Chem. Soc., 1907, 29, 1592; this J., 1907, 875), and is shown in Fig. 9. No motor is necessary, and the electrodes are stationary. The electrolyte is rapidly rotated in the magnetic field due to the solenoid which surrounds the beaker. When the current flows through the solenoid a uniform magnetic

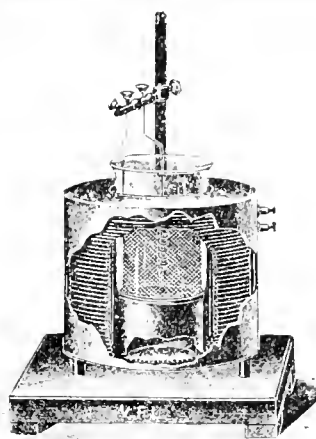


FIG. 9.

field is formed in the beaker, the lines of force being vertical. If, now, the current passes from one electrode to the other through the electrolyte, the lines of current in the latter are radial and horizontal. Every infinitesimal strip of electrolyte between the electrodes acts as if it were a wire carrying a current. The current direction is in every case perpendicular to the magnetic lines of force, which, therefore, push the electrolyte in a direction perpendicular to their direction and to that of the current. In other words, every particle of the electrolyte between the electrodes is acted on by a horizontal force which pushes it in a direction perpendicular to a radius of the cylinder drawn through it. The whole electrolyte therefore revolves about the anode as a cylinder about its axis. The electrolytic cell and the solenoid may be connected in series or worked by separate circuits. The heat developed in the solenoid may be used for warming the electrolyte, but if this is not desired the beaker may be surrounded by a spiral or lead pipe through which cold water flows. Very satisfactory results were obtained with this apparatus in the electrolytic determination of copper and zinc.

The above sketch of the various apparatus is not by any means complete; it has been given in order to illustrate various kinds of apparatus. For other apparatus, and especially that dealing with the electrolytic determination of anions (Hildebrand, J. Amer. Chem. Soc., 1907, 29, 447; this J., 1907, 644) reference must be made to the literature. Attention may be called to articles which describe sets of apparatus for rapid electro-analysis, which have been installed on a large scale either in work or in University laboratories (Sheppard, J. of Phys. Chem., 1903, 7, 568; Fairlie and Bone, Electrochem. and Metall. Ind., 1908, 6, 10; Classen, Z. Elektrochem., 1907, 13, 181).

As has already been indicated by a number of the examples given, the advantage of rotating the electrode, or, what comes to the same thing, of efficiently stirring the electrolyte, lies in the fact that the time necessary for the quantitative deposition of a metal is considerably shortened, because of the high currents which can be used. If one attempts to use high currents with stationary electrodes the usual result is that a spongy deposit is obtained. The explanation of this has been fully discussed by Dannel (Z. Elektrochem., 1903, 9, 763), Sand (Z. Elektrochem., 1904, 10, 452) and Amberg (Z. Elektrochem., 1904, 10, 385 and 853) so that we do not intend to do more than just touch on the explanation, taking as an example the electrolysis of an acid solution of copper sulphate. If too high a current is used with stationary electrodes the solution in the immediate neighbourhood of the cathode rapidly becomes depleted of copper, or rather of copper ions, since ordinary diffusion together with the migration of the ions, does not replace them as quickly as they are deposited. The result of this is that the potential of the cathode rises until it attains such a value that hydrogen can be deposited, together with any copper which may be supplied to the electrode by diffusion, or by convection currents caused by the evolved gas stirring the electrolyte.

When, however, the electrolyte is rapidly stirred, the solution in the immediate neighbourhood of the cathode is kept of the same concentration as the main bulk of the solution without any difficulty, with the result that there are always plenty of copper ions to carry the larger current used. Of course, as the deposition of copper takes place, the potential of the cathode gradually increases, and if the current is kept constant the potential will finally reach such a value that towards the end of the electrolysis hydrogen will be evolved, even with rotating electrodes. In the case of copper this evolution of hydrogen towards the end of the electrolysis does not generally much matter, but in other cases it may be advisable to continually lower the current strength as the electrolysis proceeds, and have it as nearly proportional as possible to the diminishing average concentration. This is where the advantage of the method of "graded potential" comes in, since the potential at the cathode is then kept practically constant, and the strength of the current passing will automatically diminish as the concentration of the ions which can be deposited at that potential decreases. The exact reason as to why the simultaneous deposition of hydrogen and a metal should cause the latter to be spongy in character is a matter which still remains to be definitely decided. According to some it is this simultaneous deposition which is the real cause, the hydrogen evolved preventing the deposited metal from cohering together. Others believe that an unstable hydride of the metal is first deposited, and this on decomposition leaves the metal in a spongy form. Still others give the explanation that under certain circumstances, owing to the rapid evolution of hydrogen, the solution in the immediate neighbourhood of the cathode becomes largely depleted of H-ions, thus becoming alkaline; some insoluble hydroxide of the metal is thus formed, and adheres to the cathode, preventing the metal which is further deposited from becoming coherent. It is possible that different explanations will hold for different cases.

The question may be asked: which is better, a rotating cathode or a rotating anode (assuming that a metal is being deposited, and not a peroxide)? As far as one can judge from the results which have already been published, the answer seems to be that in most cases, except as a matter of convenience, neither one is to be preferred to the other. We think it may be stated, however, that the dish cathode and wire anode is the apparatus which is least satisfactory. The way in which rapid stirring of the electrolyte acts has already been referred to, but if the question is considered more in detail, one will find that the rate of electrolysis is ultimately dependent on the rate at which diffusion takes place through a surface layer in contact with the cathode. The more efficient the stirring, the thinner is this surface layer, and the quicker the diffusion through it, and therefore the more rapid the electrolysis. Now the dish cathode and wire anode is not as mechanically efficient as the other forms of apparatus described, and it moreover suffers from the drawback, already pointed out, that the distribution of the current is very uneven. One advantage which, however, has been claimed for it, is that the rotating liquid exerts a pressure on the deposited metal (Amberg, *Z. Elektrochem.*, 1904, 10, 855) and thus makes it more adherent. This may be so, but it seems to us to be somewhat doubtful.

No one will question that, as far as the saving in time is concerned, the methods of rapid electro-analysis are a great improvement on the older ones. This does not prove, however, that it is always an advantage to use them. Since the apparatus used is more complicated than that necessary for stationary electrodes, it requires almost continuous supervision during the electrolysis—especially is this the case when the method of graded potential is used—so that no other work can be done conveniently at the same time. This does not hold when stationary electrodes are used, and electrolyses with the latter also possess the great advantage that they may be run over night, and that the apparatus required is not so costly. As to which method is used depends to a large extent on the convenience of the analyst and on the time within which the analytical results must be ready. In some cases there are no satisfactory rapid methods of analysis, but as time goes on there is no doubt that all electrolyses which can be carried out with stationary

electrodes will also be capable of being accurately done by quick methods.

In most cases work which has been carried out with one kind of apparatus may be successfully repeated with another. This is not always true, however, and a typical case seems to be that of zinc. If one can trust all the published results, methods which can be successfully employed for zinc with a dish cathode and a rotating anode cannot be used with a rotating gauze cathode. Even when using the same apparatus for a series of zinc determinations it sometimes happens that a number of bad results will be obtained, in spite of the fact that the method has hitherto been deemed satisfactory, and for which there does not seem to be any apparent reason (*Cf.* Price, *Trans. Faraday Soc.*, 1907, 3, 88). In some cases it seems as if the original observer has simply made a number of different determinations, taking the same volume of solution containing the salt in each case, and if he found that the same weight of metal was deposited in each experiment, he came to the conclusion that the method was satisfactory and published the results, without satisfying himself that *all* the metal had been deposited. This seems to have been the case in the experiments of Exner (*J. Amer. Chem. Soc.*, 1903, 25, 896), Ingham (*Ibid.*, 1904, 26, 1269), Langness (*Ibid.*, 1907, 29, 459), and Medway (*Amer. J. Sci.*, 1906, 18, 810), on the electro-analysis of zinc, as was first pointed out by Frary (*J. Amer. Chem. Soc.*, 1907, 29, 1596). One of the present authors can confirm this, as in his experiments on zinc (Price, *Trans. Faraday Soc.*, 1907, 3, 88), he endeavoured to repeat some of Exner's and Ingham's work, and could not obtain satisfactory results; at the time this was ascribed to want of practice with the apparatus, and therefore no reference was made to it in the above-mentioned paper.

In the experiments on the electro-analysis of brass, which are to be described later, we have not used the method of graded potential, but the one ordinarily used in most of the standard separations; these may generally be classed as constant current separations, even though the current may not be kept absolutely constant (*Cf.* Bancroft, *International Congress*, 1903, 4, 703). In order to prevent the second metal precipitating as soon as the first is all down, it is essential that hydrogen shall be set free by the current instead of the second metal, i.e., that the deposition potential for hydrogen shall lie below the deposition potential of the second metal. Most analyses and separations were originally made without a voltmeter being used, and consequently the constant current separations were first worked out.

In all work where a constant current method is used it is customary to give the voltage across the electrodes. This is sometimes misleading, since the voltage across the electrodes which is necessary to obtain a given current not only depends on the potentials at the electrodes, but also on the resistance of the electrolyte between them; the latter is a very variable quantity, depending on the temperature and concentration of the electrolyte and on the distance apart of the electrodes. Thus, although one may use the same current with two different kinds of apparatus, the e.m.f. necessary to obtain this current may vary somewhat in the two cases.

We have not used the method of graded potential because a number of the results have been obtained in the works where one of us is employed, and the necessary apparatus was not available there. The apparatus used is that described by Price and Judge (*loc. cit.*), the cathode consisting of a cylinder of wire gauze (4 meshes to the sq. mm.), 40 mm. long and 20 mm. in diameter. This apparatus can be conveniently used for certain potential separations, without it being necessary to use an auxiliary electrode, electrometer, etc. For example, the separation of copper and silver can be readily carried out as follows:—0.5 grm. of the alloy of copper and silver is dissolved in 4 c.c. of concentrated nitric acid, 25 grms. of ammonium acetate added, and the solution diluted to 50—75 c.c. By means of a ring burner the contents of the funnel are heated to boiling, and then 1.1 volts are put across the electrodes, a current of 1—1.5 mps. being thus obtained (*Cf.* Sand, *loc. cit.*). At this potential only silver is deposited, and if care is taken not to let the potential

rise above 1.1 volts, a complete separation of silver from copper is obtained. The deposition of silver is complete when the current has fallen to 0.1 amp. Time: 10–20 minutes.

Analysis of brass.

In dealing with the analysis of brass by rapid electrochemical methods we shall only consider the estimation of the copper and the zinc. The other metals which are usually present in very small amounts, *e.g.*, lead, iron, tin, etc., are perhaps most conveniently estimated by the ordinary chemical methods.

Estimation of copper.—The instructions with respect to the amount of nitric acid which may or may not be used in the estimation of copper in alloys are usually very indefinite, and as a consequence of this we soon met with difficulties in our experiments. We often found that at the commencement of the electrolysis a good deposit of copper was obtained, but that no matter how long the current was passed we could not get all the copper out of the solution. In some cases the solution remained strongly coloured all the time, whereas in others, after practically all the copper had been deposited—judging by the colour of the solution—on continuing to pass the current, the copper again began to dissolve. These results were due to the solvent action of the nitric acid on the deposited copper, the probable cause of the re-solution which took place in some cases being the increased solvent action brought about by the rise in temperature of the electrolyte due to the passage of the current. In order to investigate the influence of nitric acid with the particular apparatus used by us, we have carried out a large number of experiments, some of the results of which we now put forward for your consideration. Since our experiments were completed, now some little time ago, Withrow (*J. Amer. Chem. Soc.*, 1908, **30**, 381) and Fairlie and Bone (*Electrochem. and Metall. Ind.*, 1908, **6**, 58; this *J.*, 1908, 954) have published the results of somewhat similar investigations, but using different apparatus.

For the first series of experiments a solution of copper nitrate was used. This was made by dissolving a known weight of pure electrolytic copper in pure nitric acid and evaporating the solution down to dryness several times on the water bath. The residue so obtained was dissolved in water and a small quantity of nitric acid, just enough of the latter being added to dissolve the basic nitrate formed during the evaporation. The solution was made up to a definite volume, and aliquot parts taken for analysis. Some of the results are given in the following table. In each case a current of 3 amperes was used, and the voltage was also 3, except in the first experiment, when it was 4–5. All the determinations were carried out at ordinary temperature, except in the cases where they are marked with an asterisk (*), when a hot (practically boiling) solution was used. In each case the volume of the solution was about 75 c.c. and the number of rotations per minute of the cathode was 600–700. The method of working the apparatus has already been described by Price and Judge (*loc. cit.*).

Copper used.	Copper found.	Salt added.	Nitric acid used.	Sulphuric acid used.	Time.
grms. 0.5018	grms. 0.3590	grms. —	c.c. —	c.c. —	mins. 45
"	0.2290	—	4	—	30
"	0.1728	—	10	—	30
"	0.5017	—	4	1	40
"	0.5018	—	4	1	35
"	0.5008	0.25 ZnSO ₄	4	—	40
"	0.5015	0.75 "	4	—	35
* 0.5028	0.5004	1 "	4	—	35
"	0.5031	1 "	4	—	30
"	0.5029	1 "	4	—	30
"	0.5028	2 "	4	—	30
0.5018	0.4856	1 ZnSO ₄	—	—	—
"	0.4891	0.05 FeAm ₂ (SO ₄) ₂	5	—	55
"	0.4891	1 ZnSO ₄	—	—	—
"	0.0000	0.25 FeAm ₂ (SO ₄) ₂	5	—	45
"	0.5016	1 ZnSO ₄	—	—	—
"	0.5020	1 FeAm ₂ (SO ₄) ₂	5	—	30
"	0.5017	1 NiAm ₂ (SO ₄) ₂	4	—	35
"	0.5017	1 ZnSO ₄	—	—	—
"	0.5017	10 c.c. As. soln. †	4	—	30
"	0.5017	1 ZnSO ₄	—	—	—
"	0.5017	10 c.c. As. soln. †	4	—	35

† 1 c.c. of the arsenic acid solution used contained 0.00052 gm. of arsenic.

Each of the above results has been repeated several times, but all the experiments are not given in order to save space. It will be noticed that in all the experiments where nitric acid is the only additional electrolyte the copper is never completely deposited, but that when 1 c.c. of concentrated sulphuric acid or 1 gm. of zinc sulphate is added a quantitative result is obtained, the electrolysis taking place at ordinary temperatures. At high temperatures it is necessary to use 2 grms. of zinc sulphate. In all cases where iron is present the results are low; this is due to the fact that oxidation of the ferrous salt takes place at the anode, and the ferric salt so formed dissolves some of the deposited copper. This action of iron salts can be prevented by reducing the area of the anode very considerably, or by using a diaphragm round the anode (*Cf. Sand, Trans. Chem. Soc.*, 1908, **93**, 1572). The amount of iron which is generally present in brass is, however, not enough to interfere with the ordinary electrolytic methods, as will be seen later. It is interesting to observe that quantitative results were obtained in the presence of considerable quantities of arsenic, which was present in the pentavalent condition*; moreover the deposit was always a very good colour.

In the next series of experiments a solution of pure copper sulphate was used, with the following results:—

Copper used.	Copper found.	Nitric acid used.	Sulphuric acid used.	Time.	Remarks.
grms. 0.5075	grms. 0.5078	c.c. 4	c.c. —	mins. 35	
"	0.5075	4	—	35	
"	0.5070	4	—	30	
"	0.5076	—	2	30	Deposit was bright for 10 mins., and then went dull.
"	0.5072	—	2	20	Deposit dark red.
"	0.5075	—	5	30	
"	0.5095	—	2	20	Plus 10 c.c. As. solution. Deposit black.

The above results show that, in the presence of sulphuric acid and nitric acid in the proportions given, the copper is quantitatively deposited. Even when free sulphuric acid is alone present correct results are obtained, although the deposits are of a dull or dark red colour; this is due to the deposit becoming slightly powdery towards the end of the electrolysis, although not to such an extent that some of it is lost in the washing. (*Cf. Sand, loc. cit.*) If the solutions contain a large amount of free sulphuric acid, or if the current (3 amps.) is passed too long, the deposit is liable to become black, owing to some of the sulphuric acid being reduced to sulphuretted hydrogen, which gives rise to the formation of copper sulphide. This can be obviated by cutting down the current as the electrolysis proceeds (*Cf. pp. 120 and 122*). Unless free nitric acid is present the addition of arsenic causes the deposit to become black, and the result is high.

In all the experiments detailed above, the times given do not refer to the minimum times necessary for the deposition of the copper. An excess of current has always been used, in order to see if the results were thereby affected, since in actual practice one cannot always stop the electrolysis immediately the copper is all deposited.

As the result of our experiments we have come to the conclusion that copper cannot be quantitatively deposited with certainty from a solution in which nitric acid is the only acid present. This statement refers to the use of rotating electrodes; with stationary electrodes (and electrolytes) all the copper can often be so deposited, although the time necessary is very prolonged; even in the latter case, however, the result is never certain, and it is better to have sulphuric acid present.

Estimation of copper and zinc in brass.—Two methods have been employed for the estimation of copper and zinc in brass.

1.—About 0.7 gm. of brass is dissolved in 4 c.c. of concentrated nitric acid and a little water; the solution is

* *Cf. Ashbrook, Jour. Amer. Chem. Soc.*, 1904, **26**, 1283.

then transferred* to the tap funnel of the apparatus, made up to 75–100 c.c., 1 c.c. of strong sulphuric acid added, and electrolysed, using 3 amperes and 3 volts (approx.). The copper is all deposited in 20–30 minutes, and the deposit is treated in the usual manner. The solution and washings are run off into a porcelain dish and evaporated down on the water bath, completing the evaporation on a sand bath until sulphuric acid fumes appear, in order to drive off all the nitric acid. The residue is dissolved in a few c.c. of water (with a little sulphuric acid if necessary) and a solution of sodium hydroxide (250 grms. per litre) carefully added till the zinc begins to precipitate out as hydroxide (about 6–8 c.c. of the alkali are necessary). Enough ammonia is then added to dissolve the precipitate, the solution is gently warmed† till the precipitate of ferric hydrate separates, and filtered through a small funnel and filter paper in order to remove the iron. The precipitate of ferric hydrate is washed with hot water and ammonia (about 6–8 c.c. of strong ammonia are necessary in the two operations). Glacial acetic acid is then added until the solution is just acid, and the latter is then electrolysed with 2 amps. and 4–4.5 volts, using the cathode on which the copper has been previously deposited. Time necessary, about 20 mins. The deposits are in all cases very good, and the results accurate. The ammonium acetate in the presence of sodium sulphate does not affect the deposit of zinc, although ammonium acetate alone as additional electrolyte gives high results (*Cf.* Price, *Trans. Faraday Soc.*, 1907, 3, 88). Several of the ferric hydroxide precipitates have been tested for zinc by dissolving them in acid, reprecipitating, and testing the filtrate with ferrocyanide, but in no case was any found.

The statement is often made, that small amounts of

in a beaker on a sand bath till it becomes syrupy; it is allowed to cool somewhat, 3 c.c. of concentrated sulphuric acid added, and again heated till fumes of sulphuric acid appear. This method obviates bumping, and is quite satisfactory. After taking up again with water, keeping the bulk down as much as possible, any lead sulphate is filtered off, the filtrate being run into the electrolysing funnel, which should be slightly larger than the one generally used (capacity 140 c.c.). The volume of the solution so obtained is about 75 c.c. The copper is then deposited, using a current of 2.5 amps. at 2.5 volts for 5–10 minutes, and then 0.5 amps. (2 volts) for about 20 minutes. A bright deposit of copper is thus obtained. If the current is not reduced as stated, a dark coloured deposit results. The solution is then run off into a small beaker, together with the wash water, very little of which is sufficient if a fine jet is used. The deposit is finally washed with alcohol, dried and weighed. 9 c.c. of strong ammonia are added to the solution, which is then just raised to boiling and filtered back into the electrolysing funnel, the ferric hydrate precipitate being washed with hot water and a little ammonia. The zinc is then deposited on to the weighed copper deposit, using a current of 2 amps. at 3–4 volts. Time necessary, 20–25 mins. The zinc deposit is washed with water and alcohol, and then dried and weighed. It has been shown previously by one of us that good results are obtained for zinc, using an ammonium sulphate plus ammonium hydroxide electrolyte. (*Price, loc. cit.*)

The point should be again emphasised, that in order to obtain satisfactory results, it is necessary to remove the lead, tin and iron, if they would otherwise be present as precipitates suspended in the electrolyte.

Brasses taken.	Copper deposited.	Zinc deposited.	Copper.	Zinc.	Lead.	Iron.	Tin.	Other elements.	Total.
grms.	grms.	grms.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
0.7024	0.4944	0.2050	70.39	29.19	0.26	0.16	—	—	100.00
0.6958	0.4960	0.1950	71.29	28.03	0.52	0.19	—	—	100.03
0.7088	0.5064	0.1904	71.45	28.13	0.21	0.21	—	—	100.00
0.5000	0.4022	0.0612	80.44	12.24	1.11	0.06	6.10	—	99.95
0.6556	0.4690	0.1600	71.54	24.41	0.56	trace	1.89	1.61 Al.	100.01
0.6019	0.4448	0.1438	73.00	23.89	1.73	0.11	0.41	—	100.04
0.6508	0.5099	0.0188	77.04	2.86	12.03	0.04	7.36	—	99.93
0.7048	0.5017	0.1976	71.18	28.04	0.30	0.41	—	—	100.02
0.6997	0.4828	—	69.00	—	—	0.62	—	{ 30.03 Mn } { 0.35 Si }	100.00

‡ In this case it was necessary to remove the lead as sulphate in order to get a good copper deposit in the solution containing sulphuric acid. If the sulphate of lead is left suspended in the solution, some of it adheres to the copper on the cathode.

suspended precipitate may be left in an electrolyte during electrolysis; this is by no means advisable, however, when rotating electrodes are used.

The above are only a few of the results which have been obtained. The method has now been in daily use for over a year in a works laboratory, and has been found entirely satisfactory for all kinds of brasses.

II.—In the first method some considerable time is taken up in evaporating down the solution after the removal of the copper, in order to get rid of the nitric acid. This does not much matter when a number of analyses are being carried out at the same time, since the evaporations can then be arranged so that there is practically no waiting. The second method about to be given obviates the long evaporation after the copper has been deposited. It is as follows:—0.5–0.75 gm. of brass is dissolved in 2–3 c.c. concentrated nitric acid diluted with about 5 c.c. water. If tin is present the solution is diluted slightly and the oxide filtered off; the filtrate is then evaporated‡ down

* If tin is present, the oxide must be filtered off before proceeding with the electrolysis.

† The solution should not be boiled, otherwise the excess of ammonia is driven off and a hydrate of zinc separates, which is soluble only with difficulty in ammonia.

‡ This evaporation takes very little time, since the bulk of the solution is small.

Brass taken.	Copper deposited.	Zinc deposited.	Copper.	Zinc.	Total.
grms.	grms.	grms.	per cent.	per cent.	

I.—The brass contained 0.03 per cent. of iron. No lead or tin.

0.5032	0.3192	0.1845	63.43	36.67	100.13
0.5053	0.3200	0.1856	63.33	36.73	100.09
0.5013	0.3177	0.1842	63.38	36.74	100.15
0.5017	0.3181	0.1838	63.40	36.64	100.07
0.5045	0.3195	0.1847	63.33	36.61	99.97
0.5012	0.3173	0.1834	63.31	36.50	99.93
0.5033	0.3187	0.1830	63.32	36.54	99.89

II.—The brass contained 0.59 per cent. of lead, 0.29 per cent. of tin, and 0.06 per cent. of iron.

0.7540	0.4237	0.3237	56.10	42.03	100.06
0.7526	0.4230	0.3225	56.21	42.84	99.99
0.7529	0.4238	0.3220	56.29	42.77	100.00
0.7504	0.4220	0.3212	56.24	42.80	99.98

III.—The brass contained 0.20 per cent. of lead and 0.13 per cent. of iron.

0.7527	0.5266	0.2231	69.06	29.64	99.93
0.7531	0.5275	0.2227	70.04	29.57	99.94
0.7545	0.5286	0.2239	70.06	29.68	100.07
0.7549	0.5282	0.2238	69.97	29.65	99.95

In the first four experiments given above, the ferric hydrate was not removed before the zinc was deposited, the result being that the percentage of the latter shows a tendency to be high.

FIGURES.

1. E. F. Smith's Electro-analysis. 4th Edition. (Blakiston's Son, & Co.) Fig. 12, p. 44.
2. E. F. Smith's Electro-analysis. 4th Edition. (Blakiston's Son, & Co.) Fig. 25, p. 73.
3. Trans. Chem. Soc., 1907, **91**, Figs. 1a, 1b, 1c, p. 376.
4. Trans. Chem. Soc., 1907, **91**, Fig. 4, p. 378.
5. Smith's Electro-analysis. Fig. 17, p. 58.
6. Trans. Faraday Soc., 1906, **2**, 85.
- 6A. From drawing.
7. Smith's Electro-analysis. Fig. 14, p. 47.
8. Zeit. für. Elektrochemie, 1907, **13**, 469.
9. Journ. Amer. Chem. Soc., 1907, **29**, 1592.

DISCUSSION.

The CHAIRMAN said that the electrolytic analysis of copper was one of the most rapid and accurate in metallurgy. As a matter of routine in an ordinary laboratory he thought it was more convenient to allow the determination to go on overnight. The determination was started when one left the laboratory in the evening, and as a rule the copper was ready to weigh on the following morning. What degree of accuracy was obtainable in estimating zinc? It was frequently important to secure the greatest accuracy with reference to the percentage of zinc in high-class spelters. It was usual to make this estimation by difference, after estimating the small amount of impurities present. Would it be possible by the electrolytic method to determine the zinc to 0.03–0.05 per cent.?

Professor T. TURNER said that Dr. Price had confined himself largely to the copper alloys, but, Dr. Sand applied the same method to white metals, and the separation of tin from lead, antimony, and other metals. Then the analyses became more complicated. Regular metallurgical work was distinguished from the work of the professional analytical chemist in that the metallurgist had considerable routine work, and the same kind of materials to test day after day. He thought the old-fashioned method of working a batch of copper analyses by electrolysis, weighing out one batch of say 30 or 40 samples in morning, and weighing in the afternoon, and weighing out a fresh batch in the afternoon to be dealt with on the following day, was simple, and generally speaking left little to be desired. In this way one could do as many assays as a man could weigh in and out.

Mr. E. A. LEWIS did not think the new method of copper estimation would ever oust the old method with stationary electrodes. There were serious objections to the new method; one was the small bulk of solution which was electrolysed, and the other was the smallness of the funnel. And unless the experiments were done by an experienced chemist, they were likely to lead to serious loss. Was the lead peroxide precipitated according to the proper formula; or did it contain less lead than it should do, as in the stationary electrodes? Also was any information available as to the methods for the separation of nickel and zinc? because such methods should be of value in the analyses of German silver.

Mr. H. L. HEATHCOTE said with regard to the interchangeability of a rotating electrode and a rotated electrolyte he gathered from Dr. Price that the effect produced was the same. He (Mr. Heathcote) had not found, in all cases, that the same effect was produced, and exhibited two small pieces of steel tube, which he said had been nickel-plated in an ordinary solution, containing a brightening addition. In the one instance the deposit was almost as brilliant as one that had been mopped; in the other, the solution alone was rotated and the difference was remarkable, the deposit being quite dull. That result was confirmed by other experiments; and showed he thought a radical difference in the effect of rotating the cathode and rotating the electrolyte. As to the cause of sponginess: in the case of nickel his experiments showed that it was due to hydrogen or other gases being projected into the nickel. Microscopic examination showed cavities. He agreed with Dr. Price that the rate of deposition was controlled by the rate of diffusion.

Mr. D. M. LEVY said that during the summer he had an opportunity of seeing Mr. Fairlie's electrolytic apparatus at work at the Tennessee Copper Company's Works in

the U.S.A. They used two methods. In order to see how the matte was running during the day, and where they wanted to return results in about $\frac{1}{2}$ an hour, then they used the rotating cathodes, using about 3 amperes, at five or six volts, and working with hot solution. But for accounting work and works control, where accurate results were essential, they then ran overnight with stationary electrodes. They were quite satisfied with the results of the rapid method using rotating cathodes compared with the chemical methods; although he did not think they were absolutely accurate. They were fortunate at Tennessee in having pure mattes to deal with, containing little but copper, iron, and sulphur. Where there was an electrical installation, or where one could get it easily, and one desired to return results quickly in order to see how the furnace was working, the rapid method with rotating electrodes could not be beaten. In his paper on the so-called "Acetate-copper" Dr. Benedicts (of Upsala) had showed that nodules on the copper surface deposited from acetate solutions contained acetate in some form or other; and that in certain circumstances the sponginess was due to some mechanical fault, through the holding up of portions of the electrolyte in the deposit. The effects of rotation, velocity, temperature and voltage, &c., on the deposit, had been worked out, and the results were very interesting.

Dr. PRICE, in reply, said he made an investigation some time ago (Trans. Faraday Soc. 1907, **3**, 88) on the electrolytic determination of zinc, using a rotating cathode. Instead of starting with zinc, a solution of pure zinc sulphate was used, and his results were accurate to the extent of about four parts in 3000. That did not, of course, quite reach the standards of accuracy desired by the chairman: 99.80 as distinguished from 99.85 per cent. Mr. Humphreys and himself entertained the idea of attacking the estimation of zinc (spelter) as their next problem, in order to see precisely what accuracy could be obtained. It seemed to him, however, that where the difference was exceedingly small such as between 99.80 and 99.85 it was better to estimate the impurities present, and take the zinc by difference. Professor Turner had referred to Sand's method for estimating white metals; but it should be borne in mind, in the separation of antimony and tin, that it was necessary to use the method of graded potential.

Mr. Lewis appeared to doubt whether the method was sufficiently accurate for works. His reply was that those methods were in constant use in more than one large copper works where such analyses were carried out daily. As far as the degree of accuracy was concerned they believed it was quite as great with the quick method as with stationary electrodes. Moreover, anyone acquainted with electrochemical methods of analysis knows that it is advisable to keep the volume of the electrolyte as small as possible. Mr. Levy had pointed out that Messrs. Fairlie and Bone were disinclined to trust the results with the rotating electrodes as much as with the stationary. It might be that their particular apparatus was not altogether suitable. The design did not seem to be altogether satisfactory, since there was not a very even distribution of the current between the anode and cathode. Moreover, he (Dr. Price) was under the impression that the anode, and not the cathode, was rotated. Mr. Humphreys' experience as to reliability was quite conclusive. In reply to Mr. Lewis he (Dr. Price) had always thought that there was always less lead than corresponds the formula PbO_2 owing to the peroxide being deposited in the hydrated condition. This was true whether rotating or stationary electrodes were used. In regard to the separation of nickel and zinc, if there were any nickel in the brass the nickel would deposit with the zinc if their method was used; there was, however, no nickel in the brasses they had analysed. The separation of nickel and zinc could be carried out by the method of graded potential. They had tried one or two experiments by a combination of the ordinary chemical and the electrochemical methods and had been able to analyse German silver quite accurately. Mr. Heathcote's observations confirmed the general experience, in that experiments carried out on a large scale and on a small scale would not always give the same results. So far as ordinary electro-

lytic determinations were concerned he did not think there was much difference whether the electrolyte was stirred independently or whether the stirring was done by means of one of the electrodes. The latter method was certainly the most convenient in electro-analysis.

Mr. HUMPHREYS emphasised that the same degree of accuracy could be obtained with rotating electrodes as with the fixed electrodes. From 18 months' experience with both methods, with regard to the estimation of copper, he assured them that equally accurate results were to be obtained from both methods. The electro-analysis of zinc was much more satisfactory with rotating than with stationary electrodes.

Sydney Section.

Meeting held at Sydney on Wednesday, October 14th, 1908.

MR. J. A. SCHOFIELD IN THE CHAIR.

METHODS OF CHEMICAL CONTROL IN THE NEW ZEALAND MEAT FREEZING WORKS.

BY ALLISTER M. WRIGHT.

The methods of chemical control in freezing works are of a most varied character, and may be either qualitative or quantitative; qualitative to determine if certain impurities are absent, or whether the colour, odour, or taste of the finished product meet the requirements demanded; quantitative to determine if the products have been economically manufactured, and to make sure that the finished products conform to the guarantee to the purchaser.

In the examination of many by-products empirical methods are adopted which are useful when rapid results are demanded, in other cases more accurate methods must be employed.

Tankage.—In the examination of this, the constituents determined are moisture, tri-calcic phosphate, nitrogen, and fat. The moisture is determined in 2 grms. by heating for three hours in the water oven. Tri-calcic phosphate is determined in 2 grms. by igniting, dissolving in hydrochloric acid, adding ammonia solution until a precipitate is formed, re-dissolving in slight excess of citric acid, and filtering. Magnesia mixture is added and the precipitate allowed to stand two hours before filtering. It is redissolved in hydrochloric acid, and re-precipitated with ammonia, then filtered, ignited, and weighed. Nitrogen is determined in 1 gm. by the Kjeldahl method. The fat is determined in 1 gm. of the substance by treating it with 50 c.c. of carbon tetrachloride in a conical flask, placed in a shaking machine for half an hour, filtering off an aliquot portion, and evaporating. The moisture should not exceed 10 per cent., and in this condition the tankage may be stacked in heaps without heating, and consequent loss of nitrogen.

The percentage of fat and nitrogen serve as important indications of the economical rendering of the raw offal. The fat should not exceed 15 per cent.; a higher proportion indicates over-cooking. The nitrogen contents multiplied by 6.25 should not vary more than 1 per cent. from the organic matter other than fat; a low proportion indicates that the offal has been under-cooked.

The following analyses show the composition of well prepared dried tankage:—

	1.	2.	3.
Moisture, per cent.	10.62	8.24	6.29
Tri-calcic phosphate, per cent.	23.94	11.60	12.12
Nitrogen, per cent.	7.50	10.16	10.08
Fat, per cent.	15.32	14.40	15.96

Dried blood.—In the examination of dried blood, the moisture and nitrogen are determined. The moisture should not exceed 10 per cent., and the nitrogen should be about 15 per cent. Should the moisture exceed this, the blood will rapidly heat, and lose nitrogen. Blood to be economically treated should be cooked and dried

as rapidly as possible after killing, and on the same day; if this is not done a serious loss of nitrogen results.

The following are typical analyses of dried blood:—

	1.	2.	3.
Moisture, per cent.	9.25	8.30	10.20
Nitrogen, per cent.	14.40	14.51	13.96

Tankage and dried blood are used mainly in the manufacture of complete commercial fertilisers.

Tallow.—Tallows are examined for their "titer" or the determination of the solidifying point of the fatty acids which are separated from the tallow. The method used is that recommended by the Assoc. of Official Agricultural Chemists of America, described in Bulletin No. 99, Bureau of Chemistry, U.S. Department of Agriculture, p. 61.

Other determinations are those of water, dirt, which may include portions of animal tissues, and free fatty acids. The titer of first grade tallows will generally lie between 45.5° and 48.5° C., that of second grade between 43° and 45°, and third grade between 40° and 43°.

The acidity ranges between 0.75 and 7 per cent. in good to fair quality tallow, whilst in some samples it may reach 50 per cent.

Wool.—In the examination of wools, the following methods are used:—

Moisture is determined in 1 gm. by drying at 110° C. for one hour in an air oven. After removal from the oven the sample must be placed in a desiccator over sulphuric acid and cooled under vacuum, and thereafter weighed as rapidly as possible.

Natural wool grease is determined by extracting 2 grms. of the wool in hot alcohol, and evaporating an aliquot portion for the total fat. In another portion the free acid is determined, and after deducting this as fatty acids, the balance is considered to be natural wool grease. In another 2 grms. the total fats are extracted with ether, and after deducting the natural wool grease, the balance is entered as other fatty matter. After drying and weighing the wool from the previous determination the sand, dirt, and lime may be approximately determined by shaking them out mechanically, the residue being again dried and weighed as wool fibre. The results so obtained are sufficiently accurate for comparative purposes, and the control work on shod wool.

The following analyses are typical:—

	12.22	13.40	11.08	10.86	12.80	12.74
Moisture, per cent.	12.22	13.40	11.08	10.86	12.80	12.74
Natural wool grease, per cent.	5.42	3.44	7.28	14.54	3.68	11.90
Other fatty matter, per cent.	1.86	1.02	1.62	0.56	1.56	
Sand, dirt, lime, &c. per cent.	5.74	6.42	10.30	7.36	12.26	
Wool fibre, per cent.	4.76	75.72	69.72	66.68	69.70	56.28

Meat extract.—The following determinations are made:—Moisture, ash, fat, substance precipitable by 80 per cent. alcohol, and substance soluble in 80 per cent. alcohol. In addition the taste and colour of the extract are noted. The methods of analysis have been described by the author.* Preserved meats and bacon are principally examined for preservatives (chiefly boric acid) and ptomaines.

Boric acid is determined in 10 grms. of the meat by digesting it in 30 c.c. of concentrated sulphuric acid and 250 c.c. of methyl alcohol with frequent shaking, for two hours, and then subjecting the whole to distillation, more alcohol being added from time to time as the distillation proceeds. After distilling for about 1½ hours, the distillate is diluted with water to a convenient volume; to an aliquot portion is added glycerine, about one-third of its volume, and this is titrated with deci-normal sodium hydroxide, using phenolphthalein as indicator. Various meats showed by this method boric acid content of 0.108 per cent., 0.232 per cent., 0.310 per cent.

In the examination for ptomaines the Stas-Gautier

* This J., 1907, 1229.

method is used.* Indication of ptomaines is rarely found except in blown tins and obviously decomposed meats.

Oleomargarine.—The colour of oleomargarine from mutton fat should be nearly pure white, that from beef fat should be light yellow. There should be no indication of rancidity, and no more than a trace of free acid.

Glue.—In the examination of glue, moisture, ash, gelatin, non-nitrogenous matter, nitrogen, and water absorbed in forty-eight hours are determined. The condition after soaking for forty-eight hours is also observed. The methods of analyses employed are those described by Rideal†. In the drying of glue certain determinations are made to ascertain and regulate the amount of moisture in the air of the dryer. For rapid and fairly accurate work, a "Hygrodeik" is used. This is a wet and dry bulb thermometer, to which is attached an indicator, with a chart upon which the various tables and calculations are plotted, so that the relative humidity and grains of water per cubic foot are shown at once without reference to tables, or further calculation. The following determinations and readings show the moisture, and relative humidity of the air on entering the dryer and on leaving it:—

	Air entering the dryer.		Air leaving the dryer.	
Temperature . . .	64° F.	65° F.	53° F.	54° F.
Relative humidity	40	45	95	93
Grains of water per cubic foot . . .	2.8	3.1	4.4	4.3

Other analyses.—The chemicals used in connection with the treatment of skins, as sodium sulphide, arsenic sulphide, lime, salt, sulphuric, lactic, acetic, and formic acids, must be as free as possible from soluble iron compounds. Lubricating oils, used in connection with refrigerating machinery using anhydrous ammonia, should be non-saponifiable. The author some years ago was consulted with reference to trouble in a refrigerating machine, and found that it arose from the use of a readily saponifiable oil, producing an ammonia soap in the machine. Where steam is used in direct contact with food products, no boiler compound should be used containing volatile organic compounds, as contamination of food has been definitely traced to this source. Hence the feed water must be examined periodically.

The methods herein described are those in use in the laboratory of the Christchurch Meat Company, Ltd., and for permission to read this paper I have to express my thanks to the General Manager.

DISCUSSION.

Mr. L. MEGGITT thought the extraction of fat in tankage with carbon tetrachloride was novel, and he would like to know why this solvent was chosen. With regard to the statement that tankage will not keep if its moisture was over 10 per cent., he would be surprised if it would keep when it contained anything like so much. He did not think the factor 6.25 was a good one for the nitrogen, as the material was not all protein: 6.66 was a truer factor, while for gelatin and glue 5.9 was not far wrong. For the examination of glue he considered that Rideal's methods of analysis gave no indication of the commercial value. The proportion of nitrogen, for example, meant nothing, for a glue worth only £30 might contain the same proportion as one worth £100. Besides colour, taste, smell, and fracture, the "jelly" test alone was valuable, i.e., the comparative stiffness and the viscosity at a definite temperature with varying proportions of water. In determining the acidity of tallow he thought it was usual to dissolve in hot alcohol, and inquired whether the use of ether with the alcohol was to enable the determination to be done in the cold. He considered the methods of the Association of Agricultural Chemists of America were the most up to date and generally

applicable. He agreed with many of the statements of the author, and thought his remarks regarding saponifiable oils in refrigerators were very interesting.

Mr. T. STEEL noticed that for the determination of fat in tankage only 1 gm. was used, and then only an aliquot part of the extract evaporated. To attempt to get 1 gm. to truly represent such an uneven kind of mixture as tankage seemed to be an unsatisfactory procedure. Then with regard to allowing 1 gm. of the wool to cool (after drying) over sulphuric acid in a vacuum and then weighing in the air, he suggested that a stoppered weighing tube would be much simpler and more satisfactory than having refinement at one end and neglect at the other.

Mr. A. A. RAMSAY pointed out that when examining meat extracts for boric acid, which would only be present in small proportion, the distillation method was slow and tedious. He thought the small proportion of boric acid might be extracted with chloroform, or might even be dissolved out with glycerine and titrated at once.

Dr. J. M. PETRIE noticed that in the paper two methods were described for estimating fat—one by extracting with carbon tetrachloride, and the other with alcohol. Recent investigations had shown that it was quite impossible to extract the whole of it. Hot alcohol gave the most complete extraction, while ether only came within 60 per cent. of hot alcohol, and petroleum spirit within 45 per cent. At the same time alcohol extracted too much, dissolving out also such bodies as cholesterol.

Mr. WRIGHT, who was unable to be present, wrote in reply, that he had found by experiment that carbon tetrachloride was as good a fat solvent as ether or petroleum ether, and on account of its non-inflammable nature used it for extraction where rapid determinations were called for. It had been his experience that tankage would keep for at least a year with a moisture content of from 8 to 10 per cent., provided the fat did not exceed 15 per cent. His reason for using ether with alcohol, in the determination of acidity in fats, was that solution was more readily effected. When tankage was finely ground for analysis it could be reduced to a fairly even mixture, and one gm. was sufficient to represent the sample drawn. The suggestion of a stoppered weighing tube was certainly a simpler and more satisfactory method than that described in the paper. He was unable to agree with Dr. Petrie's remarks with reference to petroleum ether as a fat solvent. For tankage especially he had found it most satisfactory, dissolving out practically all the fat, without any of the glycogen which was almost invariably present; this solvent was always used by him when extracting fat from animal tissues with the Soxhlet apparatus. Owing to the nature and diversity of the problems calling for solution in technical analysis as applied to the freezing works, and owing to the limited information afforded by the literature on special branches of chemical technology, it was somewhat difficult for a chemist to devise original methods which would combine scientific accuracy with the rapidity demanded in a works laboratory, and thus maintain a high standard of quality in the products and the economical utilisation of the by-products.

Meeting held at Sydney on Wednesday, Nov. 11, 1908.

MR. J. A. SCHOFIELD IN THE CHAIR.

THE CIRCULATION OF HEATED LIQUIDS.

BY E. V. MILLER.

Seeing that in industrial operations heat is applied to liquids in a great variety of apparatus, in many of which the rapidity of circulation of the fluid is an important efficiency factor, it becomes a matter of interest to ascertain the precise mechanism of this circulation, i.e., how it is related to the source of heat, to the shape of the heating apparatus, and to other circumstances.

* Mitchell, *Flesh Foods*, p. 298.

† Glue and Glue Testing, pp. 108-135.

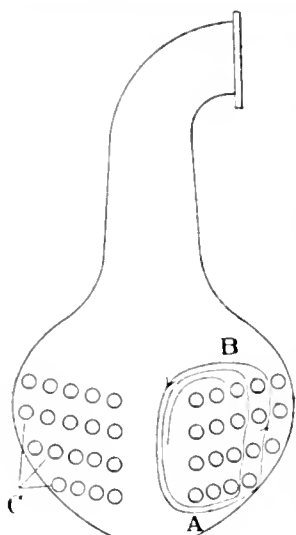


Fig. 1.

The question first presented itself in reference to the heating of sugar solutions in a vacuum pan. Fig. 1 shows a section of a type of vacuum pan, where the heating surface consists of copper pipes coiled in nearly flat spirals (shown in section at C), to the inside of which steam under pressure is admitted. There is no communication between the solution and the inside of the pipes, the condensed water which forms in the latter being removed without admixture with the sugar solution. The circulation in such a pan is known to be in the direction indicated by the arrows on the stream line shown. The central space where the liquid descends is called the well.

Circulation before boiling.—Considering now the circulation of the liquid while it is being heated, and before attaining the boiling point, the cause of the movement must be a difference between the mean density of the portion of each stream line, A to B (in the direction of the arrows), and that from B to A, through the well, this being brought about through dilatation of the hotter arm. The ultimate cause of the circulation is, then, that the mean temperature of the portion of stream line A to B is, and continues, greater than the mean temperature of the portion B to A. If we follow a particle of the liquid in its course round a stream line as it starts from A and rises close to the heating surfaces, it will on this portion of its journey be receiving heat, and will rise in temperature until it begins to descend into the well, when, being further from the heating surfaces, it will receive little or no heat, so that it will remain practically at the temperature it had attained at the summit, B, of its course. This cycle will be repeated after it again reaches A.

Now, instead of regarding the heating of a particle as time goes on, consider the temperatures existing at any one instant all round a stream line. In this case, if there is a temperature gradient along the course A to B, there must be an opposite temperature gradient along the course B to A. Thus the difference between the mean temperatures of the two portions of the stream line does not depend, at any rate directly, on the temperatures at A and B, but on some difference in the character of the gradients existing along the two arms of the stream line. The problem can be much simplified by considering an arrangement whereby all temperatures would remain constant as regards time. Fig. 2 represents an endless tube filled

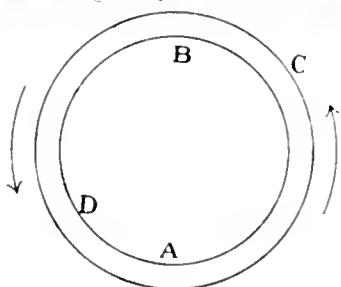


Fig. 2.

with liquid. To the arm ACB a source of heat of constant temperature is applied (say steam in a jacket); while to

the arm BDA, also jacketed, is applied some cooling medium whose temperature can also be kept constant. Time being given for things to assume a steady state, the following conditions will hold:—The velocity of circulation, as measured by the mass passing any cross section of the tube in unit time, will be constant; the rate of accession of heat by the arm ACB from the source of heat will be constant, and will equal the rate of exit of heat from the other arm to the cooling medium; the quantity of heat stored in the liquid will be constant, and the temperature existing at any fixed point of the tube will remain constant as regards time. The whole area of a cross section of the interior of the tube may not be at the same temperature. The temperature at a point of the tube, then, means the mean temperature over the cross section at that point. The temperature gradient means the rate at which the temperature at a point changes per unit length of the tube. Each arm will receive heat, and each will be cooled.

Let T = temperature of the hot source. Let x = distance along the tube in the direction ACB. Then x at A = 0, and x at B = x_1 . t = excess of temperature at any point over that at A. t_0 = temperature at A. t_1 = temperature at B. (Thus the temperature at any point = $t_0 + t$.)

At a point on ACB consider a volume consisting of a length, dx , of the full area of cross section of the stream. There are two influences tending to cause change of temperature throughout this volume. The first is the receipt of heat from the source, and the second is the continual influx of liquid coming from a cooler region. Since the temperature of the volume actually remains constant as regards time, these two influences must be equal and opposite. Expressions may be found for them by considering the effect of each in the absence of the other, as follows:—

Change of temperature by conduction of heat from source.—If movement of the liquid mass were suddenly stopped, the temperature all along ACB would at once begin to increase, the rate of increase being some function of the difference between the temperature of the source and that of the liquid. Probably it will not be far wrong to say that the rate of increase of temperature $\frac{dt}{d\tau}$ (where

τ = time) would be proportional to the difference between the temperature of the source and that of the liquid; and for want of more exact knowledge this will be assumed. We have, then, at a point at which the temperature is $t_0 + t$:—

$$\frac{dt}{d\tau} = k \{ T - (t_0 + t) \} \dots \dots \dots (1)$$

where k is a constant.

Change of temperature by convection.—If we suppose the receipt of heat from the source to suddenly cease while the movement of the liquid continues, the temperature at any point on ACB will at once commence to fall owing to the advent of cooler liquid. The rate of this change will be proportional to the product of the temperature gradient, $\frac{dt}{dx}$, and the velocity; or, since the latter is constant, it will be proportional simply to $\frac{dt}{dx}$. Thus we have

$$\frac{dt}{d\tau} = K \frac{dt}{dx} \dots \dots \dots (2)$$

where K is constant.

Combining (1) and (2) we get $\frac{dt}{dx} + Lt = L(T - t_0)$, where L

stands for k/K ; whence $t = Ce^{-Lx} + T - t_0 \dots \dots \dots (3)$ To find C and L we have the following conditions:—When $x = 0$, $t = 0$, and $C = t_0 - T$; when $x = x_1$, $t = t_1 - t_0 = Ce^{-Lx_1} + T - t_0$, or $Ce^{-Lx_1} = t_1 - T$. Substituting for C , $e^{-Lx_1} = \frac{t_1 - T}{t_0 - T}$, or $-L = \frac{1}{x_1} \log \frac{t_1 - T}{t_0 - T}$, so that, in terms of known quantities

$$t = (t_0 - T) e^{x_1 \log \frac{t_1 - T}{t_0 - T}} + T - t_0.$$

Calculation of a special case.

Let $x_1 = 10$ units of length, $T = 240^\circ \text{ F}$, $t_0 = 140^\circ \text{ F}$, and $t_1 = 150^\circ \text{ F}$. Then $t_1 - T = -90$, and $t_0 - T = -100$, so

that $t = 100(1 - e^{-0.010536x})$. From this the accompanying table of corresponding values of x and t has been calculated. The third column gives the differences of temperature for each unit advance in distance, so that these figures represent approximately the temperature gradients at the different points.

x .	t .	Difference.
0	0.0	—
1	1.0481	1.0481
2	2.0852	1.0371
3	3.1101	1.0249
4	4.1268	1.0167
5	5.1311	1.0043
6	6.1259	0.9948
7	7.1098	0.9839
8	8.0833	0.9735
9	9.0467	0.9634
10	10.0000	0.9533

It will be noticed that the increase of temperature per unit length is greatest near A and falls off as B is approached. This has the effect of making the mean temperature along the arm greater than the average of the extreme temperatures t_0 and t_1 , which is 145° F. A close approximation to the mean temperature will be got by taking the average of those in the middle column (5.0867) and adding t_0 , thus giving 145.0867. This is 0.0867° above the mean of the extreme temperatures.

Or, the true mean temperature, $t_0 + t$, may be derived from the original equation (3), by integrating (i.e., multiplying each value of t by its corresponding dx), and dividing by x_1 , which is the sum of the dx 's. Thus we have, where $t = t_0 + t - t_0$

$$t = \frac{1}{x_1} \int_0^{x_1} Ce^{-Lx} dx + \frac{1}{x_1} \int_0^{x_1} (T - t_0) dx$$

$$= \frac{1}{x_1} \left\{ -\frac{C}{L} e^{-Lx_1} + \frac{C}{L} \right\} + \frac{1}{x_1} \{ (T - t_0) x_1 \}$$

$$= \frac{C}{Lx_1} (1 - e^{-Lx_1}) + T - t_0$$

Taking the numerical values of the special case: $C = -949.137$, $e^{-Lx_1} = 0.9000$, and $T - t_0 = 100$. So we have $t = 100 - 949.137(1 - 0.9) = 5.0863$, and the mean temperature will be 145.0863.

The problem of the mean temperature of the cooled arm is a precise counterpart of the above, and leads to the result that the mean temperature of the liquid in this arm is as much below the average of the temperatures at A and B as the mean temperature of the heated arm is above it. Thus to get the whole difference between the mean temperatures of the two arms we must double t as found for one arm and subtract $t_1 - t_0$. In the numerical example the difference between the mean temperatures of the arms would be $(2 \times 5.0863) - 10 = 0.1726$ ° F.

The curves shown in Fig. 3, plotted from the numerical example, indicate the character of the change of temper-

ature as we pass from A to B and thence from B to A; but in order to make the departure of these curves from straightness visible, the figures after the decimal points in the middle column have all been multiplied by ten.

Regarding the difference in mean temperature of the heated and non-heated portion of the stream lines in a vacuum pan as the cause of the circulation, the above analysis shows how small that difference is likely to be in most cases. Tests of temperatures at points in the vacuum pan corresponding to A and B, when the charge was being heated up, showed that the difference never exceeded 5° F. It follows that the difference in mean temperature in the two arms of a stream line must have been much less than 0.17° F., that found for the numerical example, where the range of temperature was taken as 10°.

Inspection of the curves of Fig. 3 shows that the variation of the temperature gradient along the two arms is the real cause of the circulation, for if this did not vary, i.e., if both curves were straight, then the mean temperature, and consequently the mean density, would be the same in both arms, and no driving force would exist.

If, now, the temperature gradient were prevented from diminishing, or were to be made to increase along ACB, by applying more intense heat to the upper part of the arm, this would reduce the difference between the mean temperatures of the arms, and the circulation would be retarded, or might practically cease, notwithstanding that the range between the temperatures at A and B would be increased, and that more heat would be entering the heated arm per unit time than before. As this result appeared somewhat unexpected the writer attempted to test its truth in the following way:—

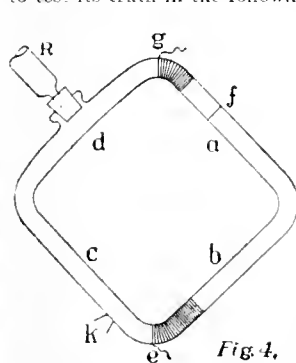


Fig. 4 shows an endless tube of glass, such as is sold for demonstration of circulation of liquids. The arms a and b were wound closely with insulated manganin wire in a single layer. There were two coils, the lower one extending from e to f , and the upper from f to g . The whole tube was then wound round with lint as a non-conductor of heat, except about 2½ centimeters at k for

observation. The tube was filled with water containing light particles in suspension. The circulation was observed with a lens arranged so that particles in about the middle of the stream were in good focus, and at the same time marks on the outside of the tube were not too far out of focus to be recognisable. These marks were 2 cm. apart, and the time taken by particles to pass between them was taken by a stop watch. The resistance of the arm circuit e to f was 890 ohms, that of the circuit f to g , 207 ohms. External resistances were added to these two arm circuits to adjust the currents through them, which were in parallel. The supply of current was from a lighting circuit of 105 volts.

Experiment 1.—Equal current in both coils (0.12 amp.). As was expected, this induced rapid circulation at first, but this quickly fell off. The velocity 1½ minutes after starting the current was 5½ cm. per second, but this fell off until, in the period between 15 and 21 minutes from start, the circulation was practically constant at 0.11 cm. per second. The current in the upper coil was then increased to 0.45 amp. This soon began to retard the circulation, so that in 26 minutes from start it was barely perceptible. The glass at k was now just warm to the touch. At 39 minutes the circulation had practically stopped. Immediately afterwards the water suddenly spouted out of the relief tube R with some force, showing that the water in the upper portion of the circulation tube was boiling. The rapid initial circulation was doubtless due to the lack of any opposing temperature gradient in the arms

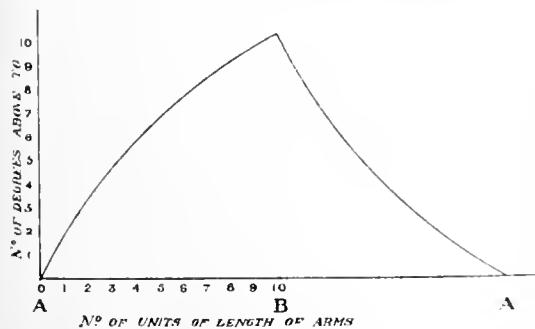


Fig. 3.

d and *c*. As this became established the circulation settled down to a constant and much slower rate.

Experiment 2.—Starting with cold water again, currents of 0.12 and 0.45 amp. were put on from the start, the larger current being in the upper coil. Much more heat must now have been entering the arms *a* and *b* than in the first experiment, yet the circulation after one minute was only 0.24 cm. per second, and in 3½ minutes this had become reduced to 0.12 cm. per second—about the same as in the first experiment after 13 minutes. In 4½ minutes the circulation was seen to be in opposite directions, the liquid in the upper part of the observation space passing upwards, that in the lower part downwards. Doubtless the resistance winding being taken to the very lowest point of the tube (see Fig. 4), coupled with the fact that there was no circulation of the whole body of liquid to contend against, caused this action. The stoppage of circulation, indicated by theory and thus demonstrated, due to increasing the temperature of the upper portion of the heated arm, is not difficult to understand if we pay attention to what occurs in the other arm. If the portion, *fg*, is made very hot, and consequently light, it will pass on into the arm, *dc*, and soon there will be a column of light liquid in that arm as long as *fg*, or if the circulation does not then stop, longer than the column, *fg*.

In a mass of liquid, a stream line is somewhat differently circumstanced from the tube depicted in Fig. 4, since it would be free to "short circuit." With the heat distribution of the two foregoing experiments, the stream lines would doubtless do this; that is, they would form two circuits, one above the other, corresponding to the two regions of different temperature. In a mass of liquid circulation will only take place between the lowest point of the heating surface and the surface of the liquid, and will not extend to the bottom of the liquid if the heating surface does not extend there. Any liquid below the heating surface will remain stagnant. This refers of course only to liquids before they reach their boiling point, as is illustrated by a later experiment.

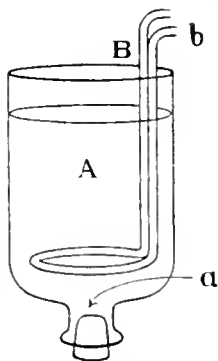


Fig. 5.

Circulation when boiling.—Passing now to the case of a liquid when boiling, the following experiment will show that the circulation can no longer be due either to temperature differences or to differences of temperature gradients, but is closely connected with the disengagement of vapour. A, in Fig. 5, is an inverted bell jar, about 7 inches deep, nearly filled with water in which particles were suspended in

order to show the circulation. B is a ¼-inch brass tube, bent into a single coil having a diameter nearly as great as that of the bell jar. The coil could be raised or lowered in the water, and was supplied with high pressure steam at *b*. Starting with the cold water the coil was placed rather low down in the vessel and steam turned on. An immediate but sluggish circulation resulted, the lighter particles rising all round the coil, proceeding to the surface, and returning downwards near the axis of the jar. The heavier particles all settled down into the slight pocket at *a*. The circulation extended only ¼ inch below the coil; the liquid below that was stagnant. In order to avoid unequal heating and risk of fracture of the jar the water was stirred from the bottom from time to time by means of a rod. Immediately after each stirring the heavier particles sank into the pocket again, and in the intervals between the stirrings the liquid below the coil became stagnant. This continued until bubbles of air began to rise up from the coil, when the circulation slightly improved. When the water was nearly boiling the coil was raised to within an inch of the surface. On boiling, a violent circulation was set up, which reached to the bottom of the jar, and

swept the heavier particles into its course. This continued when the coil was raised half an inch, indeed it was not until the coil was right up to the surface of the liquid that the heavier particles again settled down to the bottom. During boiling there was rather less steam supplied than during heating up.

If the temperature gradient along a stream line in this apparatus be considered it will be obvious that it must be zero everywhere, for every portion of the liquid must be at the same temperature within a small fraction of one degree. The very brisk circulation is none the less due to expansion and to gravity, but the expansion is that of the liquid into vapour. One portion of a stream line consists of liquid, and the other of mixed liquid and vapour, which, of course, will have a much smaller density. Unlike the case where the liquid is being heated up before boiling, this rarefied material is not carried to the downward portion of the stream line, but is eliminated at the summit; and this is why, in the apparatus of Fig. 5, the circulation during boiling did not form a short circuit but extended to the bottom of the jar, even though the heating was only taking place at the top, whereas before boiling the circulation was limited to ¼ inch under the coil. An example of this difference is afforded by the process of heating up cold water in a Cornish boiler where the heating surface is chiefly near the surface of the water in the boiler. When the upper part of the water is nearly to boiling point the lower portion is still quite cold, but a few minutes of actual boiling bring all parts to the same temperature.

When liquid boils in any vessel the boiling point is not the same at a depth in the liquid as it is on the surface, on account of the hydrostatic pressure of the liquid. With atmospheric pressure on the surface of the liquid this variation of boiling point is slight, except where the depth of the liquid is great. The working of geysers is explained on this principle. But in a vacuum pan the variation of boiling point from this cause may be considerable. If the absolute pressure on the surface of the liquid is equal to 2 in. of mercury, and if we have water boiling in the pan, its temperature will be about 102° F. But 3 feet under the surface the liquid is under the pressure of the water above it in addition to the pressure at the surface. The total pressure would equal 4½ inches of mercury—more than double the pressure at the surface—and the water 3 feet under the surface could not boil unless its temperature reached about 130° F.

To test this point practically a 16-candle-power electric lamp, properly insulated and protected, was fitted into the interior of a vacuum pan, and a sight glass was also fitted at the end of a tube 10 in. long and projecting that distance into the pan. This was fixed in such a position that the light from the lamp would come through the glass after having traversed 9 or 10 in. of the liquid just over the bottom coil near where it entered the pan. This would be the hottest portion of the coil. On looking through the tube when the lamp was lit up, the lamp and a portion of the surface of the bottom coil could be plainly seen. (See Fig. 6, where *a* is the sight tube, and *b* is the lamp; *c* is a sight glass for observing the surface of the liquid, and *d* is another allowing access of light to it.) On exhausting the air from the pan and recharging (which is done through the pipe, *f*), when the liquid reached the level of the light the latter was obliterated owing to froth, but as the level of the liquid rose the light gradually appeared. Steam was then supplied to all the coils. After some time, when the liquid in the pan was boiling violently on the surface as seen through the upper sight glass, raising a wave about 2 ft.

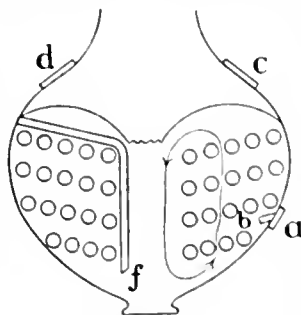


Fig. 6.

high all round the pan, as shown in Fig. 6, there was so little disturbance at the sight tube that the shape of the lamp filament was quite distinct, in fact, the liquid appeared to be quiescent except for a few very small bubbles, presumably of air, which kept crossing close to the glass. There was no trace of boiling at the coil surface. The temperatures at the surface of the liquid and at the lowest coil were practically the same. Invariably on allowing more liquid to enter the pan through the feed pipe, *i.* clouds of bubbles rushed past the sight glass and completely obliterated the light. These were probably derived from air dissolved in the liquid. On stopping the feed the light appeared again. Similar trials were made on several different occasions of boiling, and in no case was any boiling observed at the heating surface, even when steam was shut off all the upper coils. Then the boiling, clearly enough visible on the surface, was due entirely to the heating surface the hottest part of which was under observation. It is instructive to follow the temperatures round a stream line. These will be constant as regards time, or in the case of solutions will alter slowly with the density. From A, going through the coils towards B, the temperature will increase according to the law already found for the non-boiling period. At the same time the boiling point will decrease as we approach the surface, so that at some point between A and B the increasing temperature will meet the decreasing boiling point and ebullition will take place. Between that point and B all the heat taken up by the liquid from the whole heating surface will be rendered latent by evaporation; and at B, and from B to A through the well, the liquid will be at one temperature. It has been repeatedly found that the temperatures above and below the coils of a boiling liquid in a vacuum pan are so nearly identical that slight irregularities mask any difference there may be. The distance below the surface at which boiling occurs will (other things remaining the same) decrease as the rate of circulation increases, and *vice versa*. For if the circulation is very rapid there will be but slight increase of temperature as the liquid rises among the coils, and it will have to travel to a region of lower boiling point (*i.e.*, nearer the surface of the liquid) before ebullition can occur.

Rapidity of circulation.—The factors which control the rapidity of circulation can now be made clear. The rate depends ultimately, of course, on the rate of transference of heat from the steam in the coils to the liquid outside them. This again is a function of the difference of temperature between the steam and the liquid touching the coils. The maintenance of this difference depends on the heat conductance of the coils, and the rate at which heat can penetrate into the liquid. In the absence of circulation heat would have to penetrate the liquid by conduction only, and, as most liquids are very bad conductors of heat, a steep temperature gradient would be set up in a direction normal to the heating surface. A brisk circulation sweeps this away and causes the temperature of the liquid in contact with the heating surface to approximate to that of the body of the liquid. Thus the rate of heat transference, and therefore the rate of evaporation, depends (in so far as the liquid is a factor in the case) almost wholly on the rapidity of circulation, whereby new portions of the liquid are continually being brought into contact with the heating surface. If the circulation is very efficient the rate of evaporation depends more on the nature (material, thickness, &c.) of the coils. The more it is deficient the more it depends on the nature of the liquid, and not on the coils.

Since, as before shown, any increase in rate of evaporation tends to induce an increase in circulation, while, conversely, any increase in the latter reacts to produce an increase in evaporation, it is clear that by removing as far as possible all obstacles to circulation considerable increase in rate of evaporation may result. There is little doubt, however, that such increase tends to a limit conditioned by the properties of the liquid itself. But even if this were not the case; if circulation, in spite of obstacles, could increase to such an extent as to do away with any temperature gradient in the liquid, normal

to the heating surface, still evaporation would be limited by the conductance of the coils.

The obstacles to circulation consist of the walls of the vessel, the coils and other apparatus with their supports, and the viscosity of the liquid. With homogeneous liquids the latter is constant at a given temperature, but with solutions it increases, sometimes enormously, with the concentration. This introduces a factor which may produce curious results. Very impure sugar solutions become exceedingly viscous on evaporation. In dealing with such a solution in the vacuum pan it is often found that a stage is reached when evaporation almost ceases, notwithstanding that the temperature of the mass of substance in the pan is, and remains, very much (80° to 90° F.) below that of the steam in the coils. This is probably brought about as follows:—Owing to sluggish circulation in the first place, the temperature of the liquid touching any portion of the heating surface is enabled to rise to the boiling point, even though its locus should be deep under the surface. The increase of circulation which this ebullition would tend to bring about would be opposed by an increased viscosity due to the accompanying concentration; and if the effect of the latter should exceed that of the former the circulation would be still further retarded. The liquid in contact with the heating surface would become very concentrated and viscous, and would attain a much higher temperature than would the rest of the liquid in the pan. Thus it is likely that in such cases a non-conducting layer of highly viscous liquid is automatically formed all over the heating surfaces, which nearly stops the entrance of heat into the liquid, and can be but slowly replaced by the feeble circulation which alone can be maintained by the very slow evaporation.

The blowing of steam through the liquid in such a way as to assist circulation is found to expedite evaporation considerably. It is obvious that by increasing the pressure of steam used in the coils, and thereby raising its temperature, the rate at which heat enters the liquid may be increased. If, for instance, the liquid is boiling at 160° F. and the pressure of steam in the coils is 10 lb. per sq. in., then the temperature of the steam will be 240° F., and the difference of temperatures of steam and liquid 80° F. If, now, the steam pressure is raised to 70 lb. per sq. in., which corresponds to a temperature of 316° F., the difference between the temperature of the steam and that of the liquid will be 156° F., or nearly double what it was before. This will cause a much more rapid transfer of heat, not only because at the higher temperature a pound of steam contains more heat, but chiefly because more steam will be used. The resulting increase in evaporation produces brisker circulation, which again reacts on the evaporation, as has been already described. Or, if a very brisk circulation is a desideratum, some of the obstructing heating surface may be removed without reducing the rate of evaporation. The increase of efficiency due to the use of high pressure steam is thus made clear.

Obituary.

WILLIAM MARTIN HABIRSHAW.

W. M. Habirshaw was born February, 1835, in New York City. Previous to the year 1873, Mr. Habirshaw served in the United States Navy as an engineer. Subsequently leaving the navy, he opened a laboratory in New York for commercial analysis and as a chemical and technical consultant, and continued there in that capacity, till about the year 1877. With regard to subsequent years, his services in advancing by improvements and inventions the interests of the iron, sugar, and fertiliser industries have been of great value. He devoted much time and labour to the practical applications of electricity in chemical industry, producing insulating materials which have been in use for many years.

W. M. Habirshaw died on Aug. 15th, 1908, at Saratoga Springs.

He was an original member of the Society of Chemical Industry.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Kilns or ovens; Recovering waste heat from brick, pipe, pottery and other — and utilisation of such waste heat. J. H. Oxley and A. Crossley, Gosmont, Yorks. Eng. Pat. 28,079, Dec. 20, 1907.

A STEAM-JET is fixed in a suitable chamber opening out of the kiln. When the firing is completed, a damper between the kiln and this blast-chamber is opened, the steam turned on, and the hot gases drawn from the kiln by suction and conveyed by pipe or flue to any place required. Pipes conveying the heat to drying chambers are fitted with adjustable outlets, so that the discharge of hot air may be distributed over the whole, or concentrated in any part of the drying room, as desired.

—H. H. S.

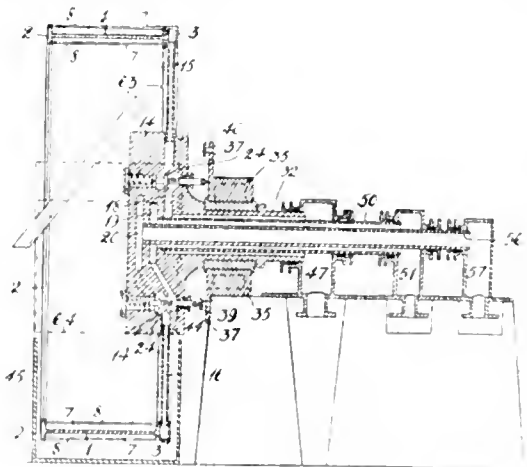
Ovens [for pottery, etc.]; Construction of —. A. Parvillée, Paris. Eng. Pat. 18,730, Sept. 7, 1908. Under Int. Conv., Sept. 9, 1907.

IN order to avoid the excessive strains due to rapid heating and cooling, the kiln is built with two walls, the outer being of armoured concrete, and the inner one, constituting the oven proper, of refractory material. The space between the two walls is filled with non-conducting and slightly compressible material, such as iron dross or clinkers mixed with a little sandy clay. The arrangement may be extended to a whole battery of kilns.—H. H. S.

[Incandescence] Heating by radiation; Refractory mantles or the like for —. M. Delage, Paris. Eng. Pat. 28,407, Dec. 24, 1907. Under Int. Conv., Feb. 27, 1907.

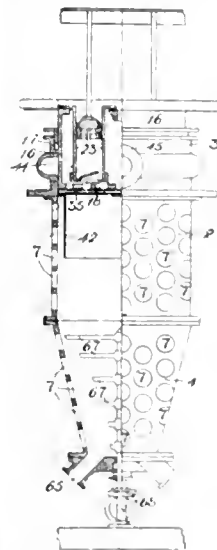
A MANTLE knitted from asbestos thread is soaked in a solution of the soluble salts of metals having refractory oxides, dried, and stretched upon a mould to give it the desired form. This is done in order to harden and stiffen the mantle. It is then calcined in a gas flame and a thick layer of cerium oxide is deposited upon it by soaking it in a strong solution of a cerium salt, drying and subsequently calcining it.—W. H. C.

Filtering apparatus; Rotary —. A. J. Arbuckle and A. Osborne, Johannesburg, Transvaal. Eng. Pat. 20,400, Sept. 28, 1908.



A CYLINDRICAL frame, 1, having a solid flange, 2, on its outer edge and a hollow flange, 3, on its inner edge, is divided into several compartments by transverse ribs. It is covered on its inner and outer surface by curved perforated plates, 7, over which filter cloth, 8, is stretched. The compartments do not communicate with one another, and the frame is carried from a hub, 14, by radiating hollow arms, 15, 16. There are four arms for each section of the frame; one for filtering by suction, one for drying by vacuum, and two for back pressure. The hollow arms communicate at their outer ends with the filtering chambers by the hollow flange, 3, which is also divided into compartments to correspond with the filtering chambers; and at their inner ends with hollow passages pierced in the hub. The passages, 18, are for suction and communicate with the chamber, 47 which is connected to a suction producing device. The passages, 19, communicate with the chamber, 51, connected to a vacuum pump, and the passages, 20, communicate with the chamber, 57, connected to a back-pressure pump. The passages are provided with valves, 24, operated by cam-plates, 39, 40, on the face of the plate, 37. The shaft is supported on a bearing, 35, and is rotated by suitable means. The concentric pipes, 32, 50, 56, are connected to the chambers, 47, 51, 57, by stuffing-boxes. The material to be filtered is fed into the trough, 45, into which the cylindrical frame dips, and on rotation, the liquid is sucked through the cloth and the solid matter forms a cake on the surfaces of the chambers. As the rotation proceeds, the chambers emerge from the liquid, the suction passages are closed and the vacuum passages are opened and the deposit is dried by the air drawn through. On continued rotation the vacuum passages are closed, the back pressure passages are opened, and a current of liquid is forced from the interior through the surface of the filters, thus detaching the solids, which fall on to the shoots, 63, 64, by which they are conducted away.—W. H. C.

Filter-press; Continuous —. A. J. Arbuckle, Johannesburg, Transvaal. U.S. Pat. 905,129, Dec. 1, 1908.



the smaller filters, 7. The liquid which passes into the hollow plunger, 16, is withdrawn by the pumps, 23,

and the solids are gradually compacted into the cone, 4, from which they are finally discharged through the pipes, 65, their discharge being facilitated by the blades, 67, driven by the gear, 68. In order to prevent the pores of the filter-cloth from being blocked up, a small portion of the filtrate is forced back through the filters at each upward stroke of 16. This is effected in the case of the plunger, 16, by the partial vacuum produced at the commencement of the upstroke and in the case of the smaller filters by a number of small back-pressure pumps, one of which is connected to each small filter, 7, by a suitable pipe, and which are all operated simultaneously on the upstroke of 16.—W. H. C.

Dryer. J. P. Grupe, Davenport, Iowa. U.S. Pat. 907,993, Dec. 29, 1908.

THE claim is for the provision of a cylindrical stationary extension to the feed end of a rotary drying cylinder. The extension has a transverse plate inclined towards the dryer, through which the feed conveyor tube passes. The vapour outlet pipe is connected to the upper part of the cylindrical extension.—W. H. C.

Evaporator. C. L. Schalitz, San Francisco, Cal. U.S. Pat. 908,028, Jan. 5, 1909.

THE evaporator is divided into a number of superposed communicating evaporating chambers by arched partitions. A steam coil is arranged upon each partition and has an inlet opening into the chamber below and an outlet connected to an exhaust apparatus. Vacuum is created in all the chambers by a suitable device, and the lowest chamber is heated by a steam coil, the admission of steam to which is controlled by a valve operated by a lever which is weighted down by a vessel full of mercury, and is normally closed. A pipe leading from the lowest chamber dips into the mercury. As the vacuum in the chamber increases, the mercury is drawn up into the pipe and the weight acting on the lever becomes less, so that the valve opens and admits the steam to the coil. Consequently the amount of steam admitted depends upon the degree of vacuum existing in the evaporator.—W. H. C.

Evaporating liquids; Apparatus for —. J. L. Schrade, New York. U.S. Pat. 909,460, Jan. 12, 1909.

THE liquid to be evaporated is sprayed into the upper end of a vertical cylinder having an outlet at the top. The lower portion of the wall of the cylinder is perforated and is surrounded by a jacket in which is a steam coil. Air is blown through a perforated pipe into the lower portion of the jacket and displaces the warm air, which passes through the perforations into the cylinder, where it ascends and meets the falling spray of liquid. The liquid is vaporized and is carried away by the upward current of air, the solid particles falling to the bottom of the vessel, from which they are discharged.—W. H. C.

Washing and lixiviation of granular or fibrous materials; Apparatus for —. W. Fink, Ger. Pat. 204,474, July 8, 1906. Addition to Ger. Pat. 202,499.

THE present patent relates to improvements in the apparatus described in the main patent (see Fr. Pat. 369,763 of 1906; this J., 1907, 190), whereby air is forced into the washing liquid and causes a whirling motion of the material, thereby aiding the washing and lixiviation.—A. S.

Columns for distilling and rectifying purposes; Notched —. F. Pampe, Halle on Saale, Germany. Eng. Pat. 26,584, Dec. 2, 1907. Under Int. Conv., Dec. 1, 1906.

SEE Fr. Pat. 384,775 of 1907; this J., 1908, 493.—T. F. B.

Kiln; Rotary —. M. G. Semper, Weferlingen, Germany. U.S. Pat. 909,464, Jan. 12, 1909.

SEE Fr. Pat. 390,586 of 1908; this J., 1908, 1101.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

PATENTS.

Fuel; Artificial —. G. W. Herheim, Seattle, Wash. U.S. Pat. 907,398, Dec. 29, 1908.

PETROLEUM oil is mixed with dried peat, heated, and afterwards mixed with dextrin as a binding agent. The resulting mass is briquetted hot.—W. H. C.

Gas-producer control. B. E. Eldred, Assignor to Combustion Utilities Co., New York. U.S. Pat. 908,454, Jan. 5, 1909.

PRODUCTS of combustion are delivered into a gas-producer by a fan, or other draught-producing device which exhausts the gases from a chimney and delivers them to the producer. The pipe connection on the suction side of the fan has two mechanically operated valves. One of these is open when the fan is working and controls the supply of gas; the other is closed and is connected to the air. When the fan ceases to work, the valves are automatically reversed so that there is no return flow of the gas from the producer to the chimney.—W. H. C.

Gas-producer. J. A. Smitmans, Pittsburg, Pa. U.S. Pat. 908,812, Jan. 5, 1909.

THE generator is divided by vertical partitions into a number of chambers communicating below and open above. A cover provided with a feed hopper and a gas-delivery pipe rests upon the chambers and closes them. This cover can be rotated so that the hopper and gas-outlet pipe each only communicate with one chamber at a time and never with the same chamber at the same time.—W. H. C.

Gas-producer. C. L. Straub, Milwaukee, Wis., Assignor to Power and Mining Machinery Co., New York. U.S. Pat. 909,345, Jan. 12, 1909.

THE producer is provided with an evaporator or boiler below the fuel hopper and above the heating chamber. The latter has a refractory lining which extends horizontally inwards at the top towards the centre, above the bottom of the boiler. The hot gases are caused to circulate over the extended portion of the lining to heat the boiler, and the latter is provided with pipes which pass downward through the wall of the producer and serve to conduct steam from the boiler to the fire zone.—W. H. C.

Gas-producer. P. G. Schmidt, Timwater, Wash. U.S. Pat. 909,690, Jan. 12, 1909.

A NUMBER of adjustable shields are arranged transversely in the body of the producer above the grate. The shields are connected by pipes passing through the top of the producer to an external main by which the gas is conducted to a casing or chamber which surrounds the producer at the level of the grate and from which the gas is discharged. Another pipe connects the space above the fuel with the annular chamber or with the space below the grate and is provided with a valve controlled by a thermostat placed within the producer.—W. H. C.

Gas-producer for heating gas retorts or for other purposes. P. V. Parsy, Fr. Pat. 393,810, Nov. 6, 1907.

IN order to obtain the depth of combustion zone necessary to reduce the whole of the carbon dioxide first formed to carbon monoxide, without using a very deep producer chamber, it is proposed to construct the latter in such a way that the gas and air pass through in a horizontal rather than in a vertical direction. This is effected by making the producer chamber of greater length than depth and by taking away the gas from the back, at the same level as that of the openings by which the air enters at the front of the producer. It is also claimed that owing to the proximity of the zone of combustion to the ash-pit, an increased evaporation of the water supplied to the latter is effected, with a consequent increase in the proportion of water-gas in the gas produced. Further the charging can be effected without allowing a large volume of air to enter the generator, which would reduce the temperature of the combustion zone.—W. H. C.

Mixed gas; Production of — from illuminating gas and water-gas. H. Strache. Ger. Pat. 205,252, July 21, 1906.

THE incandescent coke falls directly from the retorts in which the illuminating gas is produced, into the gas-producing chamber below, and is then treated alternately for the manufacture of producer-gas to be used for heating the gas retorts and of water-gas, which is led into the retorts. During the "hot blow" period, the pressure above and below the junction between the gas-producing chamber and the retorts is kept approximately equal, in order to prevent any appreciable flow of producer gas into the retorts or of illuminating gas into the gas-producing chamber, and thus avoid the necessity of using valves.

—A. S.

Distillation gases; Apparatus for treating —. L. Wolf, Dübendorf, Switzerland. U.S. Pat. 909,125, Jan. 5, 1909.

THE distillation gases are first passed through a cooling apparatus where they are cooled by the expansion and vapourisation of petroleum or gasoline contained in a jacket surrounding the cooler. After the heavier bodies have been condensed, the remaining uncondensable gases are aspirated by a pump and forced under high pressure into the gasoline.—W. H. C.

Gasometers; Protecting the iron walls of — from the action of the cyanogen compounds dissolved out of the gas by the water of the hydraulic lutes. O. Kaysser, Fr. Pat. 393,661, Aug. 26, 1908. Under Int. Conv., Sept. 5, 1907.

POTASSIUM permanganate either alone or mixed with cement is added to the water which forms the hydraulic seal and is stated to convert the cyanogen compounds into bodies which have no deleterious action on the iron.

—W. H. C.

Electrode or pencil for arc-lights. I. Ladoff, Cleveland, Ohio, Assignor to P. C. Peck, New York. U.S. Pat. 909,428, Jan. 12, 1909.

THE claim is for the combination of a positive electrode consisting of an axially disposed iron core surrounded by carbon or graphite, with a negative electrode composed chiefly of "ferrie" and "titanic" material.—W. H. C.

[*Electric*] *Lamps; Process for exhausting* —. M. M. Merritt, Middleton, Mass., Assignor to Boston Incandescent Lamp Co., Danvers, Mass. U.S. Pat. 909,811, Jan. 12, 1909.

A "VOLATILE chemical agent" is introduced into the lamp bulb, which is then connected to a pump and exhausted to the required degree. The filament is then raised to incandescence, whereby the "chemical agent" is partly volatilised while the bulb is still connected to the pump. The bulb is then sealed off and the residual gas is acted on in the presence of the incandescent filament by the "chemical agent" which is completely volatilised.—W. H. C.

Electric incandescence lamps; Metallic filaments for —. F. J. Planchon. Fr. Pat. 393,888, Nov. 9, 1907.

A MASS is prepared by mixing an aqueous or alkaline solution of aluminous matter with an alkaline solution of tungsten or molybdenum sulphide, or with an alkaline sulphotungstate or sulphomolybdate. The mixture is then precipitated by the addition of an acid and the washed precipitate is made into a plastic or viscous mass with water or an alkaline solution and extruded into a thread or filament which is received in a bath of acid. The filament so formed is then finished by any of the usual processes.—W. H. C.

Incandescence body; Preparation of an —. M. von Curnh. Fr. Pat. 393,587, Aug. 21, 1908.

FIBROUS organic materials are saturated with a solution of appropriate rare earths, dried, and broken up. The fragments are then mixed with thorium oxide and with some refractory material (magnesia for preference) and the mixture is made into a paste with a solution of rare

earths. The mass is moulded into suitable shapes, dried, and burned off, when a porous body is obtained which is said to withstand shocks and the pores of which are lined with a film of rare earths which incandesces when the body is heated.—W. H. C.

Fuel; Artificial —. J. W. Leadbeater, Doncaster, Assignor to J. S. Booth and J. Holroyd, Wakefield. U.S. Pat. 909,626, Jan. 12, 1909.

SEE Eng. Pat. 17,069 of 1906; this J., 1907, 675.—T. F. B.

Coke ovens. V. D. F. Fieschi, Douai, France. Eng. Pat. 28,049, Dec. 19, 1907. Under Int. Conv., Dec. 19, 1906.

SEE Fr. Pat. 385,355 of 1907; this J., 1908, 553.—T. F. B.

Briquettes; Apparatus for treating —. B. Wagner, Stettin, Germany. U.S. Pat. 908,912, Jan. 5, 1909.

SEE Addition of Sept. 4, 1907, to Fr. Pat. 350,536 of 1905; this J., 1908, 152.—T. F. B.

Electric lamps; Manufacture of glowing bodies of refractory metals for —. A. Lederer, Atzgersdorf, Austria-Hungary. U.S. Pat. 908,682, Jan. 5, 1909.

SEE Eng. Pat. 7188 of 1906; this J., 1907, 462.—T. F. B.

Hydrocyanic acid from gases. Eng. Pat. 1806. See VII.

Tungsten alloys. Fr. Pat. 393,595. See XIX.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Pine, fir, birch, and beech woods; Destructive distillation of —. P. Klason, G. v. Heidenstam, and E. Norlin. Arkiv Kemi, Min. och Geol., 1908, 3, [10], 1—17. Chem. Zentr., 1909, 1, 109—110.

PINE and fir woods yield about the same quantity of water; birch wood yields much more, and beech wood occupies an intermediate position in this respect. The charcoal from all four kinds of wood has almost the same composition. The calorific values of the different charcoals are: fir, 7685 eals.; pine, 7695; birch, 7680; and beech, 7655 eals. All four woods yield about the same quantity of acetone, but the two conifers yield only about half as much acetic acid and methyl alcohol as the other two woods. The course of the carbonisation in its relation to time and temperature is represented graphically. Taking 275° C. as the reaction temperature, the thermal effect of the carbonisation was calculated from the heat of combustion of the wood and of the distillation products (both at 20° C.), and the specific heats and heats of evaporation of the constituents. The following were the results:—Cotton, 152 eals.; fir wood, 317; pine, 223; birch, 289; and beech wood, 316 eals.; in the case of the four woods, the thermal effect amounted to about 6 per cent. of the heat of combustion of the wood. The thermal effects of the reactions at higher temperatures were also calculated. The lower the temperature, and the less secondary reactions interfered, the more exothermic was the reaction. The carbonisation of wood is somewhat more exothermic than that of cellulose, for which the heat of reaction amounts to only about 5 per cent. of the heat of combustion. The methyl alcohol is produced from the methoxyl groups of the lignone; both cellulose and lignone yield acetic acid. The calorific value of the combustible distillation gases is, on the average, about 3.8 per cent. of that of the wood.—A. S.

Pyridine; Aqueous solutions of —. E. Baud. Compt. rend., 1909, 148, 96—98.

THE author has determined the freezing points, contractions of volume, the indices of refraction, and the heats of solution of mixtures of pyridine

and water. On freezing the solutions, ice crystallises from those containing from 0 to 55 per cent. of pyridine; a higher hydrate of pyridine crystallises from solutions containing from 55 to 77 per cent. of the base, and a lower hydrate from mixtures between 77 and 83 per cent.; from more concentrated solutions, pure pyridine separates. The mixture containing 83 per cent. of pyridine shows the lowest freezing point, $-68^{\circ}\text{C}.$ and is a eutectic mixture. The various physical data indicate that at least two hydrates of pyridine exist, one with 2 mols. of water and the other with 6 mols. At the ordinary temperature these hydrates are dissociated in solution, as is shown by the rounded form of the thermal curves and the large variation in the heat of solution of pure pyridine inversely with the temperature. The hydrate richest in water is the less stable of the two. There is a striking concordance between the curve of contractions and that of the heats of formation calculated per 100 c.c. of the mixture. The latter values are a measure of the quantity of hydrate existing in a constant volume. The contraction, therefore, would appear to be in close connection with the extent of combination of the two liquids.—J. F. B.

o-Toluidine and *o*-nitrotoluene; Method of determining small quantities of impurities in —. A. F. Holleman. Rec. trav. chim. Pays-Bas, 1908, 27, 458–462.

THE impurity usually encountered in *o*-toluidine is the *p*-compound and the amount of this is estimated by converting the sample into the acetyl derivative and observing the solidifying point. The solidifying points of known mixtures of the acetyl compounds of *o*- and *p*-toluidine are given in the following table:—

Percentage of <i>p</i> -compound.	Solidifying point, $^{\circ}\text{C}.$
0	109.15
1.12	108.45
2.42	107.75
9.58	103.2
13.6	100.8

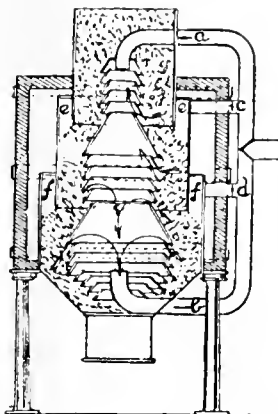
42.8 grms. of the toluidine to be tested are added slowly to a solution of 25.2 grms. of oxalic acid dissolved in 1 litre of hot water. After cooling to $0^{\circ}\text{C}.$ the crystals are collected on a filter and washed once with a little water. The toluidine is then regenerated from both crystals and filtrate by adding caustic soda and distilling in steam. After separating the oil, the aqueous liquor must be extracted twice with ether to avoid loss. Both portions of toluidine are now converted into the acetyl compound by using, for one grm. of toluidine, 2 c.c. of glacial acetic acid and 1 c.c. of acetic anhydride, evaporating on a water-bath and distilling in a vacuum. The solidifying point of the two portions is determined and the amount of *p*-toluidine deduced from the above table. When the amount of *p*-compound exceeds 1–2 per cent., the toluidine can be directly converted into the acetyl derivative without first preparing the oxalate. The presence of *p*-nitrotoluene in *o*-nitrotoluene is detected by first reducing with iron and hydrochloric acid and treating the resulting toluidine in the above manner.—J. C. C.

PATENTS.

Sulphur-containing petroleum; Apparatus for utilising —. J. E. Eggleston, Assignor to Standard Oil Co., Bayonne, N.J. U.S. Pat. 908,400, Dec. 29, 1908.

THE crude petroleum is caused to pass through a continuous still formed of a series of vessels, the liquid outlet of the first being connected to the liquid inlet of the second, and so on. The stills are heated to different appropriate temperatures and the vapours from each are passed through separate condensers. The hydrogen sulphide is conveyed by a pipe from the ends of the condensers to a furnace where it is burned into sulphur dioxide, which is either converted into sulphuric acid or is utilised in any other desired way.—W. H. C.

Carbonising furnace. E. Lorenz. Ger. Pat. 204,399, Feb. 2, 1908.



THE patent relates to furnaces for the carbonisation of lignite, peat, etc., consisting of several concentric movable cylinders, heated externally, with inner gas spaces or chambers formed by funnel-shaped bells or hoods (see Fig.). Instead of always leading off the distillation gases from the interior of the bells through the pipes, *a, b*, two additional pipes, *c, d*, are provided, communicating with the spaces, *e, f*, between adjacent cylinders. The four exit pipes are provided with flap-valves, and by adjusting these, the gases may be led off either from the interior of the bells or from the spaces, *e, f*. By thus changing the direction of the gases within the furnace at intervals, the bells last considerably longer.—A. S.

Petroleum; Manufacture of a new spirit by the isomerisation of —. A. Testelin and G. Renard. Fr. Pat. 393,554, Aug. 8, 1908.

A THIN regulated stream of petroleum is injected by a jet of high-pressure superheated steam into a coil set in a furnace and heated to from $400^{\circ}\text{C}.$ to $450^{\circ}\text{C}.$ From the coil the steam and vaporised hydrocarbons are caused to pass under considerable pressure through a tube or retort filled with broken pieces of burnt fireclay which is set lower down in the furnace and heated to a full red heat. The petroleum is "cracked" and the products leave the retort through a pipe and loaded valve by which the pressure is maintained. The products, which contain both lighter and heavier hydrocarbons than the original petroleum, are passed through a fractional condensing system where they are separated. Any unchanged petroleum and heavier bodies may be treated over again until they are converted into lighter bodies.—W. H. C.

Hydrocarbon oils or the like; Treatment of — for the production of volatile spirit. J. Noad, East Ham, and E. J. Townsend, London. Eng. Pat. 13,675, June 27, 1908.

SEE Fr. Pat. 393,433 of 1908: this J., 1909, 84.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

PATENTS.

Anthracene derivatives; Production of —. Farbenfabr. vorm. F. Bayer and Co. Fourth addition, dated Aug. 27, 1908 (under Int. Conv., Sept. 2, 1907), to Fr. Pat. 372,676, Dec. 18, 1906 (this J., 1907, 523).

ACETYLATED α -aminoanthraquinone and its derivatives can be converted into pyridones by treating them with the salts of organic acids. The reaction can proceed in the presence of acetic anhydride and it is therefore possible to acetylate α -aminoanthraquinone, or one of its derivatives, and to convert the acetyl derivative into the corresponding pyridone in one operation. Example 1: A mixture of 10 kilos. of *t*-acetylamine-4-chloroanthraquinone, 20 kilos. of fused potassium acetate, and 100 kilos. of nitrobenzene is boiled for 10 hours. The mixture is then cooled and the condensation product which is precipitated, is filtered off, washed with boiling nitrobenzene, and drained. Anthrapyridone is thus obtained in yellow needles, dissolving in sulphuric acid to give a yellow fluorescent solution. Example 2: A mixture of

10 kilos. of finely powdered α -aminoanthraquinone, 20 kilos. of fused potassium acetate, and 100 kilos. of acetic anhydride is boiled until no acetylated aminoanthraquinone remains. The mass is treated with boiling water and the precipitate is filtered off, washed, and dried.

—P. F. C.

Dyestuffs of the Malachite Green series; Process for preparing blue-green to green acid — fast to alkalis. Anilinfarben- und Extrakt-fabr. vorm. J. R. Geigy. Ger. Pat. 204,034, Dec. 7, 1907.

2,6-DICHLOROBENZALDEHYDE or its 3-nitro-derivative is condensed with ethyl (or methyl) benzylanilinesulphonic acid, and the leuco compound oxidised. The chlorine atoms render the dyestuff quite fast to alkali, and only cause slight blueness of shade.—T. F. B.

Leuco-diaminoanthraquinones and diaminoanthraquinones and their hydroxy- and sulpha-derivatives; Preparation of —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 205,149, July 28, 1907.

LEUCO-QUINIZARIN or its hydroxy-derivatives or sulphonic acids are converted by heating with ammonia in aqueous or alcoholic solution into the corresponding leuco derivatives of 1,4-diaminoanthraquinone; oxidation, such as by treatment with concentrated sulphuric acid, converts these into the 1,4-diaminoanthraquinone derivatives. The preparation of 1,4-diaminoanthraquinone and of its 5,8-dihydroxy-derivative and 5-sulphonic acid is described in detail in the specification.—T. F. B.

Anthracene dyestuffs soluble in water; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 205,214, March 5, 1908.

ANTHRACENE dyestuffs soluble in water are obtained by halogenating heteronuclear α -amino- or α -alkylaminoanthraquinonesulphonic acids, and treating the products with mono- or di-alkylamines in presence of catalytic agents such as copper powder. The dyestuff from 2,4-dibromo-1-aminoanthraquinone-5-sulphonic acid dyes mordanted or unmordanted wool fast, clear blue shades.—T. F. B.

Disazo dyestuffs; Process for preparing red —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 205,661, Oct. 5, 1906. Addition to Ger. Pat. 204,102, April 26, 1906.

THE dyestuffs are prepared as described in the principal patent (see Eng. Pat. 9548 of 1907; this J., 1907, 960) except that, instead of using 2,5,7-aminonaphtholsulphonic acid or its acidyl derivatives as final components, the compound of formaldehyde-bisulphite with 2,5,7-aminonaphtholsulphonic acid is employed.—T. F. B.

Sulphide dyestuffs; Process for preparing —. B. Rassow. Ger. Pat. 205,216, Sept. 26, 1907.

DIAMINODIPHENYLMETHANE or its homologues or derivatives, and also symmetrical disubstituted *N*-alkyl derivatives of these compounds, providing they have at least two amino-hydrogen atoms free, are converted into sulphide dyestuffs by treatment with "sulphur sesquioxide" in sulphuric acid solution. 0.4 part of sulphur is added to 15 parts of fuming sulphuric acid (25 per cent. anhydride); 1.5 parts of *p,p'*-diaminodiphenylmethane are then slowly stirred in, the temperature of the mixture being kept below 40° C. After standing for four or five hours, the mass is poured into 80 parts of cold water, the solution is heated until evolution of sulphur dioxide ceases, and the dyestuff is separated in the form of paste. The dyestuffs obtained by this process dye unmordanted cotton dark green shades from sodium sulphide solutions; by oxidation the shades are converted to Bordeaux red or brick red.—T. F. B.

Thioindigo dyestuffs; Process for preparing —. Badische Anilin und Soda Fabrik. Ger. Pat. 205,324, Oct. 3, 1907.

ACETYLENE-*bis*-THIOSALICYLIC acid or its homologues or derivatives, $R(COOR)_2S.CH_2CH_2S.R.COOR$, where *R* represents a benzene or naphthalene nucleus, are obtained

by the action of dihalogen-ethylenes on thiosalicylic acids, etc. They can be converted into thioindigo dyestuffs by treatment with "acid" condensing agents, e.g., sulphuric acid, aluminium chloride, or zinc chloride, etc.—T. F. B.

2-p-Nitrosophenylaminonaphthalene-6,8-disulphonic acid; Process for preparing —. Badische Anilin und Soda Fabrik. Ger. Pat. 205,414, Nov. 22, 1907.

It is known that concentrated hydrochloric acid causes the nitroso group of the nitrosamine of 2-aminonaphthalenes to migrate to the 1-position adjacent to the amino group. It is now found that 2-phenylaminonaphthalene-6,8-disulphonic acid is converted by nitrous acid into a nitrosamine, the nitroso group of which migrates, on standing with hydrochloric acid, to the benzene nucleus, into the *p*-position to the amino-group.—T. F. B.

Sulphide dyestuff; Process for preparing a blue —. Kalle und Co. A.-G. Ger. Pat. 205,391, Oct. 10, 1907.

A SOLUTION of nitrosophenol, obtained by action of nitrosylsulphuric acid on phenol, is added, at a low temperature, to a solution of *p*-chloro-*o*-nitrodiphenylamine in sulphuric acid: after some hours the indophenol is removed from the mixture with the aid of ice, and is heated with sodium sulphide and sulphur at 120° to 130° C. for 20 hours. The resulting dyestuffs dye cotton from sulphide baths clear blue shades, fast to acids.—T. F. B.

[Azo] dyestuffs for cotton; Process for preparing substantive —. Kalle und Co. A.-G. Ger. Pat. 205,421, Sept. 3, 1907.

THE monodazo derivatives of substances of the composition, $C_6H_2.NH_2(1)X(3)SY(6)NH.Acyl(4)$, (where *X* is alkyl, alkyloxy, or halogen, and *Y* an alkyl, aryl, or CH_2COOH group), are combined with Cleve's α -naphthylaminosulphonic acid, and the resulting monoazo dyestuff is diazotised and combined with naphthols or their derivatives and then saponified. The dyestuffs thus obtained dye cotton reddish-blue shades, which can be developed on the fibre by means of β -naphthol, when fast, pure greenish-blue shades result.—T. F. B.

Intermediate products and colouring matters [thioindigo dyestuffs] containing sulphur; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 90, Jan. 1, 1908. Addition to Eng. Pat. 26,053, Nov. 25, 1907.

SEE Fr. Pat. 385,044 of 1907; this J., 1908, 497.—T. F. B.

Anthracene dyestuff and process of making same. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 909,809, Jan. 12, 1909.

SEE Fifth Addition of Feb. 8, 1908, to Fr. Pat. 309,503 of 1901; this J., 1908, 851.—T. F. B.

Monoazo dyestuff and process of making same. W. König, Ohndorf, Assignor to E. Merz, Frankfurt, Germany. U.S. Pat. 908,580, Jan. 5, 1909.

SEE Fr. Pat. 392,914 of 1908; this J., 1909, 18.—T. F. B.

Extracting dyewoods, etc. Ger. Pat. 205,253. See XIV.

Regulations, dated December 30, 1908, for the manufacture of nitro- and amino-derivatives of benzene and the manufacture of explosives with use of dinitrobenzol or dinitrotoluol. Statutory Rules and Orders, 1908, No. 1310. [T.R.]

REGULATIONS 1 (a), 2, 3, 4, and 14 (c) do not apply to any process in the manufacture of explosives in which dinitrobenzol is not used.

Part I.—Duties of Occupiers.

1. (a) Every vessel containing any substance named in Schedules A or B shall, if steam is passed into or around it, or if the temperature of the contents be at or above the temperature of boiling water, be covered in such a way

that no steam or vapour shall be discharged into the open air at a less height than 20 feet above the heads of the workers.

(b) In every room in which fumes from any substance named in Schedules A or B are evolved in the process of manufacture and are not removed as above, adequate through ventilation shall be maintained by a fan or other efficient means.

2. No substance named in Schedule A shall be broken by hand in a crystallising pan, nor shall any liquor containing it be agitated by hand, except by means of an implement at least 6 feet long.

3. No substance named in Schedule A shall be crushed, ground, or mixed in the crystalline condition, and no cartridge filling shall be done, except with an efficient exhaust draught so arranged as to carry away the dust as near as possible to the point of origin.

4. Cartridges shall not be filled by hand except by means of a suitable scoop.

5. Every drying stove shall be efficiently ventilated to the outside air in such manner that hot air from the stove shall not be drawn into any workroom.

No person shall be allowed to enter a stove to remove the contents until a free current of air has been passed through it.

6. A Health Register, containing the names of all persons employed, shall be kept in a form approved by the Chief Inspector of Factories.

7. No person shall be newly employed for more than a fortnight without a certificate of fitness granted after examination by the surgeon by signed entry in the Health Register.

8. Every person employed shall be examined by the surgeon once in each calendar month (or at such other intervals as may be prescribed in writing by the Chief Inspector of Factories) on a date of which due notice shall be given to all concerned.

9. The surgeon shall have power of suspension as regards all persons employed, and no person after suspension shall be employed without written sanction from the surgeon entered in the Health Register.

10. There shall be provided and maintained for the use of all persons employed:—

(a) Suitable overalls or suits of working clothes which shall be collected at the end of every day's work, and (in the case of overalls) washed or renewed at least once every week; and

(b) A suitable meal room, separate from any room in which a process mentioned in the Schedules is carried on, unless the works are closed during meal hours; and

(c) A suitable cloakroom for clothing put off during working hours; and

(d) A suitable place, separate from the cloakroom and meal room, for the storage of the overalls;

For the use of all persons handling substances named in the Schedules:—

(e) India-rubber gloves, which shall be collected, examined, and cleansed, at the close of the day's work and shall be repaired or renewed when defective, or other equivalent protection for the hands against contact;

For the use of all persons employed in processes mentioned in Schedule A:—

(f) Clogs or other suitable protective footwear.

11. There shall be provided and maintained in a cleanly state and in good repair for the use of all persons employed:—

A lavatory under cover, with a sufficient supply of clean towels, renewed daily, and of soap and nail brushes, and with either:—

(a) A trough with a smooth impervious surface, fitted with a waste pipe without plug, and of such length as to allow at least 2 feet for every five such persons, and having a constant supply of warm water from taps or jets above the trough at intervals of not more than 2 feet; or

(b) At least one lavatory basin for every five such persons, fitted with a waste pipe and plug or placed in a trough having a waste pipe, and having either a constant supply of hot and cold water or warm

water laid on, or (if a constant supply of heated water be not reasonably practicable) a constant supply of cold water laid on and a supply of hot water always at hand when required for use by persons employed;

For the use of all persons employed in processes mentioned in Schedules A and B:—

(c) Sufficient and suitable bath accommodation (douche or other) with hot and cold water laid on and a sufficient supply of soap and towels. Provided that the Chief Inspector may in any particular case approve of the use of public baths, if conveniently near, under the conditions (if any) named in such approval.

12. No person shall be allowed to introduce, keep, prepare, or partake of any food, drink, or tobacco in any room in which a process mentioned in the Schedules is carried on.

Part II.—Duties of Persons Employed.

13. Every person employed shall:—

(a) Present himself at the appointed time for examination by the surgeon as provided in Regulation 8;

(b) Wear the overalls or suit of working clothes provided under Regulation 10 (a), and deposit them, and clothing put off during working hours, in the places provided under Regulation 10 (c) and (d);

(c) Use the protective appliances supplied in respect of any process in which he is engaged;

(d) Carefully clean the hands before partaking of any food or leaving the premises;

(e) Take a bath at least once a week, and when the materials mentioned in the Schedules have been spilt on the clothing so as to wet the skin. Provided that (e) shall not apply to persons employed in processes mentioned in Schedule C, nor to persons exempted by signed entry of the surgeon in the Health Register.

14. No person employed shall:—

(a) After suspension, work in any process mentioned in the Schedules without written sanction from the surgeon entered in the Health Register;

(b) Introduce, keep, prepare, or partake of any food, drink, or tobacco, in any room in which a process mentioned in the Schedules is carried on

(c) Break by hand in a crystallising pan any substance named in Schedule A, or agitate any liquor containing it by hand, except by means of an implement at least 6 feet long;

(d) Interfere in any way, without the concurrence of the occupier or manager, with the means and appliances provided for the removal of the fumes and dust, and for the carrying out of these Regulations.

Schedules.

A. Processes in the manufacture of:—Dinitrobenzol; dinitrotoluol; trinitrotoluol; *p*-nitrochlorbenzol.

B. Processes in the manufacture of:—Aniline oil; aniline hydrochloride.

C. Any process in the manufacture of explosives with use of dinitrobenzol or dinitrotoluol.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Silk: Action of light on weighted — E. Ristenpart, *Z. angew. Chem.*, 1909, 22, 18–21.

WHILST the mechanical resistance of silk may be regarded as a function of the degree of weighting, its behaviour under the influence of light is more complicated. It is well known that the fibroin of pure silk undergoes a profound change on prolonged exposure to light, and is finally disintegrated; it is also known that certain substances, such as tannin or ammonium thiocyanate, are capable of inhibiting this change. The author has investigated the result of exposing weighted silk to the action of light between the months of March and August. These silks

were loaded respectively to the extent of 136 and 159 per cent. (on the weight of the silk) with tin in combination as phosphate and silicate. At the end of the period of exposure, the silks were treated (a) for one hour with 10 per cent. hydrochloric acid; (b) for 5 minutes with a cold normal solution of sodium hydroxide, and the percentage of soluble matters in each case was determined; similar determinations were also made on unexposed samples of the same silks. The results showed that the loading, in the form of stannic phosphate and silicate, underwent no change under the influence of light, but on the other hand, the fibroin was considerably decomposed. In the sample weighted to 159 per cent., 10 per cent. of the fibroin had been converted into products soluble in the above reagents; in the more lightly weighted sample, 22 per cent. of the fibroin had been converted. Thus a certain degree of protection was afforded by the heavier loading. Another silk was investigated which contained an organic loading, *viz.*, catechutannin in association with stannic oxide and sodium phosphate. In this case it was found that the tannin afforded an absolute protection to the fibroin against the disintegrating action of light, but that a change took place in the condition and solubility of the stannic oxide of the loading. Owing to the method employed for fixing the loading, with a moderately cold, weak solution of phosphate, after the tannin and stannic chloride had been absorbed, the bulk of the tin existed in the silk in the form of stannic oxide, and only a little as phosphate. The action of the light on the stannic oxide was found to convert it into metastannic acid, which is far less readily soluble in hydrochloric acid than the stannic oxide. In this sense the action of light resembles that of prolonged storage. The author concludes that the mechanical deficiency of weighted silk is a far more important practical consideration than the destructive influence of any degree of exposure to light to which the silk is likely to be subjected in practice. The latter is of scientific interest only, and is explained by the author as the result of atomic vibrations in the fibroin molecules, synchronising with those of the waves of light, with ultimate rupture and rearrangement of the groupings. The protective action of tannin, &c., is ascribed to similar vibration periods in the molecule of the protective substance, which divert the action of the light waves from the fibroin. It would appear that the quantity of protective agent present is of no importance as regards the effect, and that the substance is not destroyed in the process; it may therefore be described as a "negative catalyst" or stabiliser.—J. F. B.

Silk; Action of hydracids and their salts on —. P. Sisley. *Rev. Gen. Mat. Col.*, 1909, 13, 4—8.

GNEHM, Roth, and Thomann found that the characteristic stains which appear on silk fabrics on storing, were similar to those produced purposely by the action of perspiration, and in 1897 the author proved that they were due to the sodium chloride in perspiration, his work being confirmed by that of many other chemists. Later, it was found that on patterns spotted with a solution of sodium chloride and stored at different altitudes, different periods of time elapsed before the stains were produced, the longest period being at the highest altitude. Patterns of silk were then treated with a 2½ per cent. solution of sodium chloride and stored in the laboratory, part at 40° C., and part at the ordinary temperature (in sealed vessels to prevent their drying). Both in the case of weighted and of unweighted silk, there was as much loss of tensile strength caused by storing for 1 month at 40° C. as by keeping for 1 year at the ordinary temperature, though the effect was considerably greater on the weighted patterns. Concentrated salt solutions did not produce the stains, numerous experiments having shown that the effect ceased when the quantity of salt was greater than could be dissolved by the moisture contained in the fibre. Other chlorides and hydrochloric acid also produced the stains. It is probable that in the case of the salts, hydrolysis took place first with liberation of hydrochloric acid; for, on treating a weighted pattern, dyed with a colour very sensitive to acids, with a 2½ per cent. solution of sodium

chloride and then drying, the acid reaction was given. In the case of weighted silk, it is probable that the metal liberated from the salt combined with the acid in the weighting and left the hydrochloric acid free, thus explaining why weighted silk was stained more readily. This was borne out by the fact that on unweighted silk treated with sulphuric acid, the stains were produced as quickly as on the weighted. Hydrobromic acid and bromides produced the stains, though less rapidly. Hydrofluoric acid and hydriodic acids and their salts did not stain.

The author's theory is that the liberated acid is oxidised, with production of the halogen, for the stain is instantly produced by dilute chlorine or bromine water. Further, those dyestuffs which are not affected by chlorine are found to be those which are not discharged at the stained places; while, on impregnating silk with a 1 per cent. solution of methyl-*p*-aminophenol, a substance readily turned brown by oxidation, and then spotting with a 2½ per cent. solution of sodium chloride, a brown stain was produced in less than 12 hours. Georgevics and Mueller have shown that the iron present in the fibre is in the ferric condition at the stains and in the ferrous state elsewhere and this is confirmed by the author. It is impossible to obtain silk fibre containing no iron, but experiments with both weighted and unweighted patterns showed that the rapidity of staining did not increase with the percentage of iron, which does not therefore act as a catalytic agent in the oxidation. Meister in 1905 published the theory that copper acts as a catalytic agent. The author, however, finds that silk containing no copper is stained just the same, and considers that the porosity of the fibre aids the oxidation. Wool fabric spotted with sodium chloride and stored, was dyed deeper at the spots, thus indicating the action of chlorine, while stains were produced on a dyed film of albumin similar to those on dyed silk. Thus, the effect seems to be common to albuminous substances.—H. P. P.

Artificial silk; Proposed new French import duties on —. See Trade Report.

Artificial fibres; The dyeing of —. V. Clement. *Färber-Zeit.*, 1909, 20, 1—4.

THE artificial fibres of commerce comprise not only the artificial silks, but artificial horse-hair, straw-plaits, mixtures of non-lustrous curly waste from artificial silk manufacture with wool or shoddy, and similar waste carded and spun by itself. Denitrated collodion silk has a much stronger affinity for basic dyestuffs than "Glanzstoff" or viscose silks; and full shades can be dyed direct on the former, whereas the latter must be mordanted with tannin. If the dye-bath be too hot, there is a loss of lustre and the threads stretch unequally. The optical properties of cellulose, *e.g.*, its double refraction, cause many dyestuffs to fluoresce so strongly that they are unsuitable for artificial silk. All the artificial silks possess the defect, when dyed in bulk or in the cloth, of giving stripes of different intensities of shade. In the collodion silks this defect has been traced to differences in the percentage of residual nitrogen (1.16 to 1.61) remaining after denitration, the darker shades corresponding to higher percentages of nitrogen. In the case of "Glanzstoff" and viscose silks, the darker stripes correspond with a more pronounced oxycellulose reaction. The author thinks that the differences are not due to any irregularities of the chemical treatments subsequent to the formation of the threads, but are caused by uncontrolled changes in the cellulose, taking place under the influence of the alkaline agents employed for dissolving the cellulose prior to spinning. The product of every batch is stated to be uniform as regards its dyeing properties, but is always irregular in count ("denier"). Since this cannot be controlled, the skeins are sorted according to "denier" afterwards, and skeins from several batches are parcelled together, one batch having a different affinity for dyestuffs from another. Artificial silks must be bleached rapidly; alternate treatments with sodium hypochlorite and hydrochloric acid give the best results; the permanganate

bleach weakens the fibre. For dyeing, the basic dyestuffs of the "Janus" group give the best results as a rule. On collodion silks the "Janus" colours give full shades direct, fast to light and to water; the other silks show equally good results on tannin mordants. The "Seto" dyestuffs are also good but not particularly fast. Many of the acid dyestuffs are suitable for the direct dyeing of pale shades, fast to light but not to water. The substantive dyestuffs are used very extensively, but are not suitable for "navy blue"; this colour is best obtained by Janus Blue R or Indoin Blue toned with Methyl Violet. For black, Janus Black gives the finest shades. All dyestuffs are somewhat less fast to light on artificial silk than on cotton. The author concludes with a table of tests for the artificial silks. It is difficult to distinguish between "Glanzstoff" and viscose silks; the latter, however, gives a somewhat darker shade with Schiff's reagent than the former.—J. F. B.

Pieric acid and fibre colloids; Reaction between —. W. P. Dreaper and W. Stokes. J. Soc. Dyers and Col., 1909, 25, 10—12.

THE loss of colour of free pieric acid, under the influence of a dehydrating agent in a vacuum is well known, and the authors have now investigated the effect of similar conditions upon the colour of the dyeings of the acid upon various fibres. The dehydrating agents employed were sulphuric and phosphoric acids and the loss of colour is expressed in percentages of the original shade. These percentages were arrived at by comparison of the shades with a standard set, prepared by dyeing with known percentages of dyestuff. Dyed upon silk and wool, there is no change in the colour even after 52 days, but upon artificial silk, guncotton, and cellulose a loss of colour is noticeable in 3—10 days, and in 52 days amounts to as much as 25—50 per cent. With artificial hair the loss is not so rapid, but this is assumed to be a consequence of the physical condition of the material. There is also a marked difference in the behaviour of the acid when dyed upon silk at the boil, or in the cold; when dyed at the boil, the shade remains unaffected under the conditions of the experiment, but when dyed cold and then exposed, the loss of colour amounts to 12 per cent. after 34 days. In the presence of phosphorus pentachloride, the colour is completely destroyed both upon animal and vegetable fibres, but in all cases the shade resumes its original intensity when the affected dyeings are exposed to a moist atmosphere.—F. M.

Casein and its applications. F. W. Richardson. J. Soc. Dyers and Col., 1909, 25, 4—8.

IN the sizing of cotton warps, Carmichael has proposed the use of a mixture containing casein, 16 parts; soap, 8 parts; mineral or other oil, 60 parts; loading, 200 parts; water, 300 parts. A good dressing for cotton and linen fabrics is said to be obtained by dissolving casein with lime, and mixing this solution with that of a hard soap. A method of waterproofing with casein has been suggested, the claim being that the goods are impervious to water but remain quite permeable to air, and are therefore more suitable in wear than rubberproofed goods. According to a French patent the goods are impregnated with an alkali salt of casein, treated with formaldehyde and dried, and then steamed. Such a treatment may be suitable as a "finish," but for waterproofing, Chevallot recommends a mixture of 40 parts of casein with 200 parts of water, to which is added 1 part of slaked lime and 20 parts of soap dissolved in 240 parts of water. The goods are impregnated with this liquor, passed through a solution of aluminium acetate, dried and ironed. In calico printing, casein may with advantage replace albumin, especially in those cases where the colour of the latter is a drawback, or a diminution in the time required for fixing the colours by steaming is desired. In the discussion following the paper, mention was made of the production of non-inflammable photographic films from acetylcellulose and from casein, also the possibility of employing casein to "animalise" cotton so that this should dye like wool.—F. M.

Turkey red oils, etc. Erban. See XII.

Cutch trade in Burma. Troup. See XIV.

PATENTS.

Decoration of fabrics. M. Ratignier and H. Pervillae et Cie. First Addition, dated April 2, 1908, to Fr. Pat. 393,412, Oct. 25, 1907.

For the purpose of decorating fabrics according to the process described in the principal patent (this J., 1909, 88), any substance which can be mechanically moulded may be employed. Further the employment of flocks with openwork materials is not essential.—P. F. C.

Dyeings; Production of orange — [by means of azo dyestuffs]. Badische Anilin und Soda Fabrik. Fr. Pat. 393,580, Aug. 21, 1908. Under Int. Conv., Oct. 23, 1907.

FABRICS dyed in the usual way with Primuline are diazotised and treated with a solution of 1,3-dihydroxyquinoline or its salts; e.g., for 2 per cent. Primuline dyeings the solution may consist of 1 per cent. of dihydroxyquinoline in the form of its disodium salt, and 1.5 per cent. of "calcined" sodium carbonate. The orange dyeings produced are fast to light, washing, and acids.—T. F. B.

Cellulose threads; Method for producing —. E. Thiele, Brussels. U.S. Pat. 909,257, Jan. 12, 1909.

SEE Eng. Pat. 15,133 of 1906; this J., 1906, 1040.—T. F. B.

Vegetable textile fibres; Method of treating —. A. E. M. Rousseau, Paris. U.S. Pat. 909,457, Jan. 12, 1909.

SEE Fr. Pat. 383,062 of 1907; this J., 1908, 330.—T. F. B.

Dyeing with sulphur colouring matters; Production of reserve effects on fabrics in — and reserve pastes therefor. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 3751, Feb. 19, 1908.

SEE Fr. Pat. 387,516 of 1908; this J., 1908, 854.—T. F. B.

Indigo dyeing. H. Chaumat, Paris. Eng. Pat. 16,659, Aug. 7, 1908. Under Int. Conv., Aug. 29, 1907.

SEE Addition to Fr. Pat. 379,041 of 1906; this J., 1908, 1202.—T. F. B.

Dyeing hanks; Machine for —. J. H. Ashwell, New Basford. U.S. Pat. 909,513, Jan. 12, 1909.

SEE Fr. Pat. 382,770 of 1907; this J., 1908, 222.—T. F. B.

Printing with the aid of sulphur [sulphide] dyestuffs. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8142, April 13, 1908.

SEE Fr. Pat. 389,590 of 1908; this J., 1908, 978.—T. F. B.

Ketone sulphonylate and process of making same. A. Stock, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Main, Germany. U.S. Pat. 909,703, Jan. 12, 1909.

SEE Eng. Pat. 4073 of 1906; this J., 1906, 474.—T. F. B.

[Bleaching liquors] *Unstable solutions.* Eng. Pat. 27,463. See VII.

Waterproofing. U.S. Pat. 909,168. See XIII.A.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Calcium carbonate; Dissociation of —. D. Zavrieff. J. Chim. phys., 1909, 7, 31—57.

AT the atmospheric pressure the dissociation of calcium carbonate is rapid and complete at 910° C. The curve of dissociation pressures shows that between 700° and 950° C. there is no intermediate phase produced; and the reaction between those temperatures is reversible. At lower temperatures, the reaction is very slow, and its progress depends upon the nature of the surface of the lime or carbonate, so that definite results are difficult to obtain. Between 500° and 600° C. the intermediate substance,

(CaO) $_2$ CO_2 , mentioned by Raoult is possibly formed, but the results do not definitely show its formation; at these and lower temperatures, however, solid solutions are certainly formed, and these solid solutions, when they contain a large excess of lime, have always lower dissociation-pressures than the carbonate itself, and the reaction is not completely reversible.—J. T. D.

Sulphates, sulphites, and thiosulphates: Detection of —. W. Alexandrow. Z. anal. Chem., 1909, 48, 31–32.

For the detection of sulphates, sulphites, and thiosulphates in the presence of each other, about 0.1 gm. of the substance to be tested is dissolved in a little water, and an excess of barium nitrate, dissolved in 50 c.c. of water, is added in small quantities to the boiling solution. The liquid is then further boiled and allowed to stand for some hours, when the sulphate is completely, and the sulphite partially, precipitated, and barium thiosulphate remains in solution. The precipitate is examined by a known method, and the filtrate is precipitated with silver nitrate solution and allowed to stand for 30–40 minutes, until the silver thiosulphate has been decomposed. Then a little ammonia is added, the silver sulphide is filtered off, and the excess of silver removed from the filtrate by adding hydrochloric acid and filtering again, without heating. Ammonium chloride is added to the filtrate, until any cloudiness disappears, and the clear liquid is then oxidised with bromine water: the presence of a sulphite is indicated by a precipitate of barium sulphate.—F. SOPX.

Hydrosulphides, sulphides, and polysulphides of ammonium, sodium, and potassium. W. P. Bloxam. Z. anorg. Chem., 1908, 60, 113–122.

IN the recent work of Küster and Heberlein on polysulphides (this J., 1905, 544), no reference was made to previous work by the author (this J., 1899, 684), who had shown that aqueous solutions of normal sulphides are quite unsuitable for the preparation of pure alkali polysulphides, some thiosulphate being always formed in addition. Pure polysulphides can be obtained by dissolving sulphur in a solution of the alkali hydrosulphide. The author recapitulates his previous work and describes also the preparation of some ammonium polysulphides. If a moderately strong solution of so-called ammonium sulphide, which, however, is stated to be really a solution of $(\text{NH}_4)_2\text{S} \cdot 2\text{NH}_4\text{HS} + 2\text{NH}_4\text{OH}$, is warmed with excess of sulphur in an open vessel, a deep red solution is obtained, containing tetra-ammonium enneasulphide, $(\text{NH}_4)_9\text{S}_9$. The same compound is obtained if hydrogen sulphide be led into a solution containing ammonia and sulphur in the proportions corresponding to the formula, $(\text{NH}_4)_2\text{S} \cdot 2\text{NH}_4\text{HS} + 2\text{NH}_4\text{OH}$. If sulphur is dissolved in the "ammonium sulphide" solution in the cold, hydrogen sulphide is evolved, and crystals of tetra-ammonium heptasulphide, $(\text{NH}_4)_4\text{S}_7$, are formed. The simple or di-ammonium polysulphides hitherto obtained are probably all secondary products formed by the decomposition of tetra-ammonium enneasulphide under different conditions of temperature and concentration.—A. S.

Alums. R. Marc. Z. anorg. Chem., 1908, 60, 93–207.

A SAMPLE of potassium alum, of which the solubility at 0° C. was about 4.3 grms. in 100 c.c. of water, was not capable of readily yielding supersaturated solutions, a solution of 8 grms. in 100 c.c. of water at 18° C. crystallising when left overnight. This alum behaved in a similar manner after recrystallisation from a hot saturated solution. Experiments showed that the apparent solubility of this alum was a function of the concentration of the supersaturated solution from which the crystals were obtained. That is, if solutions of different concentration were caused to crystallise at the same temperature, by sowing with small crystals, the separation of crystals ceased at different concentrations in the different cases, the solubility being greater, the greater the initial concentration of the solution. This is attributed to the fact that the alum separated from relatively dilute solutions contains appreciably more alkali, i.e., is more basic, than that separated from a concentrated solution. This increase of basicity does not affect the crystalline form,

In comparing alums, the proportions of alkali and of sulphuric anhydride in the salt are not of so much importance as the ratio of sulphuric anhydride to alkali oxide. In the present case this ratio was 3.394 in the original sample (theoretical ratio, 3.108), but fell to 2.166, 2.321, etc., after recrystallisation. Addition of a small quantity of sulphuric acid had no effect on the properties of the alum.—A. S.

Silicate melts: Relation between viscosity and chemical composition of —. E. Greiner. N. Jahrb. f. Mineral., 1908, 11., 152–153. Chem. Zentr., 1909, 1, 258.

THE raw materials used in the experiments were silica, magnesia, aluminium and boron hydroxides, ferric oxide, ferrous, calcium, sodium, and potassium carbonates, and sodium tungstate. The melts were prepared in unglazed porcelain crucibles, 8 cm. high and 6 cm. wide at the top. It was found that in mixtures of metasilicates, Na_2SiO_3 ; $\text{R}''\text{SiO}_3$ or $\text{R}_2''(\text{SiO}_3)_2$, the viscosity, at a given temperature, increases in the following order: FeSiO_3 , MnSiO_3 , $\text{Fe}_2(\text{SiO}_3)_3$, MgSiO_3 , CaSiO_3 , $\text{Al}_2(\text{SiO}_3)_3$. Potassium metasilicate when mixed with silica gives products considerably more viscous than those obtained with sodium metasilicate. The viscosity of an acid melt of the composition, $\text{Na}_2\text{SiO}_3 \cdot \text{SiO}_2$, is lowered by the following oxides, arranged in the order of the effects they produce: FeO , MnO , Fe_2O_3 , MgO ; it is increased by lime and alumina. In general an increase of the basic constituents of a melt causes a decrease in the viscosity; the addition of one-third equivalent of ferric oxide to one equivalent of sodium metasilicate increases the viscosity; alumina acts in the same manner and with nearly as great effect as silica. Silica always causes an increase in the viscosity; boron trioxide and especially tungsten trioxide cause a decrease. No definite relation could be found between the viscosities of mixtures of the series, MgSiO_3 ; Na_2SiO_3 and CaSiO_3 ; Na_2SiO_3 , and the melting points of the components (compare Doelter, this J., 1908, 900), nor between the viscosities of complex melts and those of the silicates which might be regarded as components of such melts. The viscosity (η) may be expressed by a simple modification of Grätz's formula, $\eta = \frac{K}{1 - C^t}$, where t is the temperature and K and C are two constants, depending upon the nature of the melt. It is probable that as the temperature rises, the viscosity tolerably soon reaches a limiting value.—A. S.

Deacon {chlorine} process. K. Vogel v. Falkenstein. Z. physik. Chem., 1909, 65, 371–379.

IN practice, working at 430° C. and with a mixture of hydrochloric acid and air containing 60 per cent. of the latter, 70–71 per cent. of the hydrochloric acid used may be converted by the Deacon process into chlorine. This is the maximum limit indicated by a study of the equilibrium concerned (this J., 1907, 687). But by dehydrating the gaseous mixture, after cooling, by means of strong sulphuric acid, and then reheating at 430° C., the yield of chlorine is increased to 82.5–85 per cent., and a repetition of this treatment gives a yield of 87–89 per cent. of chlorine.—F. SOPX.

Sulphur: Compounds of — with chlorine. E. Beckmann. Z. physik. Chem., 1909, 65, 289–337.

BESIDES sulphur monochloride (S_2Cl_2), already known, the existence of the dichloride (SCl_2) and tetrachloride (SCl_4) has been definitely established. Chlorine has no appreciable action on sulphur monochloride at –33° C., but at –15° C. the dichloride is formed, and by fractionating the product at 4 mm. pressure, 80–90 per cent. of this compound distils over at –24° C. Sulphur dichloride is a dark red-brown liquid, and to it is due the dark colour of old samples of sulphur chloride. When pure, it boils without decomposition at 59° C. It begins to solidify at –80° C., and at –88° C. is an orange-yellow waxy solid which melts again at –78° to –54° C.; polymerisation probably accounts for this behaviour. Its density at 15° C. is 1.622. Chlorine combines readily with sulphur dichloride, giving the tetrachloride, which becomes solid at –70° C. and commences to melt again at –30° C. In the liquid state it readily parts with chlorine

and can only be kept in sealed vessels; it is paler in colour than the dichloride. The boiling point of sulphur monochloride is 137° – 138° C. and its melting point, -75° to -76° C.; its cryoscopic constant is 53.6° C. The molecular weights of the monochloride and dichloride respectively correspond to the formulæ given above.

—F. SODN.

Calcium cyanamide. Eng. and Min. J., Jan. 1, 1909. [T.R.]

THERE are 11 plants in Europe for making calcium cyanamide in process of construction, or in operation, the aggregate annual capacity of which is 166,000 tons. The works at Pianod'Orta, Italy, is being enlarged to increase its production from 4000 to 10,000 tons. In France, the Société Française des Produits Azotés is producing 4000 tons per year at its work at Notre Dame de Briançon. Other works of varying capacities exist in Italy, Switzerland, Germany and England. The initial plant of the American Cyanamide Company is in course of construction at Niagara Falls, Ontario, and it is anticipated that production will begin early in the spring of 1909. On the basis of 10 per cent. nitrogen content, the initial capacity of the half-unit plant at Niagara Falls will be 20,000 tons per annum. This cyanamide will yield from 12 to 15 per cent. of ammonia. In deference to requirements of American trade, free lime will be eliminated, and the nitrogen content reduced as compared with the European product.

Determining nitric acid. Hes. See XXIII.

Determining sulphite. Milbauer. See XXIII.

PATENTS.

Sulphuric acid; Simultaneous manufacture, concentration, and purification of —. G. C. de Briailles. Fr. Pat. 393,665, Oct. 31, 1907.

bottom of the vessel (1), respectively, thoroughly gas-tight joints being assured between (2) and (5) on the one hand, and between (5) and (1) on the other. Through the tube (2), which is fitted with a tap (6), a current of sulphurous acid, liquefied or in solution, is forced under pressure into the porous vessel (1). The latter is surrounded by a lead container (7), cold water circulating inside the intervening space. The tube (2), and the container (7), serve as positive and negative electrode respectively, and are insulated from one another by a rubber ring (8), surrounding the plate (9), which carries the vessel (1), and is itself supported by the insulators (10). When a suitable electric current is passed through the electrodes, the sulphurous acid combines with the oxygen liberated by the electrolysis of the water, and the sulphuric acid formed becomes concentrated as the decomposition of the water proceeds. The hydrogen liberated is withdrawn through the tap (11), and the sulphuric acid by way of the tap (13).—O. R.

Hydrocyanic acid from waste gases; Extracting —. T. M. Percy and T. H. Byrom, Wigan. Eng. Pat. 1608, Jan. 23, 1908.

THE gases are passed through a coke tower or other suitable scrubber down which a very small quantity of water is allowed to trickle, the hydrocyanic acid thus being recovered in a comparatively concentrated form. The sulphur in the solution is then precipitated by a lead salt or by other suitable means, whereupon the hydrocyanic acid is distilled off and recovered. The process is stated to be especially adapted for waste gases from coking plants, recovering ammonium sulphate.—C. J. G.

[Bleaching liquors]; *Unstable chemically or electrically produced solutions; [Rendering stable —].* F. W. Alexander, Blackheath, J. C. McClelland, Merton, and F. M. T. Lange, London. Eng. Pat. 27,463, Dec. 12, 1907.

MAGNESIUM hydroxide, oxide, or carbonate, or preparations containing these substances are added during the process of manufacture in order to render unstable hypochlorite solutions, and more especially magnesium hypochlorite solutions stable. The solution is vigorously stirred during the process by means of an ebonite rod having one or more flaps of pure rubber, or alternatively the liquid may be beaten or shaken, or else allowed to percolate through the said magnesium compounds.—C. J. G.

Hydrosulphites; Manufacture of solid —. B. Willecox, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 20,198, Sept. 25, 1908.

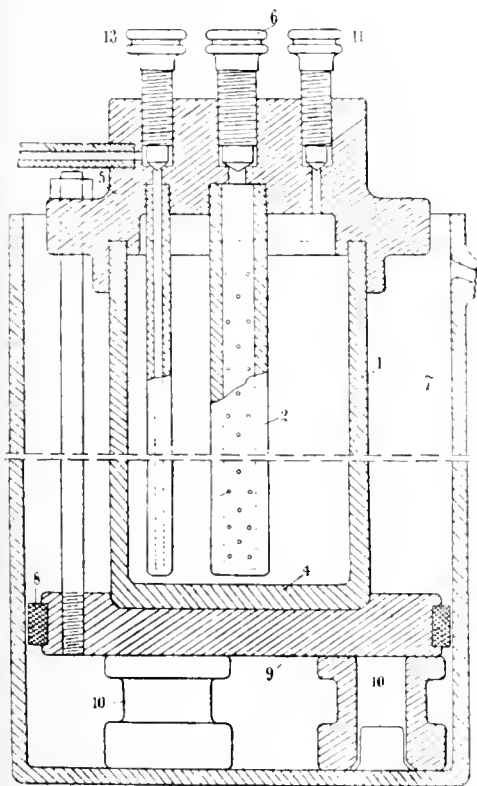
HYDROSULPHITES are obtained in a crystalline condition by passing gaseous ammonia through their aqueous solution. The crystals are filtered off, with the aid of the pump, and suction is continued until they are obtained as a thick moist paste, in which condition they are quite stable.—A. S.

Barium carbonate; Manufacture of —. A. Caffin. Fr. Pat. 393,710, Aug. 27, 1908.

FINELY powdered barytes is digested under pressure with an excess of sodium carbonate solution in an autoclave. After the mixture has been maintained at the boiling point with thorough agitation for one hour, the clear liquor is decanted off, fresh sodium carbonate solution is added, and the process repeated until the barium sulphate has been entirely converted into carbonate.—O. R.

Barium chloride and carbonate; Manufacture of —. A. Caffin. Fr. Pat. 393,880, Sept. 2, 1908.

A MIXTURE of powdered barium sulphate, an alkali chloride, and coal is calcined, and the product lixiviated with hot or cold water and filtered. Barium chloride is obtained from the filtrate by crystallisation, or barium carbonate is precipitated in the solution either by means of carbon dioxide or of a solution of an alkali carbonate.—O. R.



THE perforated lead tube (2), is fixed inside the cylindrical, porous earthenware vessel (1), and surrounded by granulated coke, retort carbon, or silicic carbide. A rigid lead cover (5), and a porcelain bottom (4), close the top and

Barium nitrate and strontium nitrate; Process for the preparation of —. Traine und Hellmers. Ger. Pat. 205,167, Jan. 3, 1908.

Barium and strontium nitrates are prepared by heating the corresponding sulphides or hydrosulphides with calcium nitrate, preferably under pressure.—A. S.

Cryolite; Process for the preparation of artificial — from fluorspar. G. Loesekamm. Ger. Pat. 205,209, Nov. 20, 1907.

FLUORSPAR is roasted with potassium sulphate and charcoal, the product is lixiviated with water, and the solution, containing potassium fluoride, is treated in one of the following ways:—(1). It is mixed with sodium sulphate, and the precipitated sodium fluoride converted into sodium-aluminium fluoride by treatment with aluminium sulphate. (2). It is treated with aluminium sulphate, and the resulting potassium-aluminium fluoride treated with sodium sulphate. (3). It is treated directly with a solution containing sodium sulphate and aluminium sulphate.—A. S.

Potassium sulphide solution; Process for the preparation of —. J. A. Reich. Ger. Pat. 205,538, March 8, 1907.

THE requisite proportions of barium sulphide and potassium sulphate are finely ground together, and the mixture is introduced, in a thin stream, into boiling water, the boiling being continued, with or without application of pressure, until the reaction is complete. Air is excluded throughout the process.—A. S.

Silicon monoxide; Process of treating —. H. N. Potter, New Rochelle, N. Y., Assignor to G. Westinghouse, Pittsburgh, Pa. U.S. Pat. 908,131, Dec. 29, 1908.

FINELY-DIVIDED silicon monoxide is converted into the dioxide by burning it while suspended in an oxidising atmosphere.—F. SODX.

Liquefaction of gases and separation of air into commercial oxygen and nitrogen. G. A. Bobrick, Los Angeles, Cal. U.S. Pat. 908,644, Jan. 5, 1909.

THE gas (air) to be liquefied is first compressed and then after cooling is passed through a counter-current apparatus to the liquefier. The counter-current apparatus consists of a number of sections having outgoing and return pipes, the former being connected to separate expansion-chambers.—W. H. C.

Iodine; Extraction of — from seaweed. L. Boirault. Fr. Pat. 393,668, Oct. 31, 1907.

SEAWEED is arranged in the form of rings, and carbonised, the formation of ashes being prevented by occasional stirring. The charred mass is placed in wooden crates, which are introduced into a battery of lixiviators. A little calcium sulphate is added to the burnt weed, so as to convert the contained sodium carbonate and oxalate into the insoluble calcium compounds. Each lixiviating vessel consists of a cement vat provided with a double bottom, between the upper and the lower portion of which a steam pipe may be disposed to heat the solution. The concentrated lye is treated with a mixture of cupric and ferrous sulphates, in the proportion of 1 part of the former to 2 parts of the latter, and the precipitated cuprous iodide is filtered off and dried, after which it is introduced into porcelain retorts, and treated with sulphuric acid and ferric oxide. Iodine separates, and cupric and ferrous sulphates are regenerated for use in the next operation. The waste products of the process may be utilised as follows:—the extracted carbonised weed is dried and powdered; one-third of this mass serves to absorb the potassium salts contained in the waste liquor obtained from the whole mass, and after air-drying gives rise to a valuable manure. The remaining two-thirds of the charred weed is moulded into briquettes with lime and used as a fuel.—O. R.

Bromine containing chlorine; Process for purifying —. Deutsche Solvay-Werke, Act.-Ges. Ger. Pat. 205,448, Jan. 7, 1908.

CRUDE bromine is freed from chlorine by heating it carefully and very slowly to a temperature near to, but below

the boiling point of pure bromine. For instance the temperature is raised to 59° C. in the course of 36—40 hours. It is essential that the rise of temperature be very slow. It is stated that in this way samples of crude bromine containing 2.26 and 2.25 per cent. of chlorine were entirely freed from the latter with losses of only 6.3 and 3.5 per cent. respectively of bromine.—A. S.

Hydrogen peroxide; Process for the preparation of —. G. Teichner. Ger. Pat. 205,262, April 25, 1908.

IN the preparation of hydrogen peroxide by blowing superheated steam against a highly heated body (see Fischer, this J., 1908, 446; also Eng. Pat. 20,868 of 1907; this J., 1908, 123), there is a very large consumption of steam compared with the quantity of hydrogen peroxide obtained. According to the present patent, the steam leaving the heating zone is only partially condensed, and the uncondensed portion, carrying some of the hydrogen peroxide, is again passed over the heated body, these successive operations being repeated as often as is desired. It is stated that by condensing only one-tenth of the steam, 50 per cent. of the hydrogen peroxide present is recovered.—A. S.

Sulphuric acid; Method of making —. H. Petersen, Wilmersdorf, Germany. U.S. Pat. 908,696, Jan. 5, 1909. SEE Eng. Pat. 27,738 of 1907; this J., 1908, 981.—T. F. B.

Sulphuric acid; Apparatus for making —. A. Gaillard, Barcelona, Spain. U.S. Pat. 909,578, Jan. 12, 1909. SEE Eng. Pat. 11,732 of 1908; this J., 1908, 1018.—T. F. B.

Manganese salt for oxidation purposes and process for producing the same. P. Wack, Strassburg, Germany. Eng. Pat. 27,932, Dec. 18, 1907. SEE Fr. Pat. 385,471 of 1907; this J., 1908, 628.—T. F. B.

Salt ammoniac; Process of producing — by the decomposition of common salt with sulphate of ammonium in hot aqueous solution. B. Neumann, Cohn, Germany. Eng. Pat. 654, Jan. 10, 1908.

SEE Fr. Pat. 378,445 of 1907; this J., 1907, 1138.—T. F. B.

Lead salts by electrolysis. U.S. Pat. 906,103. SEE XI.4.

Silicon and silicon carbide. U.S. Pat. 908,130 and 908,357. SEE XI.4.

VIII.—GLASS, POTTERY, AND ENAMELS.

Standardisation of refractory materials. Times, Jan. 21, 1909. [T.R.]

A COMMITTEE has been formed of representatives of certain societies and manufacturers to consider ways and means for arranging the "grading" and standardising of refractory materials used in making furnaces, kilns, and ovens. At a conference held on Jan. 4th, the general opinion was that there was need for such a committee, and that the following preliminary scheme should be adopted:—(a) To arrange and classify the various refractory materials, clay, silicious, as silica and ganister; special, as magnesite, chromite, &c.; (b) To arrange standard specifications for the raw materials and for the manufactured products; (c) To consider the possibility of arranging for uniformity in certain "stock" or "standard" sizes; and (d) To arrange standard methods of testing, analysis, &c.

Each section will, at first, conduct its own part of the inquiry independently of the others, and prepare a draft of their suggestions to be submitted to the next meeting of the General Committee. These suggestions will be embodied in a provisional report to be sent back to the sections for approval or amendment, and finally published as the general report. It is proposed to revise this report periodically, to keep abreast of developments.

The sections which will conduct these independent inquiries will be industrial sections, the Ceramic Society section, and the manufacturers' section, and the scheme of procedure is as follows:—

Industrial sections include a chemical and electrical

section, a glass section, a metallurgical section (Iron and Steel Institute and Institute of Metals), a gas engineers' section, and a pottery section. The members of the committee representing the various industries should formulate the demands of their own industry. This will probably be best done by inviting opinions on the following lines:—(1) Materials at present in use, any general information as to analyses, &c.; (2) Conditions of use, nature of furnace operations, temperature, and whether the temperature is continuous or intermittent; (3) Criticism of materials at present in use; and (4) Suggestions as to improvement, both in material and in sizes and patterns available. The Ceramic Society section will deal with (1) the definition of refractoriness; (2) the grades of materials, based on (a) refractoriness; (b) class of material, aluminous, as clay and bauxite; siliceous, as ganister and silica; special, as magnesite, &c.; (3) the examination of raw materials, chemical analysis, standard methods, method of determining refractoriness, mechanical analysis, and behaviour at various temperatures, shrinkage, porosity, plasticity. The manufacturers' section will prepare suggestions as to elimination of odd and little used sizes and shapes, standard sizes and shapes, deviation from specified dimensions in special sizes, and as to the grading of clays as proposed by the English Ceramic Society.

Silicate melts. Greiner. See VII.

PATENTS.

Glass machine and process. E. L. Heintz, Coffeyville, Kans. U.S. Pat. 908,259, Dec. 29, 1908.

THE process consists in forming sheet glass by drawing a sheet from a molten mass of glass, supporting the sides of the sheet by applying guide rods to the extreme edges of the sheet, and heating these edges while allowing the body of the sheet to cool. The apparatus used consists of a crucible having openings in its bottom; a frame having depending side bars adapted to close these openings when lowered; rods secured to the lower ends of the bars and which can be drawn up through the openings when the frame is raised; and a bait between the rods.

—A. G. L.

Glass-furnaces. C. Royer. First Addition, dated Aug. 7, 1908, to Fr. Pat. 390,102, May 11, 1908 (this J., 1908, 1020).

A BAFFLE-PLATE is provided in the path of the flames, which keeps the latter longer in the neighbourhood of the central chimney, and so causes them to assume a higher temperature. The air used for combustion is also pre-heated to a greater extent than before, by causing it to traverse a second series of passages in the heated brick-work before it passes into the central shaft, whence it emerges to meet the gas in the furnace.—A. G. L.

Gas-kiln for firing and bending large plates of glass, firing china, and all kinds of enamels and ceramic ware; also applicable to other purposes. J. B. Payne, London. Eng. Pat. 27,501, Dec. 13, 1907.

A BRICK gas-kiln is provided with a bed-plate, consisting of an iron-tray, 3—4 in. in depth, filled with dry plaster of Paris. Angle-pieces provided with holes are attached to this bed-plate, the burners being attached to the angle-pieces, so that their upper ends always project one inch above the bed-plate. Between the bed-plate fitted with its angle-pieces and the walls of the kiln there is a clear space of $\frac{1}{2}$ in. The bed-plate is fixed on a carriage running on iron rails through one of the openings into the kiln; the bed-plate can be raised or lowered by means of worm gearing acting on four perpendicular screws fixed to the lower side of the bed-plate and worked by means of a handle fixed to the front of the carriage. The glass to be bent is placed on a mould of sheet-iron, which is placed on the bed-plate. Connection with the gas supply is made by flexible tubing. The bent glass is annealed in the same chamber after cutting off the gas-supply.

—A. G. L.

Ovens and kilns for drying or firing ceramic ware. A. Meakin, Ltd., and W. Jackson, Tunstall, Staffs. Eng. Pat. 26,189, Nov. 26, 1907.

THE patent refers to kilns fired with producer gas. The main gas flue is either carried round the outside of the kiln below the ground level, branches leading from this flue into each of the fire-mouths, or else it is taken directly to the middle of the kiln, below the ground level, and then made to enter a chamber out of which branch flues lead to the fire-mouths. The secondary air is admitted through flues passing under the bottom of the kiln radially toward the middle, and then returning to positions near the openings of the branch flues in the fire-mouths. The distinguishing feature is that the supply of gas and secondary air to each quarter of the kiln can be controlled, by dampers independently of a like supply to the other quarters.—H. H. S.

Ovens [for pottery]. Eng. Pat. 18,730. See I.

Kilns; Waste heat from —. Eng. Pat. 28,079. See I.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

The cement industry of the United States in 1908. E. C. Eckel. U.S. Geol. Survey. [T.R.]

ALTHOUGH detailed figures are not yet obtainable, an estimate based on the information available indicates that the production of Portland cement in the United States was somewhat less than forty million barrels. This compares as follows with the output of recent years:—1905, 35,246,812 barrels; 1906, 46,463,424 barrels; 1907, 48,785,390 barrels. The falling off from the 1907 output was heavy, and is particularly notable because it is the first decrease shown in any year by the American cement industry since its inception. The year 1909 opens with heavy stocks of cement on hand at most mills, but with good prospects for a steady, though slow, revival in the cement trade. It is unlikely that this revival will be sufficiently rapid to push mills to their capacity during the year. The total maximum capacity of existing plants is now about 60,000,000 barrels a year.

International Association for Testing Materials; Congress of —. See under X.

PATENTS.

Magnesia cement. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co., N.J. U.S. Pat. 909,171, Jan. 12, 1909.

THE cement consists of a dry, substantially non-hygroscopic powder composed of magnesium oxide and saline substances, e.g., alkali chlorides and magnesium sulphate. The cement reacts with water to form a hard translucent material containing magnesium oxychloride. Zinc oxide may be added to the cement.—A. G. L.

Hydraulic cements, etc.; Art of making —. W. H. Harding, Philadelphia, Pa. U.S. Pats. 908,092—908,094, Dec. 29, 1908.

CALCAREOUS rock and "cement rock" (clay, etc.) are charged into a vertical kiln of the Rosendale type, with a layer of coal for each layer of rock. The quantity of fuel used, and the rate of combustion, are proportioned so as to effect the calcination of two-thirds to nine-tenths of the rock. The calcined materials are ground, thoroughly mixed and burnt to cement in a rotatory kiln. Or else, the preliminary calcination of the raw materials may be effected in separate kilns; or, finally, only the calcareous rock may be calcined, the clay, etc., being only ground and dried, but not calcined, before the cement materials are mixed.—A. G. L.

Sand; Process for consolidating and rendering water bearing — water-tight by means of a "milk" of cement injected under high pressure. Compagnie des Mines de Béthune. Fr. Pat. 393,814, Nov. 5, 1907.

BORINGS in strata of water-bearing sand are rendered water-tight by injecting a mixture of water and cement into the sand from a narrow tube furnished with openings at the end, from which the cement mixture is projected under high pressure by means of a pump.—A. G. L.

Plastic compositions (cements, etc.); Preparation of —. W. F. Lake, London. From H. S. Spackman Engineering Co., Philadelphia. Eng. Pat. 19,110, May 9, 1908. SEE Fr. Pat. 390,194 of 1908; this J., 1908, 1021.—T. F. B.

Kilns; Waste heat from —. Eng. Pat. 28,079. See I.

Silicon carbide. U.S. Pat. 908,357. See X1A.

Waterproofing. U.S. Pats. 909,167 *et seq.* See X11A.

X.—METALS AND METALLURGY.

* *Steel; The structure of hardened —.* I. Formation and transformation of austenite. W. J. Kurbatow and M. M. Matwejew. Metallurgie, 1908, 5, 721–728.

THE authors propose to investigate the structure of hardened steel by a series of comparative papers which shall cover the ground. The present paper is a tentative attempt to examine the formation and transformations of austenite, which was chosen because its transformations can be carried out at a lower temperature and more gradually than is the case with the constituents of unhardened steel, and because it occurs in larger and better characterised crystals than do martensite, troostite, and sorbite, which also are present in hardened steel. To prepare austenite, Osmond's method was followed, on a small scale, steel containing 1.8–2.2 per cent. of carbon being heated to a temperature near its melting-point (1280° C.), and then quenched in mercury at not above 130° C. The authors summarise the conclusions at which they have arrived, partly from their own work, and partly from that of others, as follows:—The crystals of austenite are separated by needle-shaped crystals ("fers de lance") of troostite-sorbite, and by a network of troostite. On tempering, austenite probably changes into sorbite and troostite-sorbite, sorbite into pearlite. The old idea of transformation, austenite to martensite to troostite to sorbite to pearlite, the authors believe to be incorrect. The equilibrium, austenite \rightleftharpoons sorbite, changes from right to left at 90–150° C., and above 1000° C., and from left to right between 150° C. and 750° C., with a maximum at 250° C. There exist at least two compounds which are coloured by sodium picroate; on reheating, one changes more rapidly than the other into cementite or ferrite; if the transformation is rapid, the second compound changes into lamellated pearlite, if slow, into grains of pearlite. The first compound is to be regarded as troostite, the second as sorbite. Austenite itself is probably another carbide, of approximately the formula, $\text{Fe}_3\text{C}(\text{Fe}_3\text{C} \text{ to } \text{Fe}_{10}\text{C})$, which is stable above 1000° C., whilst the net-work of troostite is stable only below 250° C. Possibly, however, austenite is only a solution of carbon or carbide in γ -iron. Troostite and sorbite represent solutions of carbon in iron (α or β). Austenite heated to 65°–85° C. for 3 months suffers no change; even at 100° C. practically no transformation takes place; but at 118° C. a few days' heating suffices to produce noticeable effects. The transformations of steel proceed in distinct stages, and the same properties (capability of hardening, etc.) which render it valuable technically impede its investigation scientifically.

—A. G. L.

Manganese; Influence of — on the system, iron-carbon [steel]. F. Wüst. Metallurgie, 1909, 6, 3–14.

A NUMBER of iron-manganese-carbon mixtures were prepared: (1), by heating Swedish pig-iron containing 4.28 per cent. of carbon with manganese and sugar-charcoal in carbon crucibles in a "kryptol" electric

furnace, the melting points being observed; and (2), by heating the melts so obtained in magnesite crucibles in a Heraeus furnace at a temperature 10° C. above their melting-points for one hour. The magnesite crucibles were placed in iron tubes through which a stream of nitrogen was led, in order to protect the Marquardt-mass tubes of the furnace from destruction by the manganese, which volatilises appreciably even at the low temperatures used. It was found that addition of manganese regularly increased the quantity of carbon taken up, from 4.28 per cent. for the pig-iron containing 0.06 per cent. of manganese to 5.90 per cent. of carbon for a melt containing 80.45 per cent. of manganese. The melting-point dropped from 1132° C. for the pig-iron to 1124° C. for a melt containing 4.23 per cent. of manganese; from this point it remained almost constant until 13 per cent. of manganese was reached, after which the melting-point increased gradually to 1258° C. for a melt containing 80 per cent. of manganese. The influence of manganese on the pearlite arrest-point is more marked. Up to about 5 per cent. of manganese, each one per cent. added lowers this point about 20–25° C. on the cooling curve, and causes hysteresis (difference of the point as found on the heating and cooling curves) amounting to about 28° C. Beyond 5 per cent. of manganese the pearlite point disappears altogether. Manganese has little effect on the composition of the iron-carbon eutectic, 16 per cent. of manganese producing an eutectic with 4.05 per cent. of carbon or only 0.15 per cent. less than for the original pig-iron. This is contrary to Guillet's statement that 15 per cent. of manganese lowers the carbon content of the eutectic to 3.6 per cent. Manganese delays the separation of carbon as graphite, possibly because the iron-manganese carbides formed at high temperatures are more stable than the corresponding iron carbides; rapidly-cooled melts containing 50 per cent. of manganese approximated to the composition expressed by the formula, $(\text{Fe}, \text{Mn})_3\text{C}$. Microscopical examination of the melts confirmed the above results; the presence of manganese hinders the formation of pearlite, and favours that of troostite and of solid solutions. Melts with more than 5 per cent. of manganese contain no pearlite, and consist of a solid solution of carbides, martensite and cementite, in γ -iron.—A. G. L.

Gold extraction in Rhodesia. R. C. H. Cooke. J. Chem. Met. and Min. Soc., S. Africa, 1908, 9, 152–156.

THE ore at the Giant Mine in the Hartley district, a heavily mineralised chlorite schist, containing ironstone and quartz, is crushed and stamped, using 1250 lb. stamps and a $\frac{3}{4}$ to $\frac{1}{2}$ in. mesh screen. The duty per stamp reaches 15 tons per 24 hours, on account of the soft nature of the ore and the large apertures of the screens. The amalgamated plates, which are only 4 ft. long, retain 30 per cent. of the gold, the rest of the gold being "rusty" and not amenable to amalgamation. It is stated that the big tonnage and the coarseness of the pulp, does not injuriously affect the plates. After passing over amalgam traps, which collect about 400 oz. of amalgam per month, the pulp is de-watered in a "spitz" to a ratio of about one of water to one of sand, and the sands are crushed in a tube mill. The overflow from the de-watering "spitz" joins the discharge from the tube mill, and the whole is concentrated on the old type of blanket tables. These consist of a series of strips of material, 3 by $4\frac{1}{2}$ ft., resembling a military rug in texture, which are taken up and shaken in water, by hand, every half hour. The tailings coarser than 120-mesh are returned to the tube-mill for re-grinding. The concentrates, amounting to about 4 to 5 tons per day, and containing about 55 per cent. of the assay value of the ore, are re-concentrated on blanket tables to about a tenth. These final concentrates are rotated in amalgamation barrels with 300 c.c. of nitric acid for 4 hours, to clean the "rusty" gold; mercury is then added, and complete amalgamation attained in another four hours. Any gold remaining in the tailings is removed by passing the latter over an auxiliary blanket table and two sets of canvas tables, the final tailings running to waste, assaying under 1 dw. An extraction of nearly 88 per cent. of the total gold is attained, at a present cost of five shillings per ton. A diagram is given showing the arrangement of the plant.—F. R.

Gold-lead bullion; Cupellation of —. G. Melville. J. Chem. Met. and Min. Soc., S. Africa 1908, 9, 157—158.

A DETAILED description is given of the method of making the Mabor "tests" in use on the Crown Reef Mine, Transvaal. The "breast" of the "test" is composed of 60 lb. of new "mabor," a patent composition of magnesia, 30 lb. of Portland cement, and 30 lb. of crushed firebrick; the body consists of 150 lb. of used "mabor" assay cups, 75 lb. of cement, and 75 lb. of crushed firebrick. The materials are all ground to pass a 40-mesh (linear) sieve, and thoroughly mixed with 12 per cent. of water. The "tests" are tamped for $\frac{3}{4}$ hour, and then carved out and the litharge channels made. The life of these "tests" varies, but in one case, 15 cupellations were made and a total of 520 bars of 1000 oz. each cupelled in the one "test." A new "test" should not be used for 4 or 5 months, but, when required, it is fitted into an ordinary cupel furnace, two lead-gold bars are placed in it, and the temperature is very slowly raised. The lead-gold bullion is fed in, until the bath nearly reaches the litharge channel, the blast being then turned on, and when sufficient litharge is formed, the feed is continued until the litharge overflows. Three and a half 1000 oz. bars can be cupelled per hour. After all the lead-bullion has been fed in, the temperature is raised, and the "test" gradually tipped forward until all the lead is oxidised and blown off. The gold is then subjected to a higher temperature and a reduced blast, to eliminate as much of the remaining base metal as possible. The cupel "test" is finally lowered from the furnace and the gold removed.—F. R.

Detinning of tin-plate and its technical importance. K. Goldschmidt. Stahl u. Eisen, 1908, 28, 1919—1926.

IN the author's process of detinning (this J., 1907, 22) the scrap is packed tightly into baskets which are placed mechanically in closed vessels. The vessels are cooled and chlorine pumped in at a pressure of 4 atmospheres until the pressure remains constant, when chlorine and stannic chloride are removed from the vessels by suction. The residual iron is washed with water to remove the thin film of ferric chloride formed, which, if allowed to remain, causes rapid rusting of the iron. Lately, the demand for pure scrap-iron has led to the treatment of used tins, besides that of scrap proper. Before detinning, the tins must be carefully freed from moisture, organic matter, and solder (this J., 1907, 99). At present, about 75,000 tons of tin-plate are detinned yearly in Germany; in the rest of Europe about 25,000 tons and in the United States about 60,000 tons are dealt with per annum, yielding altogether 3000—3500 tons of tin yearly. The scrap-iron so obtained in Germany is approximately equal in quantity to that imported into that country.—A. G. L.

Ferrosilicon. G. W. Gray. Times Eng. Suppl., Jan. 27, 1909. (See also this J., 1904, 324. Also Dupré and Lloyd, this J., 1904, 622. Further see this J. 1906, 817; and 1909, 25.) [T.R.]

IN a letter on the dangers of ferrosilicon, the writer points out that only the 50 per cent. variety has, up to the present, caused trouble. Ferrosilicon made in the blast furnace and containing only a comparatively low percentage of silicon is quite safe to carry, as is the electrically made alloy containing up to, say, 40 per cent. of silicon, and also the alloy containing above, say, 60 per cent. of silicon up to 99 per cent., the only quality which need be looked upon with suspicion being that containing between, say, 40 and 60 per cent. of silicon, and even then only when it is made at certain works. This badly made alloy is dangerous to carry under any circumstances, and if packed, as has been suggested, in hermetically sealed iron drums, the danger of explosion would only be increased.

Bearing metals; The problem of —. S. K. Patteson. Electrochem. and Met. Ind., 1909, 7, 21—22.

THE increase of speed of modern heavy machinery has caused the subject of bearing metals to be one of great importance. The chief obstacle to the development of the turbine lies in the difficulty of securing proper bearing surfaces. Much of the bearing metal in use is sold under trade names, and little data is available as to the exact

composition of those alloys found most suitable for special requirements. Of all the commoner metals, lead has the greatest anti-frictional properties owing to the ease with which it "flows" under pressure, any inequality or damage of the surface of the bearing being rapidly equalised, thereby distributing the pressure over the largest surface and reducing the possibility of overheating. This property of readily flowing, however, prevents its use for heavy machinery as it cannot be retained in the recesses of the bearings, and a certain proportion of other material is necessary to give it stability. The following table gives approximately the percentage composition of the chief bearing metals on the market.

Alloys.	Lead.	Tin.	Anti-mony.	Copper.	Zinc.
Babbitt 1	80.0	20.0	—	—	—
Babbitt 2	72.0	21.0	7.0	—	—
Babbitt 3	70.0	10.0	20.0	—	—
Babbitt 4	80.5	11.5	7.5	—	—
Babbitt 5	0.5	68.0	—	1.0	31.5
Babbitt 6	—	20.0	—	—	80.0
Babbitt 7	—	86.0	10.0	4.0	—
White metal	82.0	—	12.0	6.0	—
White brass	—	64.0	—	2.0	34.0
"Magnolia metal" ..	80.0	4.75	15.0	trace	(14, 0.25)
"Car brass lining" ..	80.5	11.5	7.5	0.5	—
"Ajax" plastic bronze ..	30.0	5.0	—	65.0	—
"Ajax metal"	11.5	11.5	—	77.0	—
P.R.R. Car brass ..	15.0	8.0	—	77.0	—
"S. bearing metal" ..	9.5	10.0	—	70.7	(P, 0.8)
"Delta metal"	5.1	2.4	—	92.4	(Fe, 0.1)
"Carmelia metal" ..	14.8	4.3	—	70.2	10.2
					(Fe, 0.5)
					(Na, 1.3)
Tempered lead ..	98.5	0.08	0.11	—	—

The more lead a bearing metal contains the better are its anti-frictional qualities but also the softer and less resistant it is to compression. In order to combine strength with anti-frictional properties, bearings composed of iron or steel grids filled with a soft bearing metal have been tried.—F. R.

Magnesium-silicon alloys. R. Vogel. Z. anorg. Chem., 1909, 61, 46—53.

THE results of the thermal and microscopic study of the alloys indicates the existence of one compound, Mg_2Si , m.pt. $1102^\circ C$; this forms with silicon and with magnesium, eutectics melting at about 950° and $645^\circ C$, and containing 42 and 96 per cent. of magnesium respectively.—A. S.

Silicon; Alloys of — with tin, lead, and thallium. S. Tamaru. Z. anorg. Chem., 1909, 61, 40—45.

THE commercial silicon used contained 6.08 per cent. of iron and 1.74 per cent. of aluminium. Silicon and tin are miscible in all proportions in the liquid condition; no compounds are formed. Silicon is not miscible with lead or with thallium in the liquid condition.—A. S.

Cobalt and bismuth; Alloys of —. F. Duclleiz. Bull. Soc. Chim., 1909, 5, 61—62.

A STUDY of the alloys of cobalt and bismuth shows that these metals do not combine when heated together in an atmosphere of hydrogen, and that the liquid metals are only miscible within narrow limits. Prolonged heating of the alloys at $1400^\circ C$ results in complete elimination of the bismuth by volatilisation, pure cobalt remaining.—F. SONN.

International Association for Testing Materials; Congress of —. [T.R.]

THE fifth Congress of the International Association for Testing Materials will be held in Copenhagen in September, 1909. The principal questions to be discussed are divided under three heads:—

(a) Metals; (b) Cements; (c) Miscellaneous.

Among the more important problems are the following:—

(1) How to introduce international specifications for testing iron and steel.

(2) To establish methods for determining the uniformity of shipments of iron and steel, and to study how the ball-pressure tests can be used for piece-tests.

- (3) To establish uniform methods of testing cast iron.
- (4) To study the principles for specifications of copper.
- (6) The relation of chemical composition and weathering qualities in building stones; the action of smoke and sulphur dioxide on building stones; the weathering qualities of slates.
- (7) Rapid methods for determining the strength of cements.
- (8) Methods for determining the value of puzzuolanas for mortars.
- (9) Methods for determining the beginning and duration of the setting of cements.
- (10) The simplest method of separating the finest particles in Portland cement by liquid and air processes.
- (11) The behaviour of cements in sea water.
- (12) Accelerated tests of the constancy of volume of cements.
- (13) Influence of the proportion of water and sand on the strength of Roman and other cements.
- (14) Investigation of reinforced concrete.
- (15) Uniform tests of cements by prisms, and determination of a standard sand.
- (16) Method of testing the protective power of paints on metallic structures.
- (17) Uniform nomenclature of iron and steel.
- (18) Uniform definition and nomenclature of the bitumens.
- (19) Methods of testing caoutchouc.
- (20) Principles of specifications of oil for technical purposes.

Particulars may be obtained from the Iron and Steel Institute, Victoria Street, Westminster, S.W.; Prof. E. Marburg, American Society for Testing Materials, Philadelphia, Pa., U.S.A.; and Prof. W. H. Warren, University of Sydney, N.S.W.

Papers, which should not exceed eight octavo pages, should be sent in without delay to the General Secretary of the Association, Nordbahnstrasse 50, Wien II., Austria.

Mineral and metal production of the United States in 1908.

Eng. and Min. J., Jan. 9, 1909. [T.R.]

THE following table summarises the estimated production of the more important minerals and metals in the United States in 1908, so far as it has been possible to collect the statistics at so early a date. The figures for copper, lead, and spelter are based on reports received directly from the producers, who have communicated their actual output during the first 11 months of the year, together with their estimates of probable production in December; in many cases the estimates are for the last few days of December only. The other statistics are based chiefly on the reports of producers, State mine inspectors, and special correspondents:—

Uranium and euallium; Determination of —. Engle. See XXIII.

Determining copper. Hawley. See XXIII.

Antimony and tin; Gravimetric determination of —. Cohen and Morgan. See XXIII.

Silicate melts. Greiner. See VII.

PATENTS.

Metals; Coating of —. F. Plathner and V. Dorn, Berlin. Eng. Pat. 92, Jan. 1, 1908. Addition to Eng. Pat. 15,535 of 1906.

A MIXTURE, composed of powdered tin or lead, or some alloy having a lower melting point than lead, with a deoxidising substance and a neutral liquid, such as water or alcohol, is placed on the sheet of metal to be coated. Rolls, heated to a temperature sufficient to melt the metallic coating powder, are applied and a coating is produced and smoothed simultaneously. The rolls must be made of some material, such as aluminium, to which the coating does not adhere. Wire is coated by being electrically heated to a temperature above the melting point of the coating powder and then passing it rapidly through a bath of the coating mixture kept cool by suitable means. The wire is "finished" by passing it through a vessel packed with asbestos.—F. R.

Metals [zinc, etc.]; Process of coating with —. C. H. Zieme, Assignor to G. L. Patterson, W. R. Kinnear, and C. W. Johnson, New Castle, Pa. U.S. Pat. 909,274, Jan. 12, 1909.

A METAL is coated with a number of other metals (amongst which zinc predominates), by heating the metal after applying to its surface a slip consisting of a liquid mixed with 10 per cent. of a finely divided inert substance and 90 per cent. of a mixture of 95 per cent. of partially oxidised zinc with 5 per cent. of other metallic oxides.—A. G. L.

Zinc; Extraction of — from ores by the precipitation process. A. H. Imbert, Grand-Montrouge, France. Eng. Pat. 13,492, June 25, 1908.

BLENDE, or other ore, is fused with iron peroxide in a closed vessel, and cast iron, preferably molten, added. Heat is applied externally, care being taken to protect the mixture from contact with the air. The zinc is vaporised, and is collected in condensers, the iron being subsequently recovered from the residue. Oxidised zinc ores are first mixed with an equal weight of blende and then treated as described above.—F. R.

		1907.		1908.	
Product.	Unit.	Quantity.	Value.	Quantity.	Value.
			Dollars.		Dollars.
<i>Non-metallic—</i>					
Coal, bituminous	Short ton	388,222,868	463,654,776	338,688,000	390,103,984
Coal, anthracite	Short ton	86,341,832	198,653,218	80,280,000	184,682,317
Iron ore	Long ton	52,055,070	117,560,255	34,202,000	61,563,100
Limestone flux	Long ton	15,722,801	7,480,121	9,650,000	3,860,000
Petroleum.....	Barrel	164,377,030	123,260,948	184,734,678	131,770,288
<i>Manufactured—</i>					
Coke	Short ton	36,093,622	99,055,150	22,697,000	53,926,887
Copper sulphate	Pound	44,867,650	2,804,228	45,144,000	2,198,513
“Lead, sublimed white”	Short ton	8,700	1,026,600	9,100	973,700
Zinc oxide (a)	Short ton	85,390	7,731,100	65,100	5,876,040
<i>Metallic—</i>					
Copper	Pound	879,241,766	181,660,142	952,395,477	127,849,569
Gold	Oz. fine	4,375,215	90,435,700	4,650,562	96,313,256
Iron, pig.....	Long ton	25,442,013	580,077,896	15,828,000	268,284,600
Lead	Short ton	350,130	37,288,845	323,841	27,202,644
Mercury	Flask	20,932	780,566	20,000	840,000
Silver	Oz. fine	56,514,700	34,910,358	51,798,053	27,382,523
Zinc	Short ton	249,012	29,763,735	207,735	10,635,112

(a) Includes zinc-lead pigment.

Extraction apparatus [for ores or slimes]. C. M. Chamberlain, Pueblo, Colo. U.S. Pat. 899,512, Sept. 29, 1908.

THE apparatus, which is intended for the treatment of crushed ores or slimes, consists of a barrel containing a number of longitudinal filter-trays. The pulp is admitted through an upper inlet having an auxiliary inlet for the solvent liquid, water, etc., into a distributing chamber which communicates by separate inlets with the compartments formed by the filter-trays. The inlets are provided with seals to determine the depth to which each compartment shall be filled. The filtered liquid is discharged from the lower portion of each tray by means of branch pipes connected with a main outlet. The cakes on the filter-trays are loosened by forcing water upwards through the discharge pipes and then removed by detaching the discharge end and tilting the barrel.—O. F. H.

Matte or speiss; Art of separating metals from —. A. J. Wadhams, Riverton, N.J., and R. C. Stanley, New Brighton, N.Y., Assignors to Internat. Nickel Co., Bayonne, N.J. U.S. Pats. 900,452—900,454, Oct. 6, 1908.

ARSENICAL matte or speiss containing silver, nickel, cobalt, and iron is subjected to alternate reducing and oxidising roasts to remove most of the arsenic. The remaining arsenic is then removed by roasting with sodium nitrate and soda ash and dissolving out the sodium arsenate so formed. The residue is then treated with hydrochloric acid by which iron, nickel, and cobalt are dissolved, leaving most of the silver in the metallic state or as chloride. Iron is then removed from the solution by caustic lime, and silver together with any copper precipitated with hydrogen sulphide. Or, after roasting to remove most of the arsenic, the material is crushed and treated with boiling sulphuric acid of about 35° B., which dissolves a large proportion of the silver and some of the copper, nickel, and cobalt. The silver is deposited on copper and the solution neutralised with caustic soda and evaporated until nickel and cobalt sulphates crystallise out. The crystals are then calcined and the resulting oxides dissolved in hydrochloric acid, and the iron precipitated with lime, leaving a solution containing chlorides of copper, nickel, and cobalt, together with a small quantity of silver chloride which had escaped deposition on the copper.—O. F. H.

Chromiferous pig-iron; Process for manufacturing steel from —. F. D. Carney, Assignor to the Pennsylvania Steel Co., Steelton, Pa. U.S. Pat. 902,052, Oct. 27, 1908.

CHROMIFEROUS pig-iron containing 2—40 per cent. of chromium is blown preferably in an acid-lined converter, the temperature of the metal being kept as low as possible by charging scrap into the converter or by admitting steam with the blast. The blown metal, containing a small quantity of chromium, may then be recarburised and cast, or it may be transferred to a basic-lined open-hearth furnace where the remaining phosphorus and chromium are removed. The open-hearth furnace is charged previous to the addition of the molten metal from the converter with a small quantity of basic material and pig-iron in order to produce a "boil."—O. F. H.

[Iron] ores; Process of reducing —. G. L. Fogler, Pittsburg, Pa., Assignor to Fogler Heat and Reduction Co., Tacoma, Wash. U.S. Pat. 908,234, Dec. 29, 1908.

IRON ores containing silica are fused in a furnace under reduced pressure. The iron silicate so produced is treated in the same, or another furnace, with glass fluxes and a reducing agent, for the separation of the iron.—F. R.

Armour plates for ships, and other objects of steel or of steel alloys; Cementation process for making —. G. Ansaldo Armstrong and Co. Fr. Pat. 393,355, Aug. 10, 1908.

PLATES of mild steel are given a superficial layer rich in carbon by heating them in compressed carbonaceous gases. Thus, a highly carburized layer 8—9 mm. thick may be obtained by heating mild steel plates at 1100° C. for less than 12 hours in carbon monoxide gas under a pressure of 4

atmospheres. The plates may be surrounded with solid carbonaceous cementing material, and may afterwards be subjected to the usual thermal and mechanical treatment.—A. G. L.

Steel; Process of making an improved —. W. Sauntry Metals Co. Fr. Pat. 393,452, Aug. 18, 1908.

STEEL is heated somewhat above its critical temperature, and is quenched in a liquid capable of evolving chlorine. It is next heated slightly below its critical temperature, and quenched in the same liquid. It may be heated a third time, again to a point below its critical temperature, and quenched as before. It is claimed that a very even, fine-grained steel results, possessing increased tenacity and elasticity. The quenching liquid may be composed of 4.5 litres of water, 124 grms. of sodium chloride, 124 grms. of ammonium chloride, 10 c.c. of chlorine water ($\text{Cl} + 10\text{H}_2\text{O}$), 0.1 gm. of magnesium chloride, and 0.08 gm. of hippuric acid. Or, the hippuric acid may be replaced by uranium oxide, and hydrochloric and nitric acids added.—A. G. L.

Cast iron; Reducing the carbon content of —. R. Schiessl. Ger. Pat. 205,210, June 6, 1907.

THE cast iron is melted in a cupola furnace and sodium hydroxide is melted in an adjacent retort, and the two liquids are then allowed to flow, in regulated quantities, into a refining hearth. The alkali reacts with the carbon of the iron to form carbonate. The residual metal can be cast, the carbon left in it being in the form of pearlite.—A. S.

Metallurgical condenser, and method of condensing volatile metals. W. McA. Johnson, Hartford, Conn. U.S. Pats. 902,534 and 902,535, Oct. 27, 1908.

THE apparatus, which is intended more particularly for the condensation of zinc vapour, consists of a condensing chamber in which are a number of shallow horizontal troughs, at different levels, filled with molten zinc. As the zinc condenses, it overflows from trough to trough, thus giving a largely increased condensing surface, and is finally ladled out from the reservoir at the bottom of the condensing chamber. The troughs are supported on flues through which hot gases may be passed to regulate the temperature of the molten metal. The uppermost flues and troughs are provided with exterior basins guarded by seals, so that, if necessary, metal may be transferred to them from the reservoir in order to maintain a constant stream of molten metal from top to bottom of the condensing chamber. The metallic vapour is admitted at the upper end of the condensing chamber and the residual gases escape by an outlet at the bottom.—O. F. H.

Reduction-furnace [for the reduction of tungsten trioxide, etc.]. C. Van Brunt, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 903,922, Nov. 17, 1908.

THE furnace consists of a number of horizontal combustion tubes, placed parallel to one another, the end of each tube being connected to the beginning of the next, by means of return pipes which serve as gas-drying chambers and contain a suitable drying agent; the ends of the combustion tubes are water cooled. A gas heater is situated at right angles to, and immediately below the tubes, and is slowly advanced along the length of the tubes simultaneously. The oxide to be reduced is placed in long "boats" in the tubes and hydrogen gas is circulated through the apparatus. Heat is then applied simultaneously to the ends of the tubes and gradually advanced as reduction proceeds, the water vapour produced being absorbed in the drying chambers.—F. R.

Furnace [; Metallurgical —]. J. P. McLimans, New York. U.S. Pat. 908,311, Dec. 29, 1908.

THE downcomer flue of a regenerative furnace for metallurgical and other purposes is terminated below by shoulders or projections, under which is run a car, adapted to receive flue-dust, etc. Shafts and cams are provided for raising the car into contact with the shoulders and so closing the flue and making a tight joint.—F. R.

Metals and alloys; Reduction process for producing — G. O. Seward and F. von Kugelgen, Holcombs Rock, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 908,154, Dec. 29, 1908.

METALLIC oxides, etc., are reduced and then alloyed by mixing them with a powdered brittle alloy, consisting of an alkaline-earth metal and some other metal, and "heating such mixture to ignition."—F. R.

Alloy [of platinum metals]. J. F. Clapp, Los Angeles, Cal. U.S. Pat. 909,283, Jan. 12, 1909.

THE alloy consists of iron (40–90 per cent.), iridium (1–30 per cent.), and platinum (0.2–14 per cent.), the percentage of iron being greater than that of iridium or platinum. Metals capable of facilitating solution of the iridium and platinum in molten iron may be added, e.g., molybdenum, or molybdenum, copper, and nickel.—A. G. L.

[Copper] ores; Process of reducing — J. Herman, Lincoln, Nebr. U.S. Pat. 909,795, Jan. 12, 1909.

METALLIC copper is produced by treating copper ores with hot reducing gases given off on burning carbonaceous fuel. The copper is extracted by means of a chloride solution, which is then electrolysed so as to yield metallic copper at the cathode and to regenerate the chloride solution at the anode.—A. G. L.

Brass; Process for "tempering" — C. A. Perrin, Fr. Pat. 393,629, Oct. 30, 1907.

THE brass to be "tempered" is heated to a cherry-red heat, and then plunged into a large quantity (100 litres) of a liquid containing copper sulphate, to which other substances may also be added. A suitable composition for the quenching liquid is: Copper sulphate, 250 grms.; plumbago, 100; gum arabic, 250; borax, 200; and magnesium sulphate, 200 grms.; "dissolved" in 10 litres of water.—A. G. L.

[Tin] Metal; Process for the treatment, fusion, and detection of — from stanniferous products of all kinds, especially from the finely-divided metal obtained by electrolytically detinning tin-plate. H. Mennicke, Fr. Pat. 393,364, Aug. 14, 1908. Under Int. Conv., July 10, 1908.

THE finely divided tin obtained by electrolytically stripping tin-plate is compressed into metallic grains by agitation under water in a vessel provided with an internal agitator, and to which fresh water is continually supplied to wash away the alkaline liquid originally adhering to the metal. After about 2 hours, the heavy grains of tin are separated from the light dross and from the liquid, and are stored under oil. They are next mixed with 5 per cent. of anthracite free from sulphur and ash, or with charcoal, and with 20 per cent. of sodium carbonate, and are fused in a small crucible furnace, the temperature after the first half-hour being raised to 1000° C. for 15 minutes, and then kept at 750–800° C. for another half-hour. The escaping gases are washed with water to condense the small amount of tin volatilised. The slag is dissolved in hot water, the solution containing sodium stannate is filtered, and stannic hydroxide precipitated by a current of carbon dioxide. After filtration, sodium hydroxide is regenerated in the liquid by treatment with lime, and is used for the electrolysis of a fresh batch of tin-plate.—A. G. L.

Cinders, slags or other fused materials; Process for mixing reagents or other substances with — Société des Chèvres de France, Fr. Pat. 393,813, Nov. 6, 1907.

FINELY divided materials are injected into fused substances issuing from a furnace by means of a blast issuing from a tuyère. Thus, e.g., ground sand may be mixed with the slag from a copper furnace, in order to yield a material suitable for the manufacture of high-grade ferro-silicon or other silicon alloy.—A. G. L.

Ores and other materials; Metallurgic treatment or smelting of — K. Birkeland, Christiania. Eng. Pat. 913, Jan. 14, 1908.

SEE FR. Pat. 386,059 of 1908; this J., 1908, 756.—T. F. B.

Steel from chromiferous pig iron; Process for manufacturing — F. D. Carney, Steelton, Pa., U.S.A. Eng. Pat. 16,093, July 29, 1908. Under Int. Conv., Aug. 28, 1907.

SEE U.S. Pat. 902,052 of 1908; preceding.—T. F. B.

Metallic plating, coating, or fouling from metallic or other surfaces; Removal of — T. R. Bayliss, Northfield, W. R. Hodgkinson, Blackheath, J. H. Harcastle, Lee, A. H. Coote, Westcombe Park, and R. A. E. Payne, Edgbaston, Assignors to King's Norton Metal Co., Ltd., London. U.S. Pat. 908,937, Jan. 5, 1909.

SEE FR. Pat. 387,117 of 1908; this J., 1908, 818.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(1.)—ELECTRO-CHEMISTRY.

Ozone; Formation of — at rotating anodes. F. Fischer and K. Bendixsohn. Z. anorg. Chem., 1909, 61, 13–39.

IT has been shown previously (this J., 1907, 156, 208) that by the electrolysis of sulphuric acid, using special platinum electrodes, in which only a narrow strip of the metal is exposed, the remainder being covered with glass, oxygen containing 23 per cent. by weight of ozone can be obtained by cooling the interior of the electrodes with water of 13° C., and containing 28 per cent. by cooling with calcium chloride solution at –14° C. The present authors have tried the effect of using rotating electrodes. Three kinds of electrodes were tried:—(1), wire electrodes, in which two fine platinum wires were sealed into projections on a glass stem; (2), roller electrodes, in which pieces of platinum foil were sealed into the opposite sides of an enlargement at the end of a glass stem, somewhat of the form of a thermometer bulb; (3), disc electrodes, in which a circular piece of platinum foil was sealed between two glass discs, and the whole sealed on to the end of a glass stem at right angles to the axis; in one case the exposed strip of the foil was continuous, but in another, gaps were made. In all forms of electrodes, the glass stems were hollow and filled with mercury, by means of which contact was made. The results of experiments with these electrodes showed that higher yields of ozone were obtained with rotating than with fixed wire electrodes. With the foil electrodes, on the other hand, higher results were obtained when the electrodes were at rest than when they were rotated. The most important condition for the attainment of high yields appears to be that the exposed portion of the platinum be extremely thin. In one experiment with a disc foil electrode, in which gaps had been cut in the exposed strips of platinum, oxygen containing 23.4 per cent. by weight of ozone was obtained without special cooling.—A. S.

Benzoic acid; Conversion of — into salicylic acid [by electrolysis]. G. Bargellini and G. Inghilleri. Rend. Soc. Chim. di Roma, 1908, 6, 333–334.

SALICYLIC acid was produced by subjecting to electrolysis with a current of 8 volts, a solution of 10 grms. of benzoic acid in 75 c.c. of acetic acid and 300 c.c. of water. Electrolysis was effected in a glass beaker on the bottom of which was a layer of mercury of 78 sq. cm. area, which served as cathode; the anode consisted of a piece of platinised platinum foil of 7 sq. cm. area. The most favourable temperature was found to be 50°–60° C.; below 50° C. little or no salicylic acid was formed, whilst above 60° C. a red resin was produced, which adhered to the anode. Under similar conditions, salicylic acid yielded a compound, melting about 200° C., probably a dihydroxybenzoic acid; phthalic acid also yielded probably a dihydroxy-derivative.—A. S.

Reducing benzoic and salicylic acids. Mettler. See XX.

Regulations, dated Dec. 23, 1908, for the generation, transformation, distribution, and use of electrical energy in premises under the Factory and Workshop Acts, 1901 and 1907. Statutory Rules and Orders, 1908. No. 1312. (Price 1d.)

PATENTS.

Insulating and other purposes; Manufacturing artificial plates for —. E. Weidinger, Höchst, and H. Kahn, Frankfurt a/M, Germany. Eng. Pat. 28,117, Dec. 20, 1907.

BASIC materials, such as finely-ground china clay and disintegrated asbestos, are brought to a plastic condition by the addition of a solution of water-glass, with or without a small quantity of an anhydrous binding medium, such as indiarubber solution. Powdered stone, or an appropriate colouring material, may be added to the basic substances employed, in order to increase the density of the finished material. The water-glass solution, and also any moisture contained in the basic materials, acts upon the clay and asbestos, forming hydrated silicates, without the employment of heat, thus producing an insulating substance free from pores.—B. N.

Insulating composition; Solid —. Standard Varnish Works. Fr. Pat. 393,217, Aug. 11, 1908.

THE material, which is not attacked by mineral oils, is composed of castor oil, a fossil gum, such as kauri gum, and rosin.—O. F. H.

Electrolyte. E. C. Broadwell, Assignor to J. W. Meaker, jun., Chicago, Ill. U.S. Pat. 905,837, Dec. 8, 1908.

THE electrolyte consists of a solution of an inorganic salt and a carboxylic sulphonic acid salt of the metal to be deposited, e.g., zinc sulphate and zinc naphthalenedisulphonate. The electrolyte may also contain a salt of a metal to alloy with the metal deposited.—O. F. H.

Pigments by electrolysis; Art of producing —. E. D. Chaplin, Boston, Mass., Assignor to International Lead Companies. U.S. Pat. 906,102, Dec. 8, 1908.

LEAD is dissolved in an electrolytic cell in which the electrolyte is separated by electrolysis into a solvent of lead and an alkali hydroxide. An oxidising agent is added to prevent the formation of insoluble salts of lead, and the lead solution withdrawn. The alkali hydroxide is also withdrawn and converted into carbonate, which is used to produce white lead directly from the lead solution.—O. F. H.

Lead salts by electrolysis; Art of producing —. E. D. Chaplin, Boston, Mass., Assignor to International Lead Companies. U.S. Pat. 906,103, Dec. 8, 1908.

LEAD ore or impure lead is made the anode of an electrolytic cell, the lead and other metals passing into solution in the electrolyte in the presence of an oxidising agent to prevent the formation of insoluble lead salts. The electrolyte is continuously withdrawn, the metals other than lead recovered in metallic form by contact deposition, and the lead converted into the desired lead salt, e.g., precipitated as lead carbonate.—O. F. H.

Electrolytic apparatus. E. D. Chaplin, Boston, Mass., Assignor to International Lead Companies. U.S. Pat. 906,104, Dec. 8, 1908.

A NEUTRAL solution (electrolyte) passes from a storage tank to a series of electrolytic cells at a lower level. The solutions from the anode and cathode compartments of the electrolytic cells are discharged into two storage tanks at a still lower level, and thence pumped up to two tanks above the neutral solution tank. The anode and cathode solutions then pass to precipitating vessels which have outlets to a filter tank and to the neutral solution tank.—O. F. H.

Silicon; Method of producing —. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 908,130, Dec. 29, 1908.

CRUDE silicon, containing silicon carbide, is purified by maintaining it in a fused state in an electric furnace on a bed of silica, thus oxidising the carbon and reducing some of the silica. The same furnace is previously employed for preparing the crude silicon.—F. SOBX.

Silicon carbide; Method of producing —. F. J. Tong, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 908,357, Dec. 29, 1908.

THE process consists in embedding an electric resistance conductor in a porous charge of silicious and carbonaceous material, initially heating the charge by the passage through it of heated gases or by the combustion of an excess of carbon in it by means of oxidising gases, and then further heating the charge sufficiently to produce silicon carbide by passing a current through the resistance.—F. SOBX.

Electric furnace. P. L. T. Héroult, La Praz, Assignor to Soc. Electro Metallurgique Française, Froges, France. U.S. Pat. 908,407, Dec. 29, 1907.

THE electrode for the furnace passes through a stuffing-box provided with a packing of loose granular conducting material, and enlarged towards its outer end so that the withdrawal of the electrode tends to loosen the packing. Means are provided to pass a current through the stuffing-box to the electrode.—A. G. L.

Alkali-metal amalgams; Apparatus for decomposing — [electrolytically]. C. F. Carrier, jun., Elmira, N.Y. U.S. Pat. 908,545, Jan. 5, 1909.

THE apparatus comprises a vessel containing the amalgam, an electrolyte in contact with the amalgam, and a body of graphite, consisting of a number of spaced plates, in contact with the amalgam and the electrolyte. The bottoms of the plates are recessed, and an inlet for the amalgam, and an outlet for the mercury, are arranged on opposite sides of the plates. Metallic weighting and spacing bars are bolted between the tops of the graphite plates, and assist in making contact between the plates and the amalgam.—B. N.

Circulating-pump for electrolytic cells. C. F. Carrier, jun., Elmira, N.Y. U.S. Pat. 908,546, Jan. 5, 1909.

A MERCURY conduit extends between the decomposing and oxidising compartments of an electrolytic cell having a mercury cathode, the conduit being provided with "a pump-well," or casing, "opening upwardly from the conduit," and containing a "rotor," the conduits, casing, and "rotor" consisting of non-metallic material, such as vitrified earthenware. The "rotor" is less in diameter than the well, the former "comprising a cylinder having substantially radial vanes projecting from its lower surface and terminating at the periphery of the cylinder."—B. N.

Ozone; Apparatus for preparing —. D. E. Parker, Niagara Falls, N.Y. U.S. Pat. 909,017, Jan. 5, 1909.

THE ozone is prepared by electrolysing molten sodium peroxide which is fed from a hopper provided with a worm feed into a hot-water jacketed melting pot, into which the electrodes conveying the current dip. The pot is supported on trunnions so that it can be tilted, to discharge the molten contents, and the hopper is supported on a bracket, above the pot and can be moved aside, when it is desired to tilt the pot.—W. H. C.

Ozone; Apparatus for the generation of —. Cie. pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. First Addition, dated Aug. 14, 1908, to Fr. Pat. 380,713, July 24, 1907.

THE transformer, mounted on a suitable board which may be attached to a wall, may have an iron-clad or open core, the ends of the latter being expanded into a fan-like form. The electrodes, which are mounted in front of the board and below the transformer, consist of an inner metallic sheet, attached to a separating sheet of glass, and metallic gauze.—B. N.

Galvanic cell. C. F. G. A. Heil. First Addition, dated July 3, 1908 (under Int. Conv., June 11, 1908), to Fr. Pat. 392,429, July 1, 1908 (this J., 1909, 28).

THE mercury compounds used in the composition of the galvanic cell may be partly replaced by manganese dioxide.

The following is given as a suitable mixture—30 parts of manganese dioxide, 20 parts of mercury sulphate, 3 parts of mercury oxide, and 14 parts of graphite.—O. F. H.

Galvanic cell which becomes active on warming. J. Spiliotopol. Ger. Pat. 205,089, July 9, 1905.

THE cell has a tin cathode and a carbon anode, with chromium chloride solution as electrolyte, and a mixture of amorphous carbon, graphite, and manganous chloride, saturated with water, as depolariser. On warming, hydrochloric acid is produced by the action of water on the manganous chloride, manganese monoxide being also formed. In presence of water, hydrochloric acid interacts with both manganous chloride and manganese monoxide, with production of hydrated manganese peroxide and chlorine; there are thus two depolarising agents available.—A. S.

Electrodes containing powdered metals; Manufacture of —. C. Cornaro. Fr. Pat. 393,311, June 26, 1908. Under Int. Conv., June 27, 1907.

ELECTRODES of large radiating surface and very high specific resistance are made by preparing an intimate mixture of carbon, finely divided metal, such as aluminium or nickel, and metallic oxides or salts, such as oxides of magnesium, calcium, or manganese. The mixture is made into a paste with a solution of dextrin or other binding agent and pressed into plates or other forms under a pressure of about 200 atmospheres, the pressure being regulated to give the required specific resistance. The plates so formed are then heated to drive off the water and decompose the dextrin, and when cold submitted to a pressure equal to that previously employed.—O. F. H.

Conducting material; Composition and manufacture of a — of high electrical resistance. W. A. Phillips and F. R. Bacon. Fr. Pat. 393,430, Aug. 18, 1908.

THE conducting material consists of a non-conducting, fire-proof base such as clay, mixed with Portland cement or other calcareous binding agent, and which may be strengthened by inserting in it metallic foil or wire; and of one or more conducting substances, especially sulphites of iron and lead, or other compounds, e.g., oxides, arsenites, phosphates, etc., of these or other metals. The electrical resistance of lead sulphite increases with increasing temperature, whilst that of iron sulphite decreases, so that various effects may be obtained. The non-conducting base may be heated by itself and then immersed in a solution of the conducting substances; or the materials may be mixed together in the solid state; or the metallic compounds may be volatilised, and condensed drop by drop on the non-conducting material, by which they are absorbed in degree dependent on the proportion of calcareous material present. The mixed materials are burnt, and are suitable for constructing rheostats, for resistances for heating purposes, etc.—A. G. L.

Organic products; Process for the oxidation and reduction of — by electrolysis. H. Chaumat. Fr. Pat. 393,561, Oct. 29, 1907.

THE organic substance is intimately mixed with a conducting powder, such as graphite, on which the liberated oxygen and hydrogen are without action. The mixture is made into an agglomerated form, or simply piled up around a conductor, such as carbon, which constitutes the electrode, and which is bound to the negative pole for reduction and to the positive pole for oxidation.—B. N.

Phenols and formaldehyde; Insoluble condensation products [insulating materials] of —. L. H. Buckeland, Vonkers, U.S.A. Eng. Pat. 1921, Jan. 28, 1908.

SEE Fr. Pat. 386,627 of 1908; this J., 1908, 690.—T. F. B.

Electric furnaces. H. Helberger, München, Germany. Eng. Pat. 13,257, June 22, 1908.

SEE Fr. Pat. 391,919 of 1908; this J., 1908, 1119.—T. F. B.

Ozone; Apparatus for generating —. W. Kölle, Stuttgart, Germany. Assignor to W. Elworthy, Wellington, Somerset, and C. Held, Stuttgart. U.S. Pat. 909,309, Jan. 12, 1909.

SEE Fr. Pat. 386,869 of 1908; this J., 1908, 817.—T. F. B.

Electrode. U.S. Pat. 909,428. See II.

[*Electric*] *lamps.* U.S. Pat. 909,811. See II.

Electric lamp filaments. Fr. Pat. 393,888. See II.

[*Bleaching liquors*] *Unstable solutions.* Eng. Pat. 27,463. See VII.

Sulphuric acid. Fr. Pat. 393,665. See VII.

(B).—ELECTRO-METALLURGY.

Aluminium; Use of aluminium silicates in the manufacture of —. M. Moldenhauer. Metallurgie, 1909, 6, 14—19.

AFTER discussing various methods which have been proposed for obtaining aluminium from aluminium silicates (clay), the author describes experiments made by himself, which show that pure alumina can be prepared from clay by two distinct operations in the electric furnace, a high-grade ferrosilicon being obtained as by-product. In the first stage, calcined clay is heated with low-grade ferrosilicon and coke in an electric resistance furnace; the products obtained are carbon monoxide, ferrosilicon rich in silicon, and fused alumina containing some silica and a little iron oxide. The impure alumina is heated in a second similar furnace with iron oxide (haematite) and coke; the products in this case are carbon monoxide, low-grade ferrosilicon, and pure alumina; the latter in admixture with cryolite is then electrolysed as usual and the ferrosilicon returned to the first furnace. As regards the cryolite, its melting-point was found to be 975° C. Addition of alumina lowers the melting-point until a minimum is reached at 880° for 20 per cent. of alumina. Cryolite containing 20—25 per cent. of alumina is saturated with the latter; if more alumina is added the mixture rapidly becomes stiff.—A. G. L.

Zinc coatings; Production of — electrolytically. C. Richter. Elektrochem. Zeits., 1908, 15, 194—198. Chem. Zentr., 1909, 1, 321—322.

IT is stated that lustrous coatings of zinc can be obtained electrolytically, at the ordinary temperature, with a current of 1—1.5 amperes per sq. dem., and 1.135—1.8 volts, from a bath containing 140.23 grms. of crystallised zinc sulphate, 42.59 grms. of ammonium sulphate, and 1.274 grms. of sulphuric acid per litre. The composition of the bath is kept constant by the addition, during the electrolysis, of a solution consisting of 1 gm. of sulphuric acid, 0.889 gm. of ammonium sulphate, and 20.882 grms. of water. The satisfactory condition of the zinc coating is attributed to its being deposited as the result of a secondary reaction at the cathode. According to this view, the ammonium sulphate is first dissociated, with liberation of ammonium ions at the cathode, and solution of zinc as sulphate from the anode. The zinc sulphate forms a double sulphate with the ammonium sulphate, and this interacts with the ammonium ions to form ammonium sulphate with separation of metallic zinc.—A. S.

PATENTS.

Nickel; Removing electrolytic — or other metallic coating of metallic surfaces. A. Levy, Paris. Eng. Pat. 13,666, June 27, 1908.

THE articles are suspended on the positive pole, in a bath containing an electrolyte of sulphuric acid (48° to 52° B.) with a cathode of iron, aluminium, lead, or the like, or an electrolyte of "monohydrated nitric acid," the cathode, in the latter case, consisting of iron or aluminium. Instead of leaving the articles to be treated on the positive pole during the whole of the operation,

the current is reversed several times during the action, by means of a "reverser" if continuous current is used, or by the employment of an alternating current.—B. N.

Nickel from silicious ores; Process of obtaining —. E. F. Price, Niagara Falls, N.Y., Assignor to Central Trust Co., New York. U.S. Pats. 909,666 and 909,667, Jan. 12, 1909.

FERRO-NICKEL is electrically smelted from a silicious ore of nickel and iron mixed with carbon, either by surrounding an electric arc with a considerable body of the charge sufficient to protect the electrodes from oxidation, or else by passing an electric current through the charge functioning in this case as resistance material. The molten ferro-nickel produced is treated with air and an acid flux to remove iron, and the resulting high-grade nickel product is treated with a metallic deoxidising agent.—A. G. L.

Slimes; Treating electrolytic — for the recovery of metals. A. J. McNab, Assignor to W. H. Aldridge, Trail, British Columbia. U.S. Pat. 908,603, Jan. 5, 1909.

THE slime is treated with an alkali sulphide in order to convert metals, such as arsenic and antimony, into soluble sulphides, these being separated in solution from the insoluble sulphides, such as silver sulphide. Antimony is removed from the solution by electrolysis, and arsenic subsequently by crystallisation. The residue of insoluble sulphides is roasted, and the silver sulphate, which is formed, is separated by solution, the metallic silver being afterwards precipitated by a suitable reagent.—B. N.

Tungsten; Process for making alloys of — and of other similar and difficultly fusible metals. Siemens and Halske A.-G. Fr. Pat. 393,595, Aug. 22, 1908. Under Int. Conv., Sept. 14 and 26, and Dec. 9, 1907.

DUCTILE alloys of tungsten, nickel, and other metals are claimed, containing at least 60 per cent. of tungsten and at least 1 per cent. of nickel, especially an alloy containing 85–90 per cent. of tungsten and 15–10 per cent. of nickel, in which a part of the tungsten may be replaced by molybdenum or similar metal, and a part (up to 5 per cent.) of the nickel by iron. The ductile alloys are obtained by mixing finely-divided tungsten and nickel, or their oxides, especially the "colloidal" tungstic acid claimed in Fr. Pat. 378,743 of 1907 (this J., 1907, 1192), with a binding agent such as paraffin wax, forming the mass into thin rods, drying, and heating the rods electrically in tubes through which a current of hydrogen is led. The temperature is raised very gradually to 1100° C., where it is kept for 1 hour, after which it is raised for 5 minutes to about 1400° C. The metallic rods obtained are then reheated, in the same way, at 1400–1500° C., depending on their composition, to give them the required ductility. The rods are next worked or drawn into very thin wire suitable for electric incandescent filaments. This wire is then freed from nickel by placing it in a vacuum and heating it by passing an electric current through the wire, the nickel volatilising during this process.—A. G. L.

Sodium; Electrolytic manufacture of —. Soc. d'Electrochimie and P. L. Hulin. Fr. Pat. 393,706, Nov. 2, 1907.

FUSED caustic soda is electrolysed in an apparatus provided with a removable cathode, formed of a number of copper rods suitably spaced apart. The anodes consist of sheets of iron or steel, either in the form of a cylinder, with the cathode rods arranged concentrically within the cylinder, or as flat plates with rows of cathode rods parallel to the plates. Above the space between the electrodes is arranged a separator, in the form of a frame or hoop, partially immersed in the caustic soda, and serving to collect the metal. An alternative form is described, consisting of a removable tray with the edge turned downwards, the metal being collected within the tray and protected from contact with the air. The metal is withdrawn from a narrow tube mounted on the tray. The action diminishes considerably after a time, but the surface of the cathode may be revived by periodical

washing. A sheet-iron conductor is arranged below the electrolytic bath, and serves to heat the latter, the conductor being brought to a red heat by a suitable current.—B. N.

Ferrosilicon; Process of treating acid slags or silicious iron ores, with a view to their use for the manufacture of — in the electric furnace. V. C. Bertolus. Fr. Pat. 393,818, Aug. 31, 1908.

ACID slags from a Siemens-Martin or Bessemer furnace, silicious iron ores, etc., are granulated or powdered, mixed with a reducing agent, e.g., coke or charcoal, and with silica, and formed into briquettes with the aid of tar, sodium silicate, etc. If phosphorus is present, a small quantity of sodium chloride, or other chloride, is added to eliminate it. The briquettes are then heated in an electric furnace to produce ferrosilicon.—A. G. L.

Tin plating; Electrolytic —. J. Feith. Ger. Pat. 295,051, March 13, 1907.

IT is stated that by addition of a small quantity of a cadmium salt to the bath, strong adherent coatings are produced, and hollows of 40 cm. depth are efficiently coated without the use of special anodes. A suitable electrolyte consists of 30–60 grms. of cadmium chloride and 1–2 kilos. of a tin salt per 100 litres.—A. S.

Printing plates; Process for preparing — by means of electrolytic etching. H. Streckel-Aufermann, Munich, Germany. U.S. Pat. 909,831, Jan. 12, 1909.

SEE Fr. Pat. 372,294 of 1906; this J., 1907, 536.—T. F. B.

Electric furnaces; Conducting hearth for —. C. A. Keller. Fr. Pat. 393,740, Nov. 4, 1907.

SEE Eng. Pat. 21,741 of 1908; this J., 1909, 97.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Fats; Hydrolysis of — by means of pancreas. E. Baur. Z. angew. Chem., 1909, 22, 97–100.

IN Lewkowitzsch's experiments with lipase from pig's liver (this J., 1903, 67) the small extent of hydrolysis was attributed to deficient emulsification. (Compare however Lewkowitzsch, this J., 1903, 1094). Subsequently Fokin (this J., 1904, 1152) succeeded in hydrolysing almond oil to the extent of 82 per cent. in 7 days by means of pancreatic juice with the addition of small amounts of alkali during the reaction. He considered the method unsuitable, however, for technical purposes. The author has found that an addition of Turkey-red oil to the mixture of fat, water, and pancreas produces an excellent emulsion, but that such an addition is unnecessary if the mixture be maintained at a very slight but definite degree of alkalinity. For use on a large scale a dry preparation of the pancreatic glands is required. The fresh pancreas of swine is freed from fat and connective tissue, then finely cut up by machinery, and allowed to stand for a day or more in contact with twice its amount of alcohol. The mass is now strained and pressed, and the residue once more finely divided in the machine and again treated with alcohol. The united turbid alcoholic extracts are treated with sufficient ether to precipitate the suspended particles of the glands, and the deposit is washed with ether, and spread in a thin layer on filter paper to dry. As thus obtained it is a light, friable, odourless, and tasteless powder, which retains for many months its lipolytic power intact. The residual mass from the alcoholic extractions may be treated with ether and dried in the air, and used as a preparation of second quality. Its action is slower than that of the purer preparation. The pancreas of oxen may also be used in the manufacture of a durable preparation. It has the same lipolytic power as the preparation from swine, but has the drawback that the fibres of connective tissue are larger. In using these preparations they are first formed into a homogeneous paste with water, which is then mixed with the fat to

be hydrolysed in the proportion of about 5 per cent. When the oil or melted fat is mechanically stirred with the paste, emulsification soon occurs. After 30 minutes to 1 hour, 5 per cent. sodium carbonate solution is gradually added, the addition being so regulated that the emulsion when tested with red and blue litmus paper always produces a violet stain on each. After about 1 to 2 hours the requisite amount of alkali (corresponding to about 25 per cent. of the fatty acids) will have been added, and the mass will usually have become too thick from the separation of fatty acids for the stirring to be continued. The mass is then left to itself. After 5 hours from 60 to 80 per cent. of the fat will usually have been hydrolysed, and the hydrolysis will be complete in 1 to 4 days. In one of the typical experiments quoted, 100 grms. of ox-tallow were melted and mixed at 40° C. with 6 grms. of pancreas powder made into a paste with 60 c.c. of water. The mass was stirred for an hour at 35° C., after which 80 c.c. of $N/1$ sodium carbonate solution were added little by little. After 5 hours 66 per cent. of the fat had been hydrolysed, and the reaction was complete in 4 days. In place of such preparations, freshly-obtained pancreas may be employed, after being finely divided and ground up in a mortar with the requisite quantity of water. It has the drawback, however, that the fibres may interfere with the stirring apparatus during the hydrolysis. In the author's opinion pancreatic hydrolysis of fats might be used with advantage in the stearine industry. It has the advantage over hydrolysis with castor seeds that the reaction is complete, whereas with the latter only about 90 per cent. of the fatty acids are liberated. On the other hand, castor seeds are cheaper and more easily dealt with than the pancreatic glands of animals.—C. A. M.

Fish oils: Bromine addition-compounds of — H. Bull and J. C. F. Johannesen. *Chem.-Zeit.*, 1909, **33**, 73–74.

HEUSER and Mitchell (this J., 1899, 77) described methods of differentiating the oils of marine animals by means of the amounts of insoluble bromides to be obtained from the oils themselves and their fatty acids. As the authors have met with difficulties in the filtration of the precipitates yielded by the glycerides, they have worked out conditions for obtaining concordant results with the fatty acids. The following method is that chosen as the most satisfactory of those tried and described in the paper:—From 0.9 to 1.1 grm. of the fatty acids is dissolved in 25 c.c. of a mixture of 100 c.c. of glacial acetic acid and 500 c.c. of anhydrous ether, and the flask (of about 75 c.c. capacity) closed and immersed in ice-water. Bromine is now slowly added, drop by drop, from a burette, with constant shaking, and after the addition of 0.5 c.c. the flask is left for some minutes in the ice-water, and then allowed to stand for 3 hours at the ordinary temperature. The precipitate is collected in a weighed Soxhlet's filter-tube containing asbestos, the filtration being accelerated by means of a filter-pump. The flask is rinsed out with 3 portions of 5 c.c. of the mixture of ether and acetic acid, and the precipitate finally washed twice with the same quantities of solvent, after which the tube is dried for 2 hours at 100° C. and weighed. The amounts of bromide thus obtained in closely concordant determinations from the fatty acids from 10 samples of commercial cod liver oil ranged from 27.40 to 37.77 per cent.—C. A. M.

Cottonseed oil: "Denaturing" of — G. Winterfeld. *Chem.-Zeit.*, 1909, **33**, 37–38.

PRIOR to 1906 the German Customs regulations prescribed that fatty oils intended for technical purposes should be "denatured" by, *inter alia*, the addition of 3 kilos. of potassium hydroxide solution of sp. gr. 1.29 or of sodium hydroxide solution of sp. gr. 1.34 to 100 kilos. of oil. As it was found that 80 to 90 per cent. of such oil could be recovered and used for food, the use of sodium or potassium hydroxides for this purpose was prohibited. As the substances, such as rosenary oil, still permitted are more expensive than the alkali solutions, the author has made experiments to determine to what extent the

latter are effective. He shows that in the case of cottonseed oil containing 10 to 15 per cent. of potassium hydroxide solution of sp. gr. 1.32 or of sodium hydroxide solution of sp. gr. 1.34, it is possible to recover from 60 to 80 per cent. of the oil, which, though of inferior quality, might still be used for food purposes; but that it is questionable whether the treatment would be profitable. In his opinion cottonseed oil would be effectively "denatured" by the addition of the above-named proportion of alkali.—C. A. M.

Oil from "Carapa Guyanensis" (Carapa Procerca, DC.). J. Lewkowitsch. *Analyst*, 1909, **34**, 10–11.

THE oil to which the following figures relate was obtained from seeds sent from Sierra Leone as *Carapa guyanensis*, Aubl., but they were probably derived from *Carapa procerca*, DC., of which *C. guyanensis* and *C. guineensis* are synonyms (see this J., 1908, 578). The seeds examined consisted of:—Good kernels, 35.5 per cent.; bad (mouldy) kernels, 27.0 per cent.; shells, 37.5 per cent. The sound kernels yielded by extraction with ether, 57.26 per cent. of oil, having an iodine value of 75.09. The oils obtained from the kernels by cold and hot pressing gave the following figures on analysis:—

	Cold-pressed oil.	Hot-pressed oil.
Yield, per cent.	24.0	27.0
Sp. gr. at 40°/40° C.	0.9170	0.9174
Sp. gr. at 15.5°/15.5° C.	0.9272	0.9327
Solidification point	12° C.	14° C.
Melting point	15°–36° C.	15°–48° C.
Saponification value	197.1	196.4
Iodine value	75.07	71.25
Reichert-Meissl value	3.53	3.14
Unsaponifiable matter, per cent.	1.51	2.04
<i>Insoluble fatty acids.</i>		
Fatty acids + unsap. matter, per cent.	95.13	92.66
Solidifying point (titer test)	35–45° C.	36–15° C.
Neutralisation value	192.4	192.0
Mean mol. wt. of fatty acids ...	291.5	292.1
"Liquid fatty acids" (yielding ether-soluble lead salts), per cent.	65.9	63.4
"Solid fatty acids" (yielding ether-insol. lead salts), per cent.	34.1	36.54
Iodine value of "liquid acids" ...	107.4	108.0
Iodine value of "solid acids" ...	16.6	17.9

The oil did not contain any optically active substances.—W. P. S.

Turkey red oils or similar fatty preparations; Behaviour of mixtures of — with glycerides and especially tournant oils and their substitution products. F. Erban. *Z. angew. Chem.*, 1909, **22**, 55–69.

FROM experiments described in detail the author concludes that neither free oleic acid nor ricinoleic acid has a solvent action upon glycerides, but that higher hydroxy-acids render Schmitz's "Oeläther" (a commercial product probably consisting of the glyceride of a hydroxy-acid) soluble, and have probably an analogous effect upon other glycerides of hydroxy-acids. With regard to Turkey-red oils it appears that unwashed products of a low degree of sulphonation (provided they do not contain too much unaltered castor oil) are capable under all conditions of dissolving certain glycerides, such as are present in many tournant oils and esters of oxidised oils. Oils of an intermediate degree of sulphonation have this property so long as they are not treated with excess of alkali, whilst highly-sulphonated oils have a solvent action in the fresh unwashed condition, but lose it partially or completely after washing and neutralisation. This characteristic appears therefore, to stand in direct relationship to the proportion of glycerides remaining in a Turkey-red oil, and to be lost when the glycerides are decomposed with the formation of free sulphonated fatty acids. Saponification cannot be the cause of solution of glycerides still present, since in the experiments described, clear solutions were, as a rule, obtained only so long as the reaction was still slightly acid, whilst on the other hand

even a small excess of alkali had an injurious effect when the product was neutralised and allowed to stand. The solubility of tourment oils does not depend upon the proportion of free acids they contain, since mixtures of 73 per cent. of neutral fat with 27 per cent. of oleic acid only yield emulsions, and tourment oils are met with in commerce, which have higher and lower acidities than this and are also insoluble. It is probable that these differences may be found to be due to the varying proportion of diglycerides in the oils.—C. A. M.

Soap solutions; Action of carbon dioxide on —. G. Fendler and O. Kuhn. *Z. angew. Chem.*, 1909, 22, 107—108.

CARBON dioxide can effect the dissociation of soap solutions even when they are strongly alkaline and contain a large amount of alcohol. The proportion of fatty acids liberated varies considerably with the nature of the fat from which the soap was derived. Thus in comparative experiments, 5 grms. of fat or oil were saponified with 10 c.c. of alcoholic potassium hydroxide (20 grms. per 100 c.c. of 70 per cent. alcohol), and the soap dissolved in alcohol and water, so that the final solution (100 c.c.) contained 40 per cent. of alcohol. Each solution was treated for an hour with a fairly rapid current of carbon dioxide previously passed through 40 per cent. alcohol. It was found that the soap solutions from lard, butter, tallow, coconut oil, and arachis oil became more or less turbid, whilst olive and almond oil soap solutions remained clear. The following amounts of fatty acids were extracted with petroleum spirit from the respective solutions:—Lard, 9.94; butter fat, 8.00; tallow, 7.61; coconut oil, 12.30; olive oil, 13.79; arachis oil, 15.34; almond oil, 14.50; and linseed oil, 14.32 per cent. In experiments with butter fat soap solution in which the treatment with carbon dioxide and extraction of the fatty acids was repeated 12 times, it was found that the acids of high molecular weight were the first to be liberated.

—C. A. M.

Colophony reaction. Foerster. See XIII.B.

Butter and coconut oil. Paal and Amberger. See XVIII.A.

PATENT.

Rosin soap and the like; Apparatus and method for the manufacture of —. A. W. Carmichael, Savannah, Ga. U.S. Pats. 909,958 and 909,951, Jan. 5, 1909.

(1). THE apparatus consists of a vessel provided with a steam-jacket; a rotating "foam-beater" or stirrer is fitted inside and at the top of the vessel, and means are provided for withdrawing the liquid from the bottom of the vessel and discharging it into the space above the stirrer. (2). The process consists in heating a saponified solution of rosin in the vessel described above; the stirrer breaks down the foam rising at the surface of the solution and, during the heating, the solution is pumped from the bottom of the vessel and discharged into the latter above the stirrer.—W. P. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

PATENTS.

Waterproofing paint for Portland cement buildings. (1) and (3), and *waterproofing fibres and fabrics* (2). T. A. Edison, Orange, N.J., Assignor to North Jersey Paint Co., Stewartsville, N.J. U.S. Pats. 909,167—909,169, Jan. 12, 1909.

(1). The waterproof paint consists of petroleum residue known as "B.S." dissolved in a suitable solvent, to which boiled linseed oil and a coloured pigment may be added. (2). Fibres and fabrics are impregnated with that portion of a petroleum residue known as "B.S." which is soluble in benzene and has been freed from the insoluble portion. (3). The waterproofing paint consists of that portion of

a petroleum residue known as "B.S." which is soluble in benzene, dissolved in benzene and freed from the insoluble portion and from a part of the solvent.—A. G. L.

Pigments by electrolysis; Art of producing —. U.S. Pat. 906,102. See XI.1.

(B).—RESINS, VARNISHES.

Colophony; A colour reaction of —. P. Foerster. *Ann. Chim. analyt.*, 1909, 14, 14—17.

HALPHEN'S reagent for the detection of traces of rosin oil in mineral oil (*Ann. Chim. analyt.*, 1903, 8, 9) is also capable of detecting traces of colophony. It consists of:—(A). 1 part by volume of phenol dissolved in 2 parts of carbon tetrachloride; and (B). 1 part of bromine in 4 parts of carbon tetrachloride. On treating a little powdered colophony in a basin with 2 c.c. of solution A, and bringing the liquid close to the solution B, a bright blue coloration, subsequently changing to violet, is produced at the place where the vapours of bromine impinge. The reaction differs from that given by rosin oil, for in that case the first coloration is violet. In applying the reaction to the detection of colophony in other substances, it is usually necessary to separate the colophony beforehand. In the case of soap a small quantity of the sample is dissolved in 80 per cent. alcohol, the solution treated with calcium chloride and filtered, and the filtrate slightly acidified with hydrochloric acid and evaporated. The residue is then tested with Halphen's reagent. In testing shellac, 2 grms. of the substance are pulverised with sand, the mixture shaken for 5 to 10 minutes with 10 to 15 c.c. of ether, the liquid filtered and evaporated, and the residue tested with the reagent. *Jalap resin*:—From 0.2 to 0.5 gm. of the resin is treated with a few c.c. of petroleum spirit, the liquid filtered after a few moments, the filtrate evaporated, and the residue tested. If the jalap contained 1 to 2 per cent. of colophony a distinct blue coloration is obtained. For the detection of traces of gnaiaecum resin, a little of the jalap is dissolved in a few drops of acetic acid, or, better, acetic anhydride, and the solution subjected to the action of the bromine vapours from the solution B. In the presence of gnaiaecum resin a bright blue coloration, changed to green by excess of bromine, is obtained.

—C. A. M.

PATENTS.

Printing-inks. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pats. 908,132 and 908,133, Dec. 29, 1908.

CLAIM is made for, (1), a printing ink composed essentially of a drying varnish, colouring matter, and silicon monoxide "in a partially dissociated condition" (obtained as a brown powder by the partial reduction of silica); (2), a printing ink composed of a suitable varnish, a colouring ingredient, and that form of silicon dioxide, resulting from the oxidation of silicon monoxide. (See U.S. Pat. 908,131, page 140.)—F. SONN.

Pine oil, pine tar oil, or wood tar oil; Purification of —. L. Ahlers. *Ger. Pat.* 204,391, June 30, 1906.

THE oil, which has been previously treated with alkali and washed with water, is heated with zinc dust in a still provided with a reflux condenser. For example, 1000 kilos. of pine tar oil are heated with 10 kilos. of zinc dust for 1 hour at about 100° C. by means of indirect steam. After cooling, the oil is separated and is washed, in a vessel provided with an agitator, with warm soft water, until the latter is no longer coloured yellow on addition of alkali. The oil is finally distilled with steam.—A. S.

Shellac; Decolorisation of —. F. Daum. *Ger. Pat.* 205,172, March 1, 1907.

THE shellac is treated with an aqueous emulsion of fats, and the latter are subsequently removed by extraction or by other suitable means. For instance, 6 kilos. of coconut oil or other fat are formed into an emulsion with 300 litres of hot water, 100 kilos. of stick-lac or dark-coloured shellac are added, and the whole is agitated and boiled. The shellac is then removed, and after

cooling, is dissolved in alcohol, the dirt and excess of fat being separated by filtering the solution or allowing it to settle.—A. S.

Linoleum substitute; Process and apparatus for making a — from fibrous materials. N. Rief. Fr. Pat. 393,868, Sept. 2, 1908.

THE process relates to the manufacture of a material similar to linoleum, the substances used being cellulose, cork, peat, etc., and vulcanised oil. The fibrous material is passed between rollers provided with helical cutters, by means of which it is finely divided and is then delivered in the form of a sheet into a vessel where both surfaces of the sheet are sprayed with the agglutinating solution. Arriving at the bottom of the vessel, the treated material is forced, by means of a screw, between rollers and then through heated channels, where the vulcanisation is completed. The agglutinating solution is prepared by heating oil, or a mixture of oil and pitch, to a temperature of 150° C. for 15 minutes, during which time a current of air is blown through it; melted sulphur containing a catalytic agent, such as resin or metals in a finely divided state, is then added rapidly, and the mixture is cooled before vulcanisation is completed. Colouring matters and basic substances may be added and the liquid is then sprayed on the fibrous material as described. A particularly durable linoleum is obtained if the fibrous material be also sprayed, at the same time that it receives the agglutinating liquid, with small quantities of sulphur chloride or nitric acid.—W. P. S.

Linoleum substitute; Preparation of a —. J. Michael, Ger. Pat. 205,770, Aug. 31, 1907.

A FATTY oil is heated for a short time and is then vulcanised by treatment with a molten mixture of rosin and sulphur, air being blown into the mass during the operation. The vulcanised oil, before it sets, is then distributed, in a fine state of division, over the fabric which is to form the foundation of the material. If a specially hard material is desired, small quantities of a vulcanising agent, capable of being spread or finely divided, e.g., sulphur chloride, are mixed with the vulcanised oil as it is being distributed over the fabric, and the material is subsequently passed between heated rollers.—A. S.

Resinous products; Manufacture of —. Les Produits Chimiques de Croissy, Paris. Eng. Pat. 16,528, Aug. 5, 1908. Under Int. Conv., Aug. 5, 1907.

SEE Fr. Pat. 390,713 of 1907; this J., 1908, 1122.—T. F. B.

(C).—INDIA-RUBBER. &c.

Rubber-latex; Coagulation of —. G. Lamy-Torrillon, J. d'Agric. Tropicale, 1908, 257–261, and 327–331; Gummi-Zeit., 1909, 23, 436–437.

A MORE or less complete summary of the known processes of coagulation is given, classified under three headings, viz., (1), mechanical processes; (2), chemical processes; and (3), processes which involve the application of both mechanical and chemical means.—E. W. L.

Caoutchouc; Cultivation, extraction, and preparation of —. F. Frank. Ber. deutsch. Pharm. Ges., 1908, 18, 559–598.

GENERAL descriptive treatise, with 19 illustrations.

PATENT.

Rubber; Manufacture of —. M. Wildermann, London. U.S. Pat. 908,925, Jan. 5, 1909.

SEE Eng. Pat. 9290 of 1906; this J., 1907, 624.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Cutch trade in Burma; A note on the present position and future prospects of the —. R. S. Troup. Indian Forest Records, 1908, 1, [III].

BURMA cutch is obtained by extracting chips of the heartwood of *Acacia catechu*, Willd. with water, then

boiling down the extract to a syrup and allowing it to set. Its valuable constituents are a tannin and catechin. The quantity and the value of the cutch exported from Burma have seriously decreased during recent years. The following reasons are assigned for this decline:—(1). Cutch was formerly employed to a large extent for dyeing, but it has been almost entirely replaced for this purpose by artificial dyestuffs and it is now chiefly employed for preserving fishing nets and sails. (2). Inferior qualities of Burma cutch have been largely displaced from the market by the cheaper mangrove cutch, an extract from the barks of mangroves, the chief of which are *Ceriops Candolleana* and *Rhizophora spp.* Mangrove cutch does not answer the general tests for cutches. It is quite soluble in cold water and contains no catechin. (3). Adulteration of cutch was freely practised in past years and did permanent harm to the trade. The quality now manufactured is rarely adulterated, its chief fault being that it occasionally contains too much moisture.

Cutch exported from Burma during the years 1894–95 to 1906–07.

Year.	Foreign.			Coasting.		
	Quan- tity.	Value.	Per ton.	Quan- tity.	Value.	Per ton.
	Tons.	Rupees.		Tons.	Rupees.	
1894–95	5,524	22,34,516	404	3,989	14,95,102	374
1895–96	7,827	33,52,484	428	3,333	13,06,637	392
1896–97	5,853	22,90,365	391	1,620	6,32,916	390
1897–98	4,821	18,58,752	385	614	2,30,201	375
1898–99	3,075	12,77,985	415	655	3,06,521	467
1899–00	6,302	24,34,101	386	1,159	5,76,171	497
1900–01	4,949	18,42,063	372	1,102	5,30,730	481
1901–02	3,273	11,94,898	365	770	3,21,237	417
1902–03	3,460	13,18,921	381	953	4,20,208	440
1903–04	5,492	19,11,943	348	1,322	5,36,387	405
1904–05	3,018	9,31,596	308	779	3,12,749	401
1905–06	2,723	8,48,887	311	755	3,59,069	475
1906–07	4,772	15,53,470	325	868	3,61,905	417

Note.—15 rupees = £1.

—P. F. C.

Sole leathers; Colouring matters in connection with —. H. G. Crockett. J. Soc. Dyers and Color., 1909, 25, 8–10.

THE leather derives its colour from the natural colouring matters contained in the tanning material and the aim is to imitate the colour produced by oak bark. Where other tanning materials, such as American hemlock (which produces a pink to red colour), have been employed, this is not always easy, and manufacturers of tanning extracts often sell their products under guarantee that these are decolorised by certain methods. The colour of the leather is preserved during drying by the exercise of great care, thus avoiding dark edges and stains; the finished huts are often finally coloured by rubbing pigment colours ("chrome yellow" or ochre mixed with size and oil) into the grain, wiping, brushing, and finally rolling under a heavy brass roller. Annatto or aniline dyestuffs may also be used to level the shade and cover defects. "Surface" finished leather however is always detected by cutting, the edges of the cut being different in colour to the surface. Shoemakers have also learnt how to colour the shoe sole and waist, so that it shall appear to be of well-tanned bark leather. Saffron, dragon's blood, cochineal, annatto, chrysoidine, Bismarck brown, logwood, and nigrosine have all been recommended and used.—F. M.

Cascin and its applications. Richardson. See V.

PATENTS.

Tanning materials, dyewoods, sugar beets, etc.; Process and apparatus for the extraction of — on the counter-current principle. M. Gollmert. Ger. Pat. 205,233, Feb. 24, 1907.

THE extraction is effected in a long horizontal vessel, and in order to avoid the mixing of fresh or weaker

liquor with stronger liquor, without the use of separate compartments, the quantity of fresh solvent introduced is so regulated that the level of the liquor is below that of the material being extracted, throughout the length of the vessel. A horizontal shaft passes through the chamber, and carries screw segments and agitating blades alternately.—A. S.

Albuminoid materials [casein, etc.]; Treatment of —. R. Desgeorge and F. Lebreil. First Addition, dated Oct. 31, 1907, to Fr. Pat. 82,122, Nov. 29, 1906 (this J., 1908, 170).

THE casein, after being subjected to electrolysis as described in the original specification, is heated to a temperature of about 120° C., and then washed in a current of water, in order to more readily eliminate phosphates, etc.—W. P. S.

Glue and gelatin; Plaited cotton threads for drying —. E. Manoury et Cie. Fr. Pat. 393,922, Sep. 4, 1908.

THE use of plaited cotton threads is claimed for drying gelatin and glue; these threads are lighter and dry more quickly than the hemp threads usually employed.—W. P. S.

Tanning or manufacturing leather; Process of —. A. Seyewetz and L. Meunier. Lyons, France. Eng. Pat. 287, Jan. 4, 1908. Under Int. Conv., Feb. 25, 1907.

SEE Fr. Pat. 385,957 of 1907; this J., 1908, 580.—T. F. B.

Tanning extracts; Manufacture of —. D. Stewart, Inverness. U.S. Pat. 909,343, Jan. 12, 1909.

SEE Eng. Pat. 5438 of 1907; this J., 1907, 1153.—T. F. B.

XV.—MANURES, &c.

Nitrification and denitrification in soils. St. v. Lazarewski. N. Jahrb. f. Mineral., 1908, II., 186. Chem. Zentr., 1909, 1, 309—310.

NITRIFYING bacteria occur most abundantly in the top layers of the soil, down to a depth of 10 cm.; at a depth of 50 cm., they are very rare. Their existence depends upon the presence of oxygen and humus. After growing certain plants on the soil, the number of nitrifying bacteria increases, even in the deeper layers. The most favourable temperature for nitrification in the soil is about 25°—27° C., or 10° lower than is the case in artificial nutrient media. The soluble organic substances present, in small quantities, in the soil have no injurious effect on nitrification, but probably accelerate it, since in pure cultures, dextrose has a favourable effect when added in quantities up to 1 per cent., and is injurious only in larger amounts. Denitrifying bacteria are present in large quantities in the upper layers of the soil; their distribution with regard to depth is quite irregular, and they frequently occur abundantly even at depths greater than 1 m. In mixed cultures the optimum temperatures for nitrifying and denitrifying bacteria appear to be nearly identical.—A. S.

Nitrolime [crude calcium cyanamide]; Decomposition of — in the soil. (1) F. Löhms and R. Moll. Zentrbl. Bakter. u. Parasitenk., 1908, II. Abt., 22, 254—281; (2) H. Kappen, *ibid.*, 281—298. Chem. Zentr., 1909, 1, 310—311.

DISCUSSIONS as to the manner in which calcium cyanamide is converted into available nitrogenous compounds in the soil. (See also this J., 1908, 991.)—A. S.

PATENT.

Manure and alkali salts; Process for the manufacture of —. A. Vasseux, Ailly sur Noye, France. U.S. Pat. 909,350, Jan. 12, 1909.

SEE Fr. Pat. 377,703 of 1907; this J., 1907, 1101.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Starch; Formation of crystalline substances (polysaccharides), having no reducing action on Fehling's solution, from — by the action of microbes. F. Schardinger. Zentrbl. Bakter. u. Parasitenk., 1908, II. Abt., 22, 98—103. Chem. Zentr., 1909, 1, 68—69.

AQUEOUS pastes of wheat, rice, maize, potato, and arrowroot starches, containing some sodium chloride and 1 part of ammonium phosphate and 0.25 part of magnesium sulphate per 1000, were inoculated with well washed potato cultures of *Bac. macerans* (see Zentrbl. Bakter. u. Parasitenk., II. Abt., 14, 772; 19, 161) at 40° C., and then kept at 45° C. After 3—4 days the potato and arrowroot starches were almost completely dissolved; in the other cases, solution proceeded more slowly; in the early stages of the action, an odour of acetone was perceptible. The solutions produced contained one or more crystallisable compounds. The hexagonal crystals obtained from the solution yielded by wheat starch, when treated with iodine under the microscope, were seen to disappear, their place being taken by greyish-green to greyish-yellow bundles of needles; when two adjacent bundles of needles crossed each other, the region of contact appeared blue. The hexagonal crystals also took up water, yielding prisms. The best yield of the crystalline substance was obtained from wheat, but it was most easily obtained pure from arrowroot. Its content of water of crystallisation ranged from 14.17—14.76 per cent., according to its origin; its specific rotatory power in 1 per cent. aqueous solution at 20° C. was +136° to +138.4°; its composition was probably represented by the formula, $C_6H_{10}O_5 + 3H_2O$. The author names it "crystallised amyloextrin." From the mother-liquor from wheat amyloextrin, lancet-shaped needles of a second substance were isolated. This was named "crystallised amylose"; its specific rotatory power in 1 per cent. solution at 20° C. was +127.4°. Neither of the substances in 1 per cent. aqueous solution reduced Fehling's solution, nor were they fermented by yeast. Iodine produced a precipitate in a solution of the amyloextrin, but not in a solution containing equal proportions of the amyloextrin and amylose.—A. S.

PATENTS.

Sugar and ethyl alcohol; Process for the industrial production of —. J. B. Gailhat. Fr. Pat. 393,716, Aug. 28, 1908.

CLADI is made for the use of the following materials for the production of sugar and alcohol:—pea pods and stalks, maize stalks, asparagus stalks, red clover, etc. It is essential that these materials be used while green.—W. P. S.

Gum tragacanth; Manufacture of —. C. V. Greenwood. Liverpool. Eng. Pat. 569, Jan. 9, 1908.

GUM tragacanth as made by the process described in Eng. Pats. 24,877 of 1894 and 10,822 of 1905 (this J., 1906, 944) may be rendered more soluble by the addition, during the course of manufacture, of formic acid. Other organic acids, whether added or formed in the gum by the action of enzymes, may be used. When the gum is intended for edible purposes, it is preferable to add tartaric or citric acid, or a suitable enzyme. About 1 lb. of formic acid may be added to each ton of the gum. The treated gum may be concentrated either with or without the addition of waxes, resins, gums, or starchy material, etc.—W. P. S.

Extracting sugar beets, etc. Ger. Pat. 205,253. See XIV.

XVII.—BREWING, WINES, SPIRITS, &c.

Diastatic processes; Surface influences in —. F. Emmlander. Z.-Chem. u. Ind. Kolloide, 1908, 2, 308—310.

COMPARATIVE mashing experiments were made with 50 grms. of malt: (1), in the usual manner; (2), with a thin layer of toluene covering the mixture; and (3), with a covering layer of vaseline oil. In the two latter cases,

the extract contained more dextrin but less maltose and albumin than in the first case; also the ratio of non-sugar to sugar in the extract was greater when covering layers were used. Continuous stirring during the mashing process had no considerable effect on the proportions of maltose, dextrin, and albumin in the extract, but contrary to expectation, the final degree of attenuation was higher with the wort prepared in the usual manner than when the mashing was effected with continuous stirring. Comparative experiments were also made as to the influence of the surface of the containing vessel, the results being shown in the following table:—In (1) the mashing was effected in the usual manner; in (2) the mashing beaker was coated with shellac; in (3) the mixture was covered with a layer of paraffin oil.

	(1)	(2)	(3)
	per cent.	per cent.	per cent.
Maltose in extract	62.90	62.37	61.47
Albumin ..	4.70	4.78	4.35
Sugar : non-sugar	1 : 0.59	1 : 0.58	1 : 0.63

—A. S.

Colour malt in the brewery: Methods of applying — G. Jakob and E. Rausch. *Woch. für Brau.*, 1909, 26, 1—6.

IN preparing dark beers of the Munich type, the colour malt may either be mixed in the mash tun or else employed for brewing a special black beer or concentrated beer colouring, which is then blended with the bulk either before or after fermentation. The authors prefer the first mode of application, but if the colour malt be subjected to the usual decoction process, or even if it be added to the mash tun after running off the wort and before sparging, the temperature at which extraction takes place is so high that acrid matters, which injuriously affect the flavour of the beer, are derived from the husk. On the other hand, if the colour malt be infused cold, there is a deficiency in the yield of extract of about 6 per cent. and a deficiency in the colouring power of about 25 per cent., as compared with extraction at 100° C. This deficiency would involve an increased consumption of colour malt amounting to 33 per cent. when working by cold infusion, but since the proportion of colour malt employed is generally only 0.8—1.0 per cent. of the total malt, the improvement in flavour obtained by cold extraction compensates for the increased cost; moreover a wort of lower gravity may be brewed. The colour malt should be very finely ground and mixed with cold water in a separate small mash-tun. After infusing for 15 minutes, the coloured extract should be run off clear into the main mash tun and the residue should be extracted several times with cold water. In this way the soluble carbohydrates of the colour malt are fully saccharified without the grains being heated with the rest of the mash. Several methods are available for the preparation of special colouring beers or beer-colourings; six processes are mentioned by the authors, who select Schramm's process as the simplest and most convenient. This consists in infusing the colour malt with cold water and clarifying the extract by filtration, finally concentrating it to the consistency of caramel. An extract so prepared has no acrid flavour and possesses the property of imparting a yellowish colour to the foam of the beer.—J. E. B.

Extract: Increase of the — [of malt] by previous doughing-in of the grist. J. J. van Hest. *Z. ges. Brauw.*, 1909, 32, 30—31.

THE author criticises Bleisch's statement (this J., 1909, 34) that the increase of extract obtained from malt by previous doughing-in of the malt at a temperature of 1—25° C. (34—77° F.) is an apparent and not a real increase. The principal cause of the increase is that at 34—77° F., starch, albumin, pentosans, colouring matters, mineral salts, etc., are attacked which would not be attacked at a mashing temperature of about 113° F., so that no increase in the extract is observed if the mash is allowed to stand for 1—10 hours at 113° F. The author shows that

doughing-in gives a greater yield of beer and that the reality of the increased extract is confirmed by estimation of the solid matter remaining in the grains.—T. H. P.

Digestive mashing. W. Windisch. *Woch. f. Brau.*, 1909, 26, 18—20.

THE author has had occasion to examine many beers prepared from worts obtained by Van Hest's process of digestive mashing, in which the malt is doughed-in at ordinary temperature and allowed to stand over-night before the mashing is proceeded with (see Bleisch, this J., 1909, 34). The method when applied to the preparation of pale beer worts frequently leads to the production of a foxy colour in the finished article which is very objectionable. Experiments were carried out to discover which part of the corn was responsible for this production of colour and it was found to be derived from the husk, as mashes in which only the meal and grits were doughed-in, the husks being added at the time of the mashing proper, gave wort of nearly the normal tint, whereas that yielded by the mixed grist was nearly twice as dark. The character of the beer is also frequently affected prejudicially, although this is by no means always so. The increase in yield of extract produced by doughing-in is greatest with under-modified malts and least with thoroughly modified material. (See preceding abstract.)—R. L. S.

Extract: Increased yield of — from malt by preliminary digestion of the grist. E. Moufang. *Woch. f. Brau.*, 1909, 26, 43.

THAT an increase in the extract yielded by a malt may be effected by digestion or doughing-in of the grist previous to mashing is quite feasible, such procedure resulting in: (1), mechanical actions due to thorough moistening of the grist; and (2), enzyme actions, by which the starch and, principally, the proteins are degraded; that such proteolytic action does take place is rendered probable by an observed alteration of the form in which the soluble nitrogen compounds appear in the final wort when the doughed-in grist has been allowed to stand for some hours previous to mashing. Experiment shows that the constituents thus dissolved are really in solution and remain so, the boiled wort from a doughed-in grist containing 0.2—0.4 per cent. more extract than when doughing-in is omitted. (See also this J., 1909, 34, and preceding abstracts.)

—T. H. P.

Yeast juice: Fractional precipitation of expressed — E. Buchner and F. Duchacek. *Biochem. Zeits.*, 1909, 15, 221—253.

IT has not yet been found possible to separate the enzymes, yeast zymase and lactacidase (this J., 1905, 246), concerned in the fermentation of sugar, and the name zymase may be used provisionally to denote the mixture of enzymes. But yeast juice contains another body, indispensable for sugar decomposition, the so-called co-enzyme (Harden and Young, this J., 1906, 490, 1111), which is dialysable and can withstand boiling. Since zymase and the co-enzyme may behave differently towards precipitants, the authors have now revised earlier work on the precipitation of the constituents of yeast juice. Preliminary experiments made to determine the fermenting power of the expressed juices used, and the regenerative power of the various boiled juices, showed, in confirmation of earlier results, that juice which has lost its fermenting power by exercise of this function, acquires it again on addition of boiled juice. If, however, the exhausted juice is left for some time after it has lost its fermenting power, it cannot be regenerated by addition of boiled juice: the boiled juice is more stable, being able to regenerate exhausted juice after it has been kept for more than three weeks. Active juice can be rendered more active by addition of boiled juice, which appears to indicate that active juice is often deficient in co-enzyme. In previous experiments on fractional precipitation, the expressed juice has generally been added to the precipitant, but the authors point out that a systematic separation of the constituents according to their solubility, cannot be thus effected, since the first portion of the juice comes in contact with a large excess of precipitant. They have

therefore generally added the precipitant (acetone, alcohol, or alcohol-ether) to the juice, with stirring. Acetone was found to be a better precipitant than alcohol-ether, and much better than absolute alcohol. In some cases, three fractions were obtained, and in others, only two, in order to lessen the time of contact between precipitate and precipitant. The first and second fractions, in all cases, showed only a slight fermenting power, the third generally showed none. Addition of boiled juice increased the activity of fractions 1 and 2, that of No. 1 generally to a greater extent. Hence, fraction 1 appears to be poorer in co-enzyme, which is thrown down more abundantly as the precipitant becomes more concentrated; a progressive increase of the phosphoric acid-content from fraction 1 to fraction 3, accords with this view. The fractions were found to increase the fermenting power of fresh expressed juice, and to regenerate exhausted juice; the second fraction had a greater regenerating power than the first, this also, probably being connected with the greater content of co-enzyme in the former. The fermenting power of a mixture of the three successive fractions was found to be only about one-third of that of the original juice; addition of the final mother liquor (freed from precipitant and concentrated) did not increase this activity. These results show that important constituents of the fermenting agent are destroyed during fractional precipitation. The co-enzyme is very sensitive to certain influences and it was found that the activity of the united fractions was considerably increased by addition of boiled juice (in one case, to five-sevenths of that of the original juice). If, instead of adding acetone to the juice, the latter is added to 10 volumes of acetone, the precipitate obtained, even though left in contact with the precipitant for an hour, has as great a fermenting power as the original juice; though the same amount of precipitate is obtained by adding 10 volumes of acetone to the juice, the activity of this precipitate is more or less destroyed. The authors conclude that when acetone is run, drop by drop, into the juice (and, generally, when the juice comes in contact with a small quantity of acetone), precipitates of high water-content are obtained, which rapidly suffer change, probably owing to mutual enzyme action; with the reverse process, the precipitate obtained has a low water-content and is more stable. Experiments in which juices of strong and weak activity were added to 10 volumes of acetone, showed that the yield of precipitate from the latter was only four-fifths of that obtained from the former; it may be that in juice of low fermenting power, the coagulable protein is already considerably decomposed, and the fermentation agent injured, by the proteolytic enzymes.—L. E.

Alcoholic fermentation: Influence of aëration on the volatile products of —. E. Kayser and A. Demolon. *Compt. rend.*, 1909, 148, 103—105. (See also this J., 1907, 1060.)

THE authors have previously called attention to the part played by the living yeast in the ageing of wine on the lees in contact with air. They have now studied the changes due to moderate aëration in a fermented liquid in presence of the yeast. The liquid was composed of an extract of malt culms, containing originally 15.7 per cent. of sugar. Two yeasts were studied, one a champagne wine yeast and the other a powerfully aerobic yeast from pineapples, and parallel fermentations were made: (a), in flasks with long necks, nearly full of liquid, (b), in flat, wide flasks only partially filled, so as to expose a large surface to the air. Analyses were then made after one and six months respectively. Comparing the results after one month, the effect of aëration on the composition of the "wine" was very marked. In the case of the wine yeast, the difference between the flask with small exposed surface and that with a large surface was shown mainly in the large production of aldehydes in the latter. In the case of the more powerfully oxidising pineapple yeast, the aldehydes were only moderately pronounced and the effect of the aëration was marked more especially by the production of volatile acids. In the second series, after six months, in the case of the wine yeast, the aldehydes had increased in the flask with restricted aëration, but had decreased in the flat, wide flask. In the case of the

pineapple yeast the alcohol had largely disappeared after six months, the aldehydes had totally disappeared, and the volatile acids had considerably decreased, particularly in the wide flask. In this case respiratory oxidation had been very active and the quantity of yeast had largely increased, some of the volatile acid being consumed and a portion being converted into esters, which had increased particularly in the flask with restricted aëration. In the case of wines, when the proportion of aldehydes increases during ageing, it is due to the fixation of these compounds, e.g., by the colouring matters, and their protection from secondary oxidation.—J. F. B.

Beer: Pasteurisation of —. P. Petit. *Woch. f. Brau.*, 1909, 26, 20—21.

DURING pasteurisation a portion of the carbon dioxide contained in the beer is liberated and not redissolved on cooling, so that an excess pressure within the bottle is produced. The breakage of bottles during pasteurisation averages 4—5 per cent. and may rise to 8 per cent., and the author has studied the question of the pressures generated during the heating. He finds that beer expands approximately 2 per cent. during heating from 0° C. to 66° C., and if this space only is left above the liquid in a hermetically closed vessel, the pressure rises to 39 atmospheres, but if only as little as 0.1 per cent. more space is left, only 21 atmospheres pressure is attained and a further 0.2 per cent. space reduces it to 11 atmospheres. With an air space of 2.5 per cent. of its volume above the beer, the pressure only reaches 8 atmospheres. The author considers that bottles intended for use in a pasteurising plant should be bought under a guarantee that they will stand a pressure of 30 atmospheres.—R. L. S.

Stout: Studies on —. N. van Laer and J. D. Wilson. *Woch. für Brau.*, 1909, 26, 6—9.

THE authors have made a number of comparative analyses of stouts and ales of approximately the same original gravities, from which it would appear that those kinds of stout which are most popular and most generally prescribed by physicians are distinguished by their high acidity, being particularly rich in non-volatile acids. Biological examination showed that the favourite stouts were heavily infected with the lactic acid bacterium, *Saccharobacillus Pastorianus*, whereas ales were comparatively free from this organism. The authors suggest that the hygroscopic nature of black malt and its caramelised condition make it a favourable medium, during storage, for the development of this species of bacterium, the spores of which are not destroyed in the process of boiling the wort. The *Saccharobacillus* was observed to occur most profusely in those stouts which were richest in assimilable nitrogen and therefore offered favourable conditions for the development of infecting organisms. Owing to the dark colour of stout, infections may be allowed to occur which would not be tolerated in the case of an ale, which is required to be quite bright, but it is known that stouts are peculiarly liable to instability. The authors suggest that the presence of lactic acid bacteria in stout is not necessarily a fault, and quote the recent investigation of Metchnikoff in support of their further suggestion that these bacteria may be actually beneficial to health, and that their presence may account for the medicinal qualities with which stout is popularly credited. The authors point out however that the lactic acid bacteria of stout differ from those of milk, studied by Metchnikoff, in the fact that they soon die in presence of the acid which they have produced.—J. F. B.

Wines with sulphide flavour: Restoration of —. G. Gimel. *Bull. Assoc. Chim. Suar. et Dist.*, 1908, 26, 478—479.

To remove sulphuretted hydrogen from wine, the author recommends the use of copper turnings (15 grms. per hl.). The metal, which may be contained in a wicker cage, is immersed in the wine for 24 hours, the wine being stirred three or four times during this period.—L. E.

Starch: [Polysaccharides from —.] Schardinger. See XVI.

PATENTS.

Whiskey-still. J. F. Jett, Carrollton, Ky., Assignor to J. F. Jett, Peoria, Ill. U.S. Pat. 908,465, Jan. 5, 1909.

THE apparatus consists of a chamber surrounded by a steam jacket and surmounted by a distilling column. A series of independent steam coils are disposed in the chamber for the purpose of generating vapour from the spent beer, the "live" beer being introduced into the upper part of the column and encountering the vapour from the spent beer at the bottom of the column. Means are also provided for exhausting the steam from the coils and for agitating the spent beer in the heating chamber. —W. P. S.

Distillers' wash or slop; Process and apparatus for concentrating —. F. Pampe, Halle on Saale, Germany. Eng. Pat. 26,581, Dec. 2, 1907. Under Int. Conv., Dec. 1, 1906.

SEE Fr. Pat. 381,476 of 1907; this J., 1908, 435.—T. F. B.

Cooking maize and other cereals; Apparatus and process for —. F. Pampe, Halle on Saale, Germany. Eng. Pat. 26,583, Dec. 2, 1907. Under Int. Conv., Dec. 1, 1906.

SEE Fr. Pat. 385,266 of 1907; this J., 1908, 586.—T. F. B.

Sugar and alcohol. Fr. Pat. 393,716. See XVI.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(A).—FOODS.

Gluten in wheat flour; Determination of dry —. O. Rammstedt. Z. angew. Chem., 1909, 22, 16—18.

THE usual procedure in the determination of gluten in flour is to knead the dough with the hands under running water and to dry and weigh the residual gluten. This gluten presents considerable difficulty in drying, owing to the fact that it tends to flow together in a mass, and then to form a hard dry skin on the outside which prevents the escape of water from the inside. In order to facilitate the drying, Bremer devised perforated clay cylinders around which the slab of gluten was wrapped and thus kept distended during drying. These cylinders, however, are expensive and are not easily cleaned. Another method consists in spreading the gluten in a thin layer on the bottom of a Petri dish. The author has found, however, that the best substitute for the clay cylinders is a tinned iron spice-grater. These present the same advantages as the clay cylinders as regards rapid drying and moreover are readily cleaned after use. Determinations showed that the rate of drying on the cylinders or graters is somewhat more rapid than in Petri dishes, but the difference is not of much importance in view of the crude nature of the determination. Drying is complete in 1½ hours in an air oven at 120° C. or in a vacuum oven at 110° C., but the latter is much to be preferred, because the gluten undergoes considerable changes when heated in air.—J. F. B.

Flour; Detection of bleached. L. Weil. Chem.-Zeit., 1909, 33, 29.

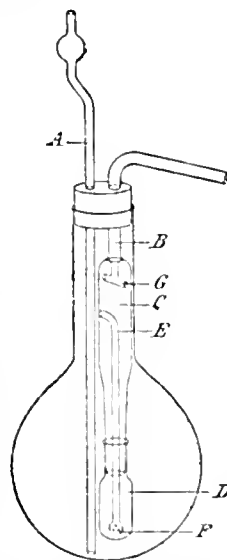
WHILST the Griess-Hosvay reagent (this J., 1907, 1211) is capable of detecting very minute quantities of nitrous acid, and will show the presence of this acid in flours which have been bleached by treatment with ozonised air, the author finds that the information yielded by the test is not altogether reliable, as certain unbleached flours give a coloration with the reagent. For instance, flour from some Russian wheat gave a coloration at once; La Plata and Kansas flours reacted after standing for 5 minutes, Swedish flour after 9 minutes, and German flour after 20 minutes. These flours therefore contain normally a small quantity of nitrous acid or some other substance which gives rise to the reaction. The author

recommends the following test for ascertaining whether a flour has been bleached. A quantity of the flour is placed in a closed vessel through which a current of hydrogen sulphide is passed for one hour; the colour of the flour thus treated is then compared with that of the original sample. Unbleached flour exhibits no difference in colour after treatment with hydrogen sulphide, but bleached flour becomes darker, acquiring the original colour it possessed before bleaching.—W. P. S.

Formaldehyde in milk; Detection and determination of —. H. S. Shrewsbury and A. W. Knapp. Analyst, 1909, 34, 12—13.

TO 5 c.c. of milk in a test-tube are added 10 c.c. of a freshly prepared mixture of 0.1 c.c. of pure nitric acid and 100 c.c. of concentrated hydrochloric acid. The tube and its contents are then placed in a water-bath at a temperature of 50° C. for 10 minutes and afterwards cooled rapidly to about 15° C. A violet coloration shows the presence of formaldehyde, and its intensity indicates the amount, which may be determined by comparison in the usual way. In the case of milk free from formaldehyde, the colour remains unaltered. From 0.1 to 0.2 part of formaldehyde per million parts of milk may be detected by means of the test.—W. P. S.

Cocoanut oil; Detection of — in butter. C. Paal and C. Amberger. Z. Untersuch. Nahr. Genussm., 1909, 17, 23—51.



A METHOD is based upon the determination of the amount of insoluble cadmium salts yielded by the distilled volatile fatty acids (see following abstract) considered in conjunction with the other values of the fat. Irregularities due to variations of manipulation may be avoided by carrying out the distillation in a current of steam in a flask like that shown in the figure. This apparatus consists of a flask holding about 1½ litres, and closed by a cork through which pass the tube, B (connected with a condenser), and the tube, A. The distillation vessel consists of an upper tube, C, fitted by means of a ground-in connection into the vessel, D, into which steam is introduced from the large flask through the tube, E. The device, G, in the neck of the tube, C, prevents particles of fat or water from being mechanically carried over. In testing a fat, 2.5 grms. are saponified with 10 grms. of glycerol-soda solution (20 c.c. of 50 per cent. sodium hydroxide solution diluted to 200 c.c. with glycerin). The soap is dissolved in 50 c.c. of hot freshly-boiled water, and the solution cooled to 55° to 60° C., and treated with 25 c.c. of dilute sulphuric acid (25 c.c. H₂SO₄ per litre). After standing for 10 to 12 hours, the solidified fatty acids are collected on a porcelain filter-plate covered with filter paper, washed with 50 c.c. of cold water and introduced into the vessel, D, the filter funnel being subsequently rinsed with 5 c.c. of 1 per cent. sulphuric acid to transfer the last particles. The vessel, D, is now connected with the tube, C, and the large flask charged with 800 c.c. of water and 1 gm. of finely powdered pumice stone. Heat is applied beneath a wire gauze and so regulated that 200 c.c. of distillate are obtained in 35 to 40 minutes. The distillation is then stopped, and the condenser connected with a flask containing absolute alcohol, the distillation of 50 c.c. of which removes fatty acids adhering to the condenser tube. The combined distillates (250 c.c.) are rendered alkaline with N/10 potassium hydroxide solution, and the amount of volatile acids nearly insoluble in water determined by titration with N/10 sulphuric acid. The neutral solution

is again rendered alkaline with 1 c.c. of $N/10$ potassium hydroxide solution, and concentrated on the water-bath to 40–45 c.c. It is then transferred to a graduated cylinder, made up to 50 c.c. with water, neutralised with $N/10$ sulphuric acid, and treated with 2 c.c. of a 20 per cent. solution of cadmium sulphate (4 c.c. in the case of fats containing over 40 per cent. of coconut oil). The precipitate is collected in a Gooch crucible, washed with 50 c.c. of water, and dried at 102° – 106° C. until constant in weight. It consists of cadmium salts of caprylic, capric, and lauric acids in proportions varying with the nature of the fat; the cadmium salts of butyric and caproic acids are soluble in water. The cadmium values (in mgrms.) obtained in this way ranged from 70.0 to 90.0 in the case of 32 samples of pure butter, whilst the same samples with the addition of 10 per cent. of coconut oil gave values of 104.0 to 124.0. A sample of coconut oil gave a cadmium value of 470 and two commercial preparations of that fat, values of 455 and 441 respectively. Feeding experiments showed that only after very large quantities of coconut oil-cake had been given to the cows did the cadmium value of the butter approximate that of butter containing 10 per cent. of coconut oil. Further experiments showed that variations in the butter fat due to the period of lactation did not affect the cadmium value sufficiently to cause difficulties in judging the purity. Low cadmium values (70 to 75) were, as a rule, obtained with the butter of cows at a late stage of lactation. Owing to the variations in the cadmium values of pure butter fat, the detection of 10 to 15 per cent. of coconut oil is only possible by considering the results of this method in conjunction with other values. So far, the following limits have held good:—Butter may be regarded as adulterated with coconut oil:—(1). When the cadmium value exceeds 100 and the Jucknack-Pasternack difference lies within the limits of +4.25 and –3.5. (2). When the cadmium value exceeds 110, while the saponification value does not exceed 235 or the Jucknack-Pasternack difference exceed –8. (3). When with a saponification value not exceeding 235, but with a Jucknack-Pasternack difference of more than –8, the cadmium value exceeds 120. (4). When the cadmium value exceeds 130 and the saponification value 235. (5). Butter with a Reichert-Meissl value of 28.0 and over need not, for practical purposes, be taken into consideration.—C. A. M.

Butter fat and coconut oil; Metallic salts of the volatile fatty acids of —. C. Paal and C. Amberger. Z. Untersuch. Nahr. Genussm., 1909, 17, 1–22.

Ox precipitating the volatile fatty acids of butter fat and of coconut oil by means of salts of heavy metals, pronounced differences are obtained in the amounts of the respective precipitates, and these are especially noticeable in the case of the zinc and cadmium salts. Thus the distillate obtained in determining the Reichert-Meissl value of coconut oil yields from 3 to 6 times as much insoluble zinc salts as the distillate from pure butter fat. A mixture containing 10 per cent. of coconut oil yields almost double the quantity given by the pure butter fat, whilst a mixture containing 50 per cent. gives as much as or more than that from pure coconut oil. Thus the zinc precipitates from the volatile acids from 5 grms. of six pure samples of butter fat weighed from 41 to 125 mgrms., whilst the corresponding precipitates from two samples of coconut oil weighed 110 and 135 mgrms. respectively. Since mixtures of two kinds of pure butter with 10 per cent. of coconut oil yielded 110 and 135 mgrms. respectively of insoluble zinc salts, or as much as certain pure butters, the certain detection of small quantities of coconut oil by means of this value alone is out of the question. Similar results were obtained by precipitation with silver, cadmium, and barium salts, and it was also found that slight variations in the method of distillation of the volatile fatty acids had considerable influence upon the quantity of insoluble precipitate subsequently obtained.—C. A. M.

Flour; Bleached —. U.S. Food Inspection Decision No. 100. [T.R.]

THE Board of Food Inspection has given it as their unanimous opinion that flour bleached with nitrogen

peroxide is an adulterated product under the Food and Drugs Act, 1906; also that no statement on the label can bring such bleached flour within the law, and that such flour cannot legally be made or sold in the District of Columbia or in the Territories, or be transported or sold in interstate commerce.

Vegetables greened with copper salts; Admission of — into the United States. U.S. Food Inspection Decision No. 102. [T.R.]

VEGETABLES greened with copper salts, but which do not contain an excessive amount of copper, and which are otherwise suitable for food, will be allowed entry into the United States until further notice, if the label bears the statement that copper sulphate or other copper salts have been used to colour the vegetables.

“Denaturing” cottonseed oil. Winterfeld. See XII.

PATENTS.

Milk preparation from cows' milk; Manufacture of a —. E. Bohlen. Ger. Pat. 205,965, Jan. 29, 1908.

Cows' milk is diluted with water and mixed with a neutral solution of pure lactalbumin. One kilo. of sterilised lactalbumin is dissolved in a sterilised lye containing 60 grms. of sodium hydroxide, the excess of alkali is removed by dialysis or neutralised with acid, and a quantity of the solution containing from 3 to 6 grms. of lactalbumin is added to 1 litre of a milk food prepared in the usual manner by addition of cream, lactose, and water to cows' milk. —A. S.

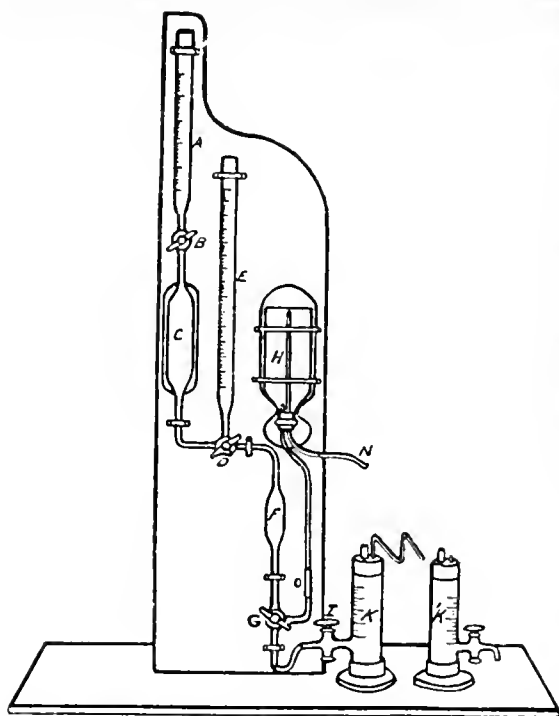
Butter; Manufacture of —. J. V. M. Risberg, Södertelje. Assignor to Aktiebolaget Baltic-Separator, Stockholm. U.S. Pat. 908,887, Jan. 5, 1909.

SEE Eng. Pat. 8708 of 1907; this J., 1907, 774.—T. F. B.

(B.)—SANITATION; WATER PURIFICATION.

Water; Colorimetric determination of dissolved oxygen in —. G. B. Frankforter, G. W. Walker, and A. D. Wilhoit. J. Amer. Chem. Soc., 1909, 31, 35–43.

THE method described depends on the change in colour of cuprous-ammonium chloride when brought in contact with oxygen (see this J., 1901, 1071) and the authors have devised an apparatus in which a solution of the pure, colourless double salt can be prepared and kept ready for use. This apparatus is shown in the accompanying figure; it is constructed entirely of glass. Copper wire is introduced into the reservoir, C, the opening in the stop-cock being large enough to admit the pieces, and C is then filled with a saturated solution of cuprous chloride in hydrochloric acid. After any cupric chloride which may be present has been reduced, the burette, A, is filled with concentrated hydrochloric acid. The tube, F, serves for mixing the cuprous chloride with the ammonia which is contained in the burette, E, the three-way tap, D, allowing the necessary quantities of the two solutions to be discharged. The reservoir, H, is filled with the sample of water, corked, placed in position, and connected with the apparatus at O; the tube, N, is connected with a hydrogen apparatus. The colorimeter tube, K, is then filled with the water by opening the tap, I, and the three-way tap, G, care being taken that all small bubbles of air are removed. The colorimeter tubes hold exactly 102 c.c. Two c.c. of the cuprous-ammonium chloride are next introduced; this is accomplished by connecting F (previously filled with reagent) with K, opening B and cautiously opening D. When 0.5 c.c. of the reagent have been introduced into K, B is closed and D is turned so as to connect E, containing ammonia, with K; 1.5 c.c. of the reagent having been admitted into K, making 2.0 c.c. in all, the tap is closed. These operations admit simultaneously quantities of cuprous chloride and ammonia to the tube, F, so that the latter is kept full of the reagent. The colorimeter tube now contains 100 c.c. of the water plus



2 c.c. of reagent, and after the tap, I, has been closed, the blue coloration produced is compared with that given by a known quantity of a standard solution of cupric chloride solution contained in a second colorimeter tube, 'K'. This standard solution is prepared by dissolving 1.1364 grms. of pure copper in *aqua regia*, evaporating the excess of acid, and diluting the residual solution to 1 litre. Each c.c. of the solution is equivalent to 1 c.c. of oxygen in a litre of water when the quantity of water taken for analysis is 100 c.c.—W. P. S.

Wood pulp mill effluents. Vogel. See XIX.

PATENTS.

Refuse consuming furnaces. W. Fairweather, London.

From Decarie Manufacturing Co., Minneapolis, U.S.A.
Eng. Pat. 28,682, Dec. 31, 1907.

THE furnace consists of a circular or rectangular combustion chamber in which is fitted a basket-grate formed of a number of water-circulating tubes; these tubes are in connection with a water and steam tank situated around and above the chamber. Wet garbage is filled into the basket-grate and is dried by the gases and flames coming from an auxiliary furnace; as it dries, the garbage falls from the basket on to a grate below, where it is consumed. The gases from the combustion chamber pass through perforated firebricks at the top of the chamber, thence downwards through a flue containing water tubes at the side of the chamber, and over the surface of water contained in a tank at the bottom of the flue. The water in this tank absorbs much of the solid or uncombusted material in the gases. The latter are then conducted under a draught furnace and into a combustion chamber in which are walls reaching almost to the top and bottom, respectively. On leaving this chamber, the gases pass through a sheet of falling water before escaping into a chimney. (See also Eng. Pat. 18,915 of 1905; this J., 1906, 492.)

—W. P. S.

(C).—DISINFECTANTS.

PATENT.

Antiseptic and other purposes; Composition for —.

H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 909,527, Jan. 12, 1909.

CLAIM is made for a new anhydrous composition of matter consisting of formaldehyde and an inert, unctuous, water-repellent vehicle, *e.g.*, "a fixed aliphatic oxy-acid ester."—A. S.

XIX.—PAPER, PASTEBOARD, &c.

Wood pulp mills; Effluents from —. J. H. Vogel.
Z. angew. Chem., 1909, 22, 49—55.

THE pollution of rivers by the effluents from sulphite wood pulp mills may be direct, *e.g.*, by fibres, dissolved organic matters, and sulphurous acid, or indirect, *e.g.*, by the growth and subsequent putrefaction of fungi and algae. Of the first class of polluting substances, the cellulose fibres are the most objectionable and the most easily removed. These fibres collect and precipitate impurities from sewage effluents and effluents of other factories, and are deposited in the form of a putrefying mud at the bottom of the river. In cases of damage due to pollution, *e.g.*, fish poisoning or damage to crops after floods, the ease with which the fibres are identified causes the responsibility to be thrown on the pulp mill, even though the fibres are harmless in themselves and constitute only a small proportion of the mud. The cost of removing the fibres from the effluent is largely counterbalanced by the value of the recovered product, so that all mills should aim at discharging an effluent containing not more than 40—60 mgrms. of suspended fibres per litre, according to the size of the river. The waste liquors themselves, if diluted 100 times, are perfectly harmless to fish and to vegetation, thus no direct damage is likely to ensue from their presence in the river. But the indirect nuisance caused by the growth and putrefaction of fungi may assume very grave proportions in a slow-flowing river. The waste liquors at their original concentration are absolutely non-putrescible; the growths are developed by the continuous feeding of the lyes into the channel in a highly dilute form. A mill producing 40 tons of cellulose per day will discharge about 300 cub. m. of original lye and 780 cub. m. of wash-waters. The lye will very rarely contain 4 grms. of free sulphur dioxide per litre, and this will be largely neutralised by the basic constituents of the wash-waters. The best method of preventing growths is to adopt the system of periodical discharges of large quantities of lye instead of the continuous discharge of small quantities. The lyes and washings should be collected in a reservoir, freed from fibres, and discharged once or twice every 24 hours at such a rate that the total dilution of the original lye amounts to 100 times. The time of discharge might be about 40 minutes, but every case requires particular consideration; much depends also on the degree of pollution by putrescible and de-oxidising effluents from other sources. The author is opposed to the regulation requiring the neutralisation of the effluents by lime. A neutral or alkaline condition of the lyes greatly favours the growth of fungi. It would seem that the apparently "free" sulphurous acid in these lyes is probably in loose combination with the sugars, and is far less poisonous to fish than pure sulphurous acid. All that is necessary is to ensure that the "free" sulphurous acid does not amount to more than 1 gm. per litre of effluent; the basic matters in the river water will then do all that is necessary. In the case of very small water-courses, if the periodical discharge of the effluent be adopted, it may be necessary to dilute the lyes in the reservoir before discharging.—J. P. B.

Swedish paper pulp in the United States; Extra duty on —. Papier-Zeit., 1909, 34, 2. [T.R.]

ACCORDING to the United States tariff, the customs officials can assess on an increased scale any goods on which, or on the materials used in the manufacture of which, the exporting country levies an export duty. It has only just come to the knowledge of the officials that, according to a decree of the Swedish Government, which came into operation in 1905, wood, mechanical wood pulp and cellulose, exported from certain districts of Sweden, are subject to an export duty. This tax is levied in order to cover the expenses of the Government supervision of the forests, and it amounts to 0.66 to 1.32d. per cub. metre of wood, 6.59d. per ton of dry cellulose pulp, and 3.96d. per ton of dry mechanical pulp. The export duty on moist pulp is one-half that on dry pulp.

The U.S. Customs have now decided to charge an extra duty of 13½ cents per ton (2,240 lb.) on Swedish pulps, over and above the tariff duty.—J. F. B.

Paper; Relations between moisture-content and strength of —. L. Friedrich. *Papierfabrikant*, 1909, 7, 7—8.

It is well known that the mechanical properties of paper are influenced by the percentage of hygroscopic moisture present in the paper at the time of testing. With increased percentage of moisture, there is a decrease in tensile strength and, up to a limit, an increase in the extensibility and in the resistance to creasing and rubbing. In recognition of this variation it is customary, when great accuracy is desired, to allow the paper to remain for a few hours in an atmosphere artificially maintained at a humidity of 65 per cent., before testing. The author's investigations have shown that when paper had been stored in an atmosphere of 40 per cent. humidity (a condition by no means rare in dry rooms), and was then transferred to the standard atmosphere for testing, 2 hours in this latter atmosphere were not sufficient for the establishment of a new equilibrium. The time required for the complete conditioning of the paper varied with its nature, being least in the case of ordinary "news" paper. With papers of better quality it was necessary to leave the papers in the standard atmosphere for at least six hours before results comparable with those obtained after 24 hours' exposure were obtained. For instance, with a normal paper of the class 2a, transferred from an atmosphere of 40 per cent. humidity to one of 65 per cent., the hygroscopic moisture rose from 6.3 per cent. after 2 hours' exposure to 6.7 per cent. after 6 hours. Coincident with this change in the moisture-content of the paper, the "breaking length" fell from 5215 to 5030 m., the "elongation" rose from 3.80 per cent. to 4.05 per cent., and the resistance number on Schopper's creasing machine rose from 213 to 224. These variations are far from being negligible, and the time required to establish equilibrium would of course be very much greater if the paper were originally in a drier condition than that corresponding with an atmosphere of 40 per cent. humidity.—J. F. B.

PATENT.

Cellulose solutions; Process for the production of —. E. Crumière, Paris. U.S. Pat. 908,754, Jan. 5, 1909.

SEE Fr. Pat. 361,048 of 1905; this J., 1906, 691.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Alkaloids in coca leaves; Determination of —. A. W. K. de Jong. *Rec. trav. chim. Pays-Bas*, 1908, 27, 419—421.

THE author prefers the following method for estimating the alkaloids in coca leaves instead of the Keller-De Jong process. 12.5 grms. of finely powdered leaves are mixed with 5 c.c. of 25 per cent. ammonia and the mixture extracted in a Soxhlet apparatus with light petroleum for 10 to 15 hours. After transferring the extract to a stoppered funnel and washing out the flask with light petroleum, the leaves are extracted again for 3 hours and the light petroleum tested by shaking it with 2 or 3 c.c. of dilute hydrochloric acid; the acid should not give a turbidity with ammonia. The alkaloid extract is now shaken with 50 c.c. and then with 25 c.c. of dilute (0.5 per cent.) hydrochloric acid. When an emulsion is formed, this is transferred to a flask and the liquids separated by a current of air. The acid solution is then filtered through a small filter previously washed twice with water. The filtrate is shaken once with ether (which is set aside) and rendered alkaline with ammonia. It is then shaken first with 50 and then with 25 c.c. of ether, the ethereal solution allowed to stand for a few minutes, transferred to a tared flask (care being taken not to pour in any drops of water), the flask washed twice with a few c.c. of ether, which are added to the bulk, the solution evaporated, and the flask heated several times

in boiling water; after each heating a current of air is passed through. The flask is finally dried in a desiccator and weighed.—J. C. C.

Quinine sulphate; [Official description of —]. L. Vaudin. *J. Pharm. Chim.*, 1909, 29, 60—61.

ACCORDING to the French Codex of 1884, quinine sulphate was tested by means of ammonia, a method which allowed the presence of as much as 5 per cent. of the salts of quinidine and cinchonidine. The Pharmacopœa of 1908 has introduced tests which are only satisfied by pure quinine sulphate. Pure quinine sulphate satisfying these conditions will cost about 45 per cent. more than that produced in accordance with the former requirements. The author suggests that less stringent tests should be introduced to prevent inconvenience owing to the increased cost of pure quinine sulphate. The new Pharmacopœa comes into force on May 15th next.—F. SHON.

Amara milk; Preliminary note on the composition of —. A. Rathje. *Arch. Pharm.*, 1909, 247, 49—53.

AMARA milk is used in the Amazon region as a remedy for consumption. It is the latex of one of the *Apocynaceæ* indigenous to Brazil, possibly a species of the genus *Hancornia*. The following substances were found to be present in the milk: plant acids, gelatinous substances; sugars; esters of tannic acids; water; esters of formic, acetic, propionic, and butyric acids; fatty acids melting at 53°—54° C., 63°—64° C., 69°—70° C., 78°—79° C.; phytosterol; and hydrocarbons of the melting points, 120°—121° C., 196°—197° C., 200°—201° C., and 201°—205° C. The milk has the sp. gr. 1.0304, a sour taste, and an acid reaction.—F. SHON.

Tolu balsam; Detection of rosin in —. E. Perrot and A. Goris. *Bull. Sci. pharm.*, 1908, 636. *Apoth.-Zeit.*, 1909, 24, 9.

FIVE grms. of Tolu balsam are shaken with 30 c.c. of carbon bisulphide in the cold, or with gentle warming. The solvent is decanted and evaporated; the residue is treated with 10 c.c. of light petroleum spirit, filtered, and shaken with a 1 per 1000 solution of copper acetate. The presence of rosin is indicated by the appearance of a green colour. Two per cent. of rosin, or less, may be detected thus. The test is not applicable to Peruvian balsam, for the pure drug gives a green colour under these conditions.—J. O. B.

Lemon oil; Determination of aldehydes in —. A. H. Bennett. *Analyst*, 1909, 34, 14—17.

THE method described is a slight modification of that proposed by Walther (this J., 1899, 1161); in order to overcome the objection that the carbon dioxide evolved carries off hydroxylamine, the author, instead of using sodium bicarbonate, adds to the solution of the hydrochloride a quantity of an alcoholic solution of potassium hydroxide sufficient to liberate an amount of hydroxylamine in excess of that required to combine with the citral present, but not sufficient to completely neutralise the acid of the hydrochloride. Such a partially-neutralised solution can be boiled under a reflux condenser without any loss of the base taking place. The details of the process are:—Twenty c.c. of lemon oil are mixed with 20 c.c. of $N/2$ solution of hydroxylamine (in 80 per cent. alcohol) and to the mixture are added about 8 c.c. of $N/4$ alcoholic solution of potassium hydroxide and 20 c.c. of alcohol. The mixture is boiled under a reflux condenser for 30 minutes, then allowed to cool, the condenser is washed, and the contents of the flask are diluted with 250 c.c. of water. The solution is next made neutral to phenolphthalein, and finally titrated with $N/2$ sulphuric acid, using methyl orange as indicator. The number of c.c. of acid required, subtracted from the number used in a blank experiment in which no lemon oil is present, represents the amount of hydroxylamine which has combined with the citral, and multiplied by 0.076 gives the weight of citral. It is recommended that drops of an aqueous solution of methyl orange placed on a white plate be used in the titration.—W. P. S.

Lemon oil; [*Adulterated* —]. E. J. Parry. Chem. and Drugg., 1909, 74, 121.

THE author states that since the earthquake in Sicily, a great deal of grossly adulterated lemon oil has appeared on the market. He gives particulars of various samples adulterated with petroleum, castor oil, and oil of turpentine, and of others diluted with lemon oil terpenes; these latter were possibly so-called "super-oil."—A. S.

Eucalyptus globulus oil; *South African* —. E. F. Harrison. Pharm. J., 1909, 82, 4.

A SPECIMEN of *Eucalyptus globulus* oil from the Transvaal had the following characters:—Sp. gr. 0.9227 at 15° C.; $[\alpha]_D^{20} = +3.33'$; cineol content, 83.7 per cent. by the phosphoric acid method; no phellandrene was present. The oil is of good quality for medicinal use.

—J. O. B.

Atoxyl [*sodium p-aminophenylarsinate*]; *Distinguishing* — from *arsacetin* [*sodium p-acetaminophenylarsinate*]. A. Labat. Bull. Soc. Pharm. Bord., 1908, 289. Pharm. J., 1909, 82, 60.

THE chief advantages of arsacetin over atoxyl are that it may be sterilised in an autoclave at 130° C. without decomposition, and that it is less toxic. It may be distinguished from atoxyl by a number of reactions, among which are the following:—Ten per cent. aqueous solutions are used. On mixing a drop of the atoxyl solution on an object glass with a drop of a 1 per cent. solution of cobalt nitrate, nickel chloride, manganese sulphate, or magnesium sulphate, there is obtained a crop of small crystals, sometimes resembling those of ammonio-magnesium phosphate. In the case of manganese sulphate, a small part of the precipitate is amorphous, but all the rest is crystalline. Arsacetin, on the contrary, gives an amorphous precipitate with cobalt nitrate and manganese sulphate, but none at all with the other reagents. On mixing 1 c.c. of 95 per cent. alcohol and two drops of atoxyl solution, a crystalline precipitate is formed, but none with arsacetin. On mixing 1 c.c. of the atoxyl solution with 1 c.c. of 5 per cent. sulphuric acid, there is formed a very slight crystalline deposit; with a solution of half the strength there is no reaction. Arsacetin, under these conditions, gives a precipitate so dense that a magma is produced. In both cases the crystals are in the form of hexagonal tables. On adding bromine water, drop by drop, to 1 c.c. of the atoxyl solution, there is formed an amorphous precipitate surmounting a pale yellow liquid. With arsacetin the precipitate formed is deposited in tufts of fine needles, easily observed under slight magnification. When 0.20 grm. of arsacetin is heated with 10 c.c. of a mixture of equal parts of alcohol and sulphuric acid, the odour of ethyl acetate is given off; atoxyl gives no such odour.

Salicylic acid; *Reduction of* —, to *salicylic aldehyde*. H. Weil. Ber., 1908, 41, 4147—4148.

IN presence of excess of boric acid, sodium amalgam is capable of reducing sodium salicylate to salicylic aldehyde; 15 grms. of salicylic acid neutralised by 5.5 grms. of sodium hydroxide are diluted to 1 litre with hot water, 18 grms. of *p*-toluidine dissolved in it, and the whole is cooled with constant stirring. Then 15 grms. of boric acid are added, and, gradually, 330—430 grms. of 2 per cent. sodium amalgam. During this addition, the liquid must be constantly stirred, and boric acid added so as to keep the solution always slightly acid (about 120 grms. in all). The suspended aldehyde-toluidine is filtered off, acidified, and distilled in steam, when the aldehyde passes over and toluidine salt remains.—J. T. D.

Benzoic and salicylic acids; *Electrolytic reduction of* —, to *aldehydes*. C. Mettler. Ber., 1908, 41, 4148—4150.

THE reduction by sodium amalgam discovered by Weil (see preceding abstract) can be modified so as to make use of the electrolysis of a sodium salt. A solution of sodium sulphate is in the first instance electrolysed with a mercury cathode so that the electrolysis of the sodium salicylate may be started with a sodium amalgam electrode; the solution of sodium salicylate and boric acid is then

placed in the cell, with a quantity of benzene, and electrolysis begun with constant mechanical agitation. As the aldehyde is formed, it dissolves in the benzene; and at the end of the operation the benzene and aldehyde are distilled over in steam, and afterwards separated. Many substituted benzoic acids can be reduced in this manner.

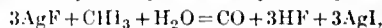
—J. T. D.

Methylaniline and dimethylaniline; *Recognition of* — in the presence of each other. H. Emde. Arch. Pharm., 1909, 247, 77—79.

THE platinum salts can be used to distinguish between methylaniline and dimethylaniline in the presence of each other. Methylaniline platinum chloride, $(\text{BHCl})_2\text{PtCl}_4$, forms short orange-coloured crystals, which decompose at 199° C., and can be crystallised from hot water containing hydrochloric acid. Dimethylaniline platinum chloride, $(\text{BHCl})_2\text{PtCl}_4$, is produced by dissolving the base in strong hydrochloric acid, and adding the solution to 10 per cent. platinum chloride solution. The orange-yellow precipitate is filtered off in the cold and recrystallised from alcohol containing hydrogen chloride. It then forms orange-red needles, decomposing at 173° C. If a mixture of the bases is suspected, a small portion dissolved in acid is added to a platinum chloride solution, and the platinum double salts separated by crystallising from alcohol. If methylaniline only is to be looked for, the mixture can be crystallised from water. The presence of 5 per cent. of methylaniline in dimethylaniline can be recognised in this way.—F. SUPN.

Iodoform; *Action of* — on *silver fluoride and chloride*. O. de Coninck. Bull. Soc. Chim., 1909, 5, 62—63.

BY the action of silver chloride, in the presence of water at 94° C., iodoform is converted into chloroform, and silver iodide is formed. With silver fluoride, however, the reaction may be represented by the equation,



the evolved gas generally containing also a little carbon dioxide.—F. SUPN.

Benzoic acid into salicylic acid. Bargellini and Inghilleri. See XIA.

PATENTS.

Dihalogen-acetyl chloride, dihalogen-acetic acid, and derivatives thereof; *Manufacture of* —. H. K. Tompkins, and The Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 5104, March 10, 1908.

THE tetra-halogen compounds obtained by treating dichlorovinyl ether, $\text{CHCl}:\text{CClOC}_2\text{H}_5$, with chlorine or bromine, are decomposed into ethyl chloride or bromide and dihalogen-acetyl chlorides, by heating. The latter react slowly with water forming the corresponding dihalogen-acetic acids; with ammonia, dihalogenated acetamides are formed, and with aniline the anilides of the acids; with alcohol they yield ethyl dihalogen acetic esters.—T. F. B.

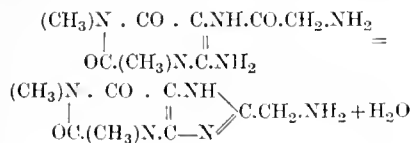
Formic acid; *Manufacture of* —. Soc. Anon. des Établissements Eycken et Leroy. Fr. Pat. 393,526, May 21, 1908.

SODIUM formate, alone, or in the presence of formic or acetic acid, is distilled with oxalic acid, the resulting sodium oxalate is converted into caustic soda and calcium oxalate by means of lime, and oxalic acid is recovered from its calcium salt by means of sulphuric acid, the object being to recover the oxalic acid used, and also the soda (as sodium hydroxide) whilst formic acid is distilled off and condensed in the usual way.—O. R.

Purine derivatives; *Process for producing new* —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 393,564, Aug. 12, 1908. Under Int. Conv., Feb. 22 and 26, 1908.

BY treating 4,5-diaminopyrimidines with halogen derivatives of organic acids, water is eliminated between the acid and the 5-hydroxy group; the halogen-acylaminoaminopyrimidines thus formed react with ammonia,

the halogen group being replaced by an amino-group; by treating these compounds with condensing agents (e.g., alkali hydroxides), water is eliminated and purine derivatives are obtained. Thus, from monochloroacetic acid and 1,3-dimethyl-2,6-dioxy-4,5-diaminopyrimidine, the amino compound and its conversion into the purine derivative are as follows:—



—T. F. B.

Mercury salt solutions; Preparation of stable —. A. Busch. Ger. Pat. 204,932, Nov. 23, 1907. Addition to Ger. Pat. 187,697.

COMPOUNDS of mercuric salts with hexamethylenetetramine are obtained in stable solution by dissolving the double salt in excess of soap solution, with addition of sufficient albumose to prevent precipitation of the mercury by the usual reagents. A solution corresponding to a 1 per cent. mercuric chloride solution is obtained by mixing 1.26 grms. of hexamethylenetetramine-dimercuric chloride with an equal weight of albumose, and stirring the mixture into 97.5 c.c. of a 5 per cent. soap solution until solution is complete.—T. F. B.

Gallie acid salts; Preparation of dry, stable —. Knoll and Co. Ger. Pat. 204,959, Feb. 6, 1908.

SOLUTIONS of gallates extracted from fresh galls, and purified in the known manner and extracted with chloroform, are mixed with gum tragacanth; they can then be evaporated to dryness at temperatures below 55° C. The resulting preparations are nearly colourless, and insoluble in ether and chloroform; alcohol extracts the gallate, leaving the tragacanth undissolved.—T. F. B.

Camphene free from chlorine; Process for preparing solid —. A. Roesler. Ger. Pat. 205,295, Jan. 26, 1908.

THE halogen acid is said to be quantitatively removed from pinene hydrohalides by heating for 24 hours under pressure with a meta- or pyroborate, silicate, phosphate, or arsenate, in aqueous solution; the camphene is isolated by distillation with steam. 10 kilos. of solid pinene hydrochloride, 13.8 kilos. of crystallised borax, and 15 litres of water are heated for 24 hours in an autoclave, at 220° C. The camphene obtained (yield 97 per cent. of theory) is free from chlorine and boils below 160° C.—T. F. B.

Sodium-amino compounds, alone or mixed with potassium-amino compounds; Process for preparing — from primary or secondary aromatic amines. Basler Chem. Fabrik. Ger. Pat. 205,493, April 7, 1906.

COMPOUNDS of sodium with aromatic amines are readily obtained by the action of the metal on the amine in presence of sodium or potassium hydroxide; if potassium hydroxide is used, a mixture of the sodium and potassium compounds is formed. For example, 50 grms. of dry potassium hydroxide are heated in an iron vessel to 200° C., 11.5 grms. of sodium are slowly added, and 47.5 grms. of aniline are then gradually added, under a reflux condenser. The product is a reddish-brown, crystalline mass.

—T. F. B.

Sodium glycerylphosphate; Process for the preparation of —. J. A. Wülling. Ger. Pat. 205,579, April 30, 1908.

SODIUM metaphosphate or a mixture of disodium phosphate and metaphosphoric acid is heated with excess of glycerin *in vacuo* to 120°–210° C., and the resulting monosodium glycerylphosphate is converted into the disodium compound in the usual manner.—A. S.

Hydrazoic acid; Process for the preparation of —. R. Stollé. Ger. Pat. 205,683, March 10, 1908.

By treating hydrazine hydrate or salts of hydrazine with nitrous acid esters, or with nitrous acid and alcohols, in alkaline solution, good yields of hydrazoic acid are obtained. *Example*.—1 kilo. of hydrazine hydrate is boiled for 24 hours with 4 kilos. of amyl nitrite and a solution of 3 kilos. of potassium hydroxide in 15 kilos. of alcohol. The alcohol is then distilled off, amyl alcohol removed by distillation with steam, and the residue diluted with water to 10 litres and boiled for 3 hours after addition of 2.5 kilos. of ammonium sulphate. After cooling, 1 kilo. of sulphuric acid is added, and the hydrazoic acid recovered from the solution by distillation. A yield of 70–80 per cent. of the theoretical quantity of hydrazoic acid is obtained.

—A. S.

Cascara sagrada bark; Process for the preparation of a clear extract, soluble in water, not containing zinc, and free from bitterness, from —. M. Penschuck. Ger. Pat. 206,467, Oct. 10, 1907.

THE powdered bark or its concentrated aqueous extract is heated with zinc oxide and water, filtered, and the filtrate evaporated in a vacuum. If any zinc sulphate is formed in the treatment with zinc oxide, this is removed by means of a small quantity of alkali carbonate.—A. S.

Camphor; Process for the manufacture of —. Dr. Schmitz and Co., Dusseldorf, Germany. Eng. Pat. 3750, Feb. 19, 1908. Under Int. Conv., March 12, 1907.

SEE Fr. Pat. 387,053 of 1908; this J., 1908, 832.—T. F. B.

Santalol ether. J. Callsen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 909,541, Jan. 12, 1909.

SEE Ger. Pat. 202,352 of 1907; this J., 1908, 1177.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Screens with polychrome divisions for the photography of colours; Process for obtaining —. J. M. Borrel. Fr. Pat. 393,557, Oct. 29, 1907.

A GELATIN film is sensitised by means of a bichromate or other substance which is converted, by the action of light, into a mordant for the dyestuffs to be used for colouring the screen, whilst, at the same time, the unaltered sensitiser acts as a resist for the dyestuff. One-third of the sensitised film is exposed to light, washed, and dyed with the first colour; it is then again sensitised and the process repeated with the second and third colours, the resulting screen being thus composed of a series of small areas in the three colours.—T. F. B.

Paper or similar substance; Process of glazing — for use as a temporary support for photographic and cinematograph films during the manufacture of the latter. L. L. T. Labbé and H. E. Perret. Fr. Pat. 393,627. Aug. 24, 1908.

STRIPS of paper or linen are treated with a solution containing 5 grms. of celluloid in 100 grms. of acetone; the strips are then dried and coated with a varnish consisting of a mixture of 50 c.c. of petroleum spirit and 50 grms. of a paste prepared by grinding together white copal and boiled linseed oil. When the varnish has dried, a coating of gelatin is applied; this is prepared by dissolving 10 grms. of gelatin in 100 c.c. of hot water, adding 4 c.c. of glycerin, and then, immediately before use, 0.5 gm. of either formaldehyde, potassium bichromate, or aluminium acetate. Finally, a coating of a solution of 10 grms. of wax in 100 c.c. of alcohol is applied.—W. P. S.

Gelatin film for use in cinematography, and process of making the same. L. L. T. Labbé and H. E. Perret. Fr. Pat. 393,628, Aug. 24, 1908.

A GLAZED strip of paper or linen prepared as described in the preceding abstract is coated with the gelatin solution also there described. After being dried for about 24 hours at a temperature of 30° C., the film is varnished with the copal solution, and again dried for 24 hours. The varnished gelatin film is then detached from the prepared paper strip and the surface of the film which was in contact with the paper strip is varnished and allowed to dry. The gelatin solution and the varnish may be decolorised by the addition of a small quantity of oxalic acid.—W. P. S.

Photographic developing and fixing solutions. F. Jeannot and M. Bremner, Paris. Eng. Pat. 15,657, July 23, 1908. Under Int. Conv., July 23, 1907.

SEE Fr. Pat. 390,265 of 1907; this J., 1908, 1041.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Smokeless powders; Indicators and stabilisers in —. A. Carneiro. Z. ges. Schiess- und Sprengstoffwesen, 1909, 4, 29—30.

THE author has made some experiments on the addition of diphenylamine to smokeless powders, as regards its effect upon the heat test. Guttman's diphenylamine test papers were used. One grm. of the nitrocellulose powder was taken for the tests, which were carried out at a temperature of 80° C. In the case of nitroglycerine explosives the temperature was 70° C. The nitrocellulose powders having an original heat test of 9 to 11 minutes showed a drop in heat test of $\frac{1}{2}$ to 3 minutes after the addition of 1 per cent. of diphenylamine. The nitroglycerine explosives of 18 and 29 minutes heat test showed a drop of 1 to 4 minutes under similar conditions. After heating for 72 hours at 38° C., similar nitrocellulose powders showed a rise in heat test of 3 to 5 minutes, whilst the same samples containing diphenylamine showed a rise of only about $\frac{1}{2}$ to 1 minute. A similar treatment of nitroglycerine explosives gave a drop in heat test of 4 to 10 $\frac{1}{2}$ minutes in the untreated explosive and 9 to 12 $\frac{1}{2}$ minutes in the same samples containing diphenylamine. The author concludes that diphenylamine cannot be considered as a stabiliser for smokeless powder.—G. W. M. D.

Explosives; Gases resulting from the use of high —. W. Collen. J. Chem. Met. and Min. Soc., S. Africa, 1908, 9, 144—152.

THEORETICALLY, the gases evolved by the explosion of a scientifically constituted blasting gelatin are carbon dioxide, nitrogen, and water vapour, all of which are comparatively innocuous, and the results of tests made on modern blasting gelatin, in steel bombs, are found to approximate closely to the theoretical. In order to test if carbon monoxide was also formed, as has been stated, the author has collected and analysed a large number of samples of mine air, immediately before and after blasting. The samples were taken at a depth of 1400 to 1700 ft. Comparative tests were made, using newly-made blasting gelatin, three months old gelatin, a patent "neutralizer" or "anti-fume" mixture, and a gelatin of "special" composition. In every case, carbon monoxide was found in dangerous quantity (0.467—1.28 per cent.), a slight improvement however being shown when using the "special" gelatin, but even in this case, the ratio of carbon monoxide to dioxide was 1 to 9. A considerable quantity of carbon monoxide was also generated by the burning of the fuse, 96 ft. of which was generally required for each "blast." Electric firing is therefore preferable. Experiments in tamping, showed that a slight improvement was caused by the use of "Daga," a preparation somewhat resembling clay, in place of the usual sand cartridges. Details of the experiments and analyses are included in the paper, which is the first of a series of three or four.—F. B.

Regulations for the manufacture of explosives with use of dinitrobenzol or dinitroethanol. Statutory Rules and Orders No. 1310, [T.R.] See under IV.

PATENTS.

Explosives. F. W. Bawden, Johannesburg, Transvaal. Eng. Pat. 20,279, Sept. 26, 1908. (See also Eng. Pat. 4046 of 1908; this J., 1908, 923.)

LAMPBLACK and molasses are added to potassium chlorate for the purpose of imparting plasticity and to render the explosive waterproof. Nitrates of barium, potassium, or ammonium may be substituted for the whole, or a part of the potassium chlorate. Three specific mixtures for various purposes are claimed.—C. J. G.

Nitrocellulose powders; Process for the preparation of gelatinous —. Cyanid Ges., Ges. m. b. H. Ger. Pat. 265,762, Dec. 23, 1905. Addition to Ger. Pat. 201,215.

INSTEAD of adding cyanamide, dicyanodiamide, or tri-cyanotriamide to powders composed of nitrocellulose or of nitrocellulose and nitroglycerin, as described in the main patent (see Eng. Pat. 27,515 of 1903; this J., 1905, 44) salts of dicyanodiamidine are added.—A. S.

Matches. L. Carré, London. Eng. Pat. 117, Jan. 2, 1908.

PIECES of straw, haulms, rushes, or grass are dipped in a celluloid solution, or other inflammable substance, such as a liquid animal, vegetable, or mineral fat, or a mixture of these. They are then heated in an oven to remove superfluous fat, and afterwards dipped in the match composition.—A. S.

Blasting powder. H. D. Fairis and A. C. Jex, Wetaskiwin, Canada. Eng. Pat. 20,574, Sept. 30, 1908.

SEE U.S. Pat. 891,334 of 1908; this J., 1908, 836.—T. F. B.

Primers; Charging of —. F. Hyronimus, Cugny, France. U.S. Pat. 908,674, Jan. 5, 1909.

SEE Fr. Pat. 384,792 of 1907; this J., 1908, 524.—T. F. B.

Gunpowder; Smokeless —. C. P. H. Claessen, Wilmersdorf, Germany. U.S. Pat. 909,546, Jan. 12, 1909.

SEE Eng. Pat. 16,725 of 1906; this J., 1906, 1174.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

PATENT.

Thermo-elements; Improving the junctions of —. A. Rittershausen. Ger. Pat. 205,009, May 1, 1907.

IRREGULARITIES, such as grooves or ridges, are formed in the faces of the metals to be joined, and union is then effected by means of electrolysis, pressure, or the like, but not by soldering.—A. S.

INORGANIC—QUANTITATIVE.

Nitric acid; Determination of — gravimetrically. A. Hes. Z. anal. Chem., 1909, 48, 81—98.

AN examination of Busch's gravimetric method of determining nitrates (this J., 1905, 291, 638) shows that the solution should contain about 0.1 per cent. of nitrate, and, after the addition of "nitron," the solution (e.g., a sample of water) should be diluted or concentrated to that strength. Dextrin, gelatin, and probably other organic compounds hinder the crystallisation of the "nitron" nitrate, but the presence of aluminium sulphate, magnesium sulphate, ammonium sulphate, potassium phosphate, magnesium chloride, tartaric acid, citric acid, sucrose, and dextrose does not affect the accuracy of the method, provided the precipitate is sufficiently washed; oxalic acid causes high results. Chloric acid precipitates "nitron" quantitatively as the chlorate, if the solution contain about 0.25 per cent. of chloric acid, and nitric and chloric acids may be determined in the presence of each other, if the quantity of one be known.—F. SONX.

Sulphite; Determination of — by titration with permanganate. J. Milbaner. Z. anal. Chem., 1909, 48, 17—24.

THE determination of sulphites by titration with permanganate is unsatisfactory unless special precautions are taken, because oxidation to sulphuric acid is not quite complete. Good results are obtained if the very dilute sulphite solution, containing not more than 1 mgrm. of sulphur dioxide per c.c., be added to ten times the calculated quantity of permanganate solution (1 c.c. = 1 mgrm. of sulphur dioxide), acidified with more than 20 volume per cent. of strong sulphuric acid, and the excess of permanganate be titrated with standard oxalic acid, ferrous sulphate, or hydrogen peroxide solution. Some substances, such as bromine and iodine, when added in traces, exert a favourable influence on the reaction.

—F. SONN.

Halogen; Determination of — gravimetrically by means of silver nitrate. E. Alefeld. Z. anal. Chem., 1909, 48, 79—80.

THE time required for a determination of halogen by the usual gravimetric method with silver nitrate may be considerably shortened by the addition of ether before precipitation. The solution containing the halogen is added to about 5 c.c. of ether, and then 5 c.c. of dilute nitric acid are introduced, and silver nitrate solution added, drop by drop, with careful swirling of the liquid, until the finely divided precipitate begins to clot together and settle. The liquid is then filtered, before it becomes clear, through a Gooch crucible, previously heated until of constant weight and moistened with ether, whereby a clear filtrate is obtained immediately, and, after washing with cold water, the precipitate is dried and heated to incipient fusion.—F. SONN.

Potassium in animal liquids; Volumetric determination of —. W. A. Drushel. Z. anorg. Chem., 1909, 61, 137—146.

THE liquid is evaporated to dryness and if no albumin is present, the residue is oxidised with a mixture of nitric and sulphuric acids (9:1); in presence of albumin, oxidation is effected with bromine or with nitric acid alone, in the latter case the oxidised residue being moistened with concentrated sulphuric acid and again heated. The product is then dissolved in dilute acetic acid, and the potassium determined as described previously (this J., 1907, 1256). If the potassium cobaltinitrite precipitate be washed with sodium chloride solution instead of with water, the asbestos filter need not be so tightly packed.

—A. S.

Barium; Volumetric determination of —. A. E. Hill and W. A. H. Zink. J. Amer. Chem. Soc., 1909, 31, 43—49.

THE method is based on the precipitation of barium as iodate and on the oxidising action of this compound upon a solution of an iodide, with subsequent titration of the free iodine. A quantity of the solution of the soluble barium compound (hydroxide, chloride, bromide, iodide, nitrate, acetate, etc.) equivalent to about 0.1 grm. of barium is rendered faintly alkaline by the addition of ammonia, which should be free from carbonate; water is added to make the volume up to about 70 c.c., and a solution of potassium iodate (containing about 36 grms. of the salt per litre) is run in, the mixture being well stirred meanwhile. A sufficient quantity of the iodate to precipitate the barium together with an excess of about 25 c.c. is added in all. After 5 minutes stirring, the precipitate is collected on a filter, washed three times with concentrated ammonia, and then three or four times with 95 per cent. alcohol. The precipitate and filter are transferred to a flask, water is added, and then 50 c.c. of a 10 per cent. solution of potassium iodide free from iodate. After the addition of 10 c.c. of concentrated hydrochloric acid, the liberated iodine is titrated with a standardised solution of sodium thiosulphate. Every twelve mols. of thiosulphate used are equivalent to one atom of barium. The presence of small amounts of sodium, potassium,

ammonium, or magnesium compounds is without effect on the accuracy of the results obtained by the method, but large proportions tend to the formation of occluded iodates which count as barium in the final titration. Calcium and strontium, except in traces, must not be present.—W. P. S.

Copper; Permanganate method for determining —. F. G. Hawley. Eng. and Min. J., 1908, 86, 1155—1156.

THIS method has been in use for three years, at the Cananea Consolidated Copper Company's works, where it is daily checked by the electrolytic method and found to agree within about 0.04 per cent. with careful work. The assay occupies about 30 minutes and 20 determinations can be completed in an hour and a half. 0.5 grm., or more, of the ore is treated with 10—12 c.c. of a mixture of sulphuric and nitric acids (1:3) and rapidly boiled until dense fumes of sulphuric anhydride are evolved. After cooling slightly, the mixture is diluted with 35 c.c. of water and just neutralised with ammonia. 4 c.c. of hydrochloric acid are then added and the copper and iron reduced by the addition of 10 c.c. of a 20 per cent. solution of sodium sulphite. The solution is then boiled and the copper precipitated by 5 c.c. of a 4 per cent. solution of potassium thiocyanate. The boiling is continued for a few minutes, but before all the sulphurous acid has been expelled, the assay is set aside, and after 5 minutes, the solution is filtered, and the precipitate washed with a small quantity of hot, but not boiling, water. The precipitate is decomposed, on the paper, by a boiling 6 per cent. solution of sodium hydroxide, into soluble sodium thiocyanate and insoluble cuprous hydroxide. After well washing the residue, the filtrate is acidulated with sulphuric acid and the liberated thiocyanic acid titrated with a standard solution of potassium permanganate, 1 c.c. of which is equivalent to 0.01 grm. of iron. The iron value multiplied by 0.197 gives the copper content. Copper thiocyanate is not absolutely insoluble, but under similar conditions the loss is practically constant. It has been found that 0.005 grm. of copper remain in solution, but a partial compensation is made by the presence of small amounts of oxidisable matter, so that an allowance of 0.0025 grm. of copper should be added to the amount of copper found. Where extreme accuracy is not required, the permanganate solution may be made so that each c.c. is equivalent to 1 per cent. of copper on 0.5 grm. of ore. If the ore contains tale, clay, or similar minerals rendering filtering slow, 4 to 8 drops of hydrofluoric acid should be added to the acids used for decomposing the ore. No metal commonly found in ores is said to interfere with the accuracy of the results.—F. R.

Antimony and tin; Gravimetric determination of —. E. Cahen and G. T. Morgan. Analyst, 1909, 34, 3—9.

THE authors have submitted to a critical examination various methods which have been proposed for the determination of antimony and tin. The method described by Vortmann and Metzl (this J., 1905, 942) is capable, under certain narrowly defined conditions, of affording a quantitative separation of antimony from tin. Whilst the antimony thus separated may be weighed as the trisulphide after the latter has been heated to 150° C. in an atmosphere of carbon dioxide, no simple method is available for the determination of the tin in the filtrate from the antimony trisulphide. Phosphoric acid appears to be precipitated along with the stannic sulphide, when the tin is thrown down as sulphide. In order that the method may be effective, it is essential to avoid the presence of nitric acid or other oxidising agent, a condition not readily attained when antimony and tin are to be separated from the other metals of the sulphide group. Czerwek's method (this J., 1906, 829) was found to be trustworthy for the separation and determination of tin, but quite useless for the determination of antimony; the tin phosphate retained traces of antimony even after repeated washings with ammonium nitrate or dilute tartaric acid solution, and traces of tin made their appearance in the filtrates. It was also found that a mixture of tin and antimony, unlike an alloy of these metals, did not dissolve in the mixed acids. Henz's method (this J.,

1904, 133) whether worked as described by Fresenius, or by any of the modifications favoured by other chemists, was found to be the most accurate and rapid method for the determination of antimony and tin. The following points of detail are, however, worthy of note:—(1). Sulphuric acid should not be substituted for *aqua regia* as the solvent of the mixed metals; (2), the amount of potassium sulphide must be reduced to a minimum; (3), an excess of hydrogen peroxide is essential to the success of the operation; (4), the antimony sulphide may be dried at 280° C. in an atmosphere of carbon dioxide; and (5), the tin may be deposited electrolytically by the employment of rotating electrodes.—W. P. S.

Bismuth: Determination of — volumetrically. R. Ehrenfeld and A. Indra. Z. anal. Chem., 1909, 48, 24–26.

The solution for the determination is made with the least possible quantity of dilute nitric acid and the bismuth precipitated by adding an excess of standard sodium phosphate solution, in the cold; the liquid is then made up to a measured volume and, when the precipitate has settled, is filtered. An aliquot part of the filtrate is mixed with the quantity of ammonium acetate required to combine with the free nitric acid present, and 10–20 drops of cochineal tincture, made according to Repiton's method [boiling powdered cochineal with 100 c.c. of water for an hour, replacing the water lost by evaporation, again raising to the boiling point, and then filtering the cooled solution, after adding 50 c.c. of alcohol], are added, so that the liquid has a dull brick-red colour. The excess of phosphate is then determined by uranyl acetate solution which has been standardised against the sodium phosphate, using the same number of drops of cochineal tincture as before; as this is run in, the colour becomes gradually paler, until almost white, and then changes, rather sharply, to a dull green. In no case should the supernatant liquid appear reddish at the end of the reaction.—F. SOPH.

Uranium and vanadium: Determination of —. W. D. Engle. Eng. and Min. J., 1909, 87, 155.

The following method is said to yield results agreeing closely with those obtained by gravimetric methods and to effect a considerable saving of time. From 0.5 to 2 grm. of the ore is weighed out, care being taken that the amount of uranium in the assay does not exceed 0.25 grm. The sample is decomposed with 20 c.c. of dilute sulphuric acid (1:5) and evaporated until sulphuric anhydride fumes are evolved. If organic matter is present, nitric and sulphuric acids are used for the decomposition. After cooling and diluting to 100 c.c., the uranium and vanadium are oxidised by 3 c.c. of hydrogen peroxide and an excess of sodium or ammonium carbonate added. The solution is then boiled for a few minutes, partially cooled, filtered, and the precipitated iron washed, redissolved with dilute sulphuric acid, and reprecipitated. The solution is maintained in a highly oxidised condition by the use of hydrogen peroxide. The combined filtrates are acidified with sulphuric acid and 0.5 to 1 grm. of ammonium phosphate added. The solution is boiled to expel the carbon dioxide, uranyl ammonium phosphate being soluble in ammonium carbonate. It is then made ammoniacal, boiled, acidified with acetic acid, and filtered. The precipitate is washed with a 4 per cent. solution of ammonium sulphate which prevents the tendency of the precipitate to pass through the paper. If the amount of uranium is very small, a little aluminium sulphate should be added for the same purpose. The filtrate, which contains the vanadium, is treated with 10 c.c. of strong sulphuric acid and 2 grms. of sodium sulphite. The excess of sulphur dioxide is boiled off, and the hot solution immediately titrated with *N*/20 potassium permanganate solution. The vanadium or V_2O_5 factors are obtained by multiplying the iron factor of the permanganate by 0.9159 or 1.631 respectively. The uranium precipitate is dissolved in dilute sulphuric acid, and granulated zinc of known purity added. The reduction is continued for 45 minutes, after which the solution is decanted off and the zinc washed. The solution and washings are titrated with *N*/20 per-

manganate solution, the iron factor of which multiplied by 2.133 gives the factor for uranium, or by 2.5167, the factor for U_3O_8 .—F. R.

Detecting sulphates, sulphites, and thiosulphates. Alexandrow. See VII.

Water; Dissolved oxygen in —. Frankforter and others. See XVIIIB.

Colophony reaction. Foerster. See XIII B.

ORGANIC QUALITATIVE.

Detecting bleached flour. Weil. See XVIII A.

Formaldehyde in milk. Shrewsbury and Knapp. See XVIII A.

Butter and coconut oil. Paul and Amberger. See XVIII A.

Rosin in tolu balsam. Perrot and Goris. See XX.

Atoxyl and arsacetin. Labat. See XX.

Methyl- and dimethyl-aniline. Emde. See XX.

ORGANIC QUANTITATIVE.

Halogens; Determination of — in organic compounds. C. W. Bacon. J. Amer. Chem. Soc. 1909, 31, 49–52.

HAVING found the method proposed by Stepanoff (this J., 1907, 35) to be untrustworthy when carried out as described, the author has undertaken an investigation with the view of ascertaining the conditions under which nascent hydrogen can be relied upon to reduce organic halogens quantitatively. The method given below is the result of this investigation. About 0.2 grm. of the halogen compound is placed in a dry, pear-shaped flask. If *w* be the number of grms. of the compound taken, add 15*w* c.c. of alcohol (at least 98 per cent.) if the compound contain chlorine, or 6*w* c.c. if the compound contain bromine, or 4*w* c.c. if it contain iodine. The mixture is then heated under a reflux condenser and metallic sodium is added through the condenser; this operation should extend over at least 30 minutes. A total of 19.5*w* grms. of sodium are added if chlorine be present, 8.5*w* grms. in the case of bromine, or 5.5*w* grms. in the case of iodine. The mixture is boiled for 1 hour longer (this is essential), cooled to about 50° C., diluted through the condenser with cold water, acidified with nitric acid, an excess of silver nitrate added, and the excess then titrated according to Volhard's method. If the halogen involved be chlorine, the silver halide is removed by filtration before titrating; otherwise, filtration is unnecessary.—W. P. S.

o-Toluidine and o-nitrotolucene. Holleman. See III.

Gluten in wheat flour. Rammstedt. See XVIII A.

Formaldehyde in milk. Shrewsbury and Knapp. See XVIII A.

Alkaloids in coca leaves. De Jong. See XX.

Aldehydes in lemon oil. Bennett. See XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES

Solvate theory; Present status of the —. H. C. Jones. Amer. Chem. J., 1909, 41, 19–57.

IN the present paper is given an account of the more important facts established, and of the more important conclusions reached, as the result of investigations on the nature of solutions extending over 10 years, and of which detailed descriptions of the various steps have been published at intervals. A relation between the amount of water of crystallisation of a substance and the extent of the

depression of the freezing point of water caused by such substance holds for a large number of compounds and is strong evidence for the existence of complex hydrates in aqueous solutions. The existence of hydrates accounts for the facts: (1), that the minimum in the boiling-point curve occurs at a greater concentration than the minimum in the freezing-point curve of aqueous solutions of a given substance; (2), that the temperature at which a substance crystallises is lower, the larger the amount of water of crystallisation it contains; and (3), that there is a connection between the hydrating power of ions and the temperature-coefficients of their electric conductivity, those ions with the greatest hydrating power having the largest temperature-coefficients, and the more dilute solutions, containing more complex hydrates, having larger temperature-coefficients than the more concentrated solutions. There is evidence of the same general character for the existence of solvates (analogous to hydrates) in non-aqueous solutions. Evidence in favour of the solvate-theory is also described, which has been adduced by study of the absorption spectra of solutions and the effect of one salt with hydrating power upon another salt present in the same aqueous solution and also possessing hydrating power. (See also this J., 1899, 791; 1900, 355; 1902, 1352; 1906, 563; 1908, 334.)—A. S.

Trade Report.

Proposed alteration in the French patent laws. "Times" Eng. Suppl., Feb. 3, 1909.

The Minister of Commerce has just introduced into the Chamber an important Bill dealing with the working of patents.

Under the existing law the owner of a patent is compelled to undertake the working of it within a period of three years from the date of application, with the penalty of forfeiture of his rights for non-compliance with the Act. The patentee must carry out his invention in France, but the Act does not clearly define what must be the nature of the working of the patent, and hence it is easy to evade the provisions.

The proposed amended patent law involves the sacrifice of all rights conveyed under the patent in the case of a patentee failing to carry out his discovery or his invention in France within a period of three years dating from the day on which he deposits his application, or who shall have discontinued the working of his patent for three consecutive years, unless he shows justifiable cause for the interruption of the work. Forfeiture is likewise decreed in the case of a patentee who carries on the working of his patent exclusively or almost wholly on other than French soil, or who, after a sufficient time has elapsed (as the Law Courts may determine), fails to show that his patent has been worked in France, or in the colonies, on a sufficiently extensive scale. Similar provisions are laid down in the case of models and designs.

The Bill also specifies that modifications may be introduced subsequently arising out of diplomatic agreements which may have the effect of imposing strict reciprocity between the two contracting parties.

Proposed new French Customs tariff.

The Customs Commission of the French Chamber of Deputies have recently issued their Report, in which recommendations are made for the amendment of certain sections of the French Customs tariff. The proposals have yet to be dealt with by the French Legislature, and may be substantially altered as the result of further consideration. A translation of the proposals in their present preliminary form has just been issued as a Parliamentary Paper, and those portions of the tariff in which no alteration is proposed are also included, and the present rates of duty are added for comparison.

Copies of the Return may be obtained at the price of 1s. per copy, either directly or through any bookseller, from Messrs. Wyman and Sons, Ltd., London, E.C.; Messrs. Oliver and Boyd, Edinburgh; or Messrs. E.

Ponsonby, Dublin. In ordering, the reference number, Cd. 4489, should be quoted.

Below will be found some of the more important proposed alterations:—

	Old Min. fr. per 100 kilos.	New Min. fr. per 100 kilos.
Zinc sulphide	See No. 282	2.50
282 <i>Chemical products not specified.</i>		
Alcoholic, not less than	5% ad val.	5% ad val.
Solid dye extracts, black or violet	10.00	16.00
" red or yellow	15.00	24.00
Carbons for electric lighting	30.00 to 50.00	16.00
Lithopone	Not spec.	2.50
Glue in plates or powder	Free	5.00
<i>Gelatin—</i>		
Metallized, watered, or glazed ..	—	30.00
Other	—	10.00
Size	Not spec.	2.50
Paste for printing cylinders	3.75	15.00
Albumin	Free	20.00
Milk sugar	Free	25.00
Fixed vegetable oils	Various	14.00
Alimentary vegetable fats	Not spec.	25.00
Chemical perfumes and essences ..	Not spec.	20% ad val.
Cement, slow	0.50	0.60
" quick	0.25	0.40
Sulphur, manufactured	2.25	3.50
Heavy oil and petroleum residues ..	8.00	9.00
Liquid carbon dioxide	—	6.00
Oleic acid	Free	1.00
Stearic acid	8.00	10.00
Quebracho extract solid	3.00	8.00
" liquid	3.00	5.00
Chestnut extract	3.00	5.00
Zinc oxide	Free	3.00
Soda, crude, under 30% strength ..	5.85*	1.90
Refined soda salts	—	1.90
Other	—	4.10
Refined soda salts—		
At least 60% in strength	4.10*	—
Less than 60% in strength	14.00*	—
Soda crystals	1.90*	—
Natron	1.90	—
Wet of artificial silk or artificial silk		
forming 10% at least	200.00	600.00
Artificial silk yarn, twisted, un-		
bleached, or dyed—		
Puref	According to	500.00
content of		
alcohol		
Mixed	According to component	
	part paying highest	
	duty	
Alcohol, methylic	9.25	4.25
Aldehyde, formic	See 282	4.00
Alumina, anhydrous	25.00	20.00
Hydrate of alumina	13.50	10.00
White lead	5.00	10.00
Double chloride of aluminium and		
sodium	18.50	—
Ether of any strength	30.00†	50.00‡
Collodion	30.00‡	50.00‡
Nitrate of lime, calcic cyanamide ..	See No. 282	—
<i>Metals—</i>		
Aluminium:		
Ore		Free
Ingots		90.00
Plates or bars	150.00	120.00
Wire, over 1 mm.		105.00
" under 1 mm.		125.00
Pig iron containing between 5% and		
15% manganese	1.50	2.00
Spiegel iron containing between 15%		
and 25% manganese	1.50	2.50
Manganese containing over 95%		
manganese	Not spec.	50.00
Ferro silicon and silicon carbide—		
5%—20% silicon		3.50
20%—70% "	3.50§	5.00
70%—95% "		7.00
Silicon over 95% silicon	Not spec.	25.00
Silicospiegel with more than 30% of		
silicon and manganese	3.50	5.00
Ferro chromium 10%—25%		
chromium		3.50
Ferro chromium with more than		
25% chromium	3.50;	10.00
And over 6% carbon		20.00
2%—6% "		30.00
1%—2% "		40.00
Less than 1% "		

* Including tax to cover supervision of soda factories.

† Plus Indirect Tax on alcohol used in manufacture.

‡ Not including internal Revenue Tax.

§ Ferro silicon containing more than 5% silicon.

¶ Ferro chromium containing 10% or more of chromium.

	Old Min. fr. per 100 kilos.	New Min. fr. per 100 kilos.
Tungsten, pure or alloyed with iron...	Not spec.	40.00
Molybdenum or titanium, pure or alloyed with iron	5% ad val.	100.00
Vanadium, pure or alloyed with iron	10.00	400.00
Ferro-aluminium containing 20% or more of aluminium	7.50	40.00
Iron and steel*	10.00	8.00
Copper bars		
plates:		
4 m. and less in length		10.00
Over 4 m. thick		12.00
Under 4 m. " "	10.00	
Over 4 m. in length:		
More than 4 m. thick		12.00
Under 4 m. thick		15.00
Copper wire—		
Diam. 1 mm. or more		10.00
" between 1/10 and 1/4 mm.	10.00	15.00
" under 1/10 mm.		30.00
Lead, small shot	6.50	9.00
Tin, wire	6.00	8.00
" leaves, under 1/10 mm. thick	6.00	30.00
Nickel wire, pure—		
Over 1 mm. thick	10.00	15.00
Under		18.00
Nickel wire with copper—		
Over 1 mm. thick	17.50	18.00
Under		20.00

* The alterations must be studied in the original.

New Books.

YEAR-BOOK OF PHARMACY, comprising Abstracts of Papers relating to Pharmacy, Materia Medica, and Chemistry, contributed to British and Foreign Journals from July 1, 1907, to June 30, 1908, with the Transactions of the British Pharmaceutical Conference at the Forty-Fifth Annual Meeting held in Aberdeen, September, 1908. Editor of the Year-book, J. O. BRATHWAITE. Editors of the Transactions, E. SAVILLE PECK, M.A., and EDMUND WHITE, B.Sc. J. and A. Churchill, 7, Great Marlborough Street, London. 1908. Price 10s. 6d.

Svo volume, containing 537 pages of subject matter, 336 of abstracts, etc., and 201 of Transactions. Indexes of names and subjects close the work. The Transactions include a list of members of the British Pharmaceutical Conference, and of the Officers, Council, etc.

THE MECHANICAL APPLIANCES OF THE CHEMICAL AND METALLURGICAL INDUSTRIES. A complete description of the Machines and Apparatus used in Chemical and Metallurgical Processes for Chemists, Metallurgists, Engineers, Manufacturers, Superintendents and Students. By OSKAR NAGEL, Ph.D. Published by the Author, New York. 1908. VACHER & SONS, Great Smith Street, London, S.W. Price \$2.00, or, 8s. 6d. net.

Svo volume, containing 302 pages of subject matter, with 292 illustrations, and an alphabetical index of subjects. The subject matter is classified in the following groups:—I. General. Covering. Packing. Expansion-joints. Valves. Steam-traps, etc. II. Steam and water power. III. Gas power. IV. Electric power. V. Transportation of solids. VI. Transportation of liquids. VII. Transportation of gases. VIII. Grinding. IX. Mixing machines. X. Firing and furnaces. XI. Separating. XII. Purification of gases. XIII. Evaporating. Distilling, and Condensing. XIV. Drying Appliances. XV. Measurement of temperature. APPENDIX. The Works chemist as engineer.

GESÄTTIGTE-SALZLÖSUNGEN VOM STANDPUNKT DER PHASENLEHRE. Von ERNST JANECKE. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price M 9.00.

Svo volume, containing 179 pages of subject matter, with 85 tables, and 153 illustrations. Classified tables

of contents in illustrations and tables, are given at the end of the work, and an alphabetical index of names of authors. The work is dedicated to the author's teacher, Prof. Dr. J. H. van't Hoff. The subject matter is classified as follows:—I. Introduction. Phase rule. II. Classification of solutions according to the phase rule. III. Saturated solutions of salts which appear in the solid phase only in the anhydrous condition. IV. Solutions in which both the anhydrous salt and hydrates appear in the solid phase. V. Solutions of two salts with similar ions, when no mixed crystals are formed. VI. Formation of mixed crystals as solid phase in saturated solutions of two salts with similar ions. VII. Solutions of a salt in basic and acid aqueous media. VIII. Solutions of three salts with similar ions, in water. IX. Solutions of four salts with similar ions. X. Solutions of reciprocal pairs of salts. XI. Solutions of reciprocal pairs of salts on saturation with a fifth and sixth salt. XII. Solutions of mixtures of salts.

GRUNDRISSE DER ALLGEMEINEN CHEMIE. Von WILHELM OSTWALD. Vierte, völlig umgearbeitete Auflage. Wilhelm Engelmann's Verlag, Leipzig, 1909. Price M. 20. (Cloth M. 21.20, Half-calf M. 22.50.)

LARGE Svo volume, containing 644 pages of subject matter with 67 illustrations, and indexes both of names and subject matter. The leading themes and general classification are as follows:—BOOK I. MATERIALS. (i), Laws of conservation. (ii), Forms. (iii), Heat phenomena of gases, and the first law of energy. (iv), Liquids. (v), Solid bodies. BOOK II. STOICHIOMETRY. (vi), Equivalents and combining weights. (vii), Gay Lussac's law. (viii), Dilute solutions. (ix), Chemical constitution. BOOK III. CHEMICAL THERMODYNAMICS. (x), Thermochemistry. (xi), Chemical kinetics. (xii to xiv), Chemical equilibria (a), of the first order; (b), of the second order, and (c), of the third and higher order. BOOK IV. ELECTROCHEMISTRY. (xv), Electrolytic conduction. (xvi), Ions. (xvii), Electrolytic equilibria. (xviii), Voltaic cells. (xix), Electrolysis and polarisation. BOOK V. MICROCHEMISTRY. (xx), Theory. (xxi and xxii), Special microchemistry. (xxiii), Kinetic theory of gases. BOOK VI. PHOTOCHEMISTRY. (xxiv), Radiant energy. (xxv), Chemical action of light. (xxvi), Radio-activity, etc. BOOK VII. CHEMICAL RELATIONSHIP. (xxvii), Methods. (xxviii), Stoichiometrical relationships.

HISTOIRE DU DÉVELOPPEMENT DE LA CHIMIE DEPUIS LAVOISIER JUSQU'À NOS JOURS. Par A. LAZENBURG. Translation of the 4th German edition. By A. CORVISY. Librairie Scientifique A. Hermann et Fils, 6, rue de la Sorbonne, 6, Paris. 1909. Price 15 frs.

LARGE Svo volume, containing 375 pages of subject matter, with alphabetical indexes of names, and table of contents. The work is classified as to subject matter according to the following scheme:—I. Phlogiston theory, and its overthrow. II. Change of ideas as to combustion. Priestley, Scheele, Lavoisier. III. Chemical nomenclature. IV. Richter's researches. Dalton's atomic theory, etc. V. Electrochemical theory of Davy. Gay Lussac's law of volumes, etc. VI. Berzelius' chemical system. Dulong and Petit. Proust. Dumas' determination of vapour densities. VII. Organic chemistry and its beginnings, etc. VIII. Theory of radicals. IX. Graham on phosphoric acid. Liebig on acids generally etc. X. Influence of Gmelin's school. Theory of residues. Polybasic acids. XI. Divisibility of the molecules of the elements. Williamson. Polyatomic radicals. XII. Mixed types. Kolbe and Berzelius. Polybasicity, etc. XIII. Idea of types. Quadrivalence of carbon. Specific volumes, etc. XIV. Theory of aromatic compounds. Quinones. Industry of dyestuffs, etc. XV. Fundamental ideas of chemistry. Phenomena of dissociation. Thermochemistry. Photochemistry. XVI. Law of mass action. Phase rule. Solutions. Liquid air, etc. XVII. Study of radium. New conception of valency. Solid solutions. Allotropy. Suboxides and peroxides. Catalysis. Chemistry of colloids.

STRAITS SETTLEMENTS, REPORT OF THE RESIDENT-GENERAL OF THE FEDERATED MALAY STATES FOR 1907. [Cd. 4471.] Wyman and Sons, Fetter Lane, E.C. Price 3d.

THIS publication contains a copy of the annual report for 1907 of the Resident-General of the Federated Malay States.

REPORT ON THE TRADE IN IMPORTS AND EXPORTS AT IRISH PORTS DURING THE YEAR ENDED 31ST DECEMBER, 1907. [Cd. 4429.] Wyman and Sons, Fetter Lane, E.C. Price 1s.

IN this report (the fourth) a considerable advance has been made in the completeness of the returns, and it may be taken that the tables given represent within 1 or 2 per cent. of the gross quantities of Irish imports and exports.

POISONS AND PHARMACY ACT, 1908. [8 Edw. 7, Ch. 55.] Price 1½d.

SECTION 2 relates to the sale of poisonous substances exclusively for horticulture and agriculture, and Section 5 to the labelling of sulphuric, nitric, and hydrochloric acids, soluble oxalates, etc.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY

APPLICATIONS.

1381. Hunt. *See under VII.*

1530. Sparks. Cooling granular, pulverulent, and like material. Jan. 21.

1599. Ges. f. Kunst. Zug, and Schwabach. Conveying gases.* Jan. 22.

1626. Rose. *See under II.*

1650. Delporte. Agglomerating or hardening finely-divided or friable substances. Jan. 23.

1659. Webb and others. *See under X.*

1716. Suero. Manufacture of filters.* Jan. 23.

1719. Wallis. Pipette. Jan. 23.

1726. Beaven and Lancaster. *See under XVII.*

1781. Pages, Camus, et Cie., and Bardy. Pulverising, spreading, and mixing fluids. [Fr. Appl., Jan. 27, 1908.]* Jan. 25.

2049. Fawcett, Preston, and Co., and Shield. Evaporating apparatus. Jan. 28.

2101. Bramwell. Filtering apparatus.* Jan. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

1455 (1908). Black and Lennox. Continuous drying machines. Jan. 27.

4491 (1908). McNeil and McNeil. Apparatus for drying, roasting, etc., pulverulent or granular material. Jan. 27.

4861 (1908). Bousfield. Pycnometer. Jan. 27.

7879 (1908). Winder. Non-conducting coverings for steam boilers, etc. Jan. 27.

9669 (1908). Clark and Krenl. Filters. Jan. 27.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

1247. Zailer. Manufacture of peat products for fuel.* Jan. 18.

1248. Novel Combustible mixture for explosion motors. [Swiss Appl., July 2, 1908.]* Jan. 18.

1261 and 1262. McMullen. Power gas producers. Jan. 18.

1284. Ely. Apparatus used in the manufacture of gases. Jan. 19.

1484. Dempster and Sons, and others. Gas retorts. Jan. 21.

1626. Rose. Exhaustion of metal filament lamps and other apparatus requiring a high vacuum. Jan. 22.

1629. Lewes. Incandescent mantles. Jan. 22.

1630. Milbourne. Gas purifiers. Jan. 22.

1866. Bansart. Regenerative coke ovens.* Jan. 26.

1882. Pilgrim and Pilgrim. Gas generators.* Jan. 26.

1890. Glasgow. Manufacture of water gas. [U.S. Appl., Nov. 20, 1908.]* Jan. 26.

1928. British Thomson-Houston Co. (General Electric Co.). Electric lamp filaments. Jan. 26.

1937. Dempster and Sons, Ltd., and Brooke. Gas retorts. Jan. 27.

2027. British Thomson-Houston Co. (General Electric Co.). Manufacture of electric arc electrodes. Jan. 27.

2028 and 2029. British Thomson-Houston Co. (General Electric Co.). Manufacture of electric lamp filaments. Jan. 27.

2413. Davis. Gas washers. Jan. 28.

2292. Blau. Production of liquid illuminating gas. [Ger. Appl., Jan. 31, 1908.]* Jan. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

19,659 (1908). Thompson (Von Inwold and Von Inwold). Manufacture of incandescent filaments for electric lamps. Jan. 27.

23,806 (1908). Manger. Transforming alcohol for use as fuel. Feb. 3.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

1708. Knottenbelt. Treatment of petroleum, rock oils, etc.* Jan. 23.

1858. Royley. Treatment of shales. Jan. 26.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

1227. Newton (Bayer und Co.). Manufacture of azo dyestuffs and process of developing them on the fibre. Jan. 18.

1244. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the pyrazolone group. Jan. 18.

1245. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo dyestuffs. Jan. 18.

1397. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Jan. 20.

1600. Newton (Bayer und Co.). Manufacture of dyestuffs of the galloxyanine series. Jan. 22.

1816. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. [Addition to No. 25,311 of 1908.]* Jan. 25.

2290. Act.-Ges. f. Anilinfabr. Manufacture of sulphurised dyestuffs soluble in water. [Ger. Appl., Feb. 10, 1908.]* Jan. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

13,499 (1908). Stephan and Rahtjen. Producing compounds of α -isatinanilide and its homologues with sulphurous acid. Jan. 27.

16,207 (1908). Durand, Huguenin, et Cie. Manufacture of leuco derivatives of anilides of gallocyanines or their sulpho-derivatives. Jan. 27.

19,793 (1908). Ges. f. Chem. Ind. in Basel. Manufacture of chlorinated derivatives of indigo. Jan. 27.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

1227. Newton (Bayer and Co.). *See under IV.*

1291. Gottlieb. Decoration of textile and like fabrics. [Addition to No. 24,913 of 1905.]* Jan. 19.

1375. Rothwell-Jackson and Edge. Device for circulating liquids through bleaching kiers, etc. Jan. 20.

1407. Luxberg. Producing threads of artificial silk. Jan. 20.

1774. Ashwell. Recovering caustic soda from the weak solutions resulting from mercerisation of cotton, etc. Jan. 25.

1920. Fowler. Dyeing, and dyes for use therein. Jan. 26.

2313. Heimann. Treatment of fabrics.* Jan. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

1265 (1908). Guadagni. Production of artificial silk. Jan. 27.

8302 (1908). Sperry. Preparation of silk dyers' products. Jan. 27.

8393 (1908). Payne and Wallace. Dyeing machines. Jan. 27.

12,253 (1908). Guadagni. Machines for producing artificial silk threads. Jan. 27.

15,015 (1908). Boullier and Lafais. Manufacture of artificial silk. Jan. 27.

23,725 (1908). Gallati-Grob. *See under XII.*

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

1381. Hunt (Love). Lixiviating apparatus particularly for extracting sodium nitrate from caliche. [Addition to No. 7007 of 1906.]* Jan. 20.

1424. Wakefield. Treatment of calcium carbide. Jan. 20.

1585. Carulla. Manufacture of ammonium salts and iron oxide from ferrous liquors. [Addition to No. 27,302 of 1908.] Jan. 22.

1735. Schmidt. Dissolving silica direct from natural silica and silicates. Jan. 25.

1844. Poulsen. Utilisation of gelatinous silica. [Comprising in No. 491, Jan. 8, 1909.] Jan. 26.

2007. Simpson and Oviatt. *See under X.*

2010. Fuchs. Production of magnesium compounds and calcium carbonate from dolomite. Jan. 27.

2071. Clacher. *See under XI.*

2109. Giana. Converting salts of tribasic phosphoric acid into salts of pyrophosphoric acid. [Ital. Appl., June 30, 1908.]* Jan. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

1842 (1908). Johnson (Badische Anilin und Soda Fabrik). Production of titanium-nitrogen compounds. Jan. 27.

3428 (1908). Dyes (Hempel). Manufacture of formic acid. Jan. 27.

10,522 (1908). Carrara. Preparation of zinc chloride. Jan. 27.

14,824 (1908). Soc. Commerciale du Carbone de Calcium. Fixation of phosphoretted hydrogen. Feb. 3.

19,988 (1908). Hoyermann. Removing superphosphates from a decomposition chamber. Jan. 27.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

1319. Thomas. *See under IX.*

1918. Oppermann (Hitecock). Manufacture of sheet glass.* Jan. 26.

2294 and 2295. Sadamon, Grace, and Exploration Co., Ltd. Preparation of china clay. Jan. 30.

COMPLETE SPECIFICATION ACCEPTED.

11,321 (1908). Grünzweig and Hartmann. Impregnating ceramic and like porous objects. Jan. 27.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

1319. Thomas. Kilns for making bricks, tiles, pottery, etc. Jan. 19.

1477. Davis. Making raw material bricks for the production of Portland cement clinker in stationary kilns. Jan. 21.

1849. Best. Manufacture of heat-insulating materials. Jan. 26.

2250. Stephenson. Kilns for burning bricks and tiles. Jan. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

1339 (1908). Bonnefort. Manufacture of artificial stones. Jan. 27.

15,625 (1908). Snyder. Manufacture of cement. Feb. 3.

24,325 (1908). Albon and Parker. Manufacture of firebricks. Feb. 3.

X.—METALS AND METALLURGY.

APPLICATIONS.

1332. Kuzel. Manufacture of metal filaments. [Ger. Appl., Feb. 22, 1908.]* Jan. 19.

1339. St. Laurent and others. Manufacture of aluminium alloys. Jan. 19.

1365. Barclay and Rodgers. Impts. in German silver. Jan. 20.

1403. Bryant and Ivinson. Solders for metals and alloys. Jan. 20.

1404. Bryant and Ivinson. Treatment of metals and alloys. Jan. 20.

1485. Dauncey and Donne. Extraction of metals from ores. Jan. 21.

1519. Parnell. Treatment of ores. Jan. 21.

1639. Webb and others. Smelting, melting, or heating metals, ores, and other substances. Jan. 23.

1677. Goodland and others. Apparatus for recovering the metallic contents of ores, etc. Jan. 23.

1703. Ingram. Blast furnaces. Jan. 23.

1786. Boulton (Kroeschell Bros. Co.). Crucible furnaces.* Jan. 25.

1789. Horwood. Separation of zinc blende and other constituents from ore concentrates and slimes.* Jan. 25.

1791. Braey-Laurent and Moritz. Furnaces for roasting pyrites and other ores. [Fr. Appl., June 3, 1908.]* Jan. 25.

1882. Sulman and Durant. Treatment of metalliferous ores or compounds. Jan. 26.

1887. Reynolds. Manufacture of steel. Jan. 26.

2007. Simpson and Oviatt. Reduction of metallic oxides, sulphides, and carbonates. Jan. 27.

2192. Sebillot and Maclaure. Treatment of ores with sulphuric acid. [Fr. Appl., Jan. 29, 1908.]* Jan. 29.

COMPLETE SPECIFICATIONS ACCEPTED.

1582 (1908). Birkbeck (Just Mining and Extraction Co.). Cyanide process for extracting precious metals from ores. Feb. 3.

12,383 (1908). Churchward. Production of alloyed steels. Jan. 27.

13,888 (1908). Fennell and Sackett. Manufacture of articles of wrought iron, mild steel, and their alloys. Feb. 3.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

1340. St. Laurent and others. Secondary batteries. Jan. 19.

1345. British Thomson-Houston Co. (General Electric Co.). Aluminium electro-lytic cells. [Comprised in No. 18,619 of 1908.]* Jan. 19.

1425. Hutchins. Insulation of electrical conductors. Jan. 20.

1436. Dolphin. Obtaining copper and other metals by the electrolytic process, and septa for separating solutions. Jan. 20.

1448. Newlands, Eastick, and Rouse. Making an electrolyte to facilitate carriage of the same. Jan. 21.

1503. Marino. Treatment of wood for use in accumulators. Jan. 21.

1879. Walter. Electrolytic cells. Jan. 26.

2071. Clacher. Purifying carbon for electrical and other purposes. Jan. 28.

2127 & 2128. British Thomson-Houston Co. (General Electric Co.). Electrical insulating material.* Jan. 28.

2216. Centrals, f. Wissensch.-Techn. Untersuchungen. Producing long voltaic arcs. [Ger. Appl., Feb. 1, 1908.]* Jan. 29.

COMPLETE SPECIFICATIONS ACCEPTED.

1470 (1908). British Thomson-Houston Co. (General Electric Co.). Electric furnaces. Feb. 3.

8425 (1908). Evans (Elektrochem. Werke). Production of electrical discharges. Jan. 27.

12,634 (1908). Keller. Electric furnaces. Feb. 3.

28,147 (1908). Gibbs. Electrolytic cells. Jan. 27.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATION

1550. Justice (Mills and Battle). Extraction of oil from oleaginous material such as seed.* Jan. 21.

COMPLETE SPECIFICATIONS ACCEPTED.

11,121 (1908). Imbert. Preparation of emulsifying agents. Feb. 3.

23,725 (1908). Gallati-Grob. Production of a fluid washing and bleaching compound. Feb. 3.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

COMPLETE SPECIFICATION ACCEPTED.

6584 (1908). Hannay and Wilson. Manufacture of a white sulphate of lead pigment. Feb. 3.

(B.)—RESINS, VARNISHES.

APPLICATION.

1990. Geuthe. Manufacture of linoxyn, etc., especially for making linoleum. [Ger. Appl., Feb. 26, 1908.]* Jan. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

23,005 (1908). Linoleum Manufacturing Co., and others. Manufacture of floorcloths, wall coverings, etc. Feb. 3.

23,039 (1908). Terrisse. Treatment of hard and semi hard copals and preparation of varnishes. Jan. 27.

(C.)—INDIA-RUBBER.

APPLICATION.

1888. Bloxam (Callender). Manufacture of indiarubber or analogous material. Jan. 26.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATION.

1865. Lehmann. Preparation of colourless glue.* Jan. 26.

COMPLETE SPECIFICATION ACCEPTED.

22,368 (1908). Leconte. Preparing hides for the manufacture of leather. Jan. 27.

XV.—MANURES, &c.

COMPLETE SPECIFICATION ACCEPTED.

19,902 (1908). Lake (Amer. Bacteria-ized Fertiliser Co.). Fertilisers. Jan. 27.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATION.

2219. Wynberg and Wynberg. Treatment of sugar cane and sugar cane waste.* Jan. 29.

COMPLETE SPECIFICATION ACCEPTED.

8699 (1908). Goldschmidt. Treatment of the juice of potatoes. Feb. 3.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

1269. Melhuish. Treatment of malt liquors. [Addition to No. 13,528 of 1908.]* Jan. 18.

1726. Beaven and Lancaster. Furnaces of malt and other kilns and drying apparatus. Jan. 25.

2202. Charmat. Fermenting, clarifying, and drawing-off apparatus for effervescing liquids. [Fr. Appl., Feb. 1, 1908.]* Jan. 29.

COMPLETE SPECIFICATION ACCEPTED.

13,528 (1908). Melhuish. Priming of malt liquors. Feb. 3.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

1342. Weck Ges. Sterilising apparatus. [Ger. Appl., Jan. 20, 1908.]* Jan. 19.

1444. Rittmann (Herdeen). Flour. Jan. 20.

2202. Charmat. See under XVII.

COMPLETE SPECIFICATION ACCEPTED.

6438 (1908). Desmaroux. Sterilising liquids of organic origin. Jan. 27.

(B).—SANITATION; WATER PURIFICATION.

APPLICATION.

1239. Wilton. Treatment of sewage and materials therefor. Jan. 18.

COMPLETE SPECIFICATION ACCEPTED.

10,557 (1908). Ives. Treatment of sewage. Jan. 27.

(C).—DISINFECTANTS.

APPLICATION.

1238. Wilton. Disinfectants. Jan. 18.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

1715. Galay and Galay. Air-proof and waterproof paper and films.* Jan. 23.

1874. Gray and Moore. Making paper waterproof and semi-transparent. Jan. 26.

COMPLETE SPECIFICATION ACCEPTED.

8708 (1908). Lilienfeld. Manufacture of cellulose derivatives from viscose. Feb. 3.

XX.—FINE CHEMICALS, ALKALOIDS,
ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

1431. Kalle und Co. Production of substances for conferring on human beings and other animals immunity against disease. [Ger. Appl., March 24, 1908.]* Jan. 20.

1560 and 1561. Wellcome and Barger. Production of physiologically active bases. Jan. 22.

1984. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Jan. 27.

2020. Fritzsche und Co. Manufacture of *n*-propyl ester of *p*-aminobenzoic acid. [Ger. Appl., March 24, 1908.]* Jan. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

7319 (1908). Bentley, Weizmann, and Clayton Aniline Co. Treatment of liquid pinene hydrochloride and production of solid pinene hydrochloride and camphene. Feb. 3.

§ 14,408 (1908). Zimmermann (Chem. Fabr. auf Aetien, vorm. E. Schering). Manufacture of bornyl oxalate. Jan. 27.

XXI.—PHOTOGRAPHIC MATERIALS AND
PROCESSES.

APPLICATION.

1498. Sonnenberg. Photographic plates, films, papers, etc. Jan. 21.

COMPLETE SPECIFICATIONS ACCEPTED.

23,615 (1907). Clifton and Wells. Colour photography. Feb. 3.

1689 (1908). Caldwell. Production of sensitised surfaces for photography. Jan. 27.

18,750 and 20,909 (1908). Brasseur. Manufacture of screens for colour photography. Jan. 27.

21,839 (1908). Verein. Kunstseide Fabr. Making colour screens for photography, etc. Jan. 27.

XXII.—EXPLOSIVES, MATCHES, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

1677 (1908). Sparre. Manufacture of explosives. Jan. 27.

9259 (1908). Kynoch, Ltd., and Udal. Wrappers for blasting explosives. Jan. 27.

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Birmingham Section.

*Meeting held at Birmingham University on Thursday,
November 5th, 1908.*

MR. HENRY SILVESTER, B.Sc., F.I.C., IN THE CHAIR.

THE UNIVERSITY TRAINING OF INDUSTRIAL CHEMISTS.

BY HENRY L. HEATHCOTE, B.Sc.

(Abstract.)

At the Annual General Meeting of the Society of Chemical Industry in Birmingham in 1907, Sir Oliver Lodge, the Principal of the University, speaking about the Department of Applied Chemistry, said: "We have not yet attacked the building for Applied Chemistry, and really Applied Chemistry seems so enormous and portentous a subject that I really don't know how to begin. Perhaps some ideas will be suggested in this meeting as to what we ought to do." The Committee of the Birmingham Section thought that a paper on the subject would lead to a discussion that might throw some light on the question of how applied chemistry may best be taught at Universities.

Having gone through the mill myself, I was anxious to do something to guide those who are striving to fit themselves for the work of an industrial chemist. I also hoped that something might be said which could be applied by those whose business it is to conduct commercial undertakings, for chemistry lies at the very core of all schemes for the welfare of the manufacturer, and of commerce generally.

First of all the industrial chemist must be a sound chemist, and any considerable departure from the full degree course of the University would impair this. He wants all the theory he can get. Theory is a labour-saving device in every sense of the word, and the sounder the man be in theory the fewer futile experiments will he make, and the more efficient will he and his laboratory be. A degree stands not for so much knowledge, but as a mark that the owner has developed to a high degree the mental machinery for obtaining and handling information in an efficient manner. So all industrial chemistry should be post-graduate, and I propose to limit myself to suggestions respecting post-graduate work. If any alteration has to be made in the graduate course, we may leave suggestions for the making of it to those whose special business it is to produce scientists.

In the post-graduate work of the applied chemist we should have lectures and much laboratory practice in a great variety of commercial materials and products—finished and unfinished—their composition and properties being ascertained by chemical, physical, and mechanical tests, and their uses illustrated during the lectures, mention being also made of their sources, prices, and any special restrictions to their carriage or use. This knowledge is the basis of all industrial chemistry, be it the construction of new plant or the improvement of an old process. We must certainly not restrict the materials to those employed in and produced by local industries, but it would be well to see that as many as possible of them were included.

Having dealt with commercial materials, we might have a lecture course with some laboratory practice in the processes of industrial chemistry, such as transporting solids, liquids, and gases; weighing and measuring; grinding etc.; melting, dissolving, emulsifying, and absorbing; cleaning, washing, drying; heating and cooling; evaporating and distilling; crystallising and dialysis; separating solubles and insolubles; electrolysis; oxidation and reduction; precipitation and prevention of recipitation. This course might well be mainly descriptive, and on the lines of Grossmann's little book, "The Elements of Chemical Engineering," might give accounts

of the large scale equivalents of the laboratory Bunsen, the beaker, the filter, the blowpipe, the U tube, the burette clip, etc. The object of this course would be to make the student acquainted with the items of plant that are common to many industries, and to show him what "plant" is. No attempt would be made to study a number of the large aggregates of plant that characterise the several chemical industries; perhaps one or two which illustrated important chemical, physical, or economic achievements might be briefly described. In the laboratory he should handle these items of plant sufficiently to acquire a mental grasp of the construction and purpose of the appliance and its parts. Manual dexterity should not be expected. In this way he will learn by experience some of the differences between small and large scale appliances, and in the lectures differences in the results produced when passing from the small to the large scale should be carefully examined and explained. This will familiarise the student with some of the difficulties that meet the experimenter who is trying to reduce a new process to practice on a commercial scale and facilitate this generally difficult and tedious change.

In accordance with the principle of keeping costs well to the front in the mind of the student, he should learn the approximate cost and sources of these items of plant, and also the cost of the plant required for producing definite chemical and physical changes. In this part of the course the student will have already met some of the forms of power. In the next part he should make a special study of the chemical, physical, and mechanical effects of power on commercial materials. He should learn the cost of the various kinds of power. The special advantages of each and the consumption of power in producing definite chemical and physical changes should be calculated and classified. All this might be taught in the Department of Industrial Chemistry.

In the engineering department he should learn the form and purpose of a number of tools and appliances used in engineering, how to read blue prints, and make rough drawings. He should be able to calculate and ascertain the stresses and strains in simple structures—should, in fact, go through an elementary general engineering course, including the strength and testing of materials and simple structures.

This information is not to equip him for working plant or for designing or constructing machines or structures, but because, as a chemist, he will require it. The industrial chemist in a works corresponds to the special senses in a human being. The engineer corresponds to the muscular and kinæsthetic senses which serve a purpose very different to that served by the organs of predication. Consequently we must select courses so as to steer clear of producing anything like the chemical engineer.

In the department of metallurgy the student might be familiarised with the microscopical examination of metals and alloys, and in the physics department with calorimetry and pyrometry.

In the department of commerce the industrial chemist must learn something of industrial economy, the statics and dynamics of the social organism: wealth, and its production, value, price, costing, selling, plant, tools, maintenance, depreciation, and the factors that influence it, the relations of employers to employed, and the law relating to employment.

The final course in the applied chemistry department might well be aimed to develop the faculty of synthesis, and might include lectures on "Invention," a study being made of improvements and patents. This course could be run in conjunction with research on an industrial problem. This should be drawn up so as to bring in as many commercial considerations as possible to exercise the student in their practical synthesis and acquaint him with the sources of information. If the research is one likely to end in patent specification so much the better. It is neither necessary nor advisable for the future industrial chemist to pursue research in pure chemistry; in

that the purity of the product would be one of his chief aims, whereas the chief concern of the industrial chemist is the applicability of his product.

Professor Kipping, in his address to the Chemical Section of the British Association, appears to favour the pure chemist with some knowledge of chemical engineering, and probably many will prefer this combination so long as the plant required does not have to be bought by the University. To my mind, however, it is much better to study existing commercial products and processes thoroughly well before attempting to improve on them. With his suggestion that temporary scholarships might be founded for special research work I heartily concur. This system is at work, not only at the University of Kansas, but also in that of Illinois, where there are several from \$250 to \$500; and in Michigan, where there is one for gas research and one for pharmaceutical research. But this should follow after courses in industrial chemistry. Furthermore, the product would be much of a specialist, and although, as we all know, specialists are often useful and successful men, yet a University is not the place for producing specialists—the two ideas are fundamentally opposed. The only condition which might serve as an excuse for specialisation to suit particular industries is when one or more industries is dominant in the district and has absorbed a great amount of capital and labour. Not until any one industry, by reason of its special bequests or special development, earned the right to special attention from the University could there be any chance, in my opinion, of chemical plant of a special character being added at the University's expense. The dominant chemical industry in the Birmingham and Midland district is iron and steel making, and the University Metallurgy Department already contains special plant, which is worked by the students and a few experienced workmen under Professor Turner and his assistants. The other chemical industries in this district are acid and alkali manufacture, phosphorus and chlorates, cyanides, varnishes and pigments, tar and ammonia distillation, pharmaceutical preparations, enamel, gas manufacture, soap and explosives, leather tanning, glass making, pottery and porcelain making, electro-plating, and brewing, no one of which is dominant. This fact, to my mind, is a final argument against further specialisation at present, and furnishes another reason for making the training a broad one.

It is important, however, to face this question of specialisation from every point of view. A University is not only a teaching institution, but it is supposed to further the knowledge of the subjects it deals with. Precisely how this idea will be worked out in the case of a Department of Applied Chemistry it is hard to predict, but it is quite possible that in some cases the knowledge desired will only be obtained if the process or product in question is studied on the commercial scale. The need for this would become apparent in the course of a research, and it seems that the directions for specialisation would be a natural outcome of the research work of the department. From the point of view of expense it is clear that the amount invested in items of plant would be as small as possible. Some items of plant are necessary in order to neutralise the cramping effect of tremulously handling fragile beakers and chasing the minutest particle of some precipitate, to educate a delight in moving something worth moving and getting a really good yield though the melting point may be a trifle low. The student should use plant until he feels himself to be master of it, and every part his ready servant.

There are many Universities, Technical Colleges, etc., that have Departments of Applied Chemistry not organised on these lines. I felt it my duty to make myself acquainted as far as possible with the courses and equipment of such departments both at home and abroad, but however interesting it would be to give some account of their methods, I feel convinced that every locality must consider its own special needs and not follow any precedents till after careful study of its own requirements.

These other Departments of Applied Chemistry seem to fall naturally into three main classes according to the main product aimed at, viz., the pure chemist, the works

chemist, and the chemical engineer. It is particularly interesting to note how institutions of the extreme types are tending to become more like the middle type. Birmingham University is an example of the one change, and as an example of the other the Massachusetts Institute of Technology, in 1903, abolished certain options in their course of chemical engineering and decided to make it essentially a course of chemistry, with some work in applied mechanics and mechanical engineering. Another recent change in that Institute is the transfer of instruction in industrial chemistry from the third year to the fourth year.

The works is not the proper place for a chemist to acquire all his knowledge of industrial chemistry. It is altogether too hard on the student to expect him to prove satisfactory under these conditions. Professor Kipping has recently pointed out the disastrous results that have attended this policy. The University seems in every way a suitable place for the prospective applied chemist to study his profession; there the change from pure chemist to works chemist can be made as gradual as is necessary; there he can pass gradually from laboratory appliances to their large scale equivalents. These fundamental industrial appliances, processes, and materials can be represented to him as the "elements" of industry. When certain of these combine they go to form one industry; when others combine another industry is formed, and so on. Visits to works can be made into an exercise in "analysis" and analogous exercises in synthesis could be performed. What he has to learn about economics could be introduced in a similar way. For instance, the phenomena of supply and demand for commercial commodities have their counterpart in the phenomena of solution, diffusion, and crystallisation. The solubility and rate of diffusion regulate the "supply" of solid to a liquid or medium capable of taking it up. The higher the temperature the more rapidly will—as a rule—the solution be effected, and the more rapid the rate of travel the quicker are letters and goods carried and the sooner the demand for a commercial commodity is met and supplied. The phenomena of supersaturation have their counterpart in over-production, and its results and so on. In the works he will get no such kindly tuition. At the University, too, he is near the other departments of learning that he should attend. At the same time, it should be possible at any rate in Birmingham for much of the analytical work to be done in the fine laboratories of the Municipal Technical School and perhaps for other courses to be elaborated there, and duly recognised as qualifying for graduation or other University privileges.

Now, in conclusion, is this programme, which is dictated by considerations both general and local, feasible? It has been said that no man exists so versatile as to properly direct a department like that I have sketched. It has also been suggested that the best way is to employ outside experts. There are obvious advantages in bringing experts into touch with the University, but, if we wish to avoid specialisation, it would be better to do without specialists, and try to instal a Professor, Assistant Professor, or director as the permanent head and organiser of all the courses. It would not be very difficult to find the right man; he is not expected to be an expert in all departments of applied chemistry. And if there is no such man it does not alter the fact that if this is the right kind of department a man must be found to direct it. When an article that is in great demand cannot be bought on the market, the manufacturer makes it himself if he really wants it. The University should make sure that it knows what kind of man is wanted, and then—if not forthcoming—select the most promising material and mould it—or set it to make itself—into the required finished product.

Comments on extract from foregoing paper.

Professor R. MELDOLA: In substance I agree generally with your proposals. In fact, I had, during the vacation, been making rough notes of my ideas before I knew of your intention to read this paper, and it is most interesting to me to find how far our views coincide.

Professor W. A. TILDEN: (1) The establishment of departments of applied chemistry in the colleges and

Universities will not improve the situation in England to any appreciable extent until the manufacturers generally are prepared to employ scientific chemists and pay them adequately. A man of ability will not spend five or six years in study at his own expense unless there is a career for him in prospect at the end of it. Too many of the so-called "chemists" in works are people of inferior education and ability, who would, in most cases, take a low place in any profession, say, medicine, law, or engineering. To attract ability in the direction of applied chemists, it must be made known generally to the public that this is a field in which at least a living can be made.

(2) I disapprove of attempts to imitate industrial apparatus in a college. The whole of the conditions under which work can be done are so different that the expense is not justified. This opinion, however, does not exclude the idea of giving instruction in mechanical drawing, properties of constructive materials, the principles of the steam engine, the dynamo, and the methods of handling large quantities of solids, liquids, and gases. But a student will get more useful information from a visit to a gas works or vitriol works than he would derive from an attempt to work a charge of material, say, 1/100th of commercial dimensions under conditions in which cost and kind of labour, etc., cannot be measured, and in apparatus which may become antiquated in a year or two.

(3) It is futile to expect any University or college to turn out chemists ready to play a leading part in all kinds of chemical industries. The man who, for example, knows all about soap might be useless in a cement works or an explosive works. The man who is likely to be most useful must be a man of natural ability, who has given five years at least to mathematics, physics, chemistry and elementary applications of mechanics and electricity. At the end of that time he will be prepared to undertake the special study which can only be undertaken when he has decided what department of chemistry he is going into. This can best be done in connection with the industry itself, and here the manufacturer who intends to use scientific assistance ought to step in and having found the well trained chemist take him into the works and teach him the business as is done in Germany and to some extent in America.

(4) Of course every well educated man should have a certain knowledge of book-keeping and business methods. But this is essentially the work of the business manager and not of the chemist. If the latter is to be employed in the study of markets and economic questions he cannot be expected to do anything in the way of improvement of processes and manufactures in which he is interested. His place should be in the laboratory, or when in the works he should be associated with the engineer, with whom he should work in harmony.

Sir WILLIAM RAMSAY: In this country no settlement has occurred for two reasons:—Few, if any, works employ a sufficient number of chemists, and few, if any, allow their chemists to know what goes on. In Germany works draw their chemists from two sources—Polytechnika and Universities. In the former an attempt is made on the broad lines you indicate, to give young men a suitable training. Such young men, however, are not found to be equal in ability or capacity to the product of the Universities. The reason stated is that though Polytechnika students are well informed as to what has been done, they do not know how to tackle new problems; or if they try to do so, their energies are directed to attempting small improvements in detail. The German University student, as everyone knows, is trained in research; he learns a method of thought, and can easily substitute a practical for a theoretical problem. Anyhow, I have been told that the University man commands a larger initial salary than the Polytechnikum man, and as a rule gives more satisfaction in the long run.

The student in Germany gets his training in the works. I have been told by one who employs 150 chemists, that they sort themselves rapidly into three classes:—(a) the routine men, who like to spend their time over analyses. These check the raw material and the

finished products. They are quite happy in doing this class of work. These are the most numerous. (b) The research chemists, who try new processes, suggested by themselves or others. (c) The managers of departments, or foremen who prefer to direct the manufacture and keep the hands up to their work. The Polytechnika men belong mostly to the first class; some to the third. The University men to the second, mostly; a good many to the third.

It would be possible to give a complete technical training in a University only if the man were to devote, say, 10 or 15 years of his life to being trained. By that time, he would probably be unfit for any post. Far better stick to science, to learn the methods of thought and of work; if the man has it in him, he will soon pick up the commercial and technical sides. I could give you numerous instances where pure scientific chemists are making large sums or receiving large salaries; their works experience lasted perhaps a year or two years.

Mr. THOMAS TYLER: Chemical technology cannot be taught on any sufficiently practical scale in a University like Birmingham, though particular branches of technology can be very efficiently illustrated, and a few—very few—demonstrated. All research sooner or later tends to practical application. There must be autoclaves, presses, filters (vacuum and pressure), compressed air, and even high pressure steam, with sufficient electrolytic appliances to investigate the fruitful field opening in that direction. But these are aids to the development of what after all is the instinct of practicality. I know well trained men of high scientific accomplishments who have been and are in works laboratories, but whom I would rather pay to do nothing than place in charge of works. No man is fit to be a technical chemist, in the true sense, unless he is grounded in the principles of chemistry, physics, elementary mechanics, metallurgy, electricity, mathematics, geometry (and drawing), and botany. A technologist must not be ignorant of German and French, particularly German. With these departments of science plus common sense, you probably have your man minus experience, and no University will give him that.

Mr. G. S. ALBRIGHT: The man who is valuable in a works must have the soundest possible knowledge of the various branches of pure science—the more the better—-but especially, of course, chemistry, physics, mathematics, and mechanics. His knowledge should be such that he can tackle any investigation set before him from various aspects, and if he has not the information at hand in all cases he should know where to look for it.

The more he has seen of the working out of industrial operations the better—one transfer of a laboratory process to a works scale if watched by an intelligent man will go far to make him into a useful chemist. He should have learnt how to properly set down and index all his work and to keep clear records and make out cost sheets. He must be honest, honourable, and reliable—the labour and research of years are embodied in practical chemical processes and are a very portable asset; hence the hesitation of many manufacturers to admit students into their works.

As to the amount of practical training which a University can give, much more might be done to give a trained chemist some insight into the difficulties of practice. Probably after graduation he should spend at least a year in studying the history of chemical processes, with their successes, and especially their failures and the causes for the failures—assisted possibly by a museum of specimens of the products and of the materials used in the construction of chemical plant.

On the practical side all that is wanted is a "crèche" laboratory where certain processes could be put through on the 1 cwt. scale. A course would consist of one or two processes carried through from the laboratory into the crèche, with minute attention to the differences in apparatus and appliances necessary—quantities, times, temperatures, all noted, and conclusions drawn from the crèche work all finally embodied in a cost sheet, showing probable labour, fuel, repair of plant and raw materials, &c.

A few comparatively simple processes which involved

boiling either with or without pressure, filtration, evaporation, drying, furnacing, and such like would give the student a real insight with some of the difficulties of practice and show how often means and operations which are easy at the Laboratory are difficult outside and sometimes *vice versa*. Here the student becomes familiar with the conversion of laboratory into practical commercial quantities and volumes—a most useful art.

In addition some knowledge of engineering drawing and the getting out of quantities is about all the equipment which a University can expect to give, except where a special industry is dominant, such as dyeing at Bradford or Leeds, where the *crèche* is on a small scale and can be specialised.

PROFESSOR A. SMITHELLS: I am strongly of opinion that there is room for a type of University teaching which shall concern itself with the borderland knowledge which lies between formal science and the craftsmanship of chemical industries.

PROFESSOR H. R. PROCTER: One of the conclusions to be drawn from your paper is that no one method of teaching industrial chemistry is applicable to all industries. While I can imagine that a miniature blast furnace would yield no useful information, it is quite certain that small sized plant in other industries is capable of giving useful results, or why would it be so common in some trades for manufacturers themselves to have small experimental installations? The object of a University technical department should be not to supersede practical experience in the works, which is essential; but to teach things which the works in the particular trade cannot teach. In a teaching laboratory many small scale experiments can be made which are impossible on a manufacturing scale, and while, in the works, investigations, however interesting, are merely pursued to the stage of immediate profit, it is possible in a scientific laboratory to carry them further with ultimately yet more important results. The greatest obstacle to technical teaching is the attitude of the manufacturers themselves, who ask for a training which must take at least 5 years, and will only pay the wages of an ordinary skilled mechanic. Under these circumstances prizes are so few that the more promising young men will not take the technical side.

DR. G. H. BAILEY: A *rapprochement* between University authorities and industry is urgently called for in the interests of both, and the main difficulties will vanish when once it is fully realised that University teaching is incomplete without its practical bearings and that industrial chemistry rests for its support on the kind of teaching which the University should afford.

As an illustration of the importance of this attitude of mind, the following is my own experience:—I have lectured for many years on sulphuric acid and alkali as an optional subject for the degree in the Honours School of Chemistry at the University. Notwithstanding that of all special subjects I considered this (and do still) the most suitable, I became impressed with the undesirability of training the industrial chemist by means of a special course. I therefore proposed over 20 years ago to substitute general chemical technology of engineering and practice in analysis and operations of a suitable nature according to the syllabus quoted in an address to the Manchester Section of the Society in 1905. The working out of such a course was a very arduous undertaking, but I carried it through two evening sessions, 1888 to 1890. It met with appreciation on the part of the many engineers and chemists who attended it, and I pressed for its adoption as a substitute for, or a supplement to, the special course in sulphuric acid and alkali for day students. The proposal met with no support from the authorities, who failed to realise that such a training was called for.

MR. EUSTACE CAREY: The technology of some industries can be learnt to a much greater extent in the laboratory than is possible in other industries. The large scale operations cannot be learnt and practised otherwise than in the works, and the only method of procedure is for a chemist to be employed in the laboratory at the commencement of his career with any firm. In a short time, he is naturally, as soon as opportunity offers, placed in charge of some practical branch of the business; it

may be to pioneer in something new, which has been initiated in the laboratory, or to take charge of some department which is already established. The latter course, in my own opinion, is much the better for the young chemist. In short, practical technology can only be learnt by practice in the works.

MR. A. SOUTHALL: The product of such a system of training as that described should prove valuable in almost any chemical industry, provided that: (a) The subject of it did subordinate all to the question of profit and loss. (b) The subject did not acquire contempt for the implements and apparatus he would have to employ on the large scale which are not usually comparable with the elaborate appliances available at Universities. (c) The proposed course insisted on accuracy in chemical analytical work.

In the special branch of pharmaceutical chemistry, the manufacturer selects the most promising material and moulds it, or sets it to make itself into the finished product.

PROFESSOR T. GRAY: The course of study which you suggest seems to me very good; it is, in fact, very similar to that followed in this college. Our aim is to give the student a general knowledge of the principles of engineering which will enable him to appreciate the engineer's point of view, and this, I understand, is your proposal. To ask the student to take a complete engineering course in addition to his chemistry course would be quite useless, and even if students could be induced to spend the necessary time the results would not be satisfactory. The addition of the subjects you mention to the ordinary University course in the form of post-graduate work would probably cause the least inconvenience; but in colleges such as ours, where all the students intend to adopt an industrial career, I think it an advantage to introduce the engineering element at an earlier stage. The students should know something about drawing, mechanics of structures, prime movers, and sources of power before they attend the applied chemistry courses. In order to permit of this without taking too much time away from their principal studies we have extended the diploma course to four years. In the first year the students have engineering drawing three hours weekly, and mechanics two hours weekly. In the second year mechanics three hours weekly; and in the third, motive engineering two hours weekly. These classes form an addition to the usual chemistry, mathematics, and physics courses. In the third year lectures on general technical chemistry are given. These take up materials of construction of plant, from a chemical point of view; water for industrial purposes; fuels and their applications; and the various industrial operations, such as grinding, mixing, separation of solids, etc., evaporating, distillation, etc., with examples chosen from different industries. In the fourth year the time is divided between the pure chemistry and applied chemistry laboratory. In the latter they work through exercises on sampling and analysis of gases with the well known forms of apparatus; pyrometry by calorimetric, thermo-electric, electrical resistance, heat and light radiation methods, including standardisation; calorimetry by different methods, including the use of the bomb and gas calorimeters; exercises with experimental gas producer; tests of efficiency of combustion of boiler furnace with calculation of various heat losses; exercises with filter press; separation of solids by settling and filtering *in vacuo*; evaporation, including multiple effect evaporation, for which we have a small plant with 40 sq. ft. heating surface; refrigeration; crystallisation. The object is to teach students how to make the necessary experiments, with quantities of substance from a few lb. up to a cwt., which form the preliminary stage in the development of a new process. So far as possible the experimental plant is on the model of that used on a large scale industrially. We have now under consideration the addition of a course in economics, but so far nothing has been done in this important department.

DISCUSSION.

The CHAIRMAN said that the training of industrial chemists in the past had frequently formed the subject for

addresses and discussions by the Society of Chemical Industry, and the evolution of so complicated an organism as Mr. Heathcote had described justified, he thought, the considerable amount of attention the topic had received. Within the last eighteen months there had been a revival of interest in the relation of science to industry. Professor Meldola, in his address to the Chemical Society, which was widely circulated, devoted a considerable portion of it to the influence of the more recent institutions upon chemical industry, and the autumn address of Professor Kipping to the British Association, in which he dealt with similar questions, would be within the recollection of all. The views put forward in those addresses, together with those expressed by Mr. Heathcote and his correspondents, pretty well covered the ground to be discussed. All were agreed that a sound scientific education must be the basis of the training of an industrial chemist, and it was only in the post-graduate course where a marked divergence of opinion existed. On the one hand it was argued that familiarity with operations on a large scale would give a practical bias to the mind of the student, and enable him more readily to apply his science to industrial practice. Quite recently he had occasion to compare the old calendars of some of our Universities and colleges with the more recent ones, and he was struck with the provisions that are now made for courses in subjects that Mr. Heathcote stated to be desirable. For instance, in Birmingham University experience could be obtained by intending industrial chemists in the testing and managing of boilers, gas engines, producers; analyses of gases; measurement of high temperatures; ammonia plant, blowers, etc. Drawing: The reading and making of drawings of plant of a type found in chemical works, etc. Materials used in various structures. The testing of the strength of materials, etc.; hydraulics, etc. A number of Universities and colleges had provided facilities of a similar kind, and if these opportunities were not largely taken advantage of it must be reluctantly attributed to the lack of demand on the part of manufacturers for such a product.

On the other hand, it was argued that the post-graduate course should be largely devoted to original research, for such a training induced originality of mind and resourcefulness, and from such an education new processes and valuable modifications of old ones would be much more likely to result. The Universities were quite capable now of supplying either type of man, and the real difficulty was that there were so few openings to reward a student at the end of a rather expensive training. More co-operation between the Universities and industry was desirable, and the discussion of the subject by the meeting would, he thought, help in that direction. A better understanding would result in a wider field of work for the trained chemist, and that would favourably affect both education and industry.

Professor FRANKLAND said that industrial chemistry was the making of money out of chemical processes, and the industrial chemist was the man who could do that. The possession of any other qualities was quite immaterial; as long as one could make money out of chemical processes one was a successful industrial chemist. They ought to be quite clear as to the kind of industrial chemist they were considering from an educational standpoint. They were, he thought, all agreed that he was to be an industrial chemist of the highest order. In many chemical industries there were many so-called chemists employed who were doing useful work in their way; but who were not true "industrial chemists." He fully agreed with Mr. Heathcote when he said that he did not propose that any of his suggested industrial departments should interfere with the training in pure chemistry which such a future industrial chemist would receive. There could be no doubt that the industrial chemist must be fully equipped with the knowledge of the general principles of chemistry; and he agreed that the more he knew of such general principles and the greater his theoretical attainments the greater use would be to the industrial concern he joined or directed. In this matter of ideal education they were always confronted with a most formidable difficulty: the length of time which a student was prepared to devote to his

studies. After an experience of many years, he could tell them it was with the greatest difficulty that students could be induced to remain three years at a University. They wanted to be earning money, and may be, to marry, at an age which was not consistent with spending more than three years at a University. Most of those who had to do with the teaching of pure chemistry knew that the duration of student life was much too short. No proper grasp of chemical science could be obtained in the course of three years even by students of considerable ability; still less by the great majority of the students. On that account he was at present engaged on a scheme, the object of which was to provide a four years' course of study at the University; four years in which the B.Sc. degree could be obtained. All industrial chemistry would have to come after: it would have to come after the four years' course which led to the B.Sc. degree had been completed. He thought that no diminution in the amount of purely chemical training should be admitted. Three years was the minimum. He hoped that nothing less than that would be admitted by any University; indeed he trusted that the period would be extended to four years so far as chemistry was concerned. A rearrangement of the subsidiary subjects for the B.Sc. degree might be permitted. The calendar of the Birmingham University showed what had been the result of considerations of that kind.

Professors Brown, Turner, Burstall, Dixon, and himself had elaborated a scheme of study in the Birmingham University which they believed would form a suitable subsidiary subject to students who were contemplating taking the B.Sc. degree, in chemistry, as the principal subject. They proposed that students should take as a subsidiary subject a number of engineering matters such as had been referred to by the chairman. They thought that was permissible because the subjects selected from the engineering syllabus were not matters of purely utilitarian importance, but subjects which expanded the mind. They were all probably agreed that there should be this undisturbed study for the pure science degree. Then the differences of opinion arose. Some favoured a post-graduate general course of industrial chemistry; others objected to this; while there were yet others who were in favour of a special course in some selected branch of industrial chemistry. In respect to this matter his mind was not crystallised; though he would point out that at the University they had proceeded, so far, on the idea of a specialised course. They had two separate departments of applied chemistry: the brewing department and the metallurgical department. It was interesting that those two departments had been developed by their professors on entirely different lines. As to the use of plant there appeared to be great difference of opinion. In Professor Turner's metallurgical department, they saw chimneys, furnaces, and wheelbarrows and such things characteristic of works; but in the brewing department they would not see anything suggestive of either beer, wines, or spirits. A temperance party might be taken into that laboratory without fear of anything being seen connected with intoxicating liquors. He did not profess to know which was the proper way to conduct such training. He imagined, however, that what was suitable and necessary in one branch of applied science, might be unsuitable and unnecessary in another; and he had no doubt that each of his two colleagues was doing his work in the best possible way. Similar differences would doubtless be found in other branches of applied chemistry. He had no sort of objection to the creation of a Chair of Applied Chemistry provided that it would be a post-graduate subject. He could imagine that it would be an interesting and stimulating class to attend. He did not think the question of value raised by Mr. Heathcote a difficult matter. Students did not think much of value, because they were not paying for their education. When a man was engaged in an industrial concern he had to think about value, because if he did not produce paying results he would be dismissed. A man placed in a position of responsibility soon appreciated what value was. The man who could undertake the duties of this Professor of Applied Chemistry, if he were to teach general applied chemistry in the manner indicated

by Mr. Heathcote, would be a very rare bird indeed, and one difficult to catch.

If he was to be specially trained for the position, as Mr. Heathcote suggested, then he ventured to think that the "reversible reactions" by means of which he was to be made would, before his training was complete, have led to his undergoing a considerable amount of decomposition.

Mr. GEORGE CADBURY, Junr., said the ways in which chemistry might be applied in their particular case had been unfolded in a marvellous way. Of course, they bought all kinds of raw materials. With regard to the training of men, he thought it would be impossible to specialise in all the trades in which chemists would be engaged. He supposed the scope in certain trades was small; and that only a limited number of men could be engaged. It would, of course, be too much to ask the University to lay itself out to teach all those classes of chemists.

The list read out by the Chairman showed what a large variety of operations there were carried on in the Birmingham neighbourhood. The training should be of a broad character, in which those taking it should be able to appreciate the special difficulties of the industry into which they were going. The training should be such that they could tackle difficulties as they arose, and solve them in their own way. The most successful training would be that which enabled men to adapt themselves to circumstances. Adaptability was one of the chief things which should be brought out. He was not sure that that was included in Mr. Heathcote's formula. Perhaps an elementary knowledge of economics was as good a training in that as anything. What was needed to be done was to train men who would be able to tackle problems and deal with men. They had their directors to deal with, and it was essential that they should make their own points clear in simple language—not always in formula—and get on with those who were to carry on the processes they initiated. He foresaw great difficulties if they were going to specialise on any particular trade. The amount of plant required would be enormous, and there would be the danger of the knowledge imparted quickly becoming out of date. In all processes and trades the advance was rapid, particularly in the processes used; and it would be almost impossible for a professor or a department to keep up to date. On broad lines he favoured a general training, which would develop the character of men, and enable them to tackle their own special difficulties when they got into their own special line of work.

Dr. PRICE said that what chiefly impressed him in the paper was the prolonged period of time which would be necessary for an industrial chemist to spend before he got a training of the kind which Mr. Heathcote desired. It must, they understood, be a post-graduate course, that was, after 3 years, or better still, 4 years' training for a science degree; in this matter he was in agreement with Professor Frankland. He must then obtain a knowledge of the many subjects which it had been suggested it was necessary for the industrial chemist to know, which meant that he had got to spend several years in obtaining such knowledge without apparently getting time for research. It seemed to him to be absolutely necessary for the industrial chemist to have some training in research. He was sure that Mr. Heathcote, who was looked upon as a successful industrial chemist, owed his success largely to the training that he himself had in research. It was only after one had had such a training that he would be able to overcome the difficult problems which he might meet with in his every-day work. If they took a student who had gone through the ordinary University course and simply taken his degree, he very much doubted if he would be able to surmount some unexpected difficulty without a great deal of trouble. An industrial chemist of the highest type must be capable of original investigation; and if he first came into contact with such investigations in the works laboratory it was so much time wasted for the employer before he had gained the necessary experience; it seemed to him that such knowledge should be obtained if possible in

the post-graduate course. Suppose they had this course, would the manufacturers help adequately towards the better training which such a course represented? Co-operation in carrying out the curriculum was of the utmost importance. In his department at the Birmingham Municipal Technical Schools there was a very successful class in gas manufacture. Up to two sessions ago the class was taught by an engineer, and naturally the importance of chemistry was not emphasised. A change was then made, the class being divided into two sections, the one consisting of engineering and the other of chemistry. He believed in having a teacher to conduct such classes who was not only a capable chemist, but one who also had an intimate knowledge of the actual works methods. Possibly owing to the fact that gas making is a municipal undertaking here, he was able to secure the services of Dr. Davidson, the chief chemist at the Corporation Gas Works; and the classes were very successful. For this session he desired to arrange another industrial course, in connection with acid and alkali manufacture, with a teacher who possessed a proper works experience, as well as thorough scientific knowledge.

Mr. H. HOLCROFT thought Mr. Heathcote's proposal undesirable at the present time. The numbers of the unemployed were already too great. Presumably the chemists to be specially trained were intended to be employed in the British Isles, although the proposal did not state so definitely. If so, then he knew he was expressing the opinions of many manufacturers who could possibly increase their staff of chemists, that it was unwise to extend their business in this country in view of the unfavourable economic conditions prevailing, when compared with the position of foreign competitors. He could claim some little knowledge of the subject from the business side; and had discussed the question thoroughly with personal friends, chemists in this country and from the Continent, and had come to the conclusion the matter should be decided from the economic and business standpoint. It was only this consideration which would weigh with the bulk of manufacturers. Their object was clear—they wanted reasonable security for their capital and an adequate return as interest on their money. He also attributed want of success on the part of the manufacturers either now or in the past, not to their ineptitude or any want of skill on the part of British chemists, but to the fault of the prevailing economic conditions. He instanced the coal tar industry, and said the same skill and knowledge which was responsible for the birth of the industry was undoubtedly competent to develop it to the highest point, especially with the advantage of being first in the field, if economic conditions had not stood in the way. The new Patent Laws might possibly do something to lessen the inequality and place the British manufacturer in a better position to compete, but much yet remained to be done.

Mr. A. E. TUCKER submitted that it was common knowledge among manufacturers that University training was not one necessarily resulting in the best chemist; and he thought this must be so, because the personality of the men so immensely influenced the result. Again, it was a matter on which there was common agreement that there were many highly successful and highly scientific men occupying important positions in all branches of industry who had never studied at a University. He knew several such in the Birmingham district. He desired to question Mr. Heathcote's proposition that theory was a labour-saving axiom; in his experience the old maxim that "an ounce of practice, etc." still held. Mr. Heathcote must have seen, like himself, important practical results in works which had been obtained by experience alone and which were not amenable to any ordinary theory, and indeed were sometimes opposed to theory. He could give instances in which this proposition was true. As to a Chair of Industrial Chemistry, if by this was meant the inclusion of the multifarious branches of industrial chemistry, he regarded such a recommendation as altogether beyond the range of practical politics. The industrial chemist, so called could not be taught outside the works, these should be his University and any attempt in establishing small

industrial plants in Universities would, he believed, prove highly costly and quite unsuccessful.

Dr. R. S. MORRELL said there was one suggestion he wished to make, and if adopted he thought it would help to clear up the difficulty of the application of University research to the wants of the manufacturer. Research might be made of more immediate use to the manufacturer if there were a closer connection between works chemists and the University. Speaking from experience, he found that there was much pure laboratory work to be done which could be well carried out in the University. The work would be good training in research for a post-graduate student in his second year. The results would have no direct money value—they could only be useful in the hands of a works chemist, who with his knowledge of industrial conditions could turn them into £ s. d. Such a scheme of research would enable the manufacturers to encourage research scholarships and fellowships, and would eliminate the feeling that there was a danger of disclosing trade secrets by so doing. It might be asked, "How much of the research work done in the University would be of practical use or application in this generation?" He feared it would be far too little. He did not think that the manufacturer would ever allow the student, and much less the professor, to have the run of the "works"; but he thought he could influence University research through the suggestions of his works chemist so that results might be obtained which would be of value to the present generation.

Mr. E. A. LEWIS was of opinion that applied chemistry could only be taught by applied chemists, and that every University should have a lecturer on the chemical and metallurgical staff with at least 10 years' works experience. Many teachers had an idea that if their students passed examinations they were competent chemists. Theoretical examinations might be necessary, but examinations in practical chemistry were a waste of time, being no test whatever of competency in applied chemistry. When an employer engaged a young chemist he required to know if he was an accurate worker during the whole of his college career, not during a few hours in an examination, he also wanted to know if he could think in tons. In many colleges the estimation of impurities in commercial products was never taught, and yet an employer was often more interested in the traces of impurity present than the principal constituents. The art of sampling was usually ignored altogether, although in many commercial laboratories it was as important as analysis. The granting of degrees or diplomas after a 3 years' course of training was wrong; no degree or diploma for technical chemistry or metallurgy should be given except after 5 years' works experience or for some original research on applied chemistry. He agreed with Mr. Heathcote that analyses of commercial materials should be practised. A large amount of applied chemistry could only be learnt by practical experience in a works.

Mr. HEATHCOTE, in reply, said Dr. Price and Professor Frankland had touched upon the main difficulty—the question of time necessary for such a course as he suggested. His attitude was that some training in industrial chemistry was necessary, and he assumed that as his major premise. In this, pure chemistry was necessary; and after that he placed research, and then as much of the general training that one could get in in the time available. The trend of the Chairman's remarks was to point to the lack of openings for University-trained industrial chemists. While he (the speaker) admitted the truth of all that the Chairman said, he felt it true—and a truth that should always be associated with the admitted lack of demand—that the cure for the defect lay with industrial chemists themselves. They and they only could prove the value of their abilities and it was for them to increase the availability of their information and express it in such terms and in such places that it could reach and be understood by manufacturers. If they found by experience that their training had not been quite the most suitable, it was for them to voice their requirements and hope for the sympathetic attention of the Universities and other educating institutions. He was glad that Professor Frankland had no objections

to express, other than time considerations, to the scheme outlined in the paper. Professor Frankland did not think the question of value a very difficult one. He (the speaker) had found it a very complicated one. A man placed in a responsible position might soon come to appreciate what "value" is, but that would be no reason for neglecting to study it, and its far-reaching issues, in the preparatory training. Economic conditions were referred to by Mr. Holcroft as the obstacle to the development of the coal tar industries here. This is generally admitted as one cause, but another and greater one was the departure of Hofmann for Germany because the salary offered him in England was not sufficient. He took it that Mr. Holcroft did not intend to suggest that economic conditions in the British Isles were sufficiently malign to render the training of industrial chemists undesirable. No doubt the conditions were temporarily detrimental in some chemical industries, but not in all. Furthermore, where capital had been extensively invested in chemical plant it became all the more desirable to employ a research chemist, because, on account of the activity among scientific workers, the rate of depreciation of chemical plant was apt to be very high.

Mr. Tucker doubted whether theory is a labour-saving device. He (the speaker) supposed that each strongly advocated the food he was brought up on. It would be the height of folly to advocate neglect of theory in the training of industrial chemists. Theory was the offspring of practice. Practice comes first, and when sufficiently grown and extensive to show the rules and regularities running through it, "Theory" follows—as a rule—and probes beneath the skin of fact to get to the foundations and structures upon which facts or phenomena are superposed. He believed that in attempts to initiate new practices the first thing was to ensure sound foundations, and theory was needful for this. At the same time the "ounce of practice" which knows nothing of theory ought to be used, for it often embodied wide and long experience. He heartily concurred with the suggestion of Dr. Morrell. University professors certainly had the precedent of inanimate nature when they, like the trees of yore which buried the results of their chemical activities in the earth, expended their energies now for application many centuries hence. It cannot be said, however, that this post-dating of the draft commends itself to one's common sense. Let men who excel only in this kind of work do it by all means, but do not encourage them to engage the youthful, eager, and adaptable minds of the students in like pursuits.

In conclusion, he would like to say that there must be a considerable subconscious demand for applied chemists in the engineering trades which bulk so large in and around Birmingham. If one cycle firm could employ a staff of eight in their research laboratories and keep them continually busy, there must be other industries, not usually included under the heading of chemical industries, in which chemists could do valuable work.

London Section.

*Meeting held at Burlington House on Monday,
February 1st, 1909.*

DR. J. LEWKOWITZ IN THE CHAIR.

GUNCOTTON AND ITS MANUFACTURE.

BY COL. SIR FREDERIC L. NATHAN, R.A.

Guncotton was discovered early in 1846 by Christian Friedrich Schönbein, at Bask. It was not until forty years later that it fulfilled his expectations, referred to in a letter from him to Faraday, dated the 25th August, 1846, "of becoming a dangerous rival to gunpowder," as regards its use as a propulsive explosive. Schönbein came to England in August, 1846, and was present at Woolwich on the 9th October of that year when some

successful experiments were made with his guncotton, and immediately afterwards, he, together with Böttger, who independently discovered guncotton shortly after Schönbein, entered into negotiations with Messrs. John Hall and Son, of Faversham, for the manufacture and sale of guncotton in England. This firm erected a guncotton factory adjacent to their gunpowder works, but a very disastrous explosion, on the 14th July, 1847, destroyed the factory, which was never rebuilt.

The early history of the manufacture of guncotton abroad, and of the attempts made, particularly in Austria, to adapt it for propulsive purposes in small arms and cannon, have been so fully described by S. J. von Komoeki in Vol. II. of his "*Geschichte der Explosivstoffe*," by Dr. R. Escades in "*Die Schiessbaumwolle*," and by others, that it is not proposed to deal with these matters in this paper. It is only necessary to remark that a factory was erected at Hirtenberg in Austria, where the production of guncotton on a manufacturing scale was worked out by Baron von Lenk, of the Austrian Artillery. As the general principles he elaborated with such care and perseverance are in the main those still in use, it is of interest to give briefly the general lines of his processes of manufacture. As his raw material, von Lenk employed hanks of loose cotton yarn, purified by boiling for a few minutes in a weak solution of potassium carbonate, centrifuging out the liquid, and then thoroughly washing the yarn in cold water. The cleansed yarn was dried in a hot air chamber; when dry, it was placed in airtight receptacles to cool; when cool, it was immediately dipped in the nitrating acid. The nitrating acid consisted of one part by weight of nitric acid of 1.52 specific gravity, and 3 parts by weight of sulphuric acid of 1.84 specific gravity, thoroughly mixed together and cooled. The dipping pans containing the nitrating acid were of cast iron and stood in troughs surrounded by cold water. About 6 oz. of cotton, or two skeins, were immersed in the acid at a time, and moved about in it for a few minutes, until thoroughly saturated, the cotton was then removed by means of an iron fork, placed on an iron grating above the pan, and some of the excess acid got rid of by gentle squeezing, the proportion of acid retained being about 10.5 parts by weight to 1 part by weight of the original cotton. The acid bath was made up by the addition of fresh acid after each removal. Six to eight skeins were next introduced into a stoneware pot, fitted with a lid, in which they remained for 48 hours. The pots were placed in cold water to keep their contents cool. After the 48 hours digestion the contents of the pots were emptied into a centrifugal machine and as much of the excess acid as possible extracted. On removal from the centrifugal machine, the hanks were immersed as suddenly and completely as possible in a cascade of water, washed until no longer acid to the taste, and afterwards placed in crates or perforated boxes and kept in flowing water for about three weeks. At the expiration of that time the skeins were centrifuged to remove the bulk of the water, and boiled for 15 minutes in a solution of potassium carbonate of 1.02 sp. gr. The alkaline liquid was removed, and the skeins again immersed in flowing water for a few days.

Manufacture proceeded at Hirtenberg without serious accident until the 30th July, 1862. On this day the guncotton in the magazines exploded, owing to spontaneous decomposition, and another serious explosion occurring on the 11th October, 1865, the manufacture of guncotton was officially prohibited in Austria.

Early in 1863, by the desire of the Secretary of State for War, Sir Frederick Abel took up the study of guncotton and its manufacture in this country. In his first memoir on "*Researches on Guncotton*," read before the Royal Society on the 19th April, 1866, Abel described the important steps in von Lenk's system of manufacture, mainly in connection with the production of a stable product. He was of opinion that the alkaline boiling was the most important part of the purification process, and that its function was not so much to neutralise and remove residual traces of the nitrating acid, as to dissolve unstable bodies produced by the action of the nitrating acid on small quantities of resinous and other foreign substances still retained by the tubular fibre.

The important modification introduced by Abel in the manufacture of guncotton and patented by him in 1865 (Eng. Pat. 1102), had for its object the reduction of guncotton to a pulp, and forming from this pulp grains suitable for propulsive purposes. But the "pulping" process had, he considered, a further advantage, which was described by him in the following words:—"As the difficulties attending the perfect removal of the acid with which the guncotton remains impregnated after its conversion are mainly attributable to the tubular structure of the cotton fibre, and to the circumstance that the latter contracts considerably upon conversion into pyroxylin, the complete purification of the material is very greatly facilitated by reducing the guncotton fibre to a fine state of division, similar to that of the pulp used in paper manufacture, in which form it appears likely that guncotton will receive advantageous application. By submission to the 'pulping' process, the guncotton is divided into very minute fragments, and it is at the same time violently agitated for some considerable time with a very large volume of water (rendered slightly alkaline if necessary), which is afterwards thoroughly expressed when the pulp is converted into cylinders or other forms, so that a more searching process of purification can scarcely be conceived than this disintegration of the guncotton."

It is very probable, in view of the system of purification, consisting mainly of prolonged washing in cold running water, in use at the time of Abel's introduction of the pulping process, that his treatment did produce a much purer guncotton than was formerly obtained, but recent work on the subject of the purification of guncotton has demonstrated that other points besides the complete removal of traces of the nitrating acids underlie the chemistry of the purification process. This important question will be dealt with later.

Although the pulping and granulating of guncotton did not succeed in transforming it into a propulsive explosive, the greater purity of the material resulting from the pulping process, re-established confidence in guncotton for other military purposes, such as for mines, torpedoes, and field service work, as well as for blasting purposes.

Messrs. Prentice and Co., of Stowmarket, had commenced the manufacture of guncotton according to von Lenk's system in 1863, but a serious accident occurred at this factory not long after starting manufacture. In 1865 they rebuilt and enlarged their factory and recommenced the manufacture of guncotton, introducing Abel's improvements. The Stowmarket factory now belongs to the New Explosives Company, Ltd., and is still making guncotton by the Abel process.

The manufacture of guncotton was commenced in 1863 at Waltham Abbey on a small scale under Abel's direction; it was not until 1872 that a factory capable of turning out about 250 tons of guncotton per annum was established there. The main portion of this factory consisted of old buildings which had formed part of the Saltpetre Refinery, and abutted on the principal street of the town. Fresh land, away from the town, was acquired in 1885, and a guncotton factory was built on it, and commenced work in 1890. It was considerably enlarged and altered in 1904-5, and is now capable of producing about 2000 tons of guncotton per annum by the displacement dipping process of manufacture, to be referred to later.

It has already been stated that the invention of Abel had for its object the production of guncotton in a form in which it was hoped it would be suitable for use as a propellant. To attain this object, he reduced the finished guncotton to a very fine state of division. It was subsequently found that guncotton in this condition was more readily purified than when it had to be kept in the form of skeins throughout all the processes of manufacture. Abel's process had other advantages, however. As the guncotton in its final form was reduced to a pulp, it was no longer necessary to use expensive long stapled cotton yarn, and instead of this material, waste from the cotton mills was employed; this waste cotton was, by means of suitable machinery, opened out, and in this condition it was more completely exposed to the action of the acids than were the skeins. Again, the guncotton pulp could,

by hydraulic pressure, be compressed into dense and compact masses of any desired shape, making it much more suitable for use in mines, torpedoes, and for blasting purposes, and in this condition it could be stored wet for indefinite periods. This form of compressed guncotton was rendered more valuable still when it was discovered in 1869 by Mr. E. O. Brown, of the Chemical Department, Royal Arsenal, that it could be fully detonated in its wet condition and unconfined, by fulminate of mercury.

Guncotton compressed into slabs and discs is still the form of guncotton used for mines, for torpedoes, and in connection with demolition work in the field. The processes by which these slabs and discs are produced will be dealt with later.

The von Lenk process of manufacture, as modified and improved by Abel, is universally employed at the present day, except as regards the actual process of nitration. The modifications this process has undergone will be described when dealing with this particular operation.

Before considering the actual processes of manufacture, it is desirable to say a few words about the raw materials. The base of guncotton is cellulose. The purer the cellulose, the purer the guncotton and the better the yield, other things being equal. There is little doubt that the skeins of long stapled yarn used by von Lenk were of great purity, and were free from foreign substances generally. At the same time, the fact that the skein condition was maintained in the finished guncotton made it more difficult to free it from the subsidiary products of the nitration process. This was due to the tubular structure of the cotton cellulose rendering it impossible for the purification process to remove the impurities enclosed in the long fibres. When the fibres are cut into extremely short lengths in the pulping process, this difficulty is in a great measure overcome. Cotton waste in its raw state from the mills is anything but pure; but a special industry sprang up for the purpose of converting the ordinary mill waste into a condition suitable for guncotton making. The processes it undergoes are: de-greasing by means of solvents, treatment with caustic soda, bleaching, and washing. The effect of these treatments, if properly carried out, is to produce a fairly pure resistant cellulose, and they have now been perfected to such an extent that there is no difficulty in obtaining cotton waste containing on an average not more than 0.2 to 0.3 per cent. of matter soluble in ether, and having very little altered cellulose of the nature of oxy- or hydro-cellulose. Attempts have been made to find substitutes for cotton waste equally suitable, and, if possible, less expensive. This is a matter which has received some considerable attention at the Royal Gunpowder Factory. During the last few years various materials have been investigated, and guncotton made from them on a manufacturing scale. The materials so far tested may be divided into three groups:—1. Ordinary cotton waste and weaving mill waste. 2. Short fibre from the cotton seed. 3. Fibrous materials other than cotton cellulose. As the results of experimental work the advantages and disadvantages of the three groups may be summarised as follows:—

1. *Ordinary cotton waste* from different sources varies considerably in character, and this is not without effect on the resulting guncotton. Its chief disadvantage, however, is that it generally contains considerable quantities of wood and other foreign bodies. All these substances are possible sources of regions of low stability in the guncotton. On the other hand it is plentiful, easily procured, and reasonably cheap, and it can be relied upon to produce a satisfactory guncotton as regards nitrogen-content and percentage of soluble in ether-alcohol.

Weaving mill waste is a material composed entirely of woven cotton fabric of various natures, partly broken down by mechanical means. It differs materially in character, and, as at present in the market, is liable to contain, mixed together, both soft material and hard, stiff, starchy rags. It may also be over-bleached, and contain an undue proportion of altered cellulose. In its best form it is pure cotton cellulose, remarkably free from foreign matters, and makes excellent guncotton. It is, however, apparently not procurable at present, in its best form, in anything like sufficient quantity, and its

price would probably be considerably higher than the normal price of ordinary cotton waste.

2. *The short fibre from the cotton seed*, several samples of which, from different sources, have been experimented with, would no doubt make a good guncotton, if it could be obtained freed from particles of the seed husk. Unfortunately it does not appear possible to remove the husk particles entirely by mechanical means, and the fibre is therefore subjected to a very drastic chemical treatment, which, whilst it does not remove all the husk, produces non-resistant cellulose to a considerable extent, and the final product, in consequence, gives a guncotton low in nitrogen, and with a high percentage of soluble in ether-alcohol.

3. Certain fibrous materials which, when submitted to the chlorination method of Cross and Bevan for the estimation of cellulose, were found to give a high result, were selected for experiment. Amongst these were Ramie fibre, *Marsdenia tenacissima*, to be found in certain parts of India, and *Asclepias semilunata*, which comes from Uganda. These materials contain ligneous matter, which, in the case of Ramie, is present not as an incrustation, but forming a compound cellulose with the more resistant material, and difficult to remove completely on a manufacturing scale. Even when this ligneous material has been got rid of to a considerable extent, the fibre requires a much longer nitration and boiling to produce a correct and stable guncotton. Its price also is very high. *Marsdenia tenacissima*, by a simple treatment, easily carried out on the manufacturing scale, can be made into a fairly pure resistant cellulose, giving on nitration a distinctly promising guncotton. At present, however, it is not procurable in anything like sufficient quantity, and its price is unknown. *Asclepias semilunata* can also, by a simple process of purification, be reduced to a very highly resistant normal cellulose, capable, by slightly altering the nitration process, of being converted into a guncotton similar in its properties to that prepared from cotton cellulose. So far it has not been possible to obtain this material in quantity, and its price is also unknown.

So far, therefore, the best material which has come to light for the manufacture of guncotton is weaving mill waste, if the best form could be procured in sufficient quantity, at a reasonable price. Failing weaving mill waste, cotton waste as used since the early days of guncotton manufacture still remains the best commercial form of raw material.

The nitric and sulphuric acids universally employed are commercial products of a fairly high standard of purity. It is essential that they should not contain solid impurities which might adhere to the guncotton, and which would certainly interfere with the recovery of the waste acid. Of recent years it has been possible to obtain Nordhausen sulphuric acid at a fairly reasonable price, and its use has enabled a larger proportion of waste acid to be revived than was possible when ordinary sulphuric acid only was available. It is a common practice now for explosives factories to manufacture their own nitric acid, and to revivify and recover their waste acids, and most of them possess installations of considerable size for carrying out these processes, and for mixing the two acids on a large scale. These matters hardly come within the scope of the present paper, however, even if time permitted. Before these installations existed, it was the practice to buy acids of a certain strength and mix them in the proportion of 3 parts by weight of sulphuric acid to 1 part by weight of nitric acid; now, the more correct system is being adopted of mixing large quantities, analysing the mixture, and adjusting the composition of the mixed acid by the addition of nitric or sulphuric acid, so as to obtain the correct percentage composition. The nitrating acid is, of course, made up of a certain proportion of waste acid to which new nitric acid and new sulphuric acid are added.

The manufacture of guncotton comprises the mechanical processes in connection with the preparation of the cotton waste, the chemical processes of nitration and purification, and the final mechanical operations of pulping and washing.

TEASING.

Cotton waste as supplied to the factory contains a notable percentage of hygroscopic moisture, also wood, pieces of iron, metal, string, rubber, etc. These impurities are removed as far as possible by hand picking, and the cotton is then passed through what is known as the teasing machine, which, by means of a combination of rollers, armed with iron teeth, separates the fibre of the cotton and opens out knots and lumps. As the cotton leaves the machine, it is picked over again. It was formerly the practice to cut the teased cotton in a description of guillotine into 3 inch squares. This operation was one of the features of the original Abel process, but it has been disused of late years at Waltham Abbey, because it was found that the cotton along the cut edges was felted together to such an extent as to resist the action of the nitrating acid.

DRYING.

At Waltham Abbey the cotton, as it leaves the teasing machine, is delivered on to an endless band, which carries it to the drying machine. The moisture is expelled from the cotton by a blast of hot air, supplied by a fan through a steam heater. The cotton waste passes very slowly through the machine, the operation lasting about three-quarters of an hour, and issues from it containing about half a per cent. of moisture. It is immediately weighed out into charges and placed in sheet iron boxes or other suitable receptacles with lids, to cool, for which a period of about 8 or 9 hours is sufficient. During the cooling the cotton waste re-absorbs about half a per cent. of moisture. The object of removing the moisture from the cotton waste is to prevent dilution of the nitrating acid. The above is a typical method of drying, but it is obvious that this simple operation can be effected in other ways.

NITRATION.

In von Lenk's system of manufacture the operation of nitration was carried out in two stages. The first stage was the dipping of the cotton in mixed acid contained in nitrating pans; and the second, the completion of the nitration by allowing the partially nitrated cotton to remain in contact with a weaker acid, in earthenware pots, for a prolonged time. The loss of guncotton caused by occasional decompositions in the digesting pots and the labour entailed in handling them were undoubtedly disadvantages, and led some manufacturers to revert to the even older method of completing the operation in one stage. In this system, which has been called the direct dipping process, the size of the nitrating pans was reduced to enable them to be lifted on to trucks, wheeled to the acid centrifugals and their contents tipped into them.

From this process it was but a short step to a method which has been adopted to a large extent on the Continent, and known as the nitrating centrifugal method of nitration. Instead of nitrating in pans and tipping into the centrifugal machine, the operations of nitration, digestion, and removal of the acid are all carried out in the centrifugal machine itself. In this way labour is economised and it is claimed that fewer decompositions occur and that therefore a higher yield is obtained.

It will be seen that the improvements in methods of nitration so far enumerated are of the nature of modifications of the original process such as characterise the gradual evolution of almost every manufacturing operation. The next noteworthy improvement, however, marks an entirely new departure. The inventors of the displacement system of nitration, Messrs. J. M. Thomson and W. T. Thomson, of the Royal Gunpowder Factory, Waltham Abbey, have discarded the older methods entirely, and introduced a system founded on new principles.

Before describing the displacement method, it is necessary to give a somewhat detailed account of the various processes preceding it, referred to above. It is not, however, necessary to refer to details of the earlier nitration processes, and the method of nitration used by von Lenk has been sufficiently described. The Abel nitration process, which followed very closely on the lines of von Lenk's process, was the one universally employed from about the year 1865 until comparatively modern times,

and as it is still in use in many factories both in this country and abroad, it will be described in detail as formerly carried out at Waltham Abbey.

The nitrating acid was composed of three parts of sulphuric acid of 96 per cent. mono-hydrate to one part of nitric acid of 91 per cent. mono-hydrate, thoroughly mixed and cooled. This acid was run from the store tanks into cast iron dipping pans, holding about 220 lb. each, the pans being supported in an iron tank through which cold water circulated, to keep the temperature below 70° F. The dipping pans were provided at the back with gratings, on which to press out some of the acid from the charge. The charge of cotton waste weighed 1 lb. 4 oz., and on removal from the cooling box was passed from the back through an earthenware pipe in the partition running along the back of the pans, and raked by a dipper, as rapidly as possible, into the acid. After remaining in the acid bath for about eight minutes, the cotton was removed to the grating and a portion of the acid squeezed out by means of an iron lever having an iron plate attached to one end. After a charge had been removed from the dipping pan about 13½ lb. of the mixed acid was run into it to replace the amount removed with the charge. The charge, now weighing with the adhering acid about 15 lb., was placed in an earthenware pot provided with a cover and transferred to the cooling pits, through which a stream of cold water flowed, and where it remained for 12 hours. During this period of digestion the conversion of the cotton into guncotton was completed. The contents of the pots were now emptied into a centrifugal wringing machine, and the bulk of the waste acid extracted. The guncotton was then removed from the centrifugal machine and placed in galvanised iron pans with long handles. These pans, when filled, were carried quickly across to the immersing tank and the guncotton thrown into a large bulk of water, the workmen standing by the tank and pushing the guncotton at once under the water with a stout wooden paddle. The immersing had to be done as quickly as possible, as, if the guncotton were allowed to come gradually in contact with water, it was liable to fume off. The immersing tank was fitted with a perforated copper plate, to allow the water to overflow, so that fresh water was constantly passing through the tank. The guncotton was kept well stirred by means of a wooden paddle. When 2 cwt. had been immersed, the inflow of water was stopped and the tank drained down. When all the water had been run off the tank was filled up again with fresh water. This was repeated six times or until the guncotton no longer tasted acid. When this stage had been reached the guncotton was wrung in a centrifugal machine, water from a hosepipe being turned on the guncotton for one minute during the wringing, and it was then ready for boiling.

This process, although it undoubtedly produced a good guncotton, had certain disadvantages, and the amount of labour required was very great. The plant, although individual items were not expensive, very rapidly deteriorated, and the cost of renewals and replacements was heavy. Power was required to drive the centrifugal machines, large quantities of water were used both for cooling and immersing, and decompositions, both in the pans, pots, and acid centrifugals, were by no means an infrequent occurrence.

DIRECT DIPPING.

The first attempt attended with any success to overcome some of the disadvantages of the Abel process was the introduction of what is known as the direct dipping process. This system was used on a large scale at Nobel's factory at Ardeer, in Scotland, and I am indebted to the kindness of Mr. Lundholm for a description of it, of which the following is an abstract:—

The installation consists of parallel double rows of long iron tanks known as "coolers." Iron pots termed "dippers" in which nitration is carried out stand in the coolers, 62 to each cooler. Sliding wooden covers rest on the coolers to guide the fumes from the dippers into earthenware pipes with openings at intervals, through which they are drawn by exhaust fans. The mixed acid, either cooled or warmed as necessary, is carried by lead pipes placed

between each row of coolers, and is supplied to the dippers through earthenware cocks at intervals.

Nitration.—The water in the coolers is kept at 15° C. The dippers having been placed in position in the coolers, are each filled with 127 lb. of mixed acid by measurement, from the acid taps, 4½ lb. of cotton waste are steeped in each dipper. To minimise decompositions each charge of cotton waste is added in about 10 instalments. The wooden covers are only removed to allow steeping to be done, and are then at once replaced. The temperatures of nitration are:—Initial temperature of mixed acid, 15° C.; maximum after steeping, 25° C.; temperature at end of nitration, 20° C. The duration of the nitration varies according to the output required from the plant. One, two, or three shifts may be worked per 24 hours, and the time of nitration may therefore be 24, 12, or 8 hours respectively.

The average composition of the mixed acid for a 12 hours immersion is as follows:—Sulphuric acid, 75.0 per cent.; nitric acid, 15.75 per cent.; nitrous acid, 1.30 per cent.; water, 7.95 per cent. For an eight hours immersion a higher percentage of nitric acid and less water is used; for a 24 hours immersion less nitric and more water. The average composition of the waste acid for a 12 hours immersion is:—Sulphuric acid, 77.8 per cent.; nitric acid, 11.0 per cent.; nitrous acid, 1.5 per cent.; water, 9.7 per cent.

Recovering the waste acid.—When the nitration is complete, the "dippers," covered with light aluminium lids, are placed on barrows, wheeled to the centrifugals, situated at the end of the "coolers," and the whole contents tilted out into the centrifugal. Four dippers are loaded into each centrifugal, and the guncotton having been uniformly spread round the basket, the centrifugal is run for six minutes, to remove waste acid. At the end of that time about 1 lb. of waste acid is still adhering to each pound of guncotton. The centrifugal cover, made of light aluminium, is not fixed to the centrifugal in any way, so that as little resistance as possible may be offered when there is a decomposition. This is the usual arrangement in the case of acid centrifugals. The cone of the centrifugal projects through a circular opening in the centre of the lid and is covered by a small loose aluminium box. Small holes are cut in the sides of this box, and are of service in warning the workmen when there is a decomposition, as fumes are generally seen to issue there first.

Drowning the guncotton.—When the waste acid has been removed, the guncotton is quickly lifted out of the centrifugals and thrown under the revolving paddles of the drowning tanks, which immediately immerse it. The men who do the discharging are provided with rubber gloves and wear thick flannel hoods, which completely cover the head, arms, and breast. The hoods are fitted with strong glass windows, and are connected by light rubber tubing to a supply of pure compressed air.

Prowashing.—After a given quantity of guncotton has been drowned, the water in the tanks is run off and the guncotton thrown on to draining tables forming part of the drowning tank. It is then loaded into the prowashing centrifugals, the acid water wrung out, and washed for a few minutes with cold water from a hose, to remove adhering acid. No special precautions, however, are taken to remove all acid at this stage. The bulk of the water having been removed, the guncotton is loaded from the centrifugals into bogies, and conveyed to the boiling house.

The 62 dippers in each cooler form a "charge." Eight charges are worked by each shift. The yield is 159 per cent. of dry guncotton on the dry carded cotton. The output per shift consisting of 17 men is, therefore:— $4.5 \times 159 \times 62 \times 8 \div 100 = 3549$ lb.

NITRATING CENTRIFUGALS.

The next attempt at simplifying the Abel process was one in which the nitration was effected in the acid centrifugal. A number of nitrating centrifugals have been patented, particularly in Germany, but the best known patterns are those of Messrs. Selwig and Lange, of Braunschweig.

The latest pattern is known as the "Nitrating centrifugal with acid circulation." It consists of the usual

outer casing with cover, and an under-driven rotating basket perforated with a number of holes. The machine is provided with a hinged cover with communication to an exhaust fan, and there are pipes with cocks suitably arranged for running in the nitrating acid and drawing off the waste acid. The method of working is briefly as follows:—The basket is rotated slowly, and the nitrating acid run into it and between it and the iron casing, up to about the rim. The cotton waste is introduced in small quantities at a time, and this may be done whilst the nitrating acid is running in. During nitration the basket is rotated at the rate of 20 to 30 revolutions a minute. The effect of this rotation is to cause the nitrating acid to circulate continuously through the cotton waste. On completion of the nitration the bulk of the waste acid is drawn off and the centrifugal set into rapid motion to get rid of as much more of the waste acid as possible.

According to Selwig and Lange's circular their centrifugals are now made in two sizes. The larger size nitrates 22 to 26½ lb. of cotton waste, the smaller 14½ to 17½ lb., respectively. The yield is stated to be 160 per cent. The time of a complete nitrating operation is an hour.

Messrs. Curtis's and Harvey have an installation of these centrifugals at their Dartford Works; they are of the earlier or "without acid circulation" type, and of the smaller size. Mr. MacDonald has kindly supplied me with some details in connection with their working.

The charge is 17½ lb. of cotton waste, the proportion of nitrating acid to cotton waste is 50 to 1, and its average percentage composition: nitric acid, 23.15; sulphuric acid, 69.35; water, 7.5. The nitrating operation for the production of cordite guncotton, from the running in of the nitrating acid to the removal of the guncotton, takes about an hour. The initial temperature is 15° C., the final 23° C. After extraction of the waste acid, the guncotton retains approximately its own weight of waste acid containing a fairly high percentage of nitric acid, which is lost in the immersing. Analyses of the waste acid made at Dartford, show the following mean alteration in the composition of the nitrating acid, viz., a loss of 1.70 in nitric acid, and gain of 0.91 in sulphuric, and 0.76 in water.

DISPLACEMENT PROCESS.

Guncotton has been made at Waltham Abbey by the displacement process since August, 1905. The installation consists of a number of units of 4 pans worked together. The pans are of earthenware and circular, 3 ft. 6 in. in diameter, and 10 in. deep at the side of the pan; the bottom has a fall of 2 in. to the outlet, which is three-quarters of an inch in diameter; they are supported on earthenware pedestals about 1 ft. 10 in. above the floor level. The 4 pans are connected together by lead pipes, and these are again connected to the nitrating acid supply pipe, to the strong and weak waste acid pipes, and to a waste water pipe, through a gauge-box, where the rate of flow is determined whilst the waste acids are being run off. Gravities of the acids are also taken in this box. The process proceeds as follows:—

A small perforated plate is placed over the outlet of each pan, and four perforated segment plates making a complete disc about one inch less than the inside diameter of the pan, are placed on the bottom. Aluminium fume hoods, which are connected to an exhaust fan, having been placed on the four pans, the stoneware cock on the acid supply pipe is opened, and the acid allowed to rise in the pans to the proper level. The nitrating acid is cooled in summer and warmed in winter, so as to maintain the same temperature of final nitration all the year round. The composition of the nitrating acid is 70½ per cent. sulphuric acid, 21 per cent. nitric acid, 0.6 per cent. nitrous acid, and 7.9 per cent. water; the quantity in each pan above the bottom plates is 600 lb., and below the plates is an additional 50 lb. A charge of 20 lb. of cotton waste is then immersed in the acid, handful by handful, aluminium dipping-forks being used for the purpose. When all the cotton waste has been pushed under the surface of the acid, perforated plates in segments are placed on the top of it, care being taken that all cotton waste is below the surface of the acid,

and a film of water at a temperature from 5° to 8° C. is run very gradually on the surface of the plates through

The following table gives the principal figures in connection with the four nitration processes described:—

Process.	Nature of dipping vessel.	Acids.				Quantity, lb.	Cotton waste used, lb.	Acid used per lb. of cotton waste, lb.	Time of nitration, hrs.	Yield on dry cotton waste, %.	Output per man per week, lb.
		Sulphuric acid.	Nitric acid.	Nitrous acid.	Water.						
ABEL	Cast iron pan and earthenware pot	74.00	18.00	0.60	7.40	13.75	11	11.9	12	163.75	458
ARDEER : Direct dipping	Cast-iron pot	75.00	15.75	1.30	7.95	127	41	28.2	12	159.00	1112
DARTFORD : Nitrating centrifugal	Centrifugal machine	69.35	23.15	-	7.50	800-1100	16-24	50.0	1	160.00	—
WALTHAM ABBEY : Displacement	Earthenware pan ..	70.50	21.00	0.60	7.90	650	20	32.5	21	170	1742

a distributor. The film of water prevents the escape of acid fumes and the fume hoods are then removed. The time required for dipping a charge is a quarter of an hour.

The nitration is allowed to proceed for 2½ hours. At the expiration of this period the cock leading to the gauge-box is opened, and the waste acid allowed to run off at the rate of about 17 lb. a minute. Water, cooled, if necessary, is run on the top of the perforated plates, through the distributor, at an equivalent rate. The major portion, amounting to about 80 per cent. of the total waste acid, is returned to the acid store tanks to be revived with Nordhausen sulphuric and new nitric acids. The composition of this waste acid is 72.70 per cent. sulphuric acid, 17.30 per cent. nitric acid, 0.65 per cent. nitrous acid, and 9.35 per cent. water. The remaining 20 per cent. of the waste acid is sent to the acid concentration factory for denitration and concentration. The quantity of acid thus dealt with amounts to about 4 lb. for every pound of guncotton. Its composition is 61.0 per cent. sulphuric acid, 17.35 per cent. nitric acid, 0.55 per cent. nitrous acid, and 21.10 per cent. water. A small proportion of the water which follows the recoverable waste acid is slightly acid to the extent of 0.1 lb. for every pound of guncotton made. This is the total quantity of acid that is lost during the process. In the direct dipping and nitrating centrifugal processes the quantity of waste acid left in the guncotton is at least equal to the weight of the guncotton.

The whole of the acid is displaced in three hours, and the water, which should fill the pan, is run through the guncotton, the guncotton drained down and sent over to be boiled. These operations occupy about an hour.

The following are the principal advantages which the displacement process possesses over the Abel process, and over the direct dipping and nitrating centrifugal processes where they are similar to the Abel process.

1. The displacement process takes the place of the processes of dipping, squeezing out excess acid, digesting in pots, acid centrifuging, immersing, and water centrifuging.

2. The actual dipping of the cotton waste is a very much less laborious operation—the heavy labour of squeezing out the excess acid is done away with, the absence of fumes makes the work much healthier, and injuries to workmen from acid splashes are almost unknown.

3. Loss of guncotton due to decomposition in the digesting pots and acid centrifugals, and consequent inconvenience and danger to workmen from nitrous fumes, are done away with, and the heavy loss from breakages of pots and lids is saved. Three and a half years' experience has proved that the earthenware pans are very lasting.

4. Fumes during dipping, loading, and unloading acid centrifugals and immersing, are avoided.

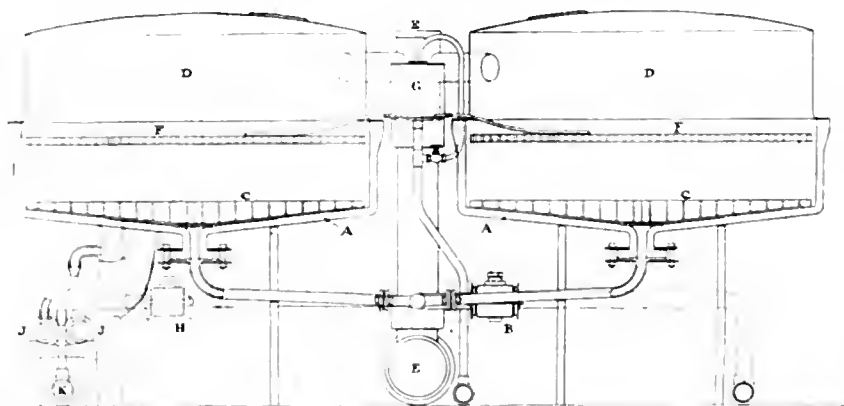
5. The quantity of acid lost is very much reduced. This reduction means also very much less pollution of the escaping washing water.

6. The recovered waste acid is very much cleaner, a matter of the greatest importance from the point of view of revivification and concentration.

7. The mechanical loss of guncotton in the acid and water centrifuging processes, and in the immersing process, is saved.

8. A more thorough preliminary washing of the guncotton is obtained with an expenditure of about one-fifth

WALTHAM ABBEY GUNCOTTON DISPLACEMENT PLANT



A.—Earthenware nitration pans.
B.—Acid inlet cock.
C.—Perforated earthenware plates.
D.—Aluminium fume hoods.
E.—Fume pipe.

F.—Perforated earthenware plates on top of guncotton.
G.—Water distributor.
H.—Outlet cock.
J.—Waste acid pipes.
K.—Waste water pipe.

of the quantity of the water, and less boiling, with consequent consumption of steam, is required in order to reach a given standard of purity.

9. Great saving in power is gained by the abolition of the acid and water centrifugals, and in the reduction in the quantity of water which has to be pumped.

10. Renewals of plant, and repairs to plant and buildings are exceedingly low.

11. The number of hands employed for any given output is much less—the total cost of labour being reduced by two-thirds.

12. The yield is improved; it averages 170 per cent.

13. Finally, a more stable guncotton, of more uniform composition, is produced. It is also far cleaner, and contains notably less mineral matter.

STABILISATION.

Boiling.—Originally stabilisation was effected by prolonged washing in cold running water followed by a very short treatment with a boiling alkaline solution. Boiling, as now understood, did not form part of the process of guncotton manufacture when manufacture was started at Waltham Abbey early in 1872. About the middle of 1873, however, boiling vats were put up at Waltham Abbey, but no records exist, unfortunately, about the details of the early boiling processes. In the official "Notes on Gunpowder and Guncotton," published by the War Office in 1878, it is stated that guncotton manufactured at Waltham Abbey underwent two boilings by steam in wooden vats for 8 hours each, the water being extracted after each boiling by wringing for 3 minutes in clean water centrifugal machines. The same boiling process was in use in 1888, according to a later edition of the same book. Five years later each boiling was extended to 12 hours, and the boiling lasted for 5 days and nights—that is, the guncotton received 10 boilings of 12 hours each. In April, 1894, this system of boiling was replaced by a system characterised by short boilings at the commencement of the process, the time of successive boilings being gradually increased. The scheme of boiling was as follows:—

No. of boiling.	Duration in hours.	No. of boiling.	Duration in hours.
1	2	7	6
2	2	8	6
3	4	9	9
4	4	10	9
5	6	11	12
6	6	12	12

This system of boiling was continued with but slight modifications until August, 1905. On the introduction of the displacement dipping process it was found, as already stated, that guncotton made in this way was brought to a condition of stability by the boiling process then in use, and just referred to, at an earlier stage than guncotton made by the Abel process. A probable explanation of this fact is that during the displacement process a zone of acid liquid at a comparatively high temperature—somewhere about 40° C.—passes through the whole of the guncotton in the dipping pan. The action of this hot acid liquid may be to oxidise certain organic impurities which are certainly present, and to cause the breaking-down of unstable nitrogen compounds into soluble or non-reactive bodies. Systematic experiments were therefore carried out, in 1905, to determine the most suitable and most economical method of purification by boiling, for displacement process guncotton. In the principal experiments two types of boiling were employed—one in which long boilings were used at first, followed by short boilings; the other in which short boilings were used at first, followed by long boilings. The following deductions were made from the results obtained in these experiments:—

1. Purification of guncotton obtained by means of long boilings at the beginning followed by shorter boilings later, is superior to that obtained when the reverse condition holds. This is substantiated by the following considerations:—Examination of the waters showed that

neutrality is obtained earlier; that less decomposition of the guncotton takes place; that the stability, as shown by the various stability tests, is greater; and that a stable condition is attained earlier.

2. A displacement washing after a long acid boiling at an early stage is a beneficial treatment. This treatment is probably responsible for the early attainment of neutrality.

The system of boiling determined on as a result of these experiments was as follows:—

No. of boiling.	Duration in hours.	No. of boiling.	Duration in hours.
1	12	6	4
2	12	7	4
3	4	8	2
4	4	9	2
5	4	10	2

with a cold water displacement wash after the first two boilings. A full account of these investigations was given in a paper on the purification and stabilisation of guncotton, read by Dr. Robertson before this Section on June 16th, 1906. This system of boiling is still in use at the Royal Gunpowder Factory.

The question of how the purification of guncotton can best be effected cannot, however, be considered as settled, nor can the system which has just been described, although it undoubtedly gives an excellent guncotton at the Royal Gunpowder Factory, be applied to guncotton made by other processes, at other factories, without full investigations as to its suitability. Another matter which must be taken into account in connection with the purification of guncotton by boiling, is the nature of the water available. The water at Waltham Abbey is very hard, and its alkalinity may be an important factor in the success of the boiling treatment in use there. This question is perhaps connected with another one, and that is, that the boiling of guncotton can be carried too far. The effect of boiling, whilst it no doubt breaks down impurities, also, no doubt, breaks down the stable ester itself. It is well known that if guncotton is boiled for a sufficiently prolonged period, the percentage of soluble matter will rise and the nitrogen-content will fall. The breaking-down of the ester will be accompanied by the formation of acid bodies, and the presence of alkali in the water will neutralise them and prevent them from reacting on the guncotton.

I have been obliged, owing to want of time, to treat this question of purification very briefly, but it is undoubtedly the most important one in connection with the manufacture of guncotton. One or two matters have been touched upon, in connection with which further work is necessary, but there are many others which will repay very careful investigation and research.

PULPING.

On completion of the boiling process the guncotton is transferred to a heating engine somewhat similar to that employed for pulping the raw material used in the manufacture of paper. It consists essentially of a large iron roller armed with steel knives, and a bed-plate also provided with knives. The roller revolves, and as the guncotton passes between the two sets of knives, it is reduced to pulp of any desired fineness. As the pulping process proceeds, the roller is gradually lowered nearer to the bed-plate.

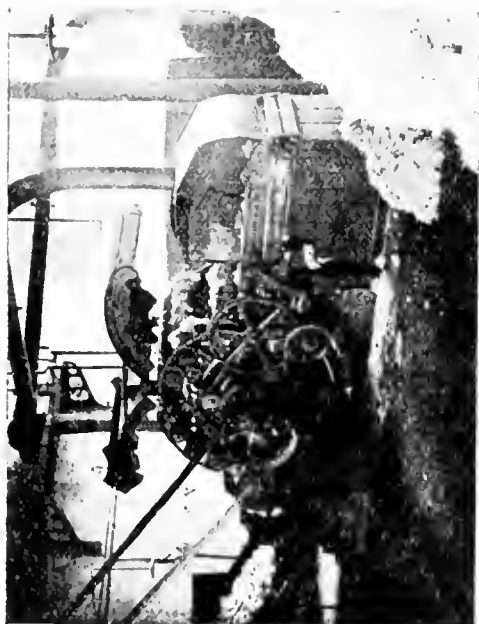
Since the introduction of a thorough system of purification by boiling, Abel's original idea that the pulping and washing the guncotton received in the pulping process had a very material effect on its purification, no longer holds good to the same extent. At the same time there is no doubt that the very long staple guncotton before pulping retains in its tubes unstable bodies which no reasonable amount of boiling will remove. The effect of pulping is to materially reduce the length of the fibres and, at the same time, to produce a certain amount of crushing in them. This allows of impurities of an acid character in the tubes being removed, either mechanically or by diffusion.



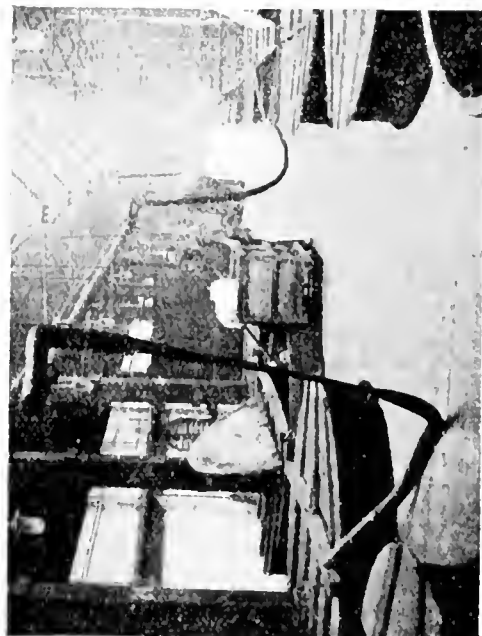
GUNCOTTON DISPLACEMENT—NITRATION MACHINE.



GUNCOTTON BEATERS AND POACHERS.



COTTON WASTE TEASING MACHINE.



GUNCOTTON ROLLING HOUSE.

REMOVAL OF FOREIGN BODIES.

After pulping, it is now customary to treat the guncotton in some mechanical way, in order to remove from it particles of metal, grit, and foreign bodies of a similar character. At the Royal Gunpowder Factory this is effected by running the guncotton pulp, suspended in a large volume of water, through grit traps, placed at intervals in a long shallow trough, the bottom of which is covered with blanket. The foreign bodies, being almost entirely heavier than the guncotton pulp, are retained in the grit traps, and the fine sand, also present in some quantity, is caught by the woolly blanket. An electro-magnet in the last grit trap removes any magnetic particles passing the ordinary grit traps. It is surprising what a large quantity of foreign bodies are removed by these arrangements. In addition to grit traps and troughs, some factories use what is known as a knotter, the function of which is to remove small knots and any large pieces of guncotton which may have escaped complete pulping.

POACHING.

Washing the guncotton during the pulping is effected in some factories by the use of drum washers fixed to the beating engine; in other factories and at the Royal Gunpowder Factory this washing is done in separate vessels, termed "poachers." The poachers in use at Waltham Abbey hold about 10 cwt. of guncotton and 1100 gallons of water, and are fitted with power-driven paddles for agitation purposes. The guncotton receives at least three washings; it is allowed to settle down after each washing, and the washing water is removed by a skimmer. The washing water contains in suspension foreign bodies of a lower specific gravity than guncotton, and in the case of the earlier washing waters, there is always present a scum containing nitro-bodies of low stability.

BLENDING.

A further purpose served by poaching is the thorough blending of a number of different batches. This is a final blending, but at the Royal Gunpowder Factory there exists a regular system of blending right through the whole of the manufacturing processes. This system is briefly as follows:—The cotton waste reaches the factory in consignments from different contractors. The waste is drawn from store in proportion to the quantities on the contracts, and is mixed and passed through the teasing machine in these proportions.

The next process where blending is possible is in charging the boiling vats. Two vats are filled simultaneously from a number of sets of pans—two pans of each set of four going into one vat; the other two of the set into the other vat. On completion of the boiling, four vats are emptied simultaneously into 32 beaters. This ensures the guncotton from the four vats being blended together in the beating process.

On completion of the pulping the beaters are run alternately into the poachers in such a manner that the contents of the 32 beaters are blended into eight poachers. The guncotton in the eight poachers is therefore uniform throughout.

The system produces guncotton of very uniform nitrogen-content. In the 1907-8, 291 tests, representing 600 tons of guncotton, gave the following nitrogen result:—

Maximum.	Minimum.	Mean.
per cent. 13.05	per cent. 12.93	per cent. 13.0195

MOULDING.

For convenience in drying the pulped guncotton it is moulded by light hydraulic pressure into cylinders which measure about 5½ inches in height and 3 inches in diameter. This is effected by running the guncotton pulp into a moulding machine provided with a number of holes into each of which fits a hollow plunger. These plungers are connected with a vacuum engine, and a good deal of the water is sucked out of the pulp by their means. The

mould block containing the guncotton is transferred to an hydraulic press, and pressure is applied, which has the effect of removing more water and of squeezing the pulp into a condition of sufficient consistency to allow of its being handled with care. In this lightly compressed form a very much larger quantity of guncotton can be dealt with in a drying chamber of any given dimensions than if it is dried in the condition of ordinary pulp, and in its compressed form it possesses the further advantage of being able to be dried on fixed racks. This does away with the necessity and risk of moving drying trays or similar arrangements in a stove. It is also obvious that much less dust is produced.

PRESSING.

If intended for use in torpedoes, mines, or other demolition work, the guncotton is moulded into suitable shapes, as described above, and the moulds are then subjected to powerful hydraulic pressure, amounting to about 6 tons on the inch, to produce the finished slabs or primers.

CONCLUSION.

I have endeavoured, very imperfectly I am afraid, to give in a comparatively brief time some account of the history of the manufacturing processes involved in the production of guncotton. Other nitrocelluloses, for the manufacture of which some of the processes are slightly modified, have not been touched upon. The subject is a very wide one, and if it were attempted to go into details, each process would require more time devoted to it than has been given to the whole manufacture.

This paper has consisted almost entirely of manufacturing details; very little attempt has been made to deal with the chemical questions involved, and nothing at all has been said about the chemistry of the nitration of cellulose nor of the chemistry of the nitrocellulose molecule. The published information on both these subjects is very considerable, and is constantly increasing. I had originally intended to attempt a brief summary of the more important papers, but I had to abandon it as quite impracticable. What must, however, strike any manufacturer of nitrocellulose when he consults the literature of the subject, is that the great bulk of it, although of intense interest, is either too theoretical for practical application, or else that the data, being for the most part the result of laboratory experiments, are not always a sure guide as to what will happen on a manufacturing scale. Our experience at the Royal Gunpowder Factory is, and it is also no doubt the experience of other manufacturers, that all experimental work should be based on sound chemical principles, but to be of practical use it must be conducted on a manufacturing scale wherever possible, and that laboratory work comes in when it is required to ascertain the nature of the results obtained. I venture to think that this is true in the case of several chemical manufactures, and it is most undoubtedly true in the manufacture of guncotton, and I therefore offer the suggestion to any of those chemists who wish to further improvements in the production of guncotton, to take the manufacturer into their confidence, work with him, and to get him to work with them.

DISCUSSION.

The CHAIRMAN asked whether there was any difference in the behaviour of cotton fibres of different origin, such as Bombay, Egyptian, and Sea Island fibres; of course, they might all be too expensive. There were some other fibres which might perhaps be used, such as the Kapok fibre and the fibre of *Cochlospermum Gossypium*, which the "Indian Museum" in Calcutta was examining at present. Those who had been allowed to see Waltham Abbey in 1900 would realise the vast advances that had been made since then, judging from the pictures thrown on the screen. He could not fully agree with what had been said about the functions of a works laboratory. In the presence of so many military men, it was rather obvious to draw the parallel between strategy and tactics in military matters and in a chemical works. The laboratory could be likened to the General

Staff which laid down the plan of campaign. And just like the tactician had to work it out in the field, so in the same way the chemist who had made the experiments on a small scale, had his work cut out for him when endeavouring to carry them out in the factory on a larger scale. No doubt the chemist would meet then with many seemingly insuperable difficulties; but having once got the result in the laboratory, he knew he had only details to deal with, however long and patient the work involved in overcoming them might be. At the same time the laboratory must supervise the large scale operations from the beginning, and in all its stages, and not simply come in at the end. Sir Frederic Nathan was in the enviable position of being able to show what he was doing, whilst manufacturers as a rule had to be more reticent; this paper, therefore, was especially instructive to the younger members of the Society, who learnt the supreme importance of details, and what amount of foresight was required to carry on a manufacture successfully. The thanks of the members were also due to the Government, who permitted the publication of all the details.

Mr. JOHN SPILLER said he had listened with great pleasure to this history of things as they were, in bygone years, when he was one of Sir F. Abel's assistants; and also to the interesting narrative of successive improvements introduced into the manufacture. He noticed particularly the considerable saving of labour, the larger production, and especially the greater purity of the finished product. It must afford every chemist the greatest satisfaction to find that matters were brought up apparently to the ultimate stage of perfection. He was in Abel's laboratory in the early days of guncotton, even before it was manufactured at Waltham Abbey or only made on quite a small scale; and he was there later when the disastrous Stowmarket explosion occurred. A year or two afterwards he was Mr. E. O. Brown's colleague when he cleared up the mystery, and gave the first indication of the true cause of that disaster, which he did by proving that even moist guncotton could be fired by detonation. There were many narrow escapes in those early days. Brown himself only escaped with his life on one occasion by a few minutes, when he came away from inspecting the magazine at Plumstead Marshes, and told them he had hardly time to lock up the place and run away. He was intending to report to Prof. Abel, but had no time to do so, because the whole thing exploded, in consequence, as it was proved, of the escape of red fumes due to decomposition. He assisted in the working out of the boiling process and some of the other operations which had been referred to. He lost the hair off one side of his face through a premature explosion in testing guncotton by heating it in a flask so as to determine the temperature at which the red fumes made their appearance. At the time they did not know everything about guncotton, and it was probably not so well purified as now. At any rate two men, a corporal and a foreman of the Royal Laboratory, were killed on 24th May, 1875, by an explosion which occurred during the compression of the blocks.

Colonel Sir HILARIO BARLOW said he was probably the largest user of guncotton in England, as they filled at the Royal Laboratory all the mines and torpedoes. Wet guncotton was a very innocent thing if it were pure, and there was not much to be apprehended from handling it, but the great difficulty was to arrange to keep it wet. Owing to the circular section of torpedoes it was necessary to shape the oblong slabs of guncotton used for filling in order to fit them in, and the slabs had to be cut up with hand saws, and of course there was a great deal of fluff or moist dust produced, and it was not an easy matter to keep the floors on to which this dust fell from getting dry. They endeavoured to keep them constantly moist, but everybody knew what workmen were, and how difficult it was to make them look after themselves. Amongst other things they tried a floor sloping from the centre to the sides with a perforated water pipe running down the middle, so as to get the flow in each direction, but it did not answer, because such an enormous flow of water from one pipe was necessary to keep a large

building wet all over, while a multiplication of pipes made many undesirable excrescences on the floor. Ultimately they had to revert to the humble watering can, which was very excellent if the men would use it. With regard to filling mines and torpedoes, there was always a hankering after using enormous blocks of guncotton, which looked at first sight an admirable system, but it was not as good as it looked. He made no criticism on the methods employed by one company he knew of who made the most admirable solid guncotton he had ever seen, so solid that a block of it over 400 lbs. in weight had to be put on the floor and cut with a cross-cut saw like a tree, in order to get blocks of it cut up for certain tests of the distribution of moisture. It was in connection with the distribution of moisture in wet guncotton that these large blocks were so inconvenient. With explosives nothing could be taken for granted; you had to find what the moisture really was, and therefore if a large block were being tested as a complete charge a piece had to be taken from the inside as one would from a cheese, and they had to invent a tool for taking these tests. It was a difficult problem, because one could not allow the water to run on the tool, as it would at once destroy the moisture test; therefore they had to have a tool with a water casing round it, and to bore in to a depth of something like 14 inches to take out the sample column and test the moisture therein. Further as to repairs. When the torpedoes were filled with a few large specially shaped blocks, the blocks retained as spare for the carrying out of repairs were only of use for the one purpose, whereas if the charges were built up of slabs like bricks of about 2 lbs. weight each, and such slabs were used for all purposes, the keeping of spare slabs for repair purposes was a simple matter. At the same time, better density was obviously obtained by filling with a few blocks rather than with a lot of small bricks.

Mr. WALTER F. REID said the author rather excused himself for not referring to the chemistry of the nitration of cellulose, but in his opinion those with most experience of the subject attached least importance to the many different views put forward on nitration, and the products derived from the operation. He thought also there was some little misunderstanding with regard to his concluding remarks about the position of the chemist. There was really very little difference between the analytical operations in the laboratory and the operations carried out in such a factory. The author had very fully utilised the services of the chemists at his disposal, being himself an excellent chemist, and when he listened to the method by which these acids were first mixed in bulk, then analysed, and then again brought up to the right strength, it occurred to him that many who for years had simply been mixing their acid by volume according to analysis had not sufficiently utilised the services of the chemist. Research work, on which the importance of all factory operations so intimately depended, had not been omitted; as was clear not only from the elaboration of this method of nitrating cotton, but also from the method of making nitroglycerin, which was described in a recent paper. The mechanical preparation of cotton still appeared to him to be somewhat crude. He would not say that this was not the best method at present on a large scale; but there still seemed something wanting in the way of a fine subdivision of the material both before and after it came in contact with the acid. He thought there was an opening also for an improvement of the process of weighing. The English climate was not always dry; there were times, as had recently happened, when the atmosphere was fully saturated with moisture, and unless special precautions were taken in exposing this finely divided, very dry cotton, it would absorb a considerable and variable quantity of moisture. This was a very difficult problem, and still awaited solution. With regard to the yield obtained, and the very large output per man in the factory, in spite of all displacement of labour, he thought labour of that kind ought to be displaced wherever it could, because the men worked under great sanitary disadvantages, and if they could in any way supplant human labour of this kind by appliances it was good for humanity. With regard to the materials used, he did

not think they had by any means reached finality, and there might be many possibilities ahead. Curiously enough, the material used was most unsuitable from its mechanical shape: the cotton fibre was a capillary tube, and unless that tube was absolutely destroyed, one could not prevent the strong capillary action with which it would retain all liquids. Until the structure was destroyed one could not be absolutely sure that the guncotton was perfectly pure. He had tried some small experiments in that direction: instead of the machine adapted from the paper industry, he had tried fine grinding, and it was quite possible on a large scale to absolutely reduce the fibres to a powder. Then the subsequent purification would be simpler, and probably the cost would be reduced. Many years ago he had tried a number of fibres which were not tubular, one of which, kapok, had been already mentioned. He thought Sir Frederic Nathan found it was a very greasy material, and he did not get a good yield from it. Incidentally, the sample of kapok, of which he had obtained a considerable quantity, had been finally utilised for another purpose. It repelled water so effectually that it had been used as a material for lining the inside of the cars of the balloons that took part in the long distance race for the Gordon-Bennett Cup. It had since been used by balloonists for lifebelts. In one explosive industry, at any rate, that of Schultze powder, one of the first smokeless powders made for sporting purposes, the cellulose from wood had been used. It was quite possible that with higher purification of wood fibre and reducing it more to the terms of cellulose, it might ultimately become a substitute for cotton in this industry. It must be remembered that they were in rather an awkward position in the explosives industry being dependent both for nitric acid and cotton on other countries; so that if the supply of either or both should be cut off they would not be able to make cordite or the other nitrated material. It would therefore be an advantage if they could find some substitute for cotton, which could be used for making nitrocellulose.

Mr. OSCAR GUTTMANN said the figures by the Abel process were given as 13.75 to 1.25 of cotton waste or 1 in 10, which was the quantity remaining in the pots after dipping and squeezing out the acid on the grid at the back, but the nitration took place in 220 parts of acid. The nitration lasted 5 minutes, but the after nitration in the pots 24 hours. The nitration was probably finished as to over 90 per cent. within the first 5 minutes, and only the last 10 per cent. were finished in the next 24 hours by the acid absorbed by the cotton. The reason so large a quantity was required was that the cotton itself was so absorbent that it could not be dipped unless there had a large excess. There were also some figures raising with respect to the output per man in the nitrating centrifugal machines; he believed it was about the same as by the Ardeer process. While it was quite true that the output per man was very much larger in the case of the displacement process, they ought to consider that by the nitrating centrifugal at least six operations can be made in a day, whilst according to the description given in the *Zeitschrift für das gesammte Schiess- und Sprengstoffwesen* in 1905, which was still true, it took at Waltham Abbey 7 to 8 hours to finish a charge. Still, this was only a feeble criticism on what was otherwise an excellent process, carried out in the absence of fumes and inconvenience to the workmen, and giving excellent guncotton such as required at Waltham Abbey. They had, however, heard from the author that it probably would not be quite as useful for other kinds of guncotton: at any rate, it would have to be tried, and he thought these trials were wanting. He could not be expected to go fully into this process, nor into the whole question of the manufacture of guncotton, since about a month ago he had done this in another place. Mr. Reid suggested that wood fibres when better purified might be useful for the production of explosives, but trials had shown that, for the reasons Mr. Reid had given, they could not get the same good result from it as from cotton. He asked the author to what he attributed the yield of 170 as against 159 and 160 of other processes. They knew that he was not a friend of the nitrating centrifugal

machine, but he saw no reason from a mechanical and manufacturing point of view why the yield should be 6 per cent. better in one case than in the other. His impression was, that at Waltham Abbey they took much greater care in selecting and preparing the materials and in the manufacture, and that this was entirely responsible for the increase. Finally, as one who had seen more than half the guncotton factories in Europe, he would say that small laboratory experiments with explosives were not directly transferable to the factory, and that in this sense Sir Frederic was quite right. He was however the last man to deprecate the work of the laboratory, because it always showed the way, and two of the most brilliant examples were the investigations of Professors Lunge and Will, who by their work had suggested a very large number of improvements. A laboratory experiment might be made on 5 grms. or on 5 lb.; and manufacturers nowadays make the latter, because experiments on large charges were absolutely and directly transferable to manufacture.

Sir FREDERIC NATHAN said the question raised by the Chairman with regard to laboratory and manufacturing experiments had been very ably answered by Mr. Guttman. He had stated in his paper that all experimental work should be based on sound chemical principles; that implied that the laboratory initiated experiments, but that the experiments themselves must be conducted on the manufacturing scale. In writing as he had done, he had in his mind an immense amount of very valuable literature on the subject of guncotton, but it had been his experience that following the method described, resulted in failure to produce on the manufacturing scale anything like the bodies obtained by those very able chemists who had worked on the laboratory scale. As regards cotton waste substitutes he had tried unsuccessfully a large number of other materials besides those he had mentioned. By the time the percentage of resistant cellulose, suitable for nitration, had been got, a vast amount of time, labour, and material had been expended for a very small result. With regard to the "teasing" system, he had described it simply as it existed; other methods had been tried, e.g., reducing the cotton waste to the condition of cotton wool, but there was nothing at all gained; on the contrary, considerable extra expense was incurred with no corresponding advantage. The method of weighing the cotton waste appeared perhaps rather crude, but when dealing with very large quantities, and a difference of $\frac{1}{2}$ per cent. of moisture one way or the other was not a very serious matter, it affected the percentage of soluble mainly, in view of the fact that in the later guncotton processes there was a considerable blending, which was moreover carried right through the operations of converting the guncotton into cordite. He entirely agreed with the views expressed by Mr. Reid with regard to the purification of nitrocellulose; it was no doubt the one operation in the manufacture which they knew less about than they would like to. Experiments on this point are being constantly made with the hope that it would not only be possible to shorten the boiling process but at the same time be able to produce a much better guncotton than was being produced even at the present time. He agreed with Mr. Reid that destroying the fibrous structure of guncotton prior to purification and boiling would probably be a material step in advance. It had occurred to him and to others, and he believed a patent had recently been taken out for that purpose. With regard to the low yield from the nitrating centrifugal, he was unable to afford any explanation. Some of the reasons why a better yield was obtained with the displacement process was that there was no loss due to fuming off, either in pots or centrifugals, or in the mechanical operations of immersing, water-centrifugally, acid-centrifugally, etc., but mainly that a more complete conversion of the cellulose into nitrocellulose took place in this process.

Manchester Section.

Meeting held at Manchester on Friday, January 8th, 1909.

MR. R. H. CLAXTON IN THE CHAIR.

THE RELATION BETWEEN THE ABSORPTION OF MOISTURE AND OF DYESTUFFS BY TEXTILE FIBRES.

BY SYDNEY H. HIGGINS, M.Sc.

While engaged in an investigation dealing with the dyeing and bleaching of textile fibres and with the mercerising of the cotton fibre, certain observations were made which pointed to a connection between the amount of dyestuff the textile fibres were capable of absorbing from solution and the amount of moisture which those fibres attract from the air; the affinity for dyestuffs seemed to correspond directly to the moisture contents. It therefore seemed of interest to determine the amounts of moisture in different fibres under ordinary atmospheric conditions, and to compare the results obtained with the quantities of dyestuffs which these fibres are capable of absorbing from solution. In addition to textile fibres, inorganic absorbents, *e.g.*, China clay, were used. No conclusions, however, could be drawn from the figures obtained when solutions of Night Blue, magenta, Diamino Sky Blue and iodine were employed. Whilst, for instance, China clay which contained 0.68 per cent. of moisture absorbed 1.69 per cent. of Night Blue a sample of silica containing 13.56 per cent. of moisture only absorbed one-seventeenth part of the dyestuff taken up by the China clay. Cotton containing 5.85 per cent. of moisture absorbed 0.36 per cent. of Night Blue, whilst 8.82 per cent. of moisture and 2.36 per cent. of Night Blue were absorbed by silk. It was found that similar divergencies prevailed in all the other cases. Therefore it was decided that, considering how the absorptions of dyestuffs and of moisture by textile fibres are influenced by the conditions under which the absorptions are conducted, proper conclusions could only be drawn when the conditions of absorption were identical in all the experiments; so that as far as possible, the same absorbing material in different physical forms was used in each series of experiments.

Hübner having shown that iodine and dyestuffs are absorbed in a somewhat similar manner by textile fibres, solutions of iodine in potassium iodide were used in some cases. It was whilst engaged in the work mentioned that many of the results here recorded were obtained, and for this reason some of the figures given in the papers (Chem. Soc. Trans., 1907, 91 and 92, 1057—1073, and this J., 1907, 26, 105—112) will have to be quoted.

TABLE I.

Time of absorption in hours.	Grms. dyestuff absorbed by 100 grms. dry material.				
	Fibre length	3.12 m.m.	2.2 m.m.	0.7 m.m.	0.4 m.m.
	29 m.m.				
1	0.1525	0.1755	0.191	0.2295	0.245
6	0.188	0.191	0.2065	0.231	0.2605
18	0.2065	0.214	0.2215	0.235	0.2605
72	0.2065	0.2065	0.2605	0.2605	0.2605
	Grms. moisture absorbed by 100 grs. dry material.				
1	1.49	2.01	1.60	1.36	1.30
18	6.23	6.44	6.16	5.79	5.75
44	6.84	6.72	6.64	6.64	6.68
109	9.34	9.24	9.28	9.18	9.10
127	9.34	9.24	9.25	9.18	9.10

In Table I. the comparison between the rate of absorption of Night Blue by wool in various states of division and of moisture from the air by the dried out samples of wool will be seen. It will be noticed that after 72 hours

the amounts of dyestuff and moisture absorbed by all the samples is practically a constant. It is also shown that both the maximum absorptions of moisture and of dyestuff are obtained during 72 hours. Whilst the figures obtained for the absorption of dyestuff show a certain regularity, it will be noticed that this is not the case with the figures obtained for the absorption of moisture. This is, without doubt, due to the difficulty of conducting the moisture absorption experiments in such a manner that absorption takes place uniformly throughout the samples. It would be necessary to find a means of keeping the fibres uniformly in contact with the air.

Samples of cotton yarn were mercerised, with and without tension, and parts of these, together with a sample of the original yarn, were bleached. Weighed samples were then allowed to absorb iodine from potassium iodide solution, and at the same time their moisture contents were found after being exposed to the atmosphere for about a week. (Hübner, *loc. cit.*)

TABLE II.

Sample of cotton.	A Iodine absorbed by 100 grms. dry material.	B Moisture absorbed by 100 grms. dry material.	B A
Ordinary unbleached ...	0.3	6.52	21.73
" bleached ...	0.2496	6.25	21.59
Mercerised without tension unbleached	0.4622	9.33	20.19
Mercerised without tension bleached	0.4216	9.12	21.63
Mercerised with tension unbleached	0.4136	8.25	19.88
Mercerised with tension bleached	0.3556	8.05	22.63

Although there is a big variation in the figures in Columns 1 and 2, it will be noticed that those in the third column are practically constant. The absorption of iodine and of moisture by cotton is, therefore, of a similar character. The bleached yarn absorbs less iodine and also less moisture than the unbleached yarn in all cases.

In a further experiment cotton yarn was well boiled out and mercerised without tension with caustic soda of different concentrations. The samples were then washed, soured, washed, dried at about 60° C., and after this exposed to the air for a considerable time. The amounts of moisture were determined by weighing before and after drying for 8 hours at 100° C.

Moisture per cent.

Ordinary cotton	6.2
Mercerised with caustic soda 10° Tw.	6.37
" " " 20° Tw.	6.68
" " " 30° Tw.	8.40
" " " 40° Tw.	9.41
" " " 50° Tw.	9.43
" " " 60° Tw.	9.57
" " " 70° Tw.	9.69

These results if plotted along with the dye trial and shrinkage curves given by Hübner and Pope (this J., 1904, 23, 407), show a remarkable similarity between the dyeing and moisture curves, in that a big jump between 20° Tw. and 30° Tw. will be found, whilst the absorption is practically constant between 40° Tw. and 50° Tw., afterwards slightly increasing to 70° Tw.

Oxley (J. Soc. Dyers and Col., 1906) has stated that mercerised cotton does not dye to as full a shade after drying as when dyed after mercerising but before drying. It has been found that ordinary cotton behaves in a similar manner. It is also known that cotton cloth, which has been thoroughly dried, even after a long exposure to the atmosphere will not absorb the amount of moisture it originally contained in the air-dry state. I have conducted experiments on the large scale which fully bear out this statement. These observations go

further to prove that the drying of cotton hinders the absorption of dyestuff and of moisture.

It is interesting to note that the absorption of moisture by the cotton fibre is also influenced largely by the materials employed in the finishing processes. From Table III. it is seen that dextrin, unlike starch, has little effect in hindering the natural absorption of moisture by the cotton fibre.

TABLE III.

Sample of cotton.	Finishing material.	Moisture per cent. in unfinished piece.	Moisture per cent. in finished piece.
1	5.4% white dextrin	7.06	7.01
2	3.8%	7.13	7.2
3	3.0% soluble starch	8.0	6.2

The observations recorded above point to an analogy between the absorption by textile fibres of moisture from the air (*i.e.*, a vapour from a gaseous medium) and of dyestuffs from solution (*i.e.*, solids from a liquid medium).

DISCUSSION.

Mr. JULIUS HÜBNER said that he quite appreciated the difficulties mentioned with regard to the moisture absorption tests. It would be quite possible, nevertheless, to devise a method by means of which the cotton and the wool fibres could be disintegrated in such a manner that the mass could be kept uniformly in contact with the air during exposure. In quoting the remarks made by Mr. Oxley and by Dr. Knecht as to the absorption of colours by mercerised cotton which has been dried previous to the dyeing, he presumed that Mr. Higgins referred to similar experiments which the speaker carried out during September, 1907, and which fully bore out the observations made by Mr. Oxley. He had also observed, at the same time, that ordinary cotton behaved in a somewhat similar way; the difference in shade was, however, not as pronounced as when cotton treated with mercerising agents was used. The fact that ordinary cotton when dried after boiling and bleaching absorbed less colour than when it was dyed without previous drying had probably been observed by many dyers.

Mr. G. LAKE said that the author seemed to have exposed the cloth to the ordinary atmospheric moisture of the room. He himself had made many experiments on this subject, and did not agree with the statement that yarn or cloth would not take up their original amount of moisture again after being heated to 100° C.

Mr. WHITESIDE asked if the author had tried colour absorption experiments, comparing cotton pieces, which had been conditioned for some time, with pieces fresh from the loom. It was well known that it was difficult to obtain identical results in dyeing the two kinds of cloth.

Mr. CROWTHER asked Mr. Higgins what process he employed for the estimation of moisture in the fibres. He had conducted a series of experiments on the absorption of colour by mercerised cotton which he was sorry to say were never finished. He noticed, as Mr. Higgins had stated, that mercerised cotton lost moisture the longer it was allowed to remain in a dry atmosphere, and that this loss was proportionate, as far as he could tell, to the diminution in the affinity for colour. He was unable to obtain a point of equilibrium with regard to the substantive cotton colours. It appeared that the phenomena of mercerisation were in no sense permanent under ordinary atmospheric conditions.

Mr. ARDERN said that assuming the effect of mercerising as to increase the surface of the cotton, he would suggest that this might to some extent account for the increased finity for water.

Mr. HOSEASON said, that in the mercerisation of cotton, there was, apparently, a possibility of dissolving or changing minutely occurring colour selective bodies, resembling the staining of certain animal and vegetable

cells which, as was well known, absorbed some colours selectively. Had any experiments been conducted conclusively, say, with fibre freed as far as possible, by chemical means, of these possible selective substances?

Mr. HIGGINS, in reply, stated that if the heating of cotton to 100° C. had an effect on the affinity for dyestuffs then the heating to a lower temperature of say 80° or even less should have some effect. With regard to the surface of mercerised cotton, he was inclined to agree with Mr. Ardern, namely, that an increased surface was exposed. As to the effect of mercerisation dissolving out some constituents of the cotton, he considered that it was acknowledged that this was not the case. The gradual loss of moisture by mercerised cotton in the air was very interesting. The moisture determinations were made in each case by heating the cotton yarn for eight hours at 100°. In reply to Mr. Lake, he stated that the pieces were exposed for three weeks, and weighed repeatedly during that time. Though the moisture in the air during the three weeks would vary considerably, the pieces never came back to the original weight. He fully agreed with Mr. Hübner that it was desirable that the matter should be investigated more fully.

A VOLUMETRIC METHOD FOR THE ESTIMATION OF TITANIUM AND OF TITANIUM AND IRON IN THE PRESENCE OF EACH OTHER.

(A communication from the Chemical Department of the Municipal School of Technology, Manchester.)

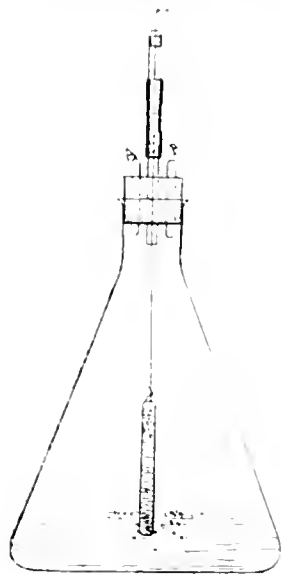
BY EVA HIBBERT, A.M.S.T.

In the Journal of the American Chemical Society (1895, p. 878), Wells and Mitchell describe a process which is really an improved modification of Pisan's method for the estimation of titanium, and which depends upon the oxidation of a titanous salt by means of potassium permanganate. By this method both iron and titanium are estimated together, and it is necessary to apply special means to determine the iron; the titanium being found by difference. The process described by these authors involves the use of sulphuretted hydrogen for the reduction of the iron, and the method is rather a long one.

It was shown by Knecht and Hibbert (*Ber.*, 36, 1549) that by reducing a titanous salt with zinc and hydrochloric acid in a flask fitted with a Bunsen valve, the titanium could be estimated directly by titration with a standard solution of ferric iron, using potassium sulphocyanide as indicator.* In the same paper the authors also showed that it was possible to estimate iron in the ferric condition by means of titanous chloride, and the method, while giving accurate results, renders possible the volumetric estimation of ferric iron in a much shorter time than by the reduction of iron to the ferrous condition and subsequent oxidation with permanganate.

In the *Chemiker Zeit.*, 1907, p. 639, Prof. Knecht drew attention to an extremely delicate test for titanium, which was based on the reducing action of titanous chloride on methylene blue, and by means of which the metal could be detected in amounts even less than 0.00001 grm. The method, which is described below, is based on this observation. The titanium must be in the reduced condition, that is, in the form of a titanous salt. In order to secure this, the solution of the titanous salt is introduced along with some hydrochloric acid, into a flask fitted with a rubber stopper having three holes; one of these is fitted with a Bunsen valve, through which a platinum wire having a piece of zinc attached to it is passed, and the other two holes are temporarily closed with two glass rods (see sketch). In this way the zinc is suspended in the

* In a paper read before the Soc. chimica di Roma in Feb., 1907, G. Gallo takes credit for the use of the identical reaction for the volumetric estimation of titanium, but it is clear that the method was anticipated four years previously.



titanium solution, and when the reduction has proceeded for 15 to 20 minutes and the solution has been boiled, one of the glass rods, A, is removed, and a stream of carbon dioxide is passed into the flask, through a tube inserted in its place. The zinc is removed from the solution by raising the platinum wire through the small pierced indiarubber stopper at C, and the other glass rod, B, is then removed also. After the zinc has been washed with a little freshly boiled water, passed from a wash bottle, the solution is titrated with standard methylene blue run into the opening at B from a burette. The methylene blue is standardised by titration with titanous chloride.* The titanium in the titanium potassium fluoride used in 1903 was estimated in this way, the original method with iron alum was repeated, and the estimation was also done gravimetrically. The results were as follows:—

Titanium by methylene blue.	By iron.	Gravimetric.
(1) 18.54%	18.56	18.47
(2) 18.46%	—	—
(3) 18.38%	—	—

Theoretically titanium=18.60% for $K_2TiF_6 \cdot H_2O$.

To prove beyond doubt that the interaction between titanous chloride and methylene blue is quantitative, the recrystallised methylene blue zinc double salt was titrated with titanous chloride, and gave 100.15 per cent. This was used for titrating the recrystallised potassium titanium oxalate, $TiO.C_2O_4.K_2C_2O_4$, dried at $100^\circ C$. This gave 14.76 per cent. of titanium (theoretical, 15.07 per cent.).

In order to show that the method employed for dissolving the titanium in an ore is satisfactory, that process was used in the case of the double oxalate. It consists in fusing the substance with about 10 parts of caustic potash in a nickel dish. The melt is allowed to cool, and is then treated with water, transferred to a beaker, and hydrochloric acid is added.

Titanium and iron.—Ferrous chloride will not reduce methylene blue, so that the method affords a means of estimating titanium in the presence of iron. The mode of procedure is exactly the same as if titanium is present alone, and the iron can be estimated in the ferric condition in a separate portion by titration with a standard solution of titanous chloride. In order to prove the possibility of estimating titanium in the presence of iron, mixtures

of known quantities of iron and titanium were prepared, and the titanium was estimated by the methylene blue method. When much iron is present, it is necessary to allow the zinc to react for at least 20 minutes in order to ensure the complete reduction of both iron and titanium.

Experiment.	Titanium found, grm.	Titanium taken, grm.	Iron taken, grm.
1	0.03089	0.03094	0.01469
2	0.03867	0.03868	0.03085
3	0.00778	0.00774	0.02938
4	0.00309	0.003094	0.04876
5	0.00158	0.001547	0.04976

The method is specially adapted for the estimation of titanium in minerals and steel. In using it for the latter purpose, however, it should be borne in mind that the salts of the lower oxides of vanadium and of tungsten also exercise a reducing action on methylene blue and on ferric salts.

ON THE VOLUMETRIC ESTIMATION OF COPPER AND CHROMIUM, AND OF COPPER, CHROMIUM, AND IRON IN ADMIXTURE.

BY EVA HIBBERT, A.M.S.T.

In a recent number of this Journal (1908, 673) S. B. Jatar describes a process for the volumetric estimation of iron and chromium in one solution. Since copper and chromium are frequently met with together in the ash of mordanted and dyed textile material, and in some cases even copper, chromium, and iron may be present, I have, at the suggestion of Prof. Knecht, worked out a process by means of which these three metals can be volumetrically determined in presence of each other. The estimations are based partly on Rhead's process of estimating copper, partly on Jatar's process for the estimation of chromium and iron, and partly on new data which I have obtained experimentally.

Copper and chromium.—For this estimation it is necessary to have the copper in the cupric condition, and the chromium as a salt of chromic acid. The amount of titanous chloride required to reduce both copper and chromium is first ascertained, and then alternative methods can be employed for determining one of the other constituents in a fresh portion of the solution.

The simplest way is to pass SO_2 through the solution, boil off the excess of sulphur dioxide, and titrate the copper with titanous chloride as described by Rhead (Journ. Chem. Soc., 1906, 1491). Another method, which is somewhat longer, is to estimate the chromium alone, by first removing the copper with sulphuretted hydrogen, and then oxidising the chromium to bichromate with hydrogen peroxide. The bichromate is estimated by titration with titanous chloride. In Jatar's paper two methods are given for the estimation of chromium. The indicator used in one of these methods consists of a mixture of ferrous sulphate and potassium sulphocyanide used on a spot plate, and in the other method (c), the indicator is practically ferric iron and potassium sulphocyanide in the solution of chromium titrated. I have found that when the latter method is used, *i.e.*, first titrating with excess of titanous chloride, and then estimating the excess of titanium with iron alum, using sulphocyanide as indicator, reliable results are obtained, and the process is more easily carried out than in using the spot plate reaction which is given the first place in his paper. This method was consequently adopted in working out the results detailed below.

Mixtures of known quantities of pure potassium bichromate and copper sulphate were prepared and titrated.

(1) Copper sulphate and potassium bichromate, titrated with excess of titanous chloride, and then titrated back with iron, using sulphocyanide as indicator, when the amount of titanium required corresponds to the copper and chromium present.

*Knecht. Soc. of Dyers and Colourists, 1905, p. 9.

(2) Titration of the copper with $TiCl_3$, after the reduction of the bichromate with sulphur dioxide.

(3) Removal of the copper by sulphuretted hydrogen, oxidation of the chromium to bichromate, and the estimation of the latter by titration with titanous chloride.

	grms. found.		grms. taken.
Potassium bichromate	0.04915 gr.	by	0.04907
Copper sulphate	0.19979 gr.	SO_2 process (2)	0.200
Potassium bichromate	0.02455	Do.	0.02453
Copper sulphate	0.09994		0.10000
Potassium bichromate	0.04906	by	0.04907
Copper sulphate	0.09965	method (3)	0.1000

If the copper and chromium are not present in the condition of cupric salt and bichromate, it is necessary to oxidise and dissolve them before titrating. In order to ascertain whether this was possible, a known amount of potassium bichromate was converted into chromium chloride by heating with strong hydrochloric acid, the chromium chloride was mixed with a known quantity of copper sulphate, and chromium and copper were then precipitated together by boiling with sodium carbonate. The mixture of hydrates of copper and chromium was filtered off, washed, dried, and heated to redness. The ash was then fused with bisulphate of potash and afterwards made up to a known volume. It was found impossible to oxidise the chromium with sodium peroxide in the presence of copper, so the method adopted was to first titrate the copper with titanous chloride in one part of the solution, and in another to remove the copper with sulphuretted hydrogen, oxidise the chromium in the filtrate with sodium peroxide, add ammonium chloride, boil, and then titrate the bichromate with titanous chloride.

A mixture of 0.2 grm. of copper sulphate and 0.04913 grm. of potassium bichromate was found in this way to contain 0.20048 grm. of copper sulphate, and 0.04880 grm. of potassium bichromate.

Copper, iron, and chromium.—To facilitate the estimation of copper, chromium, and iron in presence of each other it was found desirable to introduce new methods for the estimation of chromium and iron present together. The potassium bichromate and ferric iron are first titrated together, and the amount of titanous chloride required is afterwards used to reduce another portion of the mixture. Potassium chlorate and hydrochloric acid is then used to oxidise the iron present, which is then again titrated with titanous chloride. Another method of estimating chromium and iron together, which is also a rapid method, is to titrate both iron and chromium with titanous chloride, and then to titrate back the iron with permanganate in presence of sulphuric acid. The following estimations were carried out:—

Estimation.	By chlorate method.	By permanganate.	Actually present.
Iron	0.03413	0.03423	0.03409
Potassium bichromate	0.04911	0.04899	0.04907
Iron	0.01529	—	0.01536
Potassium bichromate	0.04928	—	0.04907
Iron	—	0.01234	0.01236
Potassium bichromate	—	0.027895	0.02789

It is obvious that in these estimations the titanous chloride used must be free from iron.

Estimation of copper, chromium, and iron.—By the following process it is possible to estimate the amount of copper, chromium, and iron in a mixture (containing potassium bichromate, copper sulphate, and ferric iron) by only three titrations:—

(1) The solution containing iron, chromium, and copper is titrated with titanous chloride until the colour of the bichromate is changed to green, when potassium sulphocyanide is added, and the titration continued until all the red colour of ferric sulphocyanide has disappeared. Sulphocyanide is not added at the beginning of the titration, because potassium bichromate acts upon ferric sulphocyanide with the formation of persulphocyanogen.

(2) A known volume of the mixture is treated with sulphuretted hydrogen, the precipitated copper is filtered

off, and the solution boiled to expel sulphuretted hydrogen. It is then treated with potassium chlorate and hydrochloric acid, and well boiled, water added, and again boiled two or three times, and it is afterwards cooled and titrated with titanous chloride, using potassium sulphocyanide as indicator.

(3) A known volume is treated with sulphur dioxide, the sulphur dioxide is boiled off and potassium chlorate and hydrochloric acid are added to the solution, which is then boiled, cooled, and titrated with titanous chloride.

The results of the three titrations give:—(1) Copper, chromium, and iron; (2) iron; (3) copper and iron.

Some of the results which have been obtained are given below.

Example 1.—1 c.c. of titanous chloride = 0.002066 grm. of iron = 0.001807 grm. of potassium bichromate = 0.009186 grm. of copper sulphate. The amounts of titanous chloride required in the titrations were:—

(1) 46.4 c.c. required by iron + copper + chromium.

(2) 8.3 c.c. required by iron.

(3) 19.2 c.c. required by iron + copper.

From these figures it will be seen that the copper present required 10.9 c.c., the chromium 27.2 c.c., and the iron 8.3 c.c. of titanous chloride.

Therefore the solution contained:—0.04915 grm. of potassium bichromate, 0.10015 grm. of copper sulphate, and 0.01715 grm. of iron. The amounts actually present were:—0.04907 grm. of bichromate; 0.1000 grm. of copper sulphate, and 0.01723 grm. of iron.

Other examples:—

	II.		III.	
	Found, grms.	Taken, grms.	Found, grms.	Taken, grms.
Potassium bichromate	0.04896	0.04907	0.02295	0.02304
Copper sulphate	0.1002	0.1000	0.07485	0.0750
Iron	0.04338	0.04318	0.03016	0.03015

Copper, chromium, and iron, in the form of the oxides, CuO , Cr_2O_3 , and Fe_2O_3 , were obtained in known quantities in admixture in the following way:—Potassium bichromate was treated with sulphur dioxide, the product was mixed with pure ferrous sulphate and copper sulphate, caustic soda was added to the boiling solution, and the precipitated hydrates were filtered off, washed, and dried. The dried precipitate was heated to redness, and the ash was then fused with potassium bisulphate. The melt was taken up with water, made up to a known volume, and portions were treated in the following way:—

(1) Titrated with titanous chloride, using sulphocyanide as indicator, to determine iron and copper.

(2) The copper was removed with sulphuretted hydrogen, and the iron, after oxidising with potassium chlorate, was determined in the filtrate by titanous chloride.

(3) The copper was removed with sulphuretted hydrogen, and the chromium and iron were oxidised with sodium peroxide, the excess of hydrogen peroxide was boiled off, hydrochloric acid was added, and the chromium and iron estimated.

The following results were obtained:—

	I.		II.	
	Found, grms.	Taken, grms.	Found, grms.	Taken, grms.
Potassium bichromate	0.04926	0.04913	0.04880	0.04913
Copper sulphate	0.39963	0.400	0.20048	0.2000
Iron	0.05232	0.05254	0.02632	0.02627

DISCUSSION.

Mr. H. L. TERRY said the volumetric estimation of copper by titanium salts was new to him. How did the titanium method compare in point of accuracy with the three processes in general use, *viz.*, the electrolytic, the iodide, and the cyanide methods? He meant more particularly with regard to ores and metallurgical products than on mixtures prepared in the laboratory. It was mentioned that in the analysis of iron, chromium, and

copper mixtures it was necessary to separate the copper, and that this was effected by sulphuretted hydrogen; it was much pleasanter to precipitate the copper with sodium thiosulphate. He always used this method in separating copper in the iodide or cyanide assay. With regard to the cyanide assay, which many chemists seemed to think could only yield approximate results, he might say that at some large copper mines in Norway it was the sole method employed for ores, mattes, and metal; at any rate this was the case on the occasion of his visit three or four years ago. If the assay was carried out on strictly defined lines it was capable of giving results of much greater accuracy than was generally supposed.

Mr. SHEPHERD said he had used the titanium method for the estimation of copper in the vats for the electroplating of iron rollers. There was often a fair amount of iron present, which it was not necessary to estimate; excess of ammonia was added to the amount taken, the ferric hydroxide filtered off and washed with dilute ammonia, the filtrate acidified, and the copper titrated in the usual way with titanous chloride.

Mr. S. B. JATON, referring to his paper published in the *Journal* of July 15th last, said that Miss Hibbert mentioned that the "c" method is preferable to the one described as "a" method; the method "a" was mentioned in connection with pure chromium salts, and not chromium and iron together. The indicator was very useful when titanous chloride was to be standardised against bichromate solutions. The "b" and "c" methods could only be used accurately when one was familiar with the delicate colour reactions involved, which required a certain amount of practice. The indicator, therefore, was a great help for one not familiar with the method.

Mr. HOSEASON asked if there was any objection to the use of hypochlorite instead of chlorate as an oxidising agent, since the former was more easy of manipulation.

Mr. LOMAX inquired if the method of estimation had been applied to the analysis of rutile.

Miss HIBBERT, in replying, said the reason why she had brought forward this method of estimating copper, chromium, and iron was, as explained in the paper, for the determination of these metals when they occur together in the ash of mordanted material. The use of hypochlorite for oxidising iron in the presence of chromium would appear to be very suitable, but she had used potassium chlorate and hydrochloric acid because they were more easily obtained in a high degree of purity. Estimations of titanium in rutile, ilmenite, and other minerals, by the methylene blue method, had been very successful. A sample of rutile, analysed by this method, was found to contain 91.0 per cent. of TiO_2 , and this agreed very closely with the iron method, but she had not yet confirmed the result gravimetrically. In reply to Mr. Shepherd, it seemed probable that when the iron was precipitated with ammonia, some copper was carried down also. Methods for the complete separation of these metals were suggested in the paper.

My subject involves the whole sampling process, whatever the nature of the commodity, substance, or conditions, and the making up of the ultimate sample for assay or analysis, regardless whether the material to be sampled is of such a nature that the separate portions drawn cannot be mixed, as for instance, wood pulp; or whether they can be mixed, as in the case of ores, coals, etc. R. W. Sindall, of London, has done considerable work on one important phase of this subject, namely, the determination of average errors. His methods consist in duplicate sampling and testing, and in this way checking the results or deducing the probable error and showing its commercial significance. So far as I know, this question under the title I have announced has never been dealt with. D. W. Brunton, in a paper, in Vol. 25 of the *Transactions of the American Institute of Mining Engineers*, entitled "The Theory and Practice of Ore Sampling," in reality enters into it when he says, "In proportion as a sample in preparation diminishes in weight by quartering, it must be re-crushed so that there shall be a constant ratio between the size of the sample and the largest particle." That is, the more nearly uniform or homogeneous any product or substance is, the smaller may be the quantity representing it. His problem is:—Given a quantity of ore composed of particles and pieces of irregular sizes, shapes, and composition, how must it be dealt with so as to arrive at a very small sample of a few grams, which shall represent in true proportion the mechanical condition and chemical composition of all the separate masses of the original pile? He says that the size of the sample in amount must always be in constant proportion with that of the largest particle. In other words—whatever the weight of the sample in preparation, the number of parts or particles must remain constant. In the practice of crushing and grinding there will always be a large proportion of particles smaller than the allowable largest, but this is incidental.

My subject deals largely with the probability and theory of errors. It is not my purpose to enter into all the mathematical refinements of this subject, even if I were able, since it is one dealing almost wholly with higher mathematics. I shall endeavour to pursue the subject only so far as it has a practical value for chemists and not for theoretical considerations.

I may divide the subject as follows:—1. A statement of the problem. 2. The law of errors. 3. The probability curve and the analysis of it. 4. A consideration of the mean value. 5. The relative accuracy obtained by drawing larger or smaller numbers of samples. 6. The determination of results within fixed limits. 7. The number of samples to be drawn.

The problem is not a determination of who is the best marksman from an examination of their shots at a target, neither is it a determination of what shots occupy a mean average distance from the bullseye. It is much simpler than a determination of this, the mean average distance from the bullseye of all the shots. This problem would involve a calculation in the area of the target, while the nature of ours limits the observation to points in a straight line, for instance, those lying on one diameter of the target. Nor is it the determination, which is true in a set of observations, as in determining the atomic weight of some element, or the estimation of the probable error from the truth in the mean of these observations.

Our proposition starts where the degree of truth in these ends, and is by nature susceptible of closer approximation. We assume that the mean of a large number of variations is the truth sought, and we want to discover how few of these observations we may select, the average of which shall not appreciably depart from the mean of the whole number. Let us suppose we have 500 separate packages of any commodity, as for instance, 500 rolls of sulphite pulp which have been run over a drying machine, generally a few points above and below the atmospherically dry limit, to determine the amount of moisture. If we draw a straight line and divide it into two equal parts we may represent the mean variation in moisture by a point at the centre, and from this point lay off in one direction distances representing the departures from the mean of each sample above, and in the other direction, lay off representative distances below the mean. Let

New England Section.

Meeting held at Boston on Friday, January 8, 1909.

MR. F. E. ATTEAUX IN THE CHAIR.

A MATHEMATICAL VIEW OF SAMPLING, WITH REFERENCE TO THE DEGREE OF ACCURACY TO BE OBTAINED.

BY MARTIN L. GRIFFIN.

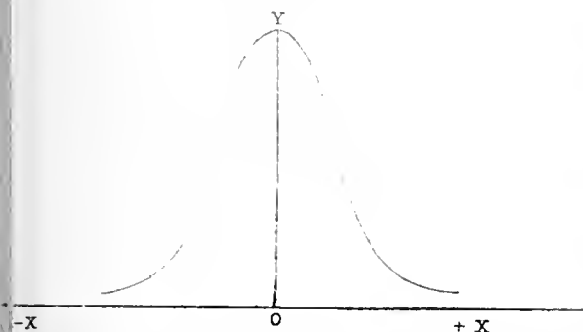
In a paper read before the New York Section of this Society, entitled, "Standard Methods of Sampling: A Review with some Suggestions,"* I referred to some ideas on sampling that I expected to give at an early date, but which have been delayed until this time.

* This *Journal*, 1905, 183.

us assume that we have tested these 500 rolls of pulp and find the results to be as follows:—

Positive departure.			Negative departure.		
Moisture between.	No. of rolls.	Per cent.	Moisture between.	No. of rolls.	Per cent.
4—5%	10	2	4—5%	10	2
3—4%	20	4	3—4%	20	4
2—3%	40	8	2—3%	40	8
1—2%	80	16	1—2%	80	16
0—1%	100	20	0—1%	100	20

Plotting as ordinates the number of rolls and the corresponding mean variation in moisture as abscissæ, we shall get the following curve:—



In doing so we shall observe: (a) That there are as many samples represented on one side of the origin as on the other. (b) That within equal distances from the origin on each side there is an equal number of samples represented. (c) That by far the greater number will arrange themselves very close to the origin. (d) That small errors are more frequent than large ones. (e) That the greater the variation the less the frequency, and hence very large variations do not occur.

Now any mathematical relation between a variation (X) and the probability of its occurrence (Y) must satisfy these characteristics. When such a function, $Y=f(x)$, is plotted as we have illustrated, it will have a maximum ordinate, OY, corresponding to the mean, that is, no error. It will be symmetrical with reference to this ordinate, the Y axis; and as X increases Y must decrease, until when X becomes very large, Y will become vanishingly small. This corresponds to the fifth observation above, namely, that very large variations from the mean cannot occur. As a matter of actual manufacturing operations they scarcely exist. For example, a manufacturer desires to dry his pulp so as to get the allowable limit of atmospheric moisture as nearly as possible. Obviously it will be his desire to do this, because he does not want to pay freight on water, or if he must he will use wet presses without any attempt to reach this degree of dryness. If any quantity falls below his standard they will be included in the average. If he were punctilious in his orders to his superintendent about uniform conditions of moisture it would mean that if any mishap occurred in drying, resulting in a very few very wet rolls, they would be thrown out, or if the workmen were careless and they were included it could not affect the result because the number (y) was so small.

$$Y = Ke^{-h^2x^2}$$

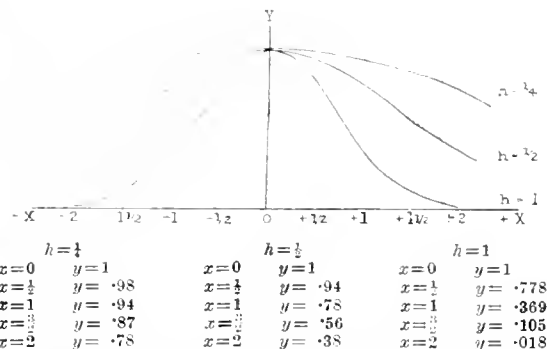
is the equation which represents this probability curve or curve of variation of any particular roll or average or any given number of rolls from the mean of the whole number. To find the meaning of the constant K, let us solve the equation by putting $X=0$, then $Y=K$, which is the maximum ordinate of the curve. K corresponds to the number of those rolls whose content in moisture coincides with the mean itself. The height at which the curve cuts the Y axis represents the magnitude of the arithmetical mean; K has nothing to do with the actual shape of the curve beyond increasing the length

of the maximum ordinate. It must be borne in mind that it is not the maximum ordinate for any value of X, and only coincides with it when $X=0$. It follows, then, that as K has nothing to do with the curve, the sampling of any of the K rolls has no influence in fixing the result and we may disregard them. Therefore, when $X=0$ and $Y=K$ the whole number of rolls are alike, i.e., any one of them represents the average. Hence the drawing of one sample only will suffice.

The meaning of h is found by making $K=1$ and plotting corresponding values of X and Y. For

$X = \pm \frac{1}{2}, \pm 1, \pm \frac{3}{2}, \pm 2, \dots$, when $h=1, \frac{1}{2}, \frac{1}{4}, \dots$ etc.

$$y = Ke^{-h^2x^2} \quad K=1.$$



In this way it will be observed that though all the curves cut the Y axis at the same point, the greater the value of h , the steeper will be the curve in the neighbourhood of the ordinate OY.

The physical significance of this is, that the greater the magnitude of h , the more accurate the results, and the less will be the magnitude of the deviation of individual samples from the arithmetical mean of the whole number. h relates to the number of rolls of pulp approaching in variation the mean; if it is very large, there is very little variation from the mean in the content of moisture; the condition of the rolls is practically the same, and hence very close to the mean average. In sampling the h rolls, where h is large, the possibility of error is greatly reduced, and when we know h is large the necessity for taking a fixed number of samples to keep within an allowable limit of error is much less. Mathematically h has been called "the absolute measure of precision."

At this point some observations regarding the expression "mean average" value should be made. We, as chemists, draw samples from irregular masses and piles of commodities, as coal, limestone, ores, or packages of different sizes and weights, and quite frequently they do not bear a fixed ratio to the mass or weight they represent, yet we grind or mix and average them arithmetically. In so doing we introduce a probable error by the manner of taking the samples. In order that the arithmetical mean may be free from all error, we must draw equal weights from equal quantities by weight. For instance, in the sampling of bales or bundles of wood pulp for moisture, if the determination is to be made from the aggregate weight of the separate samples, they should bear a constant ratio to the weight of the respective packages from which they have been drawn. Referring to our illustration of 500 rolls of moist pulp, we have proceeded on the assumption that each roll of pulp was of equal weight and that the sample represented the condition of the rolls, and that equal weight samples had been drawn. Under these conditions the arithmetical average of the samples would give correct results. In other words our samples might all be weighed together in one weighing. The general statement for this is:—The best value to represent a number of observations of equal weight is their arithmetical mean; while the best value of different weights is obtained by multiplying each observation by its weight and dividing the sum of the products by the sum of their different weights.

It has been demonstrated that the probable error of the arithmetical mean of a series of observations is

inversely as the square root of their number. From which we see how easy it is to over-estimate the effect of largely increasing the number of observations or samples. If E denotes the probable error of the mean of ten samples, in order to reduce this error one-half, or one-half E , we must draw forty samples, and to obtain one-third E we would have to draw ninety samples. The converse of this is that the probable error is increased directly as the square root of the number of observations is diminished, that is the reduction by one-fourth in the number of samples taken doubles the error.

I have made use of this illustration in which it appears that each roll of pulp has been tested, for the purpose of analysing the problem mathematically, and drawing the resulting conclusions. It is, of course, an ideal illustration, and the results of such a sampling and testing, if it were possible, would be free from error.

The fundamental preliminary to sampling a mass of any commodity which may be mixed and quartered down is that it shall be mixed and crushed and quartered down successively mechanically in the abstract, and that the weight of each successive quarter shall bear a direct relation to the size of the mesh of a corresponding screen, and that it shall all pass through this screen. A set of standard screens corresponding to a set of weights diminishing proportionally in the quartering process would be very valuable to chemists. In sampling commodities which cannot be mixed, the theoretical fundamental conception is that in the process by which they have been produced there is a certain cycle of varying conditions which repeat themselves. This is inevitably so. The cycle may be large and the frequency small, and if so the sampling must be extensive. If the cycle

is small and the frequency large the sampling may be trifling. But all of this is included in the main argument of this paper.

From the discussion of the subject thus far we see that the number of samples within certain limits to be drawn does not play as important a part as is generally supposed, however, its importance is greatly dependent upon the representative value of each sample. This, of course, pertains to the sampling. The sampler must be free from all bias and personal errors in his work, or there will be an added error. My paper, therefore, becomes an argument also for greater knowledge of the product to be sampled, how it has been produced, etc., and greater care and diligence in the mode of sampling. The commercial value of the products sampled will also play a very important part in determining what the allowable limit of error should be, and this will affect the number of samples and the mode of sampling.

We may therefore conclude that if a chemist is conversant with the history of the product which he is about to sample and knows how to draw proper samples, the number may be very limited, perhaps ten and not more than 20 or 25. If he lacks the knowledge and ability to do this part of the work, the drawing of almost any number of samples will not be trustworthy.

New York Section.

At a meeting of the Section on Nov. 20th, 1908, held at the Chemists' Club, Mr. Frederick Klein read a paper on "Selenium."

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

English.—8s. each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Separating subdivided solid matter from a liquid, particularly applicable for thickening ore pulp and for feeding or measuring the pulp or solid. E. E. and A. S. Elmore. London. Eng. Pat. 26,821, Dec. 4, 1907.

THE mud or pulp to be separated is fed into a conical vessel known as a "spitzkasten" and the separation takes place in the known manner. The invention relates to the provision of a chamber at the apex of the cone through which the separated solids are discharged. This chamber has an upper valve opening upwards and a lower valve opening downwards, and forms a kind of lock for the passage of the solids. The valves are operated alternately by concentric rods which pass up through the vessel and are actuated by mechanism situated on the cover. In order to sweep the solids into the apex of the cone, slowly rotating rakes are arranged within the tank, supported by a frame having wheels which run on a track situated, in order to avoid clogging by deposited solids, in the overflow gutter which extends round the upper edge of the tank.—W. H. C.

Evaporating or concentrating apparatus. J. and C. McNeil, Govan. Eng. Pat. 5069, March 6, 1908.

THE claim is for improvements in the apparatus described in Eng. Pat. 8763 of 1900 (this J. 1901, 160). The chamber or box forming the steam space has the top and bottom plates dished upwards parallel to each other. The upper plate is of greater diameter than the lower one,

so that the chamber has the shape of an inverted truncated cone. The tubes are set at right angles to the plates, and are consequently inclined to the vertical, but parallel to the side of the steam chamber. A circulating space is left between the chamber wall and the wall of the evaporator, and the liquid is introduced by a perforated ring fixed either centrally over the tube chamber or above the circulating space.—W. H. C.

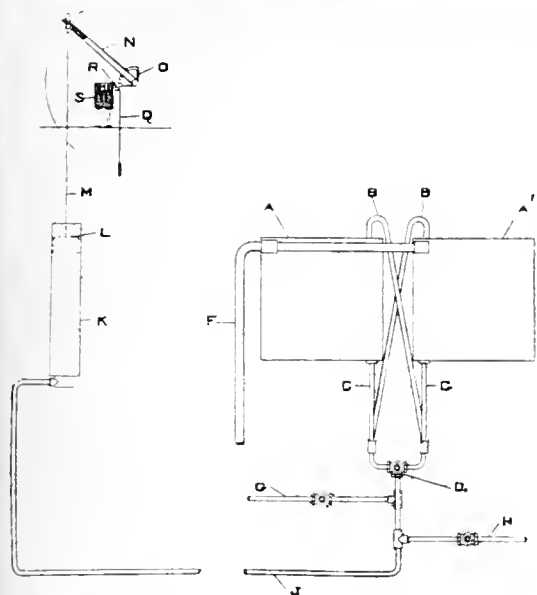
Mixing and pulverising apparatus for liquids. A. Martin. Paris. Eng. Pat. 6552, March 21, 1908.

THE liquid to be pulverised is pumped by a set of three pumps driven from the same shaft by cranks set at an angle of 120° to one another, so that one pump is always working into a pressure chamber. From this chamber the liquid is allowed to escape under strong pressure controlled by a piston, actuated by a spring, into a system of narrow passages. The thin streams of liquid are broken up and mixed again in these passages and finally discharged from two opposite nozzles, whereby the liquid is atomised.

—W. H. C.

Recording the quantity of water or other liquid evaporated in a boiler or the like. J. Stratton and E. A. Claremont, Manchester. Eng. Pat. 10,588, May 15, 1908.

Two calibrated tanks, A, A', of equal capacity, and provided with an overflow, F, are fixed side by side at the same level. They are alternately filled with the liquid to be measured by the pipes, B, B', which are connected by a three-way tap, behind the tap, D, shown in the figure, to the supply main, G. They are alternately emptied by the pipes, C, C', connected by the three-way



tap, D, to the delivery pipe, H. The two taps are so coupled together that when one tank is being filled the other is being emptied, and *vice versa*. The delivery pipe, H, is connected by a branch, J, with a float tank, K, and the float, L, is connected by a rod, M, with the lever, N, and the quadrant, O, from which a rod, Q, depends and carries a pen, R, which records the movement of the float on the chart carried by the clockwork drum, S. The tank, A', being filled with liquid, the taps, D, are reversed, and A is filled and A' emptied. As soon as the taps are turned, the float-tank, K, is in connection with the tank, A', and the liquid rises in K, to the same level as in A'; the float also rises and an upward vertical line is drawn on the chart. As the level of liquid falls in A', it also falls in K, and the float falls also, the rate of fall being proportional to the rate at which liquid is withdrawn from A', and an inclined downward line is marked on the chart. When A' is empty, the taps, D, are reversed again and the process repeated. The quantity of liquid used is calculated from the record on the chart, S.—W. H. C.

Filtering apparatus. A. J. Arbuckle and A. Osborne, Johannesburg, Transvaal. Eng. Pat. 21,452, Oct. 10, 1908.

THE apparatus is similar to that described in Eng. Pat. 20,400 of 1908 (this J., 1909, 130), except that the filters consist of frames suspended from the periphery of a rotating frame. As the filters are lowered into the tank containing the pulp to be filtered, the suction valves are automatically opened, the clear liquid is drawn through and the solids left on the surface of the filter. The suction valves are closed shortly after the filters emerge from the pulp tank, and the deposits are drained by the suction. As the frame revolves, the suspended filters come in contact with a guide plate which tilts them at an angle, and at the same time the back pressure valve is opened and compressed air is admitted behind the filter surface, which causes the deposit to peel off and to fall on to a shoot. Another guide plate then engages with a roller at the end of the filter, and allows the latter to gently resume the horizontal position before re-entering the pulp tank.

—W. H. C.

Drying apparatus. J. E. Kohn, Bay City, and J. B. Roos, Owosso, Mich. U.S. Pat. 910,671, Jan. 19, 1909.

THE claim is for an inclined rotary drying cylinder mounted within a chamber provided with a fan to create a draught to remove the moisture-laden drying medium. The material to be dried is fed into the open upper end of the inclined cylinder and is discharged through openings near the lower end, which is closed by a tube-plate. From

the latter a number of tubes project longitudinally through the cylinder. The heating medium is caused to pass through the tubes and through the cylinder.—W. H. C.

Crystals; Manufacture of large ——. J. Bock, Radebeul, Germany. U.S. Pat. 910,490, Jan. 26, 1909.

SEE Fr. Pat. 374,968 of 1907; this J., 1907, 872.—T. F. B.

Digesters. T. J. Hutchinson, Fr. Pat. 394,208, Sept. 11, 1908. Under Int. Conv., Sept. 11, 1907.

SEE Eng. Pat. 20,266 of 1907; this J., 1909, 105.—T. F. B.

Drying apparatus; Centrifugal ——. actuated by fluid pressure. J. W. and W. A. Macfarlane, Fr. Pat. 394,440, Sept. 4, 1908. Under Int. Conv., Sept. 10, 1907.

SEE Eng. Pat. 20,177 of 1907; this J., 1908, 1007.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Coals; Action of air and of oxidising agents on ——. O. Boudouard, Compt. rend., 1909, 148, 284—286.

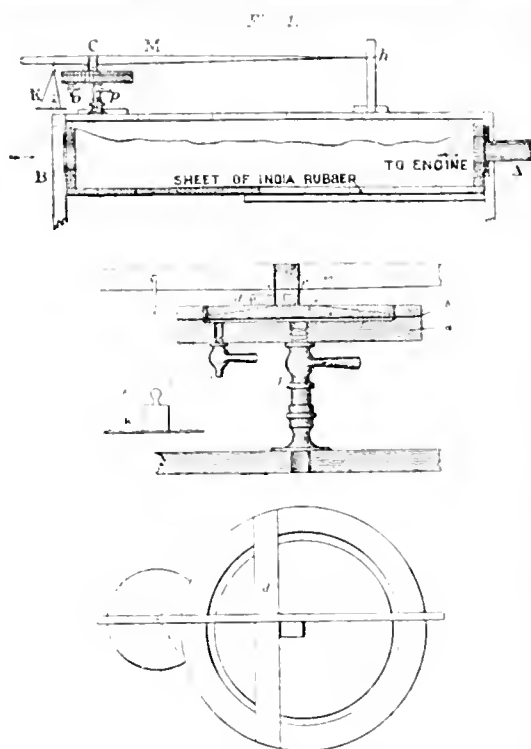
THE author has examined seven samples of coal—anthracite, coking and smithy coals, and lignite. He finds that in all cases humic acid is produced on exposure to air, by slow oxidation of the coal. This action is much more rapid at 100° C. than at the ordinary temperature. The coking coals after this exposure, and formation of humic acid, entirely lost their coking power, and yielded a non-coherent residue on carbonisation. Humic acid is produced in much greater quantity by the action of nitric acid on the coal than by atmospheric oxidation. In this case there is sometimes increase of weight, sometimes decrease, according as the fixation of oxygen (and of nitrous residues) is greater or less than the evolution of carbon in the form of gaseous compounds. (See this J., 1908, 1197).—J. T. D.

Gases; Flameless combustion of ——. and conditions of incandescence lighting. J. Meunier, Compt. rend., 1909, 148, 292—294.

CONTINUING his researches (this J., 1908, 494), the author finds that a platinum spiral substituted for the usual mantle in a Welsbach burner can be kept incandescent by combustion of the gaseous mixture on its surface, without communicating flame; and that the incandescence is more vivid as the mixture is made to approach more closely, by opening the air-holes, the composition for maximum explosiveness. Moreover, the sensitiveness of the flame to outside influence is very great. A sudden pinch of the gas supply tube is accompanied by explosion; and if, before the visible incandescence of the wire has disappeared, the tube be suddenly released, there is again explosion and the flame is established, whilst if the release be gradual, the wire again glows without flame. Slight currents of air, produced by a wave of the hand or of a handkerchief at some distance, are enough to produce explosion and establishment of flame; and the sensitiveness of the burner in this respect is greater as the mixture is nearer the composition for maximum explosiveness.—J. T. D.

Measuring the air- or gas-supply to engines and furnaces. A. G. Ashcroft, Proc. Inst. Civil Eng., 1907—1908, 173, [iii].

THE experiments were undertaken to determine if the volume of air passing through an orifice could be accurately deduced from the difference of pressure existing on the opposite sides of the orifice. An oil-engine was converted into an air-pump, by setting the valves so that at every other stroke a charge of air was drawn in at the air-supply pipe and expelled through the exhaust. The volume swept through by the piston was calculated from an indicator diagram taken with a specially constructed, delicate indicator. This was found to differ for different speeds. The volume of air drawn into the pump per minute was found by multiplying the volume swept through at each stroke at the given



speed by half the number of strokes per minute. By this means it was possible to accurately determine the volume of air drawn into the pump when working at different speeds. The air-inlet pipe of the pump was connected to the pressure measuring apparatus and the latter was calibrated. It could then be used to measure the volume of air drawn into the air- or gas-engine, or furnace. The air-measuring apparatus consisted of a box, 5 ft. long, 1 ft. 9 in. wide, and 11 in. deep, shown in Fig. 1. It was connected at A, to the inlet-pipe of the pump and was provided at B, with a plate having a sharp-edged orifice, 3 in. diam. The bottom of the box consisted for more than half its length of india-rubber sheet in order to equalise the pressure inside. The pressure within the box was measured by a special pressure gauge, shown at C, Fig. 1, and on an enlarged scale in Fig. 2. A circular box, *a*, was connected to the interior of the measuring box by the pipe and tap, *p*, and with the air by the tap, *o*. A rubber diaphragm, *b*, 5 in. diam., was stretched over the box and strengthened by the disc, *e*. A long lever, *m*, was supported from the cross-bar, *d*, by a piece of thin steel spring, *c*, which acted as a fulcrum. A scale-pan, *K*, was attached to one end of the lever, the other end of which terminated in a pointer which indicated the position on the scale, *h*. The diaphragm, *b*, was connected to the lever as shown by a piece of thin steel spring, *f*, attached to *e*. In order to determine the pressure in the measuring-box, the tap, *p*, was shut and *o* was opened. The position of the pointer on the scale, *h*, was noted and the tap, *o*, closed. The tap, *p*, was then slightly opened so that any excess or deficiency of pressure existing within the box acted on the diaphragm, *b*, and caused a slight oscillation of the pointer. This was then brought back to its original position by adjusting the weights in the scale-pan, *K*. It was found that the volume of air passing through the orifice varied as the square root of the weight necessary to bring the pointer back to its position. For the particular apparatus used this may be expressed by the equation:—

Vol. of air in cu. ft. per min. = $10.7\sqrt{\text{grms. in scale-pan.}}$
The results of a number of experiments are given in a table.—W. H. C.

PATENTS.

Gas producers. W. Stewart, Motherwell, N.B., and J. Stewart, Codnor Park, Derby, Eng. Pat. 829, Jan. 14, 1908.

The patent relates to fuel-feeding mechanism for pressure and suction gas producers. A fixed water-cooled casing depending from the top plate of the producer is provided with inclined lateral outlet openings, and with bearings for an inner water-cooled rotating casing. The inner casing, which is provided with a feeding hopper, has outlet openings which register intermittently with the openings in the fixed casing. The fuel falls on to the arms of a water-cooled spreader which is supported from the inner casing of the feeding device and rotates with it. When the device is applied to a suction gas producer, the water spaces are arranged to form the vaporiser or boiler for supplying steam to the producer.—A. T. L.

Gas-producers; Water vessels or vaporisers for —. H. Ries, Munich, Eng. Pat. 966, Jan. 15, 1908.

A VAPORISER for generating steam by means of the heat of the gases leaving a producer consists of a water-vessel having water chambers of rectangular cross-section, which extend downwards and rest on the brickwork of the flue. In another construction, the vaporiser consists of an upper and a lower water chamber connected by four vertical waterways; the lower water chamber rests upon brickwork supports in the flue, arranged so as to allow the hot gases to pass below it as well as between the two chambers.—A. T. L.

Producer gas plants. W. Blakeley, Dowshury, Eng. Pat. 4492, Feb. 28, 1908.

IN a suction gas plant, the top of the scrubber is formed by a water-sealed bell. The variations of the water-level in the sealing-trough cause a more uniform flow of gas through the producer, and the interior of the scrubber can be inspected without breaking joints.—A. T. L.

Gas generators. E. Hanappe, Brussels, Eng. Pat. 15,178, July 17, 1908.

A SUCTION gas producer is provided with a vaporiser arranged around and above the fire-door and open to the space below the grate. An air inlet to the vaporiser and an air inlet, at a lower level, in the ash-pit door are permanently open, so that in the intervals between the suction strokes of the engine there is an up-draught of air through the ash-pit and vaporiser, carrying away the excess of steam. The fire may be poked at any time through the opening in the ash-pit door, and the producer may be worked with low-grade fuel.—A. T. L.

Gas producers. J. J. Bowmer, Newcastle-on-Tyne, Eng. Pat. 20,686, April 1, 1908.

THE patent relates to the provision of a sliding plate at the bottom of a gas-producer, and is specially applicable to the form of producer described in Eng. Pat. 21,682 of 1907 (this J., 1908, 1052). In this form of apparatus, the steam required is generated from the water in the sealing trough at the bottom of the producer. According to the present patent, a sliding plate is arranged below the level of the water in the sealing trough, and is connected with levers by which it can be moved backwards and forwards in order to successively loosen the clinker and cause it to drop into the sealing trough. When the invention is applied to a producer without a water-seal, the sliding plate is in the form of a damper which can be inserted below the fire-grate and above the door of the ash-pit, so that ashes can be removed without interrupting the working of the producer.—A. S.

Gas producer. P. G. Schmidt, Tumwater, Wash. U.S. Pat. 910,319, Jan. 19, 1909.

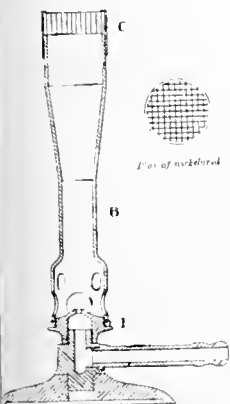
THE producer chamber comprises a combustion zone in the lower part, separated from a distillation zone in the upper part by a shield, the producer gas being led away from the centre of the shield by a vertical pipe.

The gases formed in the distillation zone are drawn off from the upper part of the producer through a valved down-pipe and are delivered below the grate. The down-pipe passes outside the producer, and is provided with a by-pass leading from a point above to a point below the valve. An exhaustor, driven at a variable speed from a cone belt-pulley, is arranged in the by-pass and may deliver the gases to the down-pipe or direct to the producer-gas main as desired. The temperature of the distillation zone is kept constant by means of a thermostat which controls a throttle-valve in the by-pass and the speed of the exhaustor simultaneously.—A. T. L.

Lighting gas [and coke]; Manufacture of —. A. L. H. Bienaimé and A. Requier. Fr. Pat. 394,311, Nov. 22, 1907.

It is desired to obtain coke free from dust and ready for use without breaking, and to facilitate the discharging of the gas-retorts, the coal is powdered and briquetted with not more than 4 per cent. of tar or other binding agent. The process is applicable to coals which after briquetting are non-caking, and coke-breeze may be treated in the same manner.—A. T. L.

Gas and vapour burners; Incandescent —. A. G. Méker, Nogent sur Marne, France. Eng. Pat. 22,075, Oct. 13, 1904. Under Int. Conv., Oct. 31, 1903.



THE essential features of the new burner are: (1), the exact proportioning of the size of the gas injector hole to that of the air inlet holes, so as to obtain a mixture of the gas with just the precise amount of air required for complete combustion; (2), the special shape of the lower part of the burner and of the mixing chamber, to ensure the correct speed and thorough mixing of the gas and air; and (3), the deep nickel grid at the mouth of the burner to prevent "flashing back" of the flame. A sectional view of the burner is shown in the figure. The gas enters by the side tube, and passes through the hole in the injector piece, I. The air is drawn in

through the large air holes, and mixes thoroughly with the gas as both ascend the tube, B, at the top of which is a brass cap, holding the deep (10 mm.) nickel grid, C. The lower part of the flame yielded by the burner consists of a number of very small blue flames, about 1.5–2 mm. high, each corresponding to one of the passages of the grid; immediately above this zone, the flame is quite homogeneous and of uniform temperature.—A. S.

[Electric lamp filaments] Conductors; Manufacture of refractory —. W. C. Arsem, Schenectady, U.S.A. Eng. Pat. 17,618, Aug. 21, 1908. Under Int. Conv., Aug. 24, 1907.

For the manufacture of refractory conductors for electric incandescence lamps from tungsten or similar metals, the oxides of the metals are mixed with excess of lamp-black, e.g., in the proportion of 18 to 20 parts of carbon to 100 parts of oxide, and the mixture is then heated in a vacuum furnace to 1000° C., the reduced metal being prevented from forming coarse grains by the excess of finely distributed carbon remaining. By burning the reduced metal in air, an oxide in a state of very fine subdivision is obtained. This is subsequently mixed with a quantity of carbon not quite sufficient for reduction and with an agglutinant dissolved in benzene, the solvent being afterwards volatilised by a current of air. The mixture is then squirted through a die of 0.006 inch diameter and $\frac{3}{4}$ inches long, to retain any coarse particles and finally through holes of 0.003 inch diameter, yielding threads suitable for filaments. These threads are covered with talc and baked at 325° to 350° C. and then embedded in pure silica for reduction in a graphite crucible. The oxide being in excess, no carbon remains in the finished filaments and the excess of oxide may be removed by volatilisation.—R. L.

Gaseous fuels; Treatment of — and apparatus therefor. Cie. du Gaz de Lyon, Lyon, France. Eng. Pat. 2720, Feb. 6, 1908. Under Int. Conv., March 1, 1907.

SEE Fr. Pat. 375,164 of 1907; this J., 1907, 863.—T. F. B.

Gas generator applicable for producing combustible gases. G. Marconnet, Paris. U.S. Pat. 909,920, Jan. 19, 1909.

SEE Fr. Pat. 370,301 of 1906; this J., 1907, 310.—T. F. B.

Gas; Manufacture of —. International Gas Development Co. Fr. Pat. 394,545, Sept. 22, 1908.

SEE U.S. Pat. 899,690 of 1908; this J., 1908, 1052.—T. F. B.

Metallic filaments or rods for electric incandescent lamps. F. J. Planchon, Paris. Eng. Pat. 5040, March 5, 1908. Under Int. Conv., Nov. 9, 1907.

SEE Fr. Pat. 393,888 of 1907; this J., 1909, 132.—T. F. B.

Incandescent filaments for electric lamps; Process for making —. W. P. Thompson, Liverpool. From O. and R. von Inwald, Vienna. Eng. Pat. 19,659, Sept. 18, 1908.

SEE Fr. Pat. 391,722 of 1908; this J., 1908, 1145.—T. F. B.

Photometer. Eng. Pat. 6971. See XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum; Analysis of Tschimion —. P. Andrejew. Petroleum, 1908, 4, 207–210.

Tschimion is situated in Fergana, Central Asiatic-Russian territory. The crude oil found here, is a rather thick, dark brown liquid, of sp. gr. 0.872, and decidedly dichroic. It solidifies at -8.5°C ., flashes at -5.5°C . (Abel), and burns at 37°C . The paraffin wax content is 5.14 per cent., and the total content of asphaltic substances, 3.23 per cent., these proportions, in conjunction with the medium sp. gr. and low viscosity, indicating a high content of light fractions ("benzine"). The ultimate analysis gave: carbon, 85.79; hydrogen, 13.65; and ash, 0.02 per cent. Fractional distillation furnished the following products: fraction below 150°C ., 17.75 per cent. (sp. gr. 0.739); 150° – 200°C ., 9 (sp. gr. 0.790); 200 – 250°C ., 8.20 (sp. gr. 0.826); 250° – 300°C ., 19.50 (sp. gr. 0.842); above 300°C ., 40.40 (sp. gr. 0.8986); residue, 3.00; loss, 2.14 per cent. The crude oil is capable of yielding up to 6 per cent. of light distillate boiling below 100°C ., up to 5.5 per cent. boiling between 100° and 125°C ., and 4.7 per cent. of heavy "benzine" (b. pt. 125° – 150°C .). The refined lamp oil fractions are of good quality, having the sp. gr. 0.8185, viscosity, 1.2 at 18°C .; and flashing point, 29.5°C . The higher fraction, above 300°C ., is very thick, contains up to 12 per cent. of paraffin wax, and has the viscosity 7.3 at 50°C . A tendency to decomposition is exhibited during fractional distillation, the fraction distilling at 200° – 225°C . showing a reddish tinge, and the higher fractions ranging from wine-yellow to dark brown with greenish fluorescence. The iodine value of the fractions distilling between 200° and 250°C . is 3, increasing to 9.6 in the next higher fraction, and to 29.3 above 300°C . The analysis of the fractions between 150° and 160°C . gives results corresponding to the formula, $\text{C}_{20}\text{H}_{22}$. In utilising Tschimion oil, attempts were made at first to employ the fractions above the lamp oil series as fuel, but without success; and a similar result attended the endeavour to employ it for the same purpose after the removal of the lightest fractions only, the residue being too thick on account of its high paraffin wax content, so that the latter had also to be eliminated.—C. S.

Petroleum products; Fundamental errors in the manufacture of — in Roumania. R. Wischin. Monit. Pétrole, Roumain, 1908, 865; Petroleum, 1908, 4, 210.

IN the Roumanian petroleum industry, owing to lack of experience, the methods of treating the oil were founded on a wrong basis, without sufficient consideration of

the peculiarities of the crude oil. This oil needs special care in distillation, owing to the presence of constituents that decompose at high temperatures, and of others that polymerise under these conditions, especially when the vapours of the distillates are exposed to heat. The best method of counteracting these tendencies is by continuous distillation, in small stills kept filled to a given height, the vapours being allowed to escape freely. The proper fractionation of the distillates, by means of suitable dephlegmating columns, is also important; and for this purpose the friction type of dephlegmator is preferable, the heavy vapours being condensed by contact with the sharp corners of the apparatus, whilst the lighter vapours, remaining uncondensed, escape.—C. S.

PATENT.

Petroleum and related oils; Desulphurising Lima or analogous —, C. A. Robinson, West New Brighton, N.Y., Assignor to Standard Oil Co., Bayonne, N.J. U.S. Pat. 910,584, Jan. 26, 1909.

The distillate of sp. gr. below 0.865 from the oil is treated with sulphuric acid of more than 60° B., in the proportion of not more than 60 lb. of acid per barrel of oil, the initial temperature of the mixture being kept below 66° F.—A. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

PATENTS.

Halogenised vat-dyestuffs; Manufacture of —, O. Murray, London. From Soc. of Chemical Industry, Basle, Switzerland. Eng. Pat. 8530, April 16, 1908. Addition to Eng. Pat. 6106 of 1907 (this J., 1907, 1194).

VALUABLE halogen derivatives of indirubin may be obtained by condensing a halogen-isatin derivative of the benzene or naphthalene series with indoxyl or one of its derivatives, or, if it is desired to obtain products halogenised only in the indoxyl radical, by causing a halogen-indoxyl or one of its homologues to act on isatin or one of its homologues or analogues. The dyestuffs thus obtained dye cotton in an alkaline hydrosulphite vat, giving red-violet, blue-violet, and blue tints of excellent fastness. Example: A solution of 31 parts of indoxyl in 4000 parts of water is poured quickly into a solution of 72 parts of dibromoisatin and 13 parts of sodium carbonate in 3000 parts of water, care being taken to stir well. The whole is then very rapidly heated to the boil and kept boiling gently for 2 hours, the mixture being kept neutral by the addition of sodium carbonate if necessary. The mass is then allowed to cool and the precipitated dyestuff is filtered off, washed, first with dilute sodium hydroxide solution and afterwards with hot water, and finally pressed and dried. The dried dyestuff is a brown-red powder which dissolves in concentrated sulphuric acid to a brown-violet solution and in hot nitrobenzene to a red-violet solution from which it crystallises as brown-red needles. In an alkaline hydrosulphite vat, the dyestuff dyes cotton red-violet shades.—P. F. C.

Sulphur dye or colour [Sulphide dyestuff] and process of making same, E. S. Chapin, New York. U.S. Pat. 909,151—909,156, Jan. 12, 1909.

(1). Wood sawdust is heated with sulphur and sodium sulphide until a non-hygroscopic, readily pulverisable dyestuff is formed. The product dyes cotton in fast dark yellowish-brown shades. (2). Claim is made for a sulphide dyestuff produced by heating starch with a colour-forming, aromatic chemical, sulphur, and sodium sulphide. (3). Claim is made for the process of producing dyestuffs by heating a carbohydrate or non-crystallisable polysaccharide with *m*-phenylenediamine and sulphurising substances containing an excess of sulphur. (4). By heating salicylic acid with sulphur and sodium sulphide, a dyestuff is produced which dyes cotton in "fast golden brown bronze" shades. (5). The dyestuff produced by heating together starch, sulphur, sodium sulphide, and copper sulphate dyes cotton in an alkaline bath fast "olive

brown black shades." (6). The dyestuff produced by heating together starch, *m*-phenylenediamine, copper sulphate, sulphur, and sodium sulphide dyes unmodified cotton in an alkaline bath reddish-catch brown shades.—J. C. C.

Sulphur colour [Sulphide dyestuff] and process of making same, E. T. Bundsman, Assignor to The Point Loma Chemical Co., Point Loma, Cal. U.S. Pat. 909,277, Jan. 12, 1909.

THE dyestuff produced by heating together grape sugar, *m*-nitroaniline, and sulphurising agents, dyes cotton in an alkaline bath, fast brown shades.—J. C. C.

Anthracene dyestuffs; Process for preparing blue —, Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 205,551, Jan. 26, 1908. Addition to Ger. Pat. 205,096, Nov. 30, 1907.

1,4-AMINOHYDROXY- and 1,4-alkylaminohydroxyanthraquinone-*a*-sulphonic acid are reduced to stable leuco-compounds by means of hydrosulphite, etc., in alkaline solution. These leuco-compounds, when heated with monoalkylamines, are converted into blue dyestuffs analogous to those described in the principal patent (see this J., 1909, 86).—T. F. B.

Disazo dyestuffs; Process for preparing red —, Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 205,661, June 3, 1906. Addition to Ger. Pat. 204,102, April 26, 1906.

DIAZO compounds are combined with *p*-aminobenzoyl-2,5,7-aminonaphtholsulphonic acid; this dyestuff is diazotised and combined with an aminoacyl-2,5,7-aminonaphtholsulphonic acid, in which the aminoacyl group is attached to the amino-group. The dyestuffs produced are soluble in water, and dye unmodified cotton in red shades.—T. F. B.

Disazo dyestuffs; Process for preparing yellowish-red to bluish-red —, Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 205,663, April 26, 1906. Addition to Ger. Pat. 204,102, April 26, 1906.

A DIAZO compound is combined with *m*-aminobenzoyl-2,5,7-aminonaphtholsulphonic acid, and the product is diazotised and combined with 2,5,7-aminonaphtholsulphonic acid, its *N*-acyl derivatives, or its unsymmetrical thiourea derivative.—T. F. B.

Disazo dyestuffs; Process for preparing yellowish-red to bluish-red —, Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 205,665 and 205,666, May 7, 1907. Additions to Ger. Pat. 204,102, April 26, 1906.

THE monoazo dyestuffs obtained by the combination of diazonium compounds with *p*- or *m*-aminobenzoyl-2,5,7-aminonaphtholsulphonic acids, are further diazotised and combined with pyrazolones or their sulphonic or carboxylic acids.—T. F. B.

Trisazo dyestuffs; Manufacture of —, P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5484, March 11, 1908. Addition to Eng. Pat. 14,248, June 20, 1907.

SEE Ger. Pat. 202,117 of 1907; this J., 1908, 1148.—T. F. B.

Naphthylpyrazolonesulphonic acid, P. Volkmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 910,437, Jan. 19, 1909.

SEE Fr. Pat. 391,456 of 1908; this J., 1908, 1148.—T. F. B.

Colouring matters [azo dyestuffs] suitable for use in the form of their lakes; Manufacture of —, J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 11,878, June 1, 1908.

SEE Fr. Pat. 391,155 of 1908; this J., 1908, 1148.—T. F. B.

Thioindigo leuco compounds; Process of making —, E. Münch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 910,839, Jan. 26, 1909.

SEE Fr. Pat. 385,044 of 1907; this J., 1908, 497.—T. F. B.

α-Isatin anilide and its homologues with sulphurous acid; Process of producing compounds of —. C. Stephan and A. Rahtjen, Hamburg, Germany. Eng. Pat. 13,499, June 25, 1908.

SEE Ger. Pat. 204,478 of 1907; this J., 1909, 86.—T. F. B.

Azo lake and process of making same. E. Ulrichs, Elberfeld, Assignor to Wülffing, Dahl, und Co., Barmen, Germany. U.S. Pat. 910,030, Jan. 19, 1909.

SEE Fr. Pat. 381,206 of 1907; this J., 1908, 132.—T. F. B.

Indigo; Process for preparing bromo-derivatives of —. Cie. Paris. de Couleurs d'Aniline. Addition, dated Nov. 29, 1907, to Fr. Pat. 322,348, June 14, 1902.

SEE Eng. Pat. 26,275 of 1907; this J., 1909, 17.—T. F. B.

Indigos; Process of making highly brominated — from dihalogenated indigos. Farbwerke vorm. Meister, Lucius, und Brünig. Fr. Pat. 394,200, Nov. 19, 1907.

SEE Eng. Pat. 25,514 of 1907; this J., 1909, 17.—T. F. B.

Indigos; Process of making highly brominated, dihalogenated —. Farbwerke vorm. Meister, Lucius, und Brünig. Fr. Pat. 394,237, Nov. 20, 1907, and Addition thereto, dated Nov. 30, 1907.

SEE Eng. Pat. 25,513 and 26,276 of 1907; this J., 1909, 17.—T. F. B.

Trisazo dyestuffs; Process for preparing green —. L. Cassella and Co. Fr. Pat. 394,491, Nov. 27, 1907.

SEE Ger. Pat. 204,707 of 1907; this J., 1909, 86.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Silk fabrics; Deterioration of weighted —. P. Sisley. Rev. Gen. Mat. Col., 1909, 13, 33–43.

THE only objection to the moderate weighting of silk fabrics is their subsequent deterioration, and the author now publishes the results of his ten years' research into the causes and prevention of this fault. The weighting of dyed silks, which reduces their elasticity, but has little or no effect on their initial strength, consists in fixing tin or aluminium silico-phosphate on the fibre, which it surrounds with a composition similar to enamel, both physically and chemically. This coating according to Meister is liable to devitrification just as enamels are, while a rise of temperature may cause tendering of a purely physical character owing to the different coefficients of expansion of the fibre and the coating. Another cause is dehydration; for heavily weighted silk exposed to a temperature of 120° C. for ten minutes lost its strength nearly completely, though it regained it again on re-absorbing its hygroscopic moisture. By drying at 180° C. the same silk became quite rotten. Gnehm and Baenziger having shown that exposure to a temperature of 40° C. produces no change and to one of 55–65° C. very little, Meister published the hypothesis that all deterioration was physical in character, stating that on extracting a tendered pattern with hydrofluoric acid, the strength of the fibre was restored. The author, however, found in all cases that though the fibre did resume a little of its elasticity, a great deterioration remained, and he shows that there are other causes than physical ones. It is well-known that even a moderately weighted fabric is susceptible to deterioration in the sunlight, and according to Gnehm and Baenziger, patterns weighted to 120–150 per cent. were completely tendered by exposure to the sun for 8 days, while the author has found that diffused daylight caused tenderness proportional to the intensity of the light. Experiments with several different methods of weighting showed that the old stannic hydroxide weighting was much more susceptible to light than that consisting of silico-phosphates, and that deterioration took place in all cases, appearing to be proportional to the quantity

of stannic oxide enveloping the fibre before exposure. The deteriorated fabrics were analysed and every one was found to contain a notable proportion of stannous oxide, which was not present in the unexposed portions. The author concludes from this that the stannic hydroxide acts as a catalytic agent, becoming reduced by the action of light and taking up oxygen again from the air, and that it is the oxygen liberated which tenders the fibre by a process of slow combustion. This does not take place without the aid of light, for different patterns weighted by the same method were not found to deteriorate to the same degree when kept in darkness. Most silk fibre contains both iron and copper in sufficient quantities to act catalytically and experiments showed that the proportion of iron had a slight, and that of copper a very marked, influence on the deterioration. It was shown by experiment that tendering only takes place in the presence of air and moisture and that it increases with the percentage of weighting and with the temperature, while, as the author has previously proved, traces of sodium chloride (always present in industrial water) have a certain deteriorating influence. In order to prevent deterioration altogether, a substance must be incorporated with the weighting which is colourless, inodorous, and non-poisonous and which has energetic anti-oxidation and anti-catalytic properties. Both Meister and Gianoli advocated impregnation with alkali thiocyanates. The employment of these substances presents practical difficulties which the author claims to have overcome by substituting thiocarbamides. A large number of experiments in which the patterns were impregnated with a 3 per cent. solution of thiocarbamide were uniformly successful in preventing deterioration under the influence of light, heat, and storing in darkness. The process which has been applied with invariable success is known under the name: "Traitement T.S."—H. P. P.

Calico printers; Cheap blues for —. E. Steiner. Rev. Gen. Mat. Col., 1909, 13, 44.

THE goods are printed with a reserve of citric acid either alone or mixed with tartaric acid; padded in aluminium acetate suitably thickened; steamed, washed, treated in a bath of cow's dung and sodium arsenite or phosphate; washed again, treated in a tannin or sumac bath, again washed, dyed with a basic blue dyestuff, and finally soaped and chlorinised. For deeper blues, iron acetate is added to the padding bath.—H. P. P.

Aniline Black; Use of an insoluble vanadium salt for printing —. G. Friedlander. Rev. Gen. Mat. Col., 1909, 13, 44–45.

AS catalysing agent in printing Aniline Black, copper sulphide, introduced by Lightfoot, is unsatisfactory because it becomes oxidised to sulphate, thus rendering the bath unstable, while the chromium tungstate proposed by Higgin causes the objectionable deposit of red tungstic chloride. The use of vanadium salts discovered by A. Gayard and G. Witz effects economy, very small quantities being necessary on account of their great activity; but these salts tend to the formation of black in the printing colour by reason of their solubility. The author has overcome this difficulty by employing insoluble lead metavanadate which is only dissolved by the hydrochloric acid liberated on steaming the goods. The substance is prepared by precipitating a 0.1 per cent. solution of vanadium chloride with lead acetate until the supernatant liquid remains colourless. The mixture, containing lead metavanadate in suspension, is used in the proportion of a few tenths of a milligramme for every kilogramme of the printing colour.—H. P. P.

Colouring matters [dyestuffs]; Identification of — in dyed cotton fabrics. G. E. Holden. J. Soc. Dyers and Col., 1909, 25, 47–53.

THE author uses as reagents (1), chloroform, recommended by Lenz in 1887 as a good solvent for Indigo; and (2), titanous chloride, the use of which was first suggested by Knecht in 1904. *Test for Indigo in compound shades.*—A small piece of the dyed pattern is warmed gently with chloroform: the presence of Indigo is indicated by the

blue coloration of the solvent. In all of the following groups, direct dyestuffs whether fixed by after-treatment or not, sulphur dyestuffs, mineral dyestuffs, and mordant dyestuffs are insoluble in chloroform. The test is directly applicable if the cotton has been slightly topped with basic dyestuffs, but if excessive quantities of these latter be present, they must be removed by boiling in methylated spirit containing a few drops of hydrochloric acid.

Reds.—(1). A piece of the pattern is immersed in cold chloroform. Basic reds, when fully fixed, give no coloration. The solution is coloured an intense amber by Paranitraniline Red, reddish-orange by Paranitro-orthoanisidine, Azo Pink BB, and Chloranisidine, and red by Thioindigo Scarlet R. Any coloration given by incompletely fixed basic reds can be easily distinguished from the others. (2). Direct dyestuffs are identified by the "bleeding" which occurs when a piece of the fabric is boiled with water. (3). With boiling titanous chloride solution, developed direct reds are discharged to a white or yellow colour, basic reds to a dull yellow or brown, and Alizarin Red to a maroon colour. (4). A piece of the pattern is wetted, immersed in bleaching powder solution of 5° T., and acetic acid added gradually. Azo Pink BB is discharged at once to a bright yellow-orange; Chloranisidine Red is discharged only very slowly or on addition of a comparatively large quantity of acid; Paranitro-orthoanisidine is not affected. **Pinks.**—Cold chloroform is coloured yellow by Paranitraniline and reddish-orange by Paranitro-orthoanisidine and Azo Pink BB; the two latter are distinguished as described under "Reds." Rhodamine on tannin, chrome, or alumina mordants generally gives a delicate fluorescent tint with chloroform, but can also be detected by any of the well-known tests. **Bordeaux or Claret shades.**—(1). Cold chloroform is coloured an intense red by α -Naphthylamine Claret, an intense amber by Paranitraniline red and Direct Blue mixture, brownish-red by Indanthrene Claret G, red, with fluorescence, by Thioindigo Red B and Vat Red B, and red-violet by Helindone Red 3B. No coloration is produced by basic clarets, when thoroughly fixed. (2). On boiling the pattern with water, direct clarets are recognised by "bleeding." (3). With boiling titanous chloride solution, developed clarets are completely discharged, with the exception of Primuline, which leaves a yellow colour. Sulphur clarets evolve hydrogen sulphide. Alizarin Bordeaux is reduced to a dirty brown. Basic clarets are discharged to a dull yellow or brown. **Violets.**—(1). With cold chloroform, Indanthrene Violets and Thioindigo Red B and Indigo mixture give reddish-violet fluorescent solutions, Ciba Violet B gives a blue-violet solution, and Ciba Violet R, a red-violet solution. Basic violets give no coloration when thoroughly fixed with tannin; colorations from incompletely fixed basic violets can be easily recognised. (2). On spotting with concentrated nitric acid, Indanthrene violets give a grey to black, and Thioindigo Red B and Indigo mixture, a red spot. (3). Direct, basic, and sulphur violets and Alizarin Violet can be distinguished by tests similar to those used for "Clarets." **Browns.**—(1). On immersing the pattern in cold chloroform, brown colorations are produced by Para Brown G and R, developed with "diazo para," an amber colour is yielded by Para Red with direct or coupled blacks and with Aniline Black, a red by benzidine on α - or β -naphthol, and a bluish-red by tolidine on α - or β -naphthol. (2). The direct dyes are recognised by "bleeding" on boiling with water. (3). With boiling titanous chloride solution, direct browns, developed, coupled, etc., are decolorised, basic browns are discharged to a dull yellow to brown tint, sulphur browns evolve hydrogen sulphide, Catechu Brown is scarcely affected, Para Red with direct or coupled blacks first becomes red and is then gradually decolorised, Para Red with Aniline Black is slowly discharged to a brownish-black, becoming black on exposure, and Iron Buff is decolorised and can be further identified by testing for iron. **Yellow and orange dyes.**—(1). Cold chloroform is coloured yellow by Indanthrene yellows and Algole yellows, reddish-orange by Algole Orange R, and an intense orange by metanitraniline and nitrotoluidine developed on the fibre. Developed Primuline, Indanthrene Orange RT,

and basic colours, when fully fixed, give no coloration. (2). Direct, basic, and sulphur yellows are identified as described under "Clarets." (3). With boiling titanous chloride, Indanthrene yellows become blue; Algole yellows are scarcely affected; Primuline developed with phenol or resorcinol becomes bright yellow, and can subsequently be diazotised and developed with β -naphthol to a red; Primuline treated with hypochlorite is reduced to a brownish colour and cannot be diazotised and developed. Indanthrene Orange RT is reduced to a characteristic orange tint. (4). On spotting with ammonium sulphide, Chrome Yellow and Orange are coloured black. (5). Alizarin colours are recognised by testing for the mordants. **Greens.**—(1). Cold chloroform is coloured greenish-blue by Indanthrene Green B, olive-green by Algole Dark Green B, bright yellowish-green by Indanthrene Blue RS and Indanthrene Yellow mixture, and green by some fully fixed basic greens such as Brilliant Green and Malachite Green. Some basic greens, Algole Green B, and Russian Green, etc., on iron mordant, give no colorations. (2). With boiling titanous chloride solution, direct greens, coupled greens, etc., are decolorised, basic greens are discharged to a dull yellow or brown, sulphur greens evolve hydrogen sulphide, Algole Green B gives a reddish-blue or blue colour, Indanthrene Green B gives a Grenat colour, Algole Dark Green B, a reddish-brown, and Indanthrene Blue RS and Indanthrene Yellow mixture, a dirty blue to violet colour; Russian Green, Fast Green O, etc., on iron mordant are discharged and may be further recognised by testing for iron. **Blues.**—(1). With cold chloroform, Indigo Blue, Ciba blues, Indanthrene Blue RS, Algole Blue 3G, and Algole Blue CF give blue colorations, Dianisidine Blue gives a violet, Indanthrene Blue RC gives a blue violet, with fluorescence, and Indanthrene Dark Blue BO gives a bluish-green coloration with a red fluorescence. (2). With boiling titanous chloride, Alizarin Blue gives a brownish-black colour becoming bluer on exposure to air; Indigo Blue is decolorised, very dark shades leaving an olive to blue tint; Ciba blues give a green to olive colour; Algole Blues 3G and CF are reduced to black and Grenat colours respectively. (3). On spotting with strong nitric acid, Ciba blues give a brown spot which gradually changes to a light dirty blue tint; Indigo gives a yellow spot surrounded by a green rim. Direct blues, basic blues, and sulphur blues are identified as described under "Clarets." **Blacks.**—(1). With cold chloroform, Azophor blacks give red-violet to blue-violet solutions; other blacks are insoluble. (2). With boiling dilute hydrochloric acid, a red or orange solution is obtained with Logwood Black. (3). With boiling titanous chloride, direct, developed, and coupled blacks are decolorised; basic blacks give a dull yellow to brown colour; sulphur blacks evolve hydrogen sulphide; Aniline Black and Diphenyl Black become brown; chrome mordant dyes give a brown to brownish-black colour. (4). A piece of the pattern is immersed in bleaching powder solution of 5° T., a small quantity of acetic acid is added, and after standing, the liquid is poured off, and the fabric soured with cold acetic acid and washed. With chrome mordant dyestuffs, the fibre is coloured yellow to yellowish-brown; it is subsequently tested for chromium. An olive to green coloured fibre is obtained with prussiate Aniline Blacks, and a red-brown with other Aniline Blacks and Diphenyl Black.

For printed fabrics, tests for mordants should always be made, viz., for iron and aluminium by first discharging the colour with bleaching powder solution and acetic acid, and then boiling with logwood solution; and for chromium by fusing with sodium carbonate and potassium nitrate. In the following table are given the reactions of a number of dyestuffs with titanous chloride and with bleaching powder solution of 5° T. to which a little acetic acid has been added. Most basic dyes are reduced by titanous chloride, with production of brown titanium tannate; Indanines leave a blackish coloured fibre. When using titanous chloride for testing light and medium shades of sulphur colours, the solution must first be boiled after addition of a small quantity of hydrochloric acid, in order to remove traces of hydrogen sulphide, which are frequently present.

	Titanous chloride.	Bleaching powder solution and acetic acid.
Algoe Blue CF	Grenat	Green
Algoe Blue 3G	Dirty drab	Gradually discharged
Algoe Dark Green B	Reddish-brown	Light yellow-brown
Algoe Green B	Reddish-blue	Discharged
Algoe Red B	Brown	Gradually bleached to salmon shade
Alizarin Blue	Dirty black	Discharged
Alizarin Red	Maroon	Discharged
Azo Pink 3B	Discharged	Discharged
Bromindigo FB	Olive	Weakened in shade
Chloranisidine	Discharged	Very slowly discharged
Ciba Blues	Olive	Weakened in shade
Ciba Red B	Discharged	Unaffected
Ciba Violet B	Discharged	Gradually weakened
Ciba Violet R	Discharged	in shade
Helindone Red 3B	Dirty violet	Unaffected
Helindone Red 3B with Indigo	Dirty	Red-violet
Indanthrene Blue BO	Reddish-brown	Black in shade
Indanthrene Blue BT	Black	Black in shade
Indanthrene Blue RC	Grenat	Bluish-green
Indanthrene Blue RS	Maroon	Green
Indanthrene Claret G	Brown	Becomes gradually browner
Indanthrene Green B	Grenat	Dirty brown
Indanthrene Red R	Reddish-brown	Becomes a shade "brickier"
Indanthrene Violet R	Grenat	Dirty in shade
Indanthrene Violet RT	Maroon	Redder in shade
Indigo Blue	Yellow tint	Discharged
Paranitraniline Red	Discharged	Unaffected
Paranitro-orthoanisidine	Discharged	Unaffected
Thioindigo Red B	Practically discharged	Slowly weakened in shade
Vat Red B	Bluer, then discharged	Red colour

—A. S.

PATENTS.

Threads or filaments from cellulose; Manufacture of — W. P. Dreaper, Felixstowe. Eng. Pat. 858, Jan. 14, 1908.

CELLULOSE is converted into hydrocellulose either by treating it with a strong solution of sodium hydroxide, (but without any bleaching process as at present practised, in order to prevent oxidation), or by steeping it in a solution of zinc chloride of 10° T. and then heating. The hydrocellulose thus obtained is dissolved in a solution of zinc chloride, which may be made distinctly acid to facilitate the solution, though if this be done it is subsequently necessary to neutralise the acid with zinc oxide. The solution of hydrocellulose is then treated in a vacuum at a suitable temperature to remove air bubbles and filtered. It is then forced through fine openings into a coagulating bath which may consist of:—(a), a strongly alkaline solution to which ammonium chloride and ammonia may be added to prevent the precipitation of zinc compounds; (b), a strong solution of a suitable salt such as sodium sulphate; (c), a mixture of alcohol and water. The threads prepared in this way may be mercerised and are then washed and dried, certain advantages being obtained if the drying is effected in a partial vacuum.—P. F. C.

Degreasing and cleaning fabrics, yarns, carpets, and like materials; Apparatus for — E. G. Scott, London. Eng. Pat. 27,006, Dec. 6, 1907.

THE apparatus comprises a large chamber divided into two parts by a horizontal partition, the lower part being used as a grease-extracting chamber, whilst the upper part is employed for drying the cleansed material. Endless bands, between which the goods to be cleaned are gripped, travel through the whole apparatus. On emerging from the drying chamber they divide so as to permit of the removal of the goods, but meet again just before the point of entry into the machine. The extracting chamber is provided with a number of rollers over and under which travel the endless bands carrying the material, which is thus exposed to the action of the hot or cold benzene, naphtha, etc., or other liquid employed as solvent. This extracting chamber is also divided into compartments by means of partitions and the solvent is made to travel from one com-

partment to another through pipes, the direction of flow being opposite to that in which the material is travelling. Before leaving the extracting chamber, the endless bands pass through the nip of a pair of squeezing rollers in order to remove as much as possible of the solvent from the goods. The drying chamber is also provided with a number of guide rollers. In order to vaporise, remove, and subsequently recover the solvent from the material, the drying chamber is placed within a system which also comprises an apparatus for heating air, a condenser for cooling it and separating the condensed solvent, and a fan for producing the circulation of the air through the system. The air passes through the heater into the drying chamber, becomes saturated with solvent during its passage through it, and is drawn by the action of the fan into the condenser where the solvent is condensed, the air being again circulated by the fan, and the cycle being repeated as often as is necessary. The solvent which leaves the extracting chamber is distilled to recover the grease and then used again.—P. F. C.

Scouring textile fabrics; Machines for — J. Bailey, Slaithwaite, Yorks. Eng. Pat. 444, Jan. 8, 1908.

IN the present scouring machines, the upper squeezing roller rests by its own weight on the lower one and is driven from it by friction. In practice the upper roller is liable to slip on the travelling fabric. This defect is remedied by the two following improvements. (1). The shaft of the upper roller is journaled in bearings in blocks which are capable of sliding vertically in slots in the sides of the machine. A strong spiral spring is confined in each slot between the block which holds the upper roller and a second block or plate which is fastened on its upper side to a screw which can be raised or lowered. By these means, the pressure of the upper squeezing roller on the lower one can be adjusted at will. (2). The axes of the squeezing rollers are provided with similar pulleys, and by means of an endless belt which passes over them and around suitable intermediate carrier pulleys, a positive rotary motion is transmitted from the lower to the upper roller.—P. F. C.

Paper, fabric, and other surfaces; Method and apparatus for spraying colour and other liquids on to — C. L. Burdick, Wood Green, Middlesex. Eng. Pat. 721, Jan. 11, 1908.

HITHERTO in machines of the kind described in Eng. Pats. 7344 of 1902, 8703 of 1903, and 4211 of 1905 (see Fr. Pat. 328,714 of 1903; this J., 1903, 994) in which the belt drives the stencil and thus both travel at the same speed, the stretch of the apron and of the material when leaving the stencil had in some cases a tendency to allow the wet surface of the material to soil the face of the stencil and so make a smudge when the stencil again came into contact with the material. This difficulty is avoided by driving the stencil by a friction gear, the proportions of which are such that the stencil travels rather quicker than the material under treatment. A further improvement is produced by separately driving in a variable manner the rotary device controlling the air and colour valves. Surplus colour is removed from the stencil by means of a suction apparatus in connection with a casing having a mouth arranged so as to make close contact with the stencil.—P. F. C.

Printing of textile fabrics. The Calico Printers' Assoc., Ltd., Manchester, and E. Schofield, Lennoxtown. Eng. Pat. 6970, Mar. 30, 1908.

CERTAIN acids and acid salts may be added to the customary diazo printing colours in an amount sufficient to resist other colours without interfering with the fixation of the corresponding azo colours by the combination of the diazo compound with the naphthol of the "prepare." Citric acid, phosphoric acid, and acid citrates are the acids and acid salts which can be used for this purpose. Example:—A solution of 12 parts of citric acid in 27 parts of water is thickened with starch, and 8 parts of a 33 per cent. solution of sodium hydroxide are added. 4 parts by volume of this paste are mixed with 1 part by volume of a solution of *p*-nitro-diazobenzene hydrochloride in which the free mineral acid has been neutralised by the

addition of sodium acetate and of such concentration that a gallon of the solution contains the diazo compound from 20 oz. of paranitraniline. The resist printing colour thus obtained is printed on to the fabric which has previously been padded with an alkaline solution of β -naphthol, containing 4 oz. of sodium acetate in a gallon, and dried. The printed fabric is next dried, padded or over-printed with a suitable mordant such as aluminium acetate, then aged or steamed and afterwards fixed and dyed in the ordinary way. A second example is given for the production of fast azo colours under indigo.—P. F. C.

Printing blue, violet to lilac coloured tints fast to washing and light; Process for producing in —. O. Imray, London. From Soc. of Chemical Industry, Basle, Switzerland. Eng. Pat. 19,310, Sept. 14, 1908.

By printing with a mixture of indigo and polyhalogen derivatives of indigo or indirubin or halogen substitution products of dyestuffs of the thioindigo series, tints are produced of excellent fastness to washing and light. The mixtures have moreover the advantage that they can be used for printing without caustic alkalis since the presence of alkali carbonate suffices for complete reduction and fixing.—P. F. C.

Discharging indigo dyings by means of formaldehyde-hydrosulphite or formaldehyde-sulphoxylate; Process of —. M. Schwarz. Ger. Pat. 204,565, Feb. 27, 1907.

THE discharge paste containing the reducing agent and also a primary, secondary, or tertiary amine, is printed on the indigo-dyed fabric, which is then steamed, and the indigo white washed out of the fabric. It is said that the fibre is not weakened by the process, nor are the copper rollers attacked.—T. F. B.

Artificial silk; Production of —. G. Guadagni, Pavia, Italy. Eng. Pat. 1265, Jan. 18, 1908. Under Int. Conv., Sept. 28, 1907.

SEE FR. Pat. 386,339 of 1908; this J., 1908, 682.—T. F. B.

Artificial silk; Manufacture of —. J. A. E. H. Boullier and J. Lafais, Paris. Eng. Pat. 15,915, July 15, 1908. Under Int. Conv., July 15, 1907.

SEE FR. Pat. 392,442 of 1908; this J., 1908, 1201.—T. F. B.

Silk dyers' products [stannic chloride and soap]; Preparation of —. E. A. Sperry, New York. Eng. Pat. 8302, April 14, 1908.

SEE FR. Pat. 389,188 of 1908; this J., 1908, 978.—T. F. B.

Dyeing machines. J. M. Payne, Phenix City, and G. G. Wallace, Girard, Ala., U.S.A. Eng. Pat. 8393, April 15, 1908.

SEE U.S. Pat. 887,511 of 1908; this J., 1908, 625.—T. F. B.

Dyeing fabrics in open width; Machines for —. F. Shaw, and Whitefield Velvet and Cord Dyeing Co., Ltd. Fr. Pat. 394,382, Sept. 17, 1908.

SEE Eng. Pat. 4295 of 1908; this J., 1909, 88.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Sulphuric acid; Some mixed anhydrides of —. A. Pictet and G. Karl. Bull. Soc. Chim., 1908, 3, 1114–1126.

BESIDES the mixed anhydride of sulphuric and nitric acids, previously described (this J., 1907, 923), the authors have prepared similar mixed anhydrides of sulphuric acid with nitrous, boric, and chromic acids. The mixed anhydride of sulphuric and nitrous acids is prepared by mixing together solutions of the components in carbon tetrachloride. It has the composition, $(SO_3)_2(N_2O_3)_2$, melts at 198° – 200° C., and boils at 362° – 365° C. Two mixed anhydrides of sulphuric and boric acids were obtained, viz., $(SO_3)(B_2O_3)$ and $(SO_3)_2(B_2O_3)$, by heating the components together in sealed tubes. On heating above 100° C. they are dissociated. By heating the boryl disulphate with the corresponding alcohols, the authors

prepared methyl borate (b.pt. 65° C.), ethyl borate (b.pt. about 118° C.), and amyl borate (b.pt. 255° C.). Chromyl sulphate, $(SO_3)(CrO_3)$, was prepared by heating together chromic anhydride and sulphuric anhydride in a sealed tube at 75° C. It is easily decomposed on heating, with formation of chromium sulphate and oxygen.—A. S.

Pyridine in strong ammonia solution; Detection and determination of —. G. Pinchbeck. Pharm. J., 1909, 82, 84–85, 177.

Detection.—Fifty c.c. of the ammonia solution are diluted, then neutralised with hydrochloric acid. The cool liquid is rendered alkaline with sodium hydroxide, and then shaken with 10 c.c. of chloroform. The chloroform extract is filtered and divided into two portions. To one, 0.25 c.c. of strong hydrochloric acid and 2 drops of a 2 per cent. solution of bromine in chloroform, are added. The crystalline bromo-compound, $C_5H_5NBr_2$, is precipitated if only a small amount of pyridine be present. The other portion is exposed to a current of warm air, when the residue left will have the characteristic odour of pyridine, if that base be present. *Determination.*—100 c.c. of the ammonia solution, diluted with an equal volume of water, are carefully neutralised with dilute sulphuric acid. The cool solution is then made alkaline with sodium hydroxide, diluted to 400 c.c. with distilled water, and distilled until one-third has passed over. The distillate is treated with 10 grms. of mercuric chloride, dissolved in 150 c.c. of distilled water. The precipitate is collected, and washed with cold 92 per cent. alcohol, which removes the pyridine-mercuric chloride compound. The alcoholic filtrate is carefully neutralised, diluted to 400 c.c., and again slowly distilled. The distillate should not require for neutralisation more than 2 c.c. of N/10 sodium hydroxide solution, with methyl orange indicator. This is equivalent to 0.00948 per cent. of pyridine.—J. O. B.

Felspar; Decomposition of — by water. W. Funk. Z. anorg. Chem., 1909, 22, 145–146.

CUSHMANN (this J., 1907, 608) effected the extraction of alkalis from felspar by electrolysis under specified conditions, but the author has studied the effect of water alone. The quantity of alkali dissolved, depends on the surface and the time of contact. When felspar, ground to a fine powder in the dry state and passed through a sieve with 800 holes per sq. cm., is suspended in water, the coarser particles rapidly sink to the bottom, but a considerable proportion remains suspended for weeks, the upper layers becoming opalescent. The particles remaining in suspension no longer consist of pure felspar, but are partly composed of colloidal decomposition products. An analysis of the separated colloid, after drying at 120° C., showed: water, 5–15; silica, 40–60; aluminium oxide, 11–18; potassium oxide, 17–22 per cent. The original felspar contained 12.8 per cent. of potassium oxide and 2.3 of sodium oxide. The suspended matter is a negative colloid which is readily flocculated by traces of acid. The liquid contained in the state of true solution only 0.1–0.2 per cent. of the total alkali of the felspar and mere traces of silica and alumina. Felspar which has been coarsely broken in the dry state may be ground to a fine powder in presence of water for 12 hours without forming a colloidal suspension. The decomposition of the felspar in the above experiments was not confined to its finest particles; even the heavier particles of the sediment, when stained with "methylene blue," showed a blue-coloured zone of decomposed mineral around a centre of unchanged felspar. Ground felspar, when shaken with water, gives a solution which is coloured pink by phenolphthalein, and if this alkalinity be neutralised, the pink colour gradually returns owing to further decomposition. Fused felspar decomposes far more readily than the ordinary. If carbon dioxide be passed at intervals through a suspension of felspar in water, a point is ultimately reached when the solid matter settles completely, leaving a clear liquid. This liquid was found to contain 0.7 per cent. of the total alkali in the case of ordinary felspar and 1.1 per cent. in the case of fused felspar. In practice, ground felspar shows far less tendency to "cake" in waters rich in carbon dioxide than when ordinary water is used for mixing.—J. F. B.

Calcium phosphide: Rapid preparation of —. for obtaining phosphine. C. Matignon and R. Trannoy. Compt. rend., 1909. 148, 167—170.

CALCINED calcium phosphate (232.5 parts) in fine powder, is intimately mixed with aluminium powder (108 parts) ($3\text{Ca}_3(\text{PO}_4)_2 : 8\text{Al}_2$), heated to redness, and then ignited. The resulting mixture of alumina and calcium phosphide is very uniform. To prepare phosphine from it, it is broken up and placed in a flask provided with a dropping funnel and delivery tube, and water is added. When the evolution of gas slackens, hydrochloric acid is gradually added till reaction is complete. The gas evolved, when the air has been expelled from the vessel, contains 96—97 per cent. of phosphine, the only impurity being hydrogen. (See also this J., 1900, 667.)—J. T. D.

Sulphur dichloride: Reaction of —, on metallic oxides. F. Bourion. Compt. rend., 1909. 148, 170—171.

THE simultaneous reaction on metallic oxides of sulphur dichloride and chlorine (this J., 1904, 441) yields in many cases a mixture of chloride and oxychloride, the latter being difficult or impossible to decompose. If sulphur dichloride be used alone, and be volatilised over the metallic oxide contained in a boat in a heated glass tube, the excess of sulphur dichloride being retained by condensing arrangements at the far end of the apparatus, chlorides free from oxychloride are much more readily obtained. The general reaction is, $2\text{MO} + 2\text{S}_2\text{Cl}_2 = 2\text{MCl}_2 + \text{SO}_2 + 3\text{S}$; the appearance of sulphur, therefore, as the boat is gradually heated, is an indication of the beginning of reaction, and the temperature can be raised as gradually as desirable. Too high a temperature favours the formation of oxychloride. —J. T. D.

Iodic anhydride: Action of heat on —. M. Guichard. Bull. Soc. Chim., 1909, 5, 86—89.

IODIC anhydride, when partially decomposed by heat, acquires a brown colour, a portion of the iodine and oxygen being retained in the occluded form. The ratio between the occluded elements is the same as in the anhydride itself, and both iodine and oxygen are liberated when the brown substance is dissolved in water; but the colour is not affected by treating the compound with carbon bisulphide or fuming nitric acid. The suggestion is made that this phenomenon of occlusion, though not always apparent, may be very general in cases of thermal decomposition. —F. SONN.

Borax industry of the United States. U.S. Geol. Survey, 1908. [T.R.]

WHILE the total yield in 1907 was only 5323 tons less than in 1906, and the decrease in value only \$60,890, yet the sudden drop in market value was such that by the end of 1907 only the largest properties continued to carry on mining operations. The consumption of borax has not materially increased, and in some branches of industry it has decreased. At the same time new mines opened within the year are prepared to meet even extraordinary demands as to output. California continues to be the only State which makes a commercial production of borax annually, the few small marsh deposits in Nevada being no longer productive. In 1907 the entire output was derived from the counties of San Bernardino, Inyo, and Ventura, Cal. The output of crude borax for 1907 was 52,850 short tons, valued at \$1,121,520, as compared with 58,173 short tons, valued at \$1,182,410 in 1906.

The statistics of production of borax in California from 1900 to 1907, inclusive, are given in the following table:—

Year.	Short tons.	Value.
1900.....	25,837	\$1,013,251
1901.....	23,231	1,012,118
1902.....	20,004	2,538,614
1903.....	34,430	661,400
1904.....	45,647	698,810
1905.....	46,334	1,019,154
1906.....	58,173	1,182,410
1907.....	52,850	1,121,520

The imports of borax and borates into the United States in 1907, as compared with 1906, were as follows:—*Borax*, 1907, 2,268,065 lb., valued at \$77,258; 1906, 791,425 lb., valued at \$27,243. *Borates*, calcium and sodium (crude), and refined sodium borate, 1907, 2959 lb., valued at \$175; 1906, 57,711 lb., valued at \$2436. *Boric acid*, 1907, 534,524 lb., valued at \$23,547; 1906, 986,021 lb., valued at \$33,200.

The main feature of the borax industry since about the middle of 1907 has been the steady reduction in price, which fell from 6½c. to 7c. per lb. at New York early in the year to 4½c. and 5½c. per lb. during the latter part of the year. It was this reduction in price which caused the closing of most of the other productive mines in California, although some of them had virtually exhausted the ore of a profitable grade in their properties.

In 1907 there were five producing mines in California, one in Inyo, two in San Bernardino and two in Ventura counties. With one exception these properties had ceased production by the end of that year, though some of the operators have since commenced operations at other and more favourable places.

PATENTS.

Pyrites, pyrites cinder, and the like: Treating liquors obtained from —. J. H. Thwaites, Peterborough. Eng. Pats. 24,847, Nov. 9, 1907, and 27,506, Dec. 13, 1907.

ZINCIFEROUS materials, particularly low-grade zinc ores and tailings, are added to liquors obtained from pyrites, pyrites cinder and the like, and worked up therewith. After removal of the copper, if present, the iron may be precipitated as hydrated oxide by the addition of a suitable zinc compound. The mixture is then oxidised and subsequently peroxidised, any metal which would prevent the formation of pure white zinc compounds being precipitated at an appropriate stage of the process by the addition of a suitable sulphide (see following abstract).—C. J. G.

Metallic compounds: Separation of — by wet methods. J. H. Thwaites. Fr. Pat. 393,502, Aug. 20, 1908. Under Int. Conv., Dec. 9, 1907.

THE neutral or slightly acid solution containing compounds of several metals, is treated with zinc sulphide: (1), at the ordinary temperature whereby sulphides of silver, lead, mercury, copper, bismuth, tin, arsenic, and antimony are precipitated; (2), after heating, in order to precipitate cadmium sulphide in addition to those mentioned; or (3), first at the ordinary temperature and then after heating, in order to precipitate cadmium sulphide separately from the other sulphides. The process may also be varied in other ways. For instance, the solution may be rendered strongly acid before treatment with zinc sulphide, in which case, any arsenic or antimony present as arsenate or antimonate respectively is precipitated as sulphide, and cadmium sulphide is precipitated even at the ordinary temperature. After removing the precipitated sulphides, cobalt, nickel, and manganese may be separated from the solution by treatment with an oxidising agent. The solution may also be further treated to separate any compounds which would otherwise subsequently prevent the recovery of white zinc compounds from the solution, e.g., zinc oxide, carbonate, or hydroxide may be added, the mixture being heated and oxidised if necessary, in order to precipitate hydroxides of iron, aluminium, and chromium.—A. S.

Alkali: Apparatus for recovering —. C. F. Logan, Big Island, Va. U.S. Pat. 910,074, Jan. 19, 1909.

THE apparatus comprises a concentrating chamber in the form of a vertical stack somewhat narrower at the bottom than at the top, through which heated gases are passed in an upward direction. The liquid to be concentrated is conveyed to a trough, which surrounds the exterior of the stack at its upper end, and is thence directed on to baffles arranged in the line of travel of the heated gases after they leave the stack. From these baffles the liquid is projected against the inner walls of the stack and is finally collected in a receptacle at the bottom.—C. A. W.

Caustic alkalis: Process of making — W. T. Gibbs, Buckingham, Canada. U.S. Pat. 910,662, Jan. 26, 1909.

CAUSTIC alkalis are produced by digesting finely-divided refractory silicates containing alkalis, e.g., potash feldspar, with a solution of an alkaline-earth hydroxide, for instance, milk of lime, under steam pressure. —A. S.

Metal salts: Process of forming — W. H. Allen, Detroit, Mich. U.S. Pat. 910,982, Jan. 26, 1909.

SMELTING furnace gases containing metallic fumes are mixed with acid vapours, e.g., sulphuric acid, at a temperature above that at which combination will take place, then the temperature of the mixture is reduced below that of dissociation of the salts formed by the union of the metal and the acid, and finally the gases are treated with a spray of cold water to condense the salts. —A. S.

Boron carbide: Massive and process of making same. S. A. Tucker, New York. Eng. Pat. 22,134, Oct. 11, 1907.

SEE U.S. Pat. 869,114 of 1907; this J., 1908, 80.—T. F. B.

Metallic compounds: Wet methods for the separation of — J. H. Thwaites, Peterborough. Eng. Pat. 27,102, Dec. 9, 1907.

SEE Fr. Pat. 393,502 of 1908; preceding.—T. F. B.

Pyrites, pyrites waste, and other analogous substances: Method of treating and utilising solutions from — J. H. Thwaites. Fr. Pat. 394,157, Aug. 22, 1908. Under Int. Conv., Dec. 13, 1907.

SEE Eng. Pat. 27,506 of 1907; preceding.—T. F. B.

Titanium-nitrogen compounds: Production of — J. Y. Johnson, London. From Badische Anilin und Soda-Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 1842, Jan. 27, 1908.

SEE Fr. Pat. 387,002 of 1908; this J., 1908, 809.—T. F. B.

Chloride of zinc: Process for the preparation of and apparatus therefor. G. Carrara, Milan, Italy. Eng. Pat. 10,522, May 14, 1908.

SEE Fr. Pat. 385,448 of 1907; this J., 1908, 628.—T. F. B.

Sodium chromate and other chromates: Process for making — National Electrolytic Co. Fr. Pat. 393,984, Sept. 5, 1908. Under Int. Conv., Sept. 20, 1907.

SEE U.S. Pat. 901,436 of 1908; this J., 1908, 1151.—T. F. B.

Rock salt: Process for purifying — New Salt Syndicate, Ltd. Fr. Pat. 394,305, Nov. 21, 1907.

SEE Eng. Pat. 25,442 of 1906; this J., 1908, 280.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Enamelling: Heating and pickling of the finished iron articles before — J. Grünwald. Stahl. u. Eisen, 1909, 29, 137—139.

ONLY the best brands of wrought-iron sheet should be used for enamelling. An iron of suitable composition contains 0.05—0.08 per cent. of carbon, less than 0.03 of phosphorus, 0.25—0.35 of manganese, and about 0.02 per cent. of silicon. A suitable cast-iron contains 3.5 per cent. of carbon, 2.0 of silicon, 1.4—1.8 of phosphorus, and 0.5—0.7 per cent. of manganese; for thin-walled cast-iron articles, 1—2 per cent. of good steel waste is added to the metal. The formed iron articles are heated to about 750—850° C. for not too long a period. It is important to exclude air as completely as possible during this process, to expose the surface of each article completely (i.e., not to pack the ware too tightly), and to cool slowly. Wrought-iron after this treatment should have a uniform black or velvet-brown colour. After heating, the articles are pickled for 30—45 minutes, either in hydrochloric acid (1 part of acid of sp. gr. 1.471 to 2 parts of water) at 20—30° C., or, less usually, in sulphuric

acid (15 parts of acid of sp. gr. 1.79—1.80 to 85 of water) at 70°—80° C. Both acids should be free from arsenic to avoid evolution of arseniuretted hydrogen. Pickling may be carried out in vessels provided with agitators, or through which the acid is passed systematically. As fresh acid acts very slowly, a proportion of spent liquid may be added. Spent hydrochloric acid liquors are economically reactivated by the addition of sulphuric acid. In pickling cast-iron articles, good results are obtained with sulphuric acid of 8°—10° B., to which 4 per cent. of stannous chloride or zinc chloride may be added. During heating and pickling, wrought-iron ware loses about 4 per cent. in weight, and cast-iron about 0.3 per cent. After pickling, the articles are washed in water, scrubbed, boiled in soda-lye, and finally dried at about 130° C. The sharp drying restores the mechanical properties of the iron, which are impaired by the heating and pickling. —A. G. L.

PATENTS.

Kaolin: Composition of matter particularly adapted to replace — A. Monin, Lent, France. Eng. Pat. 1935, Jan. 28, 1908.

SEE Fr. Pat. 383,356 of 1907; this J., 1908, 335.—T. F. B.

Ceramic and like porous objects: Process for impregnating — Grünzweig and Hartmann Ges.m.b.H., Ludwigshafen on Rhine, Germany. Eng. Pat. 11,321, May 25, 1908. Under Int. Conv., June 6, 1907.

SEE Fr. Pat. 390,456 of 1908; this J., 1908, 1063.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Chimney with acid-proof lining: Tall — Engineering Record, New York, 1908, 17.—S. Proc. Inst. Civil Eng., 1908, 173, [iii], 26. [T.R.]

THE tallest chimney in America, 366 feet high, has been built at Rochester, N.Y., the height being necessary to avoid nitric acid fumes being set free at a lower elevation. These fumes have a temperature of 200° F., and their condensation would destroy concrete or ordinary brick-work, hence an acid-proof brick lining separated from the main shell by an air-space of 2 inches and supported by corbels is provided, the mortar in the lining being of a special mixture of sodium silicate and asbestos wool. This separation provides for easy relining in case of deterioration notwithstanding the precautions. A feature of the construction is the provision of perforated brick blocks in the shell, of radial form and of various sizes to suit the diminishing diameter, being 4½ inches thick and 6½ inches wide on their external faces, the lengths varying between 4 inches and 10½ inches, thus securing a strong bond. The perforations facilitate the proper burning of the brick in manufacture, and also assist the adhesive power of the mortar, this having been shown to be 61½ lb. per square inch as against 21½ lb. with ordinary blocks. The outside diameter at top and bottom is 11 feet 0¼ inch and 27 feet 10¼ inches respectively. Other dimensions, and the description of the foundations and of the protection from lightning, which is of an elaborate kind, are given. A wind-pressure of 100 miles an hour is provided against, and a maximum pressure due to this and weight, will produce an effect of 21 tons per square foot on the leeward side.

Egyptian cement trade. Board of Trade J., Feb. 4, 1909 [T.R.]

PATENTS.

Cement clinker: Process of and apparatus for making — C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foste Co., New Jersey. U.S. Pat. 910,121, Jan. 19, 1909.

THE cement material is calcined in an inclined rotary kiln, from which it is delivered on to a stationary clinker in hearth in a chamber heated by a producer-gas flame

fed with hot air. Part of the combustion products from this chamber passes through the calcining kiln, and the remainder is led through regenerators for heating the air.—A. T. L.

Products for refractory, ceramic, or abrasive uses from bauxite or other aluminous earths; Process of manufacturing —. E. von Seemen, Paris. Eng. Pat. 702, Jan. 11, 1908. Under Int. Conv., Jan. 11, 1907.

SEE Fr. Pat. 386,110 of 1908; this J., 1908, 686.—T. F. B.

Sulphate of lime; Processes of treating waste hydrated —. J. E. Eastwick, Philadelphia, U.S.A. Eng. Pat. 19,369, Sept. 15, 1908.

SEE U.S. Pat. 898,451 of 1908; this J., 1908, 1021.—T. F. B.

Plaster of Paris; Process for revivifying —. J. E. Eastwick. Fr. Pat. 394,322, Sept. 15, 1908.

SEE U.S. Pat. 898,451 of 1908; this J., 1908, 1021.—T. F. B.

X.—METALS AND METALLURGY.

γ -iron; Conditions of equilibrium between carbon monoxide, carbon dioxide, and carbon dissolved in —. F. Giolitti. Rend. Soc. Chim. di Roma, 1908, 6, 337—341.

CEMENTATION steel prepared by the usual methods suffers from the great disadvantage of non-uniform composition, the outer layers frequently being very brittle owing to the presence of free cementite. By using as cementing agent, carbon monoxide mixed with different proportions of carbon dioxide or a hydrocarbon, according to the content of carbon desired in the carburised metal, the author states that it is possible to obtain carburised zones of any desired thickness in which the carbon content (between 0.1 and 1.2 per cent.) is constant within narrow limits. This method allows of the cementation of many special steels which hitherto could not be carburised on account of the great brittleness produced so soon as the amount of carbon exceeded a certain limit. The author has studied the equilibrium: $2CO \rightleftharpoons CO_2 + C$ in presence of γ -iron (by which the carbon is dissolved) at temperatures between 850° and 1500° C. The experimental results will be published when complete, but in the meantime it is stated that results have been obtained which confirm the existence of carbides other than cementite. (See this J., 1908, 154; also Fr. Pat. 392,960 and 393,355 of 1908; this J., 1909, 25, 145).—A. S.

Cementation steel; Phenomenon of "exfoliation" in — and means for preventing it. F. Giolitti. Rend. Soc. Chim. di Roma, 1908, 6, 354—358.

A piece of soft steel has been carburised by the ordinary cementation process to a depth of from 0.5 to 3 mm., and then tempered in the usual way, there is an abrupt change of structure at a depth of from 0.2 to 2 mm. It is to this change of structure that is due the phenomenon "exfoliation" which is observed when the steel is subjected to shocks or to excessive strain. Experiments showed that the carbon content of the carburised zone does not decrease regularly from the outside inwards, and this is in accord with the fact, observed previously by the author, that when a steel in which the carbon content ranges gradually from a high hyper-eutectic to a low hypo-eutectic value (e.g., cementation steel), is cooled slowly from a higher temperature to below 900° C., liquation occurs, cementite accumulating in the hyper-eutectic zone, and ferrite in the hypo-eutectic region, with an intermediate zone in which the composition is that of the eutectic, pearlite. To prevent this liquation, and consequent "exfoliation," it is necessary only to give a period of slow cooling, and experiments in which the steel was transferred directly from the cementation chamber, without allowing it to cool therein, into the tempering liquid, confirmed this view. Another method of preventing "exfoliation" consists in carburising by the method described in the preceding abstract; in this way a carburised zone in which the carbon content rises above 0.9 per cent. may be obtained, thus avoiding the presence of free cementite.—A. S.

Cementation; Lower limit of the interval of temperature within which it is possible to effect —. F. Giolitti and F. Carnevali. Rend. Soc. Chim. di Roma, 1908, 6, 359—363.

IN A previous article (see this J., 1908, 1154), the authors have stated that cementation cannot be effected at temperatures below 700° C. This statement appears to conflict with results obtained by Charpy (this J., 1903, 631, 911) on the action of carbon monoxide on iron, but the difference is due to the interpretation of the term cementation. In the authors' opinion, the term means the carburisation of a soft steel at a temperature below its melting point, with the production of a steel which does not differ with respect to micro-structure or mechanical properties from a steel of the same composition obtained in any other way and submitted to the same thermal and mechanical treatment. A repetition of Charpy's experiments at about 600° C., showed that carbon monoxide acts upon iron at this temperature, forming a compact, adherent, grey layer, probably a carbide of iron, on the surface of the metal. It is the formation of this layer which led Charpy to conclude that cementation had taken place. Microscopic examination showed, however, that this layer has not the structure of true steel, and on removing portions of it by prolonged polishing, the structure of the steel below was found to be exactly the same as before treatment. No true cementation had therefore taken place.—A. S.

Malleable cast iron; Manufacture of —. F. Giolitti. Rend. Soc. Chim. di Roma, 1908, 6, 388—393.

THE author disputes the statements of Wüst (this J., 1908, 450) that in the production of malleable cast iron, (1), decarburisation does not take place until the carbon of the cementite has separated in the form of temper-carbon; and (2), that the oxidation of the carbon in the interior of the cast iron is due exclusively to the penetration of the heated metal by oxidising gases (oxygen, carbon dioxide). A critical examination of Wüst's results, together with the results of previous work by himself and Carnevali and Gherardi, leads him to the conclusion that besides the oxidation of temper-carbon, the carbon dissolved in the iron is also directly oxidised; and that besides the penetration of the heated metal by the oxidising gases, the migration of the dissolved carbon towards the surface of the iron, owing to differences of concentration in the inner and outer portions of the metal, also plays a part.—A. S.

Magnesium-lead alloys; Electric conductivity of —. N. Stepanow. Z. anorg. Chem., 1908, 60, 209—229. Chem. Zentr., 1909, I, 349.

THE cooling curve of magnesium-lead alloys shows a maximum, corresponding to the compound, Mg_2Pb , and two eutectic points. The formation of mixed crystals (solid solutions) could not be detected either thermometrically or by microscopic examination. In agreement with the cooling curve, the electric conductivity curve is almost a straight line between 0 and 66.6 atoms per cent. of magnesium, whilst the remaining portion consists of two separate branches. The branch corresponding to alloys with from 95.5 to 100 atoms per cent. of magnesium is of a steepness hitherto only observed with solid solutions, and the author, being of the opinion that the electric conductivity offers the most sensitive means of detecting the formation of such solutions, concludes that mixed crystals containing up to 4.5 atoms per cent. of lead are formed.—A. S.

Preparing iron for enamelling. Grünwald. See VIII.

Mineral production of British Columbia. Eng. and Min. J., Jan. 30, 1909. [T.R.]

THE following are the estimated figures for the mineral production of British Columbia, with a column showing the increase (I.) or decrease (D.) as compared with 1907:—

	1908.	changes.	
Gold, placer	\$682,000	D.	\$146,000
Gold, lode	5,291,520	I.	1,236,500
Total gold	\$5,973,520	I.	\$1,090,500
Silver	1,610,000	D.	93,825
Lead	1,654,605	D.	636,763
Copper	5,792,820	D.	2,373,724
Zinc and iron	280,000	I.	229,400
Total	\$15,219,935	D.	\$1,875,912
Coal	\$5,950,000	D.	\$350,235
Coke	1,488,000	I.	150,522
Building materials, etc.	1,200,000	I.	50,900
Total	\$8,638,000	D.	\$149,113
Summary:			
Metalliferous	\$15,219,935	D.	\$1,875,912
Non-metalliferous	8,638,000	D.	149,113
Total mineral production..	\$23,857,935	D.	\$2,025,025

PATENTS.

Iron or steel; Treatment of — for the prevention of oxidation or rust. Rudge-Whitworth, Ltd., and H. L. Heathcote, Coventry. Eng. Pat. 490, Jan. 8, 1908.

THE iron or steel articles are immersed in a mixture consisting of iron phosphate or phosphates mixed with 20 times their weight of water, to which is added 1/200 part by volume of ortho-phosphoric acid. The bath is heated and retained at the boiling point for from 30 minutes to 2 hours, in which time a greenish-black film, consisting of ferrie and ferrous phosphates, is formed on the surface of the articles. The articles are washed, quickly dried, and oiled. The coating formed is durable and highly resistant to rusting influences.—F. R.

Zinc; Separation of — from its ores or compounds. H. L. Sulman, London. Eng. Pat. 701, Jan. 11, 1908.

ZINC sulphite, which is obtained for instance by the process described in Eng. Pat. 21,672 of 1906 (this J., 1907, 1144), is roasted in horizontal revolving cylinders, from which air is excluded, and is thereby converted into zinc oxide which is practically free from sulphate or sulphide. Each cylinder is furnished with an outlet pipe to conduct away the sulphurous acid and water vapour evolved, and a few large iron balls are placed in with the charge to prevent its caking.—F. R.

Zinc; Continuous process and apparatus for the extraction of — from its sulphide. T. J. Heskett, Brunswick, Australia. Eng. Pat. 1761, Jan. 25, 1908.

THE reduction is effected by bringing the sulphide into contact with a surface of molten copper or iron. The latter is contained within a crucible or retort which is maintained at a temperature above the volatilising point of zinc either by an electric arc above the surface of the metal or by external heating. The sulphide is fed upwards through the bottom of the crucible and may, if desired, be mixed with some adhesive, such as tar, so that it does not mix with the layer of molten metal. The reduced zinc passes away at the top of the furnace to condensers, whilst the liquid sulphide of copper or iron is conveyed to a reducing chamber where the metal is recovered by subjection to an air blast and—in the case of iron—simultaneous reduction with carbonaceous matter. The reduced metal is returned by gravitation into the retort and the process repeated. The waste sulphurous gases from the reducing chamber may be used to heat the furnace, or may be mixed with the zinc vapour as it passes away to prevent the oxidation of that metal. The copper or iron, becoming saturated with foreign metals contained in the ore, has to be renewed occasionally.—C. A. W.

Furnaces; Means for charging the retorts of zinc and other analogous —. E. Dor-Delattre, Dorplein, Holland. Eng. Pat. 13,822, June 30, 1908. Under Int. Conv., July 8, 1907.

THE apparatus comprises a conveyor drum provided

with a tangential outlet, and arranged so that, by means of a screw and worm, it can be turned about its own axis. In this way, any desired inclination can be given to the tangential tube through which the material is charged into the retorts. The conveyor is formed of two discs connected by a series of propeller blades; one of these discs is fixed on the shaft of a motor, while the other contains a circular opening in its centre through which the material, fed through a hopper at the top, falls into the drum. The aforesaid blades being very shallow, their inner edges are some distance from the feeding aperture at the side, and in this way the material does not become involved in the rotation of the wheel, so as to be thrown against the walls of the casing, but falls to the bottom and is at once projected into the charging tube. The whole apparatus may be fixed to a travelling crane and, during its passage between the retorts, the supply of material can be cut off by means of a damper in the hopper.—C. A. W.

Gold; Impts. in the recovery of — by the cyanide process, and in other chemical processes wherein zinc is employed. [Zinc strips or ribbons]. E. H. Strange, C. A. Pim and F. E. Matthews, London. Eng. Pat. 7211, April 1, 1908.

MOLTEN zinc is caused to issue from a narrow orifice and to impinge at once on to a rapidly moving, and suitably cooled, disc or wheel, set horizontally or at a convenient angle, so that the zinc is received on one of its side faces, or set vertically so that the zinc is received on its periphery. The rapidly moving disc conveys away the zinc as a surface film, which immediately solidifies forming a very thin strip or ribbon, having a width similar to the cross section of the orifice. The thin strips are said to act more advantageously than the usual zinc shavings, for the precipitation of gold from cyanide solutions, or for similar chemical precipitations. If the issuing zinc comes in contact with the side of the disc, the strips will have a somewhat twisted formation, which assists in maintaining air spaces in the precipitation boxes.—F. R.

Metal coating. G. H. Clamer, Philadelphia, Pa. U.S. Pat. 909,869, Jan. 19, 1909.

IRON or other similar metal is coated with zinc and afterwards with lead saturated with that metal. The coating may also contain up to 4 per cent. by weight of tin.—C. A. W.

Compound metal body and process of producing same. J. F. Monnot, Assignor to Duplex Metals Co., New York. U.S. Pat. 909,924, Jan. 19, 1909.

ARTICLES of a light metal, such as aluminium, are brought into contact with another non-ferrous metal, *e.g.*, silver, of high melting point, the latter being in a molten condition, so that it forms a layer on the aluminium. Articles coated in this way may afterwards be soldered together.—C. A. W.

Compound metal objects; Process and apparatus for producing —. J. F. Monnot, Assignor to Duplex Metals Co., New York. U.S. Pat. 910,045, Jan. 19, 1909.

THE object to be coated is passed through a bath of molten metal maintained at a temperature much above its melting point. If desired, the object may first have been heated to any particular temperature, but the transference to the bath must be made under conditions which preclude oxidation. As the object, coated with a layer of the solidified coating metal, emerges from the bath, it is further subjected to a stream of the molten metal, so that a second layer is formed upon the first.—C. A. W.

Liquids; Apparatus for extracting — from ores or other substances. E. P. Lynch, Salt Lake City, Utah. U.S. Pat. 910,075, Jan. 19, 1909.

THE apparatus consists essentially of an endless conveyor comprising a series of connected trays, each provided with a perforated false bottom covered with a layer of filter-cloth. Each tray as it moves forward is supplied

with a thin layer of the pulp, which is uniformly distributed over the surface of the cloth, the separation of the liquid being effected by applying suction through the false bottom. Means are provided for the cleansing of the mass by the application of water over the whole surface of the filter during certain portions of its travel. The solid matter is discharged at the end of the conveyor, its complete removal being effected by a pivoted scraper which engages with the bottoms of the pans as they become inverted.—C. A. W.

Blast-furnace smelting. J. W. Nesmith, Assignor to Colorado Iron Works Co., Denver, Colo. U.S. Pat. 910,082, Jan. 19, 1909.

A MIXTURE of oxidised ores, fluxes, and a carbonaceous reducing agent is fed into a blast-furnace, which is supplied independently with air and with hot combustion gases produced by burning a suitable fuel outside the furnace.—A. S.

Blast-furnace smelting; Method of —. J. W. Nesmith, Assignor to Colorado Iron Works Co., Denver, Colo. U.S. Pat. 910,480, Jan. 19, 1909.

A MIXTURE of sulphide ores and fluxes is fed into a blast-furnace, which is supplied independently with air and with hot combustion gases produced by burning a suitable fuel outside the furnace.—A. S.

Furnace for the reduction of ores. G. F. Rendall, New York, Assignor to American Reduction Company. U.S. Pat. 910,086, Jan. 19, 1909.

THE furnace is provided internally at its upper portion with an air chamber, and, at its lower portion, with a water jacket. Beneath the latter, a second chamber of annular shape is arranged so as to communicate with the air chamber. Means are provided immediately above the hearth for the introduction of a reducing gas, and, by the discharge of an injector into a condenser connected with the top of the furnace, for the creation of a suction above the charge. The hearth is supported on a carriage and can be raised or lowered at will.—C. A. W.

Crucible furnace; Gas generating —. E. H. Schwartz, Assignor to Kroeschell Bros. Co., Chicago, Ill. U.S. Pat. 910,091, Jan. 19, 1909.

THE combustion chamber is surrounded by a supplemental chamber, tuyères being arranged so as to communicate between the two. Means are provided for introducing fluid tangentially into the supplemental vessel and also for removing any accumulated liquid from the latter without the admission of air or escape of fluid.—C. A. W.

Vaniferous iron ores; Treatment of —. A. Sinding-Larsen, Christiania. Eng. Pat. 27,282, Dec. 10, 1907. Under Int. Conv., Dec. 13, 1906.

EE Fr. Pat. 384,882 of 1907; this J., 1908, 509.—T. F. B.

Aluminium; Manufacture of —. H. Herreschmidt, Paris. Eng. Pat. 433, Jan. 7, 1908. Under Int. Conv., Jan. 10, 1907.

EE Fr. Pat. 383,554 of 1907; this J., 1908, 344.—T. F. B.

Method for aluminium and its alloys, and its application. F. M. Mrazek. Fr. Pat. 394,115, Sept. 11, 1908.

EE Eng. Pat. 13,689 of 1907; this J., 1908, 1068.—T. F. B.

Alloys; Art of producing alloyed —. J. Churchward, Mount Vernon, U.S.A. Eng. Pat. 12,383, June 9, 1908. Under Int. Conv., Sept. 18, 1907.

EE U.S. Pat. 884,009 of 1908; this J., 1908, 451.—T. F. B.

Al alloys. J. Churchward. Fr. Pat. 394,239, Sept. 12, 1908.

EE U.S. Pat. 868,327 of 1907; this J., 1907, 1202.—T. F. B.

Alloys; Apparatus for washing or extracting —. R. Freygang, Hamburg, Germany. U.S. Pat. 910,279, Jan. 19, 1909.

EE Eng. Pat. 13,901 of 1907; this J., 1908, 408.—T. F. B.

Metals; Process of depositing — upon and in combination with metals or metal articles. F. W. Gauntlett, Assignor to the Sherardizing Synd., Ltd., London. U.S. Pat. 910,369, Jan. 19, 1909.

SEE Eng. Pat. 9959 of 1906; this J., 1907, 765.—T. F. B.

Oxides; Process for the reduction of refractory —. K. A. Kühne, Assignor to Titan-Ges. m. b. H., Dresden, Germany. U.S. Pat. 910,394, Jan. 19, 1909.

SEE Addition to Fr. Pat. 364,329 of 1906; this J., 1907, 1145.—T. F. B.

Nickel from silicious ores; Process for extracting —. A. Chalas. Fr. Pat. 393,991, Sept. 5, 1908. Under Int. Conv., Sept. 6, 1907.

SEE U.S. Pat. 887,735 of 1908; this J., 1908, 631.—T. F. B.

Metallurgical furnace. W. F. C. M. McCarty. Fr. Pat. 394,292, Sept. 15, 1908.

SEE U.S. Pat. 901,363 of 1908; this J., 1908, 1116.—T. F. B.

Separating solids from a liquid. Eng. Pat. 26,821. See I.

Metal salts. U.S. Pat. 910,982. See VII.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

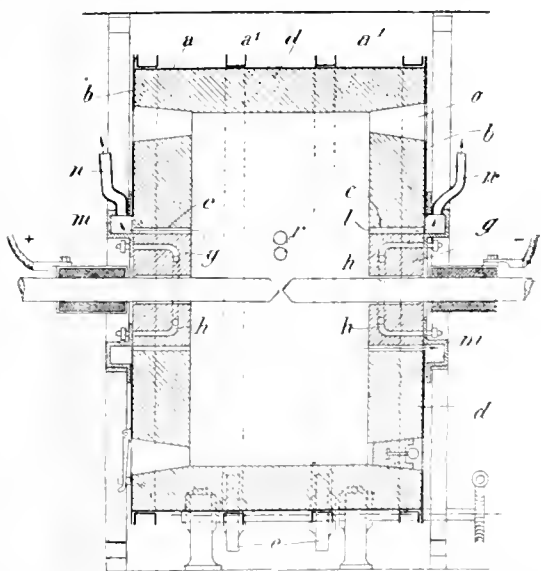
Sewage purification by electrolytic chlorine. Rideal. See XVIII.B.

PATENTS.

[*Electrical*] *Air propelling and ozonising apparatus.* J. R. Craig, jun., London. Eng. Pat. 585, Jan. 10, 1908.

THE spindle of an electric fan is connected with a high or low tension magneto-apparatus, or the fan motor may be provided with windings after the manner of a rotary converter; in either case the induced low tension current is transformed by a suitable induction coil. The secondary of the latter is connected to one or more open electrodes, consisting of radial spring wires mounted on the fan spindle on each side of a disc of mica, and located between the fan blades and the motor.—B. N.

Furnaces; Electric —. A. H. Imbert. Eng. Pat. 17,281, Aug. 17, 1908.



THE furnace comprises a cylindrical drum, a, closed at the ends by plates, b, provided with circular openings, c.

and lined with refractory material, *d*, the whole being revolved by wheels, *c*, operating in tracks, *a*¹. The central portions, *g*, of the ends, consist of refractory material, forming stationary hubs through which the electrodes pass, the hubs being provided with embedded pipes, *h*, for the circulation of a cooling fluid. The hubs, *g*, are slightly smaller in diameter than the orifices, *c*, and the gases escape from the furnace through the annular spaces, *l*, an annular box, *m*, covering each space and serving to collect and direct the gases into the pipes, *n*. Each end wall of the rotatable part is provided with two or more apertures, *o*, the charging openings on one side being arranged directly opposite to those on the other, which serve as discharging apertures. Openings, *r*, for observing the position of the arc, are arranged in the middle portion of the drum, and the length and diameter of the latter are so proportioned that the material will be directly under the arc during the treatment.—B. N.

Furnaces: Electric —. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 23,071, Oct. 29, 1908.

A TUBE of fused alumina is wound with a spiral ribbon of a refractory metal, such as platinum, acting as the heating conductor, a packing of alumina in an earthenware tube surrounding the heating conductor and alumina tube, and this in turn being surrounded by a packing of asbestos fibre in an earthenware pot. For the production of lamp filaments of tungsten, the alumina tube is placed in a vertical position, and one end is connected to a water-cooled iron tube serving as a cooling chamber, hydrogen gas being passed through the alumina tube and cooling chamber. For general use, or for dental work, a similar form of furnace is described, with a muffle-shaped tube of alumina.—B. N.

Batteries: Reversible galvanic —. H. C. Hubbell, East Orange, N.J., and H. W. Fuller, New York. Eng. Pat. 17,331, Aug. 18, 1908.

THE active material of the positive plate consists of a mixture of 60 per cent. of nickel hydroxide and 40 per cent. of silver oxide, compressed into a block on each side of a perforated supporting plate, and secured in position by envelopes of "asbestos filter papers," covered by wire cloth pockets, the edges of the latter being fastened by metal binding strips. The negative plate consists of dry-pressed tablets of cadmium oxide and nickel hydroxide, similarly mounted. Sodium or potassium hydroxide is used as the electrolyte.—B. N.

Acetates and in particular acetate of soda: Electrochemical process for the manufacture of —. C. H. Jacob, Lyon, France. Eng. Pat. 726, Jan. 11, 1908.

SEE Fr. Pat. 383,595 of 1907; this J., 1908, 341.—T. F. B.

Electrical discharge: Production of —. W. E. Evans, London. From Elektrochemische Werke, Bitterfeld, Germany. Eng. Pat. 8425, April 15, 1908.

SEE Fr. Pat. 389,112 of 1908; this J., 1908, 986.—T. F. B.

Electrical furnaces. J. Bounean, Paris. Eng. Pat. 8904, April 23, 1908. Under Int. Conv., April 24, 1907.

SEE Fr. Pat. 377,119 of 1907; this J., 1907, 1055.—T. F. B.

Refractory conductors. Eng. Pat. 17,618. See II.

Indiarubber. Eng. Pat. 21,441. See XIIIc.

(B).—ELECTRO-METALLURGY.

Electric steel furnaces: Characteristics of — in relation to decarboxation and desulphurisation. R. Amberg. Stahl u. Eisen, 1908, 29, 176—178.

THE removal of sulphur in the various types of electric furnace is explainable by reference to already ascertained facts. The main characteristic of the electric furnace is its very high temperature; and the mechanical and chemical results of this enter into the question. The

highest temperature is obtained in the Héroult furnace, just under the electrodes: this local high temperature is transmitted through the slag to the metal, and the local differences of temperature are sufficient to set up considerable convection currents. In the Stassano furnace the centre is, for a similar reason, hotter than the sides, but the differences seem not to be enough to effect mixture of the contents, as the bath is rotated at intervals round an inclined axis. In the induction furnace the temperature all through a vertical section is approximately the same: motion, and hence mixture, is obtained by alteration from place to place of the section of the bath, and (in the Röchling-Rodenhauser furnace) by means of secondary electrodes. There is also in the induction furnace an electrodynamic rotation of the contents of the bath. The temperature is nowhere so high as in the hottest parts of the Héroult furnace, and the metal is hotter than the slag. The chemical results of the high temperature in electric furnaces are, first, the direct increase of reaction-speed, and second, the higher fluidity of metal and slag, facilitating interchange of constituents and hence reaction, both in each (homogeneous) and between the two (heterogeneous). Homogeneous reaction in the slag will occur much more readily in the Héroult than in the induction furnace, as the temperature is so much higher; and those heterogeneous reactions will occur most readily in the induction furnace by which heat is carried to the slag. Hence the desulphurisation by calcium carbide, added or generated in the Héroult furnace, is not practicable at the lower temperature of the induction furnace; but the reaction is effected by ferrosilicon, for both the high temperature generated by the oxidation of the ferrosilicon, and the silica produced, render the slag more fluid and facilitate reaction. The removal of sulphur, whether by calcium carbide or by ferrosilicon, depends ultimately on the formation of calcium sulphide, and is facilitated by a reducing atmosphere (in which respect the Héroult furnace has the advantage over the induction furnace); though the segregation of manganous sulphide at the surface of the metal bath perhaps plays a subsidiary part. The formation of silicon sulphide, suggested by Osann, should not be left out of consideration, either; in an experiment of the author's on the behaviour of ferrous sulphide and silica in the electric arc, a quantity of silica was evolved far too great to be accounted for by simple volatilisation, and in all probability silicon sulphide was here formed, volatilised, and burnt to silica and sulphur dioxide. (See also this J., 1908, 691, 757, 817, 1071.)—J. T. D.

Copper sulphate: Electrolysis of solutions of —. F. Foerster. Z. Elektrochem., 1909, 15, 73—76.

THE author replies to Meyer's criticisms of his work and theories (this J., 1908, 863). He considers that the formation of cuprous sulphate at the cathode is due to the action of the current, according to the reaction $\text{Cu}'' + \ominus \rightarrow \text{Cu}'$, which takes place more readily than does the deposition of metallic copper until the equilibrium indicated by the equation, $2 \text{Cu}' : \text{Cu}'' + \text{Cu}$, is reached, i.e., until the solution is saturated with cuprous sulphate at the temperature of the experiment. The fact that the amount of cuprous oxide deposited by the current at low potentials is much less than the theoretical is due to the hydrolytic dissociation of cuprous sulphate into cuprous oxide and sulphuric acid, and to the reverse reaction, according to which cuprous oxide cannot be separated from the solution as soon as the latter has attained a certain degree of acidity.—A. G. L.

PATENTS.

Copper: Electrolytical refining of —. J. Awalo. St. Petersburg. Eng. Pat. 26,829, Dec. 4, 1907.

CRUDE copper is used as the anode, the electrolyte consisting of a neutral or alkaline solution of a cupric salt, protected from the air by a layer of oil. The cuprous salt may be produced by electrolysis, or by the previous action of metallic copper upon a cupric compound.—B.

Detinned material; Apparatus for washing — after or before electrolysis. The London Electron Works Co., Ltd., and E. Kardos, London. Eng. Pat. 17,113, Aug. 14, 1908.

A RING or carrier, provided with a toothed wheel, is mounted upon ball bearings on the washing tank, so that, by means of a pinion, the ring may be made to rotate alternately to the right and left. The perforated rectangular cage, containing the material, is lowered into the tank, and by means of a bar attached to the cage which engages with stops on the ring, the rotation of the latter may be imparted to the cage. The liquid from the washing tank passes into a settling tank, of sufficient area to allow of the separation of any suspended solids. The cleared liquid flows over a partition or bay into a receiver, from which it is pumped up again into the washing tank.—B. N.

Steel; Refining — in electric furnaces. Bismarckhütte, Upper Silesia. Eng. Pat. 6029, March 18, 1908. Under Int. Conv., Sept. 16, 1907.

SEE Fr. Pat. 386,786 of 1908; this J., 1908, 814.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Olive oils giving Baudouin's reaction; Tests of the purity of —. A. Zega and K. N. Todorovic. Chem.-Zeit., 1909, 33, 103.

A METHOD was found by the authors based on the behaviour of the hydrochloric acid solution of the red colouring matter described in this J., 1894, 69, on dilution with water. The oil under examination was examined by Villavecchia and de Fabris' well-known method of applying the Baudouin test. The mixture was shaken in a small separating funnel, and 5 c.c. of the hydrochloric acid layer withdrawn, diluted with water to 25 c.c. in a graduated cylinder, which was then shaken and allowed to stand. In the case of these pure olive oils, the colour disappeared within 5 to 8 minutes, whereas in the case of an oil containing 3 per cent. of sesamé oil, it persisted for 30 minutes.—C. A. M.

Carbon tetrachloride; Use of — in the quantitative determination of fat. O. Rammstedt. Chem.-Zeit., 1909, 33, 93—94.

THE author's experiments, described in detail, show that in the extraction of seeds a higher extract is obtained by the use of carbon tetrachloride than with ether. For example, a sample of linseed meal yielded 9.39 per cent. of extract to ether in 5 hours, as compared with 10.62 per cent. in 2½ hours, and 11.35 per cent. in 3½ hours to carbon tetrachloride. This is attributed to the extraction of more non-fatty substances by the latter solvent, and since it is also more difficult to expel carbon tetrachloride than ether from the extracted residue, the author considers that carbon tetrachloride should not be used as an extraction-solvent in analytical work.—C. A. M.

Chinese vegetable tallow. Ch. of Comm. J., Feb., 1909. [T.R.]

DURING recent years the imports of Chinese vegetable tallow to Europe, from China, have very largely increased, as is indicated by the figures in the following table of the exports from China to the United Kingdom,

Exports of vegetable tallow from China.

Country to which exported.	1905.		1906.		1907.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	lb.	£	lb.	£	lb.	£
United Kingdom	983,600	22,609	2,828,130	63,906	8,202,665	218,403
France	1,847,200	42,480	2,781,600	62,865	5,322,930	142,462
Italy	3,667,200	83,127	4,651,065	104,901	3,579,200	95,482

France, and Italy, taken from the returns of the Chinese Imperial Maritime Customs. Nine-tenths of the exports of vegetable tallow from China come from Hankow.

PATENTS.

Soap; Apparatus for making —. A. H. Trit-hard, Toronto. U.S. Pat. 910,083, Jan. 19, 1909.

THE apparatus consists of an oblong vessel with rounded ends, in which two annular heating devices ("headers") are mounted, side by side, a certain distance above the bottom. Connections are provided for supplying steam to the "headers," and steam heating pipes extend upwards from the "headers" so as to form vertical passages for the soap material. Between the "headers," at the bottom of the vessel, are agitators composed of a series of longitudinal parallel slats, connected together at an angle to the horizontal, and capable of being moved to and from the sides of the vessel, so as to convey soap material towards the vertical passages. A shaft is mounted centrally in each vertical passage and carries, at the bottom, a rotary scraper; and above this, a lifting screw for the purpose of raising soap material through the passages.—A. S.

Glycerin; Process of distilling —. F. J. Wood, New York. Assignor to Marx and Rawolle, New York. U.S. Pat. 910,440, Jan. 19, 1909.

IN the process claimed, part of the steam from which the glycerin vapours of a previous distillation have been condensed, is returned to the still, whilst the remainder is condensed, and subsequently evaporated by means of the heat given off by the glycerin in its condensation. Live steam is also introduced into the circuit between the still and the glycerin condenser.—C. A. M.

Fatty matters; Apparatus for extracting — on a large scale by means of carbon tetrachloride. P. Bernard. Fr. Pat. 394,314, Nov. 22, 1907.

SEE Eng. Pat. 28,364 of 1907; this J., 1908, 578.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

Oil paintings; Formation of cracks in —. E. Täuber. Chem.-Zeit., 1909, 33, 85—86, 94—95.

IN the author's comparative experiments to determine the influence of different pigments upon the cracking of paintings, 42 oil colours were tried. Successive layers of these were painted upon the ordinary prepared canvas at similar irregular intervals, the third and last being given six months after the first. The formation of cracks varied considerably, even when the pigments were used in one and the same medium, the so-called "quick-driers" being superior in this respect to the slowly drying pigments. The nature of the surface of the half-dry layer (*i.e.*, whether bright or dull) had no influence upon the results. The most pronounced and most numerous cracks were formed in pigments laid upon a grounding of red-lead, and the nature of the surface (whether glass, iron, aluminium, or sized paper) had no influence upon the cracking. Only very absorbent surfaces, such as are unsuitable for oil painting, diminished this tendency. Zinc white, white lead, and the two cobalt greens used as ground pigments formed layers particularly liable to crack. Zinc white also proved dangerous as a surface pigment, though the other three were innocuous. Surface coats of red lead never cracked, but cracks frequently appeared with the following pigments:—Chrome yellow, the two cobalt blues, alizarin

orange, carmine, light ochre (raw and burnt), blue-green oxide, green earth, Naples yellow, and dark cadmium yellow. In practice the ground coating ought to be

allowed to dry thoroughly before the next coating is applied in a thin layer. The addition of various resins to the drying oil had no effect in preventing cracks, but solutions of resins, such as Zanzibar copal and gum dammar resin, in turpentine oil, mixed with the pigments without oil, gave layers which showed no signs of cracking after a year. It is suggested that a mixture of a solution of a resin in turpentine oil with yolk of egg might form a sufficiently elastic medium which would closely resemble the drying oils in optical properties and would prevent the formation of cracks. An addition of egg-yolk to poppy oil, however, did not prevent the injurious influence of the latter. In special experiments with different oils it was found that poppy oil had the greatest effect in promoting the formation of cracks, then nut oil, and then linseed oil. Of 400 surfaces coated with poppy oil colours, 83 showed cracks, whilst 65 of the same number of surfaces coated with nut-oil colours cracked, but only five of those of the linseed oil experiments. The pigments in these experiments were red lead and zinc white. It would seem advisable, therefore, to discontinue the use of poppy oil in favour of linseed oil, wherever practicable. If the formation of cracks is due to the oxidation process being accompanied by a movement of the lower layer of paint, one would anticipate a simultaneous cracking of the lower layer, but in the author's experiments this was never found to be the case, the lower layer being always intact. A more likely explanation is that by the interaction of certain pigments under suitable conditions, electrical currents are produced, which cause a state of tension in the still moist surface layer. This is supported by the fact that in many cases disruption occurs while the upper coating is still soft and "tacky." The probability of the influence of electric currents on the drying process is shown by the fact that coats of the same paint spread in layers of equal thickness upon different non-absorptive surfaces require very different lengths of time to dry under parallel conditions. Thus zinc white in poppy oil spread in a moderately thick layer on copper dried in 9 days, on lead in 18 days, on porcelain in 6 months, and on zinc in a year. Taking porcelain as a neutral ground it would seem that copper has an accelerating and zinc a retarding influence on the drying of zinc white paint.—C. A. M.

PATENT.

Colouring matter suitable for use as a pigment or lake; Manufacture and production of a —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 23,714, Dec. 9, 1908.

By treating 3-chloro-6-nitraniline with formaldehyde, a greenish-yellow colouring matter can be obtained which is suitable for use as a pigment, or lake. *Example:*—345 parts of a 10 per cent. paste of 3-chloro-6-nitraniline and 30 parts of a 30 per cent. solution of formaldehyde are heated together, in a closed vessel, at a temperature of 70°–80° C., and with stirring, until no diazotisable base remains. The mixture is then allowed to cool and the product is filtered off and washed.—P. F. C.

(B.)—RESINS, VARNISHES.

PATENTS.

Varnishing, impregnating, and insulating materials; New bodies applicable as — and process for their manufacture. G. G. Diesser. Fr. Pat. 393,948, July 29, 1908. Under Int. Conv., April 24, 1908.

The bodies are prepared by heating fatty or resin acids or their compounds, or substances containing the fatty or resin acids or compounds, with carbohydrates such as starch or cellulose (oxycellulose, hydrocellulose), or with amino-acids or their compounds, or substances containing these acids or compounds, or with mixtures of these materials. The heating may be carried on: (a), with or without pressure; (b), in an inert atmosphere; (c), with escape of volatile products of decomposition; (d), at temperatures exceeding that at which the reacting substances decompose.—L. E.

Shellac preparations; Manufacture of durable —. F. Daum. Ger. Pat. 206,144, May 22, 1907.

THE moist shellac obtained by precipitation with acid from alkaline solution, is converted into a viscous solution by means of the smallest possible quantity of an indifferent solvent or of borax solution, and the solution is evaporated. For instance, 100 kilos. of the moist shellac are dissolved by means of 30 kilos. of borax and 30 kilos. of water. The solution is then heated until a portion is found to set in a few minutes to a hard transparent product when placed on a glass plate.—A. S.

Copals; Treatment of hard and semi-hard — and the preparation of varnishes. H. Terrisse, Geneva. Eng. Pat. 23,039, Oct. 29, 1908. Under Int. Conv., Oct. 29, 1907.

SEE U.S. Pat. 883,812 of 1908; this J., 1908, 457.—T. F. B.

Pine oil, pine-tar oil, and wood-tar oil; Process of purifying —. O. P. Pellnitz, Delmenhorst, Germany. U.S. Pat. 910,146, Jan. 19, 1909.

SEE Ger. Pat. 204,391; this J., 1909, 151.—C. A. M.

Turpentine oil substitute; Process for preparing a —. O. P. Pellnitz. Fr. Pat. 394,467, Sept. 19, 1908. Under Int. Conv., Sept. 21, 1907.

SEE Ger. Pat. 202,251 of 1907; this J., 1908, 1212.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Rubber; Manihot — from German E. African plantations. W. Schellmann. Der Pflanzer, 1908, [3]; Gummi-Zeit., 1909, 23, 561.

THE author has examined a large number of samples of rubber obtained from *Manihot* trees (1), of different ages, and (2), grown in different localities, with the object of ascertaining whether there is any corresponding difference to be traced in the composition of the raw rubber. The results obtained show that any differences are only small, and consist mainly of a slight decrease in the amount of resin in the rubber from the older trees.

In the results yielded by rubbers obtained from trees, of approximately the same age, grown in different districts, the differences are much of the same order, the resin-content varying from as low a value as 5.56 per cent. to 11.73 per cent. in the case of two 3 year old trees. —E. W. L.

PATENTS.

Rubber; Treatment or preparation of —. F. R. Durham, London. Eng. Pat. 5868, March 16, 1908.

IN order to dispense with the usual vacuum drying apparatus, the rubber, after coagulation, is passed between macerating rollers and then through a "creeping" machine and a sheeting machine having rollers heated to 100° to 120° F., by which means the rubber is softened and the water sufficiently removed to permit the sheets to be made into blocks. Provision is also made for heating the macerating rollers.—R. L.

Indiarubber; Treatment of —. T. Cockerill, Colombo, Ceylon. Eng. Pat. 21,441, Oct. 10, 1908. Under Int. Conv., Oct. 12, 1907.

THE caoutchouc is separated from the latex by means of an electric current, whilst on or in contact with a travelling anode. In a special form of apparatus claimed for this purpose, the anode consists of an endless travelling belt, the upper surface of which is made electrically active by contact with a brush connected with the positive pole of a dynamo, &c. Above this, at a distance of, say, $\frac{1}{4}$ to $\frac{1}{2}$ inch, is fixed the cathode, which is connected with the negative pole of the dynamo. The latex falls from a trough through a tilter, and is delivered in a regulated quantity on to the surface of the travelling anode, which is provided with raised portions at the edges so as to form a sort of trough. The belt travels forward very slowly, and under the action of the current becomes coated with a sheet of caoutchouc. At a certain

point this is removed by means of scrapers and guided by means of rollers into a washing tank of hot water, where it is scrubbed with revolving brushes or the like. Thence it is conveyed between rollers internally heated, and, if necessary, dried by other means before being delivered on to a table where it is cut into smaller sheets. The spent latex falls into a tank below the travelling belt, and, if it still contains caoutchouc, is again treated in the same way. Advantages claimed for this process are speed and the production of a purer rubber, which keeps well, retains its elasticity, and shows no signs of stickiness after a long time.—C. A. M.

Caoutchouc; Method of manufacturing solutions of —. E. Fischer, Schöneberg, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 910,520, Jan. 26, 1909.

SEE Eng. Pat. 1254 of 1908; this J., 1908, 580.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Gambier; A new sort of —. J. Paessler. Collegium, 1909, 16—20, 21—22.

A FACTORY in Indragiri (Sumatra) is now making a new form of gambier, under similar conditions to those in vogue for the manufacture of tanning extracts, *viz.*, by extraction of the twigs and leaves of the gambier shrub with water, and concentration of the extract by evaporation in vacuum pans. By this method a much better product is obtained than by the crude method in use for the manufacture of ordinary cube and block gambier. Experiments with this new form ("Indragiri gambier") show it to contain about 3 per cent. more tannin than block gambier and much less water and insoluble matter. The extract dissolves almost clear, and yields a good leather, much superior in colour to that obtained by the use of ordinary gambier. Liquors of 8, 20, 40, and 60 grms. of gambier per 250 c.c., yielded on analysis almost identical relative percentages of tannin and non-tannins, showing that the material contains no difficultly soluble tannin, and therefore in practice no waste will occur by the use of strong liquors.—H. BR.

Willow bark; Valuation of — by Von Schroeder's hydrometer method. W. Appellius and F. Merkel. Collegium, 1909, 22—24.

WILLOW bark is an excellent tanning material and is used extensively in the Russian leather industry, both for the manufacture of light and heavy leather. With a view to obtaining a quick method for the valuation of the bark, experiments have been made with Von Schroeder's hydrometer method. The method gives very similar results for tannin to those obtained by analysis, and is an admirable check for the buyer who cannot have every parcel of bark analysed.—H. BR.

Colour values [of tanning materials]; Determination of —. G. A. Kerr. J. Amer. Leather Chem. Assoc., 1909, 4, 1—9.

THE determination of the colour value of tanning materials is discussed. The writer experienced difficulty in obtaining really comparative results with the pelt test with sheep skin, the leather produced even with the same tanning material varying in colour with the texture and thickness of the skin. A few experiments were made with cotton cloth (see Reed, this J., 1909, 101) which apparently possesses the advantages of uniform texture and quality and the absence of any need for special preparation before use, but which is scarcely likely to appeal to the leather manufacturer. The author considers that all these methods leave the practical results to the imagination. The Lovibond tintometer is also found to give widely discordant results, but it is suggested that this might be remedied to some extent if more attention were paid to securing a uniform method for illuminating, and if the observations were carried out in a special dark room. The author suggests the use of the photometer for ascertaining the colour density of a tanning infusion and is endeavouring to devise a suitable instrument.—H. G. B.

Sole leather; The quality of —. R. A. Earp. Leather, 1909, 1, 7—10.

THE author discusses the causes of the superiority of the old-fashioned sole leather tanned in weak liquors over that tanned by modern processes. This he ascribes to the greater proportion of soluble non-tannins absorbed in modern sole leather tanning, which increased proportion is due to the greater concentration of the liquors and to the development of a greater absorptive power for non-tannins by the hide. The readiness with which drum-tanned sole leather wets back in water is considered to be due to the reversible absorption of these soluble non-tannins.—H. G. B.

Tanning and adsorption compounds of gelatin. Lüppler-Cramer. Z. Chem. Ind. Kolloide, 1909, 4, 21—23.

COLLOIDAL vanadium oxide is a powerful tanning agent: a one per cent. solution of vanadium chloride immediately coagulates a ten per cent. gelatin solution, whilst it renders sheets of gelatin insoluble in boiling water: as in the case of ferric chloride, etc., the vanadium chloride can be eliminated by means of potassium oxalate solution; in other respects the compound formed is analogous to the adsorption compounds of the salts of iron, chromium, and aluminium with gelatin. Albumin is immediately coagulated and gum arabic rendered insoluble by means of vanadium chloride solution. Nickel and cobalt salts do not tan gelatin, but their colloidal oxides possess strong tanning properties: the colloidal sulphides of nickel and cobalt also coagulate gelatin solutions. "Basic" chrome alum is a very powerful tanning agent; a wet photographic plate bathed for a short time in its solutions, and deprived of the superfluous moisture, can be dried over a flame without melting the film. The tendency of the compounds of higher oxides of metals to form adsorption compounds may be attributed to the fact that they more readily undergo hydrolytic dissociation, and the resulting oxides, in the form of hydrosols, are very stable.—T. F. B.

PATENTS.

Degreasing hides, skins, etc., and apparatus for extraction with volatile substances. H. A. Deroy. Fr. Pat. 394,201, Sept. 11, 1908.

THE extraction of grease, etc., from skins is effected in a series of communicating vessels, in which the skins are suspended, and which are connected to a suction device. A vacuum is first produced in the vessels in order to remove air and moisture from the skins, and the extraction is then performed in the usual way with a volatile solvent. In order to remove the last portions of the solvent from the skins, steam at a low temperature is admitted, and is subsequently condensed to recover the solvent. The skins are dried by increasing the vacuum and admitting dry steam at a relatively low temperature.—A. S.

Tanning extracts; Process for increasing the solubility of, and decolorising —. A. Kumpfmiller. Fr. Pat. 394,340, Sept. 16, 1908. Under Int. Conv., Sept. 28, 1907.

WASTE sulphite cellulose lyes which have been freed from sulphurous acid and lime, and then concentrated, are mixed with tanning extracts, in order to render them more soluble and to partially decolorise them, as well as to increase their content of "filling" substances, *i.e.*, substances which impart "body" to the leather. The process is specially applicable to strongly coloured extracts, such as mangrove extracts. It is stated that a mixture of the concentrated sulphite lye and quebracho extract has similar tanning properties to oak bark.—A. S.

Colloidal organic substances; Process for the treatment of —. The Arabel Manufacturing Co. Fr. Pat. 394,173, Aug. 28, 1908.

THE object of this process is to prevent the coagulation of colloidal organic substances at ordinary temperatures. The colloid (*e.g.*, gelatin, glue, agar-agar, casein, starch,

commercial dextrin) is treated with a solution of a salt of an organic sulphonic acid or derivative. Thus, if 300 parts of dry skim- or lude-glic are dissolved at 65–70° C. in a solution consisting of 400 parts of water and 80 parts of sodium naphthalenesulphonate, a mixture is obtained which remains liquid on cooling; the dried and ground mixture readily dissolves in warm water and even in dilute alcohol to a solution which remains liquid as before.—L. E.

Hides; Process of preparing:— for the manufacture of leather. E. Leconte, Estaires, France. Eng. Pat. 22,368, Oct. 21, 1908.

SEE FR. PAT. 883,273 OF 1907; THIS J., 1908, 291.—F. F. B.

XV.—MANURES, &c.

Soils; Action of heat and antiseptics on —. S. U. Pickering. J. Agric. Sci., 1908, 3, 32–54.

IN a previous paper (this J., 1908, 867), the author showed that when soils are heated, their content of soluble organic matters is increased, and that the soils become more favourable to vegetation but less favourable to germination. He has now found that treatment of the soil with volatile antiseptics produces an effect similar in all respects to that of heat. In various experiments recorded, soils were treated in the proportion of 1 kilo. of soil to 10–20 c.c. of antiseptics, such as carbon bisulphide, ether, chloroform, and benzene. The different antiseptics differ slightly in the intensity of their action, carbon bisulphide being the most active and ether the least, but the inhibitory substance formed by each, if not identical with that produced by heating, is exactly similar as regards the various effects it produces. The parallelism is so close that it is possible to calculate, for each antiseptic, the temperature at which heating produces an equivalent effect, and the same result is arrived at whether this calculation be based on the increase of soluble organic matter, the stimulation of vegetable growth, or the restriction of germination of seeds. The temperature equivalents of the action of the various antiseptics range from 60° to 75° C. When the treated soils are kept for a few weeks at a summer temperature, some of the organic matter which had been rendered soluble reverts to the insoluble condition, and the inhibitory action is reduced; the same reversion takes place in heated soils, especially in presence of water; in ordinary soils the soluble organic matter increases under similar conditions. The author is of opinion that all these changes are probably to be explained in chemical terms, and that they are not dependent on changes brought about in the bacterial flora of the soil. The co-existence of two opposite changes in heated soils complicates the question, but it would appear that at temperatures above 125° C. the changes due to heating are of a different order and do not produce the effects above described. All soils appear to respond to the action of heat; the proportion of the inhibitory substance formed depends on the increase in the amount of organic matter rendered soluble by the heating, but the total quantity of soluble organic matter is not always a measure of the inhibitory action of the heated soil. There appears to be no connection between the fertility of a soil and the extent to which it is altered by heating. Soils in their natural state appear to contain a certain amount of this inhibitory substance, as they act less favourably towards germination than pure water. The richer soils and those containing most soluble organic matter are slightly less favourable to germination than poorer soils.—J. F. B.

PATENT.

Fertilisers. W. E. Lake, London. From The American Bacteria-ized Fertilizer Co., Baltimore, U.S.A. Eng. Pat. 19,902, Sept. 22, 1908.

SEE U.S. PAT. 899,155 OF 1908; THIS J., 1908, 1032.—J. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

[*Sugar*] *Diffusion process; Scalding —.* K. Kaiser. Deutsche Zuckerind., 1909, 34, 97–102.

THIS process consists in heating the fresh slices with steam in the diffuser before introducing the juice. Earlier attempts to utilise this process proved unsatisfactory, but the author has used it with success during the past two campaigns. In one factory in which the process was used, the battery consisted of twelve diffusers, seven of these being under pressure. Diffusion waste water, mixed with the liquor expressed from the exhausted slices, was used alternately with fresh water, to supply the battery. The steam was obtained from the second effect at a temperature of 90–93° C., this temperature being reduced to about 75° C. in the diffuser. The process is preferable to that of ordinary diffusion on several grounds. The juice extracts more sugar from the fresh slices, the battery works more smoothly, and diffusion is more rapid. Dilution of the juice, owing to condensation of the steam, does not take place to any appreciable extent. The juice drawn off is more easily worked up than that obtained by ordinary diffusion, and the exhausted slices appear to furnish a better cattle food.—L. E.

Lactose; Methods of determining the purity of — as given in different pharmacopaeias. Hillringhaus and Heilmann. Chem.-Zeit., 1909, 33, 86.

THE German Pharmacopoeia prescribes that when 15 grms. of lactose are shaken at intervals for 30 minutes with dilute alcohol, and the liquid filtered, 10 c.c. of the filtrate should not become turbid when mixed with an equal volume of absolute alcohol, and on evaporation should not leave a residue weighing more than 0.01 gm. The authors' experiments show that the temperature has a great influence on the results of this test. Thus at 16° C. four samples of commercial lactose and one of pure lactose gave results in accordance with the official requirements; at 20° C. one of the samples yielded 1 mgrm. too much residue; and at 28° C. even chemically pure lactose gave 10 mgrms. too much. In the Japanese Pharmacopoeia an additional test is given:—1 gm. of the lactose when mixed with 5 c.c. of sulphuric acid in a shallow basin should only show a slight coloration after an hour at a temperature not exceeding 15° C. According to the authors it is essential not to let the temperature exceed this maximum, but the results are fairly similar with different strengths of acid not below 92 per cent. The form of the basin has considerable influence (the wider the surface the less the coloration), but it makes but little difference whether the basin be exposed to the air or not. Adulteration of lactose with as little as 0.1 per cent. of sucrose is readily detected by this test, the carbonised sucrose appearing as small black points upon a white ground. In the authors' opinion both the above-mentioned tests have been the cause of incorrect conclusions, and the conditions under which they are to be made ought to be more accurately defined.—C. A. M.

PATENTS.

Sugar juice; Process for evaporation of — with a view to manufacture of crystallised sugar. P. Lagrange and J. F. P. Kestner. Fr. Pat. 394,493, Sept. 22, 1908. Under Int. Conv., Oct. 9, 1907.

AN earlier process described in Fr. Pat. 324,777 of 1902 (this J., 1903, 643) necessitates evaporation in two stages and addition of sugar to the syrup. These disadvantages are removed in the present process which depends on the fact that sugar juice may be concentrated under ordinary pressure to such a degree that its boiling point exceeds 120° C. without appreciable decomposition, provided that the operation is not too long continued. The juice from the ordinary evaporators, or, in refineries, the juice which is ready to boil to grain, is transferred to an evaporating apparatus and preferably to a circulation evaporating apparatus such as that described in Fr. Pat. 315,973 of 1901, or in Fr. Pat. 361,524 of 1905 (this J., 1906, 874).

Here it is heated under atmospheric or higher pressure in order to obtain, on cooling in a crystallising vessel, all or nearly all the crystallisable sugar.—L. E.

Diffusion juices of high density ; Process for the treatment of — by the preliminary action of gaseous sulphurous acid. M. E. R. J. M. Lambert. Fr. Pat. 394,577, Sept. 23, 1908.

The object of this process is to precipitate coagulable matter from diffusion juice of high density in order to facilitate the working up of the latter. Precipitation is effected by treating the juice, heated to at least 85° C., with sulphur dioxide in one compartment of a reservoir, from whence the juice overflows into a second compartment, and runs thence by a pipe into a tank where it is defecated with lime. Contact between the juice and the sulphurous acid is so short, that in spite of the high temperature of 85° C., no inversion of sugar occurs. A float in the sulphiting compartment controls a valve which governs the supply of air to the sulphur furnace, and the amount of sulphur dioxide produced is thereby regulated according to requirements.—L. E.

Starch ; Process for the treatment of —. The Arabol Manufacturing Co. Fr. Pat. 394,167, Aug. 27, 1908.

AN earlier process (this J., 1907, 478) in which a mixture of starch and a hydrocarbon was treated with caustic alkali, involved the subsequent neutralisation of the product. In the process now described, the starch is rendered capable of swelling in cold water by treatment with a thiocyanate, the latter being subsequently removed by washing. Thus, 100 parts of dry, powdered potato starch are intimately mixed with 80 parts of a 50 per cent. solution of ammonium thiocyanate in water to which 40 parts of alcohol have been added. A small quantity of sodium sulphite may be added to prevent discoloration due to traces of iron which may be present. The thiocyanate is then removed by washing with alcohol or acetone, etc. The product swells in cold water to a paste which appears to possess, at ordinary temperatures, all the properties of starch gelatinised at higher temperatures.—L. E.

Colloidal substances. Fr. Pat. 394,173. See XIV.

XVII.—BREWING, WINES, SPIRITS, &c.

Husked barleys ; Losses in the steeping of —. M. Rigaud. Z. ges. Brauw., 1909, 32, 41—42.

THE normal loss suffered by barley in the steeping process is very small (0.6—1.5 per cent.), and A. J. Brown (this J., 1908, 134) explained this circumstance by showing that the testa of the corn constitutes a semipermeable membrane through which the soluble constituents of the corn cannot penetrate outwards. It occurred to the author that a mechanical husking treatment might involve such a serious injury to the testa that its protective action would be destroyed, and considerable losses might take place in the steep waters. The author has examined several samples of barley from which the husk had been removed ; he steeped the corns first in a 1 per cent. solution of copper sulphate, washed them, and then transferred them to a 1 per cent. solution of potassium ferrocyanide. The corns were thus stained red at those points where the testa had been broken. It was found that the number of damaged corns depended on the severity of the husking process, and that, with a husking-loss of 1.34 per cent., the percentage of damaged corns was only increased by 2, whereas with a husking-loss of 2.08 per cent., the number of damaged corns was increased by 70 per cent. When the steeping-losses were determined, it was found that the corns showing a husking-loss of 1.34 per cent. lost 0.58 per cent. of soluble matters in the steep, as against 0.44 per cent. before husking. Hence it is concluded that the husking process, if properly carried out, involves no serious loss of barley substance during steeping. But the result of the husking does not depend only on the quantity of the husk substance removed ; it depends also on the uniformity of its removal and the extent of the

damage done to the testa. But even when the husking was with intention roughly conducted, the steeping-loss was only increased from 0.54 per cent. before husking to 1.05 per cent. after husking.—J. F. B.

Malt extract ; Increased yield of — by previous doughing of the grist. C. Bleisch. Z. ges. Brauw., 1909, 32, 43—44.

IN a previous note (this J., 1909, 34) the author made some observations on var Hest's investigations on this subject. It would appear that when the doughing is effected at temperatures below 25° C., there is a slight increase in the yield of "apparent" extract, whereas at temperatures of about 45° C. there is no increase. The author uses the word "apparent" because not more than 20—25 per cent. of this small increase is due to starch ; the bulk of it consists of such products as pentosans, proteins, and mineral matters, which might injuriously affect the quality of the beer. Moreover experiments on the large scale at Weihenstephan, although they established the fact of the increased density of the wort, yielded brews which were not quite satisfactory, either as regards the course of fermentation or the flavour of the product. Some breweries have reported favourably on the process, whilst others have had to give it up owing to the excessive coloration and reddish tint which it produced in their pale beers. It would seem that the doughing process has succeeded best in those breweries which work with waters highly charged with gypsum.—J. F. B.

Beers prepared by the so-called digestive mashing process. M. Rigaud. Z. ges. Brauw., 1909, 32, 53—55. (See also this J., 1909, 34, 154.)

LABORATORY experiments on worts prepared with preliminary doughing-in of the malt gave, with fine grists, increases in extract varying from 0.33 to 2.93 per cent., the mean being 1.45 per cent. Badly modified malts or those containing many hard and starchy corns exhibit the greatest increase of extract under this treatment, which also effects clarification of opalescent worts. Experiments made in the brewery with four not exceptionally tender malts showed increases in extract, due to doughing-in, varying from 0.81 to 1.35 per cent., the mean being 1.12 per cent. The finished beers from three of these malts have been examined and analysed, the principal variations caused by doughing-in being in the colour and protein-content of the beer. In the three cases, the colours, determined by means of N/10 iodine solution, were found to be 1.55, 1.5, and 1.5 respectively, where doughing-in had been resorted to, and 0.9, 0.9, and 1.1 in the corresponding beers prepared by the ordinary method. Such increase of colour can, of course, be counterbalanced by using slightly paler malts. The increases in the amount of protein per 100 grms. of beer were from 0.357 to 0.415, from 0.337 to 0.442, and from 0.298 to 0.386 grm., the increased percentages of protein in the total extract being 1.41, 2.88, and 2.13 in the three instances. The increased proportion of protein has no effect on the stability of the beer, whilst, on the other hand, it improves its head-retaining properties, its palate-fulness, and its nutritive value.—T. H. P.

Ammoniacal fermentation. J. Effront. Compt. rend., 1909, 148, 238—241.

WHEN distillery liquors are sown with a little garden soil, fermentation soon sets in and hydrogen and carbon dioxide are liberated. The fermentation is active in presence of a free supply of air and alkali carbonates ; it causes the disappearance of the amino-acids and the formation of ammonia and volatile fatty acids. Plate cultures in air and in a vacuum show the ammoniacal fermentation to be due to the symbiotic action of an anaerobic and an aerobic ferment. The first of these is the butyric acid bacteria isolated by Winogradski, which develops quite normally in an aerated medium in presence of other aerobic bacteria, but in pure culture is very sensitive to oxygen. A pure culture was sown in solutions containing per 100 parts : 2 of dextrose, 0.5 of yeast ash, 0.2 of potassium carbonate, and 3 of various amides. The following table shows the course of fermentation at 40° C. in an atmosphere of nitrogen :—

Amide.	1 day.			3 days.		8 days.		
	Dextrose.	Total nitrogen.	Nitrogen as ammonia.	Dextrose.	Nitrogen as ammonia.	Dextrose.	Total nitrogen.	Nitrogen as ammonia.
	mgms.	mgms.	mgms.	mgms.	mgms.	mgms.	mgms.	mgms.
Glycine	1800	519	14	840	230	0	541	520
Betaine	2050	365	28	1060	138	35	367	342
Asparagine	1400	561	221	420	419	18	558	553
Glutamic acid	1720	278	11	58	97	9	286	239
Distillery liquors	115	834	36	0	621	0	827	756

At the beginning, the ammoniacal fermentation proceeds parallel to that of the dextrose and the maximum of ammonia corresponds to the complete disappearance of the sugar. The amino-acids form only ammonia: betaine alone yields trimethylamine. From distillery liquors of sp. gr. 1.074, the ratio of ammonia to trimethylamine produced, is as 85:15. At the same time a mixture of acetic, propionic, and butyric acids is formed during fermentation, in proportions varying with the nitrogenous compound used:—

Amide.	Acids. Per cent. of total acidity.		
	Acetic.	Propionic.	Butyric.
Glycine	69.7	5.2	25.1
Betaine	58.1	11.6	30.3
Asparagine	6.0	62.3	31.6
Glutamic acid	4.9	10.1	85.0
Distillery liquor	25.1	26.8	48.1

Analogous results are obtained when the solutions are sown with ordinary earth instead of pure cultures; the fermentation may now be carried out in the air, and takes place more rapidly and completely. Other ferments hardly influence the change, and in particular the putrefying bacteria are paralysed by the aeration. Winogradski has shown that in a medium deprived of combined nitrogen the butyric ferment is able to assimilate nitrogen from the air. The constant presence of the butyric ferment and the products of protein hydrolysis in the soil suggests this fermentation as a ready means of transformation of nitrogen into an assimilable form.—E. F. A.

Ciders and perries; The rate of fermentation of —.
B. T. P. Barker. J. Agric. Sci., 1908, 3, 1—21.

THERE is a direct connection between the variety of apples and pears and the rate of fermentation of their juices; as a rule those varieties which ferment most rapidly do not yield ciders of high quality. The factor of variety, however, may tend to be obscured by other factors, such as the condition of ripeness of the fruit, the climatic conditions of the season and exposure to the sun, also the nature of the soil. The main factor in determining the rate of fermentation is the amount of nitrogenous matters present which are assimilable by yeast, and the effect of the other factors mentioned above appears to be due to their influence on this. The quantity of such matters is generally insufficient, and the natural rate of fermentation is consequently slower than when yeast-nutrients are added. As a rule, the rate of fermentation of juice from unripe fruit is relatively rapid. As the ripening progresses, changes in the composition of the juice occur which result in a diminution of the quantity of assimilable nitrogen, and the rate of fermentation becomes slower until the fruit is fully ripe. After that, as maturity merges into decay, the rate of fermentation of the juice gradually increases again. In determining this question of ripeness, the colour of the fruit, i.e., the degree of exposure to sunlight, is a more decisive factor than the actual age of the fruit. So far, no constituent of the juice, other than the assimilable nitrogenous matter has been observed to exercise a direct influence on the rate of fermentation, but the mucilaginous matters may indirectly in a mechanical manner, impede the fermentation. The factor of assimilable nitrogen appears to dominate any influence

which the relative fermentative activities of different varieties of yeast might be expected to exert; the sowing of specially active yeasts, therefore, has no effect on the rate of fermentation. Aeration of the juice, whether before fermentation, by "kieveing," or during fermentation, has a marked effect in increasing the rate of fermentation. The temperature of fermentation affects the rate in the usual manner. The average rate of fermentation of a given variety of juice is subject to variation from one season to another, but allowing for this, it should be possible by selection and blending of suitable juices to control the fermentation so as to produce sweet or dry types of cider as desired. As a general rule, the more rapid the fermentation proceeds, the further does attenuation proceed, although this is not invariably the case.—J. F. B.

Artificial oxylases and peroxydases. Martinand. See XXIV.

Denatured alcohol production of the United States. Oil, Paint, and Drug Rep., Feb. 1, 1909. [T.R.]

THE production of denatured alcohol during the year 1908 amounted to 3,874,625.62 wine gallons, as compared with 3,364,590.06 gallons during the year 1907. Calculated in terms of proof gallons, the production of 1908 exceeded 7,500,000 gallons. The output in 1908 consisted of 2,046,610.89 gallons of completely denatured and 1,828,014.73 gallons of specially denatured spirits. Owing to the anticipatory production of completely denatured spirits in 1907 there was a decline in 1908 in the production of this variety of alcohol of 219,977.68 gallons, while the output of specially denatured spirits in 1908 recorded a gain of 730,013.24.

PATENT.

Distillers' mash; Process for saccharifying —. F. Pampe, Halle-on-the-Saale, Germany. Eng. Pat. 26,582, Dec. 2, 1907. Under Int. Conv., Dec. 1, 1906.

THE malt is made into a thin mash, which, by slow filtration through cloth, is separated into malt paste and germ-free filtrate. The malt paste is used to effect the initial saccharification of the mash made from the other starchy materials used, the mash being then sterilised at a temperature of 68°—70° C., and cooled to about 60° C. The saccharification is then completed by means of the germ-free malt extract in presence of germ-free air, so as to ensure the absence of all injurious organisms from the mash.—T. H. P.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Yeast; Adulteration of bakers' — [with starch]. A. Kopper. Chem.-Zeit., 1909, 33, 110.

THE adulteration of pressed bakers' yeast with starch not only defrauds the customer but the starch acts adversely on the activity of the yeast after keeping. Fermentation trials made with a yeast mixed with varying proportions of starch, after three days' keeping, showed that with 20 per cent. of starch, the fermentative activity was reduced by from 5 to 9 per cent., and with 50 per cent. of starch by 17—23 per cent. Microscopical examination of the yeast in the last case showed the presence of many

dead cells. Beer yeast is of little value for use by bakers on account of its low keeping qualities, which it imparts to articles in which it is used. The author suggests that the sale of brewers' yeast as distillery yeast for bakers should be prohibited.—E. F. A.

Proteins; Determination of the constitution of — by hydrolysis with hydrofluoric acid. Preparation of polypeptides. L. Hugounenq and A. Morel. *Compt. rend.*, 1909, 148, 236—238.

WHEN proteins are hydrolysed with hydrofluoric acid, containing less than 20 parts per 100 at the temperature of the boiling water bath, until the biuret reaction disappears, non-crystallisable products are obtained together with the arginine and lysine fractions. These new products are polypeptides of diamino-acids comparable with the synthetical products obtained by Fischer. They form well characterised picrates which serve to differentiate them from arginine and lysine. The authors have isolated the following picrates from the products of partial hydrolysis of pepsin. Diarginyl-arginine dipicrate forms voluminous crystals, m.pt. 207° C. (corr.); glutamyl-lysine picrate crystallises in prisms, m.pt. 216° C.; lysyl-lysine dipicrate separates in small plates, m.pt. 238—242° C. The products of the partial hydrolysis of gelatin yield arginylarginine picrate, which crystallises in bunches of needles, m.pt. 213° C. Groups formed by the uniting together of several molecules of arginine seem to play as important a part in the protein molecule as Kossel has shown them to do in the protamines. Hydrofluoric acid, stronger than 30 parts per 100, is able to completely hydrolyse proteins provided heating is continued long enough. If the acid, however, be too weak, even prolonged heating is not sufficient to hydrolyse certain polypeptides. The polypeptides isolated cannot have been formed from amino-acids by condensation caused by the mineral acid, since they are most abundant when hydrolysis is effected by a weak acid.—E. F. A.

Coffee plantations; Re-establishment of — by the introduction of a new species. J. Dybowski. *Compt. rend.*, 1909, 148, 232—233.

THE plantations of Arabian coffee (*Coffea arabica*) have been almost devastated in places by *Hemileia*, for which no cure or prevention has yet been found, and even in Java and Madagascar the plantations are producing less each year. Liberian coffee (*Coffea liberica*) withstands the disease better but has a lower market value. Hybrids of these two kinds have met with but indifferent success. A new coffee species (*Coffea congensis*) discovered growing wild on the shores of Oubangui, Central Africa, entirely resists *Hemileia*; it has a market value equal to that of the best Arabian coffee and a caffeine content of 1.19 per cent.; it promises therefore to be of the greatest value to the planters.—E. F. A.

Cocoa; New method of determining theobromine in —. A. Krentz. *Z. Unters. Nahr. Genussm.*, 1908, 16, 579—584.

FROM 1.5 to 2 grms. of the cocoa are mixed in a flask with 3 grms. of solid chloral alcoholate, and heated on the water-bath until the alcoholate is melted and a uniform mass is obtained by agitation. The hot melted mass is then extracted with small quantities of ether, each ether extract being filtered through a hardened filter. When about 40 to 50 c.c. of filtrate have been obtained, the solvents are distilled off, the chloral alcoholate in a tared flask under reduced pressure. The residue is then dried till of constant weight at 100—105° C. After cooling and weighing, the fat is extracted by means of carbon tetrachloride, and the insoluble theobromine is filtered off. The solvent is driven off from the filtrate, and the fatty residue is dried and weighed. The difference in the two weighings is taken as theobromine.—J. O. B.

Sodium benzoate as preservative for foodstuffs; Use of —. Report of U.S. "Referee Board." Oil, Paint, and Drug Rep., Feb. 1, 1909. [T.R.]

THE "Referee Board of Consulting Scientific Experts" has presented its report on the use of sodium benzoate

in foods to the Secretary of Agriculture; the main conclusions arrived at are as follows:—

1. Sodium benzoate in small doses (under 0.5 grm. per day) mixed with the food is without deleterious or poisonous action and is not injurious to health.

2. Sodium benzoate in large doses (up to 4 grms. per day) mixed with the food has not been found to exert any deleterious effect on the general health, nor to act as a poison in the general acceptance of the term. In some directions there were slight modifications in certain physiological processes, the exact significance of which modification is not known.

3. The admixture of sodium benzoate with food in small or large doses has not been found to injuriously affect or impair the quality or nutritive value of such food. (Compare Wiley, this J., 1908, 914).

PATENTS.

[Milk] Separators; Centrifugal —. R. W. James. London. From Separatoraktiebolaget Mundus, Stockholm, Sweden. Eng. Pat. 7728, April 7, 1908.

THE central tubular chamber up which the separated cream passes to the outlet is divided into radially disposed compartments by rods arranged parallel to the axis of rotation of the machine, instead of by ribs projecting from the feed tube.—W. H. C.

Sterilising liquids of organic origin and apparatus therefor. J. Desmaroux, Paris. Eng. Pat. 6438, March 23, 1908. Under Int. Conv., March 29, 1907.

SEE Fr. Pat. 376,226 of 1907; this J., 1907, 1025.—T. F. B.

Vegetable butter capable of being spread. P. Kolesch, Stuttgart, Germany. U.S. Pat. 910,827, Jan. 26, 1909.

SEE Eng. Pat. 18,499 of 1907; this J., 1907, 1251.—T. F. B.

(B).—SANITATION; WATER PURIFICATION.

Sewage purification and deodorisation; Application of electrolytic chlorine to — by the "orychlorides" process. S. Rideal. Faraday Soc., Feb. 9, 1909. [Advance proof.] (See also this J., 1907, 940.)

THE chlorine was produced in a new form of electrolyser, provided with a diaphragm, in order to obtain a more concentrated solution. The apparatus as used at the Guildford sewage works produced a liquid containing 8 per cent. of available chlorine, which was very stable and only slightly increased the amount of chlorides in the sewage treated. Using this solution on a sewage effluent, it was found that the addition of a quantity of available chlorine numerically equal to the five minutes' oxygen absorption figure, was more than sufficient to remove all *B. coli* from 10 c.c. in 2 hours and to leave available chlorine still present after 18 hours. Experiments were made on the large scale by the addition of electrolytic solution containing available chlorine equal to 25 to 35 per cent. of the oxygen absorption figure, to a septic tank effluent passing on to a percolating filter. The principal results obtained were that the addition of the chlorine solution did not interfere with the purification nor with the maturing of the filter; that the formation of surface growths on fine-grade material was prevented; and that the removal of growths in sprinklers, pipes, etc., could be easily accomplished. The experiments on deodorisation were made with varying amounts of orychloride solution containing 0.2 per cent. of available chlorine and it was found that an amount of available chlorine equal to 35 per cent. of the oxygen absorption figure removed all the sulphuretted hydrogen.—J. H. J.

Water; Purification of — by ozone. S. Rideal. Paper read before the Royal Sanitary Inst., Jan. 13, 1909. J. Gas Lighting, 1909, 105, 247—248.

THE author has examined the working of the installation for the sterilisation of water by ozone at the St. Maur water-works in Paris, where a large portion of the water-

supply of that city is treated. The water is drawn from the Marne, which receives a considerable amount of sewage pollution above the intake. The current for the ozonising plant is generated by means of a 45-h.p. steam engine and a Mordey alternator of 110 volts, and is changed by a transformer to a higher tension. The ozonisers are of the Siemens-Halske type and are placed in a dark, cool room. The energy consumption is about 57 Board of Trade units per million gallons of water treated, or 133 units including the energy required for compression. The cost is estimated at £d. per 1000 gallons, excluding interest, amortisation, and repairs. The author found that the physical characters of the water were greatly improved, the proportion of organic matter considerably reduced, and all but the more resistant spore forms of bacteria destroyed. No metallic contamination of the water resulted from any corrosion of the apparatus by the ozone, nor were any traces of oxides of nitrogen, chlorine compounds, or hydrogen peroxide formed. Of the ozone absorbed by the water, nearly 73 per cent. was immediately utilised in purification, 7 per cent. remained dissolved in the water, and about 20 per cent. passed off with the air current, which was used over again. The author concluded by discussing the relative advantages of the treatment of water by ozone, and its storage in reservoirs for a length of time (see this J., 1908, 873.)—A. S.

PATENTS.

Water; Purification of — by filtration, and apparatus for use therein. F. Candy, London. Eng. Pat. 9665, May 4, 1908.

THE invention relates to the production of a bacteria-arresting film on the upper part of a filter-bed, this film being formed of a substance, or substances, added to the water before the latter is passed on to the filter. The substances, such as clay, infusorial earth, milk of lime, aluminium sulphate, iron chloride or sulphate, etc., are placed in one or more tanks to which water is admitted from a side-tube on the water main; the emulsion or solution is then conducted from the tanks and mixed with the water in the main, the flow of water actuating an injector which is provided for this purpose. Stirrers are fitted in the tanks and are worked by means of a motor driven by water supplied from the main. The pressure of the water passing through the main should not be less than 7 lb. to the inch.—W. P. S.

Sewage; Process and apparatus for treating —. Oxy-chlorides (1907), Ltd. Fr. Pat. 394,277, Sept. 14, 1908.

SEE Eng. Pat. 21,566 of 1907; this J., 1908, 1080.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Hydrocellulose; Production of — by sulphuric acid. C. G. Schwalbe. Z. angew. Chem., 1909, 22, 155—156.

THE author criticises a paper by Büttner and Neuman on the above subject (this J., 1909, 105). He contests their view that elementary analysis is the best measure of the degree of resolution in the case of hydrocelluloses. Further, even if elementary analysis were sufficiently accurate, it would fail to make any distinction between hydrocelluloses and cellulose hydrates. The cupric-reduction method, on the other hand, is characteristic for hydrocelluloses and is in actual use in practice for the determination of the degree of hydrolysis. Büttner and Neuman also state that hydrocellulose is extremely resistant towards acids and alkalis. But it is pointed out that their results merely show that the residual hydrocellulose has the same elementary composition after boiling with acids as it had before, and take no account of the quantity of substance dissolved in the form of sugar, etc., as the result of the treatment with acid. Similarly, the author contests the statement as to the resistance of hydrocellulose towards alkalis. It is well known that sodium hydroxide at the boiling point dissolves a large proportion of the hydrocellulose and

that the cupric-reducing power of the residue is diminished. The author quotes some results which he has obtained by boiling Girard's hydrocellulose with 15 per cent. sodium hydroxide solution:—

Hydrocellulose.	Quantity of the sodium hydroxide solution of 15 per cent. strength.	Time of boiling.	Undissolved residue.
GRMS.	GRMS.	MIN.	PER CENT.
10	200	10	48
10	200	20	42
10	200	30	40
10	200	40	37
10	400	60	33

The blue colour produced by zinc chloride-iodine reagent with hydrocellulose is very transient and is rapidly removed by water, whereas the similar coloration with cellulose hydrates resists the action of water for a considerable time.—J. F. B.

Cellulose hydrates; The chemistry of —. C. G. Schwalbe. Z. angew. Chem., 1909, 22, 197—201.

IT is necessary to emphasise the difference between hydrolysis and hydration in the case of cellulose, although under certain conditions both may occur simultaneously. The hydrocelluloses, products of hydrolytic action, are generally characterised by free carbonyl groups which reduce Fehling's solution. The cellulose hydrates may be produced, with or without simultaneous hydrolysis, whenever cellulose is subjected to the action of alkalis, acids, or salts which exert a swelling or solvent influence in presence of water. According to Cross, hydration may take place in presence of water by mechanical action alone. Besides the cellulose hydrates artificially produced from the normal cellulose (anhydride), other types exist in nature which have never attained the dehydrated and polymerised condition of normal cellulose. These undeveloped types are sometimes included in the group of "hemicelluloses." The hydrated celluloses differ widely in their properties, but a high hygroscopic moisture is common to all; the hydrocelluloses on the other hand are distinguished by an abnormally low moisture-content. Some of the hydrates, *e.g.*, mercerised cotton, possess high tensile qualities, others, *e.g.*, the artificial silks, are mechanically deficient. These two groups also differ widely as regards their solubility in alkalis. Under certain conditions, the hydrated celluloses are resistant to esterifying influences to which the normal cellulose responds. All the hydrated celluloses are characterised by a diminished resistance to hydrolysis by acids, to an extent proportional to their "degree of hydration." Many methods have been proposed for the determination of the "degree of hydration" of a given cellulose: Vieweg measures the absorption affinity towards sodium hydroxide, Cross and Bevan utilise the thio-carbonate reaction and measure the viscosity of the product. Wübbner uses a colorimetric method with solutions of iodine in zinc chloride of different strengths, whilst Knecht measures the absorption of benzopurpurin under standard conditions. All these methods are open to objections, and the author has devised a method based on the increased susceptibility to hydrolysis by acids. The procedure is as follows: The "copper value" (cupric-reducing value) of the sample is first determined on 3 grms. of the substance in the manner previously described (see this J., 1907, 548). Another portion of the finely chopped substance is then boiled with a standard quantity of sulphuric acid of 5 per cent. strength, for 15 minutes with constant stirring. The acid is neutralised and the prescribed quantity of Fehling's solution is added without separating the hydrolysed fibre from the liquid. In this way a second "copper value" is obtained, and the difference between the two measures the hydrolysis which has taken place and which is proportional to the "degree of hydration" of the original cellulose. Some typical results are shown in the table:—

	Hygroscopic moisture.	Copper value after hydrolysis.	Copper value before hydrolysis.	Diff. rence.
	per cent.			
Cotton wool	6.1	3.3	1.1	2.2
Ditto mercerised with 8 per cent. soda lye	7.7	3.2	0.9	2.3
Ditto " " 16 " " " "	10.7	5.0	1.3	3.7
Ditto " " 24 " " " "	11.3	6.1	1.2	4.9
Ditto " " 40 " " " "	12.1	6.6	1.0	4.7
" Glanzstoff " silk	9.8	12.8	1.5	11.3
Viscose silk A	10.7	14.0	1.9	12.1
" " B	10.2	14.5	3.0	11.5
" " C	11.0	16.6	2.9	13.7
Chardonnat silk	11.4	17.7	4.1	13.6
Giffard's hydrocellulose	3.6	6.6	5.7	0.9
Mitscherlich wood pulp, unbleached	—	4.4	2.4	6.9
Ritter-Kellner wood pulp	—	3.5	2.8	2.7

PATENT.

Tanning extracts. Fr. Pat. 394,340. See XIV.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Tropine and its derivatives; Affinity values of —. V. H. Veley. Chem. Soc. Trans., 1909, 95, 1—8.

IN continuation of his previous work (this J., 1908, 1221), the author has found that tropine, the parent base of the atropine and cocaine alkaloids, has a lower affinity value than piperidine. Probably the stronger piperidine residue is modified by being conjoined to the weaker pyrrolidine residue, if the constitution recently advanced by Willstaetter is correct. Ecgonine possesses all the properties of an amphoteric electrolyte, and Willstaetter's view, that it is a betaine, or inner anhydride, is confirmed. Anhydroecgonine is a stronger base than ecgonine, and is approximately equal in affinity value to an aromatic betaine. Benzoylcegonine does not remain in combination with hydrochloric acid in weak solutions; it resembles caffeine in its basic functions. Cocaine is a relatively strong base, but is weaker than ammonia. The replacement of the carboxylic hydrogen in benzoylcegonine by the methyl group produces effects analogous to those previously observed with glycine. The affinity value of cocaine was found to be approximately, $k_b = 2.5 \times 10^{-7}$, by determining the mass of sodium hydroxide contained in a hydrolysed borax solution which was required to upset the equilibrium between a certain mass of cocaine combined with hydrochloric acid. The tropeines, atropine and homatropine, have an affinity value greater than $k_b = 1 \times 10^{-7}$, and $N/20$ solutions of their hydrochlorides show no appreciable hydrolysis when heated to boiling point.—J. O. B.

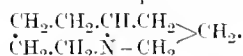
Yohimbé-bark (of the Cameroons), and its recognition in preparations. C. Griebel. Z. Unters. Nahr. u. Genussm., 1909, 17, 74—78.

THE presence of powdered Yohimbé-bark in preparations may be recognised by means of the microscope and chemical tests. Under the microscope, the powder is seen to contain large, but narrow, bast fibres, which are free from pores, and entirely free from schlerenchymatous cells. Cork cells are present, which are strongly compressed, porous, and generally free from pigment. The cells of the parenchyme have brown walls, contain practically no starch, and show clusters of reddish-brown particles. For the chemical tests, an extract is made with ether in the presence of an alkali, and the solution evaporated. The presence of yohimbine in the residue can be shown by the following reagents. With strong sulphuric acid no coloration is obtained, but the addition of a crystal of potassium bichromate causes a blue-violet streak, changing to bluish-grey and then to greenish-brown. Erdmann's reagent (sulphuric acid containing a small quantity of nitric acid) causes a dark grey-blue colour, passing quickly to yellowish-green. Fröhde's reagent (5 mgrms. of sodium molybdate in 1 c.c. of strong sulphuric acid) causes an immediate grey-blue colour, quickly turning to dark blue, finally to green. Mandelin's reagent

(1 grm. of ammonium vanadate in 200 c.c. of strong sulphuric acid) brings about a fine dark blue colour with a trace of violet in the residue itself, whilst the reagent turns to an orange colour, subsequently becoming brick-red.—F. SHDN.

δ-Coniceine; Synthesis of inactive —. K. Löffler and H. Kaim. Ber., 1909, 42, 94—107.

THE authors prepared trichloro-α-picolylmethylalkine by the condensation of α-picoline and chloral. The product was treated with alcoholic potassium hydroxide when pyridylacrylic acid was obtained, with a small quantity of α-pyridyl-lactic acid. Pyridylacrylic acid was reduced with sodium and alcohol with the formation of piperidylpropionic acid, $C_5H_{10}N.CH_2.CH_2.COOH$. The hydrochloride of the ethyl ester of piperidylpropionic acid melts at 122° C.; the ethyl ester boils at 143—144° C. at 21 mm., and has the sp. gr. 1.0214 at 15°/4° C.; the hydrochloride of the free acid melts at 188° C.; and the free acid, $C_5H_{10}N.CH_2.CH_2.COOH.2H_2O$, crystallises from water in large tablets, and melts at 147—148° C. When piperidylpropionic acid is heated in a vacuum to 200° C., 2-piperolidone, $C_5H_{13}NO$, distils over. This liquid lactone is easily soluble in water and alcohol, boils at 126—127° C. at 12 mm., and at 263°—264° C. at the ordinary pressure. α-Pyridyl-lactic acid was reduced with sodium and alcohol, and after further treatment 3-hydroxy-2-piperolidone, $C_5H_{13}O_2N$, was obtained. This substance melts at 129—130° C., boils at 183—184° C. at 18 mm., and at 304°—305° C. at the ordinary pressure. This was reduced with sodium and alcohol with the production of piperolidine,



Piperolidine in its physical constants and in the melting-point of its salts is identical with δ-coniceine, and the constitution of that alkaloid, as ascertained by Lehlmann (Annalen, 259, 193) is thus confirmed.—F. SHDN.

β-Coniceine (1-allylpiperidine); Synthesis of —. K. Löffler and G. Friedrich. Ber., 1909, 42, 107—116.

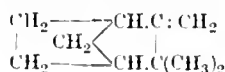
BY the treatment of α-picoline with acetaldehyde, α-picolylmethylalkine is produced. This can be reduced with sodium and alcohol to picepolymethylalkine, boiling at 222°—228° C., and melting at 56°—58° C. after crystallising from light petroleum. α-Picepolymethylalkine was treated with phosphorus pentoxide at 100° C. in a current of hydrogen, the product dissolved in ice-water, the liquid made alkaline, and the free base distilled with steam. The product was a colourless oily base, which on treatment with picric acid gave two salts, one solid and the other oily. The salts were separated by crystallisation from alcohol, and a solid picrate obtained melting at 113—114.5° C., which was decomposed with alkali in order to obtain the free base. The base obtained in this way was inactive α-allylpiperidine, $C_8H_{15}N$. It boils at 168.5°—170° C. at 753 mm., and has the sp. gr. 0.8716 at 15°/4° C.; the hydrochloride melts at 206°—207° C. This base was resolved into its optical isomerides by crystallising the bitartrate from water. The dextro-rotatory base, d-α-allylpiperidine, forms a bitartrate melting at 62—

—J. F. B.

63° C. The free base melts at 38.5°—39° C., and has $[\alpha]_D^{25} = +49.89$ at 45° C. The hydrochloride melts at 181—182° C. The laevo-rotatory base, *l*- α -allylpiperidine, was identified as β -coniceine (this J., 1905, 1186). The oily picrate associated with the picrate of inactive α -allylpiperidine, m. pt. 113—114.5° C., was found to contain a base described as *iso*- α -allylpiperidine. The hydrochloride of *iso*- α -allylpiperidine melts at 186—187° C., the free base boils at 166.5—168.5° C., and has the sp. gr. 0.8695 at 15.4° C. By means of tartaric acid, *d*-*iso*- α -allylpiperidine was obtained, which had the specific rotation, $[\alpha]_D^{25} = +24.81$ at 15° C., and formed a hydrochloride melting at 189—190° C. β -Coniceine was heated to 100° C. under pressure with hydriodic acid, and reduced with zinc dust at 0° C. The base obtained in this way was proved to be conine.—F. SUDN.

Essential oils: Constituents of —. Constitution of camphene and its oxidation by means of ozone. F. W. Semmler. Ber., 1909, 42, 246—252.

Crude camphene when oxidised with ozone gives rise to but one ozonide, $C_{10}H_{16}O_3$, showing that crude camphene is not a mixture of isomerides but a single substance. Camphene ozonide is a viscous oil, which is decomposed on steam-distillation, or by distilling in a vacuum. When the ozonide is distilled with steam, camphenilone passes over, whilst a hydroxy-acid, $C_9H_{14}O_3$, remains behind. Camphenilone melts at 40° C., boils at 73°—75° C. at 10 mm., has the sp. gr. 0.9800 at 20° C., and $n_D^{20} = 1.469$. The semicarbazone melts at 223° C. The acid, $C_9H_{14}O_3$, proved to be β -hydroxycamphenilonic acid, which is readily converted into the lactone, $C_9H_{14}O_2$. The lactone boils at 126°—128° C. at 10 mm., and sets to large tabular crystals melting at 95°—96° C. The acid, $C_9H_{14}O_3$, on distilling in a vacuum decomposes into the lactone mentioned above, and an acid, $C_9H_{14}O_2$, which boils at 136°—140° C. at 10 mm., and has the sp. gr. 1.028. The author concludes that camphene has the constitution represented by the formula:



—F. SUDN.

Grignard synthesis: Action of phenyl magnesium bromide on camphor. H. J. M. Creighton. Proc. Nova Scotia Inst. Sci., 1908, 11, 593—597. (See also this J., 1909, 682).

A SOLUTION of Japanese camphor in $\frac{1}{2}$ times its weight of ether, was allowed to drop into the calculated quantity of the phenyl magnesium bromide, and the mixture was maintained at 60° C. under a reflux condenser all night, the mixture being poured on to crushed ice, containing an excess of dilute hydrochloric acid to dissolve the precipitated magnesium hydroxide. The oil was separated from the resulting liquid, treated with sodium bisulphite, to remove any undecomposed ketone, and then washed with water and dehydrated over calcium chloride. After expelling the unaltered camphor at 205°—210° C., the product was distilled *in vacuo*, at 150° C., furnishing a pale yellow oil, amounting to about 25 per cent. of the theoretical yield. This oil has a flavour of balsam, and is miscible with alcohol, ether, and chloroform. The sp. gr. is 0.977, b. pt. 143°—145° C. at 14 mm. pressure, and 258°—260° C. at 760 mm. The mean molecular weight is 232.1, as compared with 239.17 (cal.) for $C_{16}H_{22}O$; and the percentage composition is: carbon, 83.89; hydrogen, 9.28; oxygen (by diff.), 6.83 per cent.; specific rotation (in alcohol solution) $[\alpha]_D^{25} = 7.55$. The product is a tertiary alcohol, analogous to methylborneol, and should therefore be termed phenylborneol.—C. S.

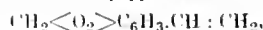
Chemotherapeutics: Present condition of —. P. Ehrlich. Ber., 1909, 42, 17—47.

THE author describes the difference between serum-therapeutics, in which the agents used are those developed in the organism, and chemotherapeutics in which synthetic remedies are employed. Synthetic remedies are especially useful in malaria and diseases caused by

trypanosomes, etc. The paper is concerned mainly with the attempts to prepare substances, which while having no appreciable injurious action on the organism, yet are capable of completely and readily destroying trypanosomes—parasites which are the cause of numerous diseases of animals, and also of sleeping sickness. The improvements and developments which have followed since the introduction of atoxyl (sodium *p*-amino-phenylarsinate) are described and discussed. In arsenophenylglycine, it is stated, a compound has been obtained which in thousands of trials on lower animals infected with trypanosomes, has never failed to effect a cure. The author is of the opinion that further work in chemotherapeutics will be more fruitful still if based on the view that independent partial functions ("chemoceptors") may be differentiated in the cell itself, and that the activity of therapeutic agents is governed by the nature of the interaction (combination, etc.) between such agents and the "chemoceptors." (See also this J., 1902, 789; 1908, 710, 1130, 1175; 1909, 169).—A. S.

Suprarenine and related substances: New synthesis of —. K. Böttcher. Ber., 1909, 42, 253—266.

IN synthesising suprarenine and allied substances, the author has isolated a number of compounds. The methylene ether of vinylpyrocatechol,



(obtained by the action of methylmagnesium iodide on piperonal) was dissolved in carbon tetrachloride, and chlorine passed through, when 3,4-methylenedioxy- β -chloro- α -hydroxyethane was produced. This substance crystallises in needles melting at 95° C. It was treated with phosphorus pentachloride, which was distilled off under reduced pressure, and the residue dissolved in acetone. Water was added slowly, the liquid carefully neutralised with sodium carbonate, extracted with ether, and the ethereal solution evaporated. The substance thereby produced is α -[3,4-dihydroxyphenyl]- β -chloro- α -hydroxyethane. After careful crystallisation from benzene, it decomposes at 100° C., and is not very stable. The same product can be produced by a similar reaction from methylenedioxyphenyl- α , β -dichloroethane. α -[3,4-Dihydroxyphenyl]- β -bromo- α -hydroxyethane is produced by analogous reactions and decomposes at 92°—93° C. Either of the above halogen-hydrins is converted into suprarenine by the action of methylamine. 3,4-Methylenedioxyphenyl- β -bromo- α -hydroxyethane was heated with sulphuryl chloride, and the excess of the latter driven off at reduced pressure. The residue was crystallised from dilute alcohol and formed long needles melting at 128°—129° C.; it was found to be α -[3,4-methylenedioxy-chlorophenyl]- β -bromo- α -hydroxyethane. The corresponding β -chloro product melts at 126°—127° C. *pseudo*-Safrol chlorohydrin, $\text{CH}_2 < \text{O}_2 > \text{C}_6\text{H}_3 \cdot \text{C}(\text{OH})(\text{CH}_3) \cdot \text{CH}_2\text{Cl}$, was produced by the action of chlorine on *pseudo*-safrol dissolved in carbon tetrachloride. This was treated with phosphorus pentachloride and acetone as before, and the chlorohydrin thus obtained was allowed to interact with methylamine to form α -methylsuprarenine. This base was purified by dissolving it in hydrochloric acid and precipitating with ammonia, when it formed a bright yellowish-brown powder. *iso*Safrol dichloride, $\text{CH}_2 < \text{O}_2 > \text{C}_6\text{H}_3 \cdot \text{CHCl} \cdot \text{CHCl} \cdot \text{CH}_3$, was prepared by the action of chlorine on *iso*safrol, and boiled at 164°—165° C. at 11 mm. By treatment with phosphorus pentachloride and acetone as before, α -[3,4-dihydroxyphenyl]- β -chloro- α -hydroxypropane was produced, which was crystallised from ethyl acetate and decomposed at 104°—105° C. The β -methylsuprarenine produced therefrom was a yellow powder. When the methylene ether of vinylpyrocatechol is treated with hydrogen bromide, methylenedioxybromophenyl- β -bromo- α -hydroxyethane is produced which melts at 157°—158° C. This substance on oxidation yields monobromopiperonylic acid, m. pt. 201°—202° C. It was treated with phosphorus pentachloride, and finally a monobromosuprarenine, $(\text{OH})_2\text{C}_6\text{H}_2\text{Br} \cdot \text{CH}(\text{OH}) \cdot \text{CH}_2 \cdot \text{NH} \cdot \text{CH}_3$, was obtained as a light-brown powder. The synthetic suprarenine formed methylamine on warming with sodium hydroxide, and gave a green coloration with

ferric chloride in dilute hydrochloric acid. Its physiological action resembled that of natural suprarenine. (See this J., 1909, 41.)—F. SHDN.

Volatilisation and sublimation, especially of high-molecular carbon compounds, at low temperatures, in a vacuum. C. J. Hansen. Ber., 1909, 42, 210—214.

The author has determined the temperature at which appreciable volatilisation of some high-molecular carbon compounds occurs in the cathode light vacuum (compare Krafft, this J., 1908, 21, 68). Some of the results are shown in the following table:—

Substance.	Temp.	Time.	Weight taken.	Loss of weight.
	°C.	hours.	grms.	grms.
Lauric acid	22	6	0.8215	0.0005
Myristic acid	27	6	0.4263	0.0003
Palmitic acid	32	12	0.4840	0.00012
Stearic acid	38	12	0.6266	0.00012
Laurone	40	10	0.4935	0.0001
Myristone	46	10	0.4638	0.0001
Palmitone	52.7	13	0.5802	0.0001
Stearone	58	13	0.5642	0.00003
Dotriacontane	63	14	0.6942	0.0002

Phenanthrene lost 34 per cent. of its weight in 12 hours at 36° C., and 12 per cent. in 12 hours at the ordinary temperature (about 20° C.). Anthracene lost 1 per cent. in 6 hours at 35° C. Phenanthraquinone lost 0.15 per cent. and anthraquinone 0.08 per cent. in 10 hours at 36° C. From 0.4547 grm. of alizarin, 0.2 mgrm. sublimed in 12 hours at 55° C. Maleic acid was sublimed without decomposition at about 80° C.; citraconic acid was sublimed at 40° C., but was converted partially into the anhydride. Phthalic acid began to decompose at 120° C., but by heating three boats, each containing 1 grm. of the coarsely powdered acid, for 48 hours at 115°—117° C., 1 grm. of pure phthalic acid was obtained as sublimate. All the temperatures given refer to the vacuum of the cathode light. (See also Kempff, this J., 1908, 1049.)

—A. S.

a-Naphthol; New reaction for —. Dané. L'Union. pharm., 1909, 50, 1.

On adding a few drops of formaldehyde solution to a solution of a few cgrms. of *a*-naphthol in caustic alkali, a green colour is formed in a few minutes in the cold, and at once on warming; this changes to deep blue. On exposing the blue solution to the air, a brown insoluble substance separates. With *β*-naphthol, no such reaction occurs; even after several months' contact no colour is formed, but a slight amount of insoluble substance is deposited. Although the blue colour commences to form on the surface of the mixture, it is not dependent on oxygen: it occurs in a precisely similar manner in a solution of *a*-naphthol protected from the atmosphere by a layer of vaseline oil.—J. O. B.

Nitrates and hydrocyanic acid; Loss of — during the drying of plants. E. Couperot. J. Pharm. Chim., 1909, 29, 100—102.

DIFFERENT portions of the plants of three varieties of lder (*Sambucus nigra*, *S. laciniata*, and *S. racemosa*) were dried by exposure to air and the amounts of hydrocyanic acid and nitrates determined. The amount of these substances in the fresh plant was also ascertained. A table is given showing the amounts of each present. It was found that drying the plant in the air caused a loss of one-fifth or even one-half of the hydrocyanic acid or nitrate originally present. If the plant was dried quickly by heating to 60° C., there appeared to be no loss, indicating that during the slow drying, a secondary fermentation must go on.—F. SHDN.

Hydrocyanic acid; Formation of —, during the action of nitric acid on phenols and quinones. A. Sewewetz and L. Poizat. Compt. rend., 1909, 148, 286—288.

THE formation of hydrocyanic acid by the action of nitric acid on organic substances appears to occur only when there is a phenolic or quinonic group present. The

author considers that an ortho- or para-nitroso-derivative of the phenol is first formed, which can function as an ortho- or para-quinoneoxime. This is oxidised in such a way as to produce mesoxalic acid and its oxime, or oxalic acid and the monoxime of dihydroxytartaric acid; and the hydrocyanic acid is derived from the oxime.

—J. T. D.

Cyanuric acid; New method of preparing — from urea. R. von Walther. J. prakt. Chem., 1909, 79, 126—128.

28X grms. of urea were mixed with 20 grms. of anhydrous zinc chloride and heated to about 220° C. After cooling, the reaction product was treated with dilute hydrochloric acid, and the crystals which separated were purified by recrystallisation from hot water. The yield of cyanuric acid thus obtained was 62 per cent. of the theoretical quantity and was not improved by varying the amount of zinc chloride used.—A. S.

Ethers; New method of preparation of —. J. B. Senderens. Compt. rend., 1909, 148, 227—229.

By the catalytic action of precipitated aluminium oxide on alcohol vapour, the alcohol is dehydrated, forming an ethylene hydrocarbon. In the case of acids, dehydration involves the participation of two molecules, carbon dioxide and an ether being formed: thus, $2\text{CH}_3\text{CO}_2\text{H} = \text{H}_2\text{O} + \text{CO}_2 + \text{CH}_3\text{COCH}_3$. It is now found, using alumina obtained by precipitating sodium aluminate with sulphuric acid, that if the temperature is maintained at 240°—260° C., the formation of ethylene from alcohol is very small; two molecules of alcohol become involved in the dehydration and ether is formed. The vapours, after passing over the heated alumina, are condensed to a liquid, which separates into two layers. The upper layer when separated by decantation, consists of ether so far dehydrated that 83.5 per cent. distils below 60° C. The process is applicable to 95 and 85 per cent. alcohol as well as to absolute alcohol. Dimethyl ether and dipropyl ether have also been obtained in a similar manner.—E. F. A.

Dihydroxyacetone; Colour reactions of —. G. Denigés. Compt. rend., 1909, 148, 172—173.

DIHYDROXYACETONE, whether prepared synthetically or by the action of the sorbose bacterium on glycerin, gives colour-reactions with certain phenolic substances and alkaloids—resorcinol, thymol, *β*-naphthol, codeine and other opium-alkaloids. The reagent in 5 per cent. alcoholic solution (0.1 c.c.), the solution of dihydroxyacetone, containing not more than 1 grm. per litre (0.4 c.c.), and exactly 2 c.c. of sulphuric acid of sp. gr. 1.84 are mixed in a test-tube, and after one or two minutes at the ordinary temperature, the tube is heated in boiling water for two minutes. With codeine, a deep greenish-blue colour is struck; with *β*-naphthol, a green colour with greenish fluorescence; with resorcinol, in the cold, a colour resembling that of solutions of bichromates; with thymol, also in the cold, a blood-red or claret colour, becoming rose at very great dilutions. All of these reactions are extremely delicate. The colorations with the different morphine alkaloids (morphine, codeine, oxydimorphine, apomorphine) permit of distinguishing these alkaloids readily from one another.—J. T. D.

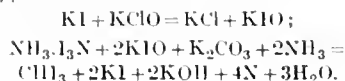
Dihydroxyacetone; Reactions of —. G. Denigés. Compt. rend., 1909, 148, 282—283.

CERTAIN colour reactions are given by dihydroxyacetone in presence of bromides (and hence by glycerin which has been converted into dihydroxyacetone by addition of bromine) which are not given by dihydroxyacetone alone. The reagents the author has used, amongst others, are especially guaiacol, salicylic acid, and gallic acid. Into a test-tube is put 0.1 c.c. of a 5 per cent. solution of the reagent, 0.1 c.c. of 4 per cent. solution of potassium bromide, 0.4 c.c. of the solution containing dihydroxyacetone (not stronger than 1 grm. per litre), and 2 c.c. of sulphuric acid of sp. gr. 1.84. The substances are mixed by shaking, and the tube is immersed for two minutes in boiling water. Guaiacol gives a deep-blue tint in a solution containing 0.1 grm. per litre, becoming more rose-coloured

as the solution becomes more dilute. Salicylic acid strikes a strawberry red colour, and gallic acid a deep violet. (See also preceding abstract.)—J. T. D.

Iodoform; *Formation of* —, G. Guerin. *J. Pharm. Chim.*, 1909, 29, 54–55.

IN the presence of ammonia and a caustic alkali, iodoform is formed by the action of iodine on carbonic acid. From 5 to 6 grms. of potassium iodide and 2 or 3 grms. of an alkali carbonate are dissolved in 50 c.c. of water, then 10 c.c. of ammonia solution and the same quantity of caustic alkali solution are added. The mixture is treated with a solution of an alkali hypochlorite, which causes the appearance of black flocks of nitrogen iodide; when this no longer readily disappears, on agitation, after adding more hypochlorite, a large excess of ammonia is added at once which brings about the almost instantaneous conversion of nitrogen iodide into iodoform. If the hypochlorite solution employed is very dilute, there is no previous separation of nitrogen iodide. The reaction appears to occur as follows:



—J. O. B.

Calcium; *Action of alcohols on metallic* —, F. M. Perkin and L. Pratt. *Chem. Soc. Proc.*, 1909, 25, 18.

WHEN calcium is added to alcohols, reaction ensues and the alkoxide, $\text{Ca}(\text{OR})_2$, is produced (this J., 1908, 39). The reaction, however, is generally slow, but is greatly facilitated by heat. Calcium hydride reacts more readily than metallic calcium, but the product is less pure than when the metal is employed, owing to impurities in the calcium hydride. Calcium ethoxide is soluble in ethyl alcohol, and crystallises with two molecules of alcohol of crystallisation. Other alkoxides are not so readily prepared, owing to their insolubility in the alcohols. Calcium ethoxide has been employed satisfactorily for organic condensations in place of sodium ethoxide.

Purity of lactose. Hillringhaus and Heilmann. See XVI.

PATENTS.

[*Theobromine double salts*] *Pharmaceutical products*; *Manufacture of new* —, G. W. Johnson. London. From Verein. Chininfabr. Zimmer und Co., Frankfurt, Germany. Eng. Pat. 6439, March 23, 1908.

DOUBLE salts of theobromine-sodium and halogen salts of the alkalis are obtained by the interaction of molecular proportions of the components. These double salts are readily soluble in water. Example: 18 parts of theobromine are dissolved in an aqueous solution of 4 parts of sodium hydroxide, 5.85 parts of sodium chloride are added, and the solution, after filtering if necessary, is evaporated.—A. S.

Nerol; *Process for the extraction of* — from oil of *Helichrysum angustifolium* and other species of *Helichrysum*. Heine and Co. Fr. Pat. 394,496, Sept. 21, 1908. Under Int. Conv., Sept. 21, 1907.

THE claims are for the extraction of nerol from oils of species of *Helichrysum*, especially *H. angustifolium*, by methods similar to those used for the extraction of this alcohol from petitgrain oil (see Fr. Pat. 326,658 of 1902; this J., 1903, 819).—A. S.

p-Aminophenylarsinic acid; *Process for preparing sulphur derivatives of* —, Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 205,617, Nov. 23, 1907.

AQUEOUS or alcoholic solutions of *p*-aminophenylarsinic acid, its homologues or derivatives, or the corresponding arsenious oxide compounds, are converted into sulphur derivatives by treatment with hydrogen sulphide. The compounds have the constitution: $\text{R}_1\text{R}_2\text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{AsS}$; $\text{R}_1\text{R}_2\text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{AsS}_2$; $(\text{R}_1\text{R}_2\text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{As})_2\text{S}_3$. They possess higher toxicity than the corresponding oxygen compounds,

but also have a stronger action on trypanosomes. The preparation of *p*-aminophenylarsenic sulphide, *p*-acetaminophenylarsenic sesquisulphide, and phenylglycimarsenic disulphide is described in the specification. Thus, 60 grms. of *p*-aminophenylarsinic acid are dissolved in 3 litres of water and 160 c.c. of hydrochloric acid (sp. gr. 1.49), and the solution saturated with hydrogen sulphide; the precipitated *p*-aminophenylarsenic sulphide, $\text{NH}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{AsS}$, is dried and freed from sulphur by extraction with carbon bisulphide.—T. F. B.

α-Naphtholarsinic acid; *Process for preparing* —, W. Adler. Ger. Pat. 205,775, Nov. 6, 1907.

α-Naphthylaminoarsinic acid, obtained by heating a mixture of *α*-naphthylamine and arsenic acid to 190° C., is diazotised, and the solution of the diazo compound treated with steam, when it is converted into *α*-naphtholarsinic acid.—T. F. B.

Camphene; *Process for preparing* —, Act.-Ges. f. Anilinfabr. Ger. Pat. 205,850, Oct. 10, 1907.

THE semi-liquid compounds resulting from the action of aniline or its homologues on pinene hydrochloride are decomposed by means of acids or salts into camphene and aniline or a homologue; a diluent may be added if desired. The aniline or other base is separated from the camphene by distillation with steam, the last traces being removed by washing with acids.—T. F. B.

Pharmaceutical compounds or mixtures [containing ferrous carbonate]; *Preparation of* —, H. W. Lake. London. From E. Lilly and Co., Indianapolis, U.S.A. Eng. Pat. 27,314, Dec. 10, 1907.

SEE U.S. Pat. 876,366 of 1908; this J., 1908, 122.—T. F. B.

Oxalates; *Method for manufacturing* —, W. A. Dyes, Manchester. From A. Hempel, Leipzig-Plagwitz, Germany. Eng. Pat. 3429, Feb. 15, 1908.

SEE Fr. Pat. 389,039 of 1908; this J., 1908, 958.—T. F. B.

Bornyl oxalate; *Manufacture of* —, A. Zimmermann, London. From Chem. Fabr. auf Actien vorm. E. Schering, Berlin. Eng. Pat. 14,408, July 7, 1908.

SEE Fr. Pat. 393,478 of 1908; this J., 1909, 108.—T. F. B.

Isobornyl esters; *Process of making* —, C. Weizmann, Rusholme, Assignor to Clayton Aniline Co., Ltd., Clayton. U.S. Pat. 910,978, Jan. 26, 1909.

SEE Fr. Pat. 386,552 of 1908; this J., 1908, 712.—T. F. B.

Hydrazine; *Production of* —, F. Raschig, Ludwigs-hafen on Rhine, Germany. U.S. Pat. 910,858, Jan. 26, 1909.

SEE Eng. Pat. 139 of 1908; this J., 1908, 522.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic developer "Pyramidal Vindonissa" [dihydroxydiphenylamine]. L. P. Clerc. Bull. Soc. Franç. Phot., 1909, 25, 48–55.

p-p'-DIHYDROXYDIPHENYLAMINE, prepared by the condensation of quinol with *p*-aminophenol, is applicable, in the form of its normal sulphate, as a photographic developer. In aqueous solution the base is rapidly oxidised, but its sulphate is quite stable in solution. It is an energetic photographic developer in presence of alkalis; formulae for the various processes are given in the paper.—T. F. B.

Colour photography; *Experimental investigation of Lippmann's process of* —, H. E. Ives. Z. wiss. Phot., 1908, 6, 373–401. Chem. Zentr., 1909, 1, 335.

THE author concludes from the results of his experimental study of Lippmann's process of colour photography (this J., 1891, 483; 1893, 464; 1895, 65), that the purity of the reflected monochromatic light is increased by decreasing the content of silver bromide in the sensitive film. For the reproduction of mixed colours, development

with quinol (hydroquinone) is suitable, followed by bleaching. The colours of natural objects are reproduced better by coarse-grained than by fine-grained films, whilst the latter are more suitable for pure colours. A reflecting film of silver can be used in place of the mercury mirror. Lippmann's films, being capable of reproducing pure colours, are well suited for use in the three-colour process.

—A. S.

Tanning and adsorption compounds of gelatin. Lüppe-Cramer. See XIV.

XXII.—EXPLOSIVES, MATCHES, &c.

Cheddites containing ammonium perchlorate in place of potassium chlorate; Report on —. Mém. des Poudres et Saltpêtres, 1907—1908, 14, 206—229.

THE explosives had the following compositions:—No. 1—Ammonium perchlorate (82), dinitrotoluene (13), and castor oil (5 parts). No. 2—Ammonium perchlorate (50), sodium nitrate (30), dinitrotoluene (15), and castor oil (5 parts).

Rate of combustion in the open.—No. 1—The rates of combustion in mm. per second at the external temperatures stated, were as follows: 2°C , 4.5 mm.; 7°C , 100 mm.; 17°C , 125 mm. No. 2—Under ordinary conditions of temperature, combustion did not take place in the open, even when the explosive, before being tested, had been kept in a dry atmosphere.

Detonation by shock.—A weight of 30 kilos, with a striking surface of 16 sq. cm. was allowed to fall from a height of 4.5 m. upon 100 grms. of each explosive spread over an area of 35 cm. by 10 cm. Cheddite No. 60 was used as a standard of comparison. The quantity which exploded in each instance was as follows:—No. 1, 17 grms.; No. 2, 13 grms.; cheddite No. 60, 27 grms. From the point of view of transmission of detonation by shock, these explosives present greater security than cheddite itself.

Special dangers of ammonium perchlorate.—Clothing impregnated with ammonium perchlorate burns more rapidly than that impregnated with potassium chlorate, though not so fiercely as when sodium chlorate is used. Explosives containing the last ingredient have, however, been authorised for manufacture in France, as it was found that this objection could be overcome. Ammonium perchlorate, as regards sensitiveness to shock, stands almost on a level with picric acid. As an explosive, ammonium perchlorate is considered to possess a considerable coefficient of safety. It is, however, pointed out that owing to the possibility of dangerous chemical reactions occurring between ammonium perchlorate and potassium and sodium chlorate, the manufacture of these two types of explosives require to be completely separated.

Experiments on heating.—A pulverised sample of electrolytic ammonium perchlorate was heated continuously at 110°C . for ten months. Up to twenty days the loss was only 0.33 per cent. after allowing for moisture. From that time onwards, a steady decrease of weight was apparent, amounting to 23 per cent. at the end of ten months. No loss in weight could be detected on heating at 40°C . for seven months. Samples of the two explosives mentioned, similarly treated, showed a loss in weight equivalent to the dinitrotoluene contained in the sample.

The two explosives are considered as chemically stable under ordinary conditions of storage. *Gaseous products reduced on explosion.*—Experiments carried out under conditions simulating those present in mining showed that explosive No. 1 produced a very considerable quantity of disagreeable acid fumes. In the case of explosive No. 2 (containing sodium nitrate), the disagreeable effect was not nearly so marked, and it is considered probable that a explosive containing 46 per cent. of ammonium perchlorate and 34 per cent. of sodium nitrate would be more satisfactory from this point of view.

Closed vessel experiments.—The following pressures per sq. cm. were registered for the charge densities mentioned:—No. 1: 1, 975 kilos.; 0.2, 2546; 0.25, 3123 kilos. No. 2: 0.1, 52 kilos.; 0.2, 1942; 0.25, 2426 kilos. *Velocity of tonation.*—No. 1—With a density of 0.69, the velocity detonation was found to be 2795 m. per second, rising

to a maximum of 4020 m. at a density of 1.04, and falling from this point to 3768 m. at a density of 1.25. No. 2—With a density of 0.88, the velocity was 2655 m. The maximum velocity (3361 m.) was obtained at a density of 1.04, and from this point the velocity fell to 3006 m. at a density of 1.34. *Sensitiveness to detonation by fulminate.*—With a detonator containing 1.5 grms. of fulminate, detonation of the explosives was always complete if the density of the explosive did not exceed 1.3. A detonator containing 0.5 gm. of fulminate caused complete detonation when the density of the explosive was not greater than 1.1. A detonator containing 0.3 gm. of fulminate completely detonated the explosive when the density was not more than 0.9. The sensitiveness to detonation was also influenced detrimentally by a low external temperature, and by a hardening of the cartridge. *Hardening of the explosive.*—In addition to hardening, properly so called, there is also contraction in the material of the cartridge, and the two phenomena are not necessarily related. For instance some varieties of cheddite harden to a very considerable extent, but contract very little. The hardening is apparently due to re-oxidation of the castor oil, owing to access of air, and the large surface of castor oil exposed on account of the fine state of division of the chlorate. Experiments with a viscometer showed that castor oil which originally ran at the rate of 20 c.c. per hour from the viscometer, fell in rate of flow to 17.5 c.c. after 1 month's heating at 60°C ; whilst the same castor oil heated during the same time in admixture with potassium chlorate, and then extracted with ether, had only a rate of flow of 2 c.c. due to increased viscosity. Side by side, a contraction goes on, at times to such an extent, that the original density of 1.23 increased to 1.44. It is to this latter fact (increase of density), that lack of detonation is to be ascribed. A reference to the influence of increase of density on unsatisfactory detonation referred to above, makes this point clear. *Detonation in lead blocks (Abel).*—The lead blocks were 255 mm. in diameter, and 288 mm. high. The hole was 28 mm. in diameter, and 180 mm. deep. 10 grms. of explosive were used, and a detonator containing 2 grms. of fulminate. The increase of volume was 226 c.c. equal to 22.6 c.c. per gm. Dynamite No. 1, in similar blocks, gave an equivalent of 25.6 and 26.3 per gm.—G. W. McD.

Explosive; New — termed "carbite"; and three types of dynamite containing dinitrotoluene; Reports by the Commission des Substances Explosives (France) on requests for sanction for the manufacture of —. Mém. des Poudres et Saltpêtres, 1907—1908, 14, 176—177, 185—187, 190—192.

(1). "CARBITE" consists of nitroglycerin (25), potassium nitrate (34), flour (38.5), barium nitrate (1), powdered bark (1), and sodium carbonate (0.5 parts). The resistance to moisture was found to be good, though the heat test was only medium. Permission for the manufacture of the explosive was granted. (2). The explosives were of the following compositions: (A). Nitroglycerin (85), nitrocotton (8), and dinitrotoluene (7 parts). (B). Nitroglycerin (75), nitrocotton (5), dinitrotoluene (8), potassium nitrate (10), and cellulose (2 parts). (C). Nitroglycerin (50), nitrocotton (3), dinitrotoluene (7), potassium or sodium nitrate (34), cellulose or flour (5.8), and red ochre (0.2 parts). At the end of seven months of storage the samples were in a good state of preservation, though explosive (C), containing sodium nitrate, showed slight traces of exudation. In view of the fact that the question of the use of dinitrotoluene as a constituent of nitroglycerin explosives for the purpose of preventing freezing, should be further studied in all its bearings, only a few thousand kilos. were authorised for manufacture.

—G. W. McD.

PATENTS.

Explosives. Anglo-French F. and S. Ltd., and J. B. Edwards, London. Eng. Pat. 24,025, Oct. 30, 1907.

THE object of the invention is to render the combustion of the explosive more regular and complete, and to prevent the production of a flame at the muzzle of the gun. For this purpose the explosive is mixed with from 2 to 7

per cent. of carnauba wax and 2 per cent. of sodium bicarbonate, or an equivalent proportion of magnesium bicarbonate or ammonium bicarbonate, together with a suitable solvent liquid (alcohol, ether, acetone). The resulting paste is rolled into the form of a sheet or the like, on the face or faces of which incisions are made, after which the sheet is subjected to a second rolling to reduce its thickness.—A. S.

Explosives. Anglo-French F. and S. Ltd., and J. B. Edwards, London. Eng. Pat. 12,188, June 4, 1908. Addition to Eng. Pat. 24,025 of 1907. (See preceding abstract.)

To prevent the production of flame during combustion, the addition to explosives of alkaline salts in the form of a paste has been suggested. But such salts may deliquesce and thus affect the stability of the explosive, and it is for the purpose of overcoming this difficulty and avoiding such liability that the present patent is taken out. According to this improvement, the explosive is mixed with beeswax (5 per cent.), sodium bicarbonate (2 per cent.), and benzine (5 per cent.). The beeswax has the effect of coating the particles of sodium bicarbonate, thus protecting them from air and moisture, whilst the benzine on decomposing during explosion, liberates hydrogen, which uniting with the oxygen of the air, forms water vapour, which again serves to extinguish flame or flash. The paste described, is subjected to the shaping process mentioned in the main patent.

—C. J. G.

Explosives and process for making the same. F. Sparre, Wilmington, U.S.A. Eng. Pat. 1677, Jan. 24, 1908. Under Int. Conv., Jan. 25, 1907.

SEE U.S. Pat. 850,326 of 1907; this J., 1907, 553.—T. F. B.

Explosives. J. Rudeloff, Schönebeck a/E., Germany. Eng. Pat. 16,599, Aug. 6, 1908.

SEE Ger. Pat. 201,306 of 1906; this J., 1908, 1178.—T. F. B.

Blasting powder. W. Eberle, Ettlingen, Germany. U.S. Pat. 901,365, Jan. 19, 1909.

SEE Eng. Pat. 15,195 of 1908; this J., 1908, 1000.—T. F. B.

Dinitroglycerin explosive and process of making. A. Mikolajczak, Kastrof, Germany. U.S. Pat. 910,936, Jan. 26, 1909.

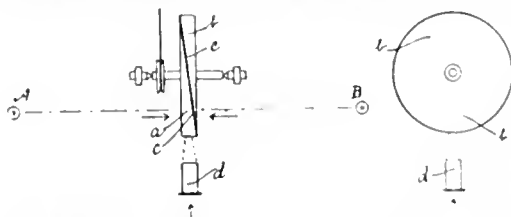
SEE Fr. Pat. 394,911 of 1904; this J., 1904, 911.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

PATENTS.

Photometer. W. Fennell, Wednesbury, and W. P. Perry, Tipton, Staffs. Eng. Pat. 6971, March 30, 1908.



THE patent relates to improved forms of flicker photometers. In one form (see figs.), a rotating disc is employed, consisting of two wedge-shaped parts, *a*, *b*, of translucent material, insulated from each other by an opaque film, *c*, and each illuminated by a source of light, *A*, and *B*, respectively, on its side and observed on edge through the eye-piece, *d*. In another form a single rotating translucent disc, with parallel sides covered with opaque films, is employed, the films being cut away alternately on either side of the disc, so that no section of the latter

is covered by more than one film. In a third modification a stationary piece of translucent material is mounted between two opaque rotating discs, each cut away so as to allow the light to pass through for alternate periods from the two sides. As translucent material paraffin wax protected by thin sheets of glass or mica, or glass vessels filled with a translucent liquid may be employed. An improved sighting arrangement is also described.

—A. S.

Fluids: Process and apparatus for the examination of —. H. B. Bishop, Fr. Pat. 394,107, Sept. 10, 1908.

THE patent relates to means for determining variations in the concentration of solutions or in the composition of fluid mixtures, by measuring the electric conductivity of such solutions or mixtures. The process consists essentially of a comparison of the conductivity of the substance under examination with that of a standard composed of the same substance. The effect of variations of temperature is thus avoided as the contents of both the standard tube and the "testing tube" are subject to such variations. The difference of electric conductivity of the standard material and the material under examination is observed by means of a device similar to a Wheatstone bridge.—A. S.

INORGANIC—QUANTITATIVE.

Cobalt: Determination of — by means of potassium nitrite. L. L. de Koninck, Bull. Soc. Chim. Belg., 1909, 23, 11—13.

THE precipitation of cobalt as potassium cobaltinitrite is best effected in the presence of free nitric acid, employing a large excess of potassium nitrite. For example, the addition of 15 c.c. of 5*N* potassium nitrite solution to 5 c.c. of *N*/₂ cobalt nitrate, acidified with 2 c.c. of 6*N* nitric acid, ensures complete precipitation of the cobalt, and the precipitate has the bright yellow colour of the pure cobaltinitrite.—F. SONN.

Pyridine in ammonia. Pinchbeck. See VII.

ORGANIC—QUALITATIVE.

Dyestuffs on dyed cotton. Holden. See V.

Olive oil and Baudouin's reaction. Zega and Todorovic. See XII.

Purity of lactose. Hillringhaus and Heilmann. See XVI.

Yohimbé bark. Griebel. See XX.

Reaction of α -naphthol. Dané. See XX.

Dihydroxyacetone reactions. Denigés. See XX.

ORGANIC—QUANTITATIVE.

Carbon tetrachloride for fat determination. Rammstedt. See XII.

Theobromine in cocoa. Kreutz. See XVIII.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Oxydases and peroxydases, Artificial —. Martinand. Compt. rend., 1909, 148, 182—183.

THE oxides of the alkali and alkaline-earth metals which can form peroxides, fix atmospheric oxygen in an active form, and produce substances resembling organic oxydases; the same is the case with the most highly oxidised salts of metals forming several oxides. These substances may be looked upon as formed of a peroxydase (the salt itself) and an oxygenase (the peroxide formed by action of air on the salt). This inorganic oxygenase can be replaced, as in organic oxydases, by hydrogen peroxide. In other respects also, these substances closely

resemble organic oxydases. These properties of alkali and alkaline-earth compounds, and of ferric chloride, are of interest in their bearing on the oxidation phenomena of animal and vegetable life.—J. T. D.

The Imperial Institute. Board of Trade J., Feb. 11, 1909. [T.R.]

DURING the last quarter of 1908, the Scientific and Technical Department of the Imperial Institute received 80 requests for investigation and despatched 114 reports during the quarter, the totals for the year 1908 being respectively 375 and 393. At the beginning of the present year 141 investigations were in progress. Rhodesian magnesite, African wild silks, West African and Indian oil-seeds, Bermuda tobacco, and a new West African rubber plant were amongst the substances more recently investigated, and assistance had been rendered in connection with the development of the flax industry in St. Helena. New colonial exhibits had been transferred from the Franco-British Exhibition to the Exhibition Galleries of the Institute. These exhibits came from many parts of the British Empire, including Australia, Canada, India, Natal, New Zealand, and West Africa.

The galleries were visited by 29,427 persons during the quarter, bringing the total for the year 1908 up to 110,189.

New Books.

LABORATORIUMSBUCH FÜR DIE ERDÖL-INDUSTRIE. Eine gedrängte Schilderung der wichtigeren in der Praxis des Erdölchemikers vorkommenden Untersuchungsmethoden. Von Dr. Richard Kissling. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price M3-00.

8vo volume, containing 82 pages of subject matter with 22 illustrations. The book forms Bd. V of a series of "Laboratoriumsbücher für die chemischen und verwandten Industrien." The subject matter is arranged as follows: I. The more important methods of investigation. II. Examination of petroleum, and the products of the petroleum industry. III. Definition of chemical engineering management. IV. Examination of the individual products employed in the industry.

LABORATORIUMSBUCH FÜR DIE BRAUNKOHLENTEER-INDUSTRIE. Braunkohlengruben, Braunkohlenteerschwefelereien und Destillationen, Paraffin und Kerzenfabriken, sowie Oelgasanstalten. Von Dr. Ed. GRAEFE. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price M. 6-60.

FORMS Bd. VI. of the series of "Laboratoriumsbücher," above referred to. 8vo. volume, containing 176 pages of subject matter with 65 illustrations, and alphabetical indexes of subjects and authors' names. The subject matter is classified and arranged under the following heads: I. Analysis of coals. II. Examination of the products: (i.) Tar. (ii.) Cokes. (iii.) Gaseous products. (v.) Aqueous products. III. Examination of the products of tar distillation. IV. Examination of the residues of the mixing processes. V. Crude paraffin and shale. VI. Examination of the materials for treating the products in the refining of paraffin. VII. Examining prepared paraffin wax. VIII. The various stages of the candle-moulding process. IX. Testing the oils. X. Special investigations of the oils. XI. Examining some by-products of the brown coal-tar distillation, and of the materials employed. XII. Analysis of the brown coal bitumen (montan wax). XIII. Examination of asphaltic oils and oil-gas.

LE LACK UND FERNISFABRIKATION. Von Professor MAX BOTTLE. Wilhelm Knapp's Verlag, Halle a. S. 1908. Price M. 4-50.

It forms Bd. XVI of the "Monographien über chemisch-technische Fabrikationsmethoden." It is an 8vo.

volume containing 122 pages of subject matter, with 29 illustrations, a list of works of reference in connection with the main topic, and indexes of subjects and names of authors. The arrangement of the text is planned as follows: I. Introductory and historical. II. Distinguishing varnishes. III. Raw materials for the varnish manufacture. IV. Preparation and general work. V. Turpentine, benzene, and petroleum spirit varnishes. (i.) Oil of turpentine varnishes. (ii.) Benzene varnishes. (iii.) Asphaltum varnishes. (iv.) Caoutchouc varnishes. VII. Alcoholic and other volatile and non-volatile varnishes. VIII. Colouring, decolorising, and filtering varnishes. IX. Preparation of printing and lithographic varnishes, soap-varnishes, resin, and casein varnishes.

RAPID METHODS FOR THE CHEMICAL ANALYSIS OF SPECIAL STEELS, STEEL-MAKING ALLOYS, AND GRAPHITE. By CHAS. M. JOHNSON, Chief Chemist to the Park Steel Works of the Crucible Steel Co. of America. John Wiley & Sons, New York. Chapman and Hall, Ltd. 1909. Price 12s. 6d.

SMALL 8vo. volume, containing 217 pages of subject matter, with 12 illustrations, and an alphabetical index. The methods described are as follows: I. Qualitative tests for chromium, vanadium, copper, titanium, nickel, molybdenum, and tungsten in steel. II. Analyses of: vanadium steel and ferro-vanadium; of titanium steel and ferro-titanium; of tungsten powders; of tungsten steel and chrome-tungsten steel; of low per cent. tungsten-steel; of molybdenum powders; of tungsten-molybdenum steels, and of ferro-chrome, chrome ore and carbonless chrome. VII. Determinations of: aluminium in steel, and of copper in steel and pig iron. VIII. Separation of nickel and copper from iron and vanadium by potassium ferrieyanide. IX. Determination of copper in metallic copper. X. Rapid determination of nickel in the presence of chromium, iron and manganese. XI. Analysis of ferromanganese. XII. Rapid volumetric method for manganese in the presence of iron, calcium, and magnesium. XIII. Determinations of carbon in iron and steel by direct ignition with red lead or litharge, and of carbon in steel, ferro-alloys, and plumbago, by means of an electric combustion furnace, &c. XIV. Carbon in steel by colour. XV. Phosphorus in steel, pig-iron, bar iron, and wash metal. XVI. Sulphur in steel, bar iron, pig iron, and wash metal. XVII. Manganese in special steels, &c. XVIII. Silicon in iron and steel. XIX. Analysis of graphite and graphite crucibles. XX. Annealing steel. XXI. Simple method for making clay combustion boats.

INTRODUCTION TO THE SCIENCE OF RADIO-ACTIVITY. By CHARLES W. RAFFETY. Longmans, Green, and Co., 39, Paternoster Row, London, 1909. Price 4s. 6d. New York, Bombay, and Calcutta.

8vo. volume containing 201 pages of subject matter, with 27 illustrations, and an alphabetical index. The subject matter is classified and arranged as follows: PART I. (i.) Spectrum of radium, &c. (ii.) Rays emitted by radium; their nature, &c. (iii.) Methods of investigation. (iv.) The α rays, &c. The β rays. Photographic action, &c. (v.) The γ rays; and secondary radiation, &c. PART II. (i.) Radio-active products. Thorium X, and Uranium X. (ii.) Radium emanation. (iii.) Theoretical considerations. (iv.) Atomic structure. Electron theory of the atom. (v.) Electron theory and the rays of the radio-active elements, &c. (vi.) Radio-active transformations of thorium. Thorium emanation. (vii.) Origin of radium. Uranium in relation to radium. PART III. (i.) Kathode, canal and X rays. Magnetic deflections, &c. (ii.) Electroscopes, &c.

THE THEORY OF VALENCY. By J. NEWTON FRIEND, Ph.D., M.Sc. Longmans, Green & Co., 39, Paternoster Row, London, 1909. Price 5s. New York, Bombay, and Calcutta.

ONE of the series of text books of Physical Chemistry edited by Sir William Ramsay, K.C.B., F.R.S. Small 8vo. volume, containing 169 pages of subject matter, with 6 illustrations, and alphabetical index of names and subjects. The text is classified as follows: I. Lavoisier,

Dalton, and Berzelius. II. Early theories of Chemical combination. III. Theory of valency. IV. Valency and the periodic law. V. Exceptions to the periodic law. VI. Valency of carbon. VII. Thiele's theory. VIII. Valency of the elements of groups O, I, II, III, and IV. IX. Valency of nitrogen. X. Valency of the elements of groups V, VI, VII, and VIII. XI. Werner's theory. XII. Electrochemical theories. XIII. Physical cause and nature of valency.

OUTLINES OF PHYSICAL CHEMISTRY. By GEORGE SENTER, Ph.D., Lecturer on Chemistry at St. Mary's Hospital, &c. Methuen & Co., 35, Essex Street, London, W.C. 1909. Price 3s. 6d.

SMALL 8vo. volume, containing 366 pages of subject matter, with 39 illustrations, and an alphabetical index. The text is classified and arranged under the following heads: I. Fundamental principles of chemistry. The atomic theory. II. Gases. III. Liquids. IV. Solutions. V. Dilute solutions. VI. Thermochemistry. VII. Equilibrium in homogeneous systems, &c. VIII. Heterogeneous equilibrium. The phase rule. IX. Velocity of reaction. Catalysis. X. Electrical conductivity. XI. Equilibrium in electrolytes. Strengths of acids and bases. Hydrolysis. XII. Theories of solution. XIII. Electromotive force.

STATISTICAL ABSTRACT FOR THE BRITISH EMPIRE IN EACH YEAR FROM 1893 TO 1907. FIFTH NUMBER. [Cd. 4486.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 2d.

This publication contains statistics of the area, population, and trade of each portion of the Empire with foreign countries and with other portions of the Empire, figures as to shipping, and statements as to the production and consumption of staple articles in the various countries of the Empire.

BULLETIN OF THE IMPERIAL INSTITUTE. Vol. VI., No. 4. Price 1s.

This issue of the Bulletin contains accounts of recent investigations made in the Scientific and Technical Department of the Imperial Institute regarding some African oils and oil seeds, rapia wax, cotton from British Guiana, fibres from Fiji, and "Bitinga" rubber, together with general notices respecting a number of economic products and their development.

FOREIGN IMPORT DUTIES, 1908. STATEMENT OF THE RATES OF IMPORT DUTIES LEVIED IN EUROPEAN COUNTRIES, EGYPT, THE UNITED STATES, MEXICO, ARGENTINA, JAPAN, CHINA AND PERSIA UPON THE PRODUCE AND MANUFACTURES OF THE UNITED KINGDOM. [Cd. 4414.] Wyman and Sons, Fetter Lane, London, E.C. Price 3s. 8d.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

2400. Crépelle-Fontaine. Obtaining and recovering alcohol and other in various industries. Feb. 1.
2485. Hampson. Diffusion processes for separating gases of different densities. Feb. 2.
2531. Black and Lennox. Continuous drying machines. [Addition to No. 12,087 of 1907.] Feb. 2.

2544. Baxter. Machines for separating solids of different densities. Feb. 2.

2643. Hemming. Cleansing solid and liquid materials and freeing them from gas. [Fr. Appl., Feb. 3, 1908.]* Feb. 3.

3302. Ilges. Process and apparatus for rectifying liquids. [Ger. Appl., Feb. 12, 1908.]* Feb. 10.

3394. Bartelt. Apparatus for liberating gases from bodies containing them. Feb. 11.

3432. Greville. Drying machines. Feb. 11.

3477. Andrews. Stills for distilling ammoniacal and other liquids. Feb. 12.

3493. Cochrane. *See under XIII.C.*

COMPLETE SPECIFICATIONS ACCEPTED.

2613 (1908). Jacob, Alexander, and Serenyi. Devices for introducing air, steam, or other gases into liquids. Feb. 10.

2815 (1908). Ogle (Cockburn). Apparatus for removing liquid from solid materials. Feb. 17.

2914 (1908). Arndt. Air pyrometers. Feb. 17.

3394 (1908). Boulé (Schmatolla). Reverberatory and like furnaces. Feb. 17.

4123 (1908). Wilson. Firing rotary or like kilns or furnaces. Feb. 17.

20,972 (1908). Maschinenfabrik Grevenbroich. Evaporating apparatus. Feb. 10.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

2313 and 2314. Fischer. Mantles for incandescent gas lamps. Feb. 1.

2389. British Thomson-Houston Co. (General Electric Co.). Treatment of electric lamp filaments. Feb. 1.

2449. Schramm and Kershaw. *See under XIII.A.*

2620. Key. Production of gas for illuminating or heating. Feb. 3.

2813. Williams. *See under VII.*

2853. Siemens and Halske A.-G. Manufacture of electric incandescence filaments from tungsten, &c. [Ger. Appl., Feb. 11, 1908. Addition to No. 4814 of 1908.]* Feb. 5.

3003. Parker. Vertical retorts for the destructive distillation of coal. Feb. 8.

3171. Larbeck. Catalytic material for automatic ignition of illuminating gas. [Fr. Appl., March 5, 1908.]* Feb. 9.

3230. Hornett. Preparation for producing greater radiant heat from coal or coke. Feb. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

2655 (1908). Vivian, Davies, and Grote. Manufacture of artificial fuel. Feb. 10.

6347 (1908). Vignon. Apparatus for making hydrogen for lighting, heating, &c. Feb. 10.

10,590 (1908). British Thomson-Houston Co. (General Electric Co.). Electric incandescence lamp filaments. Feb. 10.

14,692 (1908). Bethge. Mixture for flash lights, &c. Feb. 17.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

2873. Marriott. Treatment of natural pitch, asphalt, or bitumen. Feb. 6.

3074. Spengler. Purification of tar, tar oils, pine oils, and other distillation products.* Feb. 8.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

2373. Newton (Bayer and Co.). Manufacture of anthracene derivatives. Feb. 6.

2386. Johnson (Badische Anilin und Soda Fabrik). Manufacture of halogenated indigo. Feb. 1.

2608. Bloxam (Act. Ges. f. Anilinfabr.). Manufacture of a monoazo dyestuff especially adapted for making lakes. Feb. 3.

2609. Imray (Meister, Lucius, und Brüning). Manufacture of greenish-blue hexahalogenindigos. Feb. 3.
 2702. Newton (Bayer und Co.). Manufacture of anthracene derivatives. Feb. 4.
 2918. Haas. Derivatives of carbazol and dyestuffs therefrom. [Fr. Appl., May 15, 1908.]* Feb. 6.
 3019. Imray (Meister, Lucius, und Brüning). Manufacture of penta- and hexa-halogenised indigos. [Addition to No. 13,789 of 1908.] Feb. 8.
 3276. Newton (Bayer und Co.). Manufacture of anthracene dyestuffs. Feb. 10.
 3292. Ransford (Cassella und Co.). Manufacture of indigo sulphides and their halogen compounds. Feb. 10.
 3543. Smiles and Barnett. Blue sulphur dyestuff. Feb. 13.
 3602. Meister, Lucius, und Brüning. Manufacture of new dyestuffs. [Ger. Appl., March 28, 1908.]* Feb. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

- 2721 (1908). Ransford (Cassella und Co.). Manufacture of azo dyestuffs. Feb. 10.
 3373 (1908). Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of yellow dyes for wool. Feb. 10.
 10,412 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. Feb. 17.
 16,372 (1908). Merz. Preparation of a monoazo dye-stuff especially suitable for use as a blue-red pigment colour. Feb. 17.
 28,272 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matter. Feb. 17.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

2437. Calico Printers' Assoc., and Davis. Calico printing. Feb. 2.
 2522. Johnson (Badische Anilin und Soda Fabrik). *See under XIV.*
 2782. Sutherland. Degumming or cleansing and strengthening stalk fibres. Feb. 5.
 3055. Newton (Bayer und Co.). Process of dyeing and printing. Feb. 8.
 3087. Holden. Preventing tendering of cotton goods that have been dyed with sulphide colours. Feb. 9.
 3196. Bouchat. Apparatus for removing grease from and bleaching wool.* Feb. 9.
 3200. Dassonville. Electrolytically cleaning or bleaching animal or vegetable fibres, tissues, &c.* Feb. 9.
 3356. Bromley. Material for filling cotton, linen, or other fabrics. Feb. 11.
 3521. King. Treatment of fibres. Feb. 12.

COMPLETE SPECIFICATION ACCEPTED.

- 10,951 (1908). Shuman and Shuman. Apparatus for cleansing wool. Feb. 10.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

2521. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable hydrosulphites and mixtures containing them. Feb. 2.
 2523. Johnson (Chem. Fabr. Griesheim-Elektron). Removing carbon dioxide from gases and replacing it by hydrogen, and preparation of pure hydrogen. Feb. 2.
 2524. Johnson (Chem. Fabr. Griesheim-Elektron). Removal of arsenic from dilute sulphuric acid. Feb. 2.
 2525. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. [Comprised in No. 2414, Feb. 1908.] Feb. 3.
 2548. Bell. Purification of brine. Feb. 4.
 2813. Williams. Treatment of burnt spent oxide. Feb. 5.
 3036. Wilton and Wilton. Saturators for making sulphate of ammonia. Feb. 8.
 3061. Feld. Extraction of sulphuretted hydrogen and sulphur dioxide from gases and the obtainment of sulphur. Feb. 8.

3188. Johnson (Chem. Fabr. Griesheim-Elektron). Preparation of pure hydrogen. Feb. 9.
 3189. Peniakoff. Manufacture of sodium sulphate or other alkali sulphate. [Fr. Appl., Jan. 29, 1908.]* Feb. 9.
 3395. Bartelt. Production of chlorine. Feb. 11.
 3477. Andrews. *See under I.*
 3592. Taussig. *See under XI.*
 3622. Taussig. *See under XIX.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 2414 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. Feb. 10.
 6347 (1908). Vignon. *See under II.*
 9003 (1908). Price. Manufacture of compounds containing sulphur. Feb. 10.
 2525 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. Feb. 10.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

2490. Bloxam (Hoorickx and Hindel). Manufacture of silvered glass mirrors.* Feb. 2.
 3546. Brightmore. New abrasive material.* Feb. 13.
 2231 (1908). Vincart-Mouzin. Tunnel kiln for baking pottery, &c. Feb. 10.
 22,613 (1908). Grunzweig und Hartmann Ges. Manufacture of porous ceramic articles. Feb. 10.
 23,461 (1908). Berdel. Manufacture of porcelain or china-ware of low fusing grade. Feb. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

2534. Mueller. Impregnating wood. [Swed. Appl., Feb. 15, 1908.]* Feb. 2.
 2599. Smidth and Co. Treatment of stony and earthy materials particularly for making cement. [Ger. Appl., Feb. 27, 1908.]* Feb. 3.
 2849. Pyrotrass Soc. Anon. Granulating slag. [Fr. Appl., Feb. 13, 1908.]* Feb. 5.
 3425. Lion. Burning cement in shaft kilns with fuel waste and an oxidising blast.* Feb. 11.
 3426. Lion. Reducing expenditure on fuel in burning Portland cement.* Feb. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

- 6538 (1908). Brincker. Colouring and impregnating wood. Feb. 10.
 18,738 (1908). Allan. Manufacture of clinker for making Portland cement. Feb. 10.

X.—METALS AND METALLURGY.

APPLICATIONS.

2359. Greenway, Sulman, and Higgins. Concentration of ores. Feb. 1.
 2725. Mallmann. Crucible furnaces. Feb. 4.
 2843 and 2844. British Thomson-Houston Co. (General Electric Co.). Plating metals.* Feb. 5.
 2938. Sebillot. Recovery of metalliferous fumes obtained in roasting or smelting ores. [Fr. Appl., Feb. 7, 1908.]* Feb. 6.
 3134. Harden, and Amalgaine, Ltd. Metallic flux for joining metals. Feb. 9.
 3604. Sang. Coating metal surfaces with other metals.* Feb. 13.
 3623. Vautin. Utilisation of heat contained in slags. Feb. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

- 4644 (1908). British Thomson-Houston Co. (General Electric Co.). Reduction of metallic compounds and furnaces therefor. Feb. 10.
 5198 (1908). Miele. Producing a uniform metallic coating on metal articles. Feb. 17.
 6561 (1908). Pritchard, and United Alkali Co. Apparatus for producing iron from finely-divided ores. Feb. 10.

11,008 (1908). Rayner (Innes, Procter, and Hayles). Apparatus for separating cyanide, alkaline, and other solutions from slimes, sand, &c. Feb. 17.

11,259 (1908). Lee. Reverberatory smelting furnaces. Feb. 17.

16,807 (1908). Marks (Soc. Anon. Ital. Armstrong & Co.). Furnaces for the cementation of articles of iron, steel, and steel alloys. Feb. 17.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

2365. Greil. *See under XXIII.*

2641. Marino. Treatment of wood for use in secondary batteries.* Feb. 3.

2683. Marino. Secondary or storage batteries.* Feb. 4.

3200. Dassonville. *See under V.*

3592. Taussig. Electrolysis of alkali chlorides or the like. Feb. 13.

3599. Grunwald. Electrical induction furnaces. [Ger. Appl., May 7, 1908.]* Feb. 13.

3626. Cowper-Coles. Electrodeposition of metals. Feb. 13.

COMPLETE SPECIFICATION ACCEPTED.

3160 (1908). Cowper-Coles. Cathodes for use in electro-deposition of iron and other metals. Feb. 17.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATION.

3076. Frestadius. Extraction or separation of oils. Feb. 8.

COMPLETE SPECIFICATIONS ACCEPTED.

10,277 (1908). Doull. Filtering oils, fats, waxes, and their products. Feb. 17.

17,670 (1908). Van der Lande. Oil decolouring, bleaching, and thickening apparatus. Feb. 10.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

2449. Schramm and Kershaw. Manufacture of carbon black. Feb. 2.

2487. Waterlow Bros. and Layton, Ltd., Harrison, and Brearley. Ink for printing bankers' cheques, &c. Feb. 2.

3595. Child and Johnston. Manufacture of printing and lithographic inks. Feb. 13.

COMPLETE SPECIFICATION ACCEPTED.

16,372 (1908). Merz. *See under IV.*

(B.)—RESINS, VARNISHES.

APPLICATION.

3074. Sprenger. *See under III.*

COMPLETE SPECIFICATION ACCEPTED.

19,833 (1908). Pellnitz. Manufacture of resinous turpentine oil from pine oil. Feb. 17.

(C.)—INDIA-RUBBER.

APPLICATIONS.

2624. Wallace. *See under XX.*

3493. Cochrane. Drying rubber and other substances. Feb. 12.

COMPLETE SPECIFICATION ACCEPTED.

2787 (1908). Norzagaray. Treatment of rubber. Feb. 17.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

2504. Mackay. Leather product.* Feb. 2.

2522. Johnson (Badische Anilin und Soda Fabrik). Bleaching agent and its use for bleaching leather, glue, feathers, and straw.* Feb. 2.

XVI.—SUGAR, STARCH, GUM, &c.

COMPLETE SPECIFICATION ACCEPTED.

19,726 (1908). Klopfer. *See under XVIII.A.*

XVII.—BREWING, WINES, SPIRITS, &c.

COMPLETE SPECIFICATION ACCEPTED.

3166 (1908). Humphrey. Desiccating yeast. Feb. 10.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

2682. Kuniek. Preservation of milk without preservatives. Feb. 4.

2995. Yeo, Hall, and Goskar. Aeration of liquids and manufacture of mineral waters. Feb. 8.

3501. Stoneham and Pearson. Nutritive food. Feb. 12.

3612. Tildesley and Ritchie. Improving flour. Feb. 13.

COMPLETE SPECIFICATION ACCEPTED.

19,726 (1908). Klopfer. Recovery of starch and protein from wheat flour. Feb. 10.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

2514. Lilley. Materials and apparatus for purifying air. Feb. 2.

2594. Dales. Softening and purifying natural or polluted waters. [Addition to No. 28,221 of 1907.] Feb. 3.

3023. Thresh. Water purification. Feb. 8.

COMPLETE SPECIFICATION ACCEPTED.

20,591 (1908). Reichling. Purifying water by the removal of sulphur. Feb. 17.

(C.)—DISINFECTANTS.

APPLICATION.

2472. Schneider. Manufacture of disinfectants. [Ger. Appl., May 11, 1908. Addition to No. 3789 of 1907.]* Feb. 2.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

2486. Waterlow Bros. and Layton, Ltd., and others. Treatment of paper to prevent alterations in writing. Feb. 2.

3622. Taussig. Recovery of caustic soda or other alkali salts from waste liquors in the soda pulp process. Feb. 13.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

2400. Crépelle-Fontaine. *See under I.*

2624. Wallace. Production of isoprene. Feb. 3.

3021. Meister, Lucius, and Brünig. Manufacture of optically active phenylalkamines. [Ger. Appl., July 31, 1908.]* Feb. 8.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATION.

2832. Morton. Photographic plates. Feb. 5.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATION.

2365. Greil. Accumulator for the decomposition or analysis of water.* Feb. 1.

COMPLETE SPECIFICATION ACCEPTED.

2314 (1908). Schönberger. Determining the calorific value of gases. Feb. 10.

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Manchester Section.

Meeting held at Manchester on Friday, February 5th, 1909.

DR. E. KNECHT IN THE CHAIR.

THE CONSTANTS OF JASMINE FLOWER WAX.

BY L. G. RADCLIFFE AND J. ALLAN.

Of recent years a solvent process has been adopted at Grasse and elsewhere for obtaining the odoriferous constituents of flowers. In the case of jasmine the petals alone are extracted with a low boiling petroleum ether; the resulting solution contains the odoriferous constituents mixed with a large proportion of a wax-like substance. This petroleum ether extract on evaporation at a low temperature yields a highly odorous mass and this is designated as "Essence naturelle concrete de jasmin." In order to prepare a floral extract suitable for use in perfumery this material is macerated with strong alcohol and the mixture, after having been chilled to about -10°C . is filtered; the residue left after filtration is only faintly odorous, and is usually highly coloured, and to distinguish it the authors have named this residue *jasmine-flower wax*.

The investigation of this wax and others of floral origin appears to be of considerable interest, especially when the data obtained are compared with those given by beeswax, and the authors have in hand the examination of several of these waxes and fully realise the incompleteness of the present communication, which is due to lack of material.

The sample was a hard, yellowish-brown substance, having but a slight odour of jasmine. Since the wax was found to contain a little alcohol this was removed by keeping the wax molten until no frothing was visible, after which it was used for the following examination:—

The solidifying point, as in the titer test, was between 60° and 57°C . The examination with the Zeiss butyrorefractometer was a little difficult on account of the high melting-point of the wax, but the following figures were obtained:—

The scale reading at 84°C . was 30; 74° , 33; 70° , 36; 57° , 38; 62° , 40; 60° , 42; 56° , 44.

It is interesting to note that Leikowitsch gives for beeswax at 62°C . the reading 29.5 to 30. The acid value as determined on 5 grms. of wax dissolved in a mixture of neutral alcohol and ether; it corresponded to 2.8 grms. of potassium hydroxide for one gm. of wax.

The wax was difficult to saponify, and the saponification value was determined by dissolving the substance in neutral amyl alcohol, adding alcoholic potash as usual, and boiling for five hours on a sandbath; the final result was that 65.8 mgrms. of potassium hydroxide were required per gm. of wax. Using sodium ethylate for the saponification, the figure was 63 mgrms. The use of amyl alcohol as a solvent for difficultly saponifiable waxes greatly facilitates the reaction. The iodine value of the wax by "Ijs" method was from 52 to 53 per cent.

The fatty acids were isolated from the saponified residues in the following manner:—The residues were boiled with a large volume of water until all the alcohol was expelled, when the unsaponifiable matter separated out as a white scum; this was skimmed off as completely as possible, and was proved not to be an insoluble soap by its solubility in ether, its low melting point, and the fact that it left no residue on ignition. Subsequent experiments showed that it was very difficult to remove the whole of the unsaponifiable matter from the fatty acids which were precipitated on acidifying the soapy liquor; however, by

repeatedly dissolving the fatty acids in alkali, extracting with petroleum ether, and reprecipitating with a mineral acid, a hard white mass was obtained having a mean molecular weight of 398 and an iodine absorption of 39 per cent. It was not found practicable to obtain sufficient of these fatty acids to enable the titer test to be done, but when recrystallised from boiling alcohol the mixed acids melted slowly between 57° and 65°C . The unsaponifiable matter yielded a mass of well crystallised white needles, from ether, having a sharp melting point of 64°C .; on heating this unsaponifiable matter with soda-lime, hydrogen was evolved, indicating the presence of alcohols, but attempts to prepare acetyl derivatives were not very successful, though ultimately a substance was obtained melting at 45°C .; however the amount was too small for an analysis to be made.

In conclusion, we desire to thank Mr. Batey for his assistance in carrying out some of the above experiments.

DISCUSSION.

The CHAIRMAN believed this was the first time that the wax obtained from the flowers of an individual plant had been isolated and described, and the data appeared to indicate that this wax was not identical with beeswax.

Mr. J. H. ROSEASON mentioned that the process described was essentially similar to that recommended by Dragendorff, in his "Plant Analysis," 40 years ago, and said it was strange that so late as the present day this laboratory process had become a commercial one.

Mr. TERLESKY believed some of the fine odours in flowers were to-day being distilled by steam.

Mr. J. W. YOUNG asked if the scent prepared from the concretes ultimately resembled that of the flowers?

Mr. COLEMAN drew the authors' attention to the chlorine compounds known as "Vitran." They were coming into use for solvent purposes.

Mr. J. H. LESTER said there was obviously a difference between the jasmine wax and beeswax. So far as he remembered there was no great difficulty in the use of an autoclave at a very low pressure for purposes of saponification, but it necessitated the use of caustic-resisting vessels within the outer metallic vessel.

Mr. JOHN ALLAN said Dr. Knecht had suggested it was possible the extraction with alcohol in the first place might account for the low acid value of the jasmine wax. He thought it was extremely unlikely, because the acids which existed in these waxes were not easily soluble in alcohol, and their solubility was decreased enormously at the temperature to which the alcoholic extract was reduced before the waxes were filtered off. So small was the solubility that when one concentrated the alcoholic extracts in vacuum, as was done for the purpose of preparing the highly concentrated "concrete" essence, one obtained a substance which was certainly somewhat viscid, but perfectly fluid, and only very slightly acid. This would seem to do entirely away with the possibility of the free acid being dissolved from the wax during the alcoholic extraction. By distillation in steam it was quite possible to obtain a floral odour from one flower which would be satisfactory, and to find that a perfume or perfumed oil obtained in the same way from another flower was unsatisfactory, as the various esters in essential oils were hydrolysed to different extents under the same conditions. It was quite right that concrete scents were not absolutely true to type. The mere fact that for the purpose of distilling off the petroleum ether the material had to be subjected to heat was sufficient to alter the character of the odour. The scents obtained by the process indicated in the paper were distinctly truer as a type than those obtained by any distillation process previously employed. The autoclave could be used in the laboratory for saponifying waxes, but an ordinary flask or condenser would do as well.

EFFECT OF ADDITION OF SALT TO THE CAUSTIC SODA LYE USED IN MERCERISING.

BY JULIUS HÜBNER, M.Sc. TECH., F.I.C.

Hübner and Pope demonstrated in a paper read before this Society (Vol. 23, 1904, p. 404) that the production of the lustre during mercerisation of cotton yarn and cloth depends upon three factors, namely, the shrinking, the swelling, and the untwisting of the individual cotton fibres: they showed further that the degree of lustre produced is considerably influenced by the addition of sodium silicate or glycerin to the soda lye used in the mercerisation. W. Vieweg (Ber., 1908, 3269) concludes that cotton takes up considerably more sodium hydroxide from a soda lye which has been saturated with sodium chloride than from a lye of the same concentration containing no salt. O. K. Miller (J. Russ. Chem. Phys. Ges., 1905, 361), on the other hand, states that the absorption of sodium hydroxide by cellulose from caustic lyes is not influenced by the presence of carbonates or chlorides of the alkalis. It is indicated in Vieweg's tables that 100 grms. of cotton when immersed in a soda lye containing 12 per cent. of sodium hydroxide absorbs 8.4 grms. of sodium hydroxide, whilst it is capable of taking up 14.5 grms. of sodium hydroxide from a 12 per cent. lye which has been saturated with salt: further from a 20 per cent. lye the same amount of cotton absorbs 13.2 grms. of sodium hydroxide and 17.4 grms. of sodium hydroxide if this lye is saturated with sodium chloride. In view of these contradictory statements it seemed desirable to carry out a series of determinations under similarly exact conditions to those previously described in order to ascertain definitely whether soda lye saturated with salt actually exerts a greater mercerising action than the ordinary lye used at present in technical mercerisation. For this purpose a number of comparative experiments were carried out with cotton hanks on a hank mercerising machine, under identical conditions.

For the purpose of determining the degree of shrinkage which takes place if the hanks are treated with the caustic lye, without the application of tension, a number of hanks measuring 420 yards each were reeled. These hanks were immersed in soda lye containing 12 per cent. and 20 per cent. of sodium hydroxide respectively, with and without the addition of salt. In the preparation of the caustic soda lyes and the saturation of the same with salt, the method described by Vieweg (*loc. cit.*) was carefully followed. After immersion the hanks were washed until free from soda, dried and re-measured with the following results:—

	Shrinkage, per cent.
Soda lye, 12 per cent. sodium hydroxide	11.5
" " " saturated with salt	6.8
" " 20 per cent. sodium hydroxide	18.6
" " " saturated with salt	15.7

The shrinkage of the hanks treated with the soda lyes saturated with salt is, therefore, considerably less than is the case in mercerising with ordinary soda lye.

On dyeing the hanks treated as described above it was found that the affinity of the cotton fibres for the substantive cotton colours is considerably lessened by saturating the mercerising soda lye with salt.

On investigating under the microscope the action upon cotton fibres of the different soda lyes used in the experiments it was found that the untwisting of the individual fibres proceeds much more slowly and much less completely with lyes to which salt had been added.

After those observations had been made it only remained to be determined whether, in accordance with the observations of Hübner and Pope (*loc. cit.*), the degree of lustre produced on the fibres would be diminished by the addition of an agent (salt in this instance) which retards one or more of the typical actions, namely, shrinking, untwisting and swelling of the fibres, to the caustic soda solution used in mercerising under tension.

With this object hanks were mercerised with the different solutions, under tension, on the hank mercerising machine: the comparison of the different hanks, before and after dyeing with substantive cotton colours, showed that the lustre suffers very distinctly from the saturation of the soda lye with salt.

It seemed of interest to ascertain how cotton which has been mercerised under the conditions described above would behave towards the zinc-chloride iodine solution (Hübner, this Journal, 1908, 27, 105) which has been shown to afford a definite means of distinguishing mercerised from non-mercerised cotton. It was found in every case that the blue coloration produced by the reagent was distinctly lighter when the soda lye used in the mercerisation was saturated with salt. This is of importance bearing upon the utility of the reagent for the purpose of ascertaining the degree of mercerisation, because it proves that the depth of the blue coloration of mercerised cotton produced by the application of this reagent indicates clearly the degree of mercerisation in so far as this proceeds parallel with the shrinkage, the affinity for the substantive cotton colours, the untwisting of the fibres and with the degree of lustre which is the ultimate result of these actions. The author desires to express his thanks to Mr. I. Gilbertson for his assistance in carrying out the experiments.

DISCUSSION.

The CHAIRMAN said that he had been much impressed by Vieweg's results, and recognising in them important commercial possibilities, quite apart from their theoretical interest, had at once repeated some of his experiments. Bleached cotton yarn in skeins was treated with a 12 per cent. solution of caustic soda, and with the same strength of caustic soda containing 15 per cent. salt in solution. In the first place the shrinkage was not as great after the addition of salt as before, and on dyeing the two skeins together in a direct colour, that which had been treated with caustic soda and salt came out considerably lighter in shade. Quantitative dye trials were then undertaken in which untreated cotton, cotton treated with a 12 per cent. solution of caustic soda and cotton treated with this strength of caustic soda with 15 per cent. salt added, was dyed in Diamine Sky Blue, Chrysophenine and Benzopurpurine 4B. The amounts of colouring matter taken up were estimated in the dyed skeins by titration (indirect) with titanous chloride with the following results:—

	Untreated.	Treated with sodium hydroxide.	Treated with sodium hydroxide and salt.
	Per cent.	Per cent.	Per cent.
Diamine Sky Blue...	1.06	1.66	1.25
Chrysophenine	0.74	1.17	1.01
Benzopurpurine 4B..	1.02	1.97	1.67

He had also estimated the amounts of Benzopurpurine in the cotton used in Mr. Hübner's experiments and the results bore out those obtained in his own. His yarn, which had been treated with the 12 per cent. caustic soda solution with salt, contained 0.31 per cent. colouring matter, and without salt 0.36 per cent. With the 20 per cent. solution of caustic soda the difference was 0.39 per cent. with salt and 0.45 per cent. without. The joint results seemed fairly conclusive evidence that Vieweg's inferences could not be accepted as correct.

Mr. R. E. CROWTHER observed that when the notice of Vieweg's patent came out it appeared as though mercerisation on the commercial scale were going to be revolutionised. As they could not afford to miss anything that was likely to increase the profits of works he undertook experiments with a view to corroborating Vieweg's results. He assumed that the absorption of dye was proportionate to the amount of mercerisation. Speaking of dyeing with substantive colours, he noticed, as had been noticed by both the speakers that evening, that both Vieweg's inferences and Miller's remarks were incorrect: the addition of salt to a caustic soda lye produced a marked effect in mercerising, but that effect was in the opposite direction inferred in Vieweg's remarks. That opened up another question. Was it definitely settled whether the absorption of caustic soda was in proportion to the amount of mercerisation? From experiments he had performed

it appeared as though the amount of mercerisation was proportionate to the amount of caustic soda absorbed. Until that question was settled he did not think Vieweg's absorption figures could be altogether disputed. He had found the zinc chloride-iodine reaction more delicate than the dyeing with direct colours. In every case where he had used it the colour difference was much greater than that shown by dye trials, particularly if the caustic soda used for mercerising was only of a low strength. His experiments certainly seemed to bear out the results, as far as the absorption of dye was concerned, which had been brought forward during the evening.

Mr. W. F. A. ERMEN stated that he had tried the addition of salt to the soda lye and in every instance the lustre had suffered.

The CHAIRMAN thought the bulk of the evidence showed that Vieweg's inferences were untenable. Mr. Crowther and Mr. Ermen, from different points of view, had borne out what Mr. Hübner had put forward.

Mr. JULIUS HÜBNER, in reply to Mr. Crowther, said that it had not been the object of his note, nor, he believed, of Dr. Knecht's communication, to show whether Vieweg's statement with regard to the amount of caustic soda absorbed was correct. So far, however, all the evidence had clearly shown that the absorption of caustic soda and the degree of mercerisation were going parallel.

THE EXAMINATION OF CARBON TETRACHLORIDE.

BY L. G. RADCLIFFE.

Some time ago the author had his attention called to the fact that when carbon tetrachloride was mixed with phenylhydrazine and the whole allowed to stand an energetic reaction took place, with the evolution of heat and the formation of a solid compound. This was at first thought to be due to the presence of carbon bisulphide in the carbon tetrachloride, giving rise to the production of the well known compound $(C_6H_5NHNH_2)_2CS_2$. A subsequent examination of this white compound showed it to be free from sulphur and that, moreover, chemically pure carbon tetrachloride gave exactly the same result. This compound was a white crystalline substance melting between 198° and 200° C., and dissolved with difficulty in water but was freely soluble in alcohol or ether. Its alcoholic solution is turned red by alkalis, the colour being discharged again on the addition of acids.

During the course of these experiments it was observed that carbon tetrachloride generally did contain some carbon bisulphide and it was thought likely that it could be estimated by the reaction known to take place between carbon bisulphide and triethylphosphine. On adding triethylphosphine to commercial carbon tetrachloride dissolved in dry ether, a pink coloration resulted for a moment, and then a white precipitate formed and the colour vanished; on adding triethylphosphine to uniluted carbon tetrachloride, a violet reaction took place with the ignition of the triethylphosphine. Finally a solution of chemically pure carbon tetrachloride in absolute ether was mixed with a solution of triethylphosphine similarly diluted, and there resulted the instantaneous formation of a white precipitate, which on examination was found to contain carbon, hydrogen, chlorine, and phosphorus, but no sulphur. This white compound is therefore probably a molecular combination of carbon tetrachloride and triethylphosphine, but the examination was not continued, because it was evident that triethylphosphine was useless for the detection or estimation of carbon bisulphide in the presence of carbon tetrachloride. This triethylphosphine compound appears to decompose to an oily substance on standing, but this and also the phenylhydrazine compound are being investigated.

The foregoing experiments having shown that carbon tetrachloride behaved very similarly to carbon bisulphide, far as certain reactions were concerned, it was thought of interest to make a careful examination of the carbon tetrachloride of commerce, and to ascertain the percentage

of carbon bisulphide it contained, if possible by physical methods. The following series of determinations was made on Kahlbaum's pure carbon tetrachloride and pure carbon bisulphide and on two samples of commercial carbon tetrachloride. (The full figures are given for only one of these samples.)

TABLE I.

	Commercial carbon tetrachloride.	Pure carbon tetrachloride.	Pure carbon bisulphide.
sp.gr. at 15.5° C.	1.591	1.606	1.272
Refr. ind. at 18° C.	1.46785	1.46210	1.629815

Fractional distillation of 100 c.c.	B.pt.	$n_{D}^{18^\circ}$	B.pt.	$n_{D}^{18^\circ}$	B.pt.	$n_{D}^{18^\circ}$
One drop	67°	—	76°	—	45.6°	—
10 cc.	74°	1.4791	77.8°	1.46156	45.9°	1.6293
20 "	75°	1.4773	78°	1.4616	45.9°	1.6298
30 "	76.3°	1.4716	78°	1.4616	45.9°	1.6296
40 "	77.3°	1.4667	78°	1.4617	45.9°	1.6294
50 "	77.8°	1.4637	78°	1.46175	45.9°	1.6295
60 "	78°	1.4625	78°	1.4618	45.9°	1.6295
70 "	78°	1.4617	78°	1.4619	46°	1.6294
80 "	78°	1.4618	78°	1.4617	46.2°	1.6292
90 "	78°	1.4619	78°	1.4618	48°	1.62887
97 "	78°	1.4620	78°	1.4619	48°	1.62887

Comparisons were then made by examining artificially prepared mixtures of known amounts of pure carbon bisulphide and pure carbon tetrachloride. Later it was found that a slight modification of Gastine's method (Comptes rend., 98, 1588) for the estimation of carbon bisulphide by converting it into potassium xanthate and then titrating this with $N/10$ iodine solution was extremely accurate even in the presence of carbon tetrachloride.

The method is as follows:—A flask containing 25 c.c. of alcoholic potash and loosely corked is accurately weighed, and about 1 c.c. of the sample of carbon tetrachloride is introduced by means of a pipette, care being taken to keep the end of the pipette close to the level of the alcoholic potash; the cork is then replaced and the flask and contents again weighed, this giving the weight of the sample taken. After standing for five minutes the mixture is made slightly acid by the addition of dilute acetic acid, using phenolphthalein as indicator. Distilled water is now added and the mixture, after well cooling, is treated with an excess of solid sodium bicarbonate, which dissolves forming a milky liquid; this is now titrated with $N/10$ iodine solution and starch indicator as usual. The end reaction is very sharp. The chemical changes are represented thus:—

- (1). $KOH + C_2H_5OH + CS_2 = C_2H_5KOS_2 + H_2O$, expresses the formation of potassium xanthate;
- (2). $C_2H_5KOS_2 + CH_3COOH = C_2H_5KOS_2 + CH_3COOK$, expresses the formation of free xanthic acid.
- (3). $2C_2H_5OS_2 + I_2 = 2C_2H_5OS_2 + 2HI$.

Potassium xanthate is decomposed by hot water as follows:—



The following table shows test analyses of mixtures of pure carbon tetrachloride with known amounts of pure carbon bisulphide (by weight) by the modified xanthate method of Gastine:—

TABLE II.

Known percentage of carbon bisulphide.			Found by analysis.	
	Per cent.		Per cent.	
Pure carbon tetrachloride ..	Nil.		Nil.	
Pure carbon bisulphide ..	100		100	
Do.	3.89		3.81	
Do.	5.53		5.42	
Do.	8.96		8.94	
Do.	11.3		11.3	
Do.	16.0		15.88	

Several samples of commercial carbon tetrachloride were then examined by fractional distillation, and the

refractive index of each fraction at 18° C. determined, and also the percentage of carbon bisulphide in them. The percentage of carbon bisulphide varied from as low as 0.1 to 3.05 per cent. The following table was the result of examining the sample which contained 3.05 per cent. of carbon bisulphide:—

TABLE III.

Distillate in fractions of 10 c.c. each.	Temperature of distillation.	Refractive index at 18°.	Percentage of carbon bisulphide.
	° C.		
10 c.c.	74	1.4701	—
20 "	75	1.4773	—
30 "	76.3	1.4716	—
40 "	77.3	1.4667	4.0
50 "	77.8	1.4637	3.0
60 "	78	1.4625	1.9
70 "	78	1.4617	1.33
80 "	78	1.4618	0.75
90 "	78	1.4619	0.35

In the residue in the flask 0.10 per cent. of carbon bisulphide still remained. This sample was also tested in Abel's flash-point apparatus to see if this amount of carbon bisulphide, *viz.*, 3.05 per cent., could be detected, but with negative result.

In conclusion, I have to thank Prof. W. H. Perkin, F.R.S., for a sample of triethylphosphine, and Mr. J. F. Dunworth for his valuable assistance in carrying out the numerous determinations.

DISCUSSION.

The CHAIRMAN said the author had apparently come across two new reactions of carbon tetrachloride which might prove to be of considerable theoretical interest. It was interesting to note that the highest amounts of bisulphide stated in the paper did not render the tetrachloride inflammable and he asked whether the author had determined at what percentage of bisulphide such a mixture would become dangerous, as far as fire risks were concerned.

Mr. H. L. TERRY inquired whether any commercial significance could be attached to the examination.

Mr. W. H. COLEMAN asked whether the author had tried the method of estimation of carbon bisulphide by converting it into ammonium thiocyanate by digesting with ammonium sulphide.

Mr. R. E. CROWTHER asked if the presence of carbon bisulphide in the tetrachloride interfered with its use in the estimation of oils and fats by Wijs' method.

Mr. L. G. RADCLIFFE said, in reply to Dr. Knecht's question, he had not been able to settle that point sufficiently to be able to make a definite statement. Chemically pure carbon tetrachloride was very costly, and it was not wise to use it over again for a flash-point test. He had used one sample containing as high as 6 per cent. of carbon bisulphide, and this did not flash. Beyond the 6 per cent. he could not say. In reply to Mr. Terry, he thought that it would undoubtedly be of considerable interest to users of carbon tetrachloride. He had not tried the method mentioned by Mr. Coleman.

THE PARTIAL MERCERISATION OF COTTON CLOTH.

BY J. H. LESTER, M.Sc.

In a case recently submitted to me for examination, some cotton cloth was found to show under the microscope very marked differences in appearance in different parts of the same fibre. In many places the fibre was straight, full, and round, as is characteristic of mercerised cotton, whereas in other places it was spiral, flattened, and showing the wide central canal of normal raw cotton. It obviously became of interest to inquire as to the cause of this difference, and it was at once noticed that the well mercerised fibres were also much more deeply dyed than those which

were unmercerised; indeed, many of the unmercerised fibres were barely tinted with dye, though the cloth as a whole was of a deep purple colour. A simple further examination sufficed to show in what parts of the cloth or yarn the unmercerised and undyed parts of fibres existed. On dissecting the cloth and examining the yarns, it was seen that there were light patches in each of the hollows or bends produced by the surface contact of the warp and weft threads. It will follow from the above that the undisturbed dyed cloth showed a level and deep shade of dye, but that when the yarns were disturbed, either by tearing or otherwise, the minute light patches became visible. Examination under a very low power magnifying glass showed the effect most clearly. It was, of course, only to be expected that those parts of the cloth or fibre which were most completely mercerised should absorb the dye most completely, but I was greatly surprised to find such apparently enormous differences within such very short distances. In some instances the microscope showed three or four alternate lengths, well dyed and barely tinted, in the same ultimate fibre.

Upon such scanty information as the above, positive though I believe it to be as far as it goes, it would be unwise to found any comprehensive theory, but it appears quite warrantable to suggest that the mercerisation process may act first upon the surface fibres of cotton cloth; and where either the time, the temperature, or the strength of caustic solution are insufficient to effect complete mercerisation, the internal portions of the cloth where the fibres are brought into closest contact, will undergo mercerisation last.

DISCUSSION.

The CHAIRMAN observed that the conclusion to be derived from the author's observations was that there had been an uneven absorption of tannic acid.

Mr. JULIUS HÜBNER said the difference mentioned would not be anything like so pronounced if the pattern had been dyed with a direct dyeing cotton colour, but being mordanted with tannic acid the basic dye would show up more strongly.

Mr. R. E. CROWTHER inquired whether the warps were heavily sized or whether any precaution had been taken to remove the starch. It appeared to him there were physical differences in the state of the cloth previous to mordanting.

Mr. J. H. LESTER believed that there was a physical difference from place to place in the fibres themselves, and the varying intensity of the dye would follow upon that. As to what the treatment might have been was a matter of surmise. There must have been a fair amount of scouring to have given the cloth the level appearance it had, and also to account for the difference between the light and dark places being practically the same in the warp and the weft.

Newcastle Section.

Meeting held at Armstrong College on Thursday, 11th February, 1909.

MR. C. J. POTTER IN THE CHAIR.

THE BASES CONTAINED IN THE TAR FROM OTTO-HILGENSTOCK COKE-OVENS.

BY FREDERICK GEORGE TROBRIDGE, B.Sc.

It was thought that as the conditions of distillation in retort coke-ovens were very different from those in gas retorts, and very different qualities of coal were used in the two cases, the bases in coke-oven tar might exhibit differences from those in gas tar. Accordingly, 100 gallons of tar from Messrs. Priestman's plant of Otto Hilgenstock coke-ovens, Blaydon-on-Tyne, were washed with a 10 per cent. solution of sulphuric acid, the mixture being kept in a warm place to facilitate the separation of the acid from the tar. About 10 gallons of washings were

obtained of dark, brown-red colour, specific gravity 1.06, having a tarry smell, and still containing 6 per cent. of sulphuric acid. The liquid was first treated with steam in order to remove any volatile non-basic bodies. The residue was then made strongly alkaline by the addition of caustic soda and again treated with steam, 2000 grms. of basic oil being obtained. The bases which did not condense were passed over into dilute hydrochloric acid and were found to consist of ammonia with possibly traces of aliphatic amines.

The residue in the distilling vessel, from which the bases volatile in steam had been removed, contained a considerable amount of basic bodies non-volatile in steam, which separated as a thick tarry mass. On extraction with ether a part dissolved; the residue was a black, almost solid, basic substance, soluble in ethyl acetate; on long standing it set quite hard. The portion soluble in ether was a clear, dark yellow, almost solid base, easily and completely soluble in absolute alcohol, chloroform, benzene, and ethyl acetate, giving strongly fluorescent solutions. These bodies form hydrochlorides insoluble in ether but soluble in water to deep red solutions, which give microcrystalline precipitates with platonic chloride, mercuric chloride, stannous chloride, zinc chloride, and picric acid. On warming, however, the precipitates coagulate to oily masses.

The basic oil volatile in steam was distilled through a rod and disc still-head of 24 discs; the distillation was stopped when the temperature reached 170° C., 24 per cent. coming over below this temperature. Messrs. Brotherton and Co. of the Wear Fuel Works, Sunderland, inform me that about 70 per cent. of the bases from gas-tar distil below 140° C., whereas here we have only 24 per cent. below 170° C. The bases contained aniline, which was removed by means of the diazo-reaction, and the aniline-free base so obtained fractionally distilled 10 times.

The fractions boiling above 125° C. were each treated with mercuric chloride, a solution of the bases in hydrochloric acid being added to a hot solution (generally about 10 per cent.) of mercuric chloride. For the fractions up to 155° C. two molecules of mercuric chloride were used to one molecule of base; for those boiling above that temperature sufficient was taken to allow for three molecules of mercuric chloride to one of base, the calculations being made on the assumption that the fractions boiling between 125° and 150° C. were picolines and those between 150° and 165° C. lutidines. The bases boiling above 165° C. have not yet been examined. The mercury compounds were recrystallised from water slightly acidified with hydrochloric acid till further recrystallisation made no improvement in the melting point; the bases were then recovered by removing the mercury with hydrogen sulphide. The boiling points have been determined with standard short-scale thermometers, and melting points either with these or with one that has been checked against them. Attention is directed to the double compounds that the hydrochlorides of these bases form with platonic chloride. Great discrepancies appear in the values recorded by the various authors for their melting points; e.g., Brühl states that pyridine platinichloride melts at 240° to 242° C.; Calm and Buchka (Die Chemie des Pyridins) quote a series of values, namely 216°—218° C., 223.5° to 225.5° C., and 228°—229° C.; while Garrett and Smythe (Trans. Chem. Soc., 1902, Vol. 81) give 228°—229° C.

If pyridine platinichloride is prepared by adding a solution of platonic chloride to an acidified solution of the hydrochloride of the base in water and evaporating, crystals are obtained which melt at 241°—242° C., while a solution of the chloride is added to a solution of pyridine hydrochloride in absolute alcohol and crystals obtained by the spontaneous evaporation of the liquid without heating, the compound formed melts at 228° C. Also the compound prepared from aqueous solution differs from that from alcoholic solution in colour and crystalline habit, but not in chemical composition. An exactly similar state of affairs was found with the other bases examined, with the possible exception of γ -picoline, the bodies prepared from alcoholic solution always being lighter in colour and having lower melting points than those from aqueous solutions that have been heated. In

the cases which have so far been examined, the bodies obtained in the two ways do not differ in crystallographic system, and, in some cases, at any rate, these compounds could be converted the one into the other by recrystallisation from the different solvents. It seems that this furnishes an example of dimorphism in which the two substances belong to the same crystallographic system. The pyridine aurichloride certainly exhibits the same phenomena but those of the other bases only gave very slight indications of anything similar.

The following bases have been isolated:—

Pyridine	B.p. 115.2° C. at 759.4 mm.
2-Methylpyridine (α -picoline)	B.p. 128.8° C. at 749.7 mm.
4-Methylpyridine (γ -picoline)	Bp. 144.2° to 145° C. at 754.4 mm.
2,4-Dimethylpyridine (α , γ -lutidine) .	B.p. 158.2° C. at 753.4 mm.

Pyridine.—This base was obtained from the fraction boiling 110°—120° C. by removing the homologues of pyridine by heating with excess of a 5 per cent. solution of potassium permanganate. The platinum compound, prepared from an aqueous solution that had been heated, formed sparingly soluble red crystals of m.pt. 241°—242° C. without decomposition, and containing 34.33 per cent. of platinum. Obtained from absolute alcohol solution, the platinum compound gave sparingly soluble golden scales of m.pt. 228° C. without decomposition, and containing 34.38 per cent. of platinum (C_5H_5N)₂H₂PtCl₆ requires 34.33 per cent. of platinum.

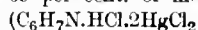
The gold compound was prepared from alcoholic solution; it gave a mass of golden-yellow crystals sparingly soluble in cold, easily in hot alcohol, m.pt. 323° C. without decomposition, the fused mass however decomposing rapidly at 324° C. It contained 46.61 per cent. of gold. When prepared by the addition of gold chloride to an aqueous solution of pyridine hydrochloride, and heating for some time, fine lemon yellow crystals of distinctly lighter colour than those from alcoholic solution were obtained; these were sparingly soluble in cold, easily in hot water, and melted at 329° C. without decomposition. The fused substance decomposes at a slightly higher temperature. This compound contained 46.85 per cent. of gold ($C_5H_5N.HCl.AuCl_3$ requires 46.85 per cent.).

The picrate was prepared by addition of picric acid to an alcoholic solution of the base. It forms canary-yellow needles, easily soluble in water or alcohol, of m.pt. 163° C. without decomposition.

The density of the base was 0.9893 at 14° C. and the refractive index (sodium light) 1.5124 at the same temperature. The specific refraction, calculated on the Lorentz and Lorenz formula = 0.3038, and the molecular refraction 24.0.

2. *Methylpyridine (α -picoline)*. From the fraction boiling at 125°—135° C. a considerable quantity of a mercuric-chloride compound was obtained crystallising in small plates or stout prisms, of m.pt. 151° C.

It contained 59.69 per cent. of mercury



requires 59.61 per cent.). The base was a colourless liquid, easily soluble in water, and having a strong pyridine-like odour. The platinum compound, prepared from alcoholic solution, forms sparingly soluble yellow scales, of m.pt. 178° C. with decomposition, and contained 32.71 per cent. of platinum. (C_6H_7N)₂H₂PtCl₆ requires 32.72 per cent. From a heated aqueous solution the platinichloride was deposited as easily soluble orange-red prisms, of m.pt. 194° C. with decomposition. This product contained 32.53 per cent. of platinum. The gold compound was obtained from alcoholic solution as a mass of bright-yellow very easily soluble crystals, of m.pt. 175° C. without decomposition, and containing 45.32 per cent. of gold ($C_6H_7N.HCl.AuCl_3$ requires 45.33 per cent.). The aurichloride, prepared from a heated aqueous solution, appeared exactly the same in all respects. The picrate forms small, pale lemon-yellow needles, easily soluble in water or alcohol, of m.pt. 161° C. without decomposition.

The density of the base is 0.9530 at 14° C., the refractive index (sodium light), is 1.4966 at 14° C. The

specific refraction = 0.3070, and the
molecular refraction = 28.55.

The base was oxidised by a 5 per cent. solution of potassium permanganate, to picolinic acid, which crystallised in fine tufts, of m.pt. 134° C.

4. *Methylpyridine* (γ -picoline). From the fraction boiling at 145°–150° C. a mercuri-chloride compound was obtained in fine needles of m.pt. 121° C. which melt in hot water to a heavy oil. The base was a colourless liquid, soluble in water, with an odour similar to that of pyridine, but less pungent. The platinumchloride is very sparingly soluble in alcohol, crystallising in fine golden scales of the orthorhombic system. M.pt. 208° C. with decomposition. It contained 32.73 per cent. of platinum; $(C_6H_7N)_2H_2PtCl_6$ requires 32.72 per cent. When prepared from aqueous solution the platinum compound formed red crystals of the orthorhombic

soluble in alcohol and fairly easily in water. A quantity obtained from a heated aqueous solution appeared exactly the same in all respects. The compound contained 43.98 per cent. of gold ($C_7H_7N.HCl.AuCl_3$ requires 44.13 per cent.).

The picrate forms pale yellow crystals, easily soluble in water of alcohol, m.pt. 178° C. without decomposition.

The density of the base is 0.9378 at 14° C.; the index of refraction (sodium light)=1.5033 at 14° C.; the specific refraction=0.3151; and the molecular refraction=33.75. On oxidation with potassium permanganate, the base was converted into lutidinic acid, of m.pt. 235° C.

Below is a table comparing the values obtained for the melting points of the platinum and gold compounds of the above bases with those quoted by other workers.

Platinum Compounds.

Base.	Brühl.	Calm and Buchka.	Garrett and Smythe.	Author's Values.	
				From alcohol.	From water.
Pyridine ..	240°–242° C.	228°–229° C.	228°–229° C.	228° C.	241° C.—242° C.
α -Picoline ..	195° C.	178° C.	194° C.	178° C.	194° C.
γ -Picoline ..	231° C.	231° C.	—	208° C.	208° C.
α,γ -Lutidine ..	230° C.	219°–220° C.	216° C.	209° C.	216° C.

Gold Compounds.

Base.	Brühl.	Calm and Buchka.	Garrett and Smythe.	Author's Values.	
				From alcohol.	From water.
Pyridine ..	unchanged	at 285° C.	—	323° C.	329° C.
α -Picoline ..	167°–168° C.	167°–168° C.	—	175° C.	175° C.
γ -Picoline ..	205° C.	205° C.	—	203° C.	205° C.
α,γ -Lutidine ..	—	—	94°	77° C.	77° C.

system, of m.pt. 208° C. and containing 32.71 per cent. of platinum. The aurichloride, obtained from alcoholic solution, gave easily soluble bright-yellow needles, of m.pt. 203° C. without decomposition, and containing 45.22 per cent. of gold.

Prepared from a heated aqueous solution, the gold compound gave bright-yellow needles of m.pt. 205° C. without decomposition, and containing 45.46 per cent. of gold ($C_6H_7N.HCl.AuCl_3$ requires 45.33 per cent.). The picrate forms small crystals of pale lemon-yellow colour easily soluble in water or alcohol, of m.pt. 160° C. without decomposition. The density of the base is 0.9603 at 12.5° C. The index of refraction (sodium light) = 1.5065 at 12.5° C., the specific refraction is 0.3097, and the molecular refraction=28.80. This is practically the same as the value for α -picoline. On oxidation of the base with potassium permanganate, isonicotinic acid was obtained, m.pt. 312° C. in a sealed tube.

2.4. *Dimethylpyridine*, (α,γ -lutidine). From the fraction boiling at 155°–160° C. a mercury compound was obtained in the form of white, hair-like needles, of m.pt. 128.5° C., containing 58.49 per cent. of mercury. $C_7H_9N.HCl.2HgCl_2$ requires 58.35 per cent.

The base was a colourless liquid, more soluble in cold water than in hot, and having a rather pleasant odour. The platinumchloride was obtained from alcoholic solution as minute prisms with pyramidal ends, and of the monoclinic system; they melted at 202° C. with decomposition, and contained 31.13 per cent. of platinum ($C_7H_9N)_2H_2PtCl_6$ requires 31.25 per cent.

The platinum compound separated from aqueous solution as orange-red crystals of the monoclinic system, containing 31.15 per cent. of platinum m.pt. 216° C. with decomposition. The gold compound, prepared from alcoholic solution, formed a yellow oil, which crystallised on standing. The crystals melted at 77° C. without decomposition, and are easily

The author has pleasure in acknowledging his indebtedness to Messrs. Priestmans, Ltd., for their kindness in providing the raw material required, and to Prof. P. Phillips Bedson, in whose laboratory the work was carried out. The investigation is being continued.

Yorkshire Section.

Meeting held at Hull on Monday, January 18, 1909.

MR. F. W. BRANSON IN THE CHAIR.

A RAPID METHOD FOR DETERMINING CARBON DIOXIDE IN THE ATMOSPHERE.

BY S. H. DAVIES AND B. G. McLELLAN.

A rapid method of determining the condition of the atmosphere in schools, factories, and other places where people congregate, is of great importance. To do this with any certainty it is necessary within a brief interval of time to test the proportion of carbon dioxide at several points in the room. Given the number of people in the room and the area, it is then easy to calculate the rate of exchange of air for the room as a whole and to observe if the exchange is uniform, or whether there are any stagnant areas.

It is generally felt that Government regulations merely defining the cubic feet of space allotted to each worker in a factory, or each child in a school, must be replaced by regulations demanding a minimum exchange of air per head, supplied at a reasonable temperature.

In the First Report of the Departmental Committee appointed by the Home Office to inquire into the venti-

lation of factories and workshops (1902), the Commissioners concluded from their own observations that it is reasonable to expect under ordinary circumstances that 10 volumes of carbon dioxide per 10,000 should not be exceeded in factories or workshops unless gas is burning in the room. Their chief recommendation was that a standard of ventilation should be prescribed for all classes of factories and workshops not otherwise specially dealt with. This standard they defined as follows:—The proportion of carbon dioxide in the air at about the breathing level and away from the immediate influence of any special source of contamination (such as a person or light) shall not rise beyond twelve volumes of carbon dioxide per 10,000 of air, and that when gas or oil is used for lighting, the proportion shall not exceed twenty volumes after dark or before the first hour after daylight. Our experience, including many hundreds of tests on the air of workrooms, confirms that of the Commissioners, that it is possible to secure sufficient ventilation in workrooms to maintain this standard, and we regard any larger proportion of carbon dioxide than ten volumes per 10,000 to indicate unsatisfactory ventilation, and more than twelve volumes an excessive contamination. It is, however, useless for a Government Department to impose any such regulations unless the percentage of carbon dioxide can be determined rapidly and with sufficient accuracy. It is desirable that an accuracy of at least one unit of carbon dioxide per 10,000 shall be secured, and that the result shall be obtained within three to four minutes.

Pettenkofer's method, in which a large volume of air, varying from two to five litres, is collected and the carbon dioxide absorbed by baryta water, the excess of baryta being titrated back with oxalic acid, can be performed with great accuracy (as modified by Letts and Blake and others). Under industrial conditions, however, it is obviously impossible to collect a large number of samples by this method.

A gas volumetric method, in which the decrease in volume due to the absorption of carbon dioxide is directly measured, has been worked out by Haldane. His neat and portable form of apparatus is well known. Judging from our experience, however, of the difficulty in obtaining strictly consistent results with this apparatus, we fear that in the hands of men with the usual training of Medical Officers of Health or Sanitary Inspectors, it would give misleading results.

A third method, known as the minimetric method, was suggested by Dr. Angus Smith and has been developed by Lunge and Zeckendorf. In this the quantity of air is determined which is necessary to saturate the reagent used for the absorption of carbon dioxide. The apparatus used by Lunge and Zeckendorf consists simply of a bottle and a rubber bulb fitted with valves so as to allow the passage of air to take place only in one direction. A known volume of standardised baryta or sodium carbonate solution tinted with phenolphthalein is introduced into the bottle, and the volume of air required

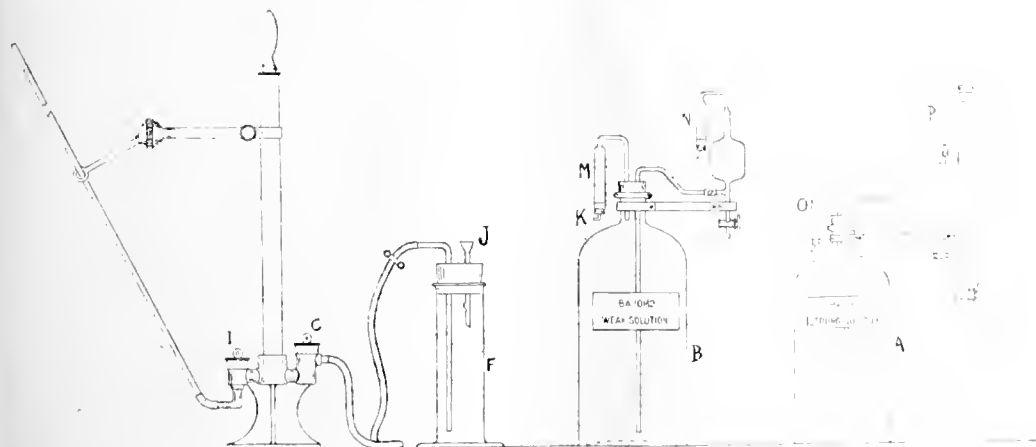
to decolorise the solution is obtained by counting the number of compressions of the ball. This gives a measure of the proportion of carbon dioxide in the air. It is evident that this process is capable of considerable refinement, and by our modifications we have secured a rapid and sufficiently reliable process. Our apparatus is illustrated in the accompanying diagram.*

The pump for measuring the air is fitted with inlet and outlet valves, I and C, and delivers 50 c.c. of air at each full stroke. The inlet side is connected to a long glass tube supported by a clamp so that the air may be taken at a distance from the operator. The outlet is connected by a piece of rubber tubing to the absorption vessel, F.

Many experimenters have dwelt on the difficulty of titrating very weak solutions of baryta such as are required for this process, and on account of this difficulty we have abandoned the titration method, and, previous to making a series of tests, we standardise the solution against fresh air. The results of the most reliable investigators give proportions of carbon dioxide in fresh air varying from 3 to 3.5 parts per 10,000. The proportion seldom rises above 3.5, even in town air, except during foggy weather. As the variation is so slight, and as the majority of these tests will be made in a town atmosphere, we have adopted 3.5 parts per 10,000 as a standard.

Two solutions are required: the stronger stock solution is made as follows:—25 grms. of pure crystallised barium hydroxide (powdered) is placed in the bottle, A, and 1 litre of distilled water added. After corking, the contents are thoroughly shaken, until the baryta is dissolved. The cork is then replaced by a rubber stopper fitted with the tubes shown in the diagram. To one of these a measuring burette is attached, and the solution is protected by two soda-lime tubes. The weak solution which is used in the apparatus is prepared in bottle, B. Two litres of distilled water are placed in this bottle and a few c.c. of alcoholic phenolphthalein added. Strong baryta solution is added a few drops at a time and the bottle well shaken after each addition until the pink colour is just permanent. We have now precipitated the carbon dioxide present in the water. A further addition of 3.3 c.c. of baryta is now made and the solution, after shaking, is ready for standardisation. The bottle is fitted with a measuring pipette and protection tubes similar to those shown on bottle A. To standardise this solution the whole apparatus is placed on a table in front of an open window on the windward side of the room, the open end of the inlet tube projecting some feet out of the window. The apparatus is now completely washed out with fresh air by working the pump several times. A drop or two of phenolphthalein solution is placed in F, followed by a measured 25 c.c. of baryta solution run through tube J. A small hand blower, attached to K, is convenient for transferring the solution from the bottle to the pipette. The vessel, F, is now

* The apparatus is now being made by Messrs. J. J. Griffin and Sons, Ltd., Kingsway, London, W.C.



thoroughly shaken for 15 seconds and this is counted as one volume of air. 50 c.c. of air is then discharged, by means of the pump, into the vessel, F, which is again shaken for the same length of time. This is followed by another 50 c.c. and so on, until the solution is just decolorised; the number of strokes of the pump being counted. During the shaking it is an advantage to have a spring clip on the rubber tube, close to vessel F, to prevent the liquid from leaving the bottle. The solution should be of such a strength that 25 c.c. is exactly decolorised by 15 strokes (14 discharges from the pump and one for the air originally present in the bottle). If the solution is either too weak or too strong it is better not to attempt to modify it, but to start afresh, varying the quantity of strong baryta accordingly. Having standardised the solution against fresh air, the apparatus can be used to test the air of a room. The inlet tube should be placed at some distance from the operator, at least 3 ft. from any person in the room, and 3 ft. away from any wall. In an ordinary test of a workroom the sample should be taken at about the breathing level.

The accompanying table was constructed from a series of parallel determinations with Pettenkofer's method. It indicates the proportion of carbon dioxide per 10,000 corresponding to any given number of strokes.

Strokes of pump.	Parts carbon dioxide per 10,000.
15	3.6
14	4.0
13	4.5
12	5.0
11	5.6
10½	5.9
10	6.3
9½	6.7
9	7.2
8½	7.7
8	8.2
7½	8.7
7	9.3
6½	10.1
6	10.9
5½	11.7
5	12.7
4½	13.8
4	15.0
3½	16.4
3	18.0
2½	19.8

A note of the general condition and temperature of the atmosphere; of the air space available; the number of people present; the presence or absence of gas jets and of any open windows should accompany the result of this test.

The apparatus is handy to manipulate, and once the solution is standardised against fresh air, a youth can rapidly perform the tests *in situ*. The strength of the solution should be checked after each series of experiments. The apparatus involves the following modifications: (a) the accurate delivery of known volumes of air; (b) sampling at a distance from the operator; (c) standardisation of the solution against fresh air instead of titration; (d) special precautions for preventing access of carbon dioxide to the solutions.

DISCUSSION.

Mr. W. GATHORNE YOUNG thought that slight modification of the author's method, to secure accurate standardisation of the absorbent solution, and increase in capacity of the air pump, might be advantageous.

Mr. S. H. DAVIES said that the authors' method was sufficiently accurate for practical purposes. The highest proportion of carbon dioxide that he had seen recorded in a living room was 81 parts per 10,000 in a Glasgow lodging-house. It had been shown that 200 to 300 parts per 10,000 of pure carbon dioxide were necessary to give any marked physiological effect.

Mr. A. R. TANKARD thought that enlargement of the shaking cylinder, resulting in larger volumes of air and solution used, would probably be an improvement from the point of view of accuracy. Ammonia and obscure organic compounds often accompanied carbon dioxide, producing undesirable effects.

Dr. H. T. CALVERT pointed out that if a half-stroke of the pump was the limit of delicacy of manipulation this meant an error of 2 per 10,000 in the atmosphere they were then breathing. Another probable defect was that rapidity of movement of the piston might cause leakage.

Mr. B. G. McLELLAN said that for most ventilation problems where the carbon dioxide was between 7 and 10 parts per 10,000 the apparatus was quite sufficiently accurate. The volume of air and solution used had been arrived at after many experiments, and the apparatus as described combined portability with accuracy.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Drying machines; Continuous — for drying grain, peat, hops, salt, sand, cement, manures, chemicals, small coal, ores, and other analogous wet or moist materials. J. Black and A. H. H., and A. B. Lennox, Newcastle-on-Tyne. Eng. Pat. 1455, Jan. 21, 1908.

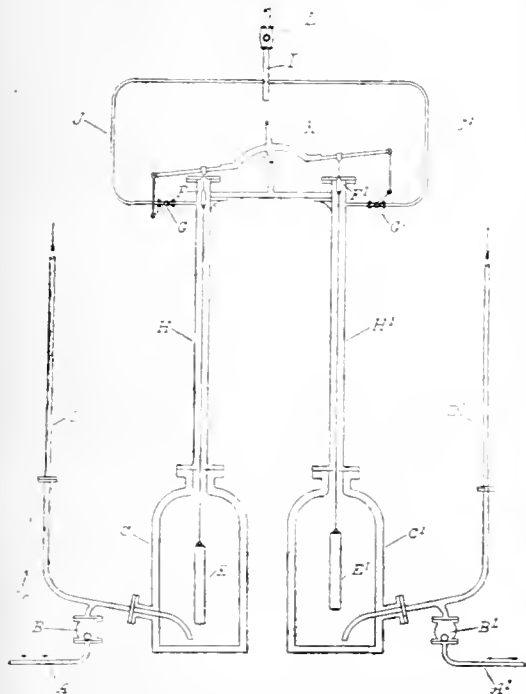
The dryer is formed of a number of superposed, vertical, flanged cylinders, bolted together and having a plate, forming a shelf bolted between each pair of flanges. A central shaft or centrally disposed cylinder attached to a shaft and rotated from below, has scrapers attached to it corresponding with each shelf. The material is introduced above the top shelf, and after completing the circle of the shelf, is discharged by the scrapers, through an opening, on to the shelf below. The drying medium enters above

the lowest shelf and circulates upwards, being forced to travel in the opposite direction to that taken by the material, by partitions or flaps depending from the shelf above and situated behind the openings.—W. H. C.

Drying, roasting, or otherwise treating pulverulent or granular materials. J. and C. McNeil, Govan, North Britain. Eng. Pat. 4491, Feb. 28, 1908.

The material to be treated is fed into one end of a horizontal, rectangular, metal vessel mounted on a hollow, perforated shaft and rotated by gearing. A number of inclined blades project inwards from each side of the vessel and form what is practically a screw or helix, which as the vessel is rotated, lifts up the material, drops it again and at the same time moves it forward through the vessel to the other end, from which it is discharged. Hot air or any other suitable drying or treating medium is introduced through the hollow, perforated shaft.—W. H. C.

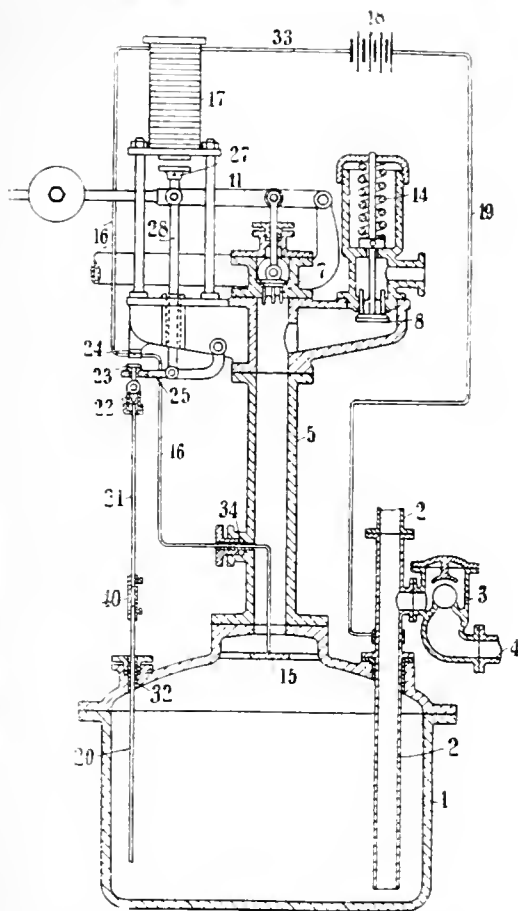
Raising acids or other liquids by compressed air, steam, or other elastic fluid under pressure; Self-acting apparatus for —. W. Rayne, Manchester. Eng. Pat. 7054, March 31, 1908.



Two pressure-vessels, C, C', are filled alternately with the liquid to be raised, through the pipes, A, A', provided with non-return valves, B, B'. In these vessels, floats, E, E', are suspended by rods which pass through the pipes, H, H', from the air-escape valves, F, F', which are themselves suspended by adjustable clips from the arms of the pivoted beam, K. The ends of the beam are connected by links with the air-valves, G, G', which control the supply of compressed-air conveyed by the branches, J, J', from the air-main, I, provided with the stop-valve, L. Supposing the vessel, C', to be just filled and C, emptied, the float, E', rises and the beam overbalances into the position shown. The air-escape valve, F', closes, the air-supply valve opens and the liquid is forced out of C', through the rising main, D'. The vessel, C, is filling during this time. As soon as C' is empty and C, full, the beam, K, overbalances in the opposite direction and the contents of C are forced out through the pipe, D. The apparatus is started and stopped by opening or closing the stop-valve, L.—W. H. C.

Elevating liquids by means of gaseous fluids under pressure. V. Schwaninger, Oggersheim, Germany. Eng. Pat. 23,175, Oct. 30, 1908.

THE apparatus consists of a pressure chamber, 1, provided with a pipe, 2, of conducting material which is insulated from the vessel, 1. The liquid to be elevated enters by the pipe, 4, and the non-return valve, 3, the air escaping through the spring-controlled valve, 8, into the atmosphere. When the liquid has filled the vessel, it comes into contact with the conductor, 15, which is connected by the wire, 16, insulated at 34, to the electro-magnet, 17. The circuit is completed by the wire, 33, the battery, 18, and the wire, 19, connected to the conducting pipe, 2. The circuit being closed by the liquid, the magnet, 17, attracts the armature, 27, which raises the end of the lever, 11, and lifts the compressed fluid inlet valve, 7, which is normally closed by the weight of the lever. The compressed fluid enters the vessel, 1, through the pipe, 5, closes the air escape-valve, 8, against the spring, 14, and forces the liquid out of the vessel through the rising main, 2. In order to prevent the circuit being broken as soon as the



level of the liquid falls below the contact, 15, a conducting wire, 20, insulated at 32, dips into the liquid in the vessel, the depth to which it enters the vessel being adjusted by the sleeve contact, 40. This is connected by the rod, 21, to the sliding contact, 22, attached to the hinged arm, 25, which is connected by the rod, 28, to the armature, 27. When the circuit is closed, the arm, 25, is lifted by the armature and the contact, 23, is brought against the contact, 24, and remains in this position until the level of the liquid falls below that of the bottom of the wire, 20. When this happens the circuit is broken and the armature, 27, drops, closing the valve, 7, and separating 23 and 24. The vessel, 1, then commences to fill again.—W. H. C.

Concentration of solutions and recovery of volatile solvents.

D. Dubois. 1st and 2nd Additions, dated Sept. 2, 1908, to Fr. Pat. 384,907, Dec. 11, 1907 (this J., 1908, 494).

In order to prevent the blocking up of the taps, connecting pipes, and pumps between the various parts of the apparatus described in the original patent, owing to the deposition of the sulphur, or other dissolved material when the solutions are cooled during their passage through the connections, the latter are kept warm. This may be effected by surrounding them with steam jackets or by any other suitable means. In the case of the outlet taps, the latter are placed within the vessel and are thus kept at such a temperature that no deposit takes place.

—W. H. C.

Exhauster for acid gases. Selwig und Lange Maschinenfabrik. Fr. Pat. 393,941, July 2, 1908.

THE fan-wheel and blades are constructed of aluminium, preferably cast aluminium, and the casing is of earthenware. The aluminium fan-wheel is said to resist acid vapours for a considerable time and to be much less liable to disruption than fan-wheels of earthenware.—W. H. C.

Agitation and separation of mixtures of solids and liquids. J. T. Carriek and B. S. Pattison. Fr. Pat. 394,133, July 11, 1908.

The patent relates to a method of agitating solids with liquids, and subsequently separating the two, and its application to the treatment of copper matte with acid is described. The treatment is carried out in a closed vessel provided with a false bottom constructed of a suitable filtering material. The hydrogen sulphide produced by the action of the acid on the matte is withdrawn from the upper part of the vessel, and, by means of a fan, forced in again at the lower part through a number of tuyères disposed just above the filtering material. The mixture is thus kept agitated during the treatment. When the decomposition of the matte is complete, the fan is stopped, and the hydrogen sulphide is displaced by steam, and led away to be utilised. The outlet for the liquid, below the filtering layer, is then opened, and to prevent caking of the precipitate on the filtering material, the fan is put in communication with the atmosphere, and air is blown in through the tuyères. The treatment and the filtration may, if desired, be performed in separate vessels. The process is applicable to all operations of a similar character to that described.—A. S.

Filter-press; Continuous —. C. C. Leclaire. Fr. Pat. 394,450, Nov. 26, 1907.

The liquid to be filtered is forced under pressure into a vertical cylinder, the walls of which form the filtering surface, and which is surrounded by a closed vessel to receive the filtrate. A vertical shaft driven from above passes through the cylinder and is provided with scrapers which detach the deposited solids from the inner surface of the filter. The lower end of the cylinder terminates in a conical discharge chamber in which the solids are compressed and then discharged by a conical screw fixed to the lower end of the central shaft. In order to facilitate the detaching of the solids from the filter surface, periodical horizontal blows or shocks are communicated to the central shaft to cause it and the scrapers to vibrate. From the discharge opening the solids may, if desired, be passed through a tube where they are washed, dried, or otherwise treated.—W. H. C.

Distillation apparatus. A. Gohmann. Ger. Pat. 205,773, Oct. 6, 1907.

The apparatus consists of a column built up of a number of superposed compartments, through which the liquid to be distilled and the heating gases or vapour flow, in zig-zag paths, in opposite directions. In the bottom of each compartment are fixed, as usual, two pipes, one through which the liquid flows into, and the other through which the vapour rises from, the compartment below. Above the bottom of each compartment is mounted a corrugated hood, the corrugations of which dip into the liquid, thus causing the heating vapour and liquid to come into intimate contact with each other.—A. S.

Volatile and liquid products; Apparatus for the purification and vaporisation of — by means of a blast of steam. P. Wachtel. Ger. Pat. 205,911, June 20, 1907.

From the receptacle containing the liquid to be purified or volatilised, rises a tube ending in a jet. A jet of steam is blown across the end of this tube, at right angles thereto, and by an injector action carries the liquid with it into a system of piping, in which are arranged baffle-plates. The baffle-plates are provided with perforations, the size of which decrease from the first plate onwards, and thus the steam and liquid are intimately mixed, whilst solid impurities are retained by the baffle-plates. The pipe supplying the steam-jet is surrounded by two concentric pipes, which can be rotated independently and are provided with holes, so that by suitable adjustment, the steam pipe can be cooled by the outer air or by any desired cooling agent, and thus the temperature of the steam can be regulated. A similar cooling device may be applied to the system of piping into which the mixture of steam and liquid is blown.—A. S.

Non-aqueous mixtures; Method of preparing — and product thereof. E. G. Acheson, Stamford, Canada. U.S. Pat. 911,358, Feb. 2, 1909.

SEE Fr. Pat. 384,698 of 1907; this J., 1908, 494.—T. F. B.

Centrifugal [separating] machine. A. J. Ericsson, Assignor to Aktiebolaget Separator, Stockholm. U.S. Pat. 911,652, Feb. 9, 1909.

SEE Eng. Pat. 16,002 of 1906; this J., 1907, 141.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Pulverised fuel for industrial furnaces. R. K. Mcade. Amer. Inst. Chem. Eng., Dec., 1908. Electrochem. and Met. Ind., 1909, 7, 61—62.

AFTER referring to the fact that in the United States powdered coal is practically the only fuel used in the manufacture of Portland cement, the author recommends its use for open-hearth metallurgical furnaces. The disadvantage of the ash settling upon the charge is not serious, since most of it is carried off by the strong draught. (For methods of burning powdered coal see this J., 1896, 888; 1900, 521; 1902, 1019; 1905, 369.)—A. S.

Coal; The coking property of —. O. Boudouard. Compt. rend., 1909, 148, 348—351.

COAL was treated with various organic solvents. All of these, excepting pyridine, extracted only very small quantities of brown tarry matter; pyridine extracted more than 10 per cent., and to a certain extent affected the coking power unfavourably. Strong hydrochloric acid had no action on coal; strong sulphuric and nitric acids destroyed the coking power, and oxalic acid was formed by the latter. Aqueous potassium hydroxide solution did not affect the coking power, nor did it remove humic acid. Both fusion with potassium hydroxide and the action of Schweitzer's reagent (ammoniacal copper solution) diminished the coking power appreciably, oxalic acid being formed in the former case. The successive action of aqueous potassium hydroxide solution, hot strong hydrochloric acid, and Schweitzer's reagent destroyed the coking power completely. The liquid obtained by treating coking coal with Schweitzer's reagent when treated with hydrochloric acid yielded a very small amount of a flocculent precipitate presenting all the characteristics of cellulose. The author concludes that the coking power of coals is caused by the presence of complex condensation-products of carbohydrates, and that the humic acid found in non-coking coals has been formed by the oxidation of these products. Anthracite is a product which has undergone so much oxidation that it no longer contains humic acid.—E. F.

Desulphurisation of spent oxide; Commercial o-dichlorobenzene as a solvent for the —. Chem. Fab. Griesheim-Elektron. J. Gasbeleucht., 1909, 52, 137—139.

COMMERCIAL o-dichlorobenzene, which consists of about 75 per cent. of o-dichlorobenzene and 25 per cent. of p-dichlorobenzene and has a flashing point of 62° C., dissolves 3.5 per cent. of its weight of sulphur at ordinary temperatures, 50 per cent. at 100° C., 200 per cent. at 110° C., 300 per cent. at 115° C., and mixes with sulphur in all proportions at 140° C. Laboratory experiments showed that spent oxide may be advantageously desulphurised by extraction with an equal weight of this solvent at 100° C. The crystallised sulphur obtained from the solution had a purity of 98.5 per cent. when the solvent had been used for six successive extractions of fresh quantities of spent oxide. The colour of the solution showed that tar became concentrated in the mother liquor; a small quantity of impurity was carried down mechanically with the crystals, but the purity of the sulphur was not increased by filtering the hot solution through wood-charcoal. The spent oxide was not dehydrated by extraction at 100° C., and the extracted product was as active as oxide desulphurised by extraction with carbon bisulphide at the ordinary temperature. The amounts of cyanogen, ammonia, and thiocyanic acid in the spent oxide were not decreased by the extraction.—A. T. L.

PATENTS.

Alcohol; Transforming — for the purpose of using it as a fuel. N. Manger, Paris, Eng. Pat. 23,806, Nov. 6, 1908.

A MIXTURE of ether and ethyl phosphide is produced by causing a stream of alcohol to flow continuously into a retort in which a mixture of alcohol and sulphuric acid and a 1 per cent. solution of white phosphorus in chloroform or some other suitable solvent, is heated. The product which distils over is a mixture of ethyl phosphide, ether, water, and alcohol; it is mixed with a small quantity of castor oil in which 1 per cent. of phosphorus has been dissolved, and is then suitable for use as a fuel for internal combustion engines.—W. H. C.

Coke-ovens and gas-producers; Portable — with portable base-pieces or hearths, applicable for use as furnaces or kilns. T. Smith, Newcastle-on-Tyne. Eng. Pat. 839, Jan. 28, 1908.

THE claim is for a metallic beehive- or dome-shaped, bottomless casing lined with firebrick, provided with an opening at the apex for charging, and lateral openings near the top for the escape of gases. In use it is fitted over a separate base on which the material to be treated rests. Both the casing and the base are provided with hooks by which they may be slung from a crane. Several ovens may be used together, being connected by movable pipes. If the coke produced is required for charging a furnace, the bottom-piece or base is hinged to the oven at one side. When the coking is completed, the cover and base are lifted together by chains or slings above the mouth of the furnace. The slings retaining the base against the cover are then released and the former swings on its hinge and allows the coke to fall into the furnace.—W. H. C.

Coke-oven; Horizontal regenerative — with horizontal flues. Act. Ges. f. Kohlendestillation. Fr. Pat. 394,077, Sept. 9, 1908.

EACH oven has a system of horizontal heating flues on each side as well as four flues beneath the sole of the oven. The side-flues are divided into two parts by a vertical partition, which is displaced horizontally from the centre line towards the coke-discharge side, so that each set of flues has the same total length, to ensure uniformity of heating. The flues on the ram side are connected in pairs with the regenerator on the coke-discharge side, and the flues on the discharge side with the regenerator on the ram side. The flues beneath the sole of the oven are also connected in pairs with the two regenerators.—W. H. C.

Water-gas; Process of making carburetted —. H. L. Doherty, New York, N.Y. U.S. Pat. 911,869, Feb. 9, 1909.

WATER-GAS is carburetted by mixing it with oil in the form of fine mist, and then passing the mixture through a heated mass of refractory material to fix the gas. The producer is blown with air in such a manner as to form mainly carbon dioxide, and the fixing chamber is heated by the sensible heat of the gases leaving the producer. The oil is sprayed by forcing it at a pressure exceeding 30 lb. per sq. in. through nozzles arranged so that the jets meet one another, particles of oil of sensible size being allowed to settle. The oil mist is then mixed with water-gas in regulated amounts and the mixture is passed through the fixing chamber.—A. T. L.

Water-gas generator. W. E. McKay, Milton, and H. N. Cheney, Boston, Mass. U.S. Pat. 911,899, Feb. 9, 1909.

THE generator is provided with movable grate-bars which can be operated from the outside without interrupting the working, and gas-tight sight-holes are arranged below the grate for viewing the base of the fuel bed. The generator may be worked continuously with alternating periods of blowing with air and with steam.—A. T. L.

Gas; Process of purifying —. E. L. Hall, Assignor to Security Savings and Trust Co., Portland, Oreg. U.S. Pat. 911,494, Feb. 2, 1909.

ILLUMINATING gas is first purified by the removal of sulphuretted hydrogen, then heated with or without the introduction of steam, to convert carbon bisulphide into sulphuretted hydrogen, and finally, the gas is again freed from sulphuretted hydrogen.—A. T. L.

Phosphoretted hydrogen [present in acetylene]; Fixation of —. Soc. Commerciale du Carbone de Calcium. Eng. Pat. 14,824, July 13, 1908. Under Int. Conv., March 6, 1908.

PHOSPHORETTED hydrogen is fixed and converted into phosphoric acid, and thus removed from gases such as crude acetylene, by means of a mixture of mercuric chloride, 10 parts; ferric chloride solution at 45° B., 600; ferric oxide (preferably obtained by precipitation, and dried at a low temperature), 250; to which 140 parts of dry infusorial earth or other inert substance may be added. The mixture forms a golden yellow, dry, and non-corrosive powder, which becomes white on use from the formation of ferrous oxychloride. The mercuric chloride acts only as a catalytic agent. The mixture also absorbs ammonia and hydrogen sulphide.—A. G. L.

Fuel, artificial; Manufacture of —. A. W. H. Vivian and G. L. Davies, London, and L. Grote, Tottenham. Eng. Pat. 2655, Feb. 6, 1908.

SEE Fr. Pat. 393,218 of 1908; this J., 1909, 16.—T. F. B.

Solder or incandescent lamp filaments. H. Kuzel, Baden, Austria. U.S. Pat. 912,245, Feb. 9, 1909.

SEE Fr. Pat. 366,267 of 1906; this J., 1906, 1035.—T. F. B.

Candles. Fr. Pat. 394,362. See XII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Carboniferous substances and bitumen. K. Charitschkow. J. Russ. Phys.-Chem. Ges., 1908, 40, 1327—1334. Chem. Zentr., 1909, 1, 576.

IN the destructive distillation of bituminous substances, products are obtained considerably different from those obtained in the distillation of coal. Asphaltum contains a larger percentage of hydrogen than coal does, and in accordance with this, yields "hydrogenised hydrocarbons" resembling the naphthenes obtained from petroleum. The author considers that there is a genetic relationship between the several natural carboniferous substances (coals, bitumens, petroleum), the differences being due to the different degrees of hydrogenation of such substances.—A. S.

Petroleum production of the United States in 1908. U.S. Geol. Survey, 1908. [T.R.]

THE great gain in production of petroleum in 1907 over 1906 required such a drain on all the great pools and developed so large a stock of unused crude oil that a further increase in 1908 was not to be expected, as a matter of either finance, trade requirements, or available petroleum resources. As the year went on, unprecedented floods in May and June and again in November brought disaster to the pipe lines of Oklahoma, and these storms also left a record of numerous oil tanks destroyed by lightning. In the Eastern fields the severe drought also seriously interfered with well drilling. The decline in production in the Glenn pool and in various Texas and Louisiana pools increased the likelihood of a total smaller than in 1907. Nevertheless, the actual record of the year shows a total beyond all records—between 175,000,000 and 180,000,000 barrels, compared to 166,000,000 in 1907. The total value is proportionately greater still, for the price of the product in California increased and it remained steady in other fields, except the Gulf, where a comparatively groundless fear of overproduction from the new Markham and Goose Creek fields caused depression. The increases

came from the steady growth in Illinois and California. Neither field showed phenomenal development. California responded to the higher prices consistent with depleted stocks, and Illinois showed the continued effect of the great investments of the previous year in this new territory.

PATENTS.

Hydrocarbons; Process for preparing — capable of absorbing water. J. Lifschütz. Ger. Pat. 205,428, July 23, 1907. Addition to Ger. Pat. 197,662, Feb. 8, 1907 (see this J., 1908, 554).

HYDROCARBONS are treated with oxidising agents, such as organic or inorganic peroxides.—T. F. B.

Petroleum and its distillates; Process for purifying crude —. L. Edelmann, Ploiesti, Roumania. U.S. Pat. 911,553, Feb. 2, 1909.

SEE Eng. Pat. 11,140 of 1908; this J., 1908, 974.—T. F. B.

Lubricating oils. Fr. Pat. 391,992. See XII.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indigoid dyestuffs derived from phenylisoxazolone. A. Wahl. Compt. rend., 1909, 148, 352—354.

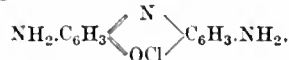
ISATIN was transformed into its chloride by the action of phosphorus pentachloride in benzene, by Baeyer's method, and to the resulting solution a boiling benzene solution of an equivalent quantity of phenylisoxazolone was added. The colour of the solution changed to violet-red, and on heating on the water-bath a dyestuff was deposited in crystals with a coppery lustre. The yield was quantitative. The product, 3-phenylisoxazolone-2-indolindigo, has

the formula, $\text{C}_6\text{H}_5\text{C}=\text{C}=\text{C}(\text{NH})\text{N}(\text{O})\text{CO}\text{CO}\text{C}_6\text{H}_4$, and is insoluble in

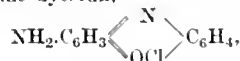
water. It dissolves in aqueous alkali and is reprecipitated from the colourless solutions by acids, but if to these alkaline solutions sodium hydrosulphite is added, a yellow liquid is obtained from which acids no longer precipitate a coloured product; this is reproduced, however, if oxidising agents such as hydrogen peroxide are added. The leuco compound appears to have no affinity for animal or vegetable fibres. The three isomeric methoxyphenylisoxazolones were also prepared and converted into the corresponding methylated dyestuffs with isatin chloride.—E. F.

Aposafrairie; The azoxine analogue of —. F. Kehrman and W. Gresly. Ber., 1909, 42, 347—349.

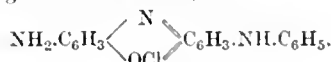
By diazotising 3:6-diaminophenazoxonium chloride,



and boiling the resulting diazo compound with alcohol, one amino-group is removed and the chloride of the simplest azoxine dyestuff,



is formed. This dissolves in water or alcohol with a yellowish blood-red colour and dyes tannin-mordanted cotton in reddish-brown shades. The dyestuff is rather unstable, being decomposed on boiling its aqueous solution. When the corresponding nitrate is warmed in alcoholic solution with aniline, a greenish-blue dyestuff, probably corresponding with the formula,



is formed.—J. C. C.

PATENTS.

Indigo; Manufacture of chlorinated derivatives of —. Ges. für Chem. Ind., Basle, Switzerland. Eng. Pat. 19,793, Sept. 21, 1908. Addition to Eng. Pat. 9546, April 24, 1907 (this J., 1908, 116).

Tri- and tetra-chloro-derivatives of indigo are prepared by subjecting indigo to the action of chlorine, in the

presence of carriers of chlorine and in diluents consisting of benzene derivatives containing one or more negative groups or elements, as substituents. Such diluents are nitrobenzene, monochlorobenzene, dichlorobenzene, chloronitrobenzene, etc. The indigo is suspended in the diluent, antimony pentachloride is added, and chlorine is passed into the mixture, which is meanwhile stirred and cooled. When the increase in weight corresponds to the formation of the derivative desired, the mixture is left to stand; the chlorinated product is afterwards filtered off, and washed with hot alcohol, dilute hydrochloric acid, dilute caustic soda, and water, and is finally dried. These derivatives yield intensely blue shades on cotton, distinguished by their fastness to chlorine.—F. M.

Indigo; Production of halogen derivatives of —. Ges. f. Chem. Ind. in Basle. Sixth Addition, dated Nov. 11, 1907, to Fr. Pat. 375,514, Feb. 25, 1907.

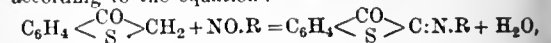
SEE Eng. Pats. 6153 and 19,563 of 1908; this J., 1908, 893, 1200. Trihalogen derivatives of indigo can also be obtained by the action of chlorine on indigo or on mono- or dibromo-indigos suspended in an indifferent medium, such as nitrobenzene, and in presence of antimony pentachloride.—T. F. B.

Indigo-white; Stable — and process of making same. R. Wimmer, Assignor to Badische Anilin- und Soda-Fabrik, Ludwigshafen, Germany. U.S. Pat. 910,889, Jan. 26, 1909.

A MIXTURE of a solution of an alkali salt of Indigo-white and sulphite-cellulose waste liquor is evaporated in a vacuum. The product is readily soluble in water and is adapted for direct use in a vat.—J. C. C.

β -Hydroxythionaphthene and $\alpha\beta$ -diketodihydrothionaphthene derivatives and dyestuffs derived therefrom; Production of —. Badische Anilin und Soda Fabrik. First Addition, dated Sept. 3, 1908 (Under Int. Conv. Oct. 20, 1907), to Fr. Pat. 374,287, Feb. 4, 1907 (this J., 1907, 757).

$\alpha\beta$ -DIKETODIHYDROTHIONAPHTHENE or its derivatives may be prepared by condensing β -ketodihydrothionaphthene or its derivatives (not substituted by halogens in the thiophene nucleus) with aromatic nitrosoamines, according to the equation:



and hydrolysing the product. Example: 15 kilos. of β -ketodihydrothionaphthene are dissolved in 1500 litres of warm water by means of caustic soda, the solution cooled to 40° C., and a concentrated alcoholic solution of 15 kilos. of *p*-nitrosodimethylaniline added. Brown flocks separate which gradually pass into a violet-black crystalline powder. The dry substance, which has the constitution:



crystallises from benzene in greenish-red dichroic prisms, m.p. 176° C., containing half a molecule of benzene of crystallisation. On trituration with 15 per cent. hydrochloric acid, it furnishes $\alpha\beta$ -diketodihydrothionaphthene which separates out, whilst dimethyl-*p*-phenylenediamine remains in solution. Similar condensations of β -ketodihydrothionaphthene with *p*-nitrosodimethylaniline, *p*-nitroso-monoethylaniline and *p*-nitrosodiphenylamine and of 3-methyl- β -ketodihydrothionaphthene with *p*-nitrosodimethylaniline are described.—J. C. C.

Dyestuff and process of making same; Orange lake —. R. Lauch, Berlin, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 912,138, Feb. 9, 1909.

A NEW orange dyestuff can be obtained by diazotising *o*-*p*-dinitroaniline and then combining with β -naphthol. The product can be used for preparing lakes.—P. F. C.

Vat [thioindigo] dyestuff; Production of a red —. Fabr. Bâloise de Prod. Chimiques. First Addition, dated Sept. 11, 1908 (under Int. Conv. Oct. 17, 1907), to Fr. Pat. 385,920, Jan. 3, 1908 (this J., 1908, 399, 681).

DYESTUFFS resembling those described in the chief patent are obtained by condensing acenaphthenequinone with

derivatives of 3-hydroxy-1-thionaphthene or of phenylthioglycolic-*o*-carboxylic acid containing a substituent in the benzene nucleus. Examples are given illustrating the use of 2-phenylthioglycolic-4-chloro-1-carboxylic acid, $C_6H_5(CO_2H)(S.CH_2.CO_2H)Cl(1:2:4)$, and of 4-ethylthio-oxythionaphthene in this condensation.—J. C. C.

Dyestuffs for wool: Process for the preparation of yellow —. Fabr. Prod. Chim. ci-dev. Sandoz. Second Addition, dated Sept. 4, 1908, to Fr. Pat. 387,245. Feb. 14, 1908 (this J., 1908, 801).

DYE STUFFS similar to those described in the first addition (this J., 1908, 1055) are obtained by replacing diazotised sulphanilic acid by diazotised β -naphthylaminemono-sulphonic acids, for example, 2-naphthylamine-1-sulphonic acid.—J. C. C.

Gallocyanine anilides; Production of new leuco-derivatives of —. Manuf. de Mat. Col. ancien. L. Durand. Huguenin, et Cie. Fr. Pat. 394,136, July 24, 1908. Under Int. Conv., July 31, 1907.

LEUCO-DERIVATIVES of arylaminogallocyanines or their sulphonic derivatives can be obtained by effecting the reduction of the dyestuffs in a medium which does not cause the elimination through heat of the arylamino-group. Suitable media are dilute alcohols, dilute ethyl tartrate, dilute formic acid, phenol, acetic, etc. The reducing agents may be hyposulphites (hydrosulphites) or their compounds, or sulphonylates, together with the corresponding quantity of hydrochloric acid, excess of the latter being avoided. The new dyestuffs give with metallic mordants, and particularly with chromium mordants, greenish-blue shades which are purer and faster than those produced by the corresponding sulphonic derivatives of the unreduced arylaminogallocyanines. Moreover they can be fixed on the cotton fibre by steaming for a short time.—J. C. C.

Azine dyestuffs; Production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 394,357, Sept. 16, 1908. Under Int. Conv., Nov. 5, 1907.

VIOLET to greenish-blue azine dyestuffs are obtained by oxidising a mixture of para-diamines or their derivatives containing at least one free amino-group and arylated 1:3-naphthylenediamines or their sulphonic acids by means of oxygen, air, or other gaseous mixtures containing oxygen, in the presence of ammoniacal copper oxide. In case the products are insoluble in water, they are rendered soluble by means of sulphonating agents. Example 1: 39 kilos. of diphenyl-1:3-naphthylenediaminesulphonic acid and 21.6 kilos. of *p*-aminodimethyl-aniline-*m*-sulphonic acid are dissolved together in 300 litres of alcohol with the addition of a solution of 50 kilos. of sodium carbonate in 300 litres of water: 5 litres of a concentrated ammoniacal solution of copper sulphate (containing 2 kilos. of copper sulphate) are added, and a strong current of air is blown through the solution, which is heated to 30°–50° C., until the diphenylnaphthylenediaminesulphonic acid has disappeared. Usually the dyestuff separates on cooling the solution, but if not, it is precipitated by adding salt. It dyes wool pure blue shades from an acid bath. Example 2: 51.4 kilos. of sodium diphenyl-1:3-naphthylenediamine-6:8-disulphonate are similarly oxidised together with 10.8 kilos. of *p*-phenylenediamine in 1600 litres of water. The resulting dyestuff gives violet shades on wool in an acid bath. Example 3: 31 kilos. of diphenyl-1:3-naphthylenediamine and 10.8 kilos. of *p*-phenylenediamine are dissolved in 300 kilos. of alcohol and oxidised as above. The product is sulphonated with fuming sulphuric acid. The resulting sulphonic acid dyes wool from an acid bath a violet shade.—J. C. C.

Anthraquinone series; Process for preparing thiocyanates of the —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 206,054, Dec. 12, 1907.

THE thiocyanates of anthraquinone or its derivatives are easily obtained by heating the diazothiocyanoates of anthraquinones with water, without the use of copper thiocyanate.—T. F. B.

Triphenylmethane dyestuffs; Process for preparing red, acid —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 205,758, Nov. 29, 1906.

BENZALDEHYDEDISULPHONIC acids are condensed with mono- or dialkyl-*m*-aminophenols or their homologues, the pyrone ring is closed by heating with substances which remove water, and the leuco-disulphonic acid thus produced is oxidised to the triphenylmethane dyestuff. The products are readily soluble, and produce fast, red dyeings.—T. F. B.

Anthrapyrimidones; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 205,914, Nov. 5, 1907. Addition to Ger. Pat. 205,035, Nov. 5, 1907. (See this J., 1907, 85.)

ANTHRAPYRIMIDONES are obtained by heating α -halogen-anthraquinones with urea, preferably in presence of an indifferent solvent and a metallic salt (e.g., cupric chloride or sodium acetate).—T. F. B.

[Azo] dyestuffs suitable for wool: Manufacture of yellow —. G. B. Ellis, London. From Chem. Fabr. vorm. Sandoz, Basle, Switzerland. Eng. Pats. 3373, Feb. 14, 1908, and 12,787, June 15, 1908.

SEE Fr. Pat. 387,245 of 1908 and Addition thereto; this J., 1908, 801, 1055.—T. F. B.

Leuco-derivatives of anilides of gallocyanines or their sulpho-derivatives; Manufacture of —. L. Durand, Huguenin, et Cie., Haningen, Germany. Eng. Pat. 16,207, July 30, 1908. Under Int. Conv., July 31, 1907.

SEE Fr. Pat. 394,136 of 1908; preceding.—T. F. B.

Monoazo dyestuff: Red —. E. Ulrichs, Elberfeld, Assignor to Wülfing, Dahl, und Co., A.-G., Barmen, Germany. U.S. Pat. 911,186, Feb. 2, 1909.

SEE Fr. Pat. 381,204 of 1907; this J., 1908, 117.—T. F. B.

Indigos; Process of making dibrominated halogenated —. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 394,746, Dec. 5, 1907.

SEE Eng. Pat. 26,538 of 1907; this J., 1908, 975.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Cotton from British Guiana. Bull. Imp. Inst., 1908, 6, 383–387.

SAMPLES of cotton cultivated in British Guiana were examined and the results compared with those obtained from samples of the same kinds of cotton examined in 1907. The results are given in a table and show that in general the cottons had retained their good qualities. Samples of six varieties of cotton cultivated by natives in the southern part of the Colony were also examined. It is stated that all of them would be readily saleable in this country.—A. S.

Fibres from Fiji. Bull. Imp. Inst., 1908, 6, 387–390.

THE fibres examined were Sisal, Mauritius, and bowstring hemps, and ramie ribbons and filasse. The results for the three hemps are shown in the following table:—

	Sisal hemp.	Mauritius hemp.	Bowstring hemp.
	Per cent.	Per cent.	Per cent.
Moisture	8.7	9.5	8.6
Ash	0.5	1.0	0.5
* α -Hydrolysis (loss) ..	8.5	14.0	9.1
* β -Hydrolysis (loss) ..	10.7	16.5	12.1
*Acid purification (loss)	0.9	5.1	1.3
Cellulose	79.0	78.0	75.0

* See this J., 1907, 757.

The three fibres were stated to be of superfine quality and would be readily saleable in large quantities, but the bowstring hemp was rather short (2.5 ft.). The

Sisal hemp was valued at £34—£35 per ton (Mexican Sisal, £25—£27), the Mauritius hemp at £31 ("good average" Mauritius, £22 10s.), and the bowstring hemp at about £27 per ton.

The ramie ribbons were of a pale-greyish straw colour, and much stiffer than a standard specimen; the strength was normal. The ribbons would be worth about £25 per ton, compared with £25—£30 for hand-scraped China grass. The sample of "filasse" was somewhat inferior to standard samples.—A. S.

Silk; Composition and chemical structure of various species of —. E. Abderhalden. Z. physiol. Chem., 1909, 58, 334—336.

THE work of E. Fischer and the author on the hydrolysis of the proteins, the isolation of the products, and the constitution of the polypeptides has enabled them to obtain a fairly complete knowledge of the constituent groups and the order of their arrangement in the case of the fibroin of Italian silk (this J., 1906, 278). It is now proposed to examine a large number of commercial varieties of silks of other origin on the same lines, and to study the differences in composition and constitution. Such an investigation involves two directions of research: total hydrolysis and partial hydrolysis. By the total hydrolysis the constituent groups are isolated separately as simple amino-acids and their relative quantities determined. But two proteins may yield on total hydrolysis exactly the same amino-acids in identical proportions and yet be different as regards the order of arrangement of these groups in the original molecule. Such a difference is detected by partial hydrolysis, whereby aggregates of two or more of the ultimate groups are obtained in the form of di- or polypeptides, which can then be characterised by means of the data accumulated in earlier work. If all the products both of total and partial hydrolysis be identical, it is highly probable that the two proteins are identical both in composition and structure.—J. F. B.

Silk; Composition and chemical structure of various species of —. 1. The monoamino-acids of New Chwang silk. E. Abderhalden and A. Rikiet. Z. physiol. Chem., 1909, 58, 337—340.

NEW Chwang silk is a definite commercial variety, but the authors have no information as to the species of silkworm producing it, nor its form of nutrition; presumably the worm feeds on oak-leaves. The raw silk was cleaned mechanically and then degummed by repeated extraction with boiling water in an autoclave. The exhaustion was never absolutely complete, so it is assumed that even pure water under pressure has a slight hydrolysing influence on silk fibroin. The raw silk lost, in the course of four extractions of 3—5 hours each, 18.95—20.0 per cent. of its weight. The hygroscopic moisture of the raw silk was 10 per cent. (dried at 120° C.), the ash was 5 per cent.; the degummed silk retained 2 per cent. of ash. The fibroin was less susceptible to acid hydrolysis than that of Milan silk, and larger quantities were left unresolved, in the form of a black-coloured residue. The process consisted in a preliminary hydrolysis with 25 per cent. sulphuric acid, for the estimation of the tyrosine, followed by two consecutive treatments for six hours with boiling, fuming hydrochloric acid. The amino-acids were isolated and estimated by known methods, the results being calculated on the weight of the ash-free fibroin, corrected for the residue remaining unresolved after each hydrolysis. The following products were isolated: glycocoll, 19.7 per cent.; alanine, 23.8; leucine, 1.6; serine, 1.0; aspartic acid, 2.9; glutamic acid, 1.7; phenylalanine, 1.2; tyrosine, 9.8; and proline, 1.85 per cent.—J. F. B.

Fibres; Use of reactions between — and gases in the textile industry. F. Erban. Chem.-Zeit., 1909, 33, 169—171, 182—184, 191—192.

AN outline is given of the different methods that have been tried with gases as reagents in the separation and bleaching of fibres, and the dyeing, mercerisation, and printing of textile materials. From a consideration of the results the author concludes that, apart from the well-known methods of sulphuring wool and silk and the

fixation of metallic mordants and Aniline Black upon cotton by means of ammonia vapour, few of the attempts have met with success. The method of von Niederrhansen, however, in which sodium aluminate is fixed upon the fibre by means of carbon dioxide is now of considerable importance in the textile industry. None of the attempts to use chlorine in bleaching, or gases or steam in dyeing textiles with Aniline Black has, as yet, been followed up to any extent. Green's process (this J., 1908, 683, 854), should it prove practicable on a large scale, must be regarded as an advance of the greatest importance in the production of Aniline Black upon fibres.—C. A. M.

Lead stains in bleached cotton yarn. W. H. Pennington. J. Soc. Dyers and Col., 1909, 25, 46—47.

IN some cotton yarn which had been bleached with calcium hypochlorite and sulphuric acid, dark brown stains appeared which were found to be due to the presence of lead peroxide. The lead contamination was traced to the use of three wooden bleaching cisterns, formed of 4-inch planks jointed with red lead; the wear and tear on the cisterns had loosened the joints and exposed the red lead, which had been converted into peroxide by the bleaching liquor. In the discussion, other instances were mentioned of lead stains having been produced during bleaching; one, where lead peroxide had been produced by bleaching liquor flowing through a leaden pipe, another where the contamination had come from a leaden floor in the bleach house, and two cases where the stains were due to lead sulphide produced in the boiling kier: in one case the headings were from yarn dyed with Chrome Orange, and in the other the stains were caused by a leaden plate placed on the top of the kier.—F. M.

Waste dye liquors; Treatment of —. W. M. Mackey. J. Soc. Dyers and Col., 1909, 25, 38—45.

IN the method of treatment described, there is no new departure from the chemical point of view, the question being mainly one of precipitation of the organic matter and the removal of the matter in suspension. Lime, and "aluminio-ferrie" were the precipitants experimented with, and preliminary laboratory trials led to the conclusion that, for effluents from woollen dyeworks, lime was in general the most suitable precipitant, judged by the amount of total solids left in the treated water, the amount of absorbed oxygen, and the degree of alkalinity. In the case of an effluent from a cotton dyeworks, the use of "aluminio-ferrie" followed by lime gave the best result. The plant described consists of a large tank into which the effluent is pumped and there mixed with milk of lime. The outflow pipe leads to a small tank, which serves as a pressure break, and from this the effluent flows to the bottom of a cylindrical vessel (a disused boiler of about 8000 gallons capacity) inclined at an angle of 15°—25°. The rate of flow is about 3000 gallons per hour, and it is found that the sludge which accumulates at the lower end of the cylinder and through which the inflowing liquid has to make its way, assists in agglomerating the suspended matter and acts to some extent as a filter. The arrangement is efficient with a rate of flow below 5000 gallons per hour. The sludge is drawn off periodically, but sufficient is left in the cylinder to ensure the removal of the suspended matter from the inflowing treated effluent.—F. M.

PATENTS.

Artificial silk threads; Machines for producing —. G. Guadagni, Pavia, Italy. Eng. Pat. 12,253, Jan. 18, 1908. Under Int. Conv., Sept. 28, 1907.

THE filtered cellulose solution flows from a reservoir into a horizontal pipe, supplied on its upper side with short vertical branch pipes at intervals of 15—20 cm. Each of these short pipes is provided with a cock, and terminates in a glass nozzle. Around this glass nozzle is fixed a cylinder, fitted with inlet and outlet pipes, through which the coagulating solution flows. Upon leaving the nozzle, the thread rises in this cylinder and is led over a stretching roller, which is run at such speed

as is suitable to the rate of flow of the cellulose solution and the fineness of the thread desired. The driving roller is of the same diameter as the stretching roller and runs at the same speed; it is partially immersed in the washing tank and drives the reeling bobbin (which is entirely immersed in the washing liquor), by direct frictional contact.—F. M.

Artificial silk threads; Manufacture of —. A. Lecœur. First Addition, dated Nov. 14, 1907, to Fr. Pat. 392,869, Oct. 8, 1907 (this J., 1909, 88).

THE necessity of a thorough treatment of the thread in the second bath mentioned in the original patent is emphasised. The bobbin upon which the thread is wound remains in the bath for at least half an hour, and is then transferred to another vessel containing a dilute solution of sodium bisulphate.—F. M.

Artificial threads; Apparatus for the manufacture of brilliant —. T. Chandelon. Fr. Pat. 394,009, Sept. 7, 1908.

THE spinning solution is forced from a reservoir through a number of fine spinning nozzles into a trough, through which flows a steady stream of the coagulating reagent. The newly formed filaments are carried along by this stream and delivered on to the surface of a rotating drum, which is so arranged that the coagulating reagent falls on to it after flowing through the trough. In addition to carrying forward the continuous filaments, the drum is caused in this way to gather up any broken threads. The apparatus is provided with devices for regulating or stopping the flow through each spinning nozzle.—P. F. C.

Cellulose threads, filaments, ribbons or films; Manufacture of —. Soc. franc. de la Viscose. Fr. Pat. 394,586, Sept. 23, 1908.

THE invention relates to an improved coagulating bath for the continuous coagulation of solutions of viscose. In this bath a mineral acid is employed in conjunction with a substance which possesses the power of coagulating viscose without decomposing it. Suitable substances are: Glucose or a body of similar nature; glycerol or other organic compound, particularly an alcohol; acetic acid or other acid of the fatty series; lastly salts or a mixture of salts, particularly ammonium sulphate and magnesium sulphate. The proportions of the coagulating agents may be varied to suit particular conditions.—J. F. B.

Washing and bleaching compound; Production of a fluid —. F. Gallati-Grob, Luchsingen, Switzerland. Eng. Pat. 23,725, Nov. 5, 1908.

CLAIM is made for a solution containing, say, 1000 grms. of sodium peroxide and 1000 grms. of powdered borax in 6 litres of water, the liquid being subsequently filtered and drawn off into bottles.—C. A. M.

Bleaching and scouring of vegetable and animal fibres and fabrics, and paper pulp; Electrolytic apparatus having transporting aprons, applicable to the — and to treatment with all liquids. A. Dassonville. First Addition, dated Sept. 3, 1908, to Fr. Pat. 387,104, Feb. 10, 1908 (this J., 1908, 817).

THIS apparatus consists of a vat, having a perforated false bottom, and provided at its ends with sheets of carbon or metal which are used as electrodes. Between these electrodes several endless aprons are arranged, cross which strips of carbon and wood are alternately inserted. Each apron is mounted on two rotating vertical rollers which are erected at opposite ends of the vat. One of each pair of rollers has a fluted surface to prevent the aprons from slipping. The material under treatment is led by a transporting device underneath a jet of hot water and then into the vat containing the liquor necessary for the treatment. It is then dragged along the vat by the moving aprons and delivered at the other end on to a carrier which passes underneath a second jet of hot water and delivers the material into a suitable receiver.—P. F. C.

Washing and scouring of animal and vegetable substances. C. Villedieu. Fr. Pat. 394,921, Dec. 11, 1907.

1000 litres of a solution of sodium carbonate or sodium hydroxide of 2°B., 500 grms. of an organic substance

such as phenol or petrol dissolved in 2–3 litres of sodium or ammonium sulphocinoleate are added. The material to be treated is immersed in this mixture for about half an hour and then washed, first with dilute acid and afterwards with water.—P. F. C.

Mercerised tissues; Device for removing the alkali from — with suction devices for the diluted lye. C. G. Haubold, jun., Ges.m.b.H. Ger. Pat. 205,962, April 27, 1907.

IN order to recover the alkali from mercerised tissues in as concentrated a condition as possible, only just sufficient water to destroy the mercerising action of the lye is used. With the ordinary devices, in which the water is under more or less pressure, it is difficult to obtain uniform distribution of such a small quantity of water over the width of the tissue. According to the present patent, the tissue after leaving the mercerising tank passes below a receptacle arranged transversely, from which water overflows on to the material below. Underneath the material, immediately below the overflow devices, are suction nozzles through which the diluted lye is drawn away.—A. S.

Thioindigo Red; Process for discharging dyeings of —. Kalle und Co. Akt.-Ges. Fr. Pat. 394,568, Sept. 22, 1908.

THE dyed material is printed with a paste which contains 12 per cent. of Hydrosulphite N.F. conc. It is then dried, steamed at 108° C. out of contact with air, and immediately passed into a bath containing 250 c.c. of alcohol and 10 c.c. of hydrochloric acid per litre. By working the material in this bath for a few minutes at 40–55° C., the leuco-derivative remaining on it is removed without having the opportunity of re-oxidising, and pure whites are obtained. The process is applicable to other thioindigo dyestuffs.—P. F. C.

Lustreing and finishing silk threads; Process and machine for —. E. Pohl, New York. U.S. Pats. 911,906 and 911,907, Feb. 9, 1909.

THE threads are loaded by the application of a finishing or lustreing solution and are then dried and ironed. The individual fibres on the surfaces of the threads are laid flat by this treatment. The threads are next led through a vibrating guide and over the edge of a heated contact device. The longitudinal motion of the transversely vibrating threads over this device fractures the surface of the finishing material and releases the imprisoned surface fibres, allowing them to project laterally.—P. F. C.

Artificial horsehair and other cellulose products having resistance and elasticity; Manufacture of —. E. Crumière, Paris. U.S. Pat. 911,868, Feb. 9, 1909.

SEE Addition of March 17, 1908, to Fr. Pat. 377,118 of 1907; this J., 1908, 977.—T. F. B.

Wool; Impts. in, and apparatus for cleansing —. F. and C. Shuman, Tacony, Pa., U.S.A. Eng. Pat. 10,951, May 20, 1908.

SEE U.S. Pats. 889,339 and 889,340 of 1908; this J., 1908, 1057.—T. F. B.

Mixed goods composed of cotton and wool; Production of effects on —. P. G. Jones, Manchester, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 911,593, Feb. 9, 1909.

SEE Eng. Pat. 13,132 of 1907; this J., 1908, 221.—T. F. B.

Treating sugar-cane, etc. U.S. Pat. 909,987. See XIX.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Sulphuric acid manufacture; Determining loss of sulphur trioxide in the wash gases of the contact process of —. H. Ljungh. Chem.-Zeit., 1909, 33, 143–144.

A SLOW stream of the exit-gases was aspirated through 600 c.c. of N/2 sodium hydroxide solution, and measured.

After passage of 1000—1500 litres, the excess of sodium hydroxide was determined in an aliquot portion of the liquid by means of hydrochloric acid and methyl orange, then the sulphite in the neutralised liquid was determined by making it up to a known volume, and running it from a burette into a known volume of $N/100$ iodine solution with starch indicator. The amount of acid required to convert this normal sulphite into acid sulphite, subtracted from the total found in the first titration, gave the amount equivalent to the sulphur trioxide in the volume of gas used (V litres), and hence the weight of sulphur trioxide (s grms.). If in 24 hours a kilos of sulphur are burnt, $2a$ kilos. of sulphur dioxide are produced; and if k per cent. of this are condensed, chiefly as trioxide, in coolers, filters, etc. (k being determinable only by actual measurement in each installation), there will reach the contact apparatus $\frac{a}{60} (100 - k)$ kilos., having at 0°C . and 760 mm.,

a volume of $0.00696a (100 - k)$ cb. m. If sulphur dioxide form p per cent. of the total volume of gases, this total volume will be $\frac{0.696a}{p} (100 - k)$ cb. m. If u per cent. of the sulphur dioxide be converted into trioxide (with half its volume of oxygen), and if $100 - f$ per cent. of the sulphur trioxide be absorbed, then the total volume of gases which escapes is

$$\frac{0.696a(100-k)}{p} - \frac{100-f}{100} \cdot \frac{1.5u}{100} (0.00696a)(100-k) \text{ cb. m.}$$

If these gases contain x grms. of sulphur trioxide, then the results of the experimental determinations above give that

$$\frac{0.696a(100-k)}{p} - \frac{(100-f)}{100} \cdot \frac{1.5u}{100} (0.00696a)(100-k) = \frac{V}{s}$$

But also, since x is the weight of f per cent. of the volume of sulphur trioxide entering the apparatus,

$$x = \frac{f}{100} \cdot \frac{1.5u}{100} (0.00696a)(100-k) (2.78) (1.2932) \text{ kilos.},$$

1.2932 kilos. being the weight of 1 cb. m. of air, and 2.78 the sp. gr. of gaseous sulphur trioxide. From these two equations the unknown quantity f can be eliminated, and it results that

$$x = \frac{2.5a(100-k) \left(\frac{1}{p} - 0.00015u \right) s}{3.6 V - s} \text{ kilos.};$$

and, s being negligibly small in comparison with V , the denominator may be written as $3.6 V$. If, instead of the absolute weight of sulphur trioxide escaping, it is preferred to express it as the percentage (F) of the total amount obtainable from the combustion of a kilos. of sulphur, then

$$F = \frac{100x}{32a} = 40 \frac{x}{a} = \frac{(100-k) \left(\frac{1}{p} - 0.015u \right) s}{3.6 V} \text{ per cent.}$$

The author has slightly modified the well-known Reich's apparatus for the iodometric determination of sulphur dioxide in the escaping gases (Lunge's "Sulphuric Acid and Alkali," 2nd edition, vol. i., 325—326). The exit-tube from the upper bottle is short, and is connected with the exit-stopcock by a piece of rubber tubing longer than the height of the bottle. The stopcock is clamped to the horizontal arm of a vertical rod, which passes through a clamp on the stand, and has at its upper end a horizontal pointer. This pointer, at the beginning and end of each observation, is made to coincide with the level of the water in the bottle, and thus the gas is measured always at the same difference from the barometric pressure.

—J. T. D.

Sodium alum. W. R. Smith. J. Amer. Chem. Soc., 1909, 31, 245—247.

SODIUM alum is obtained by allowing a solution containing aluminium and sodium sulphates to crystallise at a temperature below 30°C .; it forms mixed and layer crystals with other alums. With ordinary potassium alum, such crystals are not easily obtained, probably on account of

difference of solubilities. But sodium alum readily forms layer crystals with chrome alum. At 15°C . 100 grms. of water dissolve 111.3 grms. of crystallised sodium alum.

—F. SODX.

Chromic oxide; Solubility of —. M. Z. Jovitschitsch. Monatsh. Chem., 1909, 30, 47—50.

CHROMIC oxide, obtained from chromitite (see page 246), dissolves in nitric acid, contrary to the general statement that strongly ignited chromic oxide is insoluble in acids. To obtain pure chromic oxide, chromitite is ignited with lime and alkali carbonates, the fused mass extracted with hot water, and the clear aqueous solution saturated with hydrogen sulphide. The green precipitate is collected, carefully washed, dried at 100°C . and ignited at first over a Bunsen flame and subsequently for 10—15 minutes with a blast-flame. The dark green oxide is powdered, moistened with a few drops of water and warmed in a beaker with a little fuming nitric acid; subsequently ordinary nitric acid is added. After some 15 minutes, the acid is coloured green; when most of it has evaporated, the green liquid is poured off, fresh acid added, and the process repeated. In this way all but about 10 per cent. of the chromic oxide is brought into solution. The acid solution is evaporated on the water-bath till the nitric acid has mostly disappeared; the residue is dissolved in alcohol and again evaporated and this process is repeated. Finally the normal nitrate, $\text{Cr}_2(\text{NO}_3)_3$, is obtained in the form of a green crystalline mass with a reflecting surface as if varnished. This contains traces of acetate and oxalate, formed no doubt by the action of nitric acid on the alcohol. The nitrate absorbs three mols. of water in the air, but is not deliquescent. —E. F. A.

Gold and bromine; Combinations of —. F. Meyer. Compt. rend., 1909, 148, 346—348.

THE final product of the action of dry bromine on gold is the tribromide, AuBr_3 , which is readily obtained if the constituents are repeatedly heated, with shaking. It is a black compound, soluble in bromine and volatile in an atmosphere of bromine at about 300°C . No evidence of the existence of a dibromide, AuBr_2 , was obtained. At temperatures at which the tribromide dissociates, only one other bromide, the monobromide, AuBr , could be obtained. The dissociation-curves of the two bromides were studied, and the results are tabulated. —E. F.

Borates. Levi and Castellani. See XI.1.

PATENTS.

Hydrochloric acid; Manufacture of — by means of magnesium chloride. J. J. T. Schloesing. Fr. Pat. 394,037, Sept. 8, 1908.

THE process described in a former patent (this J., 1906, 477) is modified as follows:—To the solution of magnesium chloride, heated to 132° — 133°C ., powdered magnesia is added to the extent of one-third that required to form the ordinary oxychloride ($\text{MgCl}_2 \cdot \text{MgO} \cdot 0.6\text{H}_2\text{O}$). Heating and stirring are continued, until the mixture becomes pasty, when it is turned out and moulded into briquettes. These are dried at a low temperature (200°C .), and are then decomposed at a dull red heat, the decomposition into magnesium oxide and hydrochloric acid being effected by spreading the material on interspaced bars of refractory material in a heating chamber and passing the hot gases from an adjacent furnace or producer through the mass, from above downwards, in order to avoid crushing the friable product, steam being introduced into the chamber as required. The oxychloride formed in this process, which is claimed as new, decomposes like the ordinary oxychloride, and has the advantage of containing less magnesia, being more easily prepared, and readily moulded into briquettes. —F. SODX.

Bicalcic phosphate, magnesia, and potassium chloride; Process of simultaneously obtaining —. J. J. T. Schloesing. Fr. Pat. 394,207, Sept. 11, 1908.

SEA water or the mother liquor of salt marshes, after treatment with calcium chloride to precipitate the sulphate present, is allowed to evaporate spontaneously to a

strength of 32° B., when nearly all the sodium chloride is deposited. It is then further concentrated, by heating, to 34.5° B., by which time the potassium chloride is, in great part, deposited as the double chloride of potassium and magnesium. This double salt is decomposed by a known method, the magnesium chloride returning into solution: the solution contains also a little potassium chloride, and to prevent this interfering with the decomposition of the magnesium oxychloride later, a quantity of sulphate equivalent to it is allowed at a previous stage to remain in the liquid. The solution of magnesium chloride is then concentrated, until it boils at 133° C., and dealt with as described in the preceding abstract to give magnesia and hydrochloric acid which is condensed in a coke tower. The acid is used to dissolve tricalcic phosphate, and from the solution bicalcic phosphate is precipitated by the addition of lime, the calcium chloride solution formed being utilised in the first part of the process.—F. SODN.

Quicklime; Process and apparatus for slaking — W. Schulthess. First Addition, dated Sept. 7, 1908, to Fr. Pat. 390,357, May 18, 1908 (this J., 1908, 1018).

AN apparatus is described suitable for slaking quicklime which has been crushed to a mixture of fine powder and small lumps. The process of charging and discharging the slaking chamber is made continuous by means of mechanical measuring devices which regularly deliver the material on to feeding and discharging worms. The material to be treated, should be heated to about the temperature of the steam used in slaking, before it enters the slaking chamber, in order to prevent condensation of water upon it, and the slaking chamber itself and the receptacles connected to it are jacketed for the same purpose. It is sometimes preferable to slightly moisten the lime immediately before slaking, and this is effected by treating it with a spray of water from a pipe fixed above the feeding worm.—F. SODN.

Soft limestones; Process for burning — F. M. Meyer. Fr. Pat. 394,354, Sept. 16, 1908.

SOFT chalks, calcareous marls, etc., cannot be burned in the ordinary way and become overburnt in a rotary kiln. They are, however, satisfactorily burned in the latter, if the material and fuel are introduced at the same end of the kiln: this prevents all possibility of overburning. The hot gases leaving the kiln are utilised for preliminary drying purposes.—F. SODN.

Barium carbonate; Preparation of — from barium sulphate. L. Pernot and E. Decamps. Fr. Pat. 394,443, Sept. 9, 1908.

A MIXTURE of barium sulphate and iron oxide (Fe_2O_3), or other appropriate oxide, in molecular proportions, is heated to redness in special retorts where it is treated with a stream of carbon monoxide and hydrogen from a gas producer. The temperature should suffice for the rapid reduction of the iron oxide, but not for melting the metal, which reduces the barium sulphate to barium sulphide and becomes re-oxidised to ferric oxide, from which the barium sulphide is separated by solution in water. Barium carbonate is precipitated from the saturated solution of the sulphide by means of the carbon dioxide produced in the reduction of the iron oxide, an excess of carbon dioxide being avoided. The retorts are heated by the combustion of any reducing gas not previously oxidised in the process.

—F. SODN.

Metallurgical [zinc, cadmium, antimony, molybdenum, etc.] sulphides and alkali thiosulphates; Preparation of — by means of "nascent" alkali sulphides. P. Pipereant and A. Vila. Fr. Pat. 394,441, Sept. 5, 1908.

THE process is for the preparation of certain metallic sulphides, such as those of zinc, cadmium, antimony, molybdenum, etc., which are usually obtained in a latitious and colloidal form. The mineral or other compound of the metal is decomposed by means of caustic alkali or alkali carbonate solution, and then powdered sulphur is added, so that alkali sulphide is produced which reacts, as formed, to give the required sulphide, the

mixture being heated until precipitation is complete. With such metals as antimony and molybdenum, the sulphide is precipitated by the addition of acid, after digesting the alkaline liquid with sulphur. The sulphides are obtained in a form well-suited to technical requirements, being dense, fine-grained, and unctuous. Alkali thiosulphate is obtained as a by-product.—F. SODN.

Gases; Process for the sudden cooling of hot — in endothermic and other reactions of gases and gaseous mixtures. Kunheim und Co. Ger. Pat. 205,774, May 9, 1907.

IN gas reactions such as the formation of oxides of nitrogen from air, it is necessary to rapidly cool the reaction products. According to the present patent, this is effected by causing a current of a suitable cooling agent, such as air or steam, to which water or solid substances (ferric oxide) in an atomised condition may be added, to pass close to the flame, thus carrying away the reaction products, and then making the two together spread out so as to form a flat stream, and thus give a large surface of contact between the reaction products and the cooling medium. Several methods are described for spreading out the current of the cooling agent carrying with it the gaseous reaction products. The process may also be applied to the preparation of formaldehyde by the incomplete oxidation of methane.—A. S.

Nitrogen from air; Process for obtaining — O. P. Hurford. Fr. Pat. 394,557, Sept. 22, 1908.

CARBONACEOUS fuel, such as coal or petroleum, is burned in sufficient air to ensure exact combustion to carbon dioxide and water. The gaseous products are then subjected to the action of water which is sprayed in at various points of an acid-proof chamber, through which the gases are made to pass in a zig-zag path, in order to condense the steam and dissolve the carbon dioxide. The process of solution may be assisted by maintaining an increased pressure in the chamber, and lime-water may be used as an absorbent. On leaving the condensing chamber, the nitrogen is purified by passing through lime-water in a further chamber, and finally it is dried by means of lime or other drying agent. Valves are provided so that the gas may be cut off from the chamber, if carbon monoxide be present in the mixture leaving the furnace.—F. SODN.

Chlorine from gaseous mixtures containing it; Process for the separation of — T. Goldschmidt. Ger. Pat. 206,104, Aug. 6, 1907.

THE gaseous mixture is passed through a liquid, anhydrous, inorganic chloride or oxychloride, not containing hydrogen, preferably stannic chloride, and the resulting liquid is exposed to diminished pressure or to increased temperature, or to both, in order to recover the absorbed chlorine. Before passing the gaseous mixture into the absorbing agent, it may be compressed almost to the point at which liquefaction of the chlorine begins.—A. S.

Ammonia; Manufacture of — J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 2414, Feb. 3, 1908.

SEE Fr. Pat. 387,002 of 1908; this J., 1908, 809.—T. F. B.

Alkaline-earth cyanides; Saponification of — K. Bosch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 911,468, Feb. 2, 1909.

SEE Fr. Pat. 372,714 of 1906; this J., 1907, 527.—T. F. B.

Hydrogen; Apparatus for the production of — for lighting, heating, or other purposes. L. Vignon, Mont-plaisir, France. Eng. Pat. 6347, March 21, 1908.

SEE Addition of Dec. 27, 1907, to Fr. Pat. 373,271 of 1907; this J., 1908, 677.—T. F. B.

Chemical compounds. U.S. Pat. 910,498. See XL1

Determination of phosphates. Estes. See XXIII

VIII.—GLASS, POTTERY, AND ENAMELS.

Bottle-glass; Utilisation of rocks in the manufacture of —. Plenske. *Spezialsaal*, 1909, 42, 74—76, 88—90.

The use of crude raw materials such as rocks, slag, and dross, is recommended for the manufacture of the commoner kinds of glass. In the first place come the igneous rocks, which may contain 18 per cent. and more of alkalis, and marl, which forms a substitute for limestone. These rocks contain oxide of iron, and are therefore suitable for making the different shades of green bottle-glass. By addition of manganese or cobalt, yellow, brown, black, and blue-green tints can be obtained. The presence of alumina and magnesia in glass is important, as they improve the resistance to both chemical and physical influences. Analyses are given of various coloured glasses: (a), high in alumina and low in magnesia; and (b), those containing a medium amount of both oxides. For the first group, igneous rocks are suitable, and for the others marl or marl and igneous rocks. The great advantage lies in the high alkali-content of the rocks, which saves the expense of sodium sulphate. Analyses are given of German samples of leucitophyr, phonolite, nepheline-phonolite, trachyte, granulite, two porphyrites, syenite, and basalt, and of some marls. The best of the drosses is the so-called cobalt-sand from the working of cobalt-nickel ores, but there are important variations in its composition. Such silica, lime, and alkalis, as cannot be brought into the glass from the above rocks must be introduced as sand containing not more than 3 per cent. of alumina, chalk (95 per cent. of calcium carbonate) and Glauber salt (96 per cent. of sodium sulphate), respectively. The use of fluorspar as a flux is strongly deprecated owing to its cost, its attack on the pots, and the presence of fluorine compounds in the issuing smoke. The best flux is orthoclase. Examples are given of the method of calculating the requisite quantities of the ingredients in order to obtain a glass of given composition. —H. H. S.

Porcelain; Magnesia-cryolite —. T. Hertwig. *Tonind.-Zeit.*, 1909, 33, 181.

ALTHOUGH lime gives transparency to porcelain, its presence causes irregular shrinkage and consequent warping. Magnesia gives a greater but uniform shrinkage. Starting, therefore, with a porcelain made from 53 per cent. of clay-substance, 20 per cent. of quartz, and 27 of potash-spar, the author made an artificial magnesia-spar ($\text{MgO} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$) and introduced 3.5 per cent. of it into the mixture instead of the equivalent quantity of potash-spar. Following Seger's rule that two fluxes are more powerful than one, he also introduced soda as an artificial soda-spar ($\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$) made from cryolite. The most satisfactory mixing was—35 of Zettlitz kaolin, 20 of china clay, 21.85 of Norwegian felspar, 20 of Pleystein quartz, 1.75 of artificial magnesia-spar, and 1.4 of artificial soda-spar. —H. H. S.

PATENT.

Tunnel-kiln for baking pottery and the like. S. Vincart-Mouzin. *Nimy*, Belgium. Eng. Pat. 2231, Jan. 31, 1908.

SEE Fr. Pat. 388,585 of 1908; this J., 1908, 982.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

PATENTS.

Artificial stone; Manufacture of —. C. Bonnefont. Paris. Eng. Pat. 1339, Jan. 20, 1908.

A WHITE cement is first prepared, by slaking 1140 parts of "fat" lime, mixing it with 540 parts of kaolin free from iron, which has been previously soaked in water, sifting the mixture, forming it into bricks, and burning these, in a slow fire for the first 10 hours, and a hard porcelain fire for another 25 hours. The clinker is powdered, and 64 parts by volume of the cement so obtained are mixed with 36 parts of powdered white sandstone. The concrete

mixture is made into a slip of 35° B. with water, and 13 parts by volume of this slip are mixed with 6 parts of an aqueous solution of sodium silicate of 35° B. The mixture is poured into moulds of reinforced plaster lined with gelatin or plaster, and lightly greased before use. The objects are generally removed from the moulds after 3—6 hours, re-touched, and dried at 15—30° C. for 20—25 days. They are then immersed for 6—15 hours in a solution of sodium silicate of 25° B., rinsed, allowed to dry for 2 days, and immersed for one hour in a solution of hydrofluosilicic acid of 12°—15° B. The objects are finally dried for about 2 weeks at 30° C. To obtain more impermeable surfaces, the dipping in sodium silicate solution may be repeated at intervals of 5—6 days. Instead of making white stone as above, colouring matters may be added to the ingredients. —A. G. L.

Fire-bricks; Process for making —. I. Albon, Plaistow, Essex, and W. E. Parker, Bexley Heath, Kent. Eng. Pat. 24,325, Nov. 12, 1908.

EIGHT parts by volume of the powder obtained by grinding old fire-bricks are mixed with one part of fresh fireclay, one part of fine sand, and water. The paste is moulded into bricks without using any great pressure, and the bricks are dried for 10—30 days and burnt for 30—50 hours. —A. G. L.

Building stones, etc., from slag; Process of manufacture of —. Cöln-Müsener Bergwerks-Act.-Ver. Fr. Pat. 394,011, Sept. 7, 1908.

APPROXIMATELY equal quantities of slag which has been allowed to cool in air, and of slag which has been granulated in water, are ground together, with or without the addition of lime. The mass is moulded into bricks under pressure, and the bricks are hardened by treatment with carbon dioxide gas in chambers from which the air may be exhausted before the gas is admitted. —A. G. L.

Plaster of Paris; Process and apparatus for producing completely dehydrated —. J. L. F. Garrigou. Fr. Pat. 394,532, Nov. 29, 1907.

COARSE pieces of the gypsum to be burnt are placed on perforated trays contained in a perforated metal cylinder. The charged cylinder is lowered into an autoclave, provided with a cover secured by bolts. The autoclave is mounted in a brickwork chamber kept at a temperature of 200°—220° C. From the autoclave two lateral tubes, one placed near the bottom, the other near the top, pass to a worm condenser immersed in a vessel of water. This condenser delivers into a closed vessel, provided with an external glass tube by means of which the height of the water inside the vessel can be ascertained, and with a tapped tube leading to an air pump. The whole apparatus is exhausted at the beginning of the operation. The volume of water produced from the charge of gypsum being known, the amount of water condensed indicates the point at which the gypsum is completely dehydrated. —A. G. L.

Hydraulic cement. A. C. Spencer and E. C. Eckel, Washington, D.C. U.S. Pat. 912,266, Feb. 9, 1909.

THE claims are for a hydraulic cement mixture containing as principal ingredient a natural iron silicate, such as greensand, and in addition a material rich in an alkaline-earth, such as a calcareous material. —A. T. L.

Plastic compositions; Manufacture of — and of "accelerators" for the same. H. S. Spackman Engineering Co. First Addition, dated Sept. 1, 1908, to Fr. Pat. 390,194, May 13, 1908 (this J., 1908, 1021).

CALCAREOUS cements are mixed with an "accelerator," consisting of calcium aluminate, to which plaster of Paris may be added. The calcium aluminate is prepared by burning together lime and bauxite in such proportions that 3 molecules of lime are present for every 1 of alumina, sufficient lime being also provided to combine with any silica present. A suitable composition consists of slaked lime, 45 per cent.; silicious clay or shale, 45; calcium aluminate, 7; and plaster of Paris, 3 per cent. The slaked lime may be replaced by Portland cement, puzzuolana, etc. —A. G. L.

Portland cement: Manufacture of clinker for making —.
F. M. Allan. Fr. Pat. 394,189, Sept. 9, 1908. Under
Int. Conv., July 1, 1908.

WATER is supplied from distributors arranged above the kiln to the hottest part ("clinkering zone") of the metallic casing of a rotatory kiln, thus lowering the temperature of this part to that of the neighbouring portions. The excess water is conducted along a gutter to the burnt clinker issuing from the kiln. It is claimed that by using this device, the speed of working of the kiln is greatly increased, and that the firebrick lining lasts longer.

—A. G. L.

Artificial stone substances; Process for hardening calcareous — by means of carbonic acid. E. Schwanenberg and A. Rinne, Hanover, Germany. U.S. Pat. 911,547, Feb. 2, 1909.

SEE Fr. Pat. 369,207 of 1906; this J., 1907, 96.—T. F. B.

Cement; Manufacture of —. W. E. Snyder, Nazareth, Pa., U.S.A. Eng. Pat. 15,625, July 23, 1908.

SEE U.S. Pat. 897,938 of 1908; this J., 1908, 983.—T. F. B.

Clinker for making Portland cement; Manufacture of —.
F. M. Allan, Dunedin, New Zealand. Eng. Pat. 18,738, Sept. 7, 1908. Under Int. Conv., July 1, 1908.

SEE Fr. Pat. 394,189 of 1908; preceding.—T. F. B.

Slaking lime. Addition to Fr. Pat. 390,357. See VII.

X.—METALS AND METALLURGY.

Iron and steel; Tempering and re-heating of —.
E. Maurer. Metallurgie, 1909, 6, 33—52.

AT Osmond's suggestion, the author investigated the mechanical, physical, and chemical characteristics exhibited by pure iron (ferrite) and steels consisting wholly of austenite or of martensite, after thermal treatment. He concludes that the changes produced in the physical properties of pure iron by quenching from different temperatures are due to a deformation of α -iron, not to the formation of another allotropic modification; this conclusion is supported by the form of the curve obtained for residual magnetisation in mild steel. Further, he finds that homogeneous austenite is obtained under the same conditions as regards quenching which usually give a mixture of martensite and austenite, provided that the steel contains sufficient manganese (1.67 per cent. of manganese for 0.93 per cent. of carbon); steel containing up to 3.73 per cent. of nickel could not be converted into austenite. In steels containing but little manganese, austenite changes between 150° and 250° C. into troostite. The temperature at which the change takes place depends on the content of manganese, as shown by the physical properties (density, magnetisation, hardness) and the microscopical examination. If both austenite and martensite are present, the martensite changes first, but the rate of change is less. These observations apply only to re-heating; on cooling, austenite is converted into martensite. Hardening in liquid air acts like quenching, but in a less degree. The changes produced by quenching are due to at least two causes, one of which (the presence of temper carbon) acts on the electric conductivity, the other (probably deformation of α -iron) on the magnetisation, hardness, and density.

Osmond founds the following conclusions on the author's work: γ -iron can occur in hypo-eutectic steels as well as in hyper-eutectic steels, provided that the temperature before quenching is sufficiently high (at least 1000° C.). Hardening in liquid air also produces a small amount of γ -iron in such steels. This is shown by the small decrease in density of steel containing 0.14 per cent. of carbon at 150° C. or at 250° C. for steel with 0.4 per cent. of carbon; also by the increase or constancy of the residual magnetisation of two steels which were hardened in liquid air and then heated until a blue colour was produced. A comparison of the curves obtained for hardness and for electric conductivity

shows that no causal connection exists between the temper-carbon present and hardness; carbon can remain in solution in the steel owing to the presence of γ -iron in the martensite without producing any hardening effect. The re-heating of steel may be divided into four sharply-separated periods: From the ordinary temperature up to 150° C.; 150°–300° C.; 300°–450° C.; and 450° C. to the recalcence point. Osmond considers it likely that during the first period, 15°–150° C., the hardening carbon and its function, the electric resistance, fall rapidly; the hardness is but little changed; the residual magnetisation falls a little; the density increases owing to the disappearance of strains. During the second period, 150°–300° C., the density diminishes up to 250° C., owing to the change of γ -iron into deformed β - and α -iron, and increases again when no more γ -iron is present. The hardness also depends on the presence of the γ -iron, increasing through change of the latter to β -iron, and diminishing through the β -iron changing into α -iron. The residual magnetisation varies as the hardness, through the same causes. The electric resistance attains nearly its normal value, the change of hardening carbon into carbide being nearly complete. If no γ -iron is present, the two first periods coalesce into one period. The third period, 300°–450° C., is characterised especially by the transformation of β -iron into deformed α -iron, which, in turn, changes, but less rapidly, into crystalline α -iron. The hardness decreases rapidly, the density rises, and the residual magnetisation increases somewhat. During the last period, 450° C. to the recalcence point, the deformed α -iron changes completely into crystalline α -iron, and the individual molecules of carbide previously produced form aggregates. The hardness attains its normal value. The density falls, probably owing to the agglomeration of the carbide molecules having more effect than the crystallisation of the α -iron. The residual magnetisation diminishes owing to both causes. The above four intervals of temperature may probably serve to characterise the respective domains of martensite, troostite, sorbite, and pearlite.—A. G. L.

Malleable cast iron; Preparation of —. F. Giolitti, F. Carnevali, and G. Gherardi. Atti R. Accad. dei Lincei, Roma, 1908, [5], 17, 11, 662–667, 748–754. Chem. Zentr., 1909, 1, 695–696.

PIECES of cast iron containing 2.9–3.6 per cent. of carbon, 0.1–0.2 of silicon, and 0.03–0.18 of manganese were cleaned, surrounded with a mixture of oxides of iron, and heated at about 1000° C. After different periods the carbon content was determined at different depths, and test-pieces were also examined microscopically. It was found that the carbon content mostly changed gradually according to the depth; only in the neighbourhood of 0.9 per cent. of carbon was the curve somewhat steeper than with lower or higher proportions of carbon. In the authors' opinion there is always a pearlite zone of constant composition (compare Wüst, this J., 1908, 450) between the layers of hypo- and hyper-eutectic iron in which the carbon content changes gradually according to the depth. The diffusion of the oxidising gases from the iron oxides into the interior of the cast iron is a much more potent factor in decarburisation than the diffusion of carbon from the interior outwards. The layer of pure ferrite on the exterior of the metal is not produced from the iron oxides as stated by Wüst, but by the complete decarburisation of the outermost layers of the cast iron; pure ferrite is also produced in the interior of the metal on the bounding surfaces of cracks and fissures. The iron reduced from the oxides is spongy. The formation of the almost completely decarburised outer layer shows how much more rapidly the oxidising gases penetrate inwards than the carbon diffuses outwards.—A. S.

Iron; The rusting of —. G. T. Moody. Chem. Soc. Proc., 1909, 25, 34.

THE author considers that in the experiments described by Tilden (this J., 1908, 941), that author has lost sight of the well-known fact that commercial iron and steel invariably contain foreign substances, notably sulphur compounds, which on exposure to air and water at once furnish free

acids. The rusting observed in Tilden's experiments, in which carbonic acid was excluded, was a result primarily of interaction between acids, formed by oxidation of sulphur compounds and other foreign constituents capable of furnishing acids on reaction with water and oxygen, and iron, the resulting ferrous salt being subsequently oxidised with production of rust. Tilden's experiments conclusively show that commercial iron after treatment with chromic acid no longer rusts in presence of water and oxygen, but the inactivity is wrongly attributed to the chromic acid rendering the iron "passive." The true explanation of the inhibitive effect of chromic acid is that it removes from the surface of the iron those constituents which would otherwise subsequently yield acids on exposure to water and oxygen. That Tilden's view that the iron is rendered passive is incorrect is shown by the readiness with which the iron rusts as soon as normal air containing carbonic acid or any other acid is admitted. Tilden further states that after immersion for years of iron in dilute chromic acid, he has observed "no sign of rust or of dissolution of the iron either by change of colour or the formation of precipitate on adding excess of ammonia." In this connection it must be pointed out that ferric hydroxide is readily dissolved by chromic acid, so that visible change could not be expected. Moreover, dilute solutions of iron in chromic acid do not afford a visible precipitate or a change of colour on addition of excess of ammonia. If, however, the solution is filtered after addition of ammonia, ferric hydroxide in appreciable quantity remains on the filter-paper, and the dissolution of the iron is thereby made evident.

Thermite process. [Copper]. W. Skinder. Bull. Acad. St. Petersburg, 1908, 97-102. Chem. Zentr., 1909, I, 629.

THE reaction expressed by the equation, $3\text{CuO} + 2\text{Al} \rightarrow 3\text{Cu} + \text{Al}_2\text{O}_3$, is accompanied by a development of heat amounting to 650 cals. per kilo. of the mixture.—A. S.

Copper coinage alloys; Change of structure of — by thermal and mechanical treatment. F. Giolitti and E. Pannain. Atti R. Accad. dei Lincei, Roma, 1908 [5], 17, II, 668-670. Chem. Zentr., 1909, I, 696.

THE authors describe the method of treating the metal in the manufacture of bronze coins in Rome. The plates of metal are reduced in thickness from 7-8 mm. first to 1.5, then to 1, and finally to 0.7 mm. by heating, quenching, and repeated rolling. The alloy used by the authors contained 95.8 per cent. of copper, 3.82 of tin, and about 0.2 of lead. In the normal condition it consisted of patches of a solid solution (α) separated by crystals of a second solid solution (β). The repeated alternate heating and rolling of the alloy caused a change of structure, until finally the compression exerted in the stamping operation broke the crystals (α and β), and a finely-crystalline granular structure resulted.—A. S.

Magnetic manganese alloys. X. Manganese-aluminium-copper. F. Heusler and F. Richarz. Z. anorg. Chem., 1909, 61, 265-279.

THE magnetic properties of manganese-copper-aluminium alloys depend upon the aluminium-content and the condition of the alloy. Manganese-aluminium-bronzes (see this J., 1906, 318) when quenched from a red heat in cold water or mercury are non-magnetic. If, however, they are "aged" by keeping in boiling toluene or more rapidly (in a few hours) in boiling xylene, the magnetic properties quickly increase to a maximum value, and after this treatment the alloys show practically no hysteresis. If the alloys be cooled slowly from a red heat, they are magnetic, and the magnetic properties increase to about the same extent on "ageing" as in the case of the quenched alloys, but the slowly-cooled and "aged" alloys exhibit strong hysteresis depending upon the rate of cooling. The alloys are thus capable of existing in three conditions: (1), the labile slightly magnetic; (2), the strongly magnetic with practically no hysteresis; (3), the strongly magnetic with strong hysteresis. Experiments as to the influence of the composition of the alloys on the magnetic properties gave results from which and from other data the following conclusions are drawn:—Copper

and aluminium form a compound, AlCu_3 ; manganese and copper form a series of mixed crystals containing up to about 30 per cent. of manganese. In the compound, AlCu_3 , copper can be replaced by manganese to give compounds, $(\text{AlMn})_3\text{Cu}$, in which M_3 represents an isomorphous mixture of copper and manganese, and it is to such compounds the magnetic properties of the manganese-aluminium-copper alloys are attributed. (See also this J., 1904, 985; 1905, 850, 1237.)—A. S.

Magnetic alloy; Heusler's —. R. Jack and A. D. Ross. Proc. Roy. Phil. Soc., Glasgow, 1907-1908, 39, 41-46. (See this J., 1904, 985; 1905, 850, 1237; 1906, 318, and preceding abstract.)

THE authors have investigated the magnetic properties of an alloy consisting of 25 per cent. of manganese, 12.5 of aluminium, a trace of lead, and the remainder of copper. It was found that in the alloy in the normal condition, at least, the hysteresis was small and the saturation well marked. On heating the alloy at gradually increasing temperatures, the magnetic quality gradually improved up to 160° C., but heating at temperatures above this caused deterioration, with marked increase in hysteresis. The magnetic quality was improved most by immersing the alloy in liquid air, but it returned to its former condition when the alloy was again brought to the ordinary temperature. Quenching lessened the hysteresis, but with increasing temperatures, up to 610° C., gradually destroyed the magnetic quality. There was a well-defined minimum at 610° C. and by quenching from higher temperatures, the magnetic quality was to a considerable extent restored. The condition at the normal temperature appeared to be the stable one.—A. S.

Metallic nickel; Absorption of hydrogen by —. A. Sieverts and J. Hagenacker. Ber., 1909, 42, 338-347.

THE results of Mayer and Altmayer (this J., 1908, 1116) differ so greatly from those obtained by Sieverts and Beckmann in 1907, that the authors have repeated and extended Sieverts and Beckmann's observations, using the same small quantity of nickel as Mayer and Altmayer, and using both the nickel used in 1907, and also some prepared by themselves by reducing the oxide at as low a temperature as possible. They still find that at the atmospheric pressure 1 volume of nickel absorbs from 0.15 volume of hydrogen at 212° C. to 0.9 volume at 923° C. At 923°, and also at 822°, the volumes of gas absorbed at different pressures are proportional not to the pressures, but to their square roots, so that the hydrogen would appear to exist in the metal in the half-molecular, or atomic condition.—J. T. D.

Chromium mineral [chromitite]; A new — in Servia. M. Z. Jovitschitsch. Monatsh. Chem., 1909, 30, 39-46.

THE new mineral is a fine grained glistening sand, composed of dark and light particles, found in the streams on the sides of Mt. Zelin in Servia. The dull dark particles comprise about 2 per cent. of the whole; they are magnetic and easily separated by means of a magnet. The glistening crystals are very hard; they are not dissolved by mineral acids and are difficult to convert into chromates by the usual fusion method. They are fused with a mixture of 1 part each of sodium and potassium carbonate, and $\frac{1}{2}$ parts of lime. They have the composition, FeCrO_3 , and represent a chromic oxide in which one atom of chromium is replaced by iron—traces of aluminium and magnesium are regarded as impurities. The new mineral, which is thus different from ordinary "chromite" ($\text{FeO} \cdot \text{Cr}_2\text{O}_3$), is named *chromitite*. The dull magnetic crystals may be classified into fractions of different magnetic power: they contain 43 to 45 per cent. of iron and 21.5 to 25 per cent. of chromium, and are regarded as a double compound, $2\text{Fe}_2\text{O}_3 \cdot \text{Cr}_2\text{O}_3$.—E. F. A.

Calcium sulphate; Behaviour of — at elevated temperatures with some fluxes. H. O. Hofman and W. Mostowitsch. Bull. Amer. Inst. Mining Eng., 1909, Jan., 25-76.

THE authors have investigated the causes of the behaviour of gypsum when used in the blast-roasting of lead sulphide

ores and in other metallurgical operations. Anhydrous calcium sulphate commenced to decompose at about 1200° C., oxygen and sulphur dioxide being evolved. The material fused at about 1360° C., but was not entirely decomposed even when heated to 1400° C. Pure silica was mixed with calcium sulphate in the proportions to form mono-, di-, and tri-silicates, and heated. In each case sulphur dioxide was given off at about 1000° C., and decomposition was complete at about 1300° C., the whole of the lime and silica combining to form silicates. Pure ferric oxide sinters at 1500° C., but remains chemically unchanged. The addition of 25 per cent. of magnesia does not affect this result. A mixture of molecular proportions of calcium sulphate and ferric oxide fuses at 1250° C. with partial decomposition, oxygen and sulphur dioxide being evolved, and on continuing the heating at the same temperature for 15 minutes, complete decomposition ensues, calcium ferrite, $\text{CaO} \cdot \text{Fe}_2\text{O}_3$, being formed. Tests were also made with calcium sulphate and pure lead oxide; the calcium sulphate remained unaffected, but the lead oxide was rapidly volatilised, about 50 per cent. having been lost when a temperature of 1200° C. was attained. These tests show that gypsum added to a raw lead sulphide ore is decomposed, mainly by silica and ferric oxide, with evolution of sulphur dioxide, and has no decomposing effect on the galena, which is oxidised only by the air blast. In the case of ordinary roasting, the temperature is not raised sufficiently to decompose the gypsum, which therefore remains and increases the percentage of sulphur in the roasted charge. When roasting calcareous blends, the calcium carbonate is converted into sulphate, which is decomposed at about 1200° C. owing to the presence of silica and iron oxide. In consequence of the resistance of magnesia to combination with ferric oxide, a highly magnesian dolomite forms a more refractory lining to converters when the slag is very basic.—F. R.

Limit of elasticity: Determination of — by a thermoelectric method. A. Dinnik. J. Russ. Phys.-Chem. Ges. 1909, 40, Physik. Teil., 335—339. Chem. Zentr., 1909, 1, 421.

The mechanical extension of a metal bar is accompanied by a development of heat, the amount of which is proportional to the tensile force exerted. So soon as the limit of elasticity is exceeded, however, there is a sudden rise of temperature, so that by aid of a sensitive thermocouple, this point can be easily determined.—A. S.

Pulverised fuel. Meade. See II.

Determination of lead. Medell. See XXIII.

PATENTS.

Iron ore: Process of treating —. C. B. Morgan, Oakland, Cal. U.S. Pat. 910,707, Jan. 26, 1909.

IRON ore mixed with a flux is heated in a furnace until molten, and sufficient carbonaceous matter in the liquid state is then added to reduce the iron.—A. G. L.

Iron and steel: Process of manufacturing —. C. Ellis, White Plains, N.Y. U.S. Pat. 911,870, Feb. 9, 1909.

THE iron oxides to be reduced are passed through a reverberatory furnace on an endless band beneath a luminous flame, produced by a blast of air and powdered coal, which plays along the roof of the furnace. The oxides are shielded from direct contact with the luminous flame by a current of reducing gas, for example producer gas, which travels in the opposite direction to the oxides and to the luminous flame, and gradually becomes a flame merging with the latter.—A. T. L.

Precious metals: Ammonia-cyanide process of treating ores containing —. D. Mosher, Assignor to Ammonia Cyanide Eng. Co., San Francisco, Cal. U.S. Pat. 911,254, Feb. 2, 1909.

ORES and tailings containing gold and silver are extracted with a solution of ammonia and an alkaline-earth cyanide. If the ores or tailings contain copper, nickel, zinc, or cobalt as well as gold and silver, all the metals are extracted together by this process.—A. T. L.

Crucible furnace. E. H. Schwartz, Assignor to Kroeschell Bros. Co., Chicago, Ill. U.S. Pat. 911,271, Feb. 2, 1909.

THE furnace is provided with a concave crucible seat surrounded by a gutter having an outlet for the discharge of slag. The heating gases are admitted tangentially into the base of the furnace chamber, so as to circulate around the crucible, and air is admitted into the path of the heating gases through ducts passing diagonally through the walls into the gutter at two opposite points.—A. T. L.

Lead and zinc: Process of treating complex sulphide ores of —. E. Vuigner, First Addition, dated Nov. 11, 1907, to Fr. Pat. 381,038, Oct. 26, 1906 (this J., 1908, 129).

COMPLEX zinc ores are roasted, mixed with sufficient carbon to reduce the sulphates formed, and with a flux, e.g., fluorspar, and charged into a bath of molten iron. The zinc produced by the action of the carbon and of the iron (in presence of the silica of the ore) reduces the other metals, e.g., gold, silver, copper, lead, and antimony, present in the complex ores.—A. G. L.

Zinc: Process of extracting — from zinc sulphide ores, especially from those containing copper. E. Vuigner, First Addition, dated Nov. 12, 1907, to Fr. Pat. 381,039, Oct. 26, 1906 (this J., 1908, 129).

THE zinc ore is directly charged into a converter containing a fused sulphide, e.g., of copper or iron. The process consists in removing the sulphur by blowing in air, and reducing and volatilising the zinc by means of carbon.—A. G. L.

Converter with readily removable body and lateral introduction of air. A. Zenzes. Fr. Pat. 394,263, Sept. 14, 1908.

AIR is supplied from a hollow wind-box to a number of horizontal tuyères which traverse the lining of the converter. The wind-box is not fastened to the converter, but is kept in place by a flange on the latter. Before removing the converter for repairs, the wind-box with its attached tuyères is pulled away from the converter.

—A. G. L.

Alumina: Reduction of —. O. Serpek. Ger. Pat. 206,588, Feb. 15, 1908.

THE reduction of alumina by means of carbon can be effected only with difficulty and by the use of a very large expenditure of heat. Moreover the yield is low, because at the high temperature employed, alumina and aluminium are lost by volatilisation, and the carbon monoxide produced reacts with the aluminium with re-formation of alumina. In order to avoid these difficulties, according to the present patent, compounds of barium or of strontium, or both, are added to the charge. For example, a mixture of 40 parts of alumina, 4 parts of baryta, and 14 parts of carbon is heated in an electric arc furnace. The reaction product contains 60—70 per cent. of aluminium, of which one-half is present as metal, and the remainder as aluminium carbide. The consumption of energy amounts to about 5 kilowatt-hours per kilo. of aluminium (as metal and carbide) in the reaction product.—A. S.

Cyanide process for extracting precious metals from their ores and apparatus for carrying out such process. H. Birkbeck, London. From Just Mining and Extraction Co., Syracuse, U.S.A. Eng. Pat. 1582, Jan. 23, 1908.

SEE U.S. Pats. 880,821 and 887,268 of 1908; this J., 1908, 340 and 618.—A. G. L.

Reduction of metallic compounds and furnaces therefor. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 4644, Feb. 29, 1908.

SEE U.S. Pat. 903,922 of 1908; this J., 1909, 145.—T. F. B.

Iron: Smelting ores of —. E. D. Kendall, Elizabeth, N.J., Assignor to E. N. Dickerson, Stovall, N.C., and A. R. Ledoux, A. T. Scharps, and A. Hecksher, New York. U.S. Pat., Re-issue 12,918, Feb. 9, 1909.

SEE U.S. Pat. 894,796 of 1908; this J., 1908, 904 —A. T. L.

Metallic surfaces: Process of indurating, ornamenting, and case-hardening —. S. O. Cowper-Coles, London. U.S. Pat. 911,116, Feb. 2, 1909.

SEE Eng. Pat. 12,452 of 1906; this J., 1907, 765. — T. F. B.

Alloys: Manufacturing —. H. Kazel, Baden, Austria. U.S. Pat. 912,246, Feb. 9, 1909.

SEE Fr. Pat. 385,699 of 1907; this J., 1908, 690. — T. F. B.

Agitation and separation of mixtures. Fr. Pat. 394,133. See I.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(I.)—ELECTRO-CHEMISTRY.

Borates: Some electrolytically prepared —. M. G. Levi and S. Castellani. Atti R. Accad. dei Lincei, Roma, 1908, [5], 17. II., 613–617. Chem. Zentr., 1909, I., 594.

In the authors' experiments the cathode and anode compartments were separated by a diaphragm, and contained respectively a solution of boric acid and a solution of a salt of the metal of which it was desired to obtain the borate. With a 10 per cent. solution of an alkaline-earth chloride and a saturated solution of boric acid, using a current strength of 0.5–1 ampère, there were obtained in the first hour precipitates of fairly constant composition, $\text{Ca}(\text{Ba}, \text{Sr})\text{O} \cdot \text{B}_2\text{O}_3 \cdot 4\text{H}_2\text{O}$, at the cathode. Subsequently, or on addition of alcohol, precipitates richer in boric acid but of less constant composition were obtained; in the case of calcium, however, the composition ($\text{CaO} \cdot 2\text{B}_2\text{O}_3$) was fairly constant. With magnesium salts, the borate precipitated in the first stage of the process was strongly contaminated by oxide; after the electrolysis, a salt of approximately the composition, $3\text{MgO} \cdot 4\text{B}_2\text{O}_3$, was precipitated from the solution by alcohol. Attempts to prepare borates of heavy metals electrolytically proved unsuccessful.—A. S.

Electrical migration of invertase. Michaelis. See XVII.

PATENTS.

Cells: Electrolytic —. A. E. Gibbs, Wyandotte, Mich. U.S.A. Eng. Pat. 28,147, Dec. 17, 1907.

In electrolytic cells of the kind described in Eng. Pat. 27,830 of 1907 (this J., 1908, 80), the closed anode chamber is provided with a float for showing the level of the liquid. A vertical transparent tube, open at its lower end and closed at the top, passes through the cover of the cell, so that it extends partly within and partly outside the cell, and the stem of the float projects into this tube.

—B. N.

Furnaces: Electric —. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 1470, Jan. 21, 1908.

The object of the invention is to provide an electric tube furnace capable of use at temperatures as high as that at which carbon begins to be vaporised, without any danger of the material under treatment being contaminated with carbon. A resistance tube of refractory metal, such as tungsten, or a mixture of tungsten and thorium, is used as the heater, with a refractory non-carbonaceous packing, such as calcium oxide, alumina, thorium, etc., surrounding the tube. Outside the hot zone, the packing material may be surrounded by carbonaceous material, such as coke. Hydrogen, or some other inert gas, is passed through the packing to prevent deterioration of the exterior of the heater.—B. N.

Furnaces: [Electric] —. M. Ruthenburg, Lockport, N.Y., U.S.A. Eng. Pat. 12,498, June 9, 1908.

The furnace comprises a stationary upper casing, and a removable hearth forming a floor to the casing. The hearth may be raised or lowered by hydraulic means, and may be retained in position, after raising, by the employment of wedges. The hearth is provided with wheels, so that, when lowered, these engage with a suitable track for moving the hearth into a position for discharging its contents into a conveyor. The electrodes are supported in the chamber, which is open to the atmosphere, by means independent of both the furnace casing and the hearth.—B. N.

Electrodes of electric furnaces: Connections for the —. C. A. Keller, Paris. Eng. Pat. 12,634, June 12, 1908.

The head of the electrode is provided with an undercut recess, into which is inserted the dovetail end of a conductor, the latter consisting of a hollow copper core surrounded by a hollow cast iron or steel sheath. The sheath is provided with recesses or grooves, and molten metal, preferably copper, is poured in so as to fill these and the space between the electrode and the conductor, the metal making direct electrical connection between the electrode and the internal copper core. Water is circulated through the hollow copper core, for the purpose of cooling.—B. N.

Furnace: Electric —. J. H. Reid, Newark, N.J. U.S. Pat. 910,581 and 910,582, Jan. 26, 1909.

(1). The electrodes, for producing the arc, are provided with automatic constant current regulators, and with neutral conveying resistance elements having contracting ends extending between the ends of the electrodes. The resistance elements and the electrodes constitute a crucible for supporting the charge, and the former at the same time afford resistance to the passage of the current. (2). A polyphase current is employed, and the furnace is provided with several converging electrodes, having different phases of the current flowing through each. A vertical electrode, adapted to extend into the top of the charge, is connected to the neutral point of the polyphase system, and each of the electrodes is provided with an automatic constant current regulator.—B. N.

Chemical compounds (sodium oxides): Process of manufacturing — [electrolytically]. C. F. Carrier, jun., Elmira, N.Y. U.S. Pat. 910,498, Jan. 26, 1909.

COMPOUNDS of the alkali and alkaline-earth metals, such as sodium oxides, are obtained by continuously producing an alloy of sodium by the electrolysis of a fused bath containing metallic sodium, with a fluid cathode comprising a metal which is electronegative to sodium. The alloy thus formed is used as a fused soluble anode, the electrolyte consisting of approximately two parts of melted sodium nitrate and three parts of caustic soda, which react with the sodium of the alloy to form the desired oxide.—B. N.

Electrolytic apparatus. P. Borgnet. Second Addition, dated Sept. 14, 1908, to Fr. Pat. 377,249, April 29, 1907 (this J., 1907, 1054; 1908, 757).

THE transverse displacement of the floating cathode is prevented by guiding each extremity between two vertical rods, and the descent of the cathode below a certain point is avoided by means of a horizontal rod placed between the vertical rods.—B. N.

[Electric] Pile, with zinc and lead, and three neutral liquids. A. Sarrette. Fr. Pat. 394,123, Nov. 18, 1907.

NEGATIVE electrodes of zinc and positive electrodes of copper or lead are placed in separate porous vessels, arranged alternately in an outer bath. The negative electrode is immersed in a solution of zinc sulphate (20° to 25° B.), the positive electrode in a solution of copper sulphate (24° to 35° B.), and the porous vessels in a solution of sodium sulphate (20° to 30° B.). The porous vessels are constructed of an impermeable wood frame, with horizontal or vertical bars of wood or twine for supporting the envelope, the frame being covered with

parchment paper fastened to the wood, and enclosed in muslin. The positive electrode is made in the form of a perforated copper or lead vessel, divided by a perforated inclined wood partition into two compartments, one of which contains crystals of copper sulphate. This vessel is placed in the porous vessel containing the solution of copper sulphate, the large surface of the electrode diminishing considerably the internal resistance. The zinc sulphate and sodium sulphate solutions are introduced through funnels attached to tubes, the latter reaching to within a few centimetres of the bases of the respective vessels.

—B. N.

Ozone; Apparatus for the production of — by means of electric discharges. J. Steynis. Fr. Pat. 394,124. Nov. 18, 1907.

A LIQUID, produced by compression of a gas, is circulated through hollow electrodes, and the heat produced by the discharges is thus employed for the evaporation of the liquid. The resulting gas is again compressed in order to convert it into the liquid condition for further use.

—B. N.

Carbides; Process for the preparation of — by induction heating. G. Erlwein and V. Engelhardt. Ger. Pat. 206,175, July 9, 1907.

THE patent relates to the application of the electric induction furnace to the manufacture of calcium carbide. The charge itself forms the secondary, and the initial heating is effected by embedding closed rings of carbon in the charge, or by placing closed rings of molten or solid calcium carbide on the bottom of the fusion-trough of the furnace.—A. S.

Electric accumulators; Process of agglutinating active material for —. Q. Marino and E. W. Barton-Wright, London. U.S. Pat. 911,141, Feb. 2, 1909.

SEE Fr. Pat. 384,295 of 1907; this J., 1908, 453.—T. F. B.

Oxidising agents; Process for obtaining — by electrolysis, without the employment of a diaphragm. Siemens und Halske A.-G. Fr. Pat. 394,295, Sept. 15, 1908.

SEE Ger. Pat. 205,087; this J., 1909, 96.—B. N.

Bleaching, etc. Addition to Fr. Pat. 387,104. See V.

Water purification. U.S. Pat. 910,495. See XVIII.B.

(B.)—ELECTRO-METALLURGY.

PATENTS.

Titanium alloys; Process of making —. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., New York. U.S. Pat. 910,894, Jan. 26, 1909.

CHARGES containing titanium oxide and silica are continuously reduced by means of carbon in an electric furnace, so much silica being present that the product obtained shall contain not more than 10 per cent. of carbon.—A. G. L.

Copper; Extraction of — electrolytically from solutions containing the metal in the form of sulphate, chloride, or other salt. J. B. M. E. Vuigner. Fr. Pat. 393,968, Nov. 12, 1907.

ONE or more cathodes of copper and one or more anodes of iron are connected by an external conductor, and immersed in a solution of the copper salt. An external auxiliary electric current may be employed in addition.

—B. N.

Scouring and cleaning of small [metal] objects; Process for the electrolytic —. A. Lévy. Fr. Pat. 394,120, Nov. 13, 1907.

IN the removal of grease (scouring) and of oxide (cleaning) from metal objects by means of hydrogen liberated in an electrolytic bath, there is difficulty in effecting electrical contact with a large number of small articles. According to the present patent, the objects are placed in bulk in a basket or cage, or other appropriate receptacle, and

immersed in a suitable electrolytic bath. The basket is constructed of a metal, such as tin, zinc, or aluminium, preferably aluminium for scouring and zinc for cleaning, which is attacked by the electrolyte, and thus causes liberation of hydrogen.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Oils and oil seeds; Some African —. Bull. Imp. Inst. 1908, 6, 353—380.

THE results of the examination of specimens of the following African oils are given:—(1). Non-drying oils: ground-nut, "ikpan" seed, "inoy" kernel, "ben" seed, carapa seed, *Calodendron capense*, *Balanites aegyptiaca*, and "zawa" ("niam") oils. (2). Drying oil: *Ricinodendron Heudelotii* (*R. Africanum*) ("Nsa-sana") seed oil. (3). Solid or semi-solid fats: "shea" butter, fat from seeds of *Mimusops* sp., fat of "dika" nuts, *Pentadesma butyracea* fat, fat of "mafoureira" nuts, fat of *Pycnanthus* seeds. Several of these oils and fats have been examined previously (see this J., 1903, 751; 1904, 233, 793; 1906, 1159; 1907, 623, 976; 1908, 511, 758, 819, 1161; also Lewkowitsch, this J., 1904, 25; 1906, 30; 1907, 1265; 1908, 578; 1909, 150).

Ground-nut oil from Northern Nigeria had the usual characters, but owing to its slight peculiar odour and taste would be suitable only for soap-making.

Samples of the oil from *Balanites aegyptiaca* seeds were received from (1), Northern Nigeria ("betu" oil) and (2), the Sudan ("heglig" seeds). The kernels from the former source yielded 58.7 and those from the latter, 41 per cent. of oil. The oils had the following characters: sp. gr. at 15° C. 0.919, 0.9187; acid value, 5.0, 1.4; saponification value, 196.7, 194.2; iodine value, 92.5, 98.2; Hehner value, 95.2, 98.6; Reichert-Meissl value, (2), trace; unsaponifiable matter, (1), about 0.6 per cent.; titer test, about 34.6° C. 34° C. The oil consists of about 33 per cent. of olein, 33 of linolin, and 34 of stearin and palmitin.

Specimens of shea nuts were obtained from Northern and Southern Nigeria, the Gold Coast, and the Sudan. The yield of fat from the kernels ranged from 41.4 to 54.5 per cent. The fat ("shea butter") had the following characters:—Sp. gr. at 99°—100°/15°—15.5° C. 0.8594—0.8691; acid value, 7.6—33.9; saponif. value, 179—184.6; iodine value, 54—62.9; Hehner value, 91.2—96.5; Reichert-Meissl value, 1.4—2.6; unsaponifiable matter, 1.7—7.0 per cent.; titer test, 51.8°—53.2° C. Shea butter is used in the manufacture of candles and, to some extent, for soap-making; it is also said to be used for the manufacture of butter substitutes. For the candle and soap industries, it is worth about £24 5s. to £24 10s. per ton.

The kernels from the nuts of a species of *Mimusops*, probably *M. djave*, from Southern Nigeria, yielded 60.2 per cent. of a fat closely resembling shea butter in character.

Pentadesma butyracea fat from Sierra Leone had the sp. gr. at 100°/15.5° C. 0.859; acid value, 3.6; saponif. value, 190.1; iodine value, 41.8; Hehner value, 95.0; Reichert-Meissl value, nil; unsaponifiable matter, 1.7 per cent.; titer test, 50.7° C. The fat would perhaps be useful as an edible fat and for the manufacture of candles.

Specimens of fruit, seeds, and "mace" from *Pycnanthus* sp. from Northern Nigeria and Uganda were examined. (1). The seeds obtained from Nigeria resembled nutmegs, but contained no volatile oil; the kernels yielded 54 per cent. of an orange-coloured bitter fat. (2). The kernels from Uganda yielded 60.2 per cent. of a dark-brown, slightly bitter fat. These fats had the following characters:—Sp. gr. at 99°—100°/15° C. 0.886, 0.887; (1), m.p.t., 48.5°; saponif. value, 235—245, 255; acid value, 21, 16.5; Hehner value, 90.8, 90.9; iodine value, 48.9, 65.4; titer test, 45.8°, 37° C. The fat might be used for soap-making and for the manufacture of candles, but would need decolorising. The "mace" from Uganda yielded 57.04 per cent. of oil, which however was dark-coloured, and could not be decolorised without heavy losses.—A. S.

Maumené value of oils and fats; Determination of the —.
M. Tortelli. Chem.-Zeit., 1909, 33, 125—126, 134—135, 171—172, 184—185.

It was found by Mitchell (this J., 1901, 931) that the Maumené values obtained by dissolving the fat in carbon tetrachloride in a vacuum-jacketed tube and adding the sulphuric acid to the solution, were in most cases proportional to the iodine values. The author here shows by a long series of parallel results that this relationship between the two values may also be observed when an oil is treated in a vacuum-jacketed tube with the sulphuric acid directly (see this J., 1904, 668). In the case of solid fats the substance is melted before the addition of the acid and the specific heat of the reacting bodies taken into consideration. The ratio between the Maumené figure and the iodine value decreases with the iodine value. Thus, in the case of four samples of butter the ratio varied from 1.03 to 1.06, whilst with four samples of margarine it ranged from 1.33 to 1.49, and with four samples of cocoanut oil from 0.31 to 0.34. The method is therefore recommended as a useful means of detecting foreign fats in butter.—C. A. M.

Oleic acid; Action of ozone on —. C. Harries. Ber., 1909, 42, 446—458.

ACCORDING to Molinari (this J., 1908, 1073) ozonised air containing only a small percentage of ozone converts oleic acid into a different ozonide from that formed by air containing more ozone; otherwise it is not possible to explain the differences in their decomposition-products. The author, however, finds that this is not the case, and that the same normal oleic acid ozonide, $C_{18}H_{34}O_5$, is obtained by ozonisation of the oleic acid in different solvents with ozonised air containing different percentages of ozone, or by washing the perozonide with sodium bicarbonate solution and water. Oleic acid ozonised by oxygen containing 0.4 per cent. of ozone gave the normal ozonide with the same properties as already described (this J., 1906, 1158). Molinari (*loc. cit.*) found that the normal ozonide did not yield hydrogen peroxide on treatment with water, but the author identified that compound by three tests, including that of Arnold and Mentzel used by Molinari. The ozonide obtained by treatment with oxygen containing over 12 per cent. of ozone had the same properties, and also yielded hydrogen peroxide on treatment with water. The same reaction was also given by the normal ozonide derived from the perozonide of oleic acid (this J., 1906, 1158). The decomposition of the normal ozonide by water is monomolecular, the products containing only 9, and not 18 atoms of carbon. Acids containing 18 atoms of carbon are only obtained by boiling the ozonide with aqueous or alcoholic potassium hydroxide solution, followed by treatment with steam. The primary products of the decomposition are aldehydes and their peroxides, *viz.*: (a) nonylaldehyde and the peroxide of the semi-aldehyde of azelaic acid; or (b) nonylaldehyde peroxide and the semi-aldehyde of azelaic acid. The peroxides of the aldehydes are decomposed by water, being transformed partly into aldehydes and hydrogen peroxide, and partly into isomeric acids (see also this J., 1906, 1055).—C. A. M.

Raphia wax. Bull. Imp. Inst., 1908, 6, 380—383. (See this J., 1906, 433; 1907, 420; 1908, 987.)

IN an experimental trial with ten raphia palm leaves, the yield of wax was 0.75 per cent. of the weight of the leaves, or about 17 per cent. of the weight of dry fibre from the leaves; in practice the yield would probably be about 10 per cent. of the weight of the fibre. Two samples of the wax were examined, with the following results: sp. gr. at 99°/15.5° C., 0.836, 0.832; acid value, 4.9, 6.5; saponification value, 51.3, 50.3; iodine value, 7.68, 10.7; m.p., 82°, 83° C. It is stated that the cost of production, etc., of the wax, cannot be reduced below £80 per metric ton f.o.b. Yamatave, Madagascar; hence it is too dear for use in the manufacture of soap and candles. A good supply of the wax of pale colour and free from grit, at the price mentioned, might however find considerable use as a substitute for carnauba wax.—A. S.

Fatty acids ("total fatty matter") in soap; Determination of —. G. Fendler and L. Frank. Z. angew. Chem., 1908, 22, 252—261.

FROM a systematic study of the different methods proposed for the determination of the fatty acids in soap, the authors conclude that in the case of cocoanut and palmnut oil soaps the only exact method is to weigh the fatty acids in the form of alkali salts. For factory control they recommend Lüring's apparatus, in which the volume of fatty acids is read directly on a scale, as sufficiently satisfactory. For linseed oil soaps Hehner's method gives good results, as do also the methods in which the liberated fatty acids are shaken out with ether or petroleum spirit and the extract evaporated, provided that the residue is dried in a current of carbon dioxide. The ordinary method of liberating the fatty acids and weighing the cooled melted layer (after the addition of wax if required) is only suitable for control purposes. Alkali salts obtained from linseed oil soaps increase in weight when dried in the air. Determination of the fatty acids in the form of calcium salts and the use of Lüring's apparatus give unreliable results with these soaps. The fatty acids in olive oil and tallow soaps may be satisfactorily determined by Hehner's method or the extraction methods, and may be dried in the air. Determination of the fatty acids in the form of calcium salts is unreliable for tallow, but approximately correct for olive oil. Lüring's volumetric method is not applicable to fats of high m.p. (tallow), but gives approximately correct values with olive oil soap.—C. A. M.

Denaturation of cottonseed, china, kapok seed, and rape seed oils for illuminants. Australian Customs Order. Board of Trade J., Feb. 18, 1909. [T.R.]

A CUSTOMS ORDER (No. 1,083 of 1908) dated 19th December last, directs Collectors of Customs to give publicity to the following requirements as to the method of denaturation of cotton seed, china, kapok seed, and rape seed oils, when for use as illuminants, in the Australian Commonwealth:—

To each 100 gallons of the oil add the following, *viz.*:—20 galls. of high test kerosene, 3 galls. of commercial cod oil, and 1 gall. of thin residual oil of sp. gr. not above 0.90 at 60° F., flash-point not below 150° F.; and viscosity not above 1 min. 50 sec. at 80° F. (Redwood). The denaturants must be submitted for approval to an official analyst and the denaturation must take place in the presence of an officer.

PATENTS.

Lubricating oils with a basis of castor and mineral oils; Preparation of —. E. Boyer, L. Cavaillon, and N. Barisbae. Fr. Pat. 391,992, July 3, 1908.

CLAIM is made for a process of heating castor oil with acids, or anhydrides or chlorides of mineral or organic acids (*e.g.*, with 4 per cent. of acetic acid), so as to obtain products readily soluble in mineral oils.—C. A. M.

Fat from the bodies of animals; Method and apparatus for separating, sterilising, and clarifying —. Actien Maschinenbau-Anstalt, vorm. Venuleth und Ellenberger. Fr. Pat. 394,076, Sep. 9, 1908. Under Int. Conv., Feb. 13, 1908.

THE fat is separated partially or completely by means of steam, hot air, gas, or hot liquids, but preferably by means of the gelatinous aqueous decoction coming from the extractor, whilst at the same time the top of the separator is heated by steam also derived from the extractor. The apparatus is so arranged that the fat is kept apart from the ammoniacal vapours. In a special apparatus claimed for this purpose, the animal material is heated by means of steam under pressure in a closed upper tank. The aqueous decoction (carrying the fat) passes through a pipe at the bottom into a separator divided into two chambers. The fat rises into the inner chamber, which is heated at the top by steam conveyed from the extractor. The two chambers communicate at the top by means of a pipe provided with a tap, so that the pressure within both may be equalised, while still

leaving an upper cushion of pure air above the melted fat. This prevents the ammoniacal vapours coming from the extractor rising to any material extent into the inner chamber and contaminating the fat during its clarification and sterilisation.—C. A. M.

Fish oils and fats; Process for deodorising —. C. H. J. Wellimg. Fr. Pat. 394,456, Nov. 26, 1907.

THE oil to be purified is emulsified with alcohol, jets of the oil and alcohol being caused to impinge against each other for this purpose. After removing the portion of the alcohol which separates out, the oil is washed with hot water in order to recover that part of the alcohol which is held in suspension in the oil. The washed oil may then be treated with fuller's earth or animal charcoal. —W. P. S.

Fish oil; Process for deodorising —. G. van der Heyden. Fr. Pat. 394,530, Nov. 29, 1907.

THE oil is introduced into a vertical cylinder and heated to a temperature of 40° C. by means of a steam- or water-jacket surrounding the cylinder. Alcohol is then injected at the bottom of the cylinder, the quantity employed being about six or eight times the volume of the oil, which at the commencement of the operation should about three-quarters fill the cylinder. The alcohol rising to the top of the oil is run off into a separate vessel and when sufficient alcohol has been injected, the temperature of the oil is raised to 70° C. The oil is then separated and washed with hot water; this is attained by adding water to the oil and heating the mixture by means of a steam coil. The alcohol is evaporated, and the oil, after being separated from the water, is treated with fuller's earth at a temperature of 75° to 80° C. The alcohol used in the process may be recovered by distillation.—W. P. S.

Candles; Manufacture of stearine —. Comp. Luz Stearine. Fr. Pat. 394,362, Sept. 16, 1908.

CLAIM is made for the use of the insoluble fatty acids from the fat of the seeds of *Myristica bicuhyba* Humb. (ocuhuba fat).—C. A. M.

Emulsifying agents; Preparation of —. G. Imbert, Nürnberg, Bavaria. Eng. Pat. 11,121, May 22, 1908.

SEE Fr. Pat. 390,497 of 1908; this J., 1908, 1120.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

PATENTS.

Pigment; Manufacture of a white sulphate of lead —. J. B. Hannay, Cove Castle, Dumbartonshire, and S. B. Wilson, London. Eng. Pat. 6554, Mar. 24, 1908.

CLAIM is made for a continuous process in which the galena is introduced on to the top of the fuel in a furnace supplied with a hot-air blast, with the result that the solid and molten lead sulphide is protected from oxidation by means of its own vapours. The volatilised lead sulphide is carried upward in an atmosphere deprived of oxygen, and is oxidised to basic sulphate in a combustion chamber by the admission of an excess of cold air, followed by rapid cooling to prevent further changes. With suitable regulation there is a continuous formation of a product, the composition of which varies only within the limits of $\text{PbSO}_4 \cdot \text{PbO}$ and $2\text{PbSO}_4 \cdot \text{PbO}$; the yield of pigment is practically equal to the theoretical quantity. In special apparatus claimed for the process, the furnace is provided with rotating fire-bars cooled by means of water, so that the ash may be automatically removed from the bottom without interfering with the normal circulation of the gases.—C. A. M.

Orange lake dyestuff. U.S. Pat. 912,138. See IV.

(B).—RESINS, VARNISHES.

PATENTS.

Shellac substitute; Process for the preparation of a —. J. J. Bischoff. Ger. Pat. 206,447, May 8, 1906.

AN alcoholic extract of copal resin is mixed with oleine, and the alcohol is distilled off from the product.—A. S.

Utilisation of Australian tree called "blackboy". Fr. Pat. 394,234. See XVII.

(C).—INDIA-RUBBER, &c.

Rubber; Bitinga — from *Raphionacme utilis*. Bull. Imp. Inst., 1908, 6, 390—393.

THE plant, *Raphionacme utilis*, is known in Portuguese West Africa as "bitinga," "ecanda," and "marianga"; its tuberous roots contain a rubber-yielding latex. Specimens of the roots and of the rubber were examined. The tubers as received were covered with a dark brown scaly bark and contained about 87—89 per cent. of moisture; the yield of rubber from the dry substance was, on the average, 10.5 per cent. The specimen of rubber consisted of one piece of a pale yellowish-brown colour and two pieces of darker colour. The physical qualities of the rubber were fairly good. The light-coloured sample gave the following results on analysis: moisture, 1.0; caoutchouc, 76.8; resin, 9.0; protein, 0.6; insoluble matter (including ash, 7.11), 12.6 per cent. It was valued at 1s. to 1s. 3d. per lb., compared with fine hard Para rubber at 4s. 10d., but would probably be worth 3s. or more per lb. if properly prepared and freed from foreign matter.—A. S.

Ebonite; Analysis of —. G. Hübener. Chem.-Zeit., 1909, 33, 144—145, 155—157.

BROMINE water acts readily upon finely divided ebonite converting it into a friable bromine derivative, in which all the unsaturated linkages of the original (partially) sulphurised molecule are satisfied by bromine. By determining the combined bromine, the amount of caoutchouc hydrocarbon which is not fully sulphurised is ascertained, making use of the formula, $\text{C}_{10}\text{H}_{16}\text{Br}_4$, for the caoutchouc bromide. The remainder of the rubber hydrocarbon may be assumed to be present as disulphide, $\text{C}_{10}\text{H}_{16}\text{S}_2$, for the purposes of calculation, and may be estimated from the sulphur of vulcanisation. The latter is found by subtracting from the total sulphur, the free sulphur (estimated as described below) and the sulphur of the sulphates of certain metals present in the ash. The process is carried out as follows:—0.1 grm. of the finely divided ebonite is covered with about 75 c.c. of water and 10 c.c. of bromine, and kept at a moderate temperature until the action of the bromine is complete, and most of the excess is volatilised. The remaining bromine is then driven off by raising the temperature. The grey, flocculent solid is filtered off, and the free sulphur (which has now been oxidised to sulphuric acid) estimated in the filtrate by precipitation with barium chloride. The bromo-derivative is transferred to a flask, and heated with 10—15 c.c. of nitric acid (sp. gr. 1.4), free from halogen, in presence of 25 c.c. of $N/10$ silver nitrate, until fumes are given off. The liquid is evaporated to about 15 c.c. in bulk, diluted with water, and 5 c.c. of a saturated solution of iron alum added. The excess of silver is determined by titration with thiocyanate, and from the amount of silver converted into bromide, the amount of combined bromine is calculated. From this figure the amount of caoutchouc as bromide is ascertained as already explained. Total sulphur is determined in the usual way. When lead, calcium, or barium compounds are present in the ash, these must be estimated, and the amount of sulphur in the corresponding sulphates must be added to the free sulphur already estimated. For, either these metals are present as sulphates in the original vulcanised mixing, or are converted into sulphates by the action of the bromine or of the sulphuric acid formed by its action upon the free sulphur. The results displayed by the author are as follows:—In the case of a mixing in which, before vulcanisation, 29—31 per cent. of caoutchouc was found (by Buddle's method) the vulcanised product showed, in two experiments, free sulphur, 17.85 and 17.62

total sulphur, 22.00 and 22.00; caoutchouc (as bromide), 21.76 and 20.57; caoutchouc (as sulphide), 8.8 and 9.31; and total caoutchouc, 30.57 and 29.88 per cent. By slight modifications, the process may be made a gravimetric one throughout. Results obtained in this way, with the same sample, were: free sulphur, 18.12 and 17.75; total sulphur, 22.0 and 22.0; caoutchouc (as sulphide), 8.24 and 9.04; caoutchouc (as bromide), 21.35 and 22.42; and total caoutchouc, 29.59 and 31.46 per cent. By extraction with carbon bisulphide, the actual caoutchouc tetrabromide, $C_{10}H_{16}Br_4$, can be removed from the brominated vulcanised rubber, and the amount of this, in the sample under examination, corresponded with 13.2 per cent. of caoutchouc, calculated on the original substance. This proportion of the $C_{10}H_{16}$ molecules is therefore present in the vulcanised product without any combined sulphur. By estimating the bromine in the insoluble portion of the bromo-derivative, it was found that the whole of the remainder of the vulcanised rubber was present as $C_{10}H_{16}S$, no disulphide, $C_{10}H_{16}S_2$, being present.—E. W. L.

PATENTS.

Caoutchouc adhesive solution; Non-inflammable — H. Pichon and T. Truchelut. Fr. Pat. 394,477, Sept. 17, 1908.

A RESIN, such as copal or shellac, is added to a solution of caoutchouc in carbon tetrachloride, with the result that the injurious effect of the traces of sulphur chloride in the solvent on the adhesiveness is prevented. The resin is best added in the form of a solution in alcohol, petroleum spirit, or other solvent miscible with carbon tetrachloride. —C. A. M.

Jelutong ("dead-borneo," bask, pontianac); Process of rendering — capable of transport and storage. Hüttenbach und Co. Ger. Pat. 206,222, July 13, 1907.

THE jelutong is pressed in order to remove the greater part of the moisture it contains; it is then warmed, and whilst still moist, pressed into balls or the like, and finally coated with animal or vegetable glue which is subsequently rendered insoluble by treatment with formalin, bichromate, or other suitable agent.—A. S.

Elastic plastic mass from acetylene; Process for the preparation of an — L. Horwitz. Ger. Pat. 205,705, Jan. 22, 1907.

ELASTIC plastic masses are obtained by acting on metals or their oxides or salts with acetylene in presence of gases such as oxygen or air, or of substances capable of yielding oxygen. Special claim is made for the action of such mixtures of acetylene and oxygen, etc., on a mixture of copper and nickel. The products contain only very small proportions of the metal (e.g. less than 0.2 per cent.), which manifestly acts as a catalyst.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Leather manufacture; Chemical and biological researches on — G. Abt. Bull. Soc. d'Encour., 1908, 110, 1449—1466.

A USEFUL summary of the present state of knowledge on the subjects named.—H. G. B.

Sole leather; American — C. A. Brown. J. Amer. Leather Chem. Assoc., 1909, 4, 38—52.

THE article deals with American sole-leather from the shoe manufacturer's point of view. The author divides sole leather into two classes, namely hemlock or red leather tannage, and oak and union tannage. The former was produced in much greater quantities than the latter, and was used for cheaper classes of boots, making a very stiff and unyielding shoe, but owing to its hard and coarse-fibred nature, it did not adapt itself readily to the Goodyear welt process. The oak and union leather was used for the finer grades, and almost exclusively in all women's shoes. The introduction of the Goodyear process of welting (some 25 years ago), and its universal adoption, restricted

the use of hemlock leather on account of its unyielding nature, and that of the union leather mainly on account of its high price. Attempts were made by the shoe manufacturer to soften the hemlock leather, but this was found to be neither practical nor economical, except in the hands of large manufacturers who required mellow sole leather in large quantities at popular prices. Oak and union leathers were now being put on the market at much lower prices, owing to the demand for them in other directions. The tanners in producing cheaper classes of sole-leather began to use both weighting and bleaching agents; this resulted in loss to the shoe-manufacturer as fewer soles to the pound of leather were cut than formerly, and these of indifferent wearing ability. At present the use of tanning extracts seems to have superseded to a large extent that of hemlock bark in the tannage of American sole leather.—H. BR.

PATENTS.

Glue-tester. E. S. Smith, Niagara Falls, N.Y. U.S. Pat. 911,277, Feb. 2, 1909.

THE apparatus consists of a pressure chamber, one side of which is provided with a flexible elastic membrane; this membrane is brought into contact with the surface of the gelatinous substance to be tested, and means are provided for generating pressure in the chamber, thereby expanding the membrane and displacing the gelatinous substance. Means are also supplied for measuring the amount of such displacement, and for measuring the pressure in the chamber.—W. P. S.

Plastic material [artificial horn, etc.]. W. Claypoole, Thornton Heath, Surrey. Eng. Pat. 2122, Jan. 30, 1908.

PHENOL, cresol, or the like (e.g. 1 litre of carbolic acid) are mixed with formaldehyde (e.g. 750 c.c. of 40 per cent. formalin), and caustic soda (e.g. 20 grms.), and the mixture heated until sufficiently viscous. It is then poured into moulds, etc., and kept at about 75° C. until set, after which it is removed, heated below 100° C. to expel water, and baked until of a horn-like consistency. The presence of the caustic soda acts as an accelerator in the first or condensation reaction, and prevents the separation of water, whilst it does not interfere with the second or polymerisation reaction in the baking process, but on the contrary, reduces the time required in the oven. Sodium carbonate, sodium cresylate, or similar compounds may take the place of caustic soda. If the accelerator is not added until the second reaction (i.e. during the baking), the product will be transparent. If desired, pigments may be incorporated with the material, or small proportions of glycerin, paraffin, gums, resins, etc., may be introduced. (Compare Fr. Pat. 353,995 of 1905, this J. 1905, 1081; 1906, 195.)—C. A. M.

XV.—MANURES, &c.

Calcium cyanamide. J. Aeby. Chem.-Zeit., 1909, 33, 145.

A CONSIGNMENT of calcium cyanamide lying on the quay pending shipment gave off an unpleasant smell, and was found on investigation by the author to contain 3.4 per cent. of calcium carbide, which, reacting with atmospheric moisture, was evolving acetylene. The author suggests that contracts for the supply of calcium cyanamide should specify a maximum amount of calcium carbide, not to be exceeded; not only because of the danger during transport of samples containing an appreciable proportion, but also because of the doubtless harmful effect of acetylene upon growing plants.—I. T. D.

Determination of phosphates. Estes. See XXIII.

PATENTS.

Superphosphates; Method of, and apparatus for, removing — from a decomposition chamber. G. Hövermann, Hamburg, Germany. Eng. Pat. 19,988, Sept. 23, 1908.

THE decomposition chamber is made conical at the bottom, and has a central rotary shaft, the cutting

device attached to the shaft being so arranged that the material is cut away in slices along a conical or vertical surface, so that the cut material can fall uniformly and regularly through a central discharging aperture on to a conveyor. The cutters may form an inverted cone, and the shaft to which they are attached may be made to sink gradually as they cut through the material; or else, a rotary hollow shaft, through which extends a fixed spindle, may pass through the bottom of the chamber, and a combined vertical and inclined cutter, pivoted together, be so geared to the spindle that it removes thin vertical slices of the material, from the centre outwards, as the hollow shaft rotates, the thickness of the slice diminishing as cutting proceeds, so that a constant quantity is cut away at each revolution. In the latter case the discharging aperture is closed during charging by a hollow core let down from above, and in the former case a core is lifted into the chamber from below. The present invention very much reduces the strain to which the material is subjected and also lessens the power required for moving it.—F. Sopn.

Fertilisers; Process of making complete — J. R. Young, Norfolk, Va. U.S. Pat. 911,283, Feb. 2, 1909.

A MIXTURE consisting of from 300 to 500 lb. of powdered calcium phosphate (bone phosphate), 600 lb. of vegetable matter containing potash, and from 400 to 700 lb. of "undried press-cake of nitrogenous organic matter" or "a suitable ammoniate" containing 40–50 per cent. of moisture, is treated with from 300 to 500 lb. of sulphuric acid of about 66° B. The mass is agitated until the action partially subsides, and is then allowed to set.

—W. P. S.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar syrups; New method for the refractometric examination of impure — J. Tischtschenko. Z. Ver. deut. Zuckerind., 1909, 103–108.

THE refractometric determination of dry substance in lark, impure waste syrups is generally inaccurate owing to the high dispersion which renders the limit of total reflection ill-defined, and also, owing to the high proportion of non-sugar substances which have not the same refractive index as sucrose. To obtain a sharper reading, dilution of such syrups with water has been recommended; the Customs method elaborated by Herzfeld consists in diluting the syrup with water in the ratio 1 : 1 (compare Jappmann, this J., 1908, 698). The author points out, however, that this method is open to several objections. Thus, contraction occurs on dilution with water, the proportion of non-sugar to sugar remains unchanged, the limit of total reflection is still somewhat ill-defined, evaporation of water occurs, and the error of reading is increased since the scale divisions of the Abbé refractometer are smaller for low than for high refractive indices. The author therefore recommends that the sample should be diluted, not with water, but with a pure concentrated sugar solution of known sugar-content. A known weight of the sample is thoroughly mixed with a known weight (approximately equal quantities of each) of the sugar solution and examined by means of the Abbé refractometer at 20° C. The dry substance-content (x) of the original sample is obtained from the formula,

$$x = \frac{(a+b)P - bp}{a}$$

which a = weight of original sample, b = weight of sugar solution, p = percentage of sugar in the sugar solution (determined refractometrically), and P = percentage of dry substance in the mixture, determined refractometrically. If equal weights of sample and sugar solution be taken, the equation is simplified to $x = 2P - p$. The author has compared the results obtained refractometrically, using water and sugar solution (of 3 per cent. sugar-content) respectively for dilution, with the true content of dry substance found from determination of the water. It was found that by using sugar solution instead of water for dilution, considerably

greater accuracy was attained, the results seldom varying beyond permissible limits; these results had a tendency to be higher than the true value; this was largely owing to the fact that the sugar solution added was less concentrated than the molasses, contraction thus being not completely eliminated.—L. E.

Sugar in bagasse; Determination of — H. Pellet. Bull. Assoc. Chim. Sucri. et Dist., 1909, 26, 558–559.

THE ordinary process for determining sugar in bagasse does not give the total loss of sugar since the liquor expressed from the exhausted bagasse has a higher sugar-content than that which serves for calculating the loss of sugar. In spite of this well-known fact, however, it has been suggested that the differences observed between the results obtained by this process (or Java process as the author terms it) and those obtained by the Zamaron process (this J., 1898, 75) may be due to solution or formation of a dextrorotatory substance in the latter process. The author has found, however, that the liquid obtained by repeated extraction of bagasse from which all the sugar has been removed by Zamaron's process of successive extraction, is optically inactive, and considers that for the accurate determination of sugar in bagasse, successive extractions with boiling water by means of Zamaron's apparatus must be used.—L. E.

Maltose; Hydrolysis of — with citric acid. J. Pieraerts. Bull. Assoc. Chim. Sucri. et Dist., 1909, 26, 562–573.

THE author has made three series of experiments on the hydrolysis of maltose with citric acid. In each experiment of the first series, 50 c.c. of a 2.5 per cent. solution of hydrated maltose were heated to boiling with 10 c.c. of a 20 per cent. solution of citric acid under a reflux condenser. The periods of boiling were increased progressively throughout the series, and the degree of hydrolysis in each experiment was determined polarimetrically and by means of the cupric-reducing power of the solution. In the latter determinations, correction was made for the reducing action of the citric acid; special experiments showed that the reducing powers of maltose and dextrose in mixtures of these sugars are practically independent of each other. In the second and third series of experiments, the hydrolysis was carried out in an autoclave under pressures of 0.75 and 1.5 atmospheres respectively; otherwise, the conditions were the same as in the first series. The experiments showed that maltose is completely hydrolysed by boiling with citric acid as above described for about 30 hours, the solution becoming more or less yellow as a result of this treatment. The time required for hydrolysis is much decreased by heating under pressure; thus, under a pressure of 1.5 atmospheres, hydrolysis is complete in 2½ hours and before the solution has acquired a yellow colour.—L. E.

PATENTS.

Utilisation of Australian tree called "blackboy." Fr. Pat. 394,234. See XVII.

Treating sugar-cane, etc. U.S. Pat. 909,987. See XIX.

Cellulose from bagasse. Fr. Pat. 394,143. See XIX.

XVII.—BREWING, WINES, SPIRITS, &c.

Enzymes; Electrical migration of — L. Invertase. L. Michaelis. Biochem. Zeits., 1909, 16, 81–86.

THE author has carried out migration experiments on yeast invertase by means of the cell,

Zn | ZnSO₄ | Water | Invertase | Water | ZnSO₄ | Zn, which arrangement prevents the invertase from being subjected to the action of acids and bases formed as the result of secondary electrolytic reactions; indeed, with the arrangement employed, no acid or alkali can be detected in the second or fourth compartment, originally containing water, after a current of about 0.0005 ampère has been passing for 48 hours. At the end of the experiment, the solutions of the two water

compartments were tested for the presence of invertase by means of a solution of sucrose. The three separate experiments made, showed conclusively that the invertase moves towards the anode and must hence be regarded as possessing an acid character. This result confirms those yielded by the adsorption analysis of the invertase of yeast (see Michaelis and Ehrenreich, this J., 1908, 701.)

T. H. P.

Maize. The maltases of — R. Huere. Compt. rend., 1909, 148, 300—302.

THE author has studied the properties of the maltase secreted by two varieties of maize grown on the Landes: (1). *Early white maize*. The infusion of this grain contains an enzyme which converts maltose into dextrose very energetically at a temperature of 15° C. It is still slightly active at temperatures of 0° C. and even below. Its action is destroyed after 2 hours' heating at 50° C.; it has a slight action at 60° C., but is quite inactive at 65° C. The enzyme acts most rapidly at temperatures about 40° C. When the infusion is caused to act on starch paste, the action of the amylase at 50° C. is more rapid than that of the maltase; the latter is ultimately destroyed at that temperature, and the product contains both maltose and dextrose. At a temperature of 15° C. the action of the maltase keeps pace with that of the amylase, and dextrose is the only sugar produced. (2). *Early yellow maize*. The maltase of this grain is not active at temperatures below 20° C.; it is not entirely destroyed by heating at 80° C. The enzyme acts most rapidly at a temperature of 60°—62° C. Thus, no dextrose is produced by the saccharification of starch paste by an infusion of this grain at 20° C.; the result is the same as if amylase were the only enzyme present. The author terms the maltase of yellow maize a "high maltase," in contradistinction to that of the white maize; the latter maltase resembles the maltase of yeast in its temperature relationships.—J. F. B.

Digestion: Preliminary — of the mash. E. Moulang. Woch. f. Brau., 1909, 26, 77—81. (See also this J., 1909, 34, 154.)

THE author's experiments show that preliminary digestion of the malt grist with water does, under some circumstances, increase the yield of extract obtained. This increase is not merely an apparent one, as is shown by the diminution in the amount of the dry matter of the grains; it consists principally of starch, protein, ash, and pentosans. Malts with high content of enzymes usually exhibit the greatest increases of extract by this process. The increase of extract is influenced by: (1), the duration of digestion, the optimum being 8 hours at 15° C.; (2), the temperature during the first mashing, for which the optimum is 40—55° C.; (3), the physiological and physical condition of the malt. The quality of the beer prepared from a digested mash may, but need not, suffer; beer with bad colour and smell may, under some conditions, be obtained from badly-cured malts or malts made from coarse, thick-skinned barleys. The process of warm steeping promises to obviate such difficulties.—T. H. P.

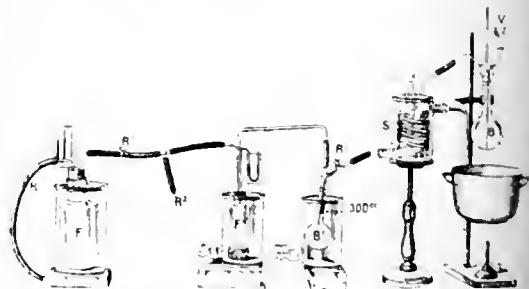
Digestion of malt. F. Emslander. Z. ges. Brauw., 1909, 32, 77—78. (See also this J., 1909, 34, 154.)

THE author's experience, extending over many years, shows that standing of the cold mash overnight or, in the winter for 24 hours, is accompanied by increase of the extract and of the amount of fermentation. It has been stated that this procedure, especially in the summer, leads to the ready formation of lactic acid. The author has however frequently observed that the formation of lactic acid is diminished by increasing the period of stand of the cold mash and by stirring of the mash. He cools the mashing liquor in the summer to 8° R. (50° F.) by means of ice and also mixes in ice with the mash, so as to prevent heating due to the swelling of the malt. The results obtained in the brewery are confirmed by those of laboratory experiments.

Beers from pre-mashed malts. W. Windisch. Woch. f. Brau., 1909, 26, 67—70.

THE author elects in future to describe as "pre-mashed" (*vermisch*), those beers produced by processes in which the malt is allowed to stand wet for some time before the mashing is proceeded with. A series of eight experiments is recorded in which malt from the same bulk was mashed in various ways, and the resulting beers compared. The malt was not very well grown and only moderately modified. In one instance the malt was mashed by the ordinary decoction method and in the others, various times of "stand" at ordinary or higher temperature were allowed before a saccharifying heat was attained. For details the original must be consulted. In all cases an increase of yield over the simple decoction brew was obtained. The fermentations were normal and the differences of flavour so slight that none but an expert could detect them. The colour in a few cases was slightly reddened. The beer obtained in the experiment where a three hour stand at 120° F. was allowed before mashing, which gave the highest yield of extract, was the least satisfactory. The bulk of the increase in extract obtained is not produced from extra conversion of starch. (See also this J., 1909, 34, 154.)—R. L. S.

Spirits: Comparative analyses of — distilled in air and under vacuum. Girard and Chauvin. Monit. scient., 1909, 23, 73—89.



THE authors have carried out an investigation at the Paris Municipal Laboratory on the use of a vacuum distillation apparatus in the analysis of potable spirits. The apparatus is shown in the figure, and is so designed as to avoid direct communication between the vacuum pump and the liquid under distillation. B (see fig.) is the distillation flask, holding 300 c.c. of the spirit to be distilled; the funnel, V, is partially filled with water for rinsing out after distillation. The condensing worm, S, is immersed in a vessel of running water at a temperature which must not be allowed to exceed 15° C. The first receiver, F', is surrounded by a freezing mixture of ice and salt, as is also the second, safety-receiver, F''; R² is a cock for breaking the vacuum. The 3-litre bottle, F, acts as a vacuum reservoir and communicates with the pump by the cock, R. When the distillation flask is charged, the cock, R³, is closed and the vessels, F, F', and B, are exhausted. The pump is then cut off by closing R, and the cock, R³, is opened, so that the flask, B, is nearly exhausted. R³ is then closed and a full vacuum created in F, which is used for maintaining the vacuum in the distillation flask as it falls during distillation, B being closed and R' opened when necessary. Distillation should begin at 20—22° C. and should be one-third completed by the time a temperature of 25° C. is reached towards the end it is necessary to raise the temperature very cautiously, finishing off at 38° C. If the operation be properly conducted, the second receiver, F'', should contain not more than 2—3 c.c. of liquid, which must be mixed with the distillate in B'; the bottle, F, should not contain any of the distillate. Comparative analyses of the distillates, obtained in this way, and of those obtained by ordinary distillation in air, showed that the fusural and the higher alcohols were identical in both methods. The alcoholic strengths were also identical. The aldehyde were always greater in quantity after ordinary distillation than with vacuum distillation. The esters showed low

results in the case of cognac and mare brandies, and higher results in the case of rums and cherry brandies, after vacuum distillation, as compared with ordinary distillation. The sum of the acidities (volatile and non-volatile) after vacuum distillation was practically identical with the total acidity of the original spirit, whereas with ordinary distillation the total acidity is always increased. A series of six distillations *in vacuo* made at different times with the same sample of spirit gave concordant results. The vacuum method of distillation gives a distillate of which the composition depends less on the skill of the chemist than the ordinary method, and since the mode of heating and condensation is strictly regular, and the chemical action of the air is excluded, the results must be considered to be more accurate than with the ordinary method of distillation. The authors also show that, in ordinary distillation, the analytical results are considerably affected by the manner in which the distillate is collected.—J. F. B.

"Cognac" obtained from *cactus figs* [prickly pears]. A. Sanna. Staz. sperim. agrar. ital., 1908, 41, 550—561. Chem. Zentr., 1909, 1, 675.

THE author drew attention first in 1900 (Annuario della R. Scuola Enologica di Cagliari, 5, 67) to the suitability of *cactus figs* (*Opuntia tuna*, Mill.) for the manufacture of alcohol. Each fruit weighs on the average 104 grms.; it contains 37 per cent. of husk, 4.2 of seeds, 6.75 of proteins, 1.34 of cellulose, and 0.28 of fat. The husks contain 65.84 per cent. of water, 2.81 of ash, and 31.35 of organic matter; the shelled fruit contains 63.32 per cent. of water, 0.9 of ash, and 35.76 of organic matter. The juice contains 15.54 per cent. of extractive substances, 0.1 of free acid, 0.69 of ash, and 11.2 of sugar. For the preparation of spirit, the crushed fruit is pressed in linen bags, and the red juice is mixed with 2 per cent. of vigorously fermenting must, and 2 per 1000 of tartaric acid. When vigorous fermentation is finished, the liquor is distilled on the water-bath. From 196 kilos. of figs, 122 litres of distillate are obtained, equivalent to 16 litres of 45 per cent. alcohol. This distillate is rectified so as to obtain a spirit containing 58 per cent. of alcohol, and this when stored in casks for four years under suitable conditions, yields a cognac, which, it is stated, corresponds completely with genuine cognac.—A. S.

Rum; *Distinction between Jamaica and artificial* —. K. Micko. Z. Untersuch. Nahr. Genussm., 1908, 16, 433.

THE aroma of genuine Jamaica rum is due to a constituent which is neither present in European spirits nor in artificial products. This constituent is a colourless substance, liquid and non-volatile at the ordinary temperature, it boils at a higher temperature than alcohol, is insoluble in dilute caustic soda, and has the general characters of an essential oil; it is not an ester, aldehyde, or ketone. For the distinction of genuine Jamaica rum from artificial products, the odour and taste offer the best means, aided by a process of fractional distillation, the characteristic aroma of the natural product being less volatile than that of the fictitious article. 200 c.c. of the spirit are diluted with 30 c.c. of water, and distilled, seven fractions, each of 25 c.c., being collected. The first two or three fractions contain the esters of formic and acetic acid, and alcohol. The odour of artificial rum comes over mainly in the following fraction. That of genuine Jamaica rum does not generally appear until the fifth and sixth fractions.—J. O. B.

Action of acids on peroxidase. Bertrand and Rozenband. See XXIV.

PATENTS.

Falt liquors; Priming of —. W. J. Melhuish. Glasgow. Eng. Pat. 13,528, June 25, 1908.

THE use of lactose is claimed for the priming of malt liquors.—J. F. B.

Ferment and process of producing it. A. D. Barr, Assignor to Mead Johnson and Co., Jersey City, N.J. U.S. Pat. 911,803, Feb. 9, 1909.

FERMENT is prepared by mixing pancreatin, yeast, sugar, and water, allowing the mixture to stand, evapor-

ating, placing the product in a suitable alkaline culture-medium, allowing it to stand, and evaporating. Generally stated, the constituents are: a proteolytic ferment, an organised ferment, carbohydrate matter, and water.

—J. F. B.

Australian tree called "blackboy"; Industrial utilisation of the — [production of alcohol, sugar, gums, and resins]. R. W. Wallace and G. Reynaud. Tr. Pat. 394,234, Nov. 20, 1907.

THE tree known in Australia under the name of "black-boy" consists of an inner, woody portion rich in saccharine matter, whilst the bark contains considerable quantities of gums, "guttas," and resins. The sugar is analogous to maple sugar, and the woody portion also contains yeasts or ferments. The process described consists in separating the woody portion from the bark, macerating the former with water, and allowing fermentation to take place; the dilute alcoholic solution obtained may then be employed for extracting a further quantity of the wood, until the alcoholic strength of the solution is such that it is worth while to distil the alcohol. The gums, etc., are obtained by treating the finely divided bark with a suitable solvent such, for instance, as the alcohol produced in the first part of the process. Or, the bark may be subjected to the action of the alcoholic vapours produced in the distillation, before these vapours are condensed. The solution containing the gums and resins is then evaporated so that the alcohol may be recovered. The residue obtained from the evaporation is utilisable as such, or the gums may be separated from the resins, etc. by a process of sifting.

—W. P. S.

Worts; After-saccharification of dextrinous —. R. Dietsche. Ger. Pat. 205,057, May 20, 1908. Addition to Ger. Pat. 181,581.

ACCORDING to the main patent (181,581), the wort was run off as hot as possible and was then boiled with the hops, and after a certain time, the boiling was interrupted, the wort cooled to about 70° C., cold mash added, and when the after-saccharification was complete, the whole again boiled, or at least heated to 80°—90° C., to destroy the diastase. According to the present additional patent, the mashing is performed with only the husks and grits of the malt, the hot wort is run off and boiled with the hops and then cooled to about 70° C. The malt flour is added to the cooled wort along with the cold mash and is rapidly saccharified. The wort is then again boiled in order to destroy the diastase.—A. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(A.)—FOODS.

Cocoa; New method of determining theobromine in —. A. Kreutz. Z. Untersuch. Nahr. Genussm., 1908, 16, 579—584.

THE free theobromine is determined as described in this J., 1909, 215. For the determination of the combined theobromine, the cocoa residue on the filter is dried, transferred to the original flask, and heated with 4 per cent. sulphuric acid for about 45 minutes, under a reflux condenser. The hot liquid is transferred to a beaker, neutralised with barium carbonate, and evaporated to dryness in a Hoffmeister capsule. The capsule and contents are then disintegrated with pure sand, and the powder extracted with chloroform for 5 hours in a Soxhlet apparatus. After distilling off the solvent, the white residue is weighed; it represents the theobromine present in the cocoa in the combined form.

—J. O. B.

Formaldehyde; Effect of — upon digestion and health. H. W. Wiley. United States Dept. of Agricult., Bureau of Chem., Circular No. 42, Dec. 21, 1908.

"FORMALDEHYDE is one of those preservatives the use of which in foods has been almost universally condemned by experts, physicians, and the general public." Neverthe-

less, as formaldehyde has heretofore been considerably used in certain foods, especially in dairy products, and is still advertised under its own and other names for use in such products to a limited extent, the author deemed it wise to investigate the question. Medical data indicate plainly that formaldehyde, even taken in small quantities, acts as an irritant to the mucous membrane, the normal organs being at once actively stimulated so as to create for the time a false appetite. The final conclusion arrived at is that the addition of formaldehyde to foods tends to derange metabolism, disturb the normal functions, and produce irritation and undue stimulation of the secretory activities, and is therefore never justifiable.

African oils and oil seeds. See XII.

Mauméné value of oils. Tortelli. See XII.

PATENTS.

Milk: Dedicating — J. H. Campbell, New York, and C. H. Campbell, Philadelphia, Assignors to National Nutrient Co., Jersey City, N.J. U.S. Pat. 910,784, January 26, 1909.

PARTIALLY skimmed milk is heated to a temperature below the coagulating point of albumin, and subjected to a blast of air until it is concentrated to a thick liquid. The latter is then delivered, in the form of a thin layer, on to the surface of a revolving drum heated internally to a temperature below 158° F. The dry film is removed from the surface of the drum before the latter has made a complete revolution, and the practically solid material thus obtained is further dried, and powdered.—W. P. S.

Proteids [casein] from buttermilk; Process of producing certain — L. H. Reuter, Berkeley, Cal. U.S. Pat. 911,269, Feb. 2, 1909.

THE buttermilk is treated, at a temperature of about 32° F., with alkali in order to neutralize the acidity and convert the casein into a soluble compound: the mixture is then heated to about 150° F. for 1 hour or more, with constant stirring, and next boiled for about 1 minute, so as to separate completely the albumin from the soluble casein. After cooling and clarifying, the mixture is filtered and the casein is precipitated from the heated filtrate by means of sulphurous acid.—W. P. S.

Potatoes; Process of treating the juice of — R. Goldschmidt, Taikowitz, Austria. Eng. Pat. 8699, April 21, 1908.

SEE Fr. Pat. 390,018 of 1908; this J., 1908, 1077.—T. F. B.

(B.)—SANITATION; WATER PURIFICATION.

Drinking water; Purification of — Times Eng. Suppl., Feb. 17, 1909.

ATTENTION is now being directed to non-submerged sand-filters for the purification of potable waters, and Dr. Miquel (of the Saint-Maur Experim. Station, Paris.) has lately conducted a long series of interesting experiments. The principle of the sand-filter, not submerged or sunk below the water-line, is as follows:—On a bed of fine-grained sand, 1·20 metre in thickness, the water undergoing purification is distributed in the form of fine rain. The surface of the filter must never become covered with a layer of liquid, even of the thinnest character. The water penetrates into the sand, percolates through it, and issues freed from any bacteria it may have previously contained. The filter must be thoroughly drained at its base. The sand must be of a fairly fine grain, preferably such as will pass through a sieve with meshes of 1 square mm. in size. Dr. Miquel's tests have been carried out with experimental filters constructed of sheet iron, 80 cm. in diameter. He has ascertained that thicknesses of sand less than 1·20 metre in depth were insufficient to effect the sterilisation of the water. The sterilisation is defective for a time after starting a new filter, but at the end of a few days, or in some cases after several weeks, it becomes satisfactory. It then wholly removes all the bacteria, and may continue

to work properly for many months without cleansing. In those instances where the liquid under treatment is the turbid water of a river, the degeneration of the filter is more rapid, but this can be avoided by a preliminary straining process in a non-submerged filter only 30 cm. in depth. The town of Chateaudun, where for many years past typhoid fever has been prevalent, has just proceeded to instal a filter on this principle, and the results obtained there have recently been laid before the Society of Civil Engineers. Sand from the river Loire was used, screened through a millimetre sieve. The filter-bed has a superficial area of 250 square metres, and the speed of filtration ranges between three and five cubic metres per metre of surface in 24 hours. It has been shown by an analysis that all the injurious bacteria were removed, and it has also been demonstrated that it is essential to avoid clogging the filter.

PATENTS.

Sewage; Treatment of — E. W. Ives, Gomersal, Yorks. Eng. Pat. 10,557, May 15, 1908.

THE invention relates to the construction of a tank or filter in which the sewage is treated. Inclined walls or slabs are placed across a tank, the walls reaching nearly to the bottom and top alternately, so that the sewage is caused to pass successively under one wall and over the next. The space between the walls may be filled with any suitable filtering material.—W. P. S.

Sewage and the like; Apparatus for the purification of — by means of sieves placed in the current of liquid. G. Windschild. Fr. Pat. 394,582, Sept. 23, 1908. Under Int. Conv., Feb. 17, and July 29, 1908.

THE sieves have the form of conical drums which are mounted horizontally, so that the lower side of the drum is immersed in the sewage or water flowing along a channel. The drums are rotated and the matters collecting on the sieves are removed by jets of compressed air when the sieve reaches the uppermost position. The jets of air are admitted to the outside of the sieve through pipes having slit-like openings, and the solid matters fall from the sieves into a shoot by which they are carried away. Means are provided for causing the pipes supplying the air-jets to pass to and fro over the surface of the sieve, and partitions or ribs are fitted on the sieves so that the solid matters do not fall off before they are over the mouth of the shoot. The lower part of the drum is supported by rollers, and a second sieve may be fixed inside the main sieve.—W. P. S.

Water; Purification of — [electrolytically]. D. L. V. Browne, Assignor to J. B. Miller, San Francisco, Cal. U.S. Pat. 910,495, Jan. 26, 1909.

THE electrolytic vessel consists of a tank provided with an inlet and outlet, and furnished with a series of anodes and cathodes "made of iron, zinc, manganese dioxide, and aluminium, the various metals being alternately placed." A series of carbon anodes and cathodes is placed at the discharge end of the tank, in order to accelerate the "flocculation" of the hydrous oxides of the undesirable metals.—B. N.

(C.)—DISINFECTANTS.

Cresol soaps; Evaluation of solutions of — W. Spalteholz. Chem.-Zeit., 1909, 33, 181—182.

A METHOD of determining the amount of water in cresol soap is based upon the fact that such soaps give clear solutions with glacial acetic acid, and that these become turbid from the separation of cresols and fatty acids on the addition of a sufficient quantity of water. Cresol soaps containing about 61 per cent. of cresol, and water up to about 13 per cent. yield clear solutions with glacial acetic acid in all proportions. When the proportion of water is above 13 per cent., there is either an immediate turbidity, or there is solution followed by turbidity. On now adding more acetic acid, a clear solution is again obtained, after the addition of a certain amount. Thus when 5 c.c. of cresol soap are treated drop by drop with

glacial acetic acid and no turbidity results, the amount of water cannot exceed 13 per cent. On titrating 5 c.c. of a cresol soap with 50 per cent. acetic acid, the amount required to produce a permanent turbidity decreases with the increase in the proportion of water. This is shown in the following results obtained with a typical cresol soap on addition of 50 per cent. acetic acid:—

Per cent. of cresol in soap	66.7	64.0
Per cent. of water in soap	5.4	9.3
Acid required to produce first turbidity, in c.c.	—	0.4
" " " " clear solution	—	2.8
" " " " final turbidity	13.4	12.5

3—6 hours. In order to facilitate the resolution of the fibre bundles, petroleum is added to the material in the digester to the extent of 5—10 per cent. of the weight of the bagasse. The boiled material is then reduced to pulp and washed in a kneading machine, refined between horizontal millstones, strained, again refined in a Jordan mill and converted into paper. (2). A cellulose pulp is prepared by digestion with

62.7	60.7	53.9	50.6	48.9	47.2	45.5
11.2	14.0	23.6	28.4	30.8	33.1	35.4
0.2	0.1	turbid	turbid	turbid	turbid	turbid
3.1	3.5	4.3	4	5.0	5.4	—
12.0	11.8	9.7	8	8.0	6.9	—

In practice this affords a rapid means of determining, e.g., whether a delivery of soap is up to sample, and an increase of 1 per cent. of water may be readily detected by the use of acetic acid of definite strength as a reagent.

—C. A. M.

Ferrous arsenate as an insecticide on plants. Vermorel and Dantony. *Compt. rend.*, 1909, 148, 302—304.

ALL the soluble salts of arsenic have an injurious action on the green organs of plants, which prevents their use as insecticides. The insoluble cupric-arsenic compounds, Scheele's green and Schweinfurth's green, when mixed with lime, are efficient and innocuous insecticides, but they lack the quality of adhesion. Lead arsenate, prepared by double decomposition, possesses all the qualities required of a good insecticide, but its white colour may cause fatal mistakes, and its use has been forbidden in consequence. The authors have employed ferrous arsenate with success for three years, and contend that this compound is free from all objections. They prepare solutions containing 400 grms. of crystallised sodium arsenate and 60 grms. of ferrous sulphate per 10 litres respectively. The iron solution is added cautiously to the arsenate solution until the mixture shows a blue reaction with uricamide test paper; the mixture is then diluted to 100 litres for use. It is important that the iron salt should be a slight excess over the arsenate. The precipitate contains ferrous hydroxide in addition to ferrous arsenate; it has a dull green colour, is an efficient insecticide, and adheres well. The proportions indicated above produce a wash containing 200 grms. of ferrous arsenate per 100 litres; stronger washes, containing 500 grms. per 100 litres, adhere still more completely. Vines, which are the plants most sensitive to the "scorching" action of arsenic preparations, suffer no ill effects from the latter dose, but a wash of 200 grms. per 100 litres is quite sufficient.

—J. F. B.

XIX.—PAPER, PASTEBOARD, &c.

PATENTS.

Agar-cane and similar substances; Process of treating — G. D. Burton, Boston, Mass. U.S. Pat. 909,987, Jan. 19, 1909.

THE specification describes a variety of treatments of vegetable fibres, with baths of soap, of salts including alates, and of electrolytic products.—A. S.

From plants, esparto, etc.; Manufacture of cellulose from — by electro-chemical treatment. F. E. M. Dubrot and J. M. E. Lockhart. Fr. Pat. 394,111, Sept. 5, 1908.

PARTS and other plants, after steeping, are subjected to the action of an electric current in presence of a solution containing sodium chloride and "soda." In this way the cellulose fibres are separated from the parenchyma, and encrusting substances are dissolved.—J. F. B.

gasse; Treatment of — for conversion into cellulose or pulp for paper or boards. Comp. Industriel de Cellulose. Fr. Pat. 394,143, Aug. 8, 1908.

TWO kinds of pulp may be made:—(1). The bagasse is led with water under a pressure of 4—6 atmospheres for

alkaline solutions and treatment in a breaking engine and beater in the usual manner.—J. F. B.

Paper pulp [from seaweed]; Process for the manufacture of — V. J. Kuess. Fr. Pat. 394,494, Sept. 21, 1908.

PLANTS of the algæ group, particularly seaweeds of all varieties, are dried in the air, cleaned and freed from sand. They are then digested at a temperature between 125° and 130° C. with an alkaline solution, preferably composed of 2 kilos. of potassium carbonate, 1 kilo. of sodium carbonate, and 0.5 kilo. of sodium hydroxide per 100 litres. The digestion is complete after 1—2 hours, and the fibres are then treated mechanically in the usual manner.

—J. F. B.

Viscose; Manufacture of cellulose derivatives from — L. Lilienfeld, Vienna. Eng. Pat. 8798, April 21, 1908.

CELLULOSE derivatives which are stable in the dry condition and are soluble in dilute alkalis, ammonia, or even in warm water, are prepared by treating crude or purified viscose, or one of its derivatives, with an oxidising agent, such as a permanganate or manganate, and precipitating the product. For instance, 10 kilos. of a solution of the zinc salt of viscose in soda lye of 3—15 per cent. strength, containing 300—600 grms. of cellulose, are mixed with successive portions of a solution containing 50—180 grms. of potassium permanganate in 2—3 litres of water. The mixture thickens at first, but on continued agitation it becomes mobile. After standing for some hours, the manganese oxides are filtered off and the cellulose compound is precipitated by an acid; or else, the whole mixture is precipitated by acid and the manganese oxides are removed by sulphurous acid. The precipitated compound is finally washed and dried; it is then soluble in a 2 per cent. sodium hydroxide solution. The solution of the sodium or ammonium compound may be dried, so as to give a product soluble in water, or insoluble metallic compounds may be obtained by precipitation with a zinc or copper salt.—J. F. B.

Cellulose compositions; Manufacture of stable — E. A. L. Rouxeville. Fr. Pat. 393,310, June 1, 1908. Under Int. Conv., June 3, 1907.

THE modified terpene hydrocarbons described in previous patents (this J., 1906, 83; 1907, 988, 1133) are soluble in the same media and mix very intimately with nitro-cellulose, natural or vulcanised gums (caoutchouc, gutta-percha, shellac) and rubber substitutes; and compositions, which are considerably more stable than celluloid when heated, are made by mixing these substances, in various proportions according to the properties desired. In certain cases ordinary cellulose may be incorporated with the terpene product, and the mixture treated with nitric acid.—J. F. B.

Plastic masses, coatings, films, imitation leather, etc. [from cellulose]; Process of manufacturing — F. Meyer. Fr. Pat. 393,963, Aug. 29, 1908.

SOLUTIONS of cellulose compounds (nitrates, acetates, and viscose) are converted into the plastic condition by the simultaneous presence of both a solvent and a coagulating substance, in such proportions that the cellulose derivative is neither truly dissolved nor fully coagulated. These plastic compositions are not sticky and can be worked in a highly concentrated condition by the usual

spreading machines. If, for instance, cellulose acetate be employed, the plastic mass is made by means of a mixture of acetone and water. Such a mass can be applied to cloth or paper and at the same time a pattern may be impressed on it with an engraved roller.—J. F. B.

Cellulose threads, etc. Fr. Pat. 394,586. See V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Enzymes capable of hydrolysing salicin and arbutin. W. Sigmund. Monatsb. Chem., 1909, 30, 77–87.

A NEW enzyme *salicase*, has been obtained from the twigs, bark and leaves of numerous varieties of willow and poplar. It slowly hydrolyses salicin to dextrose and saligenin, but is quite without action on amygdalin and is therefore not identical with emulsin. The enzyme is active either in the aqueous liquid obtained by soaking the twigs, etc., of the plant for 1–2 days or when precipitated from this by means of alcohol. In a similar manner an enzyme, *arbutase*, has been detected in ling (*Calluna vulgaris*) and bilberry (*Vaccinium myrtillus*), which hydrolyses arbutin to dextrose and quinol. This also is without action on amygdalin.—E. F. A.

Bark of Prunus serotina; Constituents of the —. Isolation of *l*-mandelonitrile glucoside. F. B. Power and C. W. Moore. Chem. Soc. Proc., 1909, 25, 27.

THE material employed, consisting of the air-dried bark of *Prunus serotina*, Ehrhart, yielded on maceration with water an amount of hydrogen cyanide corresponding with about 0.075 per cent. of its weight. It has been shown to contain *l*-mandelonitrile glucoside, $C_{11}H_{17}O_6N$ (m.p. 145–147° C.; $[\alpha]_D^{20} = -29.6$), which has also been obtained as its tetra-acetyl derivative (m.p. 136–137° C.; $[\alpha]_D^{20} = -24.0$), and an enzyme which hydrolyses β -glucosides. An alcoholic extract of the bark, on distillation with steam, yielded small amounts of benzoic acid and an essential oil, but no hydrogen cyanide. The non-volatile constituents of the bark consisted of a green resin, insoluble in either hot or cold water; a brown resin, soluble in the hot aqueous liquid, but deposited on cooling, and material which remained dissolved in the cold aqueous liquid. The green resin, amounting to about one per cent. of the weight of the bark, yielded a phytosterol, $C_{27}H_{46}O$ (m.p. 135–136° C.; $[\alpha]_D^{20} = -34.0$), palmitic, stearic, oleic, linolic, and isolinolenic acids, a little ipuranol, $C_{23}H_{38}O_2(OH)_2$, and, after acid hydrolysis, oleic acid, dextrose, and β -methylasculetin, $C_{10}H_8O_4$. The brown resin, amounting to about one per cent. of the weight of the bark, yielded, after acid hydrolysis, traces of a phytosterol, small amounts of oleic acid, β -methylasculetin, and dextrose, along with insoluble, red, resinous material. The portion of the alcoholic extract which was soluble in cold water contained the *l*-mandelonitrile glucoside, together with a quantity of sugar and tannin. It yielded, furthermore, benzoic, trimethylgallic, and *p*-cumaric acids, and traces of a substance melting at 240–241° C., and, after heating with dilute sulphuric acid, *l*-mandelic acid and β -methylasculetin were obtained.

Pinene; Oxidation of — with mercuric acetate. G. G. Henderson and J. W. Agnew. Chem. Soc. Proc., 1909, 25, 35.

By the action of aqueous mercuric acetate at the ordinary temperature, pinene is converted into sobrerol, $C_{10}H_{16}(OH)_2$, a compound formerly prepared by oxidising pinene with moist oxygen in sunlight, and sobrerol is oxidised to a hydroxyketone, $C_{10}H_{15}(OH)O$, when heated with the same reagent. The hydroxyketone is reduced to sobrerol when dissolved in moist ether and treated with sodium, and it yields carvacrol on reduction with aqueous hydriodic acid in the cold. When heated for a short time with anhydrous oxalic acid, it yields carvone together with some carvacrol, and when it is oxidised with an acidified solution of potassium permanganate, terpenylic acid is obtained. Hence it is concluded that the hydroxyketone is 8-hydroxy-carvotanacetone. Sobrerol can also be prepared by the

action of mercuric oxide on a cold solution of pinene in acetic acid, whilst if the solution be heated, the oxidation product is the hydroxyketone.

Essential oils; Constituents of —. Inversion of carvenene, $C_{10}H_{16}$, to isocarvenene. F. W. Semmler. Ber., 1909, 42, 522–527.

WHEN carvenene (this J., 1909, 106) is boiled with a 25 per cent. solution of sulphuric acid in alcohol, a terpene is produced. This is styled *isocarvenene*, and boils at 59–62° C. at 10 mm., has $n_D^{20} = 1.480$, and the sp. gr. 0.845 at 20° C. The terpinene obtained from sabinene dihydrochloride by the action of aniline was treated with bromine, when terpinolene tetrabromide was isolated. Carvenene, when reduced with sodium and amyl alcohol, forms dihydrocarvenene ($C_{10}H_{18}$, Δ^2 -tetrahydrocymene), which boils at 55–56° C. at 12 mm., and has the sp. gr. 0.824 at 20° C., and $n_D^{20} = 1.461$. By the oxidation of carvenene with ozone, a diketone, $C_8H_{14}O_2$, is produced, boiling at 82–86° C. at 10 mm., and having the sp. gr. 0.95 at 20° C., and $n_D^{20} = 1.433$; the dioxime melts at 130° C.—F. SHOX.

Cinnamomum zeylanicum, Breyer; Essential oil of the root-bark of —. A. A. L. Pilgrim. Pharm. Weekblad, 1909, 46, 50–54. Chem. Zentr., 1909, 1, 534.

THE light yellow oil has a strong odour of camphor; it is miscible with alcohol, ether, petroleum spirit, and benzene; and camphor, which is the chief constituent, separates from it even at the ordinary temperature. It contains also pinene, cineol, dipentene, phellandrene, eugenol, safrol, caryophyllene, and borneol. It has the sp. gr. 0.99366 at 15° C., and optical rotation, $+50.2^\circ$ in a 20 mm. tube.—A. S.

Suprarenine; A new synthesis of —. Note on K. Böttcher's communication. H. Pauly. Ber., 1909, 42, 484–485. (See this J., 1909, 218.)

THE author calls attention to the fact that Böttcher gives no analytical data or physical constants in support of his claim to have synthesised suprarenine (*loc. cit.*). Böttcher merely gives qualitative tests and asserts that his product has the same pharmacological action as suprarenine. The author recently attempted, without success, to produce suprarenine by the action of methylamine on 3:4-dihydroxyphenylhalogenethanolamine (Ber., 1908, 41, 4151), a method very similar to that adopted by Böttcher.—F. SHOX.

Atoxyl. III. F. Blumenthal and E. Jacoby. Biochem. Zeits., 1909, 16, 20–36. (See this J., 1908, 710.)

THE toxicity of atoxyl (sodium *p*-aminophenylarsinate) is affected by alteration of the amino-group in the sense indicated by Ehrlich and Berthelm (Ber., 1908, 40, 3292). Thus, introduction of an acetyl radical into the amino-group is accompanied by considerable diminution of the toxicity, which, however, is not affected by replacement of the amino-hydrogen by other groups, such as methyl. Complete replacement of the amino-group by iodine or hydroxyl results in increased toxicity. In the case of the mercury salt of *p*-aminophenylarsinic acid, changes in the amino-group have little influence on the toxicity. A non-poisonous product, such as the mercury salt of *p*-iodophenylarsinic acid, may, indeed, result, but the toxicity of the mercury compounds seems to be influenced more by the content of mercury than by any alteration of the amino-group. Changes in the arsenic group lead to very considerable variation in the poisonous properties, the reduction products of atoxyl and acetylatoxyl (arsacetin) being, under some circumstances, 20 to 30 times as toxic as atoxyl itself.—T. H. P.

Diphenylmethane; Preparation of —. A. Nastjukow. J. Russ. Phys.-Chem. Ges., 1908, 40, 1376–1379. Chem. Zentr., 1909, 1, 534–535.

THE author has improved the older method of preparing diphenylmethane and its homologues, by dispensing with the use of glacial acetic acid, and instead heating the mixture for 3 hours. In this way 25 grms. of diphenylmethane were obtained from 100 c.c. of formalin, 100 c.c.

of concentrated sulphuric acid, and 200 c.c. of benzene. Ditolylmethane and 3-3'-dinitrodiphenylmethane were prepared in a similar manner from toluene and nitrobenzene respectively.—A. S.

Nitromethane; Preparation of — W. Steinkopf, Ber., 1908, 41, 4457—4458.

The author describes an improvement of Preibisch's method (J. prakt. Chem., 1874, [2], 8, 310), whereby it is possible to obtain a yield of 49 per cent. of the theoretical quantity of nitromethane. A solution of 146 grms. of potassium carbonate in 200 grms. of water is added to a solution of 200 grms. of monochloroacetic acid in 200 grms. of water, the mixture being cooled. The precipitate formed redissolves on vigorous agitation. A solution of 300 grms. of potassium nitrite in 300 grms. of water is now added, and the whole is heated under a reflux condenser, until evolution of carbon dioxide begins, whereupon the flame is removed. The heat of the reaction is sufficient to keep the mixture boiling for some time, and the nitromethane distils over with the steam; the distillation is completed with the aid of the flame. The nitromethane is separated from the distillate, and the aqueous portion is redistilled three or four times to recover a further quantity. After drying with calcium chloride, the nitromethane is mixed with a quantity of mercuric oxide and again distilled.—A. S.

Nitromethane; Preparation of — A. Wahl, Bull. Soc. Chim., 1909, 5, 180—182.

The author has obtained yields of nitromethane amounting to from 50 to 52 per cent. of the theoretical quantity by a process somewhat different from that of Steinkopf (see preceding abstract). He uses throughout sodium salts instead of the corresponding potassium compounds; adds only one-fifth more than the theoretical quantity of nitrite; and distils over the nitromethane from the reaction product by means of a current of steam.—A. S.

Radioactive parent substances; Chemistry of the — D. Strömholm and T. Svedberg, Z. anorg. Chem., 1909, 61, 338—346.

The authors have applied the method of isomorphous crystallisation or precipitation to the study of radioactive substances, in the present paper to the study of thorium. It was found that Rutherford's thorium X is isomorphous with barium and lead and accompanies the former metal in precipitation-reactions; it must therefore belong to the group of alkaline-earth metals. Thorium 3 (radiothorium) is isomorphous with thorium and hence is probably quadrivalent. Thorium 2 is probably trivalent, being isomorphous with lanthanum.—A. S.

Radioactive product of the uranium series; A new — J. Darne, Compt. rend., 1909, 148, 337—339.

In treating the crude oxide of uranium X, obtained in the usual manner, with a small quantity of very dilute hydrochloric acid, a new radioactive product is obtained, mixed with ferric chloride. The new product is the immediate parent-substance of uranium X, into which it gradually changes, and is an intermediate product in the formation of uranium X from uranium. Its complete separation from uranium offers considerable difficulty.—E. F.

PATENTS.

Formic acid; Method for manufacturing — W. A. Dyes, Manchester. From A. Hempel, Leipzig-Plagwitz, Germany. Eng. Pat. 3428, Feb. 15, 1908.

FORMIC acid is manufactured by heating formates *in vacuo* with acids or acid salts, such as strong sulphuric acid, bisulphate, or pyrosulphate, the acid or acid salt being added in small portions, as the distillation proceeds. This method decomposition of the formic acid is prevented.—F. SONX.

Pinene hydrochloride; Treatment of liquid or oily and obtainment of solid pinene hydrochloride and camphene therefrom. W. H. Bentley, C. Weizmann, and Clayton Aniline Co., Manchester. Eng. Pat. 7319, Apr. 2, 1908.

In the production of pinene hydrochloride, the solid

product, which is useful for the manufacture of camphene, is always accompanied by a liquid, oily product, which is not suitable for that purpose. This liquid contains a considerable quantity of the solid hydrochloride in solution. The latter constituent may be recovered by oxidising the oily impurity by heating with dilute nitric acid (25 per cent.). An alternative process consists in polymerising the oily impurity with concentrated or fuming sulphuric acid at a temperature not exceeding 40° C. The liquid is converted into a polyterpene from which the solid hydrochloride may be separated by extraction with petroleum. A third method consists in heating the oil with a solution of an alkali or earthy hydroxide at a temperature of about 240° C., and fractionating the product after distillation with steam; in this case camphene is obtained directly.—J. F. B.

Hydro-aromatic alcohols or thymol and salicylic esters;

Process for preparing mixed carbonates of — Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 206,055, Dec. 15, 1907.

THE compounds, which possess all the therapeutic properties of their constituents, are obtained (1), by the action of the carbonate or chlorocarbonate of a hydro-aromatic alcohol or of thymol on salicylic esters; (2), by the action of the chlorocarbonate of a salicylic ester on a hydro-aromatic alcohol or thymol; (3), by treating a mixture of a salicylic ester and the alcohol with phosgene.—T. F. B.

Salicylic acid compounds; Process for preparing readily absorbed, non-irritant — N. Sulzberger and L. Spiegel. Ger. Pat. 206,056, May 4, 1906.

COMPOUNDS which have antiseptic properties, and which do not irritate the skin, are obtained by the action of fatty acids, containing not more than 12 carbon atoms, on salicylic acid or its derivatives in which the hydroxyl group is free. Thus, oleylsalicylic ethyl ester is obtained by heating sodium oleate with ethyl salicylate, in presence of phosphorus oxychloride, to 100° C.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Sensitised surfaces or films for photographic purposes;

Production of — W. H. Caldwell, Inverness, Eng. Pat. 1689, Jan. 24, 1908.

THE object of this invention is to produce sensitive surfaces on which images can be produced either by long exposure only, or by short exposure and subsequent development. To attain this result, a substance must be present which is not reduced by light after its oxidation by the liberated halogen; which will not reduce the silver salt used, in the dark; and which will absorb the halogen as rapidly as it is set free by light. Certain salts of hydrazine and hydroxylamine or their derivatives fulfil these conditions, such as hydrazine sulphate, sulphite, or phosphate, or a salt of a fatty hydrazine or hydroxylamine; when a colloid emulsion is used, formylhydrazine may be employed. The substances named may be added to the emulsion before its application to the support, or an ordinary plate, film, or paper may be immersed in a solution of the substance.—T. F. B.

Grained screens for making colour photographs; Manufacture of — C. L. A. Brasseur, Orange, N.J., U.S.A.

Eng. Pat. 18,750, Sept. 7, 1908. Under Int. Conv., Sept. 9, 1907.

A PAPER or other support is coated with an adhesive substance, which is allowed to dry; a number of grains of celluloid or other transparent substance, of different light-selection properties, are applied to the support, which is then rendered adhesive and allowed to dry; the excess of grains is removed, and the adhering grains are transferred to a transparent support, *e.g.*, of celluloid, and subjected to heat and pressure, to flatten them out;

a thin solution of celluloid is sprayed on the surface, and the film is polished between hot metal plates. (See also McDonough, this J., 1892, 937, and Lumière, this J., 1905, 104.)—T. F. B.

Polychrome screens for colour photography: Method of making —. C. L. A. Brasseur, Orange, N.J., U.S.A. Eng. Pat. 20,909, Oct. 3, 1908. Under Int. Conv., Oct. 4, 1907.

A SUPPORT is covered, in portions of its surface, such as in dots, with an adhesive; coloured grains are dusted on it, the excess removed when the adhesive is dry, and the remainder of the surface is similarly treated with grains of one or more other colours.—T. F. B.

Colour screens for colour photography or like purposes: Process for making —. Verein. Kunstseide-Fabr., A.-G., Kelsterbach a/M., Germany. Eng. Pat. 21,839, Oct. 15, 1908. Under Int. Conv., July 13, 1908.

SHEETS of celluloid or other suitable transparent, plastic material, are impressed in an etched metal line matrix, when a series of parallel recesses is formed on the sheet. The surface is printed with printer's ink, and the sheet, after the back has been suitably insulated, is stained with an alcoholic solution of a suitable dyestuff; the ink is now removed, and the surface of the sheet printed with a second colour. If it is desired to make three or more colour screens, the sheets are again impressed with an etched matrix, the resulting recesses being at right angles to the first set, and the process repeated.—T. F. B.

Photographs on plates, films, etc., with colour screens: Process for obtaining — in artificial light. G. Krebs, Fr. Pat. 304,067, Sept. 9, 1908.

COMPOSITIONS for producing artificial light for use in taking colour photographs through screens are composed of aluminium and magnesium powders, together with salts of copper, barium, cesium, indium, and thallium, amorphous phosphorus, or other substances giving green, blue, or violet colours to the flame. In using these lighting compositions, the screens are coloured with tartrazine.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Safety explosives: Tests with —. Beyling, Glückauf, 1909, 45, 109—115.

At Gelsenkirchen, safety explosives are now tested against firedamp alone, and against coal dust alone, instead of as previously against a mixture of the two (see this J., 1909, 42). The experiments were carried out in the manner previously explained, the cartridges being 35 mm. in diameter. They were fired without stemming from a mortar with a 55 mm. borehole. The explosive mixture consisted of 8 to 9 per cent. of firedamp mixed with air, and in the case of the coal dust experiments, 12 litres of fine coal dust were used, 10 litres being spread upon the floor of the gallery, whilst the other 2 litres were kept in motion in the chamber. In all, 27 different explosives were tested and the author gives in tabular form the composition of these explosives and the weight of each which either does or does not ignite the coal dust and firedamp respectively. In some cases the maximum charge which would go into the borehole was employed. In the case of other more powerful explosives, it was not considered safe to work with the maximum charge, on account of the possibility of over-straining the gun. A lesser weight was consequently used. In both instances the quantity of explosive causing ignition was therefore not actually determined.

The new explosives which have been tested are much better than the old, from the point of view of safety, but have the disadvantage of being less powerful. It is hardly possible to alter this, and therefore the less powerful explosives should be used only at those points of the mine where safety blasting agents must be

employed. One noticeable feature is that a considerable proportion of the explosives tested contained very large percentages of sodium chloride or potassium chloride, or a mixture of the two. There seems to be no doubt that sodium chloride is of very considerable advantage as regards increasing the safety of an explosive, with a coal dust mixture. This is strikingly shown in the following instance:—

150 grms. of *Carbonite No. 1* exploded the coal dust mixture, whilst 635 grms. of *Carbonite 1A* were fired in the mixture without igniting it. As will be seen from the composition of these two explosives, it is to the presence of sodium chloride that this increased feature of safety must be attributed. *Carbonite No. 1*: Nitroglycerin (25.0), sodium nitrate (30.5), flour (39.4) and potassium bichromate (5.0 parts). *Carbonite 1A*: Nitroglycerin (21.0), sodium nitrate (30.0), flour (38.0) and sodium chloride (7.0 parts).

The following explosives, as typical of some of the results, have been selected from the list given:—

Gesilit No. 1: Nitroglycerin jelly (30.75), dinitrotoluene (5.25), sodium chloride (7.0), sodium nitrate (18.0) and dextrin (39.0 parts).

Gesilit No. 2: Nitroglycerin jelly (30.75), dinitrotoluene (5.25), ammonium nitrate (22.0), sodium chloride (21.0) and dextrin (21.0 parts).

Kohlensilesia 4A: Potassium chlorate (80.0), resin (16.0) and nitrated resin (4.0 parts).

Fördit 1C: Nitroglycerin (24.5), collodion cotton (1.0), nitrotoluene (31.0), flour (2.0), dextrin (2.0), glycerin (5.5), ammonium nitrate (32.0) and potassium chloride (30.0 parts).

Verstärktes Chromammonit: (Reinforced chromammonite), Ammonium nitrate (70.0), potassium nitrate (10.0), tri-nitrotoluene (12.5), chrome ammonium alum (7.0) and vaseline (0.5 parts).

Explosive.	Firedamp explosive mixture.		Coal dust explosive mixture.	
	Ignition with:	No ignition with:	Ignition with:	No ignition with:
	grms.	grms.	grms.	grms.
Gesilit 1	845	800	—	867*
Gesilit 2	250	200	—	700*
Kohlensilesia 4A	—	400*	—	400*
Fördit 1C	350	300	—	700*
Verstärktes Chromammonit	400	350	350	300

* Maximum amount of explosive which could be charged into the mortar.

—G. W. McD.

ERRATUM.

This Journal, 1906, 560, col. 2, line 16 from bottom. For "Mommi," read "Monni."

PATENT.

Wrappers for blasting explosives. Kynoch, Ltd. Birmingham, and J. P. Udall, Walmley, Warwick. Eng. Pat. 9259, April 29, 1908.

THE object of the invention is to reduce the amount of material (the "turnover") on the end of a blasting explosive cartridge, which forms an objectionable waste between the ends of successive cartridges in a bore-hole. The sides of the wrapper (which form the ends when it is wrapped round the cartridge) are cut so as to taper instead of being parallel; the narrow end of the taper is only the length of the cartridge, and at the other end it is this length plus allowance for turnover. Thus the total amount of paper in the turnover is exactly half that resulting with an ordinary wrapper having parallel edges.—F. SOBX.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

PATENTS.

Pyknometer. W. R. Bousfield, Hendon, Middlesex. Eng. Pat. 4861, Mar. 3, 1908.

THE apparatus consists of twin cylindrical vessels, the conical upper ends of which communicate by tubes of fine bore with conical cups closed by stoppers. These twin vessels are connected together near their lower ends by a short tube and higher up by a handle which serves to suspend the apparatus in a thermostat. The instrument is used in the ordinary way, and the level is finally observed with a magnifying glass, to ascertain when a constant temperature has been attained; it is filled by suction, and air bubbles are readily removed by working the liquid backwards and forwards. Before removal from the thermostat, the cups are wiped out with a suitably shaped swab. The advantages claimed for the apparatus are: (1), its suitability for use at temperatures above or below that of weighing; (2), the great accuracy of the results obtained; (3), the readiness with which air bubbles are removed; and (4), its lightness and strength. (See Chem. Soc. Trans., 1908, 93, 679.) —F. SODN.

Calorific value of gases; Methods of and devices for determining the —. F. P. Schönberger, Sagn, Germany. Eng. Pat. 2314, Feb. 1, 1908.

EE Fr. Pat. 386,294 of 1908; this J., 1908, 715.—T. F. B.

Glue-tester. U.S. Pat. 911,277. See XIV.

INORGANIC—QUANTITATIVE.

Lead; Determination of — by the peroxide method. W. S. Medell, Eng. and Min. J., 1909, 87, 262. (See also Ericson, this J., 1908, 860.)

5 GRM. of the ore is decomposed with 10 c.c. of sulphuric acid (1:1) and 5 c.c. of a mixture of hydrochloric and nitric acids, and evaporated till fumes of sulphuric anhydride are evolved. If manganese be present, a few crystals of sodium sulphite are added to reduce any manganates. The assay is cooled and filtered, decanting as far as possible and washing several times with sulphuric acid. Six lots of 15 c.c. of a hot 3 per cent. solution of caustic soda are passed through the filter and caught in the vessel containing the residues, the filter being then well washed with hot water. The solution is boiled to dissolve the lead sulphate, cooled to 90° C., and 15 to 35 c.c. of 5 per cent. solution of potassium bromide, saturated with bromine, added. The solution is heated nearly to boiling, the constant stirring for 5 minutes, and set aside to settle, care being taken that the excess of bromine is not boiled off. It is then decanted through a filter and the paper washed once with cold water. The precipitate is washed by decantation, with three lots of 25 c.c. of water, and the filter transferred to the beaker containing the residue, and 250 c.c. of water and 5 c.c. of orthophosphoric acid added. Standard ferrous ammonium sulphate solution is added in excess to dissolve the peroxide, excess being titrated back with standard potassium permanganate solution. The ferrous ammonium sulphate solution contains 18.958 grms. per litre, 1 c.c. serving to reduce 0.005 grm. of lead from the peroxide to the monoxide. A permanganate solution contains 1.528 grms. per litre. The method is said to be short, accurate, and not affected by contaminating elements.—F. R.

Stannic acid, chromic acid, and iron; Determination of — in the presence of each other. G. Edgar, Amer. Sci., 1909, 27, 174—178.

STANNIC acid, chromic acid, and iron (ferrie) may be accurately determined in the presence of each other by the iodometric method already described (this J., 1908, 1057), provided that the chromium is determined separately by reduction with arsenious acid; for the ferrie salt is unaffected in the first distillation and is reduced by the hydriodic acid in the second. The process

is carried out, therefore, as previously indicated (*loc. cit.*), and, in another portion of the solution the chromic acid is determined by slightly acidifying with sulphuric acid, adding 3 c.c. of syrupy phosphoric acid, to precipitate the iron, and an excess of standard arsenious acid, beyond that required by the chromic acid; the solution is allowed to stand for 15—20 mins., and is then made alkaline with sodium bicarbonate, and an excess of standard iodine solution added; after standing further for from 30 minutes to an hour in a stoppered flask, the excess of iodine is removed by arsenious acid and the titration finished with iodine.—F. SODN.

Phosphoric acid; Determination of — by a colorimetric method. I. Ponget and D. Chouchak, Bull. Soc. Chim., 1909, 5, 104—109.

THE method is based on the insoluble character of the precipitate formed by the action of phosphomolybdic acid on strychnine. A very sensitive reagent is made by mixing 2.5 c.c. of pure nitric acid with 10 c.c. of a 15 per cent. solution of sodium molybdate, and then adding 1 c.c. of a cold saturated solution of strychnine sulphate. With only 0.005 mgrm. of phosphoric acid per 100 c.c., this reagent, which should be freshly prepared and perfectly clear, gives an opalescence which continues to develop for about 20 minutes. For the determination, a solution of the substance (containing 0.01 to 0.05 mgrm. of phosphoric oxide) in nitric acid is prepared, and this is evaporated to dryness on the water-bath; the cold residue is taken up by 10 c.c. of 35 per cent. nitric acid, the mixture shaken at intervals for 20 minutes, and the liquid then decanted or filtered through a small filter which has been washed with nitric acid and water; the volume of liquid is brought up to about 47 c.c. by washing, the liquid shaken, mixed with 2 c.c. of the reagent, and the mixture made up to 50 c.c. As a standard, 10 c.c. of nitric acid (35 per cent.) are added to 3 c.c. of a solution of phosphoric acid containing 10 mgrms. of phosphoric oxide per litre, water is added to about 47 c.c., and then, after shaking, 2 c.c. of the reagent are added and the volume made up to 50 c.c. After standing for 20 minutes a colorimetric comparison of these solutions is made, the opalescence showing in the colorimeter as a yellowish-brown tint, and the depths of the two liquids giving equal tints are taken as inversely proportional to the amounts of phosphoric acid present. The method gives accurate results with very small quantities of phosphoric acid, and the presence of calcium, iron, magnesium, aluminium, potassium, and sodium does not affect the determination, unless their amount is very large in comparison with that of the phosphoric acid. It is applicable to the analysis of such substances as water, soils, manures, and iron (containing more than 0.03 per cent. of phosphorus). Arsenic should not be present in larger proportion than 2—3 times that of the phosphorus. When very large quantities of other elements are present, the phosphoric acid may first be separated from the acid solution by adding a ferric salt and calcium carbonate, and the precipitate obtained then dissolved and the solution dealt with as above.—F. SODN.

Phosphates; Determination of — colorimetrically. C. Estes, J. Amer. Chem. Soc., 1909, 31, 247—250.

IN the determination of phosphates by the colorimetric method with ammonium molybdate, the intensity of the colour obtained, is very materially influenced by the presence of certain salts. The extent of this influence has been studied with the salts mentioned below, and the results show that the error in reading does not exceed 5 per cent. with a maximum of:—5 parts of sodium sulphate (decahydrate), 10 parts of potassium nitrate or magnesium sulphate (hydrate), 15 parts of potassium hydrogen sulphate, 20 parts of calcium nitrate, magnesium nitrate, or sodium chloride, 30 parts of potassium ethyl sulphate, or 50 parts of sodium nitrate per 10,000 of the solution. —F. SODN.

ORGANIC—QUALITATIVE.

Jamaica and artificial rum. Micko. See XVII.

ORGANIC—QUANTITATIVE.

- Maximum value of oils.* Tortelli. See XII.
Fatty acids in soap. Fendler and Frank. See XII.
Analysis of chocolate. Hübener. See XIII.
Sugar syrups. Tschitschenko. See XVI.
Sugar in bagasse. Pellet. See XVI.
Analysis of spirits. Girard and Chauvin. See XVII.
Theobromine in cocoa. Kreutz. See XVIII.
Cresol soaps. Spaltcholz. See XVIII.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Colloids; Extension of the idea of "solubility" to —. J. Duclaux. *Compt. rend.*, 1909, **148**, 295—297.

THE ordinary conception of a saturated solution is not applicable to colloids, but their "solubility" may be defined by another method. If a solution be enclosed in a vessel, the walls of which are permeable by the solvent but not by the solute, and subjected to a pressure higher than the osmotic pressure, the solvent will filter through the walls and the concentration of the solution will increase up to a limit. The pressure at which the solvent ceases to pass away and the colloid becomes solid, is called the "maximum osmotic pressure" and the concentration of the colloid at the limit, represents its "solubility." At the ordinary temperature, the "solubility" of gelatin is about 4 per cent., that of gelose, less than 1 per cent., whilst certain preparations of ferric hydroxide and of tungstic acid remain soluble up to 60 per cent. The maximum pressure of Predig's platinum solution is less than 2 cm. of water, whilst that of ferric hydroxide exceeds 20 m. The principle is useful for defining and measuring certain properties appertaining to colloidal solutions. *Stability.*—The stability of a colloidal solution is proportional to its maximum pressure or maximum "solubility," and may thus receive numerical expression. *Variability.*—When a coagulating substance is added to a solution of a colloid in quantity insufficient to induce coagulation, it modifies the properties of the solution either visibly or invisibly. Such modification is immediately indicated by a lowering of the maximum osmotic pressure of the solution. *Fractionation.*—In certain cases it is possible to effect a partial separation of two colloids in solution, when they have very different maximum osmotic pressures. Such separations, however, are never complete, and as a general rule, all colloids may be regarded as isomorphous. *Classification.*—The determination of the maximum osmotic pressure affords a ready means of describing a series of colloids of the same order. For instance, a very wide range of maximum pressures is shown by the various modifications of starch, of colloidal gold, and of ferric hydroxide. The basis of the phenomena of "solubility" and of maximum osmotic pressure, appears to lie in the properties of the micella itself, and is closely dependent on the size, the chemical composition, and particularly the electrical charge of the latter. Thus, one of the fundamental properties of the colloidal state is brought within the range of experimental expression.

—J. F. B.

Benzene ring [Tyrosine, etc.]; Introduction of iodine into the —. A. Oswald. *Z. physiol. Chem.*, 1909, **58**, 290—294.

WHEN a solution of albumin is treated with a solution of iodine in potassium iodide, a dark brown precipitate of an iodine derivative is gradually formed; the presence of a small amount of alkali is favourable. The product is a periodide, which readily parts with a portion of its iodine. After treatment with thiosulphate and washing, a nearly colourless product remains, which contains from 10 to 14 per cent. of combined iodine, according to the

nature of the original protein. The reaction has been ascribed to the presence of tyrosine in the protein molecule, but it is not peculiar to tyrosine, since other proteins, such as gelatin, which contain no tyrosine group, also combine with iodine. The author has made experiments in order to see whether other products of the hydrolysis of proteins containing benzene derivatives were capable of entering into combination with iodine. Experiments with phenylalanine led to negative results. On the other hand a large number of phenolic bodies readily yielded iodine derivatives when treated with iodine in presence of alkali. The author enunciates the general rule: that the presence of a hydroxyl group in the benzene nucleus imparts to the latter the property of combining readily with iodine, whilst benzene derivatives which contain no hydroxyl groups do not possess this property. The property of combining readily with iodine is also possessed by pyrrole derivatives, e.g., in the case of tryptophane, also by combined pyrrol derivatives, e.g., indole; pyrrole itself yields tetra-iodopyrrole under the above-mentioned conditions.—J. F. B.

Peroxydase; Action of acids on —. G. Bertrand and M. Rozenband. *Compt. rend.*, 1909, **148**, 297—300.

IN a previous paper (this J., 1907, 983) it was shown that traces of certain acids have a powerful inhibitory effect on the oxidising action of laccase, and that quantitatively their action is proportional to their molecular weight and inversely to their degree of basicity; the action also affords a quantitative idea of the activity of the electro-negative group attached to the manganese. The authors have now studied the action of acids on the activity of a preparation of peroxydase obtained from wheat, measuring this activity by the orange coloration developed by the ferment in a solution of guaiacol and hydrogen peroxide. In this case the acids could not be divided into two groups, one active and the other inactive, as in the case of laccase. According to their inhibitory action on peroxydase, the various acids may be arranged in a continuous series, the order of which corresponds approximately with that of their electrical conductivities, or perhaps rather of their catalytic activities. On setting out in one table the relative inhibitory power of several of the acids towards peroxydase, and in another table their relative inverting power on sucrose, it is noticed that the order is the same in both tables, but that the numerical proportions are different for the two kinds of action. There is, therefore, some disturbing influence, and this perhaps explains the fact that certain other acids do not show an approximate relationship between the two kinds of activities. This disturbing factor may possibly be the presence of neutral salts, which modify the degree of influence of the acids, so that the inhibitory effect depends not only on the acid function, but also to a large extent on the radical to which this function is attached. Lastly, the authors conclude, from the difference in the inhibitory action of acids, that the oxidising action of peroxydase is probably regulated by a very different mechanism from that of tyrosinase and laccase.—J. F. B.

Amylase; Presence of — in old grain. Brocq-Rousseau and E. Gain. *Compt. rend.*, 1909, **148**, 359—361.

GRAINS of wheat, 50 years old, which had lost their germinating power, were found to still contain diastases (dextrinase and amylase) capable of transforming starch into sugar.—E. F.

Trade Report.

United States; Imports into and exports from the — in 1908. Oil, Paint, and Drug Rep., Feb. 6, 1909.

	IMPORTS.	
	1907.	1908.
Alizarin and alizarin colours, lb.	4,676,197	3,157,30
Ammonium sulphate, lb.	70,440,992	76,475,10
Aniline salts, lb.	7,950,092	5,487,02
Argols or wine lees, lb.	32,757,138	25,260,71
Asphaltum or bitumen, crude, tons ..	127,002	131,80
Bark, hemlock, cords ..	—	—
Bark, cinchona, or other quinine, lb. ..	4,132,900	3,368,32
Cement, lb.	802,491,371	335,698,77

	1907.	1908.
Clay of all kinds, tons.....	261,187	196,778
Coal tar colours and dyes.....	\$5,850,557	\$4,531,539
Dyewood, extract of, lb.....	4,567,582	3,612,226
Other dyewoods.....	\$82,955	\$30,395
Gambier, lb.....	28,135,870	29,651,307
Glue, lb.....	7,185,640	6,648,471
Glycerin, lb.....	43,671,988	28,114,505
Grease and oils.....	\$925,819	\$960,420
Grease.....	\$307,435	\$307,437
Guano, tons.....	20,141	31,469
Gum, acabic, lb.....	5,546,062	4,300,170
Gum, camphor, crude, lb.....	3,669,889	1,812,718
Gum, camphor, refined, lb.....	—	128,989
Gum, chicle, lb.....	6,740,392	6,089,850
Gum, copal and kauri, lb.....	28,021,390	21,344,138
Hops, lb.....	7,849,548	7,163,356
Indigo, lb.....	7,341,148	6,225,755
Iodine, crude, lb.....	256,934	153,796
Lead, mfrs. of.....	812,736	\$46,486
Lead in ore, lb.....	141,075,082	218,573,433
Lead, pigs, bars, etc., lb.....	18,554,899	5,518,619
Lime, chloride of, or bleaching powd., lb.....	112,090,783	74,602,059
Linseed or flaxseed, bushels.....	81,582	—
Mineral water, doz. qts.....	1,233,033	1,011,656
Oil, coconut, lb.....	14,421,279	47,577,803
Oil, fish and other, gals.....	1,264,663	1,206,048
*Oil, mineral:—		
†Dead or cresote, gals., free.....	9,048,043	31,559,146
‡All other, dutiable.....	8,191,506	9,287,260
§All other, free.....	12,313,691	2,116
Oil, olive, mfg., gals.....	1,638,199	1,074,091
Oil, olive, other, gals.....	3,688,568	3,805,542
Oil, palm, lb.....	29,126,449	44,256,049
Oils, volatile or essential.....	\$2,687,712	\$2,276,439
and distilled.....	\$1,139,354	\$656,783
Paints and colours.....	\$2,107,122	\$1,495,998
Phosphate, crude, tons.....	29,141	31,469
Other fertilisers.....	\$4,994,346	\$4,394,434
Plumbago, tons.....	20,480	10,260
Potash, carbonate of, lb.....	27,566,363	18,684,399
Potash, caustic or hydrate of, lb.....	8,532,646	5,359,558
Potash, muriate of, lb.....	252,303,441	214,338,887
Potash, nitrate of, or saltpetre, crude, lb.....	18,291,890	16,118,160
Potash, all other, lb.....	—	—
Quebracho, extract of, lb.....	88,067,111	87,132,049
Quinine, all sorts of, oz.....	3,250,207	1,817,229
Shellac, lb.....	18,418,135	11,336,800
Soap, fancy, perfumed, and all toilet, lb.....	1,094,320	1,067,919
Soap, all other.....	\$399,747	\$380,545
Soda, ash, lb.....	6,198,136	3,515,933
Soda, nitrate of, tons.....	364,610	310,713
Soda, other salts of, lb.....	11,678,023	7,850,681
Spirits, proof gals.....	4,981,450	3,849,121
Sulphur or brimstone, crude, tons.....	20,318	19,118
Sumac, ground, lb.....	10,130,628	9,990,460
Wax, vegetable or mineral, lb.....	7,725,900	7,544,855

EXPORTS.

	1907.	1908.
Acids:—		
Sulphuric, lb.....	\$381,914	\$42,599
All other.....	—	\$326,469
Acetate of lime, lb.....	73,561,560	56,703,015
Alcohol, including pure neutral or		
Colome spirits, gals.....	405,458	131,301
Alcohol, wood, gals.....	2,468,167	1,380,820
Ashes, pot and pearl, lb.....	1,215,812	879,376
Bark for tanning, lb.....	3,208,468	3,417,494
Bark extracts for tanning.....	\$271,522	\$255,616
Beeswax, lb.....	—	—
Candles, lb.....	4,794,003	3,076,149
Cement, brls.....	900,550	846,528
Copper sulphate, lb.....	7,258,943	7,663,882
Cottonseed, lb.....	16,135,325	40,995,830
Dyes and dyestuffs.....	\$459,798	\$393,336
Glass, window.....	\$131,017	\$71,574
All other.....	\$2,670,964	\$2,123,627
Glucose, lb.....	131,228,473	95,482,151
Glue, lb.....	3,367,239	2,526,448
Grape sugar, lb.....	17,243,554	27,862,339
Grease and all soap stock.....	\$6,163,739	\$4,988,477
Gunpowder, lb.....	1,794,474	877,344
Lampblack.....	\$459,030	\$481,162
Lard, lb.....	589,268,236	581,934,236
Lard, compounds and substitutes for, lb.....	83,410,209	76,739,375
Naphtha, including all lighter products, gals.....	34,625,525	43,889,844
Oil cake, corn, lb.....	61,071,086	55,603,993
Oil cake, linseed, lb.....	714,596,395	685,870,902
Oil cake, cottonseed, lb.....	1,183,433,747	1,217,783,444
Oil, corn, gals.....	3,568,571	2,717,804
Oil, cottonseed, gals.....	39,115,276	48,930,381
Oil, fish, gals.....	595,285	56,168
Oil, illuminating, gals.....	905,924,296	1,129,004,833
Oil, lard, gals.....	221,600	260,515
Oil, linseed, gals.....	409,677	297,331

* "Dutiable," if imported from countries which impose duty on like articles imported from the United States, otherwise free.

† Not separately stated prior to July 1, 1907.

‡ For 1907 figures represent only "gallons dutiable."

§ Included in "All other fixed or expressed, etc." prior to July 1, 1907.

	1907.	1908.
Oil, lubricating, gals.....	152,028,855	147,769,024
Oil, mineral, crude, gals.....	126,306,549	149,190,017
Oil, mineral, residuum, gals.....	75,774,754	77,551,683
Oil, peppermint, lb.....	150,295	172,539
Oil, other essential.....	\$217,619	\$244,770
Oil, other vegetable.....	\$421,781	\$487,097
Oil, other animal, gals.....	556,793	704,633
Oleo oil, lb.....	204,307,701	195,213,681
Oleomargarine, lb.....	3,331,696	2,739,662
Paints and colours.....	—	—
Paraffin wax, lb.....	207,504,494	141,667,470
Phosphate rock, tons.....	1,018,212	1,188,411
Other fertilizers.....	45,000	40,578
Mercury, lb.....	384,913	224,692
Soap, toilet or fancy.....	81,206,717	\$1,110,498
Soap, all other, lb.....	60,595,544	53,569,895
Spermaceti, lb.....	—	—
Spirits, turpentine, gals.....	17,176,843	19,433,181
Starch, lb.....	59,085,836	31,518,019
Sulphur or brimstone, crude, tons.....	35,925	27,894
Tallow, lb.....	109,568,040	70,489,762
Tar, brls.....	16,708	12,367
Turpentine and pitch, brls.....	44,721	10,992
Varnish, gals.....	882,199	852,345
Washing powder, lb.....	7,998,658	7,244,994
Zinc, oxide of, lb.....	26,512,920	24,016,254
Zinc, in pigs, lb.....	1,126,753	5,280,314

New Books.

THE MANUFACTURE OF EXPLOSIVES. TWENTY YEARS' PROGRESS. Four Cantor Lectures delivered at the Royal Society of Arts in November and December, 1908. By OSCAR GUTTMANN. Whittaker and Co., 2, White Hart Street, Paternoster Square, London, E.C., and 64 and 66, Fifth Avenue, New York, 1909. Price 3s. net.

Svo volume, containing 80 pages of subject-matter, with coloured frontispiece and 11 illustrations in the text, and an alphabetical index. The matter of the four lectures is classified as follows:—I. State of the Art in 1886. Black powder, or other nitrate mixtures. Chlorate mixtures. Picric acid and picrates, &c. II. Manufacture of nitro-glycerine, Dynamites, Guncotton, Nitrostarch, &c. III. Smokeless powders: History; Manufacture; Flameless powders; Safety explosives; Coal dust; Safety explosives in practice. IV. Use of nitrocellulose for celluloid, artificial silk and varnish; Machinery driven by explosives; Factories, their construction, &c.; Merits and demerits of explosives; Stability and its proof; Stabilisers; Accidents with smokeless powder; &c.

ZWANZIG JAHRE FORTSCHRITTE IN EXPLOSIVSTOFFEN. Vier Vorträge gehalten in der Royal Society of Arts in London. November—Dezember, 1908. Von OSCAR GUTTMANN. Julius Springer's Verlag, Berlin, 1909. Price M. 3.

The same work in German.

PHYSIKALISCHE CHEMIE DER METALLE. Sechs Vorträge über die wissenschaftlichen Grundlagen der Metallurgie. Von Dr. RUDOLF SCHENCK, Professor der Physik. Chemie an der Tech. Hochschule zu Aachen. Wilhelm Knapp's Verlag, Halle a. S. 1909. Price M. 7.00.

LARGE Svo volume, containing 183 pages of subject-matter with 114 illustrations, an index to literature referring to all the six lectures, and alphabetical indexes of names and subjects. The subject-matter of the lectures is classified as follows:—I. Alterations of form; Electrical and optical properties of the metals; Theory of electrons. II. Metallic solutions and alloys. III. Alloys of metals with carbides, oxides, sulphides. Iron and steel; Phase rule. IV. Metallurgical reactions. Oxidation and reduction. V. Decomposition of carbon monoxide; Blast furnace process. VI. Reactions of the sulphides.

ON THE CALCULATION OF THERMO-CHEMICAL CONSTANTS. By H. STANLEY REDGROVE, B.Sc. Edward Arnold, 41 and 43, Maddox Street, London, W. 1909. Price 6s.

Svo volume, containing 99 pages of subject-matter, including an appendix of 4 pages, criticising Thomsen's method of calculating the thermal constants of organic substances. The work closes with an alphabetical index of the substances referred to in the text. The text is classified as follows:—I. Calculation of physico-chemical

constants. II. Calculation of thermo-chemical constants. (i.), Thermal constants of the hydrocarbons. (ii.), Thermal constants of organic halogen compounds; of organic oxygen compounds. (iii.), Thermo-chemical evidence for von Baeeyer's strain theory. (iv.), Thermal constants of organic sulphur compounds; and of organic nitrogen compounds. (v.), Summary and Conclusion.

A COMPENDIUM OF FOOD-MICROSCOPY, WITH SECTIONS ON DRUGS, WATER, AND TOBACCO. Compiled, with additions and revision, from the late Dr. A. H. HASSALL'S works on Food. By EDWY GODWIN CLAYTON. Baillière, Tindall and Cox, 8, Henrietta Street, Covent Garden, London. 1909. Price 10s. 6d. net.

8vo volume, containing 391 pages of subject-matter, with a frontispiece, and 282 plates and illustrations, followed by a glossary of terms, a bibliographic list of works of reference, list and index of illustrations, and the alphabetical index. The subject-matter receives the following arrangement:—I. Foods derived from vegetable sources. II. Foods derived from animal sources. (i.), Flesh. (ii.), Animal parasites which infest flesh. (iii.), Fish. (iv.), Milk and cream. (v.), Butter. (vi.), Cheese and cheese mites; Lard; Isinglass; Gelatin. III. Tobacco, Drugs, Bitters, and Colouring matters. IV. Water.

THE EVERYDAY USES OF PORTLAND CEMENT. The Associated Portland Cement Manufacturers, Ltd., Portland House, Lloyd's Avenue, London, E.C. 1909. Price 2s. 6d. net.

8vo volume, containing 156 pages of subject-matter, and 148 illustrations, the table of contents at the beginning serving as an index. The subject-matter is classified under the following heads:—I. Portland cement. II. Aggregates. III. Concrete. IV. Memoranda for concrete users. V. Workmanship. VI. Reinforced concrete. VII. Concrete blocks and moulded concrete. VIII. Various uses of concrete. IX. Some novel uses of concrete.

INTERNATIONAL CATALOGUE OF SCIENTIFIC LITERATURE. Sixth Annual Issue. D. CHEMISTRY. Harrison and Sons, 45, St. Martin's Lane, London, W.C. Price 37s. 6d.

8vo volume of 1078 pages, being an index of the chemical literature of 1906; the various works are indexed both under authors' names and subjects, the subjects catalogue being divided into sections, in each of which the final arrangement is in the alphabetical order of authors' names. There are also subject indexes in English, French, German, and Italian.

COAL TABLES, 1907. Parly. Paper No. 377. Wyman and Sons, Fetter Lane, E.C. Price 6d.

THIS return contains statistical tables relating to the production, consumption, and imports and exports of coal in the British Empire and the principal foreign countries in each year from 1885 to 1907, as far as the particulars can be stated; together with statements showing the production of lignite and petroleum in the principal producing countries for a series of years (in continuation of Parliamentary Paper No. 349, of Session 1907).

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

3757. Tebbutt. Treatment of materials by disintegration or pulverisation.* Feb. 15.
3922, 3923, and 3924. Dawkins (McLeod). Centrifugal separators.* Feb. 17.

4057. Peake. Electrical pyrometers. Feb. 19.
4089. Horner. Drying ovens.* Feb. 19.
4107. Elliott. Apparatus for purifying fumes and gases. Feb. 19.
4183. Longsdon and Bottomley. Centrifugal drying machines or hydro-extractors. Feb. 20.
4325. Marks (John Kommanditges, Maschinenbauanst.). Centrifugal apparatus for separating purposes.* Feb. 22.
4330. Love. Furnaces. Feb. 22.
4358. Sherwood. Filtering apparatus. Feb. 22.
4604. Vallat. *See under XVII.*
4701. Schlicht. Dehydrating peat and the like, and apparatus therefor. Feb. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

3685 (1908). Place. *See under VII.*
5685 (1908). Davey and Davey. Treating brine or other chemical to be concentrated, evaporated, or distilled, and the manufacture of vegetable black. Feb. 24.
13,360 (1908). Dixon and Middleton. Pyrometers. March 3.
16,047 (1908). Aktiebolaget Separator. Continuous strainer. Feb. 24.
17,756 (1908). Arbuckle and Osborne. Separating comminuted ore and other solid from liquids. Feb. 24.
25,323 (1908). Flick. Distilling apparatus. Feb. 24.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

3809. Green. Mantles for incandescent gas lighting. Feb. 16.
3918. Hutchins. Gas producers. Feb. 17.
3951. British Thomson-Houston Co. (General Electric Co.). Manufacture of incandescent electric lamp filaments.* Feb. 17.
3981. Gutensohn. Manufacture of combustible briquettes. Feb. 18.
4164. British Thomson-Houston Co. (General Electric Co.). Manufacture of filaments or conductors of refractory material suitable for electric lamps.* Feb. 19.
4375. Conran. Distillation of coal and by-products resulting therefrom. Feb. 22.
4792. Koppers. Preserving coke-oven walls. [Ger. Appl., March 11, 1908.]* Feb. 26.

COMPLETE SPECIFICATIONS ACCEPTED.

1409 (1908). Seymour. Coke ovens. March 3.
6047 (1908). Coke Ovens and By-Products Co., and Wellington. Coke ovens. March 3.
8186 (1908). Wellington and Everest. Manufacture of gas. Feb. 24.
12,856 (1908). Seaby-Smith. *See under X.*

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

4375. Conran. *See under II.*
4604. Vallat. *See under XVII.*

COMPLETE SPECIFICATION ACCEPTED.

25,318 (1908). Thompson (Lingner). Manufacture of condensation products of wood tar with formaldehyde. March 3.

IV.—COLOURING MATTERS AND DYE-STUFFS.

APPLICATIONS.

3758. Meister, Lucius, und Brüning. Manufacture of dyestuffs. [Ger. Appl., Aug. 31, 1908. Addition to No. 3602 of 1909.]* Feb. 15.
4767 and 4678. Newton (Bayer and Co.). Manufacture of azo dyestuffs. Feb. 26.
4859. Wülfing, Dahl, and Co. Azo dyes. [Ger. Appl., Feb. 13, 1909.]* Feb. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

- 5582 (1908). Newton (Bayer und Co.). Manufacture of indigo compounds. Feb. 24.
 7418 (1908). Badische Anilin und Soda Fabrik. Manufacture of colouring matters of the anthracene series. Feb. 24.
 20,094 (1908). Imray (Soc. Chem. Ind. in Basle). Manufacture of sulphurised vat dyestuffs of the anthracene series. March 3.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

3670. Rhodes. Apparatus for treating with liquids wool yarn and other fibrous materials. [Addition to No. 17,038 of 1908.]* Feb. 15.
 3719. Ransford (Cassella and Co.). Production of two-coloured effects on mixed fabrics. Feb. 15.
 3871. Gates and Gates. Dye jigs. Feb. 17.
 4104. Friedrich. Producing solutions for spinning artificial threads, etc. [Ger. Appl., Feb. 19, 1908.]* Feb. 19.
 4362. Courtanld and Gilles. Manufacture of crepe. Feb. 22.
 4683. Ellis (Heberlein et Cie.). Mercerising textile fabrics.* Feb. 25.
 4757. Hart. Dyeing yarns and fabrics with pigments. Feb. 26.
 4799. McDonough. Wool scouring and drying machine. [Australian Appl., Aug. 22, 1908.]* Feb. 26.

COMPLETE SPECIFICATION ACCEPTED.

- 759 (1908). Malard. Treating textile and other materials by liquid processes. Feb. 24.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

3650. Thwaites and Ralph. Treating liquors containing metallic compounds. Feb. 15.
 3704. Davidson. Fire-extinguishing compounds.* Feb. 15.
 3732. Larsen. Manufacture of silicon nitride. [Appl. in Norway, Feb. 17, 1908.]* Feb. 15.
 3939. Vautin. Treatment of neutral nitrates. Feb. 17.
 3959. Eijzman. Purification of sea-water or brine for separating salts. [Comprised in No. 11,388, May 26, 1908.]* Feb. 18.
 4167. Thwaites and Ralph. Treating and utilising liquors containing copper. Feb. 20.
 4224. Bowen. Apparatus for dearsenicating sulphuric or other acid. Feb. 20.
 4465. Barton. Manufacture of certain lead oxides or salts. Feb. 23.
 4494. Beskow and Ekedahl. Removing superphosphate from decomposition chambers. [Swed. Appl., March 2, 1908.]* Feb. 23.
 4763. Thomas and Davies. Production of oxalic acid. Feb. 26.
 4872. Chem. Fabr. Bettenhausen Marquart und Schulz. Production of a permanent ammoniacal solution of cupric acid. [Ger. Appl., March 25, 1908.]* Feb. 27.
 4876. Higgins. Manufacture of sulphite and sulphate of ammonia. Feb. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

- 3685 (1908). Place. Apparatus for liquefying air. Feb. 24.
 3740 (1908). Ward, and Barnstone Blue Lias Lime Co. Lime kilns. Feb. 24.
 3902 (1908). Dyes (Hempel). Manufacture of calcium oxalate. Feb. 24.
 3904 (1908). Dyes (Hempel). Manufacture of oxalic acid. Feb. 24.
 4897 (1908). Dyes (Hempel). Manufacture of formates and oxalates. March 3.
 5502 (1908). Goodwin and Burgess. Generation of ozone. Feb. 24.
 5685 (1908). Davey and Davey. *See under I.*

9725 (1908). Weiss. *See under XXIII.*

- 11,865 (1908). Newton (Bayer und Co.). Manufacture of alkali hydrosulphites. Feb. 24.
 15,554 (1908). Brünler. Producing an air mixture of a high ratio of oxygen from the atmosphere. March 3.
 18,434 (1908). Gibbs. Manufacture of chromates and aluminates. Feb. 24.
 20,199 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable, anhydrous hydrosulphites. Feb. 24.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATION.

4819. Lees. Abrasive or polishing material.* Feb. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

- 3255 (1908). Hadlington and Webster. Regenerative gas-fired kilns for pottery, tiles, etc. Feb. 24.
 3485 (1908). Keppeler and Spangenberg. Treatment of clay, kaolin, or ceramic masses. Feb. 24.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

4048. Claypoole. Hard agglomerate material and process for producing same.* Feb. 18.
 4512. Williams and Morris. Fire cements. Feb. 24.

COMPLETE SPECIFICATION ACCEPTED.

- 4579 (1908). Lavery. Continuous kilns for burning brick and the like. March 3.

X.—METALS AND METALLURGY.

APPLICATIONS.

3915. Kirk. Manufacture of iron, steel, and other metals. Feb. 17.
 3925. Bennett (Hormenkoi). Gold retort. Feb. 17.
 4153. Vautin. Concentration of copper ores. Feb. 19.
 4257. De Wyckoff. Alloy for use in making bullets, projectiles, etc.* Feb. 20.
 4342. Vautin. Wet separation of copper from its ores or compounds. Feb. 22.
 4357. Isherwood. Treatment of refractory lead zinc ores. Feb. 22.
 4471. Hemingway. Recovering lead and zinc from compounds. Feb. 23.
 4531. Martin. Separation of complex ores. Feb. 24.
 4558. Soc. Franç. Electrolytique. Extraction of metals from their ores. [Fr. Appl., Feb. 25, 1908.]* Feb. 24.
 4563. Howard and Hadley. Treating the fumes from zinc retorts. Feb. 24.
 4574. Soc. Franç. Electrolytique. Extraction of copper and analogous metals from ores and alloys. [Fr. Appl., Feb. 25, 1908.]* Feb. 24.
 4641. Industrial and Mineral Research Synd., Ltd., and Moeller. Separating metal combinations from the gangue of minerals and from each other by electro-magnets. Feb. 25.
 4667. Lysaght, Ltd., and Beddoe. Zinc condensers. Feb. 25.
 4805. Francis. Treatment of finely-divided ores.* Feb. 26.
 4914. Rouse. Preparation of copper ore concentrates for smelting. Feb. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

- 3651 and 3652 (1908). Casterline. Hardening and tempering steel. Feb. 24.
 4142 (1908). Foniakoff. Agglomeration of small finely-divided ores. March 3.
 4424 (1908). Harbord. Drying blast for metallurgical furnaces. Feb. 24.
 12,452 (1908). Lamon and Thomas. Improving the physical properties of metals and their alloys. Feb. 24.
 12,856 (1908). Seely-Smith. Gas producers for use in the manufacture of steel. Feb. 24.
 16,428 (1908). Mennicke. Preparing, smelting, and utilising products containing tin, especially the sponge and

slime obtained in electrolytic removal of tin from tin-plate scrap. March 3.

- 16,521 (1908). Hughes. Metallurgical furnaces. March 3.
17,756 (1908). Arbuckle and Osborne. *See under I.*

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

4175. Ruthenburg. Electrodes for electric furnaces. Feb. 20.
4553. Aktiebolaget Elektrometall. Electric furnace. [Swed. Appl., March 10, 1908.]* Feb. 24.

COMPLETE SPECIFICATIONS ACCEPTED.

- 13,134 (1908). Usine Genevoise de Dégrossissage d'Or. Electrolytic cells for separating the constituents of a mixture of metals or an alloy. Feb. 24.
16,428 (1908). Mennicke. *See under X.*
21,234 (1908). Lutz. Electroplating. Feb. 24.

XII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

3744. Bellé. Apparatus for making artificial ultramarines.* Feb. 15.
4040. Jagenberg. Production of printing-ink and oil paints. [Ger. Appl., Feb. 19, 1908.]* Feb. 18.
4695. Matthews, Pim, and Strange. Manufacture of white lead. Feb. 25.
4866. Tinkler. Production of colour by heating certain substances. Feb. 27.

COMPLETE SPECIFICATION ACCEPTED.

- 5685 (1908). Davey and Davey. *See under I.*

(B.)—RESINS, VARNISHES.

APPLICATION.

4878. Strange and Burrell. Manufacture of varnish. Feb. 27.

(C.)—INDIA-RUBBER.

APPLICATIONS.

4031. Price. Apparatus for reducing vulcanised rubber or rubber mixtures to powder. [Addition to No. 893 of 1907.] Feb. 18.
4154. Commercial Products Co. (Brend). Production of a plastic and elastic substance.* Feb. 19.

COMPLETE SPECIFICATIONS ACCEPTED.

- 3659 (1908). Immisch. Manufacture of goods of rubber, ebonite, or vulcanite. Feb. 24.
3940 (1909). Immisch. Manufacture of goods of rubber, ebonite, or vulcanite. Feb. 24.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

APPLICATIONS.

4130. Lake (Fiber Products Co.). Production of artificial leather.* Feb. 19.
4488. Lehmann. Treatment of skins and hides to remove fat, grease, and lime, and to disinfect them.* Feb. 23.

XV.—SUGAR, STARCH, GUM, Etc.

APPLICATION.

4263. Woosnam (Whetham). Treatment of amylaceous substances. Feb. 20.

XVII.—BREWING, WINES, SPIRITS, Etc.

APPLICATIONS.

4584. Thompson (Topf und Soehne). Drums for the germination of malt.* Feb. 24.
4604. Vallat. Apparatus for distilling or rectifying wines, brandy, fermented worts, alcohols, petrols, benzines, essential oils, and other liquids. [Fr. Appl., Feb. 25, 1908.]* Feb. 24.
4635. Adlam. Apparatus for chilling and carbonating beer, stout, and other liquids.* Feb. 25.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATION.

4210. Little. Treatment of flour. Feb. 20.

COMPLETE SPECIFICATION ACCEPTED.

- 27,218 (1908). Wesener. Apparatus for preparing gaseous mixtures for bleaching flour, etc. Feb. 24.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATION.

4212. Candy. Purification of water. Feb. 20.

XIX.—PAPER, PASTEBOARD, Etc.

APPLICATION.

3883. Armitage and Ibbetson, Ltd., and others. Glazing paper, cardboard, etc.* Feb. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

- 4390 (1908). Stevens. Celluloid and process for making same. March 3.
8268 (1908). Cross and Russell. Treatment of by-products from esparto grass. March 3.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

4128. Imray (Meister, Lucius, und Brüning). Manufacture of 1-p-dialkylaminoaryl-2,4-dialkyl-3-oxy-methyl-5-pyrazolones. Feb. 19.
4246. Imray (Meister, Lucius, und Brüning). Manufacture of arsonoaryl glycolic acids and arsonoarylthioglycolic acids. [Addition to No. 9855 of 1908.] Feb. 20.
4321. Newton (Bayer und Co.). Manufacture of a pharmaceutical compound. Feb. 22.
4564. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of albumose silver compounds. Feb. 24.
4604. Vallat. *See under XVII.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 11,457 (1908). Johnson (Boehringer und Soehne). Manufacture of salicylic acid derivatives. Feb. 24.
15,122 (1908). Johnson (Verein. Chininfabr. Zimmer und Co.). Santalol esters. Feb. 24.
21,566 (1908). Baekeland. Condensation product. Feb. 24.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATION.

4713. Fenske. Manufacture of irregular grain screen plates for direct colour photography. Feb. 25.

COMPLETE SPECIFICATION ACCEPTED.

- 12,341 (1908). Smith. Toning reagents and processes for toning photographic prints. Feb. 24.

XXII.—EXPLOSIVES, MATCHES, Etc.

APPLICATIONS.

3937. Lake (Verein. Köln-Rottweiler Pulverfabr.). Manufacture of plastic ammoniacal saltpetre explosives.* Feb. 17.
4094. Guttman. Buildings for the manufacture and storage of explosives. Feb. 19.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATION.

3733. Davies and McLellan. Determining the condition of the atmosphere in schools, factories, etc. Feb. 15.

COMPLETE SPECIFICATION ACCEPTED.

- 9725 (1908). Weiss. Estimating phosphoric acid. Feb. 24.

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Official Notices.

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ANNUAL GENERAL MEETING.

NOTICE IS HEREBY GIVEN that the Annual General Meeting of the Society will be held in the Jehangier Hall, Imperial Institute Buildings, London, S.W., at 10.30 in the morning of Wednesday, May 26th next.

In accordance with the provisions of By-law 21, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire on their respective offices at the forthcoming Annual Meeting.

Prof. Ira Remsen has been nominated to the office of President under By-law 20; Dr. G. Beilby, F.R.S., Mr. Grant Hooper, and Dr. R. Messel, have been nominated as Vice-Presidents under By-law 21, and Prof. R. Meldola has been nominated a Vice-President under By-law 20. Mr. Thomas Tyrer has been appointed Hon. Treasurer, and Dr. L. Mond, F.R.S., Hon. Foreign Secretary, under By-law 35.

Members are hereby invited to nominate, on or before April 22nd next, fit and proper persons to fill four vacancies among the ordinary members of the Council under By-law 24. Forms for this purpose can be obtained, on application, from the Secretary of the Society.

By-law 23:—An ordinary member of Council shall be nominated by ten or more members upon Form B in

the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any member, but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:

a. The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

b. The nomination is not made on the authorised printed form or substantially not in the manner directed thereon.

c. The nomination form is signed by less than ten members not disqualified or not ineligible to nominate as provided by the By-laws.

d. The nomination form is not received before or upon the day appointed therefor.

e. The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid shall receive notice thereof from the Secretary, and shall not be submitted for election.

Notice is also given under the provisions of By-law 38 that the Regulations set forth below will be submitted for consideration and confirmation by the members assembled at the same meeting.

CHARLES G. CRESSWELL.

Secretary.

DRAFT REGULATIONS

TO BE SUBMITTED TO

THE ANNUAL GENERAL MEETING

FOR CONFIRMATION.

(Under By-Law 38.)

MEMBERS.

1. At whatever period of the year a new Member may be elected he shall be required, unless the Council shall determine otherwise, to pay his subscription for that year; having done which he shall be entitled to receive all the numbers of the Society's Journal for that year. (c.f. By-law 7.)

2. If a Member who has been duly elected, and has paid an Entrance Fee and one or more subscriptions, resigns under By-law 14, and later seeks re-election, the Council may re-admit him without further Entrance Fee.

ANNUAL GENERAL MEETING.

3. When a ballot is required under By-law 2, then at such stage in the proceedings of the Annual General Meeting as shall be most convenient, the Members present shall hand their Ballot Lists to the General Secretary, or, in his absence, to such other person as the President may appoint. Members unable to attend the Meeting may send their Ballot Lists before the Meeting to the General Secretary in sealed envelopes. Each such sealed envelope must be marked "BALLOT LIST," and must, moreover, have written upon it the name of the Member sending it. The names written upon such sealed envelope having been compared with the Society's Register by the General Secretary, such sealed envelopes shall be opened at the Meeting by Scrutators appointed by the Meeting. The Scrutators shall see that the conditions of the Ballot are strictly fulfilled. Any Member shall be at liberty to strike out any name or names of Ordinary Members of Council printed on his voting paper.

COMMITTEES.

4. No Special Committee, nor any Committee of a Local Section shall have any control over the funds of the Society, except to the extent to which funds for its use may be voted by the Council. An account of the manner in which any funds so voted for the use of any Committee have been expended shall be furnished to the Council on or before the 15th of November in each year.

LOCAL SECTIONS.

5. All elections to the Committee of a Local Section and all elections of Officers of the Section, with the exception of those to fill up unforeseen vacancies, shall take place so that they can be reported to the Council in time to be considered at the Meeting held under By-law 24 not less than two months prior to the Annual General Meeting; but the Members of Committee and Officers thus elected shall not take office and those whom they are to succeed shall not retire from office until the close of the Annual General Meeting afore-said.

CHARLES G. CRESSWELL,
Secretary.

Birmingham Section.

Meeting held at Birmingham on Thursday, February 4th, 1909.

MR. HARRY SILVESTER, B.Sc., F.L.C., IN THE CHAIR.

THE INFLUENCE OF SMALL QUANTITIES OF ELEMENTS IN COPPER ON ITS REACTIONS WITH NITRIC ACID.

BY J. H. STANSBIE, B.Sc. (LOND.), F.L.C.

The investigation set forth in this paper is a continuation of that already described (this J., 1906, 45, 1071; 1908, 365). It deals particularly with the influence of small quantities of arsenic, phosphorus, and lead on the reactions of alloys of these elements with copper when the alloys are dissolved in nitric acid of sp. gr. 1.2, the reactions taking place at a temperature of 65° C. It also deals with alloys of lead and copper, and with the influence of variations in the temperature of the reaction and the concentration of the acid solution.

It is claimed that the first experiments prove conclusively that the presence of arsenic in small quantities has marked effects upon the reactions of copper with nitric acid, and that these effects are not cumulative, but increase to a maximum as the percentage of arsenic increases, and then decrease with further increase in the amount of arsenic. In former experiments the volume of nitric oxide liberated was taken as an indication of variations in the reactions, but these experiments, which were made with the apparatus already described, were found not to give sufficient information of the general reactions, and the apparatus was modified. With this new form of apparatus other quantities may be determined, and more certain evidence of the reactions obtained.

The alloys were prepared with every precaution to ensure the required composition. Alloys which did not fulfil the weight conditions were rejected. The compositions given in the tables are as prepared, and analyses were made in several cases to confirm the general results.

The nitric acid was distilled twice from a Wurtz flask, the first portions coming over in each case being rejected. The purified acid was then bleached by passing a current of pure, dry, and dust-free air through it while maintained at a temperature of 60° C. It had a sp. gr. of 1.417, and was diluted with re-distilled water to sp. gr. 1.2. The acid was found to be free from sulphate and chloride, and 50 c.c. evaporated in a platinum dish left only a slight stain on the dish. Griess's test gave 0.2 mgrm. of nitrous acid in 50 c.c.

The experiments with the alloys were made under exactly the same conditions, the only variable being the composition of the metal itself. The apparatus is described in a previous paper (this J., 1908, 365).

With regard to the accuracy of the apparatus it may be said that gas volumes can be measured easily to within 0.5 c.c., and the volume collected was usually upwards of 200 c.c. With careful measurement of the acid solution it is estimated that the error would be less than 10 mgrs. of acid. Every precaution was taken to bring the reaction beaker to the same position on the bung for each experiment, so as to keep the internal volume of the apparatus as constant as possible.

From the researches of Dixon, Raschig, Mandl and Russ, and others, it is clear that the conversion of nitric oxide into nitric peroxide by admixture with oxygen is not so simple as is usually stated. A portion of the nitric oxide passes through the trioxide stage, and if any of this is dissolved before further oxidation takes place, the volume of oxygen required to remove nitric oxide from a mixture of gases containing it is reduced by this amount. It may be observed, however, that if the oxygen is added with sufficient rapidity, and in considerable excess, the error introduced is negligible in a comparative series of experiments.

The solutions in the measuring flasks are made up to the mark, and the carbonate solution allowed to stand for two days for the whole of the basic copper carbonate to separate out. Generally the solution was quite free from copper; but in a few cases traces of the metal were found to be present, and the solution required boiling to complete the precipitation. Both solutions are titrated with standard permanganate and ammonium ferrous sulphate, for nitrous acid, and with standard nitric acid for excess of the alkalis, using methyl orange as an indicator.

Nitric peroxide is a constituent of the gaseous mixture liberated from the acid solution under the conditions observed, and is absorbed by the solution of sodium hydroxide in the absorption tube.

The weight of the nitrous acid found in the hydroxide solution, compared with the weight of the alkali neutralised, is always such as to show conclusively that part of it is formed from the nitric oxide with which the nitric peroxide is mixed when it enters the tube for absorption. This is in accordance with the statement made by Divers (J.C.S., 1899, 86), that the red gas obtained by the action of arsenious oxide on nitric acid of sp. gr. 1.35 is absorbed by sodium hydroxide with formation of pure sodium nitrite. The greater part of this gas is known to be a mixture of nitric oxide and nitric peroxide.

According to Dixon and Peterkin (J.C.S., 1899, 614), there is evidence that nitrogen trioxide is formed in small quantity when nitric peroxide and nitric oxide are mixed together, and as this is removed by absorption in the alkaline solution the equilibrium would be disturbed, and more of the trioxide would form, so that the whole mixture would react as the trioxide.

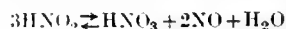
There is always a slight excess of alkali neutralised over nitrous acid found in the hydroxide solution, and as this varies in the different experiments it is most probably accounted for by traces of acid carried over from the beaker by the escaping gases. Nitric acid is evidently not formed in the reaction, and the results of the whole series of experiments make it clear that the reaction in the hydroxide solution is expressed by the equation:



It is, therefore, assumed that equal volumes of nitric peroxide and nitric oxide are absorbed, so that the volumes of the absorbed gases can be calculated. The volume of absorbed nitric oxide is added to the volume collected in the cylinder, and determined by the addition of oxygen.

From the gas collected in the cylinder, and the nitrous acid found in the hydroxide solution, the following quantities are determined and calculated. Total volume of nitric oxide liberated: volume of nitric peroxide liberated: weight of nitrous acid formed, and weight of nitric acid equivalent to the alkali neutralised.

The presence of the nitrous acid in the main solution is probably due to several reactions. It is well known that nitrous acid in aqueous solution is decomposed with evolution of nitric oxide, and formation of nitric acid, when the solution is heated. But according to Veley (Proc. Roy. Soc., 1892, 52-27) the action is reversible in the presence of free nitric acid. Thus:—



and the condition of equilibrium is reached when the ratio of the molecules of nitric acid to those of nitrous acid is 9 : 1. Either this ratio is a function of the temperature of the solution, or the presence of copper nitrate and nitrite modifies the reaction, for in the case of the dis solution of pure copper, at 65° C., during which nitric oxide is liberated freely, it is 17 : 1. Thus the re-solution

of any nitric oxide, formed by direct reduction of nitric acid, would proceed until the equilibrium point was reached, and then the remainder of the gas would escape entirely from the solution.

The formation of nitrous acid by direct reduction of nitric acid would influence the dissolution of nitric oxide by the solution in which it was liberated, as equilibrium would be the sooner reached. Also, it would seem that the total quantity of nitrous acid present in the solution of a metal depends partly upon the stability of the nitrite of the metal itself. This view is supported by the results obtained with other metals. The marked difference in the weights of nitrous acid in the solutions of copper and silver respectively is probably due to the greater stability, of the silver nitrite.

The liberation of nitric peroxide indicates another source of nitrous acid in the solution, as part of this compound would react with nitric oxide in the presence of water to reform the acid and thus pass back into solution. It would therefore appear that any quantitative determination of the different reactions by which the whole of the nitrous acid is formed in the main solution would prove a difficult problem.

The weight of nitrous acid, and the weight of nitric acid equivalent to the sodium carbonate neutralised, are determined in the main solution. The former is given in the tables, the latter is added to the quantities calculated from the hydroxide neutralised, and the nitric oxide and nitrogen liberated. The sum of these weights is given in the tables as acid traced.

The weight of nitric acid used up in the secondary reactions is also given in the tables.

Weight of nitric acid required for 250 c.c.
of the solution = 0.0393 gram.

Nessler's test.

Weight of ammonia in 500 c.c. of the
sodium carbonate solution = 0.2 mgm.

It is generally stated that ammonia is not formed in the reactions of copper with nitric acid, and that sodium carbonate free from ammonia is difficult to obtain. The carbonate used in the experiments was prepared from the bicarbonate, and heated in a muffle for an hour at a red heat. In a blank experiment made with it only a trace of ammonia was detected.

The sodium hydroxide solution gave only a trace of ammonia. The analysis of the residual gas gave no indication of the presence of nitrous oxide in it. This was also found to be the case with the residual gas from the dissolution of copper-arsenic and copper-phosphorus alloys. It is clear then that nitrous oxide is not one of the products of the secondary reactions under the conditions of the experiment; or if any of this gas is formed it is dissolved by the water in the collecting cylinder.

The quantities derived from the data given above are stated in Table I, line 3.

The weight of nitric acid used up in the secondary reactions is calculated from the relations:

$$\frac{\text{HNO}_3}{\text{NO}}; \frac{\text{HNO}_3}{\text{N}}; \frac{\text{HNO}_3}{\text{HNO}_2}; \frac{\text{HNO}_3}{\text{NH}_3}; \frac{2\text{HNO}_3}{\text{N}_2\text{O}}$$

and is regarded as an important quantity in the investigation.

The influence of variations in temperature.

A number of experiments were made to determine the influence of variations in the temperature at which the reaction takes place, all the other conditions being kept as constant as possible. The data given in the table (I.) show that the distribution of the products of the secondary reactions and the quantity of acid used up in these reactions may be appreciably modified by even small variations in temperature. This presents the one difficulty in obtaining perfectly uniform results, as it is not easy to confine the reactions within a very small range. The range within which the experiments were worked did not in the great majority of cases exceed two or three degrees, and apparent anomalies are to be explained by undetected variations. It is then to be understood that the temperatures given in the tables represent small ranges.

Inspection of columns 5 and 6 in Table I. shows that practically the whole of the acid used was traced, so that no notable reaction escaped observation; and it may be remarked that the solubility of nitrogen and nitric oxide in the water over which the gaseous mixture is collected must be very small, as it seems to have very little influence on the general results. This is in accordance with the conclusions of A. Christoff (*Zeits. Phys. Chem.* 1906, 622), who has shown that there is no measurable absorption of such gases as hydrogen, oxygen, and nitrogen through a water surface in 20 minutes. The same is probably true for nitric oxide, the principal gas dealt with in this investigation. The secondary reactions are evidently of the same character, but vary quantitatively, and the effect on the distribution is also very marked. Columns 8 and 13 show the effect of variations in temperature on the nitrous acid in solution, and indicate that part at least of the nitric oxide is formed from it. Column 16 shows that the quantity of acid used up in secondary reactions decreases with an increase in temperature.

The influence of concentration of acid.

The influence of variations in the concentration of the acid solution is just as marked as that of variations in temperature. This will be seen by reference to Table II. The weight of the acid in solution varied somewhat, but not sufficiently to exert any marked influence on the

EXPERIMENTS WITH PURE COPPER.

The results obtained from the dissolution of 1 gram of copper in 15 c.c. of 1.2 nitric acid containing 5.883 grams of HNO_3 , at 65° C., are given below.

The dissolution of the metal.

Volume of gas collected in cylinder ..	= 229.5 c.c.
Volume of oxygen added	= 150 "
Volume of residual gas	= 125.5 "
Volume of hydrogen in apparatus at commencement	= 45 "
Temperature and pressure = 15° C. and 749 mm.	

Analysis of residual gas.

20.8 c.c. of the gas mixed with excess of hydrogen gave on explosion a contraction of 30.6 c.c.	= 10.2 c.c. of oxygen.
Calculated volume of oxygen present in 20.8 c.c. of gas	= 10.5 c.c.
48.3 c.c. of the gas gave on explosion a contraction	= 17.5 " of hydrogen.
Calculated volume of hydrogen present	= 17.7 c.c.

Titration with standard permanganate.

Volume of permanganate required for 50 c.c. of the sodium carbonate solution	= 13.56 c.c.
Weight of nitrous acid in 500 c.c. of the solution	= 0.1356 gram.
Volume of permanganate required for 50 c.c. of the sodium hydroxide solution	= 5.68 c.c.
Weight of nitrous acid in 250 c.c. of the solution	= 0.0284 gram.

Titration with standard acid.

Volume of acid required for 50 c.c. of the sodium carbonate solution	= 15.33 c.c.
Weight of sodium carbonate in excess in 500 c.c. of the solution	= 1.533 gram.
Difference in volume of acid required for 25 c.c. of the sodium hydroxide solution before and after use	= 0.33 c.c.

reactions. It was found difficult to control the temperature in the case of the 1.3 acid, as the action proceeded very rapidly.

It is evident that with acid above 1.2 specific gravity the formation of nitric peroxide becomes very marked, and the smaller quantity of nitrous acid in solution seems to indicate its source, although it may be the product of a purely secondary reaction in the more concentrated acid. Also, the acid used up in secondary reactions increases notably when the concentration is above 1.2.

The dissolution in the 1.1 acid was very slow, requiring 90 minutes for completion; while in the 1.3 acid it was complete in 5 minutes. The 1.2 acid was found to give a steady action which is complete in about eight minutes, seldom varying by more than a few seconds in the various experiments. For this reason it was selected for the general experiments.

Alloys of copper and arsenic.

Table III. contains the results of a series of experiments with copper arsenic alloys dissolved in nitric acid of sp. gr. 1.2 at a temperature of 65° C. One gram of the alloy and 15 c.c. of the acid solution were used in each case.

It may be remarked that while the results given in this table confirm the earlier ones, they also considerably extend the scope of the observations. The most notable effects of variations in the composition of the alloys on their reactions, are the decrease in the volume of gas liberated, and in the quantity of acid used up in the secondary reactions, to a minimum as the percentage of arsenic increases, and then an increase in these quantities with a further increase in the content of arsenic. The variations in the volume of nitric oxide and nitrogen are also very marked. The first passes through a minimum and the second through a maximum as the arsenic increases. These important quantities are traced in Fig. 1.

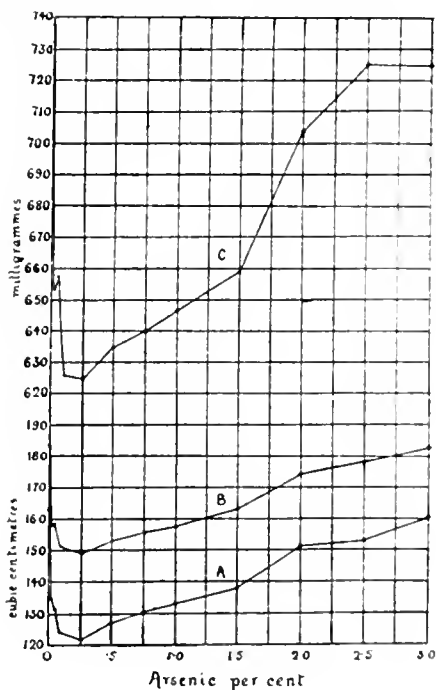


Fig. 1.

The numbers given in columns 8, 12, and 16 of Table III. are plotted on the curves A, B and C respectively.

Alloys of copper and phosphorus.

In Table IV. the results of experiments with a series of copper-phosphorus alloys are given. One gram of each alloy was dissolved in 15 c.c. of 1.2 acid, at 65° C.

The results above are of the same general character as those given in Table III., but the maximum effect is produced by a smaller content of phosphorus, and is not so marked as in the copper arsenic series. The maximum effect of phosphorus on the chemical relations of copper appears to be produced by a content of phosphorus in the neighbourhood of 0.025 per cent. (See Fig. 2.)

It may be noted that the quantities of phosphorus, arsenic, antimony, and bismuth which produce the maximum effect are in the order of their atomic weights, and it may be that the atomic volume of the added element is a factor in the influence it exerts upon the copper.

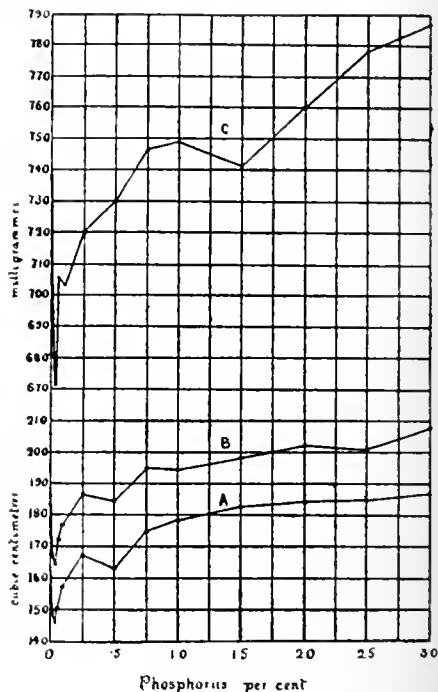


Fig. 2.

The numbers in columns 8, 12, and 16 of Table IV. are plotted on the curves A, B and C respectively.

Alloys of copper and lead.

It has been shown that small quantities of bismuth exert little or no influence on the chemical relations of copper and nitric acid, and it was thought that lead, which by itself produces a different set of reactions with nitric acid, might yield further information. It is well known that nitrous oxide is an important product of the secondary reactions of lead with nitric acid; but in the experiments with copper-lead alloys, the examination of the residual gas after the removal of the nitric oxide gave no indication of nitrous oxide even with an alloy containing 60 per cent. lead. The copper, when present in considerable quantity, appears to entirely suppress the formation of nitrous oxide. The analysis of the residual gas was made, as already indicated, by explosion with excess of hydrogen. As the excess of oxygen in the residue is known, the nitrous oxide is easily determined when present.

The following are the results obtained with the gas from the dissolution of (a) the copper-lead alloy containing 60 per cent. lead and (b) pure lead.

Analysis of residual gas.

(a) Volume of residual gas taken	=32.6 c.c.
Volume with hydrogen added	=80.8 "
Volume after explosion	=37.0 "
Volume of oxygen known to be present ..	=14.7 "
Then $80.8 - 37 = 43.8$; and $14.7 \times 3 = 44.1$.	

The contraction therefore is entirely due to oxygen present.

(b) Volume of residual gas taken	= 32.0 c.c.
Volume with hydrogen added	= 90.0 ..
Volume after explosion	= 44.6 ..
Volume of oxygen known to be present ..	= 12.2 ..

Then $90 - 44.6 = 45.4$; and $12.2 \times 3 = 36.6$.

Therefore $45.4 - 36.6 = 8.8 =$ volume of nitrous oxide present in 32 c.c. of the gas, as no contraction in volume takes place when nitrous oxide is reduced to nitrogen. The excess contraction is therefore due to the removal of a volume of hydrogen equal to that of the nitrous oxide reduced.

The experiments made with the copper-lead alloys are divided into two sets. In the first set alloys containing from 0.05 to 5 per cent. of lead are dealt with, and in the second, alloys with 20 per cent. and upwards. The results are given in Tables V. and VI., and from the quantities in columns 8, 10, and 16 of Table V. it is seen that small percentages of lead exert little or no influence on the reactions of copper with the acid, so that lead acts similarly to bismuth in this respect. The decrease in these quantities for the alloys containing an appreciable amount of lead is evidently due simply to the presence of the metal. One gram was taken in each case, and the other conditions kept as constant as possible.

In the second set (Table VI.), the weight of alloy taken is such that the same weight of acid is used in the conversion of the metals into nitrates. This allows of a better comparison of results, as it eliminates the effects of variable concentration. If then the temperature is kept constant, the only variable is the composition of the alloys, and differences in the reactions can be the more readily detected. These conditions appear to be necessary if the results are to be strictly comparable, for the escape of gaseous products from the solution depends upon its concentration and temperature, and anything that disturbs this relation, or the relation between the solution and the gas above it must cause a variation in, and a re-distribution of, the components of the system.

Examination of Table VI. shows that the secondary reactions of copper-lead alloys are very much the same as those of copper, although the reactions of lead itself are very different. There is an apparently simple explanation of this, for it is noticed that directly the alloy commences to dissolve and copper nitrate to appear in the solution the metallic particles turn red, showing that copper is deposited as fast as it is dissolved by the acid. The process is therefore practically the same as the dissolution of the copper in nitric acid, and the dissolution of lead in copper nitrate: no doubt with a more dilute solution and a slower action this would be strictly true. As the dissolution of lead by copper nitrate is the result of exchange between the two metals, no gaseous products result, and any disturbing effect would be due only to the accumulation of lead nitrate in the solution. Another point to be noticed is the support given to the statement that part at least of the nitric oxide liberated from the solution is a product of the decomposition of nitrous acid present or formed in it. By comparing the quantities in columns 8 and 13, Table VI., for the 60 and 80 per cent. alloy it is seen that the larger volume of nitric oxide corresponds to the smaller weight of nitrous acid.

On referring to column 7 it is seen that the difference between acid used and acid traced is very marked when nitrous oxide forms a considerable proportion of the evolved gas. This is no doubt due largely to the solubility of the nitrous oxide.

The reactions with lead, and with lead containing 0.1 per cent. of copper, show that a small percentage of copper in lead has little or no influence upon the reactions of lead itself with nitric acid.

According to Freer and Higley (Roscoe and Schorlemmer's Chemistry, Vol. I., p. 531), the liberated gas from the dissolution of lead in nitric acid of sp. gr. 1.2, contains 40 per cent. of nitrous oxide. This differs from the result (55 per cent.) given in Table VI., but as the temperature of the reaction is not given by them, the difference in the percentages of the gas is probably due to the different temperatures used.

The general character of the reactions of copper-lead alloys agrees with the observations of Acworth and Armstrong, that brass gives similar reactions to copper when it is dissolved in nitric acid, and it is probable that the explanation is the same.

SUMMARY.

At the conclusion of the first set of experiments, the opinion was expressed that the chief cause of the decrease in the volume of nitric oxide liberated by the dissolution of copper alloys in nitric acid is the formation of a solid solution of the added element, or of a compound of that element, in the excess of copper. Further investigations have served to confirm this view. There is very little doubt as to the formation of solid solutions in alloys of copper with arsenic, antimony, and phosphorus, and further that they become saturated within the limits indicated by the nitric acid reactions. When the saturation point is passed, the element or compound in solution is rejected on solidification, and in this rejection, not only does the excess segregate, but the solution swings past its saturation point, and becomes undersaturated. The concentration of the solid solution is thus reduced, and the influence of the dissolved element is lessened. It must, therefore, pass through a maximum as the percentage of the added element increases. The experiments with copper-bismuth alloys support this view, for the bismuth seems to be entirely rejected by molten copper on solidification, and no solid solution is formed. The experiments with the copper-lead alloys were undertaken, because these alloys have been investigated pyrometrically by Heycock and Neville (Phil. Trans. 189a, p. 42). They state that a solid solution of lead in copper does not exist with small percentages of lead. They also find that a eutectic mixture is formed in lead containing about 0.06 per cent. of copper. Reference to Table V. will make it clear that the influence of lead in small quantities on the reactions of copper with nitric acid is practically that of a simple mixture of the two metals. The great similarity of the reactions of pure lead and lead containing 0.1 per cent. of copper, indicates that the formation of a eutectic alloy containing a small percentage of the added element exerts little or no influence on the reactions of the metal, and this seems to be a natural interpretation, as the eutectic alloy is simply a mixture of the two metals.

The opinion may be expressed that the purely chemical investigation of the reactions of nitric acid with alloys should form a valuable aid to the microscopic and pyrometric examination of these important bodies, that is now being carried on with such far-reaching results. It is evident that the primary reactions alone are of a comparatively simple character, although they may furnish valuable information with regard to the heat of combination as shown by Drs. Baker and Galt, in their independent investigations of the effect of dissolving copper zinc alloys in chlorine and bromine solutions. But the secondary changes taking place in nitric acid solutions seem to be able to furnish information as to the relations of the metals in an alloy to each other. The subject is admittedly a complicated one, but if the acid is pure and the temperature of the reaction is carefully regulated, there is no reason why this method should not form a valuable aid in researches on alloys.

In the comparison of results obtained with pure metals it seems to be a necessary condition that the weights of the metals taken should be arranged so that the same weight of acid is used up in the primary reactions. This leaves the acid solution in which the secondary reactions take place of the same concentration. The same principle holds good for alloys in which notable proportions of the second metal are present. The weight of acid used up in the secondary changes is an important quantity in the investigation of a series of alloys.

Some metals react with their own nitrates in solution, but this does not appear to exert much influence in investigations in which excess of acid is used and the whole of the metal dissolved. For during the first part of the reaction when the metal is in excess the concentration of the nitrate in the solution is low, and at any time it could but slightly assist in the secondary changes under the conditions observed in the experiments.

The absence of nitrous oxide from the gases liberated by the dissolution of alloys of copper and lead up to 60 per cent. lead is remarkable. According to Heycock and Neville such alloys when very slowly solidified from the molten state consist of two conjugate alloys completely separated from each other in layers. When quickly solidified they form a kind of emulsion of two immiscible alloys.

The suppression of the nitrous oxide which is the characteristic gas in the lead reaction indicates a somewhat close relation between the two metals, for the reactions of the alloy are different to those of a mere mixture of the two metals. The copper appears to dominate the secondary reactions until the proportion of lead present is very large.

The protective action of one metal over another in a nitric acid solution is well shown in the case of gold-silver alloys from which the silver is not freely and completely dissolved until it forms upwards of 70 per cent. of the alloy. It may be that some such action takes place during the dissolution of lead in copper-lead alloys, although the copper itself dissolves. There is, however, the other explanation, which may be sufficient to account for the absence of nitrous oxide, and that is, the dissolution of lead in copper nitrate with precipitation of copper. In that case the change would be equivalent to the dissolution of alloy in the acid, and it is noticed that the particles of alloy in the acid are distinctly red until they finally disappear, showing that copper is constantly deposited upon them, and as constantly redissolved by the nitric acid.

It is well known that the physical and mechanical properties of metals and alloys are considerably modified by the presence of small quantities of added elements, and this is of considerable practical importance when the influence is in the direction of improving these properties, or in modifying one or more of them. The general effect of arsenic on copper is well known, but there is no general consensus of opinion among practical men as to the best proportion of arsenic to give the required effect. If, as is probably the case, the proportion which produces the greatest modification in the chemical relations of the alloy, acts in the same direction with regard to its physical properties, information of practical value is furnished by investigating the chemical properties of the useful metals and alloys.

Summary of views concerning the reactions of nitric acid with metals.

Very little quantitative work in connection with the gaseous products of the reactions of nitric acid with metals appears to have been done previously to 1870, although the general character of the changes had been well studied in the case of a few metals. The views generally entertained were in accordance with the hypothesis that in the formation of a salt by the interaction of an acid and a metal, the oxide of the metal is first formed and then reacts with the acid. This idea had its origin in the application of the Phlogistic Hypothesis to the explanation of salt formation. The metal was supposed to undergo calcination in the acid, and the resulting salt to dissolve in the acid solution. To account for the products of the dissolution of a metal in nitric acid it was supposed that the acid itself was the direct cause of the oxidation, and the gaseous products were the result of this primary reaction.

Thenard (*Traité de Chimie*, 1834, p. 362) sets forth this view, and describes the dissolution of copper in nitric acid with liberation of nitric oxide. He recommends the use of diluted acid, and regulation of the temperature. With the strong acid the action is rapid, much heat is evolved, and the nitric oxide is mixed with nitrous oxide and nitrogen.

Gmelin (*Chemistry*, English translation, Vol. II., 1849, p. 397) states that most metals are oxidised by nitric acid, and the resulting oxides combine with the undecomposed acid to form salts. The gaseous products are derived from the portion of the acid that oxidises the metal, and may consist of hyponitric acid, nitric oxide, nitrous oxide, and nitrogen. If the metal decomposes water, the hydrogen liberated combines with the

nitrogen of the acid, and ammonia is formed. Which of the above products are obtained depends partly on the affinity of the metal for oxygen, and partly upon the temperature and concentration of the acid solution.

Regnault (*Cours Élémentaire de Chimie*, 1851, Vol. I., p. 142) states that nitric oxide or nitrous oxide is liberated according to the nature of the metal. While zinc liberates a mixture of the two gases, copper or mercury gives pure nitric oxide if the acid is sufficiently dilute and the temperature is prevented from rising.

Pelouze and Fremy (*Traité de Chimie*, 1860, Vol. I., p. 351) give a more detailed account of the reactions of metals and nitric acid. The reactions for copper and silver are given, and it is stated that the acid must be dilute or the gas will not be pure. The effects of concentration and temperature are noted, and the appearance of red vapour in the nitric oxide when concentrated acid is used is indicated. The formation of ammonia with tin and its non-formation with copper, silver, and mercury are mentioned. The easily oxidisable metals are said to form ammonia. They also state that if the acid is cooled to -16°C . it has no action on copper. The experiments of Gay-Lussac by which he showed that with very dilute nitric acid containing nitrous acid the quantity of copper dissolved is proportional to the quantity of nitrous acid present, are mentioned, and the inference drawn that the nitric acid exerts no action on the metal. The action of "nascent" hydrogen in the formation of ammonia is referred to.

Brande and Taylor (1863) state that ammonia is formed and ammonium nitrate detected among the products when nitric acid acts upon those metals that decompose water, and refer to the reactions of copper, silver, mercury, etc. They also state that copper, tin and silver are without action on the concentrated acid, but act rapidly on the addition of a little water.

Fownes (1868) referring to copper, states that the reaction is a simple deoxidation of some of the acid by the copper, by which the metal is oxidised; and the oxide so formed is dissolved in the unchanged acid.

The oxidation of the metal by the acid with liberation of gaseous products, and the formation of the salt by the dissolution of the oxide in the excess of acid may be described as the first connected theory of the action of nitric acid and metals. This view was held by Mendeleeff as late as 1891 (*Principles of Chemistry*, Vol. I., p. 71, 1891, Eng. Trans.)

The change in view concerning the nature of acids, and their recognition as salts of hydrogen did away with the necessity of assuming the formation of the metallic oxide as the primary reaction. The simple deduction from the reaction of metals with other acids, is that the primary reaction with nitric acid consists in the formation of the nitrate of the metal with liberation of hydrogen; but as free hydrogen had not been detected in the evolved gases it was supposed that the secondary products were the result of reaction between the "nascent" hydrogen and the excess of acid. This may be called the "nascent" hydrogen theory, and is clearly expressed in Miller's *Chemistry*, Vol. II., p. 154, 1874. It was adopted by Aeworth and Armstrong (*J.C.S.*, 1877, 2, 54) in interpreting the results of their extensive research on the action of nitric acid and metals.

The work of these chemists with nitric acid may be said to be the first of a really quantitative character as far as the gaseous products of the reactions are concerned. Earlier work appears to have been chiefly concerned with the metallic compounds formed; the other products were only dealt with qualitatively. They, however, experimented with most of the common metals, and found that nitric oxide, nitrous oxide, and nitrogen were usually present in the gaseous products, although considerable variations in the percentage composition, and in the total volume of the liberated gas, were observed. In some cases one or other of the gases was absent from the product. Their statement that hydrogen is not a constituent of the gaseous mixture obtained when metals dissolve in nitric acid is incorrect in some cases. Metals that decompose water below a red heat may liberate hydrogen from nitric acid under certain conditions. This was observed, in the case of magnesium, by Dr. A. J.

Ewart (Nature, Dec. 12th, 1901). This, however, may be regarded as another argument in favour of their theory of the general reactions. They express the view that the variations in the composition and volume of the gas obtained by the action of different metals are probably due to the different energy relations of the various metals and the acid solution into which they dissolve, and they suggest that the "nascent" hydrogen takes on, as it were, the character of the metal that sets it free; so that it acts differently towards the acid which it is its function to reduce. Some such conception as this is necessary if the theory of the action of "nascent" hydrogen is to be upheld, for it is evident that equivalent weights of various metals would liberate the same weight of hydrogen, and this, as it is not generally set free, would have to disappear again in bringing about the various secondary changes. Divers (this J., 1904, p. 1185) points out that the term "nascent" is comparatively meaningless in the sense of the hydrogen itself differing in reducing value according to the metal presented to the acid. He regards the metal and the acid together as constituting either the reducing or the hydrogenising agent. This agrees with Ostwald's view of the reduction of nitric acid by metals. He states that the reducing action of a metal depends upon the concentration of the hydrogen which would be required to precipitate the metal from its salts. The function of the nitric acid used up in the secondary changes is to reduce this concentration by oxidising the liberated hydrogen to water, and thus allowing more of the metal to pass into solution. In the case of a metal which does not liberate hydrogen from acids under ordinary conditions, he assumes an exceedingly small concentration of hydrogen, which is still further reduced by the action of nitric acid, so that the metal gradually passes into solution. According to this it is necessary and sufficient to reduce the concentration of the hydrogen below that at which it would precipitate the metal for the dissolution of the metal to proceed. The fact that at the temperature of the atmosphere magnesium liberates nearly pure hydrogen from the dilute acid, and that as the temperature rises the usual gaseous products appear, seems to support the theory for increase in the temperature must tend to increase the concentration of the gas, and this tendency would be opposed by the oxidising action of the acid, which would itself undergo reduction. But it must not be forgotten that the accumulation of nitrate in the solution may modify the changes, or even completely alter them. Whether this or the rise in the temperature is the principal cause of the variation in the composition of the evolved gas requires further investigation.

The important products, other than the nitrate of the metal, that may be formed, either temporarily or permanently in the solution, have now been determined. They are the metallic nitrite, nitrous acid, hydroxylamine, ammonia, and hyponitrous acid. The recent information concerning the formation and reactions of these bodies is largely due to Divers, Rây, Raschig, and Veley; and it may be used to explain the changes by which the gaseous products resulting from the dissolution of a metal in the acid are set free.

According to Divers, the metals may be divided into two classes: (a) those metals that are inactive with nitric acid, except in the presence of nitrous acid as catalyser, and then are converted into molecular proportions of nitrate and nitrite, with water as the only other product. This is the primary reaction. The metals, silver, mercury, copper, and bismuth, belong to this class; (b) those metals that form the nitrate in the primary reaction, together with nitrous oxide, nitrogen, and ammonia, each at the same time, but independently. Zinc, tin and other metals of a strongly basic character belong to this class. All other products must be the result of secondary changes. This is the most recent theory, and is based upon experimental evidence.

In the case of silver, an example of the first class, the reactions are such that nitric oxide is the principal gaseous product, and its liberation is probably due to the interaction of silver nitrite and nitric acid as a secondary change by which nitrous acid is formed, and accumulates in the solution. Under favourable

conditions of temperature and concentration the nitrous acid decomposes thus: $3\text{HNO}_2 = \text{HNO}_3 + 2\text{NO} + \text{H}_2\text{O}$. The liberation of nitric peroxide, which is the result of the interaction of nitrous and nitric acids, takes place as the concentration of the nitric acid increases, thus: $\text{HNO}_2 + \text{HNO}_3 = \text{H}_2\text{O} + 2\text{NO}_2$.

This statement is in accordance with the author's observations, for the liberation of nitric peroxide increases as the reaction proceeds; and as the nitric acid is being added to the beaker faster than it is used up in the reaction, it accumulates in the solution.

Copper and bismuth give similar reactions, but under certain conditions nitrogen is one of the products of the change, and this indicates a further reduction of nitrous or nitric acid. The simple explanation of this is, that ammonia is formed and reacts with nitrous acid as described by Armstrong, with liberation of nitrogen: $\text{HNO}_2 + \text{NH}_3 = \text{N}_2 + 2\text{H}_2\text{O}$. There is no doubt that ammonia is formed, for some remains in the solution even in the presence of excess of nitrous acid. Also from the recent observations of Rây it is possible that hyponitrous acid may be formed and decomposed with liberation of nitrogen thus: $5\text{HNO} = \text{HNO}_3 + 2\text{H}_2\text{O} + 2\text{N}_2$. There seems to be no reason why these reduction and hydrogenisation changes should not be brought about by the metal and the acid, as they only take place to a limited degree.

In the case of the metals of the second class, of which zinc and lead are members, it would appear that the primary changes are such that the greater part of the products other than the nitrate are derived directly from the acid. But the difficulty of limiting the changes to those of a primary character in the case of metals of this class is seen in the case of lead by the evolution of nitric oxide and nitric peroxide, and in the accumulation of nitrous acid in the solution. The action of the metal on its own nitrate must also be taken into account.

The author has not found that any systematic investigations of the reactions of alloys with nitric acid, or attempts to trace the whole of the acid used in the reactions, have been made; and he thinks that the method of examining both the solution and the gaseous products obtained in a single experiment should furnish valuable information of the general reactions with metals and alloys.

By the usual methods the changes taking place in the acid solution when a given metal is being dissolved, together with the effects of concentration and temperature upon such changes, and the composition of the gaseous products of the reactions are determined by independent experiments. Thus, there appears to be some difficulty in correlating the results of the two sets of observations.

It is clear that a number of factors must be taken into consideration in order to obtain a concise view of the various reactions. These may be stated briefly as follows:—

- (1) The concentration and mass of the acid solution.
- (2) The presence of bodies other than water and nitric acid in the solution.
- (3) The nature and purity of the metal or alloy.
- (4) The temperature at which the reactions take place.
- (5) The accumulation of various products in solution.

Thus, the opinion may be expressed that it would possibly lead to a more exact classification of the metals with regard to their action upon nitric acid if they were subjected to exactly the same conditions, and each experiment made as complete as possible.

Some of the effects of variations in the concentration of the acid solution were noticed by the earlier experimenters; while observations on the influence of mass and depth of solution over the dissolving metal are of more recent date. This influence is most noticeable in the case of a gaseous product liberated either at the surface of the metal or in the solution immediately above it, if it reacts with the excess of acid. Thus it is possible to completely prevent the escape of nitric oxide from a solution of sufficient mass, concentration and depth, but in this case nitrous acid appears in the solution in proportion.

The presence of nitrous acid in nitric acid solutions

appears to exert considerable influence on its reactions, and as it seems impossible to obtain a solution of the higher acid absolutely free from the lower one, its presence must always be taken into account. The addition of a second acid which may act as a fixing agent, as in the formation of hydroxylamine, may be found useful.

That the purity of the metal is of importance is again emphasised by the author's experiments, and it seems that the metal must be pure within the limits of possible purity, or it must be considered as an alloy.

With regard to the effects of temperature, the experiments of Dr. Ewart would, if followed up, probably modify present views; but the author is not aware that Ewart, whose experiments were only roughly quantitative, has continued the work, or that any other experimenter has taken it up. The critical temperatures given are: zinc, 0° to 2°; magnesium, 17° to 19°; and copper, 19° to 21°. Below these temperatures the metals are said to show little or no signs of reaction with the acid, but above them the action commences and increases rapidly as the temperature rises.

The experiments of Acworth (J.C.S., 1875, p. 828) make it clear that the accumulation of copper nitrate, and probably nitrite, in the nitric acid solution which is dissolving copper influences the composition of the

gaseous products. Thus he found that the presence of the nitrate increases the proportions of nitrous oxide and nitrogen in the collected gases, and decreases that of nitric oxide. In this connection it may be remarked that the absence of nitrous oxide from the gas collected in the author's experiments with copper and its alloys is no doubt due to the steady flow of acid into the beaker continually flooding the metal, and thus preventing the nitrate from accumulating above it.

Ray allowed the salts to accumulate in the neighbourhood of the surface of the dissolving metal in the case of mercury; while Veley caused a copper ball to rotate in the acid solutions so as to distribute the salt or salts formed through the surrounding liquid. In view of these experiments it may be suggested that further information would be obtained by electro-depositing a metal on a platinum cathode, and then dissolving it in a nitric acid solution under constant conditions, except that in one set of experiments the cathode remains stationary, and in the other is rotated, during the action.

In conclusion, the author hopes that the work presented in this and former papers may be of use not only practically, but also in the development of the theory of the action of metals and alloys upon nitric acid.

TABLES.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
I.	28°	1	—	1·2	5883	5866	17	119·4	—	8·9	1·5	129·8	272·2	6·1	—	756
	48°	"	—	"	"	5874	9	147·6	—	11·9	4·8	163·3	183·0	20·2	—	743
	65°	"	—	"	"	5868	15	162·3	—	13·9	6·7	182·9	135·6	28·4	0·2	738
	75°	"	—	"	"	5870	13	180·0	—	10·4	11·0	201·4	92·8	46·4	—	720
	86°	"	—	"	"	5880	3	186·8	—	10·4	9·3	206·5	63·0	39·5	—	696
II.	65°	"	—	1·1	5916	5902	14	132·3	—	14·9	1·5	148·7	208·6	6·2	—	725
	"	"	—	1·2	5883	5868	15	162·3	—	13·9	6·8	183·0	135·6	28·4	—	738
	"	"	—	1·3	6012	5975	37	174·5	—	12·6	42·1	229·2	69·5	177·4	—	777
III.	"	"	0·01	1·2	5883	5855	28	135·1	—	21·3	3·5	159·9	100·6	14·8	—	658
	"	"	0·05	"	"	5874	9	128·7	—	24·2	3·7	159·6	103·7	15·8	—	651
	"	"	0·10	"	"	5858	25	124·0	—	23·6	3·1	150·7	99·0	12·9	—	625
	"	"	0·25	"	"	5865	18	121·7	—	24·3	3·0	149·0	101·0	12·7	—	626
	"	"	0·50	"	"	5880	3	127·9	—	22·8	3·2	153·9	104·0	13·6	—	639
	"	"	0·75	"	"	5855	28	130·6	—	22·0	3·3	155·9	102·0	14·0	—	640
	"	"	1·00	"	"	5865	18	133·4	—	20·9	3·2	157·5	106·9	13·3	—	647
	"	"	1·50	"	"	5865	18	137·9	—	21·4	3·7	163·5	102·4	15·3	—	659
	"	"	2·00	"	"	5873	10	151·1	—	17·7	5·6	174·4	121·0	23·7	—	706
	"	"	2·50	"	"	5863	20	153·2	—	19·6	5·3	178·1	121·5	22·6	—	725
	"	"	3·00	"	"	5878	5	160·3	—	17·4	5·1	182·8	119·0	21·4	—	725
	"	"	0·01	"	"	5859	24	147·7	—	15·7	3·6	167·0	126·3	15·0	—	685
	"	"	0·025	"	"	5878	5	146·1	—	15·7	3·3	165·1	127·1	13·8	—	681
	"	"	0·05	"	"	5870	13	150·3	—	16·2	5·8	172·3	129·8	24·3	—	706
	"	"	0·10	"	"	5860	23	157·2	—	14·3	5·0	176·5	125·6	20·9	—	707
IV.	"	"	0·25	"	"	5893	—	167·6	—	13·1	5·4	186·3	117·8	22·9	—	720
	"	"	0·50	"	"	5892	—	162·9	—	14·5	6·9	184·3	121·0	29·0	—	730
	"	"	0·75	"	"	5899	—	175·0	—	12·8	7·0	194·8	118·8	29·3	—	748
	"	"	1·00	"	"	5853	30	178·6	—	10·7	5·1	194·4	126·5	21·6	—	749
	"	"	1·50	"	"	5868	15	182·8	—	11·1	5·1	198·5	111·4	21·6	—	741
	"	"	2·00	"	"	5879	4	184·5	—	11·1	6·8	202·4	118·8	28·5	—	762
	"	"	2·50	"	"	5855	28	185·1	—	10·8	5·1	201·0	116·7	21·5	—	777
	"	"	3·00	"	"	5880	3	187·0	—	14·7	6·7	208·4	117·2	28·2	—	787
	"	"	0·05	"	"	5890	—	159·4	—	15·8	5·4	180·6	128·2	22·6	0·2	726
	"	"	0·10	"	"	5873	10	162·4	—	13·7	4·3	180·4	104·7	18·3	0·3	690
V.	"	"	0·25	"	"	5879	4	154·6	—	15·4	3·9	173·9	130·9	16·3	0·3	710
	"	"	0·50	"	"	5863	20	159·7	—	13·2	4·0	177·1	128·6	16·9	0·2	710
	"	"	0·75	"	"	5884	—	153·7	—	20·5	3·9	178·1	114·2	16·3	0·4	715
	"	"	1·00	"	"	5864	19	152·7	—	15·9	5·4	174·2	106·5	23·6	0·3	661
	"	"	3·00	"	"	5864	19	153·3	—	14·7	6·4	174·8	99·8	26·9	0·2	669
	"	"	5·00	"	"	5869	14	146·8	—	16·2	3·9	166·9	114·2	18·3	0·2	671
VI.	"	1·16	20	"	"	5872	11	158·0	—	14·4	4·9	177·3	113·0	20·5	0·63	696
	"	1·72	60	"	"	5864	19	164·8	—	21·3	3·4	189·7	94·4	14·4	1·25	727
	"	2·255	80	"	"	5861	22	157·8	2·6	19·5	2·8	182·7	136·1	11·6	2·20	709
	"	2·95	95	"	"	5762	121	62·9	17·6	13·2	1·0	93·7	85·2	4·2	3·25	481
	"	3·28	99·85	"	"	5780	103	24·1	45·7	13·6	0·7	84·1	16·3	3·0	2·70	425
	"	3·28	100	"	"	5772	111	21·0	46·0	11·8	0·6	82·4	13·2	2·4	4·50	430

Table I.—Influence of variations in temperature.

Table II.—Influence of concentration of acid.

Table III.—Alloys of copper and arsenic.

Table IV.—Alloys of copper and phosphorus.

Table V.—Alloys of copper with 5 per cent. or less of lead.

Table VI.—Alloys of copper with lead.

Column.

1. Temperature in degrees Centigrade.

2. Grams of alloy taken.

3. Percentage of second element.

4. Specific gravity of nitric acid used.

5. Mgrams. of nitric acid used.

Column.

6. Mgrams. of nitric acid traced.

7. Mgrams. of nitric acid missing.

8. C.c. of total nitric oxide liberated.

9. C.c. of nitrous oxide found.

10. C.c. of nitrogen liberated.

11. C.c. of nitric peroxide liberated.

12. C.c. of total gas liberated.

13. Mgrams. of nitrous acid in carbonate solution.

14. Mgrams. of nitrous acid in hydroxide solution, half of it formed from nitric peroxide and half from nitric oxide.

15. Mgrams. of ammonia found.

16. Mgrams. of nitric acid used up in secondary reactions.

Liverpool Section.

Meeting held at University, on Wednesday, December 9th, 1908.

MR. MAX MUSEPRATT IN THE CHAIR.

THE UNIVERSITY TRAINING OF TECHNICAL CHEMISTS.

BY PROFESSOR F. G. DONNAN, M.A., PH.D.

The English chemical manufacturer is such a very much abused individual that there must be a great deal of good in him. He is constantly being compared to his disadvantage with his German brother, the employer of scores of University graduates, and with his American brother who, it is related, goes to the University or technical school in *propria persona* and picks his men out. In short, one of the many things laid at the door of the English manufacturer is that he eyes the University graduate, if not exactly askance, at all events with a certain wariness, and that in this and other ways he makes relatively little use of the Universities of the country. Recently, Professor Kipping, in dealing with the subject in his Presidential address to the Chemical Section of the British Association, has uttered a sort of academic chemist's lament. But what about the English chemical manufacturer himself? Perhaps if he were not a silent man he too could utter a lament. I have no intention, however, of entering into the rights and wrongs of that question here. But one thing is, or ought to be abundantly clear to everybody. On the one hand we have the Universities of Great Britain and Ireland enormously increased of late in numbers and presumably in efficiency, and ready to pour forth a correspondingly increased number of young chemists every year. On the other hand, are the manufacturers and employers of trained chemists prepared to offer positions to these? On the part of the Universities there is experienced a certain sense of isolation, a certain want of direct touch with the outer world of industry, and a very considerable difficulty in finding suitable employment for their graduates. It is clearly a case where there is urgent need for conference. Some 9 or 10 years ago the German chemical manufacturers and University teachers met together and discussed the teaching of chemistry at the Hochschulen, with the result that certain reforms were introduced. This is a good example to follow, and it is all the more easily followed in this and other English-speaking countries, since the meetings of the Local Sections of the Society of Chemical Industry provide us with an almost ideal machinery for this purpose. At these meetings manufacturers, directors of technical laboratories, consulting chemists and University teachers meet, or ought to meet together, and there is not the slightest difficulty in, at all events, initiating useful discussions which might lead to the conferences alluded to above. Plain speaking on both sides will do no harm, and is highly necessary.

My object therefore in making the following remarks is to initiate such a discussion in our Liverpool Section. Although our Birmingham and Manchester colleagues have quite recently discussed the same theme, I do not think a discussion of it here will be superfluous. Indeed, it would be an extremely useful thing if every Local Section could take the matter up, and devote at least an evening to it. We should then have a good opportunity of hearing what many of our leading manufacturers and University teachers have to say on the subject, and from the various views so presented, useful conclusions could be drawn.

The first question which is generally considered in a discussion of this sort, is the following one—Is there any essential distinction between the so-called "pure" science taught at our Universities and the so-called "technical" science investigated and utilised in industry? According

Mr. Swinburne, pure science is merely the crude raw material, which only becomes the refined and finished article after it has passed through the hands of the engineer and technical chemist. In a recent inaugural address,

delivered on October 7th, 1908, to the students of the Imperial College of Science and Technology in London, Dr. Henry T. Bovey, F.R.S., Rector of the College, said, "In the case of pure science the resulting fact is viewed as an instance of a law; in the case of technology the fact itself is the important thing. Therefore the idea of utility seems to be the real key to the difference between the two—which seems to be a difference of aim. If our purpose is to establish a law we call it pure science; if our purpose is to establish a fact we call it applied science or technology." Mr. Swinburne's definition is certainly amusing, whilst that of Dr. Bovey is interesting from a philosophical standpoint. No doubt both contain a great deal of truth. I think, however, for the practical purpose of our present enquiry, the matter stands as follows. The orderly, arranged facts and the resulting laws and principles of chemistry constitute the science of chemistry. This science is obviously the same whether chemical reactions take place in a University laboratory or in a works plant. But in a works the science of chemistry is combined with two other great sciences, namely, the science of economical production and that of engineering. It is clear that the technical chemist, whilst knowing all about the facts and principles of chemistry, has two new variables to deal with, namely price or commercial possibility, and bulk or engineering possibility. As our American friends well express it, he has to reckon with the dollar co-ordinate, and also, as I have just said, with the engineering or "bulk" co-ordinate. If we say that the University Laboratory usually deals with only one co-ordinate or variable, *i.e.*, that of scientific truth or accuracy, then the works laboratory deals with a higher space determined by the three co-ordinates of scientific accuracy, price and bulk. The success of a research in a University laboratory is determined by the truth of the fact or principle established, whilst the success of a technical operation or research requires in addition the correct determination of the two other factors already mentioned.

These considerations will, I think, bring us right into the middle of our subject at once. It is clear that the first and paramount duty of the University chemical department is to teach the future technical chemists the principles and some of the facts of chemical science. I wish to lay particular emphasis on the necessity of giving the technical chemist a thorough-going grasp of theoretical principles. When the young chemist enters the works, what has he to offer his elder and more experienced colleagues, but perhaps a fresher knowledge of chemical theory and principles? As regard economics, knowledge of special facts, knowledge of practical chemical analysis and chemical engineering, he is almost sure to have nearly everything to learn. He should enter the works with his head full of theory and his soul full of humility. He has only three or four years at the University to learn the principles of his science, the principles which inflexibly govern all chemical operations. Afterwards he may have two score years and ten to learn the stern necessities and conditions of chemical industry and technical practice. The University must set him thinking, so that he will go on thinking (and theorising) amidst the rush and stress, the failures and rebuffs of modern industrial conditions.

As Professor Ostwald has told us, good practice is founded on good theory, and when a man's theory doesn't lead to good practice, it is because his particular theory is a bad or an insufficient one, not because he has a theory. In other words, good theory means a sound and comprehensive grip of chemical principles. Without that possession, a man placed in new conditions will not be able to think effectively. He will be like a ship without a compass on a strange and stormy ocean. I think I may say without impertinence that the British Universities are honestly endeavouring to impart this knowledge of principles. Even though I run the risk of being accused of special pleading, I think the increasing attention given to physical chemistry at our Universities has contributed in the past, and will in the future still more powerfully contribute towards bringing the chemical teaching of our Universities into closer contact with that theory which technical practice requires, and which must rule successful technical practice. The name, physical

chemistry, is an unfortunate one, because physical chemistry is pre-eminently the science which studies the principles governing chemical actions. The science of chemistry as it is to-day was founded some hundred years ago by studying two physical properties of matter, namely mass and volume, by means of accurate physical instruments. The modern chemistry of to-day has found it necessary in the study of chemical action to employ many other so-called physical properties measured by means of many other accurate physical instruments, such as spectrometers, polarimeters, refractometers, galvanometers, electrometers, etc. Hence the rather misleading name of "physical" chemistry, which often conveys a very wrong idea of what is meant. A vast amount of physical chemistry is concerned with the determination of the chemical affinities of substances under all possible conditions. It seeks to answer the *fundamental* question of technical practice: given certain substances in certain conditions of temperature, pressure, and concentration, what reactions will take place, to what extent will they take place, and how speedily will this occur? You are all aware how in the past history of chemical science, Geoffroy, Bergmann, Berthollet, Berthelot, Guldberg and Waage, Van't Hoff and many others have sought to find an answer to this question of questions. After many years of labour, modern physical chemistry is only slowly, but nevertheless surely, arriving at the solution of the problem. I will conclude this special pleading by giving you an example, but it is one which is peculiarly appropriate here. It is possible, as Nernst and Haber have shown, to accurately calculate the maximum output of the Deacon chlorine process under any conditions of temperature, pressure, and initial composition of the reacting gases. This calculation is based on measurements of the dissociation of water and hydrochloric acid at high temperatures, and on measurements of the e.m.f. of galvanic cells. One begins to fore-see a time when it will be possible for the technical chemist to design from theoretical principles, a plant to satisfy a given specification, just as engineers would nowadays design a dynamo or a bridge. I think that physical chemistry will be one of the main contributors to that consummation.

Whilst thus emphasising the necessity of teaching the young chemist to think in terms of modern chemical theory, I do not suppose anybody will imagine that I am advocating the abolition or reduction of practical laboratory work. Of that sort of training the young chemist cannot get too much. This matter is so well understood now-a-days, that it is unnecessary to enter into it here. Physical chemistry cannot certainly be accused of negligence in this respect, for the undergraduate who studies physical chemistry generally finds this science almost too practical for him, inasmuch as he requires to add to his accomplishments in analytical chemistry and general chemical manipulation, a practical knowledge of working in glass, metal, and wood, and a much greater skill and dexterity of manipulation in the construction and handling of apparatus.

Let us assume then that the young chemist has received a sound training in the principles of chemical theory, and has gone through good courses of practical laboratory work in inorganic, analytical, physical, and organic chemistry. It is necessary that he should also have studied mathematics and physics. Very few people seem to realise how necessary a competent knowledge of mathematics and physics is to the future technical chemist. Every scientifically treated technical process involves this knowledge, and as chemistry is now rapidly becoming a dynamically as well as statically exact science, so the necessity for employing the weapons of exact science correspondingly increases. The technical chemist who cannot use the elements of the differential and integral calculus will soon become as extinct as the Ichthyosaurus. It is a welcome and significant sign of the times, that when an eminent chemical firm advertised some time ago for chemists, they required the candidates to possess a good knowledge of mathematics and physics. I am afraid many of our young University graduates in chemistry would find considerable difficulty in satisfying those conditions. There is certainly considerable room for reform here. It is also necessary that the young chemist

should be able to read German and French, and if possible Italian. He should come to the University from school with, at any rate, a reading knowledge of German and French. French of a sort is generally taught, but schoolmasters seem to regard German as a luxury. I know of one large school where a boy may take as extras (*sic*) either Chemistry or German, but not both. Such is the ignorance of the schoolmaster. This is not the place to enter into a discussion of the various subjects of literary and educational value which our future technical chemist might or should study at the University. The main difficulty here is the question of time, so far at all events as the majority of students at the newer English Universities are concerned.

We come now to the "bulk" co-ordinate, to chemistry allied with engineering, as carried out on the large scale in works. I do not think it advisable for Universities to organise lecture courses and build laboratories designed to meet the wants of specific industries. In the first place, such lectures, to be of any real value, must be given by those actually engaged in the industry in question, and such men are not available in England. In the second place the laboratories and their equipment would be very expensive, and would tend rapidly to become obsolete. The special knowledge and experience required for a specific industry are best gained, I think, in the works itself. It might be enquired, however, whether it would not be possible and desirable to have at a University a sort of laboratory of general applied chemistry, filled with some of the general apparatus of chemical engineering, everything being adapted to carry out operations on, say, a one-ton scale. In fact the whole laboratory would constitute a small experimental plant suitable for investigating a large number of chemical processes on a "small big" scale. There is something to be said for such a plan; if a squad of students were to quantitatively study chemical reactions in a laboratory of this sort, there is no doubt that they would have an opportunity of being introduced to the "bulk" or "dollar" co-ordinate, and of learning something about the apparatus employed in chemical engineering. I believe Professor Travers, in co-operation with Professor Rudolf, is erecting such a laboratory at the Indian Institute of Science at Bangalore, and I have no doubt that these gentlemen will make it a great success. Personally I think the idea is one well worth serious consideration, and so I hope that many of those who are present here to-night, and who are familiar with the stages through which a technical process goes on its way from the laboratory to the large works plant, will express their opinion on this subject.

There is another aspect of this important question on which I should like to hear the opinion of those who are engaged in chemical industries. As I have said before, works operations appear to me to be chemistry plus engineering. Is there not some minimum of knowledge concerning engineering in general which the University chemical graduate should possess? For example, every chemical industry requires power, and that brings one at once to questions concerning fuel and fuel economy, steam-raising plant, steam engines, gas-producers, and gas and oil engines, electrical generators, water and its purification, and so on. Is it not desirable that the technical chemist should know something about these things, since whatever sort of works he may enter, he is bound to have to deal in some way or other with the cost and production of power? Personally I am of opinion that every future technical chemist should, if possible, gain some theoretical and practical knowledge (a) of fuel and fuel metallurgy, and furnace construction; (b) of the construction, testing, and use of steam-raising plant, steam engines, power gas producers, and gas engines; (c) of the construction, testing, and use of dynamos and electrical motors. Such knowledge, to be useful, should if possible be combined with some training in the general principles and types of machinery and machine parts, the use of tools, and the elements of engineering drawing. It is of course impossible to make the young chemist a fully trained engineer of any of the usual types. He will never be expected to design steam engines, or electrical motors. But if in his subsequent career he is to take his proper place in industrial work, he will

have to design chemical engineering plant and supervise the carrying of laboratory processes through all stages up to large works plant. He will be constantly face to face with questions concerning the cost of power and the economy of fuel and power producers. If he is not to become the slave of the engineer, the technical chemist must know a great deal about these things, and that knowledge should, I think, begin at the University.

I have referred above to a knowledge of fuel and metallurgy. Now we cannot expect the technical chemist to be, in general, a fully trained metallurgist, any more than a fully trained engineer. But I think he should possess some acquaintance with the properties of metals and alloys, as they are dealt with by the modern scientific metallurgist. In his subsequent career he cannot escape from metals as essential materials of construction, and he should know something more about them and their properties than can be gained from the ordinary courses of inorganic chemistry.

I have endeavoured in the preceding remarks to indicate that sort of scientific knowledge which might profitably be added to a training in scientific chemical principles. I believe that the knowledge of metallurgy and engineering to which I have referred would form the best foundation on which the young chemist could subsequently build his wider knowledge and experience of chemical engineering and works plant. I am also inclined to believe that it would be more beneficial to him in general than any attempt at a University to teach him so-called "applied" chemistry, *i.e.*, the technical details of specific industries.

But this is again one of those points on which criticism and advice are most desirable, and I hope they will be forthcoming.

I come now to the "dollar co-ordinate," to the question of economic production and commercial possibility. This is undoubtedly the most difficult and complex factor of technical success. But it is essentially *the* factor, the one which dominates all others. Can the University do anything towards preparing the young chemist in this respect? That is a very difficult question to answer. It is of course possible to include in the practical laboratory courses certain exercises involving cost of raw material and power, as well as chemical efficiency and output. Electrochemistry in particular offers a wide field for the setting of most interesting practical exercises of this sort. In this way the extra variable may be introduced, and the mind of the student accustomed in some slight degree to the consideration of the financial aspect of chemical processes. Usually, however, one cannot go very far in this respect, not indeed much further than the suggestion of possibilities. To technical men this sort of thing may seem like mere play, but I think a little of it is beneficial, as it infuses a variety and actuality into laboratory work, and does no harm to the purely scientific aspect. But there are, it appears to me, two ways in which the University graduate might receive fuller and more serious training in this branch. In the first place, lectures might be given at the University by men actually engaged in chemical industry, on the commercial and financial aspects of economic production. After all, a chemical industry is chemistry + engineering + business. Business is the third co-ordinate, the third variable. The young chemist ought to learn something about business and business methods in general and about the finance of chemical business in particular. The University graduate ought to be a man who is going to deal with things of that sort at some future period of his career. Generally speaking, he has had no business experience when he comes to the University, and has no time or opportunity afterwards to spend a year or two in an office. Here then is another of those points on which criticism and advice are earnestly sought. I might mention that we are fortunate in Liverpool in possessing a School of the Science of Commerce in connection with our University. If the lecturers to which I referred above are not available, possibly the University chemist might make some use of the School, just as he might and ought to make use of the Department of Engineering, as I have suggested previously.

In the foregoing remarks, I have endeavoured to analyse the complex nature of the preliminary training

required for technical chemistry. It may appear strange to some of you that I have made no mention of research. The reason is that I have taken it for granted. As Sir William Ramsay has well said, research is chiefly valuable to the student for the attitude of mind it produces. It is a psychological necessity. There is so much to be learnt nowadays both practically and theoretically, and the time is so short, that the text-books, laboratories, and teachers must necessarily be in this connection more or less efficient machines for rapidly imparting to the unfortunate undergraduate his heritage of the ages. During this period a great deal may be done to correct false mental attitudes, but after all the stern necessities of the case exclude much heuristic dallying. The result is that the ordinarily intelligent and industrious student has comparatively little difficulty in obtaining his B.Sc. degree. So far all is well. But before he enters the works it is necessary for the student to realise three things, namely that what he knows is as nothing compared to what he doesn't know, that the learning of knowledge is a great deal easier than the making of knowledge, and that quiet, systematic, quantitative variation and control of conditions combined with correct logic and continuous thinking is the way knowledge is made. He learns these things by carrying out some research, be it big or small, be it "pure" or be it "technical." His whole mental attitude probably changes. He begins to realise that the business of the technical chemist is as much the manufacture of new, as the adaptation of already existing knowledge. He learns to adapt himself to new conditions without regret and without surprise. All this is so well understood and practised nowadays at our Universities that it would be an impertinence on my part to labour the point. But there is one thing to which I should like to refer briefly before passing on. Some people may perhaps regret that research at our Universities is not more closely connected with questions of immediate practical interest. In this connection, Dr. Bovey said in the address to which I referred previously, "We may take it, in fact, that there will be less waste in the world's advance if the scientific man is influenced in the choice of his research by practical necessities, and if the practical man is influenced by pure science so as to be interested in and to recognise the light which may be shed on scientific relations by accidental or intentional changes of circumstances in the course of his work." This is a fine ideal and well expressed. But how is it to be carried out? As Professor Kipping has informed us, Professor Duncan in America has induced several manufacturers to found scholarships for the purpose of researches on specific technical questions. So far as Universities are concerned, I am inclined to believe that this might be a dangerous and possibly harmful precedent. The true function of a University is to impart and to increase knowledge primarily for its own sake, and to give the student a true perspective and a wide horizon. Should, however, a manufacturer apply to a University for advice and help, I do not think he will often be refused. Research on a question of immediate technical importance is just as interesting and instructive as research on any other question. I think in fact that our manufacturers would do a great deal of good if they would indicate to the Universities the general lines of scientific enquiry which might be of commercial value to the country at a not too distant future. But so many delicate questions of personal interest, patent rights, and publication inevitably creep in here, that I believe the maximum good will in the long run be gained by our manufacturers (in the manner employing University graduates in their own well-equipped laboratories to investigate special technical questions. It would, however, do the University laboratory all the good in the world to be occasionally associated with the works laboratory in the elucidation of the problems presented by practice. But is this a practical proposition? Or can it be converted into one? Here once more is a question on which the opinion of our manufacturers is exceedingly desirable. For my part I think that research at the Universities should be untrammelled, that it should proceed on its own natural lines of development, but that technical applications of new scientific truths should neither be lost sight of nor despised, and the University

staff should, without unduly interfering with the private practice of the consulting chemist, be ready and willing to give advice to manufacturers on questions with which their own work has made them specially familiar.

After this digression I will proceed to mention one remaining point, namely the time to be spent at the University. Allowing three years for the preliminary training in chemistry, physics, mathematics, and modern languages (not to mention other subjects), and two years for research work together with the study of engineering and business, I think the minimum time required is five years. If a young fellow comes to the University at 18 (and I certainly think he ought not usually to come at an earlier age), he will have completed his University work at the age of 23 or 24. There will be then a fair chance of his mind having had time to mature before he enters the works, whilst at same time he will not be too old to adapt himself readily to his new surroundings. In conclusion I wish to say that although I have put forward a sort of a scheme, I have done so chiefly in order to present a basis for discussion. I fully realise that any scheme of this sort suffers from the fact that it is a scheme. All rigid educational schedules fail to allow for the natural variations of different minds, and for the varying nature of external conditions. It may be argued that alternative courses should be allowed, that two years of chemical research alone would be better than playing with engineering, that most of our big chemical works never require any engineering or business knowledge on the part of their chemists (at all events at first), and so on. Well, I will not spoil the discussion by endeavouring to disarm criticism. Although my chief idea in writing this paper has been to elicit an expression of opinion from others, I will not conclude without summing up my own. I think that what the future technical chemist requires, is not so much a better knowledge of analysis, chemical manipulation, or chemical facts—he usually get as much of these excellent things as the limited time permits—but a better and wider grasp of modern chemical theory, together with some idea of metallurgical, engineering, and commercial science. I will not conceal my opinion that this better grasp of modern chemical theory can only be gained by combining with the usual excellent courses in inorganic and organic chemistry a much more thorough-going study of what is commonly, but improperly, called in this country, physical chemistry. By this I mean the study of the relations between matter and electricity, the inner mechanism of chemical combination and valency, and the laws of chemical affinity, equilibrium, and velocity of reactions. I believe that if the future technical chemist is not so perfectly familiar with these things that he can reason and think in terms of them, then he will be heavily handicapped in the race. I hope no one will misunderstand me so far as to think that I in any way desire to underrate the importance of a thorough knowledge of every branch of chemical science. There is, after all, only one chemistry, and any one-sided study of this great subject is bound to be injurious.

DISCUSSION.

Dr. E. K. MUSEPRATT said the first question he asked himself was: What was a technical chemist? That term would embrace any number of people following chemistry, in any number of directions, and no training could be satisfactory which did not embrace the field covered by some one of those different directions which the technical chemists might ultimately pursue. For instance, an analytical chemist, who was consulted by various manufacturers as to what was best to be done in their own special manufacture might be one. Those actually engaged in brewing, dyeing, and tanning did not require exactly the same training as those who were engaged in making the larger chemicals, or in applying electricity to the production of chemical products. A technical school might have special classes for teaching dyeing, tanning, and even brewing, but even then the students must have a general training in the principles of chemistry. But when it came to the manufacture of the larger chemicals, the iron and steel industries, and in metal-

lurgy of all kinds, a very different training was required. The first two or three years must undoubtedly be devoted to thoroughly acquiring the principles of chemistry, physics, mechanics, and the higher mathematics. Mathematics should have been learnt in secondary schools, and the matriculated student ought to have a fair grounding in mathematics even as high as the differential and integral calculus. With that foundation, the student might possibly know what was the bent of his mind, and might then, under proper University teaching and the guidance of his Professor, be able to select his future course. For engaging in the manufacture of the larger chemicals, the student should require some of the principles of engineering; though it was not to be expected that he could become a perfect engineer. He should also thoroughly grasp the principles of electricity and its application in chemistry. He should also read something of the history of the developments of chemistry in these particular branches. Anyone, for instance, who read Dr. Frank's lecture, "The Application of Chemistry to Agriculture" (this J., Nov. 30, 1908), would see that ever since Liebig in 1840 first wrote his book upon the application of chemistry in agriculture, there has been a constant progress in that application.

Research should not be too intimately connected with any particular manufacture. Here and there, it might be of some advantage, but the great importance of research was, in the words of Sir William Ramsay, "attitude of mind." The student who had taken his degree even "with honours," should not think his training at an end. The very fact of his being put to undertake original research—to discover if possible some new idea, some new fact, should give him that "attitude of mind" which would teach him how to proceed when, in any works into which he might come, some industrial research was needed. The student, who had finished his course and taken his degree, should, therefore, have one year, or possibly more, which he should devote to chemical research. After all, very much depended upon the teacher. Among the most valuable qualities a chemist who desired to improve and increase the industry in which he was engaged could possess were enthusiasm and imagination. That enthusiasm could be communicated by the Professor who superintended the studies.

Dr. J. RASCHEN wrote:—"It is only after a considerable time that a University man will become useful to the manufacturer. This time will depend on local conditions and may be short in a works where every opportunity is offered and tendered for acquiring practical knowledge, and very long in a works where this is not the case. This, to a certain extent, might be remedied in the training of the student and make him indifferent to which class of works he first goes."

"The awkwardness displayed by a man fresh from the University is very noticeable when asked to put together certain apparatus with the object of research in a special subject for manufacturing purposes, or when, as so frequently happens, an investigation of a certain patent may be necessary, and works conditions have to be repeated in the laboratory. Such a man never tackles the subject in a proper manner, and the obvious inference is that something might be done in this direction in his training. A student should be set certain problems, for which many patents will serve the purpose, and be told to first of all design the laboratory experiment, and from that the necessary plant for manufacturing purposes. It may be said that this latter belongs to the engineering department. This is true to a certain extent, but the chemist has to supply the engineer with detailed information of what he wants, in what manner reactions occur, of what material the plant must consist, and what design of apparatus would be a suitable one. With this information the engineer will be able to design the actual plant."

Mr. J. W. CLAYTON said it was gratifying to find that Prof. Donnan had treated the subject with a humility which was somewhat rare. It was usually treated so one-sidedly by the director of a University laboratory, that manufacturers were kept from joining hands with the Professors in trying to improve matters. Prof. Kipping

tried to show that England was suffering very much from the decay of industry. At the annual meeting of the Society of Chemical Industry in 1883, the President at that time also deplored the decay of the chemical industry. A great deal of the want of success in technical chemists was due to the fact that when they took a position in a works, they immediately tried to show how much they knew. If when they entered a works they recognised that they knew nothing of manufacturing operations, and spent the first two or three years in cultivating their powers of observation, there would be very much less said against research chemists than there was now. There was nothing more annoying to a practical man who had spent the whole of his life in working at a particular process, upon which he had spent time and money, than to be dictated to by a man who had had no former experience. Too much time could not be spent in studying physical chemistry, which was a subject of the greatest importance. A great many processes had come to grief through some fact depending on physical chemistry and physical chemistry alone. He could not agree that chemical engineering must be learnt at the University. It was one of those things which could be picked up better in a works, if a man had had his powers of observation properly cultivated at a University. If he went in for engineering at the works and studied at a technical school at night, he would save time at the University and get a better knowledge when he is working with a big plant. Chemical engineering should not be interlarded during the student's chemical studies.

Professor Kipping had referred to technical scholarships, during which students should work out technical problems at the University under the supervision of a Professor, who could give them the run of a works; that was the basis of Prof. Duncan's scholarships and his theory. But Prof. Duncan's scholarships would find no application here, because students who were of any value at all would need the whole run of the works to grasp all the details and understand the process thoroughly, and no manufacturer would stand that.

Prof. J. CAMPBELL BROWN wrote as follows:—

"There is still a somewhat widespread idea that a student preparing for industrial work requires much less time to acquire his academical knowledge than those that are preparing for other occupations. Although this fallacy is not so universal as it was a generation ago, it indicates an entire misapprehension of what a University is. A man who is going to use his knowledge for the purpose of carrying out manufacturing processes and devising new ones, requires as wide an education as possible, and especially requires his information to be precise. Some years ago schemes of technological instruction were drawn up, including one for technological chemistry, in which an attempt was made to give a course of training in three years, of which two were to be devoted to pure science, and one to special branches of industrial chemistry. The schemes were not, however, carried into practice, and would never have been satisfactory. It is all very well for a man to be content with a two years' course of chemistry who is to spend his life in routine testing, such as a laboratory boy can be trained to do. An industrial chemist should be acquainted with the most advanced theoretical developments of pure science, that is to say, he should go through the honours curriculum of the Universities, and should have in addition a knowledge of the way in which large quantities of material are dealt with, the varieties of plant employed in some few selected typical manufactures, and above all, he should during the whole of his studies, after the elementary year, have his attention directed to, and his mind to some extent dwelling upon, the application of the knowledge he is acquiring to industrial purposes. There are manufactures so simple that they can be understood by any second year student, although the processes are very different from those performed in the test tube and in the laboratory; while other manufacturing processes require the application of the most advanced chemical philosophy for their elucidation. To put it briefly, an industrial chemist in order to be of value to his employers should be an honours graduate, and something more.

"It was with views such as these in their minds that some teachers of chemistry many years ago introduced selected

branches of industrial chemistry as alternative subjects, of which every candidate for honours in Victoria University must study at least one. I believe that all the Universities which have sprung from Victoria have continued this system, and although it is far from being an ideal one, experience shows that it has been of great value, and that so far as it goes, it proceeds on the right lines; but having got so far, we should now proceed further in the same direction. Every student who knows that he is to be engaged in chemical industries after he leaves the University, should pass at some stage of his curriculum under the direct guidance of a teacher whose function it should be to keep himself acquainted with: (1) the development of manufacturing processes, (2) the needs of the manufacturer, and (3) the researches which will tend to improve existing manufactures, and create new ones.

"For this purpose we require a new Endowed Chair of Industrial Chemistry, and it will undoubtedly be forthcoming—such chairs are absolutely necessary to the prosperity of a nation, and the progress of civilisation.

"It is often said that a man at college cannot be taught to feed a furnace or perform any of the other details of a manufacturing process; these things must be learnt at the works—of course they must, but the University can and ought to teach him the varieties of furnaces which have been introduced in the course of generations, the reasons for the modifications, and the principles which should guide him in the selection of the best for a given purpose. These things are best taught at the University, and they are not likely to be taught at the works. He may or may not pick up the information elsewhere.

"It has been truly said that no one Professor can cover the whole range of chemical manufactures, but that is no reason why he should not cover as many as he can; experience has shown that a student trained to be familiar with one branch of manufactures has been able, without any further special training, to take up and practise successfully another and different branch into which circumstances led him.

"In Liverpool we have, for the last 20 years, or nearly that time, endeavoured to devise means whereby students pursuing studies with a view of going into the industries, should at the same time get a certain amount of instruction in engineering, and many students have been advised to take engineering courses.

"Undergraduates, however, have found that if their curriculum is limited to three years, as it now normally is, there is no room for engineering studies, and only one now and again has been able to take engineering classes after graduation. The truth is that the establishment of a three-year curriculum for graduation which has become general, almost universal, in the present generation, is a great mistake, and if we could revert to the old four year curriculum, it would be a great deal better for students in after life."

Prof. CAMPBELL BROWN strongly supported what Professor Donnan had said regarding the advantages of a consultative connection between the manufacturers and the Universities. The embryo of such a connection had always existed, and its advantages had been obvious. But he did not share his fears that the practice of choosing a practically useful problem as a subject of research, might tend to narrow the horizon of the student. The narrowness or the wideness of his view would depend upon the student himself, perhaps on his teacher, and not upon the particular landscape which he was studying. For example, seven or eight years ago an old graduate, now in a works laboratory, mentioned to him the great need for a knowledge of the vapour tensions of sulphuric acid and water of high concentrations, and at higher temperatures than had been studied by Regnault. He afterwards gave this as a subject of research to two different men, each of whom worked on the subject, and published a paper. One man took the narrow view, and did not fully produce all the knowledge required; the other took a broader view and not only made a thorough investigation of the subject he started on, but was led by his work into a more extended investigation of another branch of the subject, and produced such an excellent paper that the University of London gave him the degree of D.Sc. for it. The industrial chemist started

the subject, the University man extended the knowledge and benefited alike the industry and himself, whilst science gained from both.

Mr. T. W. SUTHER was of opinion that technical chemists should be well grounded in general chemistry, physical chemistry, mathematics, physics, and an elementary knowledge of chemical engineering would be found very useful on entering works. Indeed the student's University training should be as thorough as his time and financial position would permit. On leaving the University, the student always found it difficult to go from the gram to the ton, the laboratory balance to the 20-ton weighing machine, and from the beaker to the steam boiler. What he understood by a technical chemist was not only the man who took charge of a works' laboratory and did research work, but the man who was destined to take the complete management of works in which large manufacturing operations were carried on. For this, a thorough scientific training at a University was most important, but to be a successful technical chemist, he must have graduated at another University—Nature's University, so to speak, and at birth be endowed with that natural ability, which was to be of such priceless value to him in after life. Natural ability, when of the right kind, provided him with common sense, organising and administrative ability, tact in getting on with others, push, force of character, and the capacity of getting work done by others. It enabled the technical chemist to manage himself as a starting point in the management of a staff of officials, and in the handling of men with whose duties he ought to be completely familiar, and know exactly the amount of wages to pay for work done. Natural ability, combined with scientific training, enabled the technical chemist, in time, to control the manipulation of material on the large scale, to erect plant, keep it in a state of repair, and to manufacture at the lowest possible cost, while maintaining a high standard of excellence of the products. Above all, he had to learn to constantly bear in mind that the sole object of all manufacturing operations is to make money. If the University student was fortunate enough to be endowed with sufficient natural ability to develop these qualities by many years of works' training and experience, and also combined with it the thorough University training which Prof. Donnan has suggested, then he was bound to be a successful technical chemist, provided he was afforded one thing more—the opportunity.

Mr. H. E. PORTER, speaking as a student, thought that research was one of the most important of the points which were raised by Professor Donnan. In the necessarily crowded state of a man's first years at the University, when he assimilated knowledge at a tremendously rapid rate, he had no time to think. It was in post-graduate years, while he was pursuing research work, that he was given breathing space to become more mentally alert. The true value of research consisted in this, that when a man was placed in a new set of circumstances, he would be able to adapt himself quickly, and thus do good work.

Mr. SOUTHWICK said that the teaching of business methods seemed to be quite out of the function of the University. As to research, much would depend upon the kind of technical chemist one was discussing. Was there not a great opportunity for Professors and Directors of Research to take up technical problems? By that he meant, not some definite problem that came into a particular works, but the problems of pure science. Take, for instance, the oil industry. There were many scientific problems in all branches. This would have another important influence, in that it would cement together the manufacturer in goodwill with the University. If the University to some extent allowed its men to take up some of these problems, the effect would be to attract the manufacturer to the University, such as he understood had happened in Birmingham.

Professor DONNAN, in summing up what had been said, concluded that the majority of speakers were against any special training in business methods, finance, or engineering at the University, considering that the student's time would be best spent in acquiring a sound knowledge of mathematics, physics, and chemistry, and in learning how to attack new chemical problems.

New York Section.

Meeting held at the Chemists' Club on Friday, February 19th, 1900.

MR. MAXIMILIAN TOLIN in the chair.

COLLOID CHEMISTRY AND SOME OF ITS TECHNICAL ASPECTS.

BY JEROME ALEXANDER.

Before discussing the technical aspects of colloids, it might be well to review in a general way some of the results of recent research on this interesting class of substances, the behaviour and reactions of which stand, so to speak, midway between the physical changes of matter on the one hand, and the chemical changes of matter on the other. Instead of referring to colloids as a "class of substances," it would perhaps be more correct to speak, as Graham does (*Phil. Trans.*, 1861, p. 183), of the "colloidal condition of matter," for many substances may exist in either the colloidal or the crystalloidal state, depending upon the nature of the solvent (e.g., certain soaps) or upon the conditions governing their formation (e.g., gold, sodium chloride, calcium carbonate, silicic acid, etc.).

With the aid of the ultramicroscope, which renders visible particles approaching in minuteness molecular dimensions, Zsigmondy has shown that there is no sharp line of demarcation between suspensions and solutions, but that with increasing fineness in the subdivision of the dissolved substance, there is a progressive change in the properties of the resulting fluids, the influence of gravity gradually yielding to that of the electric charge of the particles, and of other forms of energy. Thus, in the case of metallic gold, subdivisions whose particles are 1μ and over act as real suspensions and deposit their gold, whereas much finer subdivisions (60μ and under) exhibit all the properties of metal hydrosols or colloidal solutions. In the ultramicroscope the coarser subdivisions show the well known Brownian movement, which greatly increases as the particles become smaller, until at the present limit of ultramicroscopic visibility (about 5μ), it becomes enormous, both in speed and amplitude. This visual demonstration of the kinetic theory of solution justifies Graham's statement that "the colloidal is, in fact, a dynamical state of matter; the crystalloidal being the statical condition."

On the other hand there is no sharp distinction between colloids and crystalloids, but as the particles in solution become smaller and smaller, the optical heterogeneity decreases correspondingly, finally vanishing as molecular dimensions are approached. That even crystalloid solutions are not in a strict sense homogeneous, is indicated by an experiment of van Calcar and Lobry de Bruyn (*Rec. Trav. chim. Pays-Bas*, 1904, 23, 218; this J., 1904, 822), who caused the crystallisation of a considerable part of saturated crystalloid solutions at the periphery of a rapidly rotating centrifuge.

Not only does the degree of subdivision of the solute affect the properties of solutions, but the nature of the subdivided substance also enters as an important factor, producing a great multiplicity of colloidal phenomena. The fact that colloidal gold, for example, is precipitated by the addition of electrolytes is not because its particles are, as A. A. Noyes has suggested (*J. Am. Chem. Soc.*, 27, 97), larger than those of some other colloidal solutions such as gelatin and gum arabic, which are not similarly affected, but rather because of the specific properties of the particles themselves. Following Hardy (*Zeits. phys. Chem.*, 1900, 33, 326–385), Zsigmondy has expressed this difference by dividing colloids into two classes, the reversible and the irreversible, the former redissolving after desiccation at ordinary temperatures, whereas the latter do not. The following diagram, reproduced from Zsigmondy's book,* will make this classification quite clear.

* *Colloids and the Ultramicroscope* (English translation of *Zur Erkenntnis der Kolloide*). John Wiley and Son, N.Y., Chapman and Hall, London.

Rohland (Sprechsaal, 42, 1371) has investigated the effect of the addition of colloids to clay, and studied the modifying factors; he has also pointed out that highly plastic clays act like colloids (Zeits. Chem. Ind. Kolloide, 1907, 2, 177; this J., 1908, 27, 34). In French Pat. 387,803, Feb. 24, 1908, Keppeler and Spangenberg claim the addition of alkaline humus-like materials for the purpose of rendering clay more plastic and easier to cast (this J., 1908, 857).

These effects, together with the well-known superior sizing properties of glue and similar colloids which "free out" clay and make it "coyer" in surfacing paper and in kalsomining, are readily explained by the property possessed by reversible colloids of opposing group-formation and thus producing a fine grained structure.

Plaster of Paris.

Glues, gums, and other colloidal substances delay the setting of plaster of Paris, and "retarders" of this character have been in use for years. In order to show the nature of this retarding action, I prepared some solutions of the plaster and made microscope slides of each with the following results:—

1 part plaster to 1 part water con- taining per cent. 160 test * gelatin.	Time to set in minutes.	Microscopic appearance of slide.
0	40	Characteristic crystals of calcium sulphate.
1/100	50	No crystals, except in a few spots where some colloid free solution had diffused out.
1/10	260	No crystals.
1/4	510	No crystals.
1/2	960	No crystals.
1	Not set in 48 hours	No crystals.
2	Not set in 48 hours	No crystals.

* See this J., 1906, 25, 160.

Boiler scale.

In addition to containing various salts intended to precipitate scale-forming ingredients, most formulas for "boiler-compounds" and scale-preventing mixtures include such substances as glue, dextrin, starch, potatoes, tannin, extract of hemlock, etc. These colloids undoubtedly prevent the formation of hard crystalline scale, either by inhibiting to some extent the precipitation of the scale-forming salts or by keeping the precipitate in an extremely fine non-crystallising condition.

Soils and fertilisers.

Although from time immemorial farmers have classified soils on the basis of their physical and physiological character as "light" or "heavy," "rich" or "poor," "productive" or "unproductive," etc., it is only within comparatively recent years that chemists have begun to realise the full importance of the rôle played by the colloids, especially the organic colloids of the soil.

Many important properties of soils, such as permeability, capillarity, absorption, moisture content, etc., are dependent not so much upon the chemical composition as upon the size of the constituent soil particles. (See Atterberg, Schwed. landw. Akad., 1903, and Chem.-Zeit., 1905, 29, 195; Patten and Waggaman, U.S. Dept. of Agri., Bureau of Soils, Bull. No. 52, 1908.) In coarse sand, for example, the amount of water is greatest at the bottom and smallest at the top, whereas in fine clay the distribution is much more uniform.

Among the natural agencies tending to increase the size of the minute soil particles may be mentioned heat with its drying or evaporative effect, freezing, and the coagulating or flocculating action of soluble inorganic salts and of some organic substances present in the soil. On the other hand, included in that little known class of substances vaguely described as "humus," there are numerous organic substances derived from bacterial,

plant, or animal *debris*, or exuded by the roots of plants, which act as protective colloids (*Schutzkolloide*) and tend to produce and maintain the hydrosol in a diffuse or deflocculated condition. (See P. Ehrenberg, "Die Kolloide des Ackerbodens," Zeits. angew. Chem., 1908, 41, 2122). In an excellent paper on the mechanics of soil moisture, L. J. Briggs (U.S. Dept. of Agri., Bureau of Soils, Bull. No. 10, 1897), pointed out that very small quantities of certain organic substances such as are continually being produced in the soil by the decay of organic matter, greatly decrease the surface tension of solutions, thus counteracting to a large extent the effects of the surface application of soluble salts which would tend to draw moisture to the surface by increasing the surface tension of the capillary water of soils. It is well known, however, that an excess of salts will ruin a soil physically, as is evident after flooding by sea water or the continuous application of chemical fertilisers. Of interest in this connection is the recent work of the Bureau of Soils, U.S. Dept. of Agriculture, carried out by Cameron, Schreiner, Livingston, and their co-workers. Thus, in the case of the unproductive Takoma soil, green manure, oak-leaves, tannin, and pyrogallol greatly benefited plants grown in it. The injurious effects of quinone and some other organic substances may be due to their ability to precipitate or flocculate the protective colloids of the soil; for as Lumière and Seyewetz have shown (Bull. Soc. Chim., 1907, 4, 428—431; this J., 1907, 703), quinone renders gelatin insoluble.

The fact observed by Fickenday (J. Landw., 1906, 54, 343), that more alkali is required to flocculate natural clay soils than kaolin suspensions, he attributes to the protective action of the humus present (see Keppeler and Spangenberg, J. Landw., 1907, 55, 299).

A. S. Cushman, in his excellent work upon the use of feldspathic rock as fertiliser (U.S. Dept. of Agri., Bureau of Plant Industry, Bulletin No. 104; Cushman and Hubbard, J. Am. Chem. Soc., 30, 779), has shown that the fine grinding of feldspar increases the amount of potash available under the action of water. Thus a coarse powder having an area of 43 sq. cm. per c.c. of solid feldspar yielded 0.013 per cent., whereas a fine powder whose area was 501,486 sq. cm. per c.c. yielded 0.873 per cent. of potash and soda. These fine particles averaged about 0.1 μ in diameter, which is relatively large as compared with colloidal dimensions; but under the action of physical and chemical soil agencies they undergo further disintegration, finally reaching a colloidal condition in which still more of their potash is available, a condition favoured and maintained by the organic protective colloids of the soil.

With these brief and inadequate remarks I must dismiss this subject of such vast importance and fascinating interest, referring to the extensive literature, much of which is quoted in the Bulletin No. 52 and the other publications of the Bureau of Soils.

Electroplating and electrodeposition of metals.

As might well be expected from the experiment with lead nitrate previously referred to, the addition of protective colloids to electroplating baths tends to the production of fine grained non-crystalline deposits. A. G. Betts, in a paper entitled "The phenomena of metal depositing" (J. Am. Electrochem. Soc., 1905, 8, 63), has shown that there are many factors influencing the action of the colloid, and has suggested a number of possible explanations. The correct explanation, however, has been given by Müller and Bahntje (Z. Elektrochem., 1906, 12, 317; this J., 1906, 484), who state that the added colloid keeps the deposited metal (copper) in an amorphous, non-crystalline condition, gelatin producing the most powerful effect, egg albumen considerably less, while gum and starch have comparatively little action. They also found that the deposited copper weighed about 0.2 per cent. more than under normal conditions, indicating that some of the colloid had been carried down with the metal.

The relative efficiency of the colloids just referred to, corresponds to their relative efficiency in protecting from coagulation solutions of colloidal gold (see Zsigmondy, this J., 1902, 192), which is additional evidence that we

have here another instance of protective colloidal action, by which the crystallisation forces of the metal are powerfully influenced.

Metallurgy.

Since coarsely crystalline metals are brittle, tending to split along the lines of crystal cleavage, various physical and chemical means are employed in technical practice to obtain a hard, fine-grained structure (see P. Longmuir, *Iron and Steel Inst.*, Sept. 1907; this J., 1907, 1094). Among the physical methods are chilling and rolling, while the chemical methods involve the removal of undesirable constituents (as in the conversion of pig iron into steel), or the addition of desirable constituents (as in case-hardening, and the manufacture of "chrome steel," "nickel steel," etc.). For example, P. Pütz has shown (this J., 1907, 614) that the predominant effect of vanadium in steel is to decrease the size of the ferrite grains and make the material harder; it renders the ordinary structure due to pearlite fine-grained and homogeneous. (See also Beilby, *Proc. Roy. Soc., A*, 79, 463; this J., 1907, 926.)

Now, while the question is one of very great complexity, many of the facts at present available seem to indicate that one of the causes favouring the fine-grained structure, is the inhibition of crystallisation by substances colloiddally dissolved in the molten mass. Thus, part of the carbon is iron and steel exists in the graphitic form, and as graphite is slightly soluble in iron (see C. Benedicks, *Metallurgie*, 1908, 5, 41; this J., 1908, 406), some of it will, under proper conditions, be found in colloidal form (Carnegie Research Reports, this J., 1908, 27, 570; F. Wüst, this J., 1907, 26, 412; Hersey, this J., 27, 531). Besides metals may dissolve each other and other substances colloiddally, but in the case of ordinary metals this is not easy to demonstrate, although a differential solvent acting in the presence of a protective colloid might leave a colloidal residue.

An observation I recently made is of interest here. Moissan (*Comptes rend.*, 144, 593; this J., 1907, 413) has noted that the addition of a little platinum to metallic mercury causes the latter to "emulsify" in water. Upon making up such an "emulsion," I noticed that the supernatant fluid remained turbid upon standing and therefore examined the fluid in the ultramicroscope, which revealed the presence of colloidal metallic particles in active motion.

Dyeing.

The difference between a physical mixture and a chemical compound is frequently illustrated by dissolving out the sulphur from a mixture of iron filings and sulphur dust, and showing that the solvent, carbon bisulphide, does not affect the compound, ferrous sulphide. That in many cases dyeing is due, not to chemical combination, but to an absorption of the dye by the colloidal fibre, is evident from the fact that some dyestuffs can be extracted from the dyed fibre by means of alcohol. Investigation has shown that many dyes are colloidal in solution, and the selective colouring of various fibres, tissues, cells, nuclei, etc., is probably due to the selective absorption or precipitation of one colloid by another. The ultramicroscopic researches of N. Gaidukov (*Zeits. angew. Chem.*, 21, 393) support this view.

The phenomena of dyeing are rather numerous and complicated, for the dyestuffs are numbered by thousands, and the various fibres, tissues, etc., such as cotton, silk, wool, linen, jute, and straw, all react characteristically. In some cases the colloid fibre absorbs the dye, as with basic colours which dye silk and wool directly; in other cases there is necessary a mordant which is first absorbed and then fixes the colour. Certain colours mutually precipitate each other and may in fact serve as mordants for each other; e.g., methylene blue and dianil blue 2 R.; patent blue V and magenta.

Colloid chemistry also throws much light upon many obscure points in the practical art of dyeing. It is possible to obtain much more level colours in old dye-liquors than in fresh ones, and here it seems to me that colloiddally dissolved substances are responsible, exercising a restraining action upon the absorption of the colour. The addition

of Glaubers' salt facilitates level dyeing, probably by its action as an electrolyte, producing a partial coagulation of the dyestuff, so that the particles of the latter, thereby made larger, are absorbed more slowly and evenly.

In the production of colour lakes glue or gelatin is frequently added to bring about the formation of a fine-grained precipitate of great covering power. (See Zsigmondy, p. 62.) See also the following references to some of the recent work on the theory of dyeing:—Krafft, *Ber.*, 1899, 32, 1608; this J., 1899, 757; W. Biltz, this J., 1904, 23, 439; 1905, 24, 920; Biltz and Fiescher, this J., 1906, 25, 118; R. Willstätter, this J., 1904, 23, 1085; Freundlich and Losev, this J., 1907, 26, 682; Freundlich and Neumann, this J., 1908, 27, 935; Pelet and Grand, this J., 1907, 26, 920; Pelet-Jolivet and Anderson, *Z. Chem. und Ind. Koll.*, 2, 225, this J., 1908, 1149; des Bancelles, this J., 1906, 25, 852; Pietron and Linder, this J., 1906, 25, 67; Teague and Baxton, this J., 26, 1081; 27, 441; Lewis, this J., 1908, 27, 330.

Soap.

In a comprehensive paper entitled "Modern views on the constitution of soap," read before this section (see this J., 1907, 26, 590), Lewkowitsch epitomises the views of Merklen substantially as follows: "Commercial soap is a product having an essentially variable composition dependent upon (1) the nature of the fatty acids, (2) the composition of the 'nigre' (in the case of settled soaps), (3) on the temperature at which the boiling is conducted: it behaves like a colloid, and should not be regarded as a compound of sodium salts of fatty acids with which a definite amount of water is combined chemically, but rather as an 'absorption-product' whose composition is a function of the environment in which the salts of the fatty acids happen to be at the moment of the finishing operation."

Merklen's views conflict with the views as to the chemical composition of soap previously advanced by Lewkowitsch, who states, in conclusion: "But whatever may be the outcome of renewed experiments, Merklen's views cannot fail to stimulate further research into the composition of soap, and thus help to raise the industry of soapmaking, which has too long been looked upon as a mere art, to the rank of a scientifically well-founded industry, the operations of which are governed by the laws of mass action, the phase rule, and the modern chemistry of colloids."

The colloidal nature of soap solutions is indicated by their turbidity and their gelatinisation. That the detergent action of soap is consequent upon its deflocculating effect was brought out in the interesting Cantor Lecture of H. Jackson (*J. Soc. Arts*, 55, 1101 *et seq.*), who examined microscopically the supernatant fluid resulting from washing a dirty cloth with soap and water, and found in it countless particles in a state of oscillatory motion ("pedesis"). When an individual fibre was bathed in soap solution, the dirt particles gradually loosened and began to oscillate; upon substituting salt solution for the soap, the particles flocculated and the motion ceased. An ultramicroscopic examination of the detergent effects produced by soap should prove of interest. In this connection I must make mention of the excellent paper of W. D. Richardson on "Transparent soap" (*J. Amer. Chem. Soc.*, 30, 414), which he terms a supercooled or supersaturated solution, having distinctly crystalline tendencies, and exhibiting colloidal properties. Having in mind the fact that the salts of the higher fatty acids dissolve in water as colloids, and in alcohol as crystalloids (S. Ya. Levites, *Zeits. Chem. Ind. Kolloide*, 2, 208 *et seq.*; this J., 1908, 1134; Mayer, Schaeffer, and Terroine, *Compt. rend.*, 146, 481), and also the fact that alcohol or equivalent solvents (glycerol, sugar, &c.) are used in transparent soap, it seems probable that the crystals which frequently form in it are due to the slow separation of such part of the soap as is in crystalloid solution. This view is supported by the fact adduced by Richardson (*loc. cit.*, p. 418), that the fatty acids separated from the crystals had a higher melting point than those separated from the clear matrix. The isolation of the crystals was difficult because of their ramifying tendency, which recalls some of the crystal-figures exhibited by some of the mixtures of crystalloids and colloids previously referred to.

What we may call the crystalloid phase of soap is apparently governed by the same factors as those which Tamman has pointed out as governing the crystallisation of supercooled solutions, i.e., 1st, the specific power of crystallisation; 2nd, the speed of crystallisation; 3rd, the viscosity (see Zsigmondy, p. 128 *et seq.*). Thus, gold ruby glass when quickly cooled (or supercooled) is colourless, but acquires a red colour upon reheating to the softening point. By ultramicroscopic examination Zsigmondy showed that the nuclei of metallic gold, which in the colourless glass were amicroscopic, grew into ultramicroscopic visibility in the red glass. It therefore seemed to me that a most important factor in determining the transparency of transparent soap would be the speed of cooling, and some experiments were made along this line.

A piece of commercial transparent soap was melted and cast into two cups, one of which was quickly chilled in ice, while the other was allowed to cool slowly by immersion in hot water. The quickly-cooled piece was transparent, while the other was practically opaque, and showed upon ultramicroscopic examination much larger ultramicros than the transparent piece.

Milk.

That casein exists in milk as an irreversible colloid, and can be protected by reversible colloids ("Schutzkolloide"), I have shown by the following experiment: Skim milk was diluted with water and divided into two parts, to one of which was added a little liquid glue or gelatin. The two solutions were placed in boiling tubes and acidified slightly with acid (acetic or hydrochloric). The tube without the added colloid cleared up rapidly, the precipitate formed rising to the top and leaving the fluid beneath quite clear. The tube containing the added colloid, while eventually showing some precipitate, remained milky even after several weeks' standing. Since writing the above, the ultramicroscopic observation of Kridl and Neumann (Physiol. Inst. Univ. of Vienna [Pflüger], 123, 523-539), also support the conclusion that the casein of milk is an irreversible hydrosol.

This view has an important bearing on the question of the modification of cows' milk for infant feeding, for it justifies the addition of reversible colloids such as cereal gruels, gelatin, etc., which had been opposed by some physicians on the ground that they were not normal constituents of mother's milk, or any other milk. But experiment shows that the curd resulting from the coagulation of woman's milk is much softer and more readily digested than that yielded by cow's milk, which, as an inspection of the subjoined table will show, indicates that the so-called albumin of woman's milk acts as a protective colloid.

Average composition.

	Woman's milk.	Cow's milk.
Water	88.20	87.1
Proteins (Casein (irreversible hydrosol) (Albumin (reversible hydrosol))	0.75 1.00	3.02 0.53
Fat	3.50	3.69
Sugar	6.20	4.88
Ash	0.25	—

To physicians it is certainly no novel statement that the addition of reversible colloids to cow's milk, very much increases its digestibility. Thus, Dr. A. Jacobi says ("The Intestinal Diseases of Infancy and Childhood" (1890), p. 62 *et seq.*): "There is no doubt, therefore, as to the utility of gum arabic and gelatin as an addition to cow's milk and to children's diet. Not only do they fulfil the indication of diminishing and distributing the particles in cow's milk, but they also officiate as a means of direct nourishment by preventing waste." He also points out that: "it was evident that the other ingesta were more completely digested, and that a smaller amount of excrementitious matter was discharged when gelatin was added than when omitted." In this case the added "protective" colloids act by preventing the formation

of large groups when the casein is coagulated by the acid juices of the stomach, so that the precipitate (if at all formed) is readily dissolved by the digestive enzymes. In fact, it may be that the coagulation of the casein is entirely prevented, for Jacobi remarks that milk, when mixed with gum arabic, bears the admixture of hydrochloric acid quite well. In his book on the "Diseases of Infancy and Childhood" (1902), H. Koplik states: "The amount of casein in cow's milk is not only relatively, but absolutely greater than in woman's milk. In describing woman's milk, it was stated that in cow's milk the casein forms five-sixths of the total proteids in the milk, whereas in woman's milk the casein forms two-sixths of the total proteids. This fact is of far-reaching importance. Simple dilution of cow's milk leaves it with a greater proportion of casein relatively to the other proteids than that which exists in human milk. Again, cow's milk precipitates or coagulates very early with the aid of acids and salts; woman's milk quite late, or not at all. Therefore, in the infant stomach cow's milk does not take up much acid of the gastric juice and soon coagulates in large masses. Woman's milk, on the other hand, takes up a large amount of acid of the gastric juice, and coagulates late in small masses. These differences in the modes of coagulation in the two caseins are of great importance in the study of infant feeding."

Further investigation is being made as to the nature of the chemical composition and the condition of subdivision of the casein in various milks, which have been assumed to be chemically different. Many reactions which have been held to indicate such chemical difference may be simply due to the presence of varying amounts of protective colloids, or to differences in the colloidal condition or aggregation of the same casein, consequent to some extent, perhaps, upon differences of reaction, or quantity of salts or enzymes present.

Ice cream.

It is a fact well known to practical ice cream makers, and amply proven by experience, that ice cream made without eggs, gelatin, or some similar colloidal ingredient is gritty, grainy, or sandy, or else soon becomes so upon standing; whereas ice cream made with small quantities of colloids possesses that rich, mellow, velvety texture so much in demand. Here the added colloid acts as an inhibitor of crystallisation or practically speaking as a preserver of texture. This was pointed out in a preliminary paper entitled "The Effect of Colloids upon Crystallisation," read before the New York Section of the American Chemical Society, April 10th, 1908, and published in the Zeits. Chem. Ind. der Kolloide, Feb., 1909. In this paper I also stated that the added colloid, especially gelatin, which is the one most generally used, may serve as a protective colloid in preventing the coagulation of casein, apparently an irreversible hydrosol and a normal constituent of ice cream. In view of what has been said above regarding milk, it is evident that gelatin thus renders ice cream more digestible. I convinced myself of this fact by making up two batches of ice cream under uniform conditions, one with and one without the addition of gelatin. I found the batch with gelatin smooth, velvety, and delicious, whereas the other was sandy, grainy, and unsatisfactory. I have observed the same sandiness in "Philadelphia" ice cream made from 22 per cent. cream, in which, chiefly for sentimental reasons, no gelatin had been used. The "French" ice cream of the same manufacturer contained eggs and was smooth and fine grained. (See also Liesegang, this J., 1908, 27, 634.)

A very misleading impression is given by some official food chemists referring to gelatin in ice cream as a "filler," which naturally leads to the idea that it is an inferior ingredient added in quantity to cheapen the product. But as gelatin is expensive, and as but 1 per cent. is used, such a view is evidently erroneous. The food value of gelatin as a protector of the body's nitrogen being generally admitted, and its effects in milk being very beneficial from a digestive point of view, its use in ice cream in the quantities referred to is necessary, legitimate, and scientific.

The above is of particular interest in view of the fact that the standard promulgated for ice cream by the U.S. Hon. Secretary of Agriculture acting upon the advice of the Committee on Food Standards, excludes eggs, gelatin, and similar colloids from this confection, thus making "illegal" French ice cream made according to old-established formulas. Most of the States fortunately do not accept the national standard, but permit each maker to use his own formula with reasonable limitations.

Confectionery.

In gum drops, marshmallows, "moonshine," and other candies, use is made of gum arabic, gelatin, albumen, and other colloids to prevent the crystallisation of the sugar. Thus, besides adding to the food value, they give the candy a smooth and agreeable taste, and preserve it in saleable condition.

Filtration.

The importance, in technical filtration, of the relation between the size of the particles of a precipitate and the size of the orifices in the filter, has been pointed out by Hatschek (this J., 1908, 27, 538). It is quite evident that the presence of protective colloids by tending to produce the fine or "hydrosol" condition may entirely prevent the filtration of a precipitate by ordinary means, and for this very reason the filtration of glue and gelatin liquors is practically impossible unless a flocculated "hydrogel" precipitate is first obtained. The work of Zsigmondy and Schulz on the filtration of gold hydrosols is of particular interest in this connection. (See also Bechhold, Z. Chem. und Ind. Koll., 1906, 1, 107; Z. physik. Chem., 1907, 60, 257; Biochem. Z., 6, 379; Bigelow, J. Am. Chem. Soc. 29, 1675; this J., 27, 93.)

Chemical Analysis.

The presence of colloids, especially in technical products or solutions, may lead to grave errors in analysis, so that the chemist should destroy them by ignition, or else nullify their effects by the addition of a sufficient excess of coagulant or precipitant. Reversible colloids, which are frequently referred to under the vague term "organic matter," may act: (1) by totally or partially preventing the formation of precipitates, just as tartaric acid and tartrates prevent the precipitation of alumina, chromic oxide, and ferric oxide (see Yoshimoto, this J., 1908, 27, 952); (2) by preventing the satisfactory filtration of the precipitate formed (see Mooers and Hampton, J. Am. Chem. Soc., 30, 895); (3) by rendering precipitates difficult to wash and purify (see Duclaux, this J., 1906, 25, 866).

A few experiments will serve to make clear the importance of these remarks. Three solutions of lead acetate were taken; to the first was added hydrochloric acid which yielded a heavy coagulated precipitate; to the second was added sodium chloride (a less highly ionized precipitant), which yielded a colloidal precipitate of lead chloride; to the third was added, first, a little glue solution and then sodium chloride, which in this case gave no precipitate at all.

Again, in the presence of glue, silver nitrate gives with sodium chloride only an opalescence which passes through filter paper. Even a large excess of hydrochloric acid fails to produce a precipitate. But upon adding to the solutions containing the colloid and chloride, some silver nitrate containing no protective colloid, a copious precipitation occurs at once.

Any number of experiments of this kind can be made; among those I have found of interest are:

Sodium thiosulphate	+ colloid + hydrochloric acid;
Calcium chloride	+ colloid + ammonium oxalate;
Lead acetate	+ colloid + zinc sulphate
Lead acetate	+ colloid + potassium iodide;
Lead acetate	+ colloid + potassium bichromate;
Magnesium sulphate	+ colloid + barium chloride;
Potassium ferrocyanide	+ colloid + copper sulphate;
Ferrous chloride	+ colloid + ammonia;
Hydrochloric acid	+ colloid + sodium thiosulphate;

This general and incomplete survey of some of the technical applications of colloid chemistry might

be extended indefinitely, for recent chemical literature teems with papers applicable to the subject. Thus, Fouquet (Bull. Assoc. Chim. Suer. Dist., 25, 1046) has discussed the removal of the colloids which in crude sugar prevent the clarification of the solution and crystallisation of the sucrose. O'Shaughnessy and Kimmersley (this J., 25, 719), and Fowler, Evans, and Oddie (this J., 27, 295), have discussed the importance of colloids in sewage disposal. Bayliss, in his excellent monograph on "The Nature of Enzyme Action," considers enzymes in the light of colloid-chemistry. Raschig has found (see this J., 1907, 26, 1108; c.f., also Cross, Bevan, and Briggs, this J., 1908, 27, 260) that the addition of a very small quantity of glue or gelatin to the reacting mixture greatly increases the yield of hydrazine. In weighting silk, gelatin is used to "animalise" the fibre, which it does by preventing the crystallisation of the salts used for loading, which would render the fibre brittle. (See Gnehm and Bünziger, this J., 1897, 16, 234; Jochen, U.S. Patent 792,218, this J., 1905, 24, 799; Meister, this J., 1906, 25, 128.)

The applications of colloid chemistry to tanning (see Westenfelder, Ilide and Leather, 25, 12; Herzog and Adler, this J., 1908, 27, 347; J. T. Wood, this J., 1908, 27, 384), to photography, to pharmacy, to the cement industry (see Gaines, U.S. Patent 883,683; Gresly, this J., 1908, 27, 1154), and to many other technical branches, are continually appearing in the journal and patent literature, to which those interested must refer. Among the investigators whose work in the field of colloid chemistry is of importance, may be mentioned Cotton and Monton, Bechhold, Billitzer, Biltz, Bredig, Coehn, Donau, Donnan, Duclaux, Ehrenberg, Freundlich, Hardy, Jordis, Kuzel, Levites, Lobry de Bruyn, Lottermoser, Michaelis, Müller, Nuthmann, Neuberg, Paal, Pauli, Quinke, Schulze, Spring, Svedberg, von Weimarn, Zsigmondy, and many others.

In conclusion, I would say that my object is accomplished if I have succeeded in exhibiting the great and widespread technical importance of colloids and the colloidal condition.

"COMMERS" IN HONOUR OF DR. H. SCHWEITZER.

On Saturday, March 13th, a "Commers" took place at the Liederkranz Hall, New York City, Prof. C. F. Chandler presiding, to celebrate the 25th anniversary of Dr. Hugo Schweitzer's Doctorate, the 20th anniversary of his arrival in New York, the 9th anniversary of the foundation of the Verein Deutscher Chemiker, and the completion of his 15th year of office as Hon. Secretary of the New York Section of the Society of Chemical Industry, when a presentation of plate was made.

Scottish Section.

Meeting held at Glasgow on Tuesday, February 16th, 1909.

MR. DAVID J. PLAYFAIR IN THE CHAIR.

THE FACTORS THAT CONSTITUTE VALUE IN TEAS.

BY W. CARRICK ANDERSON, M.A., D.Sc.

Although the growing and curing of tea is from beginning to end a chemical manufacture, and by no means a simple one, it is only of very recent years that chemistry has been allowed a place at any stage either in its cultivation or preparation. The pioneer work of Bamber in Ceylon and of H. H. Mann in North East India during the last decade has made a commencement in removing this reproach from an important industry by numerous observations made on the course of manufacture and by the publication of extended series of analyses of typical soils in which the tea plant flourishes and is capable of economic cultivation. Simultaneously the practice of manuring tea lands with artificial preparations more or less skilfully compounded has, in Ceylon particularly, been followed by results so remarkable in respect of heavier yields of leaf per acre as

largely to modify the scepticism with which in this, as in many another established industry, the rule of thumb manufacturer looked upon the ambitious advances of applied science. An increase in yield from, say, 400 to 600 lb. of made tea per acre on some estates within a few years as the result of artificial manuring has gone far to convince even conservative planters that the industry may have much to gain from a scientific study of its problems and particularly from an elucidation of the chemical changes that occur in the leaf before and during its manufacture into a marketable commodity.

Apart from increase of yield, however, it must be admitted that on the side of cultivation there is, up to the present, no very decided improvement that can be pointed to as the direct result of a scientific study of the question. That is to say, if we take increase in the average market price per lb. for the produce of an estate as the indication and measure of any such improvement, it is doubtful whether any unequivocal example is forthcoming of improvement in quality induced by manuring on so-called scientific lines which has been sufficiently marked to influence this average to the extent of $\frac{1}{4}$ d. or even $\frac{1}{2}$ d. per lb. On the other hand, it is a matter of common knowledge that on different estates the quality of the tea produced varies enormously, and that this variation is reflected more or less steadily in the prices obtained for it. Moreover this inequality exists even in cases where it cannot be charged to variety in the jāt or in the age of the bushes or to any difference in the degree of skill or the length of experience of those responsible for the management. It is traceable, in fact, entirely in many cases to variations in the resultant of forces that operate in the growth of the leaf which have their seat either in the soil or in the air or in the two together. A diligent inquiry, therefore, into the nature and relative values of these forces is bound sooner or later to bring to light the cause of the differences and to supply the necessary data for judging under what circumstances and to what extent the best conditions may be artificially created with due regard to the economics of the problem.

But again the resultant of the forces at work in air and soil which produces leaf of a particular quality is subject to further influence by the new forces brought to bear upon the leaf during the course of manufacture, which may have the ultimate effect of causing the most to be made of a certain quality of leaf that can be made, or of detracting more or less considerably from the potential value it possessed when it left the bush. Here the chemical problems, though complicated and difficult, are perhaps less abstruse than those to be handled in the case of leaf growth, and already a large amount of information exists bearing on the changes that take place in the withering, fermentation and drying stages of the manufacture. Though even here a beginning only has been made, there is little doubt that it is simply a matter of time till the whole series of operations in the tea factory is as thoroughly understood and as rigorously controlled as is the case in many other chemical industries that at one period were not less empirical in their ways of working. At present, variations in the quality of leaf give rise to a good deal of experimenting on most estates, the managers in some cases expending much ingenuity in devising alterations here and there that may or may not be beneficial, and in others modifying their processes as the result of hearsay regarding the supposed advantage that has accrued to some other estate through the adoption of a certain line of action.

In hardly any case is the course adopted based on any well-ascertained chemical data. It is purely empirical, and in the end has to stand or fall by what the general reports of the tea taster appear to indicate as to improvement or the reverse having taken place in the teas sent down from the estate to Calcutta, Colombo, or London.

There are two primary criticisms that may be passed on this sort of experimenting in the case of tea: (1) The factors that enter into the production of tea, good or indifferent, are very numerous, very variable in degree, and extraordinarily complicated in their interaction. (2) The qualities on which the market valuation is based are many, the importance attached to some of them is by no means always proportional to their amount, and their desirability in relation to one another, from a market point

of view, is not the same in different types of leaf. It is evident, therefore, that any alteration in the treatment of the leaf on the bush or subsequently may produce a series of changes of which some may be beneficial and some adverse, and that until the factors that collectively constitute value are differentiated and regarded, separately from one another, as contributing to the market price, there is no clear guidance available for those who would make systematic efforts towards improvement in the market valuations of their tea. The purpose of the present paper is to state briefly what these factors are, and in general terms to indicate their importance relatively to one another.

First of all, however, a word must be said on the position of the tea-taster. Since in the end the goodness of a tea is determined by the price it will fetch in the market, the services of the expert tea-taster are indispensable. He is the interpreter of the mind of the market, and speaks its wishes frequently with an accuracy that is astonishing. In arriving at his valuation he has to appraise the merits of a sample in respect collectively to flavour, pungency, thickness and colour of liquor, tippiness (if any), make or twist of leaf, and freedom from brown leaf or stalk, with allowance for any individual or local characteristics it may possess. He must also know the relative demands of the market at the moment for each separate grade of leaf, broken orange pekoes, broken pekoes, orange pekoes, pekoes, pekoe souchongs and fannings, and be able to value them accurately in relation to one another. That this can be done with the degree of precision that is sometimes shown speaks eloquently for the sensitiveness of a trained eye and palate, especially when one considers that in some establishments several hundred samples have to be tasted and valued per diem. On the other hand, the tea-taster discriminates only in a very general way between the elements that contribute to his valuation, if at all, and not to the extent or to the degree of minuteness that is required for the purposes of investigation or that is (in the case of some items at least) possible by chemical methods. For this reason, while samples must continue to be referred ultimately to the judgment of the tea-taster for his opinion on its market value, progress towards improvement will only become possible as systematic work in the laboratory is directed towards ascertaining (1) the chemical nature and origin of the bodies whose presence gives rise to one or more factors of value, and (2) the quantitative relationship in which each of these stands to market price.

Of the totality of factors mentioned above that enter into the market value of tea, one group is judged by the eye, the other by the palate, and in some cases the evidence obtainable by the eye probably carries the greater weight. It includes (1) Tip, (2) Twist or make, (3) Presence or absence of stalk and brown leaf.

By "tip" is meant that portion of the young shoot of the tea plant which consists of an unopened, or partially opened, bud developed under conditions such that, when properly handled in the subsequent manufacturing operations, it appears finally of a rich golden colour. Tip is a fluctuating quantity: largely seasonal and associated with some estates and districts to a much greater extent than with others. It is very easily diminished in amount, and may even be entirely obliterated in the course of the manufacturing operations, becoming of a dull brown or black colour, almost or altogether indistinguishable from the rest of the bulk. Its tendency is to disappear also on keeping, particularly where the tea has not been packed straight from the dryer or a final firing has been omitted. "Tip" shows principally in the fannings and broken orange, broken and orange pekoes: only in exceptional cases does it reach the pekoe grade. It is one of the consequences of the empirical valuation of teas by appearance that "tippiness" brings an altogether disproportionate addition to what might be called the real or intrinsic value of a sample: a broken orange pekoe, for example, which, if its liquor only were paid attention to, would be worth $\frac{1}{2}$ d. or 6d. per lb., might fetch 1s. 6d. per lb. in the market if possessed of a fine show of bright, golden tip. The conditions that give rise to tip are still obscure. It consists mainly of bud, but all buds will not yield tip, even with the most careful manufacture, while at other times a first leaf, in addition

to the bud, may in the finished tea be retained in the tippy condition.

Twist is another element that enters into the judgment of tea samples by the eye. To a large extent it is a sentimental consideration, a well-twisted pekoe, for example, having a neater and pleasanter appearance than one that is rough and bold in character. It is in itself no safe guide to the degree of care exercised in handling, still less is it to be taken as a criterion of relative merit intrinsically as between one sample and another. It may in one case indicate that the leaf has been underwithered from a mechanical point of view, so that it has been unable to retain the twist; in another that it has been too short a time in the rollers; and in a third that it has been very rapidly dried at a high temperature in the firing machine. Apart from the sentimental consideration, the evidence afforded by the twist of the leaf is useful only as collateral to the evidence of the liquor itself.

The presence of brown leaf or stalk in a sample of tea is the third point to which attention is given in an examination by the eye. It is due to the inclusion in the manufactured leaf of portions of the tea bush of such a character that during manufacture the chemical changes that normally take place in the stages of withering and fermentation have been able to progress in them only slowly and to a moderate extent, with the result that the finished leaf shows up brownish black, brown, or even red in colour, according to degree. Generally the presence of red leaf points to "free plucking," and the consequent inclusion of a proportion of leaves and stalks which have so far matured that the enzyme, on which depends the chemical changes that lead to the conversion of raw leaf into tea, has become greatly weakened in its action, and the changes in consequence neither go on with sufficient rapidity nor far enough to produce the bodies that, on subsequent drying of the leaf, will result in black tea. Since low-class teas at the best contain the enzyme in lesser degree than high-class growths, it follows that, apart from any greater tendency to pluck freely on low-class tea estates in order to make up in quantity what is lacking in quality, the chances are for red leaf to show itself more readily in the produce of such estates than of those in a quality district. The superficial inspection of a sample containing red leaf may, however, be very misleading as a means of estimating the extent to which this matured leaf, which is very inferior from a liquoring point of view, has been included, since it is possible in the manufacturing process to so mask its appearance by giving it a superficial darkening in colour, that it no longer obtrudes itself on the eye as red leaf. While this is not always a procedure to be recommended, since it is apt to result in a deterioration of the liquors as a whole, it may be justifiable in practice with many low-class teas where quality of liquor is of minor account compared with appearance, since in such a case the showing of a large proportion of red leaf in the sample might readily class them as unsaleable.

(2) The factors of value in tea that are judged by the palate belong of course to the infusion, and may be distinguished as (1) flavour, (2) pungency, (3) fulness or thickness of liquor and (4) colour. The last three, when appearing in fair quantity together, constitute "strength."

The flavour of tea, which is its most subtle and delicate as well as its most variable characteristic, is due to the products of the tea oil formed by enzymic oxidation at moderate temperatures. These bodies which from their sensitiveness to free oxygen as well as to liquid oxidants are probably aldehydic in character, are developed in the course of fermentation, and are very easily deteriorated or destroyed in the drying process. They are readily volatilised by steam, and, if the aqueous vapours from the drying leaf be condensed, the water smells strongly of the oil. The total quantity of oil contained even in the leaf yielding the most flavoury teas is very minute, and hitherto the quantities extracted have been insufficient to allow of an extended study of its properties. Schimmel's Report (40, 1897) states the proportion obtained as 0.006 per cent. The specific gravity is given as 0.866. The oil is said further to be slightly levo-rotatory and to be separable by distillation into two portions, one boiling below, the other above 170° C. The portion boiling below 170° C. was found to

contain a compound having a boiling point 153—154° C. and possessing a pungent, fusel-like odour. It appeared to be alcoholic in character.

Pungency, which in more or less degree is an essential quality of saleable teas, is associated with the presence of tannin-like substances in the leaf. After withering, and before rolling has commenced, the soluble cannoid bodies are usually at a minimum, but collectively they are of such a character as to impart a harsh and more or less bitter, coarse taste to the infusion. By the oxidising influence of the air, operating mainly during the period of fermentation, they are rendered more mellow and palatable, and, if the oxidation be not unduly prolonged, the harshness may be got rid of completely, or almost completely, while the liquor still retains sufficient astringency to "draw" the mouth and leave a clean feeling in it. The change is accompanied by the passage of a portion both of the tannins and analogous substances into the insoluble condition. The bodies which are oxidised consist presumably of that portion of the reserve material on which the fasting leaf has to fall back first of all after it is removed from the parent stem, so as to make good the loss sustained in respiration, and the agency employed is the enzymes which have been liberated during the starving process that went on during the continuance of the withering stage. When an infusion is said to be dull or pointless, this has usually been regarded as equivalent to saying that the proportion of tannins had been reduced to too low a figure in consequence of a rather prolonged oxidation or fermentation of the leaf. The case, however, is not quite so simple as this would appear to make it, and the desirable "point" or piquancy in the infusion, with at the same time a blandness or mellowness as an accompaniment, is probably as much a matter of the nature of the tannoid substances, consequent on the character of the oxidation, as of their absolute quantity in the infusion.

Fulness or body is a quality that, like flavour, is very variable in tea liquors. Fulness may co-exist in a liquor with a high degree of flavour, as in many North Indian teas particularly. On the other hand many flavoury teas are lacking in fulness, and again, in others, fulness may be a redeeming character when flavour is at a minimum. The development of a high degree of fulness is in many (perhaps in most) cases incompatible with retention of the highest flavour, and it is only where flavour is a marked feature of the leaf that manufacture is conducted with that as the prime object in view. In other cases, and especially in low country or common teas, the manufacture is guided by the consideration of strength in the liquors, of which fulness forms an important attribute. Where the enzyme is abundant and active in the leaf, a full liquor is not difficult to obtain even at the moderate temperatures which experience has shown to give the best all-round quality teas. But even in leaf deficient in enzyme fulness is still purchasable by conducting the fermentation at rather higher temperatures, and to some extent and within the capabilities of the particular leaf handled the only question to be answered is as to the price to be paid for it, since at these higher temperatures the oxidation of the tannin proceeds at an accelerated rate, and thus may readily induce dulness in the liquor. In the case of low-class teas, however, fulness appears so much of a desideratum that tannin oxidation may be pushed a considerable length, provided fulness is increased thereby, without detriment to the selling price. This would appear to be particularly the case in the European market, which will welcome almost any tea provided it is coloury and full, but will only tolerate a thin liquor if its fault is condoned by flavour. The cause of fulness is specific, and it is not in any way to be identified with the amount of soluble matter in the infusion. Indeed, a leaf may have 45 per cent. of its weight soluble in water on infusion, and yet be characterised as giving a thin liquor. Withering and fermentation together, when properly conducted, may actually lessen considerably the amount of matter in the leaf that is capable of going into solution in hot water, but, on the other hand, they impart to the resulting liquor more or less of the character of fulness. The body of the liquor is increased. The cause of this is to be found in changes induced in the nitrogenous constituents of the leaf during the processes of withering and fermentation. The tissues

of the young tea shoot contain (or rather develop during the process of withering) a protease which is capable, under suitable conditions, of acting on the albumens and converting them into soluble proteoses, and more especially into albumose, and it is to the presence of these bodies in quantity that the characteristic fulness or thickness of the liquors, such as are got from high-class Assam growths, for example, is primarily due.

The last element of market value of which mention must be made is colour. A large quantity of tea comes into the European market and finds a more or less ready sale there of which perhaps most has been told that can be said when it is described as giving a dark coloury liquor on infusion. In common teas this colouriness may be found without even very much fulness, and where the latter exists it has frequently been purchased at the expense of considerable loss of pungency in manufacture through the maintenance of "stewing" conditions in the drying stage. Many of the better class Assam growths, on the other hand, combine colour and fulness (even thickness) of liquor with a large amount of pungency as well. When these three elements co-exist in marked degree in a liquor it is stamped as "strong," and such strong teas, especially if possessed of appreciable flavour, are always sure of a ready market, at least in Europe. American demand, on the contrary, appears to go more in the direction of pungent, light liquoring and flavoury teas than of those giving thick and coloury liquors, a difference of taste which, if perpetuated, indicates that in future the produce of certain estates and even of some districts may be specially hypothecated to this market, and that the course of manufacture there will in time receive the necessary adjustment to meet its particular requirements.

To sum up what has been said: tea leaf is a variable substance, both by reason of soil and climate, and may be manufactured with primary reference to flavour or to the collective qualities which produce the most acceptable liquor. Within either sphere the market valuation of the product is influenced by two sets of considerations, one of which may conveniently be called "sentimental," the other "utilitarian," and both must receive attention in every effort to improve the value of the tea that is presently being manufactured. Sentiment is mainly responsible for the inordinate valuations frequently placed on "tippy" teas, as compared with intrinsically better quality leaf destitute of tip, and, in the other direction, sentiment leads to the marking down of a tea with open twist as compared with a less palatable and intrinsically inferior leaf manufactured under conditions, fortuitous perhaps, which resulted in its being turned out with a close, firm twist. The utilitarian qualities are those which contribute to the practical usefulness or desirability of the article as a food, and give it value on that ground. No mention has been made under this category of the caffeine, for the reason that, although its presence in tea leaf is undoubtedly one of the principal causes of the extended use of tea as a beverage, such variations in its quantity as occur between one tea and another do not appear to exercise any appreciable influence on market value. The utilitarian qualities most sensibly affecting value are flavour, pungency, fulness and colour of liquor. While practical research must concern itself chiefly with the improvement of teas in respect of these, the element of appearance cannot be left out of account. Tip must be conserved where it exists; red leaf must be excluded in high-class teas by careful plucking, and in the case of common teas, if free plucking be necessary because the grade is low, conditions of manufacture must be so adjusted as to obtain the best appearance consistent with retention of sufficient pungency in the liquor. Withering must be regulated to the degree necessary to give the leaf a mechanical condition such that it will retain the twist during drying. Finally, the sifting and grading of the leaf must be done carefully and yet with expedition, since if it spends too long a time on the sifter it is apt to assume a dull grey appearance that detracts appreciably from its value in the market. Teas low in tannin, common or low country growths, are specially susceptible to this form of deterioration, which, however, a little carelessness in handling may induce even on higher-class leaf, especially the whole-leaf grades.

Within the limitations imposed by appearance there is

still, however, a wide scope for the application of chemical control in the operations of the factory and for a large amount of investigation into the exact nature of the changes that go on during the withering, fermenting, and drying of the leaf, the unravelling of which is already doing something, and will in time do more, to make the course of manufacture regular and the product more uniform in quality than at present. The reactions are complex, and the work of following them out in detail difficult and tedious, but the beginning that has been made gives rise to the hope that more may be done than at present to adjust manufacturing operations in each factory along the lines calculated to enable the highest value to be got from the leaf yielded by the particular soil on the estate.

Beyond that, again, lies the problem of producing artificially the conditions for growing the most flavoury leaf, or of that having the finest liquoring qualities. Spite of the very satisfactory results manuring has given in the way of increased yields, it has not, up to the present, been successful in appreciably enhancing the quality of the leaf grown on any estate, or even to restore quality to its original standard where it had notably deteriorated. That further study will indicate how this may be done there is little doubt: to what extent the methods thereby suggested may be given effect to on a commercial scale will be an economic question to which in course each estate must find its own answer.

THE MANUFACTURE AND PROPERTIES OF SOME STARCH ESTERS.

BY JOHN TRAQUAIR.

The object of this paper is to put on record observations on the chemical properties of a comparatively new class of starch products which are chemically distinct from ordinary soluble starches. These observations are the result of 10 years' research work, a period which synchronises with a considerable development in the methods of starch conversion.

Before dealing with the starch esters, a word or two about starch itself will be permitted. The physical structure of the starch granule has been the subject of much discussion among botanists, and there still appears to be plenty of room for further investigation.

When starch is boiled under ordinary conditions, it does not form a true colloidal solution. The granules become hydrated and swell considerably, and the easily soluble inner amylose attracts water and diffuses out rapidly, while, at the same time, many of the envelopes rupture owing to the osmotic pressure set up. If maize starch, for example, is boiled on a water-bath with 15 or 20 times its weight of water for 15 minutes after swelling the resultant paste appears to be perfectly homogeneous, but if poured into cold water and allowed to stand for a few hours, a whitish mucilaginous mass settles to the bottom. On examining on a microscope, it is seen to consist of the somewhat swollen and ruptured envelopes, the more soluble amylose being in solution. This result can be obtained by treating starch with weak alkaline solutions and various other means, but the foregoing method is perhaps the simplest. The percentage of insoluble and soluble amylose so obtained varies considerably, not only with the different starches, but with the conditions of treatment. We must consider a colloidal starch solution as a heterogeneous system of complex nature, highly sensitive to hydrolytic reagents probably as a result of the amphoteric relations of the constituent units.

During the last two or three years interesting contributions have been made to our knowledge of the chemistry of the hydrolysed starch solution, but the result of this modern investigation has so far tended to emphasise the complexity of the starch granule, and supports the view that starch is a conglutinated substance solidified in the plant from an apparently dissolved state. Starch solutions all show a tendency to revert, that is, to re-form insoluble products, the cause of which may be polymerisation. This reversion occurs not only with ordinary starch when swollen, but with most of the soluble starches and other products of graduated conversion. This

property of reverting from the state of solution causes the starch paste to "set" to an insoluble jelly, and limits the sphere of application. If it were possible to devise a method by which starch could be converted into a physically uniform or homogeneous soluble derivative, giving a permanent solution, there would be considerable scope for its usefulness. It was with this end in view that experiments were first started with starch conversions, and although such permanent solutions have been known for a long time, and are easily obtained by swelling starch in presence of metallic chlorides of hygroscopic qualities, of which the chlorides of zinc, lime, and magnesia, are typical; such solutions are of limited application by reason of the presence of these salts. Ordinary methods of starch conversion, which were all examined, are either simple hydrolysis, generally assisted by the presence of a small proportion of acid, or direct oxidations, or combinations of these two, and are valueless as far as giving a permanent starch solution. The permanent solution represents the true starch colloid, and is evidenced by the evaporation of such solutions to a continuous structureless film, having considerable tensile strength. The continuous films and lustrous threads yielded by the cellulose esters in the interesting series of products which have within recent years risen to considerable industrial importance, first directed attention to the possible value of the corresponding starch esters. Starch and cellulose are closely allied. The difference in their chemical reactions is mainly one of degree.

Starch-nitrate.—This product has been known for many years, and its preparation and properties have been dealt with in various publications, one of which, "Nitrirung von Kohlenhydraten" W. Will and P. Lenze, Berl. Ber., 1898, 68), may be mentioned. The product when thoroughly purified is quite stable, but as it is only of value as an explosive, it need not be further dealt with.

Starch-formate.—Formic acid was first introduced on a commercial scale in 1902, and about the same time the first experiments were made to ascertain its action on starch. Formic acid swells starch in the cold, and if perfectly dry starch is mixed with $1\frac{1}{2}$ to 2 times its weight of 99 per cent. formic acid, it swells to a paste in three minutes. On warming on the water-bath for 15 to 20 minutes a clear, gummy solution is obtained, which can be drawn out into fine threads. On following the process with the microscope, the granules are seen to be only slightly swollen, but are transformed to a soft jelly, as they spread out under a cover glass. The clear solution on pouring into cold water is precipitated as a white flocculent mass. It is plastic at first, but on washing with water forms a granular mass which is easily filtered and dried. The product is a white powder, but lacks the characteristic starch appearance; the yield is about 120 per cent. of the starch used.

The above experiment was repeated, and the clear gummy solution obtained was diluted with an equal volume of 90 per cent. formic acid, and heated for 5 minutes before being poured into cold water. The product now retains its plastic character, and when kneaded with the fingers draws out into very fine threads, which have the appearance and lustre of artificial silk. It dries to a clear gum-like product. The ester is not very stable, and on standing in contact with air or water, slowly decomposes with the elimination of the formic radicle, and a corresponding oxidation of the starch residue. It does not give a blue but a reddish-brown coloration with iodine, and on treatment with dilute alkalis the ester is at once decomposed and the regenerated starch now gives the usual intense blue with iodine.

The product from 30 minutes' treatment at 90° C. shows a fixation of 24 per cent. formic acid on the dry product, which corresponds to a mono-formate on a C_6 formula. If starch is heated at 85° C. with twice its weight of formic acid for 30 hours and the product precipitated with alcohol, washed and dried, it shows a fixation of 55 per cent. formic acid, which corresponds to a tri-formate on a C_6 molecule. This product does not give a blue colour with iodine on saponification, which shows that the starch nucleus has been broken down during the treatment, and that the formate is a derivative of the starch resolution products—dextrine, etc.

Starch-acetate.—Experiments were begun in 1901, and about the same time a paper on the acetylation of soluble starch, by F. Pregl, was published in the Monatsh. für Chemie, 1901, 22 (19), 1049–1066. Soluble starch prepared by Zulkowsky's method was treated at ordinary temperature for 48 hours with 10 times its weight of acetic anhydride containing 1 per cent. sulphuric acid. It yielded a tri-acetate on a C_6 formula. The product is insoluble in alcohol and water, gives no coloration with iodine, and does not reduce Fehling's solution. The yield was 132 per cent. of the starch, and saponification with potassium hydroxide regenerated "soluble starch." Molecular weight determinations were not concordant, but show that the acetyl compound must be of dimensions 8 or 9 times the C_6 formula. A similar product, but soluble in alcohol, is obtained by treatment at higher temperatures (70° to 80° C.) with acetic anhydride containing about 10 per cent. sulphuric acid. The molecular weight is 840, indicating a three-fold formula, and it yields on saponification a product, $(C_6H_{10}O_5)_3N$, which does not give a blue but a red coloration with iodine and is a dextrine. With ordinary starch and acetic anhydride containing 1 per cent. sulphuric acid, acetylation takes place very slowly at ordinary temperatures, but if heated to 90° C. on a water-bath, the starch swells in a few minutes, and goes partly into solution after 30 minutes. If an equal volume of glacial acetic acid is added, a homogeneous solution results in a few minutes. This when poured into a large volume of cold water gives a voluminous granular precipitate which can be washed by decantation. The yield is only 60 per cent., showing that considerable hydrolysis has taken place. The analytical numbers for this product show a large fixation of acetic acid, viz.:—72.5 per cent., which corresponds to a tetra-acetate on a C_6 formula. Reference must also be made to the action of acetic anhydride saturated with hydrochloric acid gas (see Z. H. Skrapup and F. Mentor, Monatsh. für Chemie, 1905, 26, 1415). Also the "dichloroacetic esters" (see Kldiaschwili, J. Russ. Phy. Chem. Ges., through Brewster's Journal, 1905, 41, 688). In each case, however, the reaction simultaneously takes the course of resolution or decomposition, as in the case of acetic anhydride and sulphuric acid. The resulting esters being derivatives of products of decomposition of the original carbohydrate.

Acetic anhydride alone has no action on starch even after two days. At boiling temperature, viz., 140° C., very little acetylation takes place. After 8 hours' treatment, only 2.5 per cent. acetic acid is fixed. This is noteworthy in view of the fact that starch when treated with glacial acetic acid at 120° C. shows acetylation to a much greater extent, e.g., 8 hours' treatment gives a product containing 16 per cent. acetic acid which equals a mono-acetate on a C_6 formula.

Prolonged treatment of starch with 5 times its weight of acetic anhydride at 90° C. gave the following figures:—

Time of treatment.	Acetic acid by saponification.
	Per cent. in dry product.
15 hours	12.1
24	26.2
40	38.5
74	46.8

The products are all insoluble in water and are easily saponified by alkalis with regeneration of the starch. Even after 74 hours the starch granules are little altered.

It is evident that if the starch esters are to be of any value commercially, they must be produced cheaply, and therefore the costly acetic anhydride would require to give way to something more economical.

The action of glacial acetic acid on dry starch was next investigated. When starch is treated with twice its weight of glacial acetic acid and kept at 60° C. for two days, the product is insoluble in cold water and can be washed and dried like ordinary starch. When boiled at 1–10 it gives a paste of the usual consistency, but which shows no tendency to revert on standing, i.e., the solution remains clear for months.

The author (in conjunction with Messrs. Cross and Bevan) has given some figures regarding the acetylation of starch by treatment with glacial acetic acid. (See "Die Niederen Acetyl-derivate von Stärke und Cellulose;" Chemiker Zeitung, 1905, 29, No. 39).

The following more recent observations may be put on record:—Dry starch was treated with glacial acetic acid at 90° C. for the undernoted times, a large excess of acid being used in every case.

Time of treatment.	Acetic acid by saponification.
	Per cent. in dry product.
15 hours	7.2
24 "	10.2
40 "	15.0
50 "	22.8
60 "	28.0
74 "	33.4

At 15 hours the product just ceases to give a blue colour with iodine.

The products are all soluble in water, but insoluble in alcohol. This solubility in cold water distinguishes them from the acetic anhydride derivatives, and is due to the hydrolysing action of the small percentage of water contained in the dry starch and glacial acetic acid. The proportion of acid fixed, increases regularly with the time of treatment, and shows no breaks or steps in the reaction, as would correspond with the molecular proportions involved in the idea of a mono, di, or tri-acetate or the more elaborate series of derivatives which can be theoretically represented on the basis of C_{12} or C_{24} reacting units.

By varying the proportion of acid and the duration of heating, an indefinite number of intermediate products may be obtained. Even at 100° C., with fractional proportions of acetic acid (10 to 50 per cent. of the weight of the starch) some acetylation takes place, the well-washed product showing on saponification the fixation of 2 per cent. to 6 per cent. acetic acid. The products retain the essential characteristics of the original starch, but differ in yielding homogeneous permanent solutions.

The higher homologues of the acetic acid series, viz., propionic and butyric acids, have little action on starch, and as these acids are in no sense commercial products, the investigation was limited to a few preliminary experiments, as was the case with lactic acid.

Technical application.—Formic acid, owing to its vigorous action, evidently would be of considerable value, but its property of swelling the starch granule raised some difficulties. The acid cannot be sprayed directly on to the starch, and although its action in aqueous solution was gone into very thoroughly, satisfactory conversions could not be obtained. Solutions of formic acid of over 40 per cent. strength swells starch in the cold, and even 10 per cent. solutions swell starch at 40° C. in a few hours. Less quantities than this in aqueous solution give products which differ little from ordinary thin starch, i.e., hydrolysis takes place instead of esterification. It was found, however, that a mixture of ordinary methylated spirits and 90 per cent. formic acid did not swell starch at ordinary temperatures. The lowest proportion of alcohol that was effective was one part spirits to two parts formic acid. Experiments were made on a small working scale by mixing starch with 10 to 25 per cent. formic acid diluted in alcohol with fairly successful results. The time of conversion has to be carefully limited to prevent the production of a water soluble product. A very thin boiling product is thus obtained, but on washing with cold water it was found impossible to obtain a neutral product.

The unstable starch-formate decomposed on drying at temperatures as low as 40° C., and although the wet product was carefully neutralised, then filter-pressed and dried slowly, the dry product was distinctly acid, showing frequently as much as 0.5 per cent. free formic acid. If the product was boiled with water as usual, the acid

solution neutralised, and the boiling continued for 10 to 15 minutes, a further production of acid ensued, owing to the decomposition of the starch-formate by HOH hydrolysis. These properties naturally limited the usefulness of this conversion, as a neutral product is essential for the majority of industrial purposes.

Acetic acid in aqueous solution has little action on starch, and no useful results were obtained. Glacial acetic acid has been found to be most suitable, and gives on the whole the best results from a technical point of view. It is necessary to use as nearly anhydrous materials as possible, and therefore the starch requires to be dried, so that it contains not more than 3 or 4 per cent. moisture. For commercial purposes, the reaction must be limited to a product insoluble in cold water, so that the excess of acid can be removed by washing by decantation. With excess of acid at 90° C. the limit is about 8 hours' treatment, and at 120° C. 2 to 3 hours. The water insoluble product in each case showing a fixation of 4 to 5 per cent. acetic acid. The product, when swelled with 5 or 6 times its weight of water, gives a clear viscous solution which is permanent, and on pouring out on a glass plate dries to a clear continuous film.

Manufacture.—Owing to these laboratory experiments being satisfactory, a small plant was erected to test the reaction on a manufacturing scale. Results of many experiments showed that to obtain the maximum conversion, the starch must be as dry as possible, and an equal weight of acid used. This gives a fluid mixture which can be boiled slowly. Treatment is continued for 2 or 3 hours, and the product washed out carefully with cold water. With limited quantities of acid a series of products quite suitable for most industrial purposes were obtained. The only condition seriously affected by decreasing the quantity of acid is the keeping property of the solution, but this can be favourably modified by increasing the time of reaction.

Technical development.—The process was patented in 1902 in Britain and several other countries, and in Germany a patent was granted after considerable opposition on the part of some local makers of "soluble starch."

The word "Feculose" (from "*fecula*," Latin for starch) was registered, and by this term the various commercial starch esters are now designated. A large plant was erected in which the experience gained in the earlier stages was embodied, and although the industrial process has necessitated considerable study, and devising of special converters for carrying out the treatment of dry starch with glacial acetic acid, at temperatures of at least 120° C., still the engineering difficulties were overcome, and the plant does not call for any special description.

The development of the process was mainly on the lines of limiting the quantity of acid, and perfecting the recovery, but it was found that 10 per cent. glacial acetic acid on the dry starch was the minimum quantity which would give useful products. The acetylation can be much accelerated by using small quantities of mineral acids along with the glacial acetic acid, but under these conditions the conversion requires to be very carefully controlled, as water soluble products are very apt to result. Mixtures of glacial acetic acid and formic acid can also be used in varying proportions to give special results.

The acetylated starch as it comes from the converter contains from 4 to 5 per cent. uncombined acetic acid, which in most cases has to be removed before the product is in a marketable form. The cheapest method of doing this might be to neutralise directly with a suitable alkali, but this would mean the formation of a considerable quantity of salts, the presence of which would be objectionable for many purposes. The best method is to wash by decantation with cold water. It is therefore very necessary that the reaction should be limited to a product which is insoluble in cold water. If the reversion is carried too far, not only does the loss become very serious, but the acetylated starch granules seem to hydrate in cold water, and can only be dried to a gummy mass. Under proper conditions, the acetylated starch can be washed and dried like ordinary starch.

It has been found that the various commercial starches, e.g., potato, maize, rice, tapioca, sago, and wheat, give in some degree a product with distinct physical properties.

The larger granulated starches are preferred owing to the ease with which they are washed free of acid, but all are used more or less.

It is evident that by varying the starch base operated on, the reacting acids, the time and temperature of treatment, a range of products of endless variety can be obtained. No other reaction presents such a field of possibilities, and this is a strong point in favour of this type of reaction. It is possible to produce varieties of acetylated starch giving solutions of varying consistencies from a thick jelly at 1—10 to a thin solution at 5—10. Also types giving soft lustrous films on glass, and others stiff dull films.

Properties.—Feculose differs little in appearance from ordinary starch, and on boiling with water it gives a clear homogeneous solution which does not "set" or revert on standing a few hours. The films obtained by allowing a little of the solution to dry on a clean glass plate are clear and flexible, and equal to those obtained from the finest gelatin. The solution does not reduce Fehling's solution, and gives the usual blue with iodine. It is precipitated out by alcohol or strong solutions of certain salts similar to ordinary soluble starch, and also readily reacts with diastase under the usual conditions.

The acetylated starch (or Feculose) reacts with most chemical reagents much more easily than ordinary starch, and therefore lends itself to further modification. The washed feculose is neutral or slightly acid, and saponification with sodium hydroxide shows that only from 1—4 per cent. acetic acid is fixed on a C_6 molecule. The effect of this on the properties of the solution is out of all proportion to the fraction of the starch aggregate which evidently takes part in the reaction. It can only be assumed that the small proportion of reacting molecules is capable, on hydration, of radically influencing the whole complex, or, that some constitutional changes in the starch take place simultaneously with a fixation of acetyl groups.

Uses.—The uses of feculose can only be dealt with briefly, but it is evident that it is an ideal substitute for gelatin and vegetable gums, and has been applied successfully in many directions. It has obvious applications as a special textile finish, in which its properties as a true colloid enable it to confer lustre, and also to penetrate and give substance and "handle" to textiles in the form of yarn or cloth. The clear filming property is particularly apparent on bright colours, such as reds and yellows, where it seems to increase the intensity of the colours. On light cottons, where no softeners are used, feculose at 1 lb. per gallon gives equal results to dextrin at 3 or 4 lb. per gallon. It is also used along with ordinary starch to give flexibility and cleanness to the finish, leaving the proportion of starch to be varied according to the stiffness required. It gives excellent results for linen dressing, and in lace dressing it gives the desired springy finish, while it is the only starch product which will not dull the lustre of mercerised cotton.

Dyeing and French cleaning is another branch where its special qualities are appreciated. (See Farrell, J. Soc. Dyers and Col., Dec., 1908.)

In silk finishing little sizing materials are used, but the brilliant films given by feculose make it suitable for this class of work.

Confectionery.—Feculose is also employed in making ju-jubes and other sweets, and the fact that it can be cooked up with sugar and glucose to any "steam" temperature, opens a wide field of possibilities for its application, especially when the limitations of gum and gelatin in this direction are known and recognised.

Paper manufacture.—The use of Feculose in this particular industry has received a great deal of study, but would require to be dealt with in a special paper. It is perhaps sufficient to say that, in paper-coating, feculose gives excellent results as a size in place of "chromo" glue or casein. The surface produced has excellent printing qualities owing to its unique ink affinity. In fact, technically, Feculose might be described as a non-nitrogenous gelatin. A permanent solution of Feculose can be obtained by means of variations of the original processes, and modifications introduced by subsidiary treatments, thus enabling it to fulfil a very large range of technical requirements.

It is perhaps interesting to note that these products, representing as they do the latest developments in starch conversions, have been worked out and brought to a manufacturing stage by one of the oldest starch firms in the country.

In conclusion I have to thank the proprietors of "Feculose," Messrs. William Wotherspoon, Ltd., Gifford Starch Works, Paisley, for permission to publish the foregoing particulars, and Mr. C. E. Cross, London, for assistance and advice in preparing this paper.

Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Monday, February 22nd, 1909.

PROF. W. M. GARDNER IN THE CHAIR.

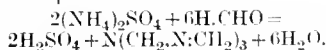
A METHOD FOR THE ESTIMATION OF NITROGEN IN ORGANIC SUBSTANCES; AND IN PARTICULAR, FOR THE DETERMINATION OF HIDE-SUBSTANCE IN LEATHERS AND OF DISSOLVED HIDE-SUBSTANCE IN THE SOAK LIQUORS AND LIME LIQUORS OF THE LEATHER FACTORY.

BY HUGH GARNER BENNETT, M.Sc.

The Kjeldahl process of nitrogen estimation is open to several sources of error, and numerous forms of apparatus have been devised to carry it out with the maximum convenience, accuracy, and speed. The great advantage of the process now suggested is that no such apparatus is at all necessary, the whole operation being conducted in one flask.

It is some years since the reaction between ammonia and formaldehyde to form hexamethylenetetramine was first employed as a means of estimating the latter, but it is only recently that the same reaction has been utilised for the estimation of ammonia. It has been shown, however, that if a formaldehyde solution be added to an ammonium salt, the formation of hexamethylenetetramine takes place as usual, and the acid combined with the ammonia remains as free acid, and can be titrated (Ronchèse, J. Pharm. Chim., 1907 (VI.), 25, 611—617). It is now suggested, therefore, that this process of ammonia estimation should be combined with the Kjeldahl method of digesting with sulphuric acid, for the estimation of nitrogen in organic substances.

The substance under examination is digested as usual with sulphuric acid until the liquor is clear, and the excess of acid carefully neutralised by adding a solution of caustic soda until a pink colour is obtained with phenolphthalein. A neutral solution of formaldehyde is then added, liberating the sulphuric acid present as ammonium sulphate, according the equation:—



Hexamethylenetetramine is quite neutral to phenolphthalein and the liberated sulphuric acid is then titrated with $N/10$ sodium hydroxide solution until the pink colour returns. From the amount of $N/10$ alkali used, the amount of ammonia originally present as ammonium sulphate, and hence also the amount of nitrogen present in the substance under examination can easily be determined.

This mode of procedure has been found very convenient for the estimation of hide-substance in leathers, one of the most important determinations in leather analysis. From 0.4 to 0.5 gm. of leather is accurately weighed out into a Jena flask of about 500 c.c. capacity and digested over a small flame with 15 c.c. of concentrated sulphuric acid until clear. The liquor in the flask is then carefully neutralised to phenolphthalein; a 50 per cent. solution of soda is used until the solution is nearly neutral, and the neutralisation then completed with $N/10$ sodium hydroxide. The formaldehyde solution (25 c.c. of about 40 per cent. strength) is now added to the flask, and after

mixing well the liquor is titrated with $N/10$ caustic soda until a permanent pink is obtained. Each c.c. of $N/10$ alkali required corresponds to 0.0017 gm. of ammonia or 0.0014 gm. of nitrogen, or 0.00786 gm. of hide-substance, as hide-substance contains 17.8 per cent. of nitrogen. Commercial solutions of formaldehyde are usually slightly acid, and of course must be made neutral before adding to the flask. This may be done by neutralising to phenolphthalein with standard caustic soda, or by shaking the solution up with barium carbonate and allowing it to stand overnight. The following results were obtained with leathers treated with this process and with the ordinary Kjeldahl process:—

No. of leather sample employed.	Percentage of nitrogen found.	
	Formaldehyde method.	Kjeldahl method.
1.....	12.20	12.20
2.....	12.50	12.48
3.....	12.20	12.20
4.....	14.70	14.68
5.....	14.00	14.00
6.....	12.08	12.12
7.....	12.21	12.19
8.....	11.64	11.61
9.....	13.25	13.24
10.....	11.67	11.65
11.....	12.40	12.40

In applying the process for the estimation of dissolved hide-substance in soak liquors and lime liquors, 100 c.c. of the filtered liquor is pipetted into the Jena flask, made distinctly acid with sulphuric acid, evaporated to small bulk, and then digested with concentrated sulphuric acid and titrated as before. The following results have been obtained with a series of tannery lime liquors:—

Liquor.	Mgrms. of nitrogen per 100 c.c. liquor.	
	Formaldehyde method.	Kjeldahl method.
1.....	15.68	15.68
2.....	42.00	41.90
3.....	45.36	45.29
4.....	19.88	19.80
5.....	50.96	50.96
6.....	12.60	12.51
7.....	42.00	41.85

The amount of hide-substance which has gone into solution is usually calculated on the assumption that 17.8 grms. of nitrogen correspond to 100 parts of dissolved hide-substance.

It is of course conceivable that in certain cases some complication may arise which will prevent the successful use of this method. One such case has come under the author's notice. In determining the nitrogenous matter in silk by both Kjeldahl and formaldehyde methods, the following results were obtained:—

Sample.	Percentage of nitrogen.	
	Formaldehyde method.	Kjeldahl method.
Black silk.....	(1) 7.4	(1) 8.7
	(2) 7.4	(2) 8.6
White silk.....	(1) 7.1	(1) 8.3
	(2) 7.1	(2) 8.2

The analyses (1) and (2) were duplicate determinations, and always showed concordance, but the two methods yield different results. For some reason a constant error is introduced, but the cause is not very obvious. A possible explanation is that amine sulphates are formed instead of ammonium sulphate, and that the amine is distilled off with ammonia in the ordinary process and neutralises some of the standard acid, but that it is not

acted upon or estimated in the formaldehyde process. Longer digestion with sulphuric acid might overcome this difficulty.

The author's thanks are due to Mr. Arnold Seymour Jones for his assistance in carrying out the experimental work recorded above.

DISCUSSION.

Prof. PROCTER said the method would probably be very useful to technical analysts because many experiments could be made in a short time with it, and the results appeared to be as accurate as by the direct method.

Prof. W. M. GARDNER asked if the method could be used with wool, artificial fertilisers, and other technical products.

Mr. H. G. BENNETT, in reply, said that the method had only been tried with lime liquors, leather, and silk. The great advantage of the method was not so much the saving of time as the fact that no special apparatus was required for carrying it out.

THE COMMERCIAL CONTROL OF TANNERY LIME LIQUORS.

BY HUGH GARNER BENNETT, M.Sc.

The lime liquors used for the depilation of hides and skins in leather manufacture are always used for several packs of goods, and although a new lime liquor is an almost completely sterile medium, the solvent effect it exerts on the various proteid matters which enter it causes a gradual increase in the amount of organic matter which is in solution. In this way it is made possible for certain bacteria to thrive, and these also assist in dissolving further quantities of both keratinous and gelatinous matter. When such liquors therefore are repeatedly used, there is not only a rapid accumulation of hydrolytic and putrefactive decomposition products of the proteids, but also an almost proportionate multiplication of the fermentive organisms; and it is evident that if this repeated use be continued indefinitely, the liquor will continue to unhair, but by virtue of its bacterial rather than its chemical activity.

In the manufacture of many leathers it is important that this bacterial action should not be taken too far, and it is in all cases desirable to know how far it is necessary, and to ascertain whether any given lime liquor is likely to produce the desired effect. Many processes have therefore been suggested for determining the age and degree of "mellowness" of an old lime liquor. The most obvious way is to determine the amount of dissolved hide substance in the liquor by the estimation of nitrogen by Kjeldahl's method, but this is far too tedious for the control of the ordinary lime yard, and is resorted to only in special cases. The estimation of the free ammonia has also been taken to indicate the age and character of such lime liquors, partly under the impression that this ammonia had a powerful unhairing action, and partly with the idea that its quantity was at any rate roughly proportional to the total dissolved hide substance and also to the bacterial activity. The accurate estimation of ammonia in a lime liquor, however, is a matter of some difficulty, and usually involves a somewhat complicated apparatus. It has recently been stated, moreover, that ammonia in old limes does not give the depilatory and solvent effect so long attributed to it, and that the effect of old limes is due almost entirely to bacterial action. The estimation of peptone acids formed by the action of formaldehyde after the removal of the lime with zinc sulphate, has recently been proposed as a measure of the dissolved hide substance, but its author, as well as the present writer, found that the results it yields are by no means strictly proportionate to the nitrogen determined by Kjeldahl's method.

The method now suggested has been employed by the author for some years, but because of its somewhat empirical nature and scientific imperfections, he has not thought it desirable to publish it. The present paper is due to the fact that it was found to be more accurate than was expected, and also because it was found to be exceedingly useful and convenient for control work. The decomposition of the proteid matters of the skin results in formation of peptones, the calcium salts of amido acids

and other weak acids, amines and a certain quantity of ammonia, all of which are of a weakly basic nature. The method of determining these is simply to titrate 25 c.c. of the filtered lime liquor with *N*/10 hydrochloric acid in the presence of phenolphthalein and methyl orange, the former being sensitive only to the strong bases (*e.g.*, lime), whilst the latter is also sensitive to the weak bases mentioned above. The 25 c.c. liquor are placed in a white porcelain basin and diluted somewhat with distilled water. Phenolphthalein (3 drops of a 1 per cent. solution) is added, and the *N*/10 acid slowly run in with constant stirring until the pink colour just disappears; the volume of acid used being then noted. Methyl orange (2 drops of a 0.1 per cent. solution) is now added to the basin, and the addition of standard acid continued until the indicator first distinctly changes towards red; the volume of acid used is again noted. The difference between the two readings represents the weak bases formed by the decomposition of the hide, and is proportional to the "dissolved hide substance" and to the bacterial activity and "mellowness" of the lime liquor. It is of course known that the end-point in titrating ammonia in the presence of phenolphthalein is not very accurate, but the quantity of ammonia in ordinary lime liquors is usually small, and forms a very meagre proportion of the nitrogenous decomposition products, and hence the error caused by its presence is not sufficient to impair seriously the accuracy of the method. The end-point with methyl orange, on the other hand, is not perfectly sharp, but can usually be confirmed very closely by a duplicate titration. The following results were obtained with a series of lime liquors, using the above method, and also estimating nitrogen by Kjeldahl's method and by the formaldehyde method recently suggested by the author.

(1) Titration difference for 25 c.c. lime liquor using <i>N</i> /10 hydrochloric acid.	(2) Ammonia obtained by Kjeldahl method; equivalent in <i>N</i> /10 sodium hydroxide.	(3) Formaldehyde method, no. of c.c. <i>N</i> /10 sodium hydroxide required.	Ratio of column (3) to column (1).
4.10	2.80	2.80	0.68
5.37	3.50	3.55	0.68
11.0	7.45	7.50	0.68
11.75	8.05	8.10	0.68
13.5	9.05	9.10	0.67

The relative concordance between the various methods with lime liquors so widely varying in age was greater than the author expected, and at any rate justifies the process now suggested for control work. The above results were obtained with lime liquors from a large leather factory where a regular system of liming is employed, and it may be taken therefore that for these liquors, 1 c.c. titration difference (with *N*/10 hydrochloric acid and 25 c.c. liquor) corresponds to 0.0053 gm. of dissolved hide substance. The author has received about 30 other comparative analyses of lime liquors from the factory, all of which confirm this factor. The most discrepant results occur with the comparatively fresh limes, in which the titration difference is small; a slight error in the end point causing a comparatively large percentage error.

It is possible, of course, that other tanyards with other systems of liming may find a different factor, but the probability is that it will be constant for any regular system. In cases where a small amount of sulphide of sodium is regularly used to assist depilation, a constant error will be introduced in the factor, depending upon the amount of sulphide. The titration must also in this case be conducted with considerable dilution; the sodium hydrate and sulphhydrate formed from the sulphide being then accurately alkaline and neutral respectively to phenolphthalein, whilst both are alkaline to methyl orange. In cases of quick depilation with considerable quantities of sodium sulphide, the most useful figure will be the total alkalinity as determined with methyl orange. The author desires to thank Mr. Arnold Seymour Jones for his

assistance in carrying out the analytical work here recorded.

DISCUSSION.

Prof. H. R. PROCTER said he had previously used the method suggested, without, however, working it out so carefully as the author had done. The method was extremely easy and gave fairly approximate results. The difficulty in the end-point could be overcome. In addition to the difference between the titrations, the total titration with phenolphthalein was of significance. Saturated lime liquors were usually used. These are about one-twentieth normal, so that if the liquors consumed more acid than was equivalent to this, the excess must be put down to ammonia or caustic soda. The latter was often present in lime liquors owing either to direct additions of sulphides or carbonates or to its removal from skins treated with these materials.

Mr. C. E. PARKER said that heavy loss was without doubt going on in different tanneries through the dissolving of hide substance in the lime liquors used. Those tanners who took proper steps to prevent this were obtaining valuable results, and therefore such a method as proposed, combining rapidity and accuracy, would be of great service in locating such losses.

Mr. J. T. WOOD said that he had been in the habit of titrating 10 c.c. of filtered lime liquor with decinormal hydrochloric acid using phenolphthalein as indicator. The liquors gradually increased in alkalinity, and when they required more than a certain number of c.c. of the acid they were no longer used. No doubt many tanners still guessed the condition of the liquors, but the method of the paper could be applied with little extra trouble than the one he used and with valuable results.

Mr. A. SEYMOUR-JONES said the method was useful for showing the exact rate at which hide substance was lost. This was of importance in the case of cotton-spinning leathers. Here the object was to get rid of a certain amount of hide-substance and to obtain a softer product, instead of getting the materials as hard and heavy as possible, as in the case of sole leather. He had used the method since Christmas with good results. Sound leather was made in the lime yard, and if this part of the work was properly done it was easy for anyone to do the rest.

THE DETECTION OF SULPHITE-CELLULOSE LIQUORS IN TANNING EXTRACTS.

BY PROF. H. R. PROCTER AND S. HIRST.

In the manufacture of paper pulp by the bisulphite process, the coniferous woods are digested under pressure with a solution of calcium bisulphite, which dissolves the ligneous constituents, leaving a comparatively pure cellulose. Enormous quantities of the used sulphite liquors, containing large amounts of dissolved vegetable matter, are run into rivers, or into the sea. It has been found, however, that after suitable decolorisation and concentration in the vacuum pan, these liquors will yield an extract very similar in appearance to oakwood, and which when analysed by the I.A.L.T.C. official hide-powder method, will show about 25 per cent. of tanning matter or substances absorbed by hide. Such a purified extract has been put upon the market under the name of "Pinewood" or "Fichtenholz" extract. If attempts are made to tan with this extract alone, it is difficult, if not impossible, to obtain a product which deserves the name of leather, the surface being apparently tanned, while the interior remains raw and unaltered, and the hide dries horny and usually of unsatisfactory colour. If, however, the hide be in the first instance partially tanned with some ordinary tanning material, or if some other tanning extract be used in conjunction with the pinewood extract, leathers are produced similar in appearance to those of ordinary tannages, as the pinewood extract appears capable of absorption, giving firmness and weight, although it probably contains no bodies analogous to the ordinary tannins. It may therefore ultimately become a useful addition to the tanner's resources, but while

experiments with it were at first apparently successful as a weighting and solidifying tan, some constituent appeared to accumulate in the liquors which led ultimately to the production of brittle or tender leather. Whether this was due to mis-management, the writers cannot at the moment say, but so far as they are aware, but little of the extract has been sold to tanners under its own name. It is, however, obviously a tempting material for the extract manufacturer, as considerable quantities can be added to tanning extracts without altering their appearance, and it shows a good percentage of tanning strength by the ordinary method of analysis. It is therefore important in the interests of the tanner that means should be discovered for the detection, and if possible, the estimation of pinewood extract in mixture, and a good deal of time has been devoted by the writers to the attempt to discover a satisfactory qualitative colour reaction, and it has been found that the following modification of the ordinary test for lignine with aniline and hydrochloric acid is very delicate and quite satisfactory.

To 5 c.c. of the extract solution, which should be of about the ordinary strength employed for analysis, 0.5 c.c. of aniline is added, and the whole is well shaken, and 2 c.c. of concentrated hydrochloric acid is then added to the mixture. With all ordinary extracts this has the effect of immediately clearing the turbidity caused by the aniline, and a perfectly transparent solution results, but where pinewood extract is present, even in comparatively small quantity, a precipitate is rapidly produced which gradually rises to the top of the liquid. Heating is not necessary, and on the whole not desirable, though it sometimes increases the rapidity of the separation of precipitate. The reaction, however, is immediate, and any slight turbidity which arises after considerable standing should be disregarded, as it sometimes occurs in the case of unaltered extracts, possibly from minute traces of ligneous matter. It is possible that this method may be developed into a quantitative form, but this has not yet been attempted by the authors.

It was also found that the "tanning substance" of the pinewood, while it was estimated as tannin by the ordinary hide-powder process, was only to a very small extent capable of reducing permanganate in the Löwenthal method, and therefore gave almost negative results in tannin, a pinewood extract showing about 25 per cent. of matters absorbed by hide being only equivalent by the Löwenthal method to about 1 per cent. of gallotannic acid. This property of low oxidisability is not shared to nearly an equivalent extent by any ordinary tanning material, and therefore pinewood extract can be detected, and even estimated approximately if present in considerable quantity, by comparison of the gravimetric and Löwenthal results.

The following table gives the values as compared to gallic acid of the tanning matters absorbed by hide-powder from 3 samples of sulphite cellulose extract, and average values for those of oakwood and chestnut extracts, with which it is most likely to be mixed.

Extract.	Gallie acid value of 1 gm. tannin.
" Fichtenholz " I	0.129
" " II	0.090
" " III	0.137
" " average	0.119
Chestnut	0.604
Oakwood	0.527

It was hoped by the authors to develop on this basis an approximate quantitative method; and arithmetically, if a be the gallic acid value of the genuine extract, b the (lower) value for "pinewood," and c that experimentally found for an unknown mixture, $\frac{a-c}{a-b}$ should be the fraction of the total "tannin" found by ordinary gravimetric analysis which is due to "pinewood." Not only, however, are the required constants usually unknown, and subject to considerable variation in

different extracts made from the same material, but even when the method is applied to known mixtures, the results are only approximate, and usually indicate less than the actual amount of "pinewood" really present, suggesting that the absorption of one of these matters by the hide is affected by the presence of the other. This point is still under investigation, and may lead to interesting results.

DISCUSSION.

Mr. H. G. BENNETT said that the facts just given showed that pinewood extract contained none of those bodies ordinarily known as "tannins." It contained, however, some substance absorbed by hide-powder. It had been suggested as profitable for weighting sole leather in drum or vat. The Löwenthal method showed the absence of true tannins.

Mr. C. E. PARKER asked how quickly the matter absorbed from pinewood extracts would wash out from leather.

Mr. H. G. BENNETT replied that it would probably wash out at the same rate as the ordinary weighting extracts, but possibly less readily.

Prof. A. SMITHells remarked that if the substance dissolved out of the pinewood by bisulphite was of an aldehydic nature, it might be expected to have some degree of tanning power.

Prof. H. R. PROCTER said he had tested for furfural and other aldehydes with negative results, but proved the presence of lignin by the aniline test.

Mr. J. E. BEDFORD suggested that a stipulation should be introduced into contracts made by tanners prohibiting the addition of pinewood extracts to tanning extracts.

Mr. C. E. PARKER welcomed the suggestion and said he would bring it before the United Board of the Tanners' Federations. Some such clause should be introduced, since the I.A.L.T.C. method of analysis did not detect the presence of pinewood extract.

THE USE OF THE LOEWENTHAL METHOD IN •THE CONTROL OF TANNERY LIQUORS.

BY PROF. H. R. PROCTER AND S. HIRST.

For the purposes of a recent paper on "The Detection of Sulphite Cellulose Liquors" (see page 293), factors were determined for the calculation of Löwenthal results to equivalent values of "tanning matters" as estimated gravimetrically, for a considerable variety of extracts and other tanning materials. The Löwenthal method is fully described in Procter's "Leather Industries Laboratory Book," and details need not be repeated, but as a large number of titrations had to be made, some mechanical improvements were adopted which greatly facilitated the operation. Self-filling burettes of the simple form shown in the figure were used both for permanganate and indigo, and the titration was carried out in a beaker of about 1 litre capacity fitted with a spindle carrying two small screw propellers, made either of stiff celluloid or of brass coated with celluloid varnish, and driven by a small turbine or electric motor. For comparison, a similar beaker filled with an already titrated liquid was placed in a similar light and beside that in use. Under these conditions titrations were very rapidly made and with almost absolute concordance, and the systematic use of the method for control of the tanning strength of liquors naturally suggested itself. Of course there is nothing new in such an idea, but no carefully thought-out and systematic mode of work has hitherto been published. For practical purposes the method requires to be as simple and rapid as is compatible with concordant results, and as tanning materials are now almost universally bought by the I.A.L.T.C. method of analysis, it is important that the figures should be comparable with this method, and on this account detannisation by chromed hide-powder was

preferred to that by gelatine, although the latter is theoretically more exact, being less affected by astringent non-tanning matters, such as gallic acid.

Since the actual amount of permanganate used varies somewhat with the operator and the details of titration, the usual method of calculating the results of a Löwenthal analysis is by direct comparison with a supposed pure solution of gallotannic acid, but as actually pure gallotannic acid cannot be obtained, allowances have to be made for an assumed but unascertained amount of impurity; commercial gallotannic acid of the best quality usually reducing more permanganate than the theoretically pure substance. Gallic acid, being crystallisable, is readily obtained in a pure form, and is oxidised by permanganate in a similar way to gallotannic acid, 1 gram. of crystallised gallic acid reducing approximately the same amount of permanganate as 1.34 grains. of the portion of the purest obtainable gallotannic acid absorbed by chromed hide-powder. There is, however, little advantage in calculating in this way, since few, if any, of the tanning materials in use contain solely gallotannic acid, and the different tannins are well known to reduce permanganate in somewhat varied proportions. It is therefore more practical and convenient to state the results of experiment in terms of gallic acid, and it is easy to obtain a factor by which the latter can be approximately calculated to any tannin as determined by the hide-powder method.

The following solutions are employed:—(1) Pure air-dried gallic acid, 0.1 gram. per 100 c.c. freshly made. (2) Purest indigo-carmine, 5 grains. per litre, with 50 grains. of concentrated sulphuric acid, 25 c.c. being used for each determination. A solution of 1 gram. "indigo pure B.A.S.F." in 25 c.c. concentrated sulphuric acid diluted to 1 litre with 25 c.c. added sulphuric acid, may also be employed. These solutions both keep well. 25 c.c. of either must require 25–30 c.c. of permanganate for oxidation, or a larger measured volume must be used. (3) Permanganate of potash solution, 0.5 gram. per litre, made by the dilution of a 5 gram. per litre solution at frequent intervals, as very weak solutions do not keep satisfactorily.

The liquor to be tested must be so diluted that 5 c.c. will not consume more than two-thirds of the permanganate required by the 25 c.c. of indigo always used, and thus the complete titration can always be made with the contents of a 50 c.c. burette. Sufficiently accurate readings can be made from the upper edges of the liquids without the use of a float. It is important that the stirring turbine should run with fair uniformity (if hand-stirring is relied on, it must be constant and efficient), and the dropping should be at a regular rate. Generally this may be as fast as separate drops can be counted, until the original blue colour has become yellow-green, after which permanganate is added drop by drop to complete discharge of the blue. It is well occasionally to time the titration so as to ensure constant work. The titration is even more easy by good artificial light diffused by ground glass or tissue paper than by daylight, the removal of the last trace of blue being shown by a very marked brightening of colour; but as the end-points are not quite identical, all the titrations for any single analysis must be done in the same light.

The tanning matter is of course indicated by the difference of titration of the original and detannised liquor, but as neither dissolved salts or traces of hide-substance have any appreciable effect on the titration, the detannisation may be much simpler than that required for actual gravimetric analysis. Washing of hide-powder after tanning is quite needless, the powder being merely bromed, pressed, weighed, and the requisite water added; and 6 c.c. of the detannised liquor counted as five; but a still greater simplification may be effected by the use of a soft Paessler's dry "lightly chromed" powder, or by the use of freshly air-dried chrome leather machine shavings as suggested by Kopecky. About 7 grains. of the dry powder and a little kaolin should be added to 100 c.c. of the diluted liquor, well mixed by hand shaking, and shaken for 10–15 minutes in the machine. The moisture of such quantity of a powder only amounts at most to 1 gram. even if the whole of it acts as water of dilution, which is very doubtful, and can at most cause an error of 1/100th of

the total tannin in the diluted liquor; and as the analysis is only for comparative purposes, and the error, such as it is, is a constant one, it may well be neglected. The detannised liquor is filtered till clear through paper, and 5 c.c. is with 25 c.c. of indigo twice titrated. If the work is systematic, the amount of dilution required for each class of liquor will be known sufficiently nearly; if not, a simple titration of the undetannised liquor will be a sufficient guide, and for this purpose it is better to dilute too much than too little. The final result is of course divided by the number of c.c. of original liquor taken per litre and multiplied by 1000. It is best to use distilled water for this dilution, but any good tap water will do for titration. Whether the liquor should be filtered clear before or after dilution, or not at all, is a matter for consideration; but if not, any suspended solids, such as those of quebracho, or the catechin of gambier, will largely dissolve on dilution, and be estimated as tannin, which is not necessarily an error, since to some extent the same thing happens as liquors become exhausted in the tannery. It is not necessary to filter the liquor for detannisation, and a good compromise would be to filter only the portion of diluted liquor required for titration, through any good quantitative paper. The systematic method of work would then be that the liquors to be tested would be brought to the laboratory first thing in the morning, and there diluted as required. 100 c.c. of each of the diluted liquors would be placed in shaking bottles with the requisite dry chromed hide-powder and kaolin and shaken by hand till well mixed; and a portion of each of the diluted liquors filtered, the first turbid portions being rejected. The operator would then shake the bottles in the machine, and set their contents to filter while he proceeded with the titrations of the diluted liquors.

The first step is to make fresh the weak permanganate by diluting 100 c.c. of 5 gram. per litre strength to 1 litre, as the strong solution keeps well while the weak soon alters, and to shake this very thoroughly in the stock-bottle to ensure complete mixture. 25 c.c. of the indigo is then twice titrated alone, and the titration repeated with 5 c.c. of the freshly-made gallic acid solution, 0.1 gram. in 100 c.c. The sum of the differences between these will give the permanganate value of 0.01 gram. of gallic acid, which will be practically constant from day to day with careful work and a single operator, and perhaps need not be every day repeated.

The titration of 5 c.c. of the diluted liquors is now similarly performed, and then that of 5 c.c. of the corresponding detannised portions, the titrations always being done in duplicate to check possible errors, and the sum of the two results taken. If now the result of the detannised liquor be deducted from that of the original diluted liquor the quantities of permanganate consumed by indigo will cancel each other, and the result will be the permanganate value of the tannin of 10 c.c. of (diluted) liquor; and

Permanganate consumed by gallic acid	permanganate consumed by liquor	1 gram. per litre gallic acid	gram. per litre of tannin in liquor expressed as gallic acid.
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If for 1 gram. per litre, the weight of the actual tannin corresponding to 1 gram. of gallic acid be substituted, the strength of the diluted liquor will be obtained directly in gram. per litre in "tanning matter"; and from this by simple multiplication by the dilution, that of the original liquor. 1.34 in place of 1 will give the strength in terms of gallotannic acid; 1.76 is the average of about 30 analyses of all the common tanning materials, and Table I. gives factors averaged from several analyses of each of the more important.

If, however, it be desired to obtain an actual experimental figure for the liquors of the particular tannery, or for any particular tanning material, this is easily done by combining the Löwenthal with an ordinary gravimetric analysis of an average liquor by the shake method; the actual "total soluble" and "non-tannin" solutions being used for the titration. Then the result in gram. per litre found gravimetrically, divided by the "gallic acid value" by Löwenthal, will give the factor required, *viz.*, the weight of the tannin corresponding to 1 gram. of gallic acid.

TABLE I.

Material.	Tannin value of 1 gm. gallic acid.	Gallic acid value of 1 gm. tannin.	Gallic acid value of 1 gm. non-tans.
Chestnut extract.....	1.52	0.655	0.095
" " ".....	1.67	0.596	0.085
" " ".....	1.64	0.607	0.080
" " ".....	1.77	0.565	0.109
" " ".....	1.70	0.590	0.200
Solid " ".....	1.66	0.600	0.245
Chestnut wood.....	1.61	0.618	0.313
Average.....	1.65	0.604	
Oakwood extract.....	1.79	0.557	0.115
" " ".....	1.93	0.516	0.047
" " ".....	1.98	0.504	0.068
Oakwood.....	1.88	0.531	0.116
Average.....	1.89	0.527	
Myrobalans extract..	1.70	0.586	0.157
" " ".....	1.82	0.549	0.185
Myrobalans.....	1.67	0.597	0.126
Average.....	1.73	0.577	
Mimosa D extract...	1.74	0.574	0.053
" " ".....	1.66	0.602	0.184
" " ".....	1.71	0.584	0.094
Liquid quebracho extract.....	1.63	0.612	0.222
Quebracho wood.....	1.70	0.588	0.220
Average.....	1.69	0.592	
Larch bark.....	1.96	0.509	0.056
Hemlock bark.....	1.97	0.501	0.083
Hemlock extract.....	2.28	0.437	0.035
Spruce bark.....	2.53	0.395	0.104
Average.....	2.18	0.460	
Valonia extract.....	1.80	0.553	0.060
Valonia.....	1.58	0.632	0.086
Sumach.....	1.53	0.650	0.073
" " ".....	1.47	0.680	0.084
Oakbark.....	1.71	0.583	0.112
Mimosa bark.....	1.88	0.529	0.031
Mangrove bark.....	1.46	0.682	0.004
Gambier cube.....	1.78	0.559	0.325
Average of all above materials.....	1.76	0.573	
Gallotannic acid.....	1.34	0.742	—
Fichtenholz I.....	7.75	0.129	0.096
(" Pinewood extract")			
Fichtenholz II.....	11.11	0.090	0.043
" " III.....	7.3	0.137	0.031
Average.....	8.72	0.119	

The Löwenthal method as applied to liquors not only has the advantage over the gravimetric method of much greater rapidity, but is probably of greater relative accuracy with weak liquors, as no concentration is required: the following figures obtained independently for a set of liquors by two different students illustrating the sort of concordance to be expected. The factor used was $\frac{1}{2}$ or 1.66, which was the average of several determinations of the materials used.

TABLE II.

Liquor.	Tanning matter per cent.	
	A.	B.
1st Suspender.....	0.17	0.17
2nd ".....	0.39	0.39
1st Handler.....	0.85	0.82
2nd ".....	1.20	1.20
3rd ".....	1.48	1.50
4th ".....	2.13	2.12
5th ".....	3.33	3.27
6th ".....	4.23	4.21

The method is one which can easily be mastered by any intelligent youth without much chemical knowledge, and if it were combined at the same time with lime-water determinations of acidity, would give information as to variations in the working of a yard which could hardly fail to be valuable commercially. It is, however, only to be recommended for continuous and systematic work, and its use for occasional analyses is more troublesome than the ordinary gravimetric method.

The method is equally adapted to the control of spent tans, since very weak liquors can be as accurately determined as strong ones, 10 c.c., or more, if necessary, being used for each titration instead of 5, so that a sufficient quantity of water can be used for complete exhaustion. The material can be dried, ground fine, and extracted in the Procter extractor in the usual way: but for comparative tests it would often be sufficient to boil up 5 lb. of the wet material as it comes from the leaches with a gallon of water for half an hour, allow to stand overnight, and draw off the liquor, making up to one gallon, if necessary, by the addition of enough water to the material to supply the loss by evaporation, and Löwenthal the liquor. Though this would give no precise information as to the exact amount of tannin left in the material, it would at once detect any variations in the completeness of the leaching, and if compared to an occasional more complete analysis, would probably give all necessary information.

As regards the theoretical significance of the Löwenthal results, it is interesting to note that the table of factors given, partially bears out the statement formerly made that catechol tannins reduce materially less permanganate than gallotannic acid or pyrogallol tans. 1 gm. of the purest gallotannic acid is only equal in reducing power to 0.742 gm. of gallic acid, and in all cases the reducing power of the "tanning matters" absorbed by hide-powder is still lower, the highest being that of sumach, of which in one sample 1 gm. had equal reducing power to 0.680 gm. gallic acid: while the lowest are the tannins of coniferous barks, ranging from about 0.4 for spruce bark to 0.5 for larch and hemlock. Chestnut extracts average about 0.6. Oakwoods and myrobalans range from 0.5 to 0.6, while mangrove bark, a pronounced catechol tan, reached 0.68. These differences are not so large as was *a priori* to be expected, a fact which greatly facilitates the use of the method for liquor testing, but which proves that the permanganate required is dependent rather on the differences of constitution of the individual tannins than on the catechol or pyrogallol nucleus. It is also evidence that even in those tannins most allied to gallotannic acid, the substance estimated by hide-powder is not simply gallotannic acid, but either includes other less oxidisable matters or compound tannins of a more complex character, and very possibly in many cases, glucosides.

The gallic acid values of the different tannins are characteristics which may be used, like the saponification values and iodine values of fats, as a means of identification. Thus an "oakwood" extract with a gallic acid value over 0.6 may be justly suspected of being a chestnut. Even in genuine extracts the differences in value which are found, no doubt point to real differences in the character of the tannin due to manufacture, mode of growth, or age, which deserve closer investigation.

In this connection it may be interesting to quote some results of detannisation by gelatine (described in Procter's "Leather Industries Laboratory Book" *), as compared with various hide-powders. It has been shown that by this modification of the method, the separation of gallotannic acid from gallic acid is very approximately accurate, although perhaps by a compensation of errors, traces of gallic acid being precipitated and traces of the tannogelatin dissolved in the acid liquor. Addition of more salt diminishes the latter error, but increases the former.

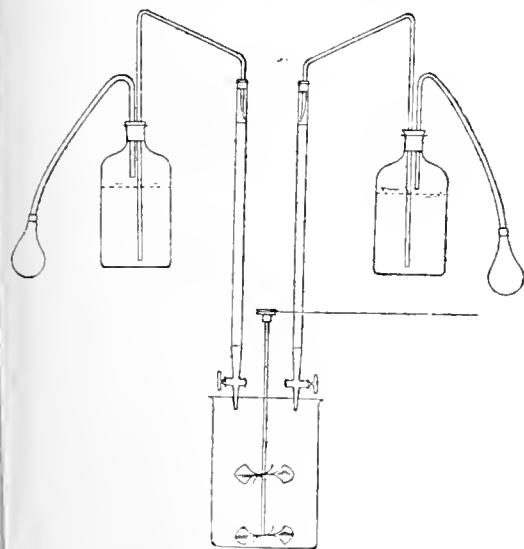
* To 50 c.c. of liquor add 25 c.c. of fresh 2 per cent. gelatine solution, 25 c.c. of a saturated solution of salt containing 50 c.c. of sulphuric acid per litre, and a teaspoonful of kaolin, shake for 15 minutes and filter and titrate 10 c.c. instead of 5 c.c.

TABLE III.
Gallic acid equivalent to non-tannins.

Extract.	Gelatine salt and acid.	Freiberg unchromed powder.	Vienna unchromed powder.	Paessler's chromed powder.	American chromed I.A.L.T.C.
Oakwood, (reputed)	0.255	0.221	0.163	0.149	0.149
Oakwood, Gondolo	0.160	0.144	0.132	0.115	0.115
Chestnut, solid	0.331	0.354	0.320	0.242	0.245
Chestnut, liquid	0.297	0.300	0.297	0.209	0.199

It will be observed that in most cases the non-tannins are highest in the case of gelatine precipitation, though in some cases they are approached or even exceeded by the unchromed hide-powders used by shaking, while those of the chromed powders are invariably much lower. It appears therefore that as regards the oxidisable matters estimated by permanganate, the unchromed powders give results nearer the scientific truth, but the much closer concordance of the chromed powders fully justifies their use for commercial purposes, and further it must be remembered that in gravimetric analysis these oxidisable and generally astringent non-tannins form only a small portion of the whole. The close agreement of Prof. Paessler's lightly chromed powder with that officially chromed, establishes the suitability of the former as a detannising agent for the Löwenthal process, and encourages the hope that a dry chromed powder may ultimately be produced, which will avoid not only the chroming, but the much more troublesome washing immediately before use which is now required.

If the gelatine method is preferred to hide-powder for liquor control it is quite as rapid, and probably less affected by large amounts of non-tannins, but the results are not directly comparable with gravimetric analysis, and some samples of gelatine exercise a slight reducing effect on permanganate, not amounting in blank experiments to more than about 0.2 c.c. per 10 c.c. of the non-tannin filtrate, and probably due to traces of sulphites. This, if desired, is easily determined and allowed for.



DISCUSSION.

Prof. W. M. GARDNER suggested the investigation of the effect of reducing instead of oxidising substances on tannins. The action of the latter was the basis of the methods of estimation at present used. If a definite substance such as benzoic acid could be obtained as a result of reduction, much more definite results might be obtained. Under certain conditions tannic acid and any other phenolic bodies gave benzoic acid on reduction.

Mr. F. W. BRANSON asked if absolutely pure chemicals were necessary when a correction factor could be used.

Mr. H. G. BENNETT said that difficulties were always experienced with certain tannins where the methods of estimation broke down. He emphasised the value of a volumetric method such as the Löwenthal method, which combined speed and accuracy, since the hide-powder process involved difficulties such as the possible presence of difficultly volatile substances like lactic acid, the impossibility of drying the exhausted extract to a constant weight, &c.

Note by Prof. H. R. PROCTER: I have not tested the recently-suggested reduction methods for the investigation of tannins, which are of great scientific interest, but do not seem as yet likely to supersede those in use for practical estimation. In reply to Mr. Branson's question, there is no doubt that in many cases absolutely pure chemicals are of the greatest importance. In the Löwenthal process the purity of the gallic acid is of the highest importance, and the indigo must be free from indigo red and other products which obscure the end-point.

NOTE ON THE DIFFUSION OF CHROMIUM, IRON AND ALUMINIUM SALTS THROUGH GELATINE JELLY.

BY PROF. H. R. PROCTER AND DOUGLAS J. LAW.

The experiments described in the following note were prepared in the first instance as a lecture demonstration, but though the results throughout must merely be regarded as qualitative they appear to present some points of interest which make them worthy of a permanent record.

If a solution of a coloured crystalline salt, such as copper sulphate, is poured on the top of solidified gelatine jelly, it diffuses into it somewhat rapidly, its progress being easily traced by the change of colour in the transparent jelly. It has been shown by Fick that in many cases diffusion in jellies is practically as rapid as in still water. In the case of coloured substances of a less definitely crystalline character the diffusion is slower, and the ultimate penetration less, while solutions of a distinctly colloidal nature either do not penetrate at all or do so to a comparatively small extent. If a mixture of two coloured substances is employed of different degrees of diffusibility two zones of diffusion are formed, of which the deeper consists only of the more diffusible substance. When operating with colourless salts, bases, or acids, it is frequently easy to determine their progress by the addition of a suitable indicator, thus that of strong bases is shown by the addition of phenolphthalein, or that of acids, by the same reagent coloured with a trace of caustic alkali.

As salts of chromium and other metals of the same group are very prone to hydrolysis and the formation of basic salts, it was of interest to determine not merely the progress of the chrome salt but that of the hydrolysed acid, and for this purpose a 5 per cent. jelly was used coloured pink with slightly alkaline phenolphthalein. This was allowed to set in Nessler cylinders, or for the purpose of lantern demonstration, in parallel-sided cells, and the solution to be tested was poured upon the top of the jelly. That gravitation had little influence on the rapidity of the diffusion was proved by repeating a similar experiment with an inverted tube. As the chrome salts diffused into the jelly, their progress was clearly noted by their colour, which, whatever the colour of the solution, is generally in the jelly of a dull bluish green, somewhat

between the colour of the well-known green and violet modifications. As, however, the chrome salts hydrolyse considerably, the penetration of the acid was much more rapid, with the consequence that a broad zone was formed beyond the chrome in which the colour of the phenolphthalein was discharged. As a rule the boundaries of these zones, though naturally shading into each other, were sufficiently sharp to allow of easy approximate measurement, especially as regards the edge of the diffused chrome salts. That of acid was distinctly sharper in the case of chrome alum than in that of chromium chloride solution. The results of these experiments are shown in the following tables, the depth of diffusion being stated in centimetres. Experiments were made with a half-saturated solution of chrome alum containing about 1 per cent. of chromium and with a 10 per cent. solution of chromium chloride containing 1.4 per cent., 10 c.c. being in each case placed above the gelatine in the Nessler tube. As the first experiments were not intended to be qualitative, this solution was not renewed, but it must be observed that under these conditions the diffusing solution must become continuously weakened with the progress of the diffusion, so that in the later stages the diffusion would go on very slowly. Before any calculations therefore could be made, this would have to be taken into account, together with the possible swelling or contraction of the jelly, and if it were possible to apply the method quantitatively it would probably be better to employ larger quantities of the solution kept gently stirred and replaced by new solution before sensible change had taken place in the concentration. Both solutions of the normal salts and others rendered basic with definite additions of sodium carbonate were employed, and one of the most striking facts observed was that the rate of diffusion and the apparent amount of hydrolysed acid was in the case of chrome chloride unaffected by these conditions, and the differences scarcely if at all exceeded that of probable experimental errors, while with the chrome alum, the diffusion of the chromium was rendered much slower, but without any corresponding influence on that of the acid. From a solution of chrome alum rendered green by boiling, the diffusion of acid was much more marked than from the violet normal salt, supporting the view that the change of colour was due to hydrolysis and the formation of a basic salt. As has been noted, the solution of chromium chloride employed was materially stronger than that of the chrome alum, and perhaps this may explain the differences of effect. A further experiment is in progress with solutions of equal chromium concentration.

The rate of diffusion was found to be quite independent of the bore of the tube.

An interesting effect noticed in some of the experiments both with chromium chloride and chrome alum was the production of striae or layers of green parallel to the surface and of greater intensity than the layers above and below. These recall the somewhat similar effects observed in the diffusion of bichromate in gelatine containing traces of silver nitrate, or conversely of silver nitrate in bichromated gelatine. The latter has been recently investigated by R. E. Liesegang (*Kolloide Z.*, 1907, 2, 70), who finds that it is much influenced by the presence of gelatines or decomposed gelatine. Ostwald has explained the phenomenon as due to the existence of a supersaturated solution of silver chromate which diffuses without precipitation to a certain concentration at which "germs" are spontaneously formed, and the concentration falls to saturation, and again diffuses till it again becomes sufficiently supersaturated. Liesegang points out that the gelatines increase the solubility of silver chromate. Although no two salts which mutually give rise to a less soluble one are present in the green chrome solutions, the explanation is probably somewhat similar. The hydrolytic dissociation and diffusion of the acid makes the salt continually more basic until at last a part becomes incapable of further diffusion, and possibly acts as a semipermeable membrane to the more basic part, while the more acid or normal portion diffuses further until it in turn becomes too basic. It is also possible that the basic salt passes spontaneously from the sol to the gel condition at a certain degree of basicity, leaving a more acid salt in solution, as it is well known that when separation takes place in such basic solutions, the portion unprecipitated is much more acid than before, the gel formation being only reversible in presence of considerable excess of acid.

The phenomena in the case of iron and aluminium salts are very similar in character to those just described, the diffusion of the acid always considerably preceding that of the base. In the case of ferric chloride, the salt fixed is of the deep brown characteristic of basic ferric salts. With alumina it is of course colourless, but may be made visible by the addition of a trace of yellow logwood infusion with which alumina forms a violet lake.

The experiments described are not only interesting as demonstrating in a striking way the hydrolysis of such salts, but also illustrate what has long been taught by one of us, and has recently been fully proved by Stiasny (*Collegium*, 1908, 337; this *J.*, 1908, 1030), that the acid and the colloidal base are absorbed independently by the amphoteric gelatine or gelatinous hide-libre, and that either may be absorbed in excess according to the conditions of the experiment.

Diffusion of Chrome Chloride in Gelatine.

Basicity of chromium chloride solution. 10 c.c. 10 per cent. $\text{CrCl}_3\cdot 6\text{H}_2\text{O}$.	19 hours.		67 hours.		91 hours.		115 hours.	
	Chrome.	Acid.	Chrome.	Acid.	Chrome.	Acid.	Chrome.	Acid.
About 1.4 per cent. chromium								
Normal salt	1.8	2.1	3.1	3.5	3.6	4.0	4.2	4.6
+1.3 c.c. $\text{N} \frac{1}{2} \text{Na}_2\text{CO}_3$	1.7	2.0	3.1	3.4	3.6	4.0	4.2	4.6
+2.6 c.c. $\text{N} \frac{1}{2} \text{Na}_2\text{CO}_3$	1.7	2.0	3.1	3.4	3.6	4.0	4.1	4.4
+5.7 c.c. $\text{N} \frac{1}{2} \text{Na}_2\text{CO}_3$	1.7	1.9	3.1	3.5	3.6	4.0	4.1	4.5
As basic as possible	1.6	2.1	3.0	3.6	3.5	4.1	4.1	4.7

Basicity of chromium chloride solution. 10 c.c. 10 per cent. $\text{CrCl}_3\cdot 6\text{H}_2\text{O}$.	139 hours.		163 hours.		17 days.		—	
	Chrome.	Acid.	Chrome.	Acid.	Chrome.	Acid.	—	—
About 1.4 per cent. chromium								
Normal salt	4.6	5.0	5.0	5.4	7.6	—	—	—
+1.3 c.c. $\text{N} \frac{1}{2} \text{Na}_2\text{CO}_3$	4.6	5.0	5.0	5.4	7.6	—	—	—
+2.6 c.c. $\text{N} \frac{1}{2} \text{Na}_2\text{CO}_3$	4.5	4.9	4.9	5.3	7.6	—	—	—
+5.7 c.c. $\text{N} \frac{1}{2} \text{Na}_2\text{CO}_3$	4.5	5.0	4.9	5.4	7.6	—	—	—
As basic as possible	4.5	5.1	4.9	5.5	—	—	—	—

Diffusion of Chrome Alum in Gelatine.

Basicity of chrome alum solution. About 1 per cent. chromium 1/2 saturated chrome alum (about 5 per cent.).	19 hours.		67 hours.		91 hours.		115 hours.	
	Chrome.	Acid.	Chrome.	Acid.	Chrome.	Acid.	Chrome.	Acid.
Normal salt	1.1	1.2	1.9	2.1	2.2	2.5	2.6	3.0
+1 c.c. N/1 sodium carbonate	0.9	1.5	1.6	2.2	2.2	2.6	2.3	2.9
+2 c.c. N/1 sodium carbonate	0.8	1.9	1.3	2.4	1.7	2.8	1.9	3.1
As basic as possible	0.7	1.7	1.2	2.3	1.6	2.7	1.7	3.5

Basicity of chrome alum solution. About 1 per cent. chromium 1/2 saturated chrome alum (about 5 per cent.).	139 hours.		163 hours.		17 days.		—	
	Chrome.	Acid.	Chrome.	Acid.	Chrome.	Acid.	—	
Normal salt	2.9	3.3	3.1	3.5	4.7	5.3	—	
+1 c.c. N/1 sodium carbonate	2.5	3.1	2.7	3.4	4.1	5.0	—	
+2 c.c. N/1 sodium carbonate	2.0	3.4	2.1	3.6	3.0	4.9	—	
As basic as possible	1.8	3.3	1.9	3.4	2.5	4.7	—	

Journal and Patent Literature.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Removal of liquid from solid materials; Apparatus for the —. P. J. Ogle, London. From F. St. Q. Cockburn, Traag, Norway. Eng. Pat. 2815, Feb. 7, 1908.

The material to be filtered is fed continuously from a hopper which rotates over a horizontal, annular filter. The latter is supported over a vacuum chamber and the liquid is sucked through, leaving the solids on the surface of the filter. Immediately in front of, and attached to, the rotating hopper is a curved skimming blade which strips off the cake of solids from the filter. The place of the removed solids is at once taken by fresh material from the hopper, so that the vacuum is not "broken" and the process is continuous. The space below the filter is divided by radial partitions into sections, each connected to a double vacuum receiver. Washing liquid is sprayed on to the surface of the deposit by a rotating arm which follows the feed-hopper at a determined distance. The filtrate and wash-water passing through the filter are directed into one or other of the double vacuum receivers by a butterfly valve operated by the rotating frame which carries the skimmer, feed-hopper, and wash-water pipe.—W. H. C.

Pressure-filters; Plate for —. C. W. Merrill, Lead, S.D. U.S. Pat. 912,867, Feb. 16, 1909.

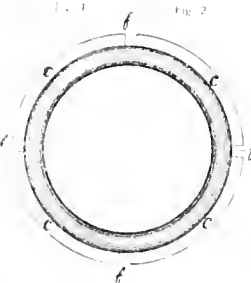
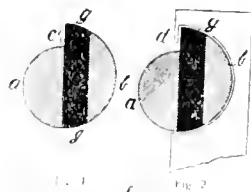
The claim is for a filter-plate having a solid central web, the surface of which is corrugated. The corrugations are arranged in such a manner that they form concentric polygons. The sides of the polygons are intersected by drainage grooves, each of which is shorter than the shortest anterior surface dimension of the filter-plate.—W. H. C.

Filtration and purification of gases and vapours. G. F. Jaubert. Fr. Pat. 394,472, Dec. 5, 1907.

The purifying material is contained in closed, cylindrical, metal casings or cartridges, the ends of which are made of thin material so that they may be easily perforated. The case or cartridge is placed between two adjustable tubular supports, each of which is provided with projecting

teeth so that when they are forced together to grip the cartridge, the teeth perforate the thin ends and allow the gas, which enters by one support and leaves by the other, to pass through the purifying material. The object of the arrangement is to prevent the deterioration of the purifying material when stored before use and to allow the introduction of the cartridge into the stream of gas without admitting any air.—W. H. C.

Packing for filter-press elements. L. Schargel. Ger. Pat. 206,711, March 13, 1908.



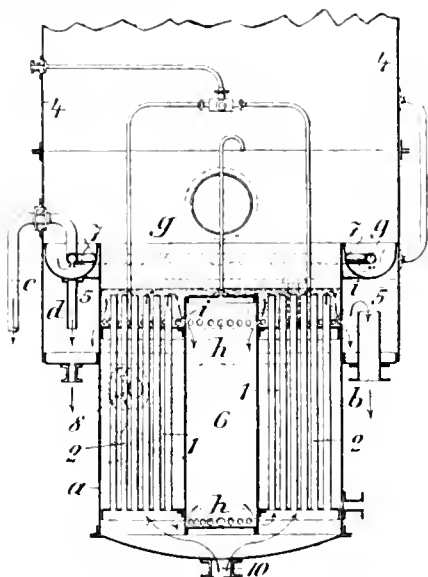
The packing consists of a flat ring, *g*, of ebonite or other suitable material, shown in cross-section, in Figs. 1 and 2, on which are fastened rings, *a*, *b*, of rubber, of any suitable cross-section. The rubber ring, *a*, does not cover the whole width of *g*, but leaves a portion, *c*, free. In this portion cuts, *f*, are made at intervals as shown in Fig. 3, corresponding to pieces, *d*, on the filter-press elements, so that the packing can easily be put in place.—A. S.

Liquids which readily deteriorate [e.g., sugar juices]; Apparatus for the filtration of —. H. Hoppe. Ger. Pat. 206,408, April 13, 1906.

A NUMBER of small sand-filter boxes are connected to common inlet and outlet pipes, the connections between the boxes and the inlet pipe being of such a kind that they

can be easily opened and closed. A lifting and transporting device is provided for removing the filter-boxes to the sand-washing apparatus. In the apparatus shown, the filter-boxes have conical bottoms with central pipes which project downwards into openings, provided with rubber rings, in the inlet-pipe for the liquid to be filtered or into the discharge pipe for the wash-water. The liquid to be filtered, e.g., sugar juice, passes upwards through the filters. Above the filter-boxes is a pipe for supplying wash-water.—A. S.

Evaporating apparatus [for sugar solutions, etc.]. Maschinenfabrik Grevenbroich, Grevenbroich, Germany. Eng. Pat. 20,972, Oct. 5, 1908. Under Int. Conv., Oct. 8, 1907.



The side of the tubular heating chamber, 1, is carried upwards beyond the bottom of the vapour chamber, 4, and the ends of the tubes, 2, also project beyond the upper tube-plate. The circulating pipe, 6, which is closed above and below, projects beyond the upper and lower tube-plates and is perforated both above and below, as shown at *h*. The liquid to be evaporated (e.g., sugar solution) enters through 10, passes up the tubes, 2, and overflows. A portion returns through the perforations, *h*, to the circulating pipe, 6, and another portion passes through the perforations, *i*, into the annular space, 5, from whence it overflows through *b*. Any froth formed overflows into the annular trough, 7, carrying with it any separated impurities. From 7, these are removed with the liquid by the pipes, *g*, *c*, and any separated liquid returns through *d* to the annular chamber, 5.—W. H. C.

Drying air; Method of and apparatus for —. H. C. Gardner, Chicago, Ill. U.S. Pat. 910,525, Jan. 26, 1909.

Air is dried by cooling it and exposing it to the action of a hygroscopic agent. The apparatus comprises three chambers. A coiled pipe conveying a refrigerating liquid passes through the first and third of the chambers, and the second chamber is traversed by tubes and forms a heat exchanger for the air, so that the cold dry air leaving the apparatus assists in the cooling of the moist air on its way to the drying chamber. The air is cooled in the first chamber, and then passes through the tubes in the heat exchanger and thence through the third chamber. A hygroscopic solution is distributed over the coiled pipe in this latter chamber, and the solution is kept in circulation and maintained at approximately the same strength throughout the process. The dried air then passes around the tubes in the heat-exchanger to the outlet of the apparatus.—A. T. L.

Kiln. J. E. Kennedy, New York. U.S. Pat. 911,658, Feb. 9, 1909.

A WATER-JACKETED tube is disposed axially within a horizontal rotary kiln, and air and gas mixed with products of combustion from the chimney are introduced into the interior of the tube by pipes. The gas and air escape into the kiln through symmetrically disposed openings in the jacketed tube, so that each part of the kiln receives substantially equal supplies of air and gas.—W. H. C.

Percolator and extractor. C. Warburton, Pawtucket, R.I. U.S. Pat. 912,634, Feb. 16, 1909.

A PERCOLATING receptacle is interposed between a closed liquid reservoir above and a closed liquid receiver below. The receiver is connected to the liquid reservoir by an air-pipe in the length of which the bulb of a rubber hand-pump is interposed. On compressing the bulb, air is withdrawn from the receiver and a partial vacuum is created therein. The air so withdrawn is forced into the upper liquid reservoir and produces a pressure on the surface of the percolating liquid.—W. H. C.

Air pyrometers. M. Arndt, Aachen, Germany. Eng. Pat. 2914, Feb. 10, 1908.

SEE FR. Pat. 388,992 of 1908; this J., 1908, 970.—T. F. B.

Distilling apparatus. E. Flick, Cologne, Germany. Eng. Pat. 25,323, Nov. 24, 1908.

SEE FR. Pat. 392,674 of 1908; this J., 1909, 15.—T. F. B.

Filling material for reaction spaces. O. Guttman, London. U.S. Pat. 912,310, Feb. 16, 1909.

SEE Eng. Pat. 4497 of 1907; this J., 1907, 859.—T. F. B.

Agitating and separating mixtures of solid matter and liquids. J. T. Carrick, Assignor to B. S. Pattison, Johannesburg. U.S. Pat. 912,541, Feb. 16, 1909.

SEE FR. Pat. 394,133 of 1908; this J., 1909, 236.—T. F. B.

Purifying materials; Process of recovering —. H. Firzel, Leipzig-Plagwitz, Germany. U.S. Pat. 913,500, Feb. 23, 1909.

SEE FR. Pat. 391,169 of 1908; this J., 1908, 1102.—T. F. B.

Compressing air or gases; Processes and apparatus for —. H. A. Humphrey, Fr. Pat. 394,645, Aug. 6, 1908. Under Int. Conv., Oct. 14, 1907.

SEE Eng. Pat. 22,646 of 1907; this J., 1908, 1101.—T. F. B.

Evaporating apparatus with continuous removal of froth and impurities from the liquid. Maschinenfabrik Grevenbroich. Fr. Pat. 394,964, Oct. 6, 1908. Under Int. Conv., Oct. 8, 1907.

SEE Eng. Pat. 20,972 of 1908; preceding.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Irish peat industries; Reports upon the —. Part II. H. Ryan. Economic Proc. Roy. Dublin Soc., 1908, 1, 465–546. (See this J., 1907, 1130.)

THE subject is treated under the following headings:—*Section I. Peat fuel industries.* 1. Properties of fuel; general remarks on peat fuel. 2. Cutting of turf in Ireland; peat digging machines. 3. Drying or "sawing" turf; defects of turf. 4. Hand-turf. 5. Press-turf; wet press processes, centrifugal press, and dry press processes. 6. Machine-turf. 7. Drying machine turf. 8. Electro-peat. 9. General plan for a turf factory; use of peat fuel. *Section II. Peat distillation industries.* 1. Turf-charcoal. 2. Coking in heaps. 3. Coking in furnaces. 4. Coking in retorts; electrical coking process; coking by superheated steam. 5. Properties of turf-charcoal; turfite or half-coked turf; utilisation of by-products; turf-tar; extraction of acetic acid and ammonia from the "gas-water"; light petroleum, lubricating oil, and wax. 6. Properties and average amounts of the by-products. 7. Turf-gas; illuminating gas from turf. 8. Heating gas from turf; turf generator gas. 9. Distillation of turf

at low temperatures; preparation of ammonium sulphate from turf. Three plates, tables showing the Irish imports and exports (1904, 1905, and 1906) of peat-moss litter and peat fuel, and a bibliography, are appended to the paper.—A. S.

Coal production and consumption in the principal countries of the world. Board of Trade J., March 4, 1909. [T.R.]

THE production of coal in the five principal coal-producing countries of the world in 1905, 1906, and 1907 was as follows:—

Countries.	1905.	1906.	1907.
	tons.*	tons.*	tons.*
United Kingdom . . .	236,129,000	251,068,000	267,831,000
Germany	119,350,000	134,914,000	140,885,000
France	34,652,000	32,920,000	35,586,000†
Belgium	21,506,000	23,191,000	23,324,000
United States of America	350,821,000	369,783,000	428,896,000‡

* Tons of 2240 lb. † Provisional figures. ‡ Including lignite.

The total known coal production of the world (exclusive of brown coal or lignite) in 1907 was about 1,000 million tons, of which the United Kingdom produced rather more than one-fourth.

The following statement shows the production of coal in the principal British Colonies and Possessions in the years 1905, 1906, and 1907. The amounts are in every case stated in tons of 2240 lb.:—

Country.	1905.	1906.	1907.
	tons.	tons.	tons.
British India	8,418,000	9,783,000	11,147,000*
Australia	7,494,000	8,596,000	9,681,000*
New Zealand	1,586,000	1,730,000	1,831,000*
Canada	7,739,000	8,717,000	9,385,000*
Transvaal	2,327,000	2,583,000	2,574,000
Cape of Good Hope . . .	147,000	128,000	129,000
Natal	1,129,000	1,239,000	1,530,000
Orange River Colony . . .	106,000	235,000	446,000

* Provisional figures.

The consumption of coal in some of the chief consuming countries is shown in the following statement, in which the countries are given in the order of importance as coal consumers in 1907:—

—	1905.	1906.	1907.
	tons.	tons.	tons.
United States	343,281,000	361,602,000	417,875,000
United Kingdom	169,017,000	174,361,000	182,674,000
Germany	106,716,000	119,282,000	128,411,000
France	45,915,000	49,441,000	52,885,000
Russia	23,604,000*	25,489,000*	24,708,000*
Austria-Hungary	19,314,000	21,234,000	24,257,000
Belgium	19,661,000	22,468,000	22,805,000

* Provisional figures.

Lignite.—The statistics of lignite production show that the principal producing countries are Germany, Austria, and Hungary, which in 1906 produced 55,513,000 tons, 23,779,000 tons, and 6,263,000 tons, respectively, whilst the provisional figures available for the production of Germany in 1907 show a production of 1,542,000 tons. In Austria the output of lignite for 1907 was 25,840,000 tons. The quantity of lignite produced in the United States is included in the figures of coal produced, which have already been given; the best available figures giving the production of lignite separately relate to 1905, when it amounted to 6,149,000 tons. In no other country does the quantity produced reach one million tons. In the United Kingdom it has in some years been nil.

Ethylene; Synthesis of — from carbon monoxide and hydrogen. E. Orlov, J. Russ. Phys.-Chem. Ges., 1908, 40, 1588—1590. Chem. Zentr., 1909, 1, 735.

A MIXTURE of hydrogen and carbon monoxide was led through a glass U-tube filled with a catalytic substance and heated at 95—100° C. The catalytic substance was prepared by impregnating pieces of coke with a solution of nickel nitrate and palladium-ammonium chloride, and subsequently heating. The gases leaving the U-tube contained up to 6.6 per cent. of ethylene. Under similar conditions no reduction of carbon dioxide to formaldehyde could be detected, but at higher temperatures carbon dioxide yielded some ethylene and methane. —A. S.

Gases; The ignition-temperatures of —. H. B. Dixon and H. F. Coward. Chem. Soc. Proc., 1909, 26, 67.

THE temperature to which two gases must be heated in order that, when brought into contact, they will inflame immediately has been determined by passing an inflammable gas up a tube, terminating in a nozzle, fixed in the centre of a second tube conveying a current of air or oxygen, and electrically heated. Thus no reaction occurred during the preliminary heating of the gases. The temperature of the gas 2 mm. below the nozzle was measured by means of a protected thermo-junction. The ignition-temperature of hydrogen thus obtained was constant, within 10°, under variation of the following circumstances: (1) The rates of flow of the gases, within wide limits. (2) The size, material, and surface condition of the jet and of the walls of the furnace. (3) The rate of heating of the furnace. (4) The position of the thermo-junction, either inside or just outside the nozzle. The ignition-temperature was at first decreased some 20° by increasing the diameter of the outer tube, but a limit was then reached when doubling the diameter produced no further decrease. The ignition-temperature was raised 5° by working under half an atmosphere pressure, but decreased by 30° under a pressure of two atmospheres. The ignition-temperature of hydrogen in air is the same as in oxygen. The results obtained at atmospheric pressure are given in the following table. The paraffins and ammonia gave numbers varying with the rates of flow of the gases, as well as with the size of the furnace tube, so that their ignition-temperatures are not so clearly defined as those of hydrogen, carbon monoxide, and the other gases. It was also stated that alteration of the proportion of the gases within wide limits had no effect on the ignition-temperature.

Gas.	Ignition temperature.			
	In oxygen.		In air.	
	Between.	Mean.	Between.	Mean.
Hydrogen	589—590	585°	580—590°	585°
Carbon monoxide (moist)	637—658	650	644—658	651
Cyanogen	803—818	811	—	—
Ethylene	500—519	510	542—547	543
Acetylene	400—440	428 (?)	406—440	423
Hydrogen sulphide	220—235	227	346—379	364
Methane	556—700	—	650—750	—
Ethane	520—630	—	520—630	—
Propane	490—570	—	—	—
Ammonia	700—860	—	—	—

PATENTS.

Fuel for internal combustion engines, and manufacture of same. S. Barth. Fr. Pat. 394,386, Sept. 17, 1908. Under Int. Conv., Aug. 6, 1908.

A CELLULAR substance such as wood, straw, peat, coal, cellulose, celluloid, paper, etc., is ground to a very fine powder and sifted to remove fibres. Any resinous or agglutinant constituents are removed, and nitrates or other substances readily yielding oxygen are added to increase the force of the explosions, if desired. The fuel is used in place of the usual liquid fuels for internal combustion engines.—A. T. L.

Briquettes; Process of mixing binding materials with small coal for the manufacture of—Gewerkschaft des Steinkohlenbergwerks Adler. Fr. Pat. 394,740, Sept. 28, 1908.

IN the manufacture of briquettes, the binding materials, in a very finely divided state, are blown into the mass of small coal by means of steam or compressed air. The binding material (e.g. pitch or naphthalene) is used in the form of very fine powder or a liquid spray, and the compressed air may advantageously be preheated.

—W. C. H.

Smoke; Purifying and rendering innocuous—H. Beernaert. Fr. Pat. 394,634, Dec. 2, 1907.

THE coal charged into the furnaces is previously mixed with a small proportion of lime or calcium carbonate in order to prevent the disengagement of sulphur dioxide. The quantity so added is adjusted according to the percentage of sulphur contained in the coal.—W. H. C.

Coke ovens; Horizontal-flued—A. Lupton, London, and T. H. Riley, Sheffield. Eng. Pat. 8926, April 24, 1908.

To facilitate the repair of coke-ovens having horizontal heating flues, superposed flues are separated by "header bricks" which rest at one end upon the oven wall, and at the other end upon the central wall separating adjacent flues. The outer ends of the "header bricks" are protected by grooved and tongued facing bricks, and the space between their inner ends is occupied by vertical slabs. The thickness of the slabs may be varied to give the usual tapering form to the oven. When any of the bricks in the oven walls require renewing, the walls of the heating flues above the repair are supported during the operation by props beneath the sound "brick headers."—A. T. L.

Gas; Process of manufacturing—from coal. B. Thümmel, Dresden-Naustütz, Germany. U.S. Pat. 912,509, Feb. 16, 1909.

GAS for actuating an internal-combustion engine is generated by causing powdered coal to fall intermittently upon a surface heated by the exploded gases of the engine, pressing the coal against the heated surface, and removing the non-volatile residue of the coal before the next charge of coal is supplied.—A. T. L.

Gas-producer. E. Lawrenz, Lynn, Mass. U.S. Pat. 912,580, Feb. 16, 1909.

THE producer comprises a cylindrical casing and a hollow lining formed of two tiers of segmental iron blocks. Water is circulated through the hollow blocks forming the upper tier, and the hot water from the upper tier is led into the lower tier of blocks. The steam generated in the lower tier of blocks is led into the producer with air which has circulated through a passage between the casing and the hollow lining.—A. T. L.

Gases; Apparatus and process for manufacturing and mixing—and delivering the mixed gases to gas-engines. B. Loomis, Hartford, Conn., and H. Pettibone, New Rochelle, N.Y., Assignors to Power and Mining Machinery Co., New York. U.S. Pat. 912,698 and 912,699, Feb. 16, 1909.

PRODUCER gas and water gas are generated alternately in a producer, and after passing through scrubbing and cleansing apparatus, the gases are collected in separate holders. The water gas and producer gas are then mixed in a third gas-holder and the mixture is delivered to an engine.

—A. T. L.

[Producer] gas; Process and apparatus for the generation of—with the admission of air and steam at the centre of the producer. R. Panck. Fr. Pat. 394,810, Sept. 30, 1908.

To prevent the formation of clinker on the grate, the whole or the greater part of the steam is admitted through openings near the apex of a central conical grate or tuyère. The interior of the grate is divided by a horizontal partition

into an upper and a lower compartment. The whole, or the greater part of the air is introduced through the lower compartment, and the whole or the greater part of the steam through the upper compartment. In one form, the conical grate is mounted eccentrically on a rotating table forming a water-trough in the base of the producer, and the grate is provided with external helical steps to facilitate the discharge of clinker. The upper and lower parts of the grate may be both conical, or the lower part may be cylindrical. The two parts may be separate, and the grate may be cooled by the circulation of water through a pipe coiled around it.—A. T. L.

[Suction] gas-producer. V. G. Montaland-Davray. Fr. Pat. 395,103, Oct. 9, 1908. Under Int. Conv., Oct. 10, 1907.

THE producer, which works with a down-draught and is suitable for semi-bituminous coals, comprises a cylindrical brick-lined casing surmounted by an annular vaporiser and an annular fuel-container. The fuel in the container is free to fall as the fire descends. Air enters through the open vertical passage formed by the annular fuel-container, and the fire can be poked at any time through this passage. Steam from the vaporiser passes through a cock controlled by the engine governor and enters the air-inlet passage just above the top of the fire. The fuel column rests upon a horizontal grate having rectangular openings. Vertical pokers, worked by a lever from outside, may be passed through these openings, and horizontal pokers, also worked from outside, may be passed between the vertical pokers when the latter are raised, in order to discharge the clinkers over the edge of the grate. The hot gases leave the producer through an opening above the level of the grate, and pass through a coke-scrubber and a filter of wood-fibre, and finally to the engine.—A. T. L.

Electric incandescent lamp filaments. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 10,590, May 15, 1908.

TUNGSTEN or other suitable refractory metal powder is made into a paste with gelatinous zirconium oxalate and extruded into threads. The latter are dried and heated, whereby the oxalate is decomposed into oxide and the filament is sintered together.—W. H. C.

[Carbon] filaments for incandescence electric lamps; Manufacture of—K. Rittersberg and H. Rubert. Fr. Pat. 394,302, Sept. 15, 1908.

THE carbon is obtained by carbonising a vegetable oil. This carbon is mixed into a paste with resin and a binding agent, and the mixture formed into filaments. The filaments are rendered conductive and are finished by heating in a furnace to 800°—1000° C. The filaments have a very high specific resistance, a life of 1000 hours, and an efficiency of about 1 watt per candle-power.—A. T. L.

Metallic filaments for incandescence lamps. Wolfram Lampen Act.-Ges. Fr. Pat. 394,585, Sept. 23, 1908. Under Int. Conv., Oct. 7, 1907.

THE patent relates to a process for removing carbon from filaments of tungsten, molybdenum, osmium, chromium, tantalum, etc., or of alloys of these metals. Instead of oxidising the carbon, the filaments are heated to redness by the passage of an electric current in an atmosphere of pure dry hydrogen and sulphuretted hydrogen. The carbon is converted into carbon bisulphide, and the metallic sulphides formed are reduced by the hydrogen.—A. T. L.

Incandescence electric lamps; Process for preventing the volatilisation of metallic filaments in—Bergmann-Elektrizitäts-Werke Akt.-Ges. Fr. Pat. 394,823, Oct. 1, 1908. Under Int. Conv., Oct. 3, 1907.

THE process consists in the introduction of traces of a complex gas, and more particularly traces of phosphoretted hydrogen, into the lamp bulb. The explanation suggested is that in consequence of the low velocity of the molecules compared with that of the hydrogen molecule, the electric discharges which are probably the cause of volatilisation in a lamp containing hydrogen, are prevented.—A. T. L.

Retort for the distillation of coal and other carbonaceous substances. T. Parker, London. U.S. Pat. 913,552, Feb. 23, 1909.

SEE Fr. Pat. 380,017 of 1907; this J., 1907, 1271.—T. F. B.

Gas-producer. G. Hatton, Brierley Hill. U.S. Pat. 912,373, Feb. 16, 1909.

SEE Eng. Pat. 13,877 of 1904; this J., 1905, 666.—T. F. B.

Metallic conductors [incandescence filaments] of high resistance; Refractory —. Cie. Franç. pour l'Exploitation des Proc. Thomson-Houston. Fr. Pat. 395,163, Oct. 12, 1908.

SEE Eng. Pat. 24,707 of 1907; this J., 1908, 849.—T. F. B.

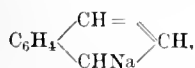
III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Destructive distillation of pit-coals. E. J. Constan and E. A. Kolbe. J. Gasbeleucht., 1908, 51, 669—673, 693—699.

THE authors studied the destructive distillation of 11 coals from France, a Spanish coal from the Pyrenees, and a French lignite. The results agree with the rule given by Sainte-Claire-Deville and Bunte for gas-coals, that the greater the proportion of oxygen in the coal, the smaller is the yield of coke and the greater the yield of volatile substances, and the greater also the quantity of moisture in the air-dried coal. The results also agree with the observation of Constan and Schläpfer that, in general, the composition and the calorific value of the coke are independent of the chemical composition of the coal, and are determined chiefly by the temperature and duration of the distillation process. The varying rates at which gas was made during the progress of the distillation were observed; the higher the percentage of volatile matter in the coal, the greater was the yield of gas during the first 10 minutes, and almost the whole of the gas was liberated during the first 25 minutes in all cases. The greater the yield of gas, the higher were the percentages of carbon dioxide, heavy hydrocarbons, carbon monoxide, and methane, and the lower the percentage of hydrogen, and in general, the lower also was the calorific value of the gas per unit weight. The heat balance of the distillation showed an average loss of 4.4 per cent. of the heat of combustion of the coal. The authors consider that no formula, such as that given by Goutal, will enable the calorific value of coal to be accurately calculated from the proximate analysis, as the proportion of fixed carbon in the ash-free coal increases, the calorific value increases to a maximum with coals containing 18—22 per cent. of volatile matter, and then decreases with semi-anthracitic and anthracitic coals. The paper also contains full details of the composition of the coke, and of the yield, composition, and calorific value of the gas, tar, and pitch.—A. T. L.

Indene; A sodium derivative of —. R. Weissgerber. Ber., 1909, 42, 560—572.

WHEN pure or crude indene is mixed with sodamide, heat developed, ammonia is evolved, and the sodium compound of indene,



formed. The mixture is warmed for 2 hours to 110—50° C., to complete the reaction. When crude indene has been used, the unattacked hydrocarbons are separated from the reaction product by distillation in a vacuum. Still purer product is obtained by adding the calculated quantity of metallic sodium to crude indene, warming the mixture for 5—6 hours to 120°—130° C., and passing in a slow stream of ammonia. At 140°—150° C. the reaction

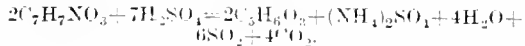
between sodium and indene proceeds without the use of ammonia; if about 2 per cent. of an organic base such as aniline, toluidine, or pyridine be added, the temperature need only be maintained at 100—105° C. for 3 hours. The reaction affords a very convenient method of obtaining pure indene from coal tar (see Ger. Pat. 205,465, this J., 1909, 84).—J. C. C.

Indene in coal tar. A. Spilker and A. Dombrowsky. Ber., 1909, 42, 572—573.

PURE indene prepared from the sodium compound (see preceding abstract) melts at —2° C., boils at 182.2—182.4° C. (corr. 761 mm.); sp. gr. at 15° C./15° C., 1.0002; and $n_D^{20}=1.5773$ at 18.5° C. The dibromide is quite stable and crystallises from petroleum in colourless, stout prisms m. pt. 31.5—32.5° C. It gives a characteristic magenta red coloration with cold, concentrated sulphuric acid, which disappears on dilution with water.—J. C. C.

o-Nitro-p-cresol; Behaviour of — towards sulphuric acid. G. Schultz and O. Löw. Ber., 1909, 42, 577—578.

By treating *o*-nitro-*p*-cresol with fuming sulphuric acid, acetylaerylic acid is formed in accordance with the equation,



—J. C. C.

Polynaphthenic acids. K. Charitschkow. J. Russ. Phys.-Chem. Ges., 1908, 40, 1757—1774. Chem. Zentr., 1909, 1, 851.

By the oxidation of Caucasian petroleum with atmospheric oxygen in presence of caustic soda, the author obtained non-crystallisable polynaphthenic acids, of sp. gr. 1.2, easily soluble in alcohol, benzene, chloroform, ether, and carbon bisulphide, slightly soluble in petroleum spirit. These acids decompose when heated *in vacuo*; they are dark-coloured, owing to the presence of asphaltum, into which they are gradually converted on keeping. They give Legal's ketone reaction (red coloration with sodium nitroprusside). The blue copper salts of the acids, unlike those of naphthenic acids, are only slightly soluble in water and hydrocarbons. The esters of the acids are oily, odourless compounds which can be readily separated from the more volatile esters of naphthenic acids. A polynaphthenic acid prepared from a petroleum fraction boiling at 169—171° C., corresponding to a decanaphthene, had the composition, $\text{C}_{20}\text{H}_{22}\text{O}_4$. On reduction with hydriodic acid in a sealed tube, it yielded a hydrocarbon resembling the heavy oil obtained on the distillation of petroleum. The polynaphthenic acids yield nitro-derivatives similar to those obtained by the action of nitric acid on the higher-boiling petroleum distillates. An acid resembling the polynaphthenic acids was obtained by oxidation of a hydrocarbon prepared from menthol by converting the latter into the corresponding iodide, and heating with phosphorus and iodine. The polynaphthenic acids probably contain two hydroxyl groups in addition to the carboxyl group.—A. S.

Dust-laying oils. Heise. See XVIII.B.

Emulsification. Marshall. See XXIV.

PATENTS.

Extinguishing fires from burning benzine, petroleum, oil of turpentine, and the like. W. E. Evans, London. From W. Graaff und Co., Ges.m.b.H., Berlin. Eng. Pat. 17,156, Aug. 14, 1908.

THE patentee proposes that fires be extinguished by applying to them a solution of bromine or iodine in carbon bisulphide, chloroform, carbon tetrachloride, etc. The vapours of bromine or iodine set free by the heat, being of high specific gravity, settle down as a layer on the burning oil, and by preventing the access of air, extinguish the fire.—W. H. C.

Distillation of bituminous coal or similar carbonaceous substances. T. Parker. Fr. Pat. 395,998, Oct. 9, 1908.

SEE Eng. Pat. 18,418 of 1907; this J., 1908, 1146.—T. F. E.

IV.—COLOURING MATTERS AND DYESTUFFS.

Dyestuffs: Relation between sensitiveness to light and constitution of —. K. Gebhard. Z. angew. Chem., 1909, 22, 433—435.

THE author finds that the sensitiveness of dyestuffs in aqueous solution towards light is favoured by a quinonoid structure, but the presence of certain groups in the molecule has also a great effect. In general, increase in the number of hydroxyl groups increases the sensitiveness to light, as is shown in the case of dyestuffs of the Alizarin class except when a third hydroxyl group enters the second benzene ring, as in Alizarin Blue X and Alizarin SX, when the sensitiveness is reduced. The sodium salts of weak acids are also favourable to attack by light, thus Acid Magenta is more sensitive than Diamond Magenta. Further, the replacement of one of the hydrogen atoms in an amino-group renders a dyestuff more sensitive to light; thus Rhodamine G is more sensitive than Rhodamine B. Hydrogen ions have a detergent effect on the light-sensitiveness, Gallein, as free acid, being more stable than when in the form of a salt. Other agents having a stabilising effect are the amino-group and the SO_4^{2-} , Br^- , and Cl^- ions. Dyestuffs containing groups tending to make them sensitive to light are rendered more stable by the introduction of stabilising groups and *vice versa*. —J. C. C.

PATENTS.

Azo dyestuffs; Manufacture of —. R. B. Ransford, London. From L. Cassella und Co., Frankfurt-on-Maine, Germany. Eng. Pat. 2721, Feb. 6, 1908.

By combining one molecule of diazotised *m*-aminophenyl-5-hydroxy-1-2-naphthimidazole-7-sulphonic acid or its dihydro derivative (hereinafter called "imidazole acids"), with a second molecule of imidazole acid, polyazo dyestuffs are obtained containing a double imidazole group. This group may be formed by combining the molecules in an alkaline solution and the product may then be combined with one molecule of a diazo compound, such as *p*-diazobenzenesulphonic acid. An easily soluble dyestuff of excellent affinity is thus produced, whereas the analogous dyestuff containing only one imidazole group hardly stains cotton. Dyestuffs containing the double group may also be obtained by diazotising the monoazo dyestuffs prepared from the imidazole acids and then combining with a second molecule of imidazole acid. If these disazo dyestuffs are diazotised and developed on the fibre, dyeings fast to washing and to acids are obtained. If they are diazotised in substance and combined with a naphtholsulphonic acid, a series of cotton dyestuffs is obtained, the members of which are soluble, fast to acids, and yield yellowish-red to bluish-red shades. Example: 19.9 kilos. of the sodium salt of sulphaniic acid are diazotised with 36 kilos. of hydrochloric acid of 21° B. and 7 kilos. of sodium nitrite. The diazo compound is introduced into a well-cooled solution of 38 kilos. of *m*-aminophenyl-5-hydroxy-1-2-dihydronaphthimidazole-7-sulphonic acid which has been dissolved together with 40 kilos. of anhydrous sodium carbonate. After two hours the mixture is heated to 70° C. and the dyestuff is then salted out and filtered off. For further diazotisation, the dyestuff is stirred to a paste with water and, after cooling, 48 kilos. of hydrochloric acid of 21° B. and 7 kilos. of sodium nitrite are added. The diazo compound is formed after about 6 hours. It is introduced into a solution of 38 kilos. of *m*-aminophenyl-5-hydroxy-1-2-dihydronaphthimidazole-7-sulphonic acid and 40 kilos. of anhydrous sodium carbonate. After heating for a short time, the dyestuff is salted out, filtered off, and dried. It forms a brown

powder which gives a brilliant red aqueous solution. In concentrated sulphuric acid it dissolves with a bluish-red colour. It dyes cotton scarlet shades, which when developed with β -naphthol yield scarlet red shades. —P. F. C.

Azo colouring matter (dyestuff); Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 28,272, Dec. 28, 1908.

By combining diazotised 2:6-dinitroaniline with β -naphthol, a scarlet dyestuff is obtained which is especially suitable for use in the form of its lakes, since these are fast to water, alcohol, lime, and light, and are insoluble in oil and do not sublime. Example: 18.3 parts of 2:6-dinitroaniline are diazotised in concentrated sulphuric acid by means of nitrosyl sulphate and the solution is run into an aqueous suspension of 15 parts of β -naphthol to which ice has been added. The combination may also be carried out in the presence of sodium carbonate, lime, acetate, or a substratum, or Turkey red oil or soap may be added. —J. C. C.

6-Nitro-3-chloro-1-aminobenzene-4-sulphonic acid or 6-nitro-3-chloro-1-aminobenzene; Process for preparing —. Badische Anilin und Soda Fabrik. Ger. Pat. 206,345, March 7, 1908.

By the sulphonation of 3-chloro-1-acetaminobenzene, the 4-sulphonic acid is obtained; this is nitrated, and the resulting mass is diluted with four or five times its weight of water and heated to 70°—80° C., when the acetyl group is readily removed; an alkali salt of 6-nitro-3-chloro-1-aminobenzene-4-sulphonic acid can then be precipitated by addition of an alkali chloride; if the quantity of water used be such that there are 20—30 parts to each 100 parts of sulphuric acid present, and the heating is carried to 100 C. for several hours, the sulpho-group as well as the acetyl group is eliminated, and 6-nitro-3-chloro-1-aminobenzene results. —T. F. E.

Azo-dyestuff. A. Bergdolt, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 912,356, Feb. 16, 1909.

By combining diazotised 1:8-aminonaphthol with 1:8-dihydroxynaphthalene-4-sulphonic acid, a dark blue azo-dyestuff is produced. This dyes wool from an acid bath in violet shades which are changed to violet-black after chroming. —J. C. C.

Indigo; Production of halogen derivatives of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 394,861, Sept. 16, 1908. Under Int. Conv., Oct. 4, 1907, Jan. 24, Feb. 29, and Mar. 7, 1908.

SEE Eng. Pat. 4423 of 1908; this J., 1909, 18. In addition to the details given in the Eng. Pat., the bromination of dichloroindigo with the formation of dichlorodibromoindigo is described; this gives redder shades than tetrabromoindigo. Further it is shown that dibromoindigo can be obtained by adding 30 parts of sodium bromide to a mixture of 10 parts of Indigo and 300 parts of concentrated sulphuric acid. —J. C. C.

Alizarin; Manufacture of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 395,137, Oct. 10, 1908. Under Int. Conv., Feb. 22, 1908.

ALIZARIN is prepared in good yield and of a high degree of purity by heating anthraquinone with highly concentrated alkali lye (80 per cent.); although by former methods where alkali lyes of up to 50 per cent. strength were used and the presence of an oxidising agent was necessary to ensure a good yield, in the present process the addition of a reducing agent actually increases the yield. Example: A mixture of 1200 kilos. of alkali lye (mixture of caustic soda and potash) of 80 per cent. strength, 100 kilos. of sodium sulphite, and 200 kilos. of anthraquinone is heated to 200° C. until the quantity of alizarin does not increase.

The mass is then poured into water, filtered, and the filtrate acidified. The alizarin may also be precipitated by forming its calcium salt and decomposing this with acid. In a second example 200 kilos. of anthraquinone are heated with 800 kilos. of the same alkali without the addition of sodium sulphite.—J. C. C.

Sulphide dyestuffs and their manufacture; New —. Act.-Ges. f. Anilinfabr. Fr. Pat. 394,832, Oct. 2, 1908.

By heating *o*-, *m*-, or *p*-toluidine or thio-*p*-toluidine or the acetyl or formyl derivatives of the former bases with phenylenediamine or *p*-nitroaniline and sulphur, sulphide dyestuffs are produced which dye cotton direct from a sulphide bath in fast yellowish olive to olive shades. Example: A mixture of 107 parts of *p*-toluidine, 162 parts of *p*-phenylenediamine, and 167 parts of sulphur is heated in a reflux apparatus to 220°–240° C. for 8 hours. The mass is dissolved in a mixture of 2460 parts of crystallised sodium sulphide and 1230 parts of water and the dyestuff is precipitated by means of a current of air or by acidifying. In a second example a mixture of 214 parts of *o*-toluidine, 420 parts of *p*-nitroaniline, and 1780 parts of sulphur is treated in a similar manner.—J. C. C.

Gallocyanines with amines; Process for preparing condensation products of —. Farbwerke vorm. L. Durand, Huguenin, und Co. Ger. Pat. 206,465, Feb. 29, 1908. Addition to Ger. Pat. 192,529, Nov. 20, 1906.

ACCORDING to the main patent, the condensation of gallocyanines with amines was carried out in presence of aromatic nitro-hydrocarbons. According to the present patent, the condensation is effected in presence of a brisk current of oxygen; substances which assist the action of the oxygen, such as manganese, iron, or vanadium compounds, may also be employed to facilitate the process.

—T. F. B.

Indigo compounds; Manufacture of [halogenated] —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5582, March 12, 1908. Addition to Eng. Pat. 4423, Feb. 27, 1908.

SEE Fr. Pat. 394,861 of 1908; preceding.—T. F. B.

Colouring matters of the anthracene series; Manufacture of —. Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7418, April 3, 1908. Addition to Eng. Pat. 10,324, May 2, 1906.

SEE Second Addition to Fr. Pat. 365,920 of 1906; this J., 1908, 1015.—T. F. B.

Compounds and colouring matters of the anthracene series; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 10,412, May 13, 1908. Addition to Eng. Pat. 14,578, July 14, 1905.

SEE Addition of May 11, 1908, to Fr. Pat. 357,239 of 1905; this J., 1908, 1055.—T. F. B.

Monoazo dyestuff especially suitable for employment as a blue-red pigment colour; Preparation of a —. K. Merz, Frankfurt, Germany. Eng. Pat. 16,372, Aug. 1, 1908. Under Int. Conv., Aug. 3, 1907.

SEE Fr. Pat. 392,914 of 1908; this J., 1909, 18.—T. F. B.

Monoazo dyestuff for lakes and its industrial applications. R. Lauch. Fr. Pat. 394,754, Sept. 28, 1908.

SEE Eng. Pat. 18,738 of 1908; this J., 1908, 1107.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Artificial silk; Weighting — and making it insoluble. A. Dubose. Soc. Ind. de Ronen, 1909, Sealed document No. 530.

TANNIN is added to the solvent used in making Chardonnetsilk. Thus the spun fibre contains tannin, and a

reducing substance is employed for the purpose of denitration, instead of ammonium sulphide, the base of this reducing substance uniting with the tannin to form an insoluble compound. Before denitrating, it is recommended that the fibre be passed through Turkey red oil. Substances which are recommended as reducers, are sulphides of magnesium, aluminium, antimony, tin, and silicon; magnesium, calcium, or aluminium hydro-sulphites or stannites, and tin chloride.

Silk fabrics; Analysis of natural and artificial —. Coppetti. Ann. Chim. analyt., 1909, 14, 47–51.

THE usual tests for distinguishing between natural and artificial silks frequently fail when the fabrics are weighted and dyed, and there are very few methods available for stripping the loading and dyestuff from the silk without destroying the fibre. The author has found that hydrofluoric acid is an excellent stripping agent, which readily removes the most refractory of the mineral loadings commonly employed. The fabric is steeped in hydrofluoric acid of the ordinary commercial strength for 5–10 minutes; it is then washed and heated in a solution of soap to the boiling point. It is washed again and placed in a 5 per cent. solution of hydrochloric acid with which it is boiled. Next it is bleached in a solution of sodium hypochlorite, again acidified, then washed and dried. An alternative method of bleaching, according to the nature and intensity of the dyestuff, consists in treating the fabric with a permanganate solution, followed by sulphurous acid. In this way the fibres are obtained practically free from mineral weighting and colouring matters, and the usual tests for the nature of the silk can be applied. When the fibres are sufficiently colourless, nitric acid is the best reagent for distinguishing between the silks of animal and those of vegetable origin; but if the residual colour is such as to mask the yellow stain produced by nitric acid, the fibres should be gently warmed on a glass slide with a 20 per cent. solution of potassium hydroxide, which dissolves the natural silks and the artificial silks which are composed of gelatin.—J. F. B.

Chlorinised wool. H. P. Pearson. J. Soc. Dyers and Col., 1909, 25, 81–83.

WOOL is chlorinised for use in the manufacture of underwear goods as follows:—Bleaching powder is dissolved in water to a solution containing 4 to 5 per cent. of available chlorine, and sodium carbonate solution is added in slight excess, the mixture being stirred, allowed to settle, and the clear liquor decanted. 100 galls. of bleaching powder solution containing 4.2 per cent. of available chlorine require 1 cwt. of 97 per cent. sodium carbonate. The resulting solution contains about 4 per cent. of available chlorine and has a sp. gr. of 1.09. The excess of alkali makes the subsequent liberation of chlorine more gradual. Solutions containing more than 4.5 per cent. of available chlorine are liable to form chlorate, which has a strong yellowing action on wool. From $\frac{1}{2}$ to 1 pint of the above-mentioned hypochlorite solution is required for each pound of wool, and a better handle is produced by adding this in two or three lots, acidifying after each addition, and running off after five or six minutes' treatment in each lot of acidified liquor. Hydrochloric acid is run in gradually to the extent of two-thirds of the volume of the hypochlorite solution for the first "end" and one-half for the second and third. The goods are well rinsed, and the colour is then restored by a bath containing 1 gallon of sodium bisulphite per 100 lb. of wool, a pint of strong sulphuric acid, previously diluted with water, being gradually run in. A bath of stannous chloride and hydrochloric acid may be used instead of the bisulphite bath. After rinsing again, the goods are scoured with soap and a very little sodium carbonate to restore the handle. It is essential that the acids should be run in very slowly; the goods must be kept moving, and occasionally squeezed, and the machine should be well covered in. Dry chlorine has no action on dry wool, and "moderately chlorinised" wool contains no chlorine, so that the expression is really a misnomer. The edges of the scales of the fibres are smoothed down by chlorinising, and the wool loses its felting property, and is therefore

almost universally employed in this condition for "guaranteed unshrinkable" goods. Chlorinised wool has much more affinity for direct dyestuffs than untreated wool, and it is possible to obtain colour effects by weaving the two together and then dyeing. For printing deep shades of black, and of some other colours, on woollen fabrics, it is necessary to first chlorinise the wool, though a lesser degree of chlorinising is employed for this purpose than for wool to be used for underwear. If a single drop of water is placed on chlorinised wool, it is fairly quickly absorbed, and the wet portion has a circular contour, whilst ordinary wool absorbs the drop very slowly and the contour of the wetted portion is irregular. Also wetted chlorinised wool has a characteristic seroop on rubbing. Comparative dyeing tests may also be used, or the fact that chlorinised and unchlorinised wool, when rubbed together, produce an electric charge sufficient to violently deflect the leaves of an electroscope. This phenomenon is not produced by two pieces of unchlorinised wool even though of different kinds. Garments of chlorinised wool wear badly.—E. F.

Adsorption (dyeing) and agglutination (felting) of the wool fibre. E. Justin-Mueller. Z. Chem. Ind. Kolloide, 1909, 4, 64—70.

THE author shows experimentally that the felting of wool is due to the swelling of the fibre, under the action of the bath, to form something very like a colloidal gel, and not to entanglement of the fibres by means of their scales, as generally supposed. This was shown by heating wool fibres with liquids whilst the fibre was rigidly fixed in the bath; scarcely any felting took place with distilled water at 100° C. in one hour; with water containing much lime, distinct felting was observed under the same conditions, whilst sulphuric acid also caused felting. The addition of a small amount of sulphuric acid diminishes the felting caused by lime in water, but it is again increased by addition of a further quantity. This felting of the fibre is not absolutely essential to dyeing. The behaviour of wool towards dyestuffs is shown to be quite different from that of wood- or bone-charcoal. Adsorption by the two latter is independent of the temperature, and of additions to the bath, whilst the wool-fibre only adsorbs the dyestuff at a temperature near the boiling point of the bath, and often only in presence of certain additions to it. Direct dyeing depends on the solubility coefficient of the dyestuff in the bath on the one hand, and on the adsorption-coefficient of the fibre under certain conditions on the other, and is a reversible phenomenon; if the former factor predominates, no dyeing takes place. The sulphuric acid used when dyeing with acid dyestuffs acts, according to the author, by lowering the solubility of the dyestuff in the bath; dyestuffs which are only slightly soluble in water do not require the addition of sulphuric acid. Basic dyestuffs, on the other hand, are more soluble in acid than in alkaline media, and therefore only dye very weakly from an acid bath. The high temperature which is necessary causes the fibre to swell, in which condition its adsorption-coefficient is sufficiently increased to overcome the solubility-coefficient of the bath.—E. F.

Paranitraniline Red; Formation of —. M. Prudhomme and A. Colin. Rev. Gen. Mat. Col., 1909, 13, 66—68.

HAVING previously shown (see this J., 1909, 87) that the best red is produced with a developing bath which contains free acetic acid and an excess of sodium acetate, the authors have now studied the effect of variations in the duration of the immersion, and in the concentration of this bath. They find that the intensity of the red produced is proportional to the concentration of the developing bath and to the duration of the immersion. The result is different when the bath contains a highly ionised acid (free hydrochloric acid for instance), for then the red does not develop until the pattern is placed in water and the shade (which is yellowish-red), is the more intense—or better, the less attenuated—the shorter the time of immersion. Given a prolonged immersion, the shade obtained is an orange-brown and the bath itself becomes coloured brown. The presence of the free acid retards the development of the colour and causes

the reaction to take quite a different course; β -naphthol is liberated and, being to some extent soluble in dilute acid, is dissolved and reacts in the bath with the diazo compound. The product, however, is different to that produced under normal conditions and can be isolated as an orange-brown powder. The conclusions arrived at are, that a good red is produced upon material which has been ground with either sodium naphtholate or free naphthol, by developing with a solution of a free diazo compound or its neutral salt. The presence of a highly ionised acid not only retards the development, by lowering the degree of ionisation of the diazo-compound, but brings about variations in the mode of combination and thus produces colours other than the red desired. Acetic acid, in equivalent proportions, does not affect the degree of ionisation of the diazo-acetate and acts but little upon the sodium naphtholate. The presence of sodium acetate hinders the diffusion of sodium naphtholate into the bath, diminishes the degree of solubility of naphthol in the acetic acid, and lowers the degree of ionisation of the acetic acid. These conditions are those which are most suitable to the production of a good red. The degree of blueness of the shade depends upon the amount of insoluble azo-colour deposited upon the fibre. The development of the colour should not occupy more than about 30 seconds, as longer contact with the diazo solution appears to injuriously affect the shade of red.—F. M.

Fastness of colours to light; Use of potassium ferriocyanide in determining the —. E. Bechtel. Rev. Gen. Mat. Col., 1909, 13, 73.

POTASSIUM ferriocyanide and ferriocyanide when in solution, are both decomposed by solar light, and the amount of decomposition varies with the concentration of the solution, the intensity of the light, and the duration of the exposure. In the absence of light the salts are quite stable. The decomposition is most rapid with the ferriocyanide and takes place according to the equation, $\text{Fe}_3(\text{CN})_{12}\text{K}_6 + 6\text{H}_2\text{O} = 6\text{KCN} + 6\text{HCN} + \text{Fe}_3(\text{OH})_6$; the concentration of the solution diminishes in arithmetical progression and the quantity of ferric hydroxide precipitated increases at the same rate. Using a solution containing say 50 grms. per litre, and placing this in hermetically sealed vessels so that no other influence but light can affect it, the amount of ferric hydroxide deposited will be a measure of the intensity of the light to which the solution was exposed. The dyestuff to be tested is dyed upon suitable material and the shade is exposed side by side with a solution of ferriocyanide, until it has faded to a definite extent, ascertained by comparison with a standard tint. The ferric hydroxide which has been precipitated from the ferriocyanide solution is then estimated and serves as a guide to the degree of fastness of the shade.—F. M.

Locust bean; The — and some of its practical applications. M. C. Lamb and F. J. Farrell. J. Soc. Dyers and Col., 1909, 25, 77—81.

THE seeds of the locust bean are removed from the pod, freed from the husks and germ, and then from the inner husk by grinding and "perlina." The two cotyledons remain, as small white discs. The gum is extracted from these by digesting with water under steam pressure for 48 hours. The gummy mass so obtained is strained through silk bags in a press, an antiseptic is added, and after setting, the product is sold as "gum tragacanth." After drying it contains:—Carbon, 43.51; hydrogen, 6.23; oxygen, 48.38; nitrogen, 0.39; and ash, 1.49 per cent. It absorbs a large quantity of water, but is soluble only to a very limited extent. The easiest way to prepare a "solution" is to stir well with hot water until the water is almost completely absorbed, heat gently, and add more water with stirring at 80° C. Gum tragacanth apparently enters into intimate combination with starches and fatty matters, and is a valuable sizing material. When a strong solution is allowed to set in a flat tray, a strong, almost transparent film is produced, which is very pliable and of great tensile strength; such films contain 60.5 per cent. of moisture. Gum tragacanth is also useful in the leather, laundry, and paper industries. Table linen may be sized with tragacanth, and can then be

passed through a multiple roll calender without any tendency to stick to the rollers. The great elasticity of a tragasol film renders the gum useful for dressing both the grain and the flesh sides of leathers, and when dyed leathers are treated in this way, the colours are rendered much faster to rubbing. It is more expensive than Irish moss and other mucilages used in leather dressing, but according to the authors, gives superior results. It is also more expensive than starch.—F. F.

Spontaneous combustion of wool waste. Nowicki. See XII.

Partial hydrolysis of proteins. Abderhalden. See XVIII.1.

PATENTS.

Weighting silk; Process of —. Wegmann et Cie. Fr. Pat. 394,696, Sept. 24, 1908.

THE silk is wound around hollow perforated bobbins, which are surrounded by perforated drums. This part of the apparatus is arranged within a circulating system through which the weighting solution, the washing liquor, etc., can be made to flow in the manner described in Fr. Pat. 335,596 of 1903 (this J., 1904, 251). The necessary liquor is forced into the interior of the bobbin, through its perforations, into the silk and through the perforations in the wall of the surrounding drum. If necessary, the drum can be replaced by a wrapper of cloth or other permeable material. The silk can also be dried in the hydro-extractor without unwinding it from the bobbins. —P. F. C.

Weighting process for muslins and other light fabrics. P. F. M. A. Durand. Fr. Pat. 395,188, Oct. 14, 1908.

THE fabric is immersed in a solution containing salts of aluminium and barium and afterwards in a second bath containing sodium sulphate, phosphate, or carbonate. The barium salt may be replaced by a soluble lead salt.—P. F. C.

Dyeing, washing, bleaching, etc., of textile materials; Apparatus for the —. H. Windrath. Ger. Pat. 206,401, Dec. 28, 1907.

THE patent relates to apparatus of the type in which the textile material is disposed in horizontal layers between perforated partitions, the dye-liquor, etc., being circulated through the layers, alternately in opposite directions, by means of a pump. According to the present specification the chamber in which the treatment is effected is divided by the horizontal perforated partitions into alternate material-compartments and liquor-compartments. The odd-numbered liquor compartments are connected to the suction-pipe and the even-numbered ones to the delivery pipe of a circulating pump, so that the liquid is forced through each of the compartments containing the textile material under identical conditions with respect to temperature, concentration, and pressure. Means are provided for reversing the direction of flow of the liquor. —A. S.

Vegetable fabrics; Process for stiffening and making impermeable —. L. S. Marix. Fr. Pat. 394,657, Aug. 28, 1908.

THE material is ironed or calendered, then immersed in a solution of celluloid, and finally dried in order to evaporate the solvent.—P. F. C.

Viscose; Process of applying and treating strands with —, and the article. L. M. Churier, Assignor to Soc. Franç. de la Viscose, Paris. U.S. Pat. 912,812, Feb. 16, 1909.

SEE Fr. Pat. 335,598 of 1903; this J., 1904, 251.—T. F. B.

Artificial threads obtained from solutions of cellulose or similar materials in an ammoniacal solution of a metallic salt or oxide; Treatment of —. P. Follet and G. Ditzler. Fr. Pat. 395,223, Oct. 13, 1908. Under Int. Conv., Oct. 15, 1907.

SEE Eng. Pat. 21,285 of 1908; this J., 1909, 87.—T. F. B.

Cloth; Apparatus for treating [dyeing, etc.] —. H. L. Gantt, Pawtucket, U.S.A. Eng. Pat. 774, Jan. 13, 1908. Under Int. Conv., May 6, 1907.

SEE Fr. Pat. 388,819 of 1908; this J., 1908, 978.—T. F. B.

Paranitraniline Red, etc.; Process of obtaining —. E. A. Fourniaux, Manchester, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pats. 913,633 and 913,634, Feb. 23, 1909.

SEE Eng. Pats. 764 and 765 of 1907; this J., 1908, 157, 158.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Hypophosphorous acid; Catalytic oxidation of — by copper. J. Bougault. Compt. rend., 1909, 148, 415—417.

WHEN solutions of 8 grms. of copper sulphate and 2 grms. of sodium hypophosphite are mixed, a brownish-yellow precipitate falls which is converted on boiling into crystalline metallic copper. If the hypophosphite be in large excess (10 grms. to 2 grms. of copper sulphate), a brown precipitate is formed, no doubt Würtz's "copper hydride," which when heated evolves hydrogen and clots together on the surface of the liquid. This clot is without action on boiling water, but boiled in solution of sodium hypophosphite, evolves hydrogen and oxidises the hypophosphite to phosphite and phosphate. The action ceases before the whole of the hypophosphite is oxidised, but on decanting the solution and adding a fresh solution of hypophosphite, it begins again. In this way a considerable quantity of hydrogen can be obtained by means of a small amount of copper (1 atom of copper to about 30 molecules of hydrogen). Copper reduced by zinc also produces this effect, but much more feebly. Probably the fundamental reaction is the catalytic decomposition of water, the hydrogen of which escapes whilst the oxygen oxidises the hypophosphite.—J. T. D.

Bleaching powder; A crystalline —. K. J. P. Orton and W. J. Jones. Chem. Soc. Proc., 1909, 26, 74.

A BASIC hydrated compound of calcium chloride and calcium hypochlorite, which separates on cooling moderately concentrated (about 2N) solutions of bleaching powder, was described. This substance has been obtained in large, prismatic crystals, the properties of which closely resemble those of bleaching powder. On the other hand, from very highly concentrated solutions of bleaching powder (about 4N), a hydrated calcium hypochlorite separates at low temperatures.

Nitrites; The action of carbon dioxide on —. E. R. Marle. Chem. Soc. Proc., 1909, 26, 74.

THE contradiction in the results obtained by Marie and Marquis (this J., 1904, 252 and 369) and Meunier (this J., 1904, 321 and 56; see also Papasogli, Gaz. chim. ital. 1881, 11, 277; Moody, this J., 1903, 1352) in investigating the action of carbon dioxide on nitrites seems to be partly due to the unsuitability of potassium iodide and starch as a test for traces of nitrites unless special precautions be taken. Warrington (Chem. News, 1885, 51, 39) finds that one of the most delicate tests for nitrous acid is the coloration produced with α -naphthylamine (Griess).

Carbon dioxide prepared from marble and hydrochloric acid, was washed by passing through water in two Drechsel bottles, and was then passed through 10 per cent. aqueous potassium nitrite in a Cloez washing bottle, the construction of which is such that it is unlikely that liquid will be mechanically carried over by the stream of gas. It was then passed into water or potassium carbonate for periods varying from one to six hours. In every case the coloration with potassium iodide and starch seemed slightly greater than that produced by the reagents alone. With

α -naphthylamine, a faint pink coloration resulted after a few minutes. To guard against the possibility of mistaking nitrite, mechanically carried over, for nitrous acid, a dry Arnold absorption apparatus was inserted between the Cloez bottle and the final flask. A slight mist appeared on the inside of the absorption bulbs, which, when washed out with water, proved faintly acid to litmus, and with α -naphthylamine gave a full red colour, appearing in about three minutes. The water in the final flask was neutral (after boiling), and gave with α -naphthylamine a faint coloration, appearing in about fifteen minutes. From the data in Warrington's paper, the quantity of nitrogen (as nitrous acid) removed by one litre of carbon dioxide is probably less than one two-hundredth of a milligram. The reduction of very dilute potassium permanganate by the solution in the final flask leads to a similar figure.

Ammonium nitrite: Decomposition and sublimation of —.
P. C. RAY. Chem. Soc. Proc., 1909, 25, 56.

WHEN an aqueous solution of ammonium nitrite is heated in a vacuum at about 37 – 40°C ., only a very small portion of the salt decomposes according to the equation: $\text{NH}_4\text{NO}_2 = 2\text{H}_2\text{O} + \text{N}_2$; the main bulk of the salt crystallises out. If the temperature is then gradually raised to 70°C ., slow decomposition continually proceeds according to the above equation, but the major portion of the salt sublimes unchanged. When this sublimate is heated by means of a naked flame, the gaseous products are nitrogen and nitric oxide, the latter often amounting to as much as 6 per cent.

Ferrous sulphate solutions: Resistance of — to atmospheric oxidation. T. Warynski. Ann. Chim. analyt., 1909, 14, 45–47.

SOLUTIONS of pure ferrous sulphate, acidified with sulphuric acid, are by no means so readily oxidised on exposure to the air as was previously supposed. Dilute solutions ($N/50$) of acidulated pure ferrous sulphate were placed in large bottles, the stoppers of which were removed once a day, to renew the supply of oxygen in contact with the liquid. The solutions were standardised from time to time, and it was ascertained that after 4 months' exposure only about 1.0–1.4 per cent. of the original iron had been oxidised from the ferrous to the ferric state. At high temperatures (80° – 96°C .) the solutions were found to be equally resistant. The presence of sulphuric acid has a retarding action on the oxidation. The solutions mentioned above contained 0.45 gm.-mol. of sulphuric acid per litre; other solutions, containing similar quantities of iron with 0.5 gm.-mol. of sulphuric acid, showed, after 120 days, an oxidation of 0.5–1.0 per cent. of the iron salt present, whilst solutions containing 2 gm.-mols. of acid showed an oxidation of only 0.1–0.2 per cent. On the other hand, minute quantities of certain impurities are capable of accelerating the oxidation of the ferrous salt. When piano wire was dissolved in such proportions that the solution contained 0.27 gm.-mol. of ferrous sulphate and 1.42 gm.-mol. of sulphuric acid per litre, the oxidation at the end of 100 days amounted to 8.86 per cent. Cupric chloride induces a very rapid oxidation of the ferrous salt; with a concentration of 0.001 gm.-mol. of cupric chloride per litre, the oxidation after 120 days amounted to 41.8 per cent. Platinum chloride and palladium nitrate are still more active catalysts than cupric chloride. Hydrochloric acid at a concentration of $N/1$ – $N/2$ also intensifies the oxidation to a moderate extent. On the other hand, certain other salts, e.g. zinc sulphate, silver nitrate, nickel chloride, chromium sulphate, vanadium sulphate, and uranium acetate were found to be without effect.—J. F. B.

Nickel sulphide: Separation of — from aqueous solution. A. Thiel and H. Ohl. Z. anorg. Chem., 1909, 61, 396–412.

It has been observed (this J., 1908, 473) that ammonium sulphide fails as a delicate test for nickel in the presence of much ammonia. This is due to a delay in the separation

of the nickel sulphide which after a while becomes apparent as a brown solution. The speed of the reaction is found to increase with the concentration of the nickel salt or of the alkaline sulphide and also with rise of temperature, but it diminishes with an increase in the ammonia concentration. The authors reject the view that the phenomena are due to the formation of complexes in the ammoniacal solution, for the separation of nickel sulphide is also hindered, though not prevented, by the presence of acids, and in the presence of acetic acid a brown colour often develops, as in alkaline solution; moreover, other reagents behave normally with nickel salts in ammoniacal solution. They put forward the following explanation:—in ammoniacal solution the complex ion, $\text{Ni}(\text{NH}_3)_6^{++}$, is in equilibrium with nickel ions, Ni^{++} , and ammonia; the concentration of the nickel ions is therefore increased by a rise in the total nickel concentration and diminished by an increase in the ammonia concentration. On adding a sulphide, a primary (labile) equilibrium is established according to the equation, $\text{Ni}^{++} + \text{S}^{--} \rightleftharpoons \text{NiS}$, the concentration of the nickel sulphide molecules rising with that of the nickel ions or sulphur ions. This comparatively soluble nickel sulphide then polymerises to a less soluble form and separates as a colloid (brown liquid) or precipitate. In acid solution the concentration of the nickel ions depends merely on that of the nickel salt, and that of the sulphur ions falls with an increase of acidity which therefore hinders the separation of the sulphide. The rate of polymerisation is increased by rise of temperature.—F. SOEX.

Bismuth hydroxide and its behaviour towards alkalis.
L. Moser. Z. anorg. Chem., 1909, 61, 379–386.

BISMUTH hydroxide is obtained, free from basic salts, by adding a solution of a bismuth salt, containing glycerin, to caustic alkali solution, and then sufficient acetic or dilute nitric acid to leave the solution only faintly alkaline. The orthohydroxide, $\text{Bi}(\text{OH})_3$, is probably first precipitated, but this loses water very readily. In the presence of alkalis the orthohydroxide changes finally to the metahydroxide, $\text{BiO}\cdot\text{OH}$, which is fairly stable in air free from carbon dioxide; this changes in colour on exposure to light, from yellowish-white to grey, another modification of the metahydroxide being apparently formed. Bismuth hydroxide is practically insoluble in cold dilute alkalis (up to $N/1$), but is distinctly soluble in strong solutions. At 100°C the solubility in strong alkalis is quite considerable, and even in dilute solutions ($3N$ to $N/2$) it is not negligible.—F. SOEX.

Bismuth halides: Hydrolysis of —. W. Horz and A. Bulla. Z. anorg. Chem., 1909, 61, 387–395.

THE hydrolysis of bismuth chloride and bromide at 25°C . is found, under all conditions of experiment, to give only the oxy salts, BiOCl and BiOBr , the reactions strictly following the law of mass action. Bismuth fluoride is perfectly stable even in boiling water, undergoing no hydrolysis.—F. SOEX.

Solutions of colloidal sulphur and crystalloids: Experimental studies on a new system of equilibrium:—. T. Svedberg. Z. Chem. Ind. Kolloide, 1909, 4, 49–54.

SOLUTIONS of colloidal sulphur were prepared by a modification of Rafo's method, by dropping a strong solution of sodium thiosulphate into cold concentrated sulphuric acid. The liquid was diluted, filtered, precipitated with sodium chloride, and the colloidal sulphur repeatedly centrifuged and redissolved in water, until free from sulphate. The solution of colloidal sulphur so obtained shows in the ultramicroscope a cone of light, which is apparently homogeneous. The colloidal solution obtained as above always contains sodium chloride; in experiments with other electrolytes it was therefore freed from this by repeatedly precipitating with the electrolyte under examination and redissolving in water. It was found that for any particular concentration of electrolyte, a state of equilibrium was quickly reached, depending on the temperature, and that the amount of dissolved colloidal

sulphur increased with the temperature according to the exponential equation: $c = e^{kt}$ where c is the percentage of sulphur in solution, t the temperature, and k a constant which is a function of the molecular concentration of the electrolyte, and independent of the nature of the anion.

—E. F.

Causticising soda ash [from cellulose digestion]. Schacht. See XIX.

Colour reaction of ferrous salts. Richard and Bidot. See XXIII.

PATENTS.

Sulphur-burner; Agitating —. J. C. Wise, Watertown, N.Y. Re-issue No. 12,921, Feb. 16, 1909, of U.S. Pat. 835,926, Nov. 13, 1906.

THE burner consists of a stationery furnace surmounted by a secondary combustion chamber and partially encircled by a concentric receptacle or hopper in which the sulphur is melted by heat from the furnace. The molten sulphur passes into the furnace through feed-holes controlled by valves, and during its combustion it is stirred by a revolving stirrer, the shaft of which passes through the bottom of the furnace and is connected with mechanism below; residual impurities from the sulphur are forced by the agitator into a special aperture, normally closed by a plate, and may be removed as desired. Air is supplied radially towards the centre of the furnace through a number of adjustable inlets above the level of the material, so that the surface is uniformly supplied with air. The gases pass out from the furnace into the secondary combustion chamber above, in which is a transverse baffle-plate which becomes heated and so raises the temperature of the incoming gases preparatory to combustion, means being also provided for regulating the flow of the gases in a divided circuitous path around the baffle-plate and for admitting air through a number of adjustable inlets immediately above and below it. The capacity of the exhaust in the combustion chamber is also capable of adjustment.—F. SODN.

Sulphur dioxide; Process of making —. C. W. Lyman, New York. U.S. Pat. 911,735, Feb. 9, 1909.

MOLTEN sulphur is delivered in "a small stream" into a closed chamber where it is at once atomised by a jet of hot compressed air impinging on it. Additional heated air is introduced so as to maintain the proper proportion of oxygen in the chamber and secure continuous combustion of the sulphur to sulphur dioxide.—F. SODN.

Sulphuric acid; Process for the rapid preparation of — without employing a lead chamber. Erste Oesterr. Sodafabrik and C. Opl. Fr. Pat. 394,739, Sept. 28, 1908.

THE process is for the rapid production of sulphuric acid, without the use of lead chambers, by sending the gases containing sulphur dioxide through absorption vessels or towers in which they are oxidised by nitrated acid, the nitric oxide formed being reoxidised to nitrous acid and absorbed by sulphuric acid again. A series of 4–6 towers working systematically is preferably employed, a part of the gases circulating through the towers and part being compressed and utilised in elevating and pulverising the nitrated acid, so as to obtain intimate contact and rapid oxidation of the sulphurous acid; or, the apparatus for elevating and pulverising the acid may be actuated partly by the compressed gases and partly by air, and a concentrating tower, giving acid of 66° B., may be added to the system in order to utilise the heat generated in the process.—F. SODN.

Automatic draught regulator for use in sulphuric acid chambers. J. Gantier. Fr. Pat. 395,221, Dec. 21, 1907.

THE patent is for an automatic regulator of the draught at the exit of sulphuric acid chambers. It consists of a damper worked by water pressure, the supply of water for

this purpose being controlled by electro-magnets, the electric circuits for which are made or broken by a float moving in sympathy with the changes of pressure in the exit shaft. The pressure may be maintained constant within 0.1 mm. of water column.—F. SODN.

Hydrated sodium carbonate; Manufacture of —. W. F. Ridenour, Philadelphia, Pa. U.S. Pat. 912,622, Feb. 16, 1909.

HYDRATED sodium carbonate is made by mixing together sodium carbonate and water in such proportions that there is insufficient water to effect the crystallisation of the product; the mixture is stirred until cool. As an example, 500 lb. of soda ash would require 120–200 lb. of water.

—F. SODN.

Ammonia; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 2525 of 1909; date of application, Feb. 3, 1908.

AMMONIA is obtained by heating titanium nitride, or cyanonitride, with an acid (sulphuric or hydrochloric acid) or with the aqueous solution of a salt (aluminium chloride) from which acid is liberated, air being excluded and temperatures of 150°–200° C. being employed. (See Eng. Pat. 2414 of 1908, and Fr. Pat. 387,002; this J., 1908, 809.)—A. G. L.

Borax; Process of making —. G. E. Bailey, Assignor to A. Stevenson, Los Angeles, Cal. U.S. Pat. 911,695, Feb. 9, 1909.

NATIVE borates of calcium or magnesium, or other ores containing the borate of a metal capable of forming an insoluble sulphate, are roasted with sodium sulphate and the product leached with water. By cooling the liquor nearly to 0° C. borax is precipitated in a finely divided state.—F. SODN.

Cyanide briquettes; Process of making —. J. Bueh, Dessau, Germany, Assignor to The Roessler and Hasslacher Chem. Co., New York. U.S. Pat. 912,538, Feb. 16, 1909.

CYANIDE crystals are formed into briquettes which are then heated in a vacuum at about 70° C. so as to evaporate the water contained in them, without decomposing the cyanide.—F. SODN.

Hydrosulphites [hyposulphites] free from water and perfectly stable; Production of —. Badische Anilin und Soda Fabrik. Second Addition, dated Sept. 28, 1908 (under Int. Conv., Nov. 5, 1907), to Fr. Pat. 354,273 of May 13, 1905. (See this J., 1905, 673; 1907, 1091.)

ACCORDING to the present addition, the hydrated hydrosulphite, freed as far as possible from mother liquor, or the solution of a hydrosulphite, is dehydrated by evaporating to dryness, preferably under diminished pressure, in a current of ammonia gas, in which the hydrosulphite is stable.—F. SODN.

Phosphated salt [table salt]; Process of manufacturing —. G. Calvé. Fr. Pat. 394,678, Sept. 15, 1908. Under Int. Conv., May 7, 1908.

THE patent is for the process of making the phosphated salt known as "Gemme extra Calvé." Highly purified salt is finely ground and then very intimately mixed with pure, white calcium phosphate. The product does not agglomerate and is not hygroscopic; it is packed in tins lined with paper.—F. SODN.

Crystallised alumina; Process of making — from bauxite. A. Simon. Fr. Pat. 394,805, Sept. 30, 1908.

CRYSTALLISED alumina, equal in hardness to corundum, is obtained from bauxite by eliminating the silica with

hydrofluoric acid and the iron with chlorine or a chloride at a high temperature. For example, the crushed bauxite may be mixed with 10–20 per cent. of sodium chloride and heated to 1200–1400° C., hydrofluoric acid being led into the fused mass, or the mineral may be first treated with hydrofluoric acid in the cold. The heating is continued for 4–6 hours, until crystallisation is effected. It is necessary to employ only the calculated quantities of the reagents, or loss of aluminium may occur.—F. SOHN.

Hydrated alumina: Process of calcining —. A. Vergé. Fr. Pat. 395,142, Dec. 18, 1907.

The calcination of hydrated alumina is carried out in thin-walled vertical cylinders of refractory material, which are heated externally as in the firing of porcelain. The cylinders pass through the top and bottom of the heating chambers and are charged from above, before heating commences, and discharged, after calcination, by opening a valve at the lower end, when the material falls into a channel or conveyor situated beneath; a series of heating chambers is preferably employed. The advantages claimed for the process are: (1), there is no loss of material; (2), the wear and tear is much reduced; (3), the heat is fully utilised; (4), there is very little handling of the material. The purity of the product is equal to that attained by other processes.—F. SOHN.

Sulphur: Process of recovering — from sulphur-bearing gases. P. S. Smith, Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pats. 912,743 and 912,744, Feb. 16, 1909.

The gases containing sulphur dioxide are mixed with water-gas, a continuous supply of which is secured by employing more than one generator. The mixed gases are heated by the combustion of the producer gas obtained as a by-product in making the water-gas, and sulphur is thus liberated by the reaction between the water-gas and sulphur dioxide.—F. SOHN.

Air and its elements: Process of separating — by fractional distillation. M. Hazard-Flamand. Fr. Pat. 394,881, Dec. 10, 1907.

The principle of the Savalle column is applied to the separation of the constituents of air. The air is first cooled to the temperature of its saturated vapour (–190° C.), partly in a heat interchanger and partly by expansion or in any other manner, and then passes into the column at the appropriate point; fractionation proceeds in the usual way, the reflux liquid at the top of the column being nitrogen, and liquid oxygen collecting at the bottom. The liquid oxygen is tapped off by a siphon into a jacket surrounding the boiler of the still, in which it is evaporated, this evaporation and the heating of the liquid in the still being effected by heat absorbed from a part of the nitrogen produced, which is cooled and compressed, and then, becoming liquefied, is returned at the top of the column as a reflux liquid. Or, the column may be surmounted by an auxiliary column, the gas issuing from the first serving to heat the boiler and evaporator of the second column, with or without the use of a dephlegmator; the liquid nitrogen thus produced is used as a reflux liquid in both columns. Auxiliary cooling of the apparatus is obtained by an external supply of liquid air or nitrogen, either supplied to the column itself or used to cool the air or nitrogen supply, or these may be cooled by previous compression and expansion.—F. SOHN.

Hydrogen: Production of —. Dellwik-Fleischer Wassergas-Ges. m. b. H. Fr. Pat. 395,132, Oct. 10, 1908.

The invention relates to the production of hydrogen by the action of steam on iron, with the alternate reduction of the oxide formed, the iron employed being prepared by the reduction of a mineral oxide which retains both porosity and resistance after repeated use. In order to prevent a deposition of carbon during the reduction of the iron oxide in the retort, the reducing gas is mixed

with a volume of steam equal to at least half the sum of the carbon monoxide and hydrocarbons present in it. It is also found economical to carry the reduction only half way, instead of completely to the metal, and this, moreover, gives purer hydrogen, since no carbon can be deposited during such partial reduction.—F. SOHN.

Alkali hydrosulphites: Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,865, June 1, 1908.

SEE Ger. Pat. 203,910 of 1908; this J., 1909, 90.—T. F. B.

Hydrosulphites: Manufacture of stable, anhydrous —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 20,199, Sept. 25, 1908.

SEE Second Addition to Fr. Pat. 354,273 of 1907; preceding.—T. F. B.

Hydrosulphites: Preparation of — in solution and in the solid state. Badische Anilin und Soda Fabrik. Second Addition, dated Sept. 28, 1908, to Fr. Pat. 293,192, Oct. 9, 1899. Under Int. Conv., Nov. 1, 1907.

SEE Eng. Pat. 20,198 of 1908; this J., 1909, 139.—T. F. B.

Chromates and aluminates: Process of making —. W. T. Gibbs, Buckingham, Canada. Eng. Pat. 18,334, Sept. 2, 1908. Under Int. Conv., Sept. 20, 1907.

SEE U.S. Pat. 901,136 of 1908; this J., 1908, 1151.—T. F. B.

Tungsten compounds: Process for making —. F. Harrison and C. H. Dorman. Fr. Pat. 394,720, Sept. 26, 1908. Under Int. Conv., Oct. 30, 1907.

SEE Eng. Pat. 23,988 of 1907; this J., 1908, 1209.—T. F. B.

Liquefying air: Apparatus for —. J. F. Place, Glen Ridge, N.J., U.S.A. Eng. Pat. 3685, Feb. 18, 1908.

SEE Fr. Pat. 391,326 of 1908; this J., 1908, 1152.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

PATENTS.

Ceramic objects: Manufacture of porous —. Grünzweig und Hartmann, Ges. m. b. H., Ludwigshafen, Germany. Eng. Pat. 22,613, Oct. 24, 1908. Under Int. Conv., May 9, 1908.

HIGHLY porous ceramic objects are obtained by mixing a combustible substance (e.g., cork), with the clay, etc., and burning in a kiln (preferably of the continuous type), to which steam and carbon dioxide, with or without oxygen or nitrogen, are admitted, so as to maintain therein a constant temperature.—A. G. L.

Porcelain or china-ware of low fusing grade: Manufacture of —. E. Berdel, Hôhr, Germany. Eng. Pat. 23,461, Nov. 3, 1908.

TRANSPARENT porcelain is obtained by mixing together 30 parts of kaolin, 5 of clay, 60 of felspar, and 5 of fluorspar free from iron, and burning at Seger cone 1 or 2. The addition of 0.1 part of "soda" renders the mass suitable for casting.—A. G. L.

Potteries, glass works, enamelling of metals, and similar industries: Plant [Furnaces] for —. F. Garros. Fr. Pat. 394,666, Sept. 5, 1908.

IN order to raise the temperature of the furnace rapidly, the door is movable, and channels are provided in the

thick part of it, for the circulation of hot or burning gases. There is also a box-saggard with double walls, between which a layer of air is enclosed. In the case of furnaces in which the saggars are surrounded on all sides by fire-holes, the heat of the combustible is utilised to the most complete extent, a fire-hole being arranged in the thick part of the door, and the products of combustion passing round suitable channels, by which the air-supply for the grates enters, in such a way that the air can be preheated, as desired, before passing through the fuel.

—W. C. H.

Window glass; Machines for the continuous drawing of — by means of a vacuum. H. D. Hershey, Fr. Pat. 394,873, Sept. 28, 1908. Under Int. Conv., Jan. 22, 1908.

SEE Eng. Pat. 19,827 of 1908; this J., 1909, 23.—T. F. B.

Clay, kaolin, or ceramic masses: Treatment of —. G. Keppeler, Darmstadt, and A. Spangenberg, Merzig, Germany. Eng. Pat. 3485, Feb. 15, 1908.

SEE Fr. Pat. 387,803 of 1908; this J., 1908, 857.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Portland cement: Influencing the physical properties of — by fine grinding. R. K. Meade. Tonind.-Zeit., 1908, 32, 2184—2187.

FINE-grinding generally has the effect of making a cement quicker in setting, sometimes to such an extent as to render the product useless; but this effect is much more marked with a cement rich in clay than with one rich in lime and lightly burnt, and with a well-proportioned cement only a slight increase in the speed of setting should result from finer grinding. The tensile strength of pure unmixed cement is reduced by fine-grinding, but that of the same cement, mixed with sand, is increased, as is seen in the following tables, which show the tensile strength in kilos. per sq. cm.

Residue on sieve of 5000 meshes
per sq. cm.

20 per cent. 10 per cent. 0 per cent.

Age (days).				
	Pure cement ..	25-94	21-65	14-06
1	" " "	67-14	52-65	39-23
7	" " "	67-70	54-48	41-76
28	" " "	16-52	24-68	26-85
7	With sand 1:3	20-88	32-90	40-49
28	" " "	11-25	16-45	18-49
7	" " 1:4	15-75	22-78	27-56
28	" " "			

Pure cement.

With sand.

Age.

As received. Fine-ground. As received. Fine-ground.

	As received.	Fine-ground.	As received.	Fine-ground.
1 day	22-99	14-76	—	—
7 days	44-29	36-91	19-54	33-72
23 days	50-97	37-96	25-10	39-02
3 months ..	51-32	37-96	27-21	40-42
6 months ..	53-43	39-37	27-42	43-25
1 year	58	40-42	28-82	48-80
2 years ...	59-76	39-37	29-88	44-99

It will be seen from the first table that for use with sand, 25 per cent. less cement is required, when the residue is reduced from 20 to 10 per cent., and the author estimates the extra cost of milling at 37 per cent., but as only 15—20 per cent. of the cost price of the cement represents the grinding of the clinker, the cost per barrel would

only be raised from 1 to 1-06 dollars. But fine-grinding brings no advantage, unless there is a corresponding increase in the percentage of impalpable powder or "flour," on which the setting properties of cement depend, and unfortunately sifting gives no idea of the relative merits of different types of mill in this respect. For instance, a sample of cement made to pass completely through a sieve with 5540 meshes per sq. cm., by repeatedly sifting and regrinding the residue, when mixed with sand showed no tensile strength after 7 days or even 3 months, but the same cement ground without sifting, until a residue of 23-5 per cent. was obtained with the same sieve, showed with sand, at 7 days, a tensile strength of 15-11 kilos., and at 3 months, 22-8 kilos. per sq. cm. The soundness of a cement is also affected to some extent by fine grinding, and a cement otherwise unsound can sometimes be made to pass the boiling test by attention to this point.—F. SOPX.

Portland cement; Influence of fine-grinding on the physical properties of —. E. Riisager. Tonind.-Zeit., 1909, 33, 258—260.

REFERRING to the work of Meade (see preceding abstract), it is pointed out that the effects of fine-grinding are specially noticeable in the cements cited, because, presumably, they were made in rotary kilns, and that thorough grinding is of great importance with cement made in this way. But it is urged that more attention should be given to the choice of a suitable type of mill, which will give the largest proportion of flour in the product, than to extra fineness of grinding, with its accompanying expense, though it is admitted that fine-grinding should be aimed at. Tube-mills are regarded as superior to ball-mills; for, by the use of a ball-mill and separator, much power is wasted, because the latter separates but a small proportion of the flour, returning most of it to the mill, which means that the same material goes through the separator and elevator many times and causes needless wear and tear, and moreover the product is inferior in the proportion of flour to that obtained with a mill in which no sifting or separation takes place during milling. Attention to the proportion of flour is of equal importance in grinding the raw materials, especially where these are hard, and an instance is cited in which it was found impossible to obtain a sound cement, when the raw materials were ground with a so-called sieveless ball-mill, though by substituting tube-mills, satisfactory results were obtained.—F. SOPX.

PATENTS.

Colouring and impregnating wood: Process for —. C. F. Brineker, jun., Copenhagen. Eng. Pat. 6538, Mar. 24, 1908.

SOLID extract of campeachy is dissolved in 10—20 times its weight of water and the wood to be impregnated is treated first with this solution under steam pressure and afterwards with a solution of iron acetate, care being taken that the wood does not absorb more of the iron solution than can be fixed by the absorbed campeachy extract. The wood is next dried at 25° C., then treated with a 15 per cent. soap solution which has been warmed slightly, again dried, and finally treated with a shellac solution to prepare it for polishing.—P. F. C.

Marble, granite, and similar materials: Process for the manufacture of artificial —. H. Jakobi. Fr. Pat. 394,688, Sept. 21, 1908.

THE moistened raw materials are worked up in a cylinder, provided with a screw, whereby the mixture is forced through the perforated bottom of the vessel in the form of small threads, which soon break off and fall on to an oscillating board or conveyor. The mixture is then sprayed with a liquid colouring material and fed into a cylindrical mixer, in which it is thoroughly worked up, and at the same time dusted over with a dry colour. The mixer is provided with an endless screw which drives the contents to the discharge end. The mixture can then be formed into the required shapes.—W. C. H.

Rotary and like kilns or furnaces [for cement, etc.]; Firing of —. A. Wilson, Doxey, Staffs. Eng. Pat. 1123, Feb. 24, 1908.

THE rotary kiln is heated by producer gas, blown into the lower end of the kiln together with air, previously heated to a high temperature by a reversible regenerator of firebrick or metal constructed so that it can be readily cleaned from dust. The regenerator may be inserted between the upper end of the kiln and the drying cylinder, or between the latter and the chimney. —A. G. L.

Hydraulic binding agents; Process for the preparation of — by the steam process. Zementfabr. Steinschal Max Reiche. Ger. Pat. 205,083, Feb. 7, 1907.

FINELY-DIVIDED cement-forming oxides, hydroxides, or salts (e.g., silicates) are mixed with slaked lime in proportions suitable for the production of cement, and the mixture is subjected to the action of superheated steam in presence of water. Or, the reaction-mixture may be composed of acid or neutral salts of cement-forming acids, together with a sufficient quantity of calcium hydroxide to yield products containing the groupings, $(-OCa)_2O$ or $(-OCa)(-OR)O$. The binding-agents thus obtained may be roasted in order to produce cements, or they may be used in the manufacture of artificial stone from materials such as quartz. —A. S.

X.—METALS AND METALLURGY.

Iron-carbon; Equilibrium diagram of the system —. H. M. Howe. Metallurgie, 1909, 6, 65—83, 105—126.

AFTER giving definitions of some terms used by him, the author discusses the merits of Roberts-Austen's diagram of the iron-carbon system as against the older diagram of Roozeboom, and cites the arguments for and against the view, deduced from Roberts-Austen's diagram, that graphite represents the stable and cementite the labile form of carbon. The correctness of this view is proved, because (1), the transformation of cementite into graphite is an exothermic reaction; (2), this transformation takes place in spite of the increase in pressure due to the greater volume occupied by the graphite formed; (3), on introducing carbon into iron, cementite is generally formed before graphite, in accordance with the general rule that of two bodies the less stable is first formed and then passes into the more stable. In addition, the direct transformation of cementite into graphite has often been proved microscopically to take place, but never the reverse; moreover, in making malleable cast-iron, cementite is transformed into graphite, often in quantity exceeding the saturation point (2.2 per cent. of carbon) of austenite. The author further discusses a number of points arising out of the diagram in great detail. —A. G. L.

Steel for motor-cars. H. C. L. Holden. "Times" Eng. Suppl., March 10, 1909.

THE various steels used for motor-car construction may be conveniently divided as follows:—(a) Carbon steel containing from 0.12 per cent. to 0.2 per cent. of carbon; (b) carbon steel containing from 0.25 per cent. to 0.4 per cent. of carbon; (c) carbon steel containing over 0.4 per cent.; (d) nickel steel containing from 3 per cent. to 4½ per cent. nickel; (e) nickel steel containing from 4½ per cent. to 6 per cent. nickel; (f) nickel steel containing from 25 per cent. to 30 per cent. nickel; (g) chrome steel, containing up to 0.3 per cent. chromium; (h) silicon steel, containing from 1 per cent. to 1.3 per cent. silicon; (i) vanadium steel, containing from 0.25 per cent. to 1 per cent. vanadium; (j) nickel chrome; (k) nickel vanadium.

The first class of steel (a) is that which is known as mild steel, it can be forged and welded without much difficulty; it is soft and readily machined, and it can be bent cold and treated much in the same way as wrought

iron, without apparent deleterious effect. When case hardened, it is extremely useful for parts where surface hardness is required as a prime factor, and not strength.

Of alloy steels, nickel steel would appear to be the most important. The addition of nickel to ordinary carbon steels, when the amount is greater than 1 per cent. and does not much exceed 6 per cent., has the effect of not only hardening the steel but of also increasing its elastic limit very materially—by approximately 3 per cent. for each 1 per cent. increase of nickel, and its ultimate strength in the same way by about 4 per cent.; it also renders the steel less susceptible to fracture by shock and by alternations of stress. These favourable conditions, however, can only be obtained by suitable thermal treatment of the material, but when this is done such steel may be considered as perhaps more reliable than any other.

A nickel steel containing 0.3 per cent. of carbon and 3 per cent. of nickel has approximately the following mechanical properties:—Elastic limit, 28 tons per square inch; ultimate strength, 42 tons per square inch, with an elongation of 20 per cent., and if thermally treated and oil hardened these can be raised to 35 and 55 with a slight reduction in the elongation. These figures can, by different proportions of carbon and nickel, be somewhat increased, but at the expense of the ductility.

Class (h) shows apparently the best proportion of nickel that can be employed where high elastic limit and strength are the qualities desired, without too much sacrifice of ductility. Generally, as the ultimate strength goes up the elongation goes down, and in the present state of our knowledge it may be said that the carbon in nickel steel should not exceed 0.5 per cent. nor the nickel 6 per cent. if the material is to be reliable. By far the greater proportion of nickel steel used for motor-cars is of the 3 to 3.5 per cent. nickel content.

(f) This is an interesting class of nickel steel which has its own peculiar uses. It contains about 0.12 per cent. carbon and from 25 to 30 per cent. of nickel. It is very little affected by high temperatures, up to bright red heat; it does not oxidise, and though not very strong, having an ultimate strength of only 36 tons, yet its elongation at the breaking point is something like 36 per cent. These properties make it very suitable for exhaust valves, for which purpose it has been somewhat widely employed by the best Continental makers.

(g) Chromium has a very distinct property of increasing the intrinsic hardness of carbon steel, but unfortunately by itself it renders the material somewhat brittle.

(h) is a somewhat interesting alloy which has been employed on the Continent to a considerable extent for gear wheels and springs. For the former purpose the proportion of silicon may reach 3 per cent., and with a comparatively low carbon content, steel is obtained which, though perhaps hard to machine, is extremely resistant against wear, and attains a fine surface. These properties are improved by thermal treatment at moderate temperatures which do not induce warping of the article. For springs the percentage of silicon ranges from 1 to 1.3 per cent. or thereabouts, and the carbon from 0.7 to 0.5 per cent., the low silicon taking the higher carbon and *vice versa*. An elastic limit of 55 tons per square inch and an ultimate strength of 70 tons per square inch, or more, may be expected from such material when tempered for a spring. It has one characteristic which is required for springs, and that is its resistance to shock, which is very high when the other figures given above are taken into account.

(j) The alloy known as nickel chrome steel seems to possess both the qualities of nickel steel with the advantages of chrome steel, but without the disadvantages of the latter, provided that the amount of chromium is kept small, generally under 1 per cent. The hardness given by the chromium tends to raise the elastic limit nearer to the ultimate strength without affecting the toughness of the material. This steel is subjected to a case-hardening process to increase the carbon content on and near the surface, and is then heated and cooled, becoming extremely hard without any quenching whatever, thus combining all the qualities that are required for many parts of the engine and transmission of a motor-car, which necessitate

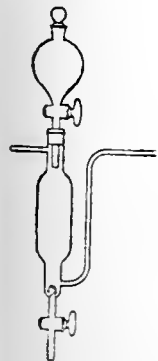
accuracy in dimension, hardness, toughness, and the greatest resistance to wear.

(i) (k) are alloys containing vanadium. When alloyed with carbon steel only, vanadium does not appear to the same advantage as it does when employed in conjunction with chromium and nickel chromium. The percentage of vanadium used is generally very small, under 0.2 per cent.

Platinum; Melting-point of —. C. Féry and C. Chêneveau. *Compt. rend.*, 1909, **148**, 401–404.

PLATINUM wires were melted by the electric current, by a Méker burner with an air-blast, and by the oxy-coal-gas blowpipe, and the melting-points determined by an optical pyrometer, allowance being made for the difference between the platinum and a black body. The temperatures registered were:—With the electric current, wire horizontal, 1690° C.; wire vertical, 1710° C. With the Méker burner and blast, 1740° C. With the oxy-coal-gas blowpipe, 1700°–1750° C., according to the oxidising or reducing character of the flame. The differences are largely due to the nature of the atmosphere surrounding the melting metal.—J. T. D.

Cuprous oxide in copper; New method for the determination of —. G. Coffetti. *Gaz. chim. ital.*, 1909, **39**, I., 137–143.



THE method is based on the fact that ammonia solution, in absence of air, will dissolve cuprous oxide but not metallic copper. The apparatus used is shown in the figure. A weighed quantity of the sample of copper, in the form of bright turnings, is introduced into the apparatus, on to a layer of glass-wool therein. The bent side tube is connected with a supply of hydrogen, which is passed through a strong solution of ammonia before entering the apparatus. When the air in the apparatus has been completely displaced by hydrogen, ammonia solution is run in from the tap-funnel. The whole is then allowed to stand until the colour of the solution does not appear to become deeper, whereupon the

liquid is run off through the small siphon, and the copper washed several times with a 10 per cent. solution of ammonia in recently boiled water. A further 50 c.c. of strong solution of ammonia is now introduced and the apparatus left for 4 or 5 hours, this series of operations being repeated until the strong ammonia solution is no longer coloured after contact with the copper for 4–5 hours. The ammoniacal solution of cuprous oxide is acidified with nitric acid, and the copper determined by electrolysis. Examples are given showing the accurate results obtained by the method.—A. S.

Copper and nickel; Process of treating magnetic pyrites containing —. Warlimont. *Metallurgie*, 1909, **6**, 83–92, 127–134.

SMALL working-scale experiments for the extraction of copper and nickel from magnetic pyrites were made on an ore containing 25.25 per cent. of sulphur, 42.40 of iron, 0.75 of copper, 3.10 of nickel, and 13.11 of silica. The ore was crushed so as to pass a sieve with 50 meshes per inch, and roasted, in lots of 5 kilos. at a time, in a small rotating horizontal kiln. The roasting was carried out for 8–10 hours at 480° C., and then for another 2–4 hours at 550° C. The gases given off contained up to 9 per cent. of sulphur dioxide. Two such intermittent kilns might be combined with one sulphuric acid plant: in a continuously working kiln the proper regulation of the temperature would be too difficult. The roasted ore contained up to 96 per cent. of the copper present in a form soluble in water, together with about 10 per cent. of

the nickel (and cobalt) and a considerable quantity of iron. It was exposed to the air in a moist state, this process of oxidation increasing the quantity of soluble copper slightly, and diminishing that of soluble iron considerably (to about half that of the copper), whilst the nickel remained practically unaffected. The oxidised ore was extracted with water, and washed two or three times with fresh water. From the solution obtained, copper was precipitated by means of scrap iron; iron was next removed by adding lime and blowing in air, and nickel (and cobalt) were finally precipitated by adding more lime. Or else, if but little cobalt was present, iron and nickel were precipitated together by means of lime, and the dried precipitate was added to the leached ore. This leached ore was next smelted for a crude nickel matte containing 45–50 per cent. of nickel, in an electric furnace, or in a reverberatory furnace. It might be necessary to add pyrites to bring up the sulphur content of the ore to 3 per cent., especially when using a reverberatory furnace. The slag obtained contained 0.23 per cent. of nickel. One H.P. year should suffice to smelt 25.5 tons of the ore. The crude nickel sulphide so obtained was next concentrated in a Bessemer converter, and the nearly pure nickel sulphide was cast into plates, which were used as anodes in the final electrolytic process. The cathodes consisted of sheets cut into the form of tridents, so that the anode surface was 2½ times the cathode surface. A current density of 60 amperes per sq.m. of anode surface was used, as with this density the cuprous sulphide in the anodes was oxidised only to cupric sulphide, thus leaving half the copper present (about 1 per cent. on the nickel) insoluble. The copper in the electrolytic nickel obtained could be still further decreased (to about 0.2 per cent.) by circulating the electrolyte, heated to about 60° C., through a vessel containing powdered nickel.

Incidentally, it was found that ferrous sulphate, heated in a current of air for 3 hours, was slightly decomposed at 460° and completely at 550° C. With copper sulphate the same treatment gave slight decomposition at 610° and complete decomposition at 650°. Nickel sulphate, containing 2.1 per cent. of free acid, was slightly decomposed at 500°, and almost completely at 670° C.—A. G. L.

Monel metal. D. H. Browne. *Electrochem. and Met. Ind.*, 1909, **7**, 114–115.

MONEL metal is a silver-white, nickel-copper alloy prepared from the nickel ores of Sudbury, Canada (see this J., 1909, 94). It contains 68–72 per cent. of nickel, 0.5–1.5 of iron, 0.014 of sulphur, and 0.073–0.15 of carbon, the remainder being copper. Its properties are profoundly influenced by the proportion of carbon and other impurities it contains, and the thermal treatment to which it is subjected. It melts at 1350° C., can be rolled between 900° and 1200° C., and annealed above 875° C.: the sp. gr. of the cast metal is 8.86–8.87 and of the rolled metal, 8.94–8.95. When rolled it becomes coated with a film of oxide, and is then very resistant to acids. The mechanical properties of the alloy are shown in the following table:—

	Cast metal.		1-in. Rods, as rolled.	1-in. Rods rolled, annealed, and cold-drawn.	1-in. Rolled plates.
	Grade C.	Grade D.			
Tensile strength ..	70,000	85,000	100,000	110,000	90,000
Elastic limit	27,000	40,000	50,000	80,000	45,000
Elongation, 2 ins.	30 %	25 %	30 %	25 %	30 %
Reduction of area	35 %	25 %	50 %	50 %	60 %

The rolled metal can be drawn into wire of all sizes down to 0.004 inch. The alloy should prove especially useful for the manufacture of seamless tubes for condensers and boilers for automobiles and motor-boats. Large castings can also be made of the alloy, which is much stronger than manganese bronze or Tobin bronze.—A. S.

Tin exports from the Federated Malay States. Board of Trade J., March 4, 1909. [T.R.]

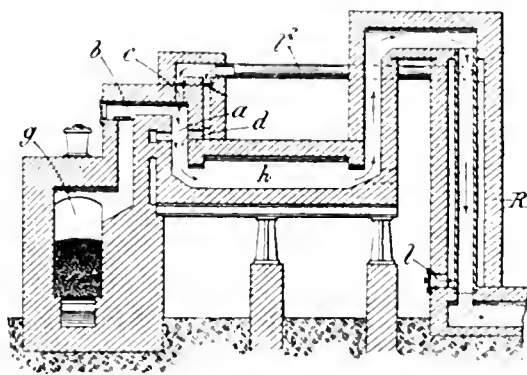
THE weight of block tin and tin ore (tin exported in the form of ore having been taken at 70 per cent. of the gross weight of the ore) exported from the Federated Malay States during each of the years 1907 and 1908 was as follows:—

State.	1907.			1908.		
	Tin.	Tin contained in tin ore.	Total.	Tin.	Tin contained in tin ore.	Total.
Perak	tons.	tons.	tons.	tons.	tons.	tons.
Selangor	5,908	19,770	25,678	4,685	23,220	27,905
Negri Sembilan	4,886	11,417	16,303	2,184	14,632	16,816
Pahang	2,393	2,993	4,486	1,131	2,690	3,821
	751	1,224	1,975	784	1,569	2,353
Total ...	13,938	34,504	48,442	8,784	42,111	50,895

Iron and steel; Corrosion of —. A. Sang. Proc. Engineers' Soc., W. Pennsylvania, 1909, 24, 493. 561.

PATENTS.

Reverberatory and like furnaces. A. I. Boulton, London. From E. Schmatolla, Berlin. Eng. Pat. 3394, Feb. 14, 1908.



At the front end of the hearth, *h*, of the furnace, is a vertical combustion chamber, *a*, which is supplied with gas from the producer, *g*, through the conduit *b*, and with heated air from the regenerator, *R*, by the conduit, *f*, and the openings, *c*, *d*. The air enters the regenerator at *f*, and becoming heated, enters the combustion chamber under a plus pressure. The gas from the producer also enters the combustion chamber under a plus pressure. If a reducing flame is required, the air is allowed to enter through the port, *c*, above the gas, the ports, *d*, being closed. If an oxidising flame is required, the port, *c*, is closed and the ports, *d*, are opened, the air entering below the gas.

W. H. C.

Iron from finely divided ores; Improvements in and apparatus for the production of —. P. M. Pritchard and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 6561, Mar. 24, 1908.

FINELY divided iron ores are mixed with carbonaceous material and fluxing agents, and fed into the upper end of an inclined rotary kiln lined with refractory material. From this kiln the material, in a more or less reduced and fluxed condition, falls into a stationary bath-chamber, adjacent to the lower end of the kiln. Preheated air and solid powdered fuel are blown into this chamber so as to produce a non-oxidising flame in the chamber and kiln.

The reduced iron and slag are drawn off from time to time, either through tap-holes, or by tilting the bath-chamber. —A. G. L.

Cyanide, alkaline and other solutions; Apparatus for separating — from slimes, sand, and the like. G. H. Rayner, London. From Innes, Procter, and Hayles, Tarkwa, West Africa. Eng. Pat. 11,008, May 21, 1908.

THE mixed slimes and solutions are admitted intermittently from a hopper through a hollow shaft into a bottomless rotating basket, consisting of suitable filtering material (cotton or metal screen, etc.) secured between an outer perforated cylinder or cone and an inner one of vertical bars or wires. The material falls on to a rotating "impeller," provided with top and bottom plates, between which are placed blades which throw the material against the inside of the filtering medium, the liquid passing through into an outer chamber, whilst the solid particles adhere to the inside of the basket. From time to time the supply of material to the basket is stopped, and the solids adhering to the inside are removed, either by mechanical scraping, or by means of air or water delivered under pressure from jets placed close to the inside of the basket. The filtering medium, owing to the vertical inner bars, is never completely cleaned, and is thus protected from the full abrasive action of the next batch of solids projected against it.

—A. G. L.

[Thorium] ores; Art of treating —. R. McKnight, Pittsburg, Pa. U.S. Pat. 912,485, Feb. 16, 1909.

THORIUM ores are treated with a large excess of an alkali chloride. The mixture is heated until volatile and soluble chlorides of thorium have been formed, the vapours being condensed. The residue whilst still hot, is passed into water, and then through a pulveriser through which water is circulated. The same quantity of water is used for successive extractions, until it becomes supersaturated with and deposits thorium compounds, leaving the alkali chloride in solution, which may be used for the treatment of fresh ore. —A. G. L.

Pyritic smelting. J. T. Carriek, Assignor to B. S. Pattison, Johannesburg, Transvaal. U.S. Pat. 912,540, Feb. 16, 1909.

MEANS are provided for injecting into the furnace, flame blasts, giving off substantially neutral combustion products, immediately below the regular air tuyères and preferably intermediate thereof, in order to produce a restricted zone of higher temperature at the base of the "focus region" of slag formation. —F. SOPK.

Flue-dust in blast furnaces; Method of effecting the precipitation of — and of preventing the formation of the same. R. W. H. Atcherson and W. Siddall, Bellaire, Ohio. U.S. Pat. 912,641, Feb. 16, 1909.

JETS of a "dust-dampening agent" under high pressure are directed into the blast furnace throughout the whole of the gas zone. —A. G. L.

Steel; Process and composition for hardening and tempering —. B. J. Casterline, San Diego, Cal., U.S.A. Eng. Pats. 3651 and 3652, Feb. 18, 1908.

SEE U.S. Pats. 879,517 and 879,518 of 1908; this J., 1908, 286. —T. F. B.

Iron or steel; Solution for treatment of —. A. Hayes, New York, Assignor to William Saunrey Metals Co., Maine. U.S. Pat. 913,657, Feb. 23, 1909.

SEE Fr. Pat. 393,452 of 1908; this J., 1909, 145. —T. F. B.

Iron and steel; Process for treating —. W. F. C. M. McCarty, Fr. Pat. 394,667, Sept. 10, 1908.

SEE U.S. Pats. 901,362, 901,546, and 901,547 of 1908; this J., 1908, 1117. —T. F. B.

Iron; Method of extracting —. C. G. P. de Laval, Stockholm. U.S. Pat. 913,405, Feb. 23, 1909.

SEE Eng. Pat. 23,069 of 1907; this J., 1908, 338. —T. F. B.

Smelting furnaces; Reverberatory —. A. D. Lee, Gila Bend, Ariz., U.S.A. Eng. Pat. 11,259, May 23, 1908.

SEE Fr. Pat. 391,409 of 1908; this J., 1908, 1157.—T. F. B.

Furnaces for the cementation of articles of iron, steel, and alloys of steel. E. C. R. Marks, London. From Soc. Anon. Ital. G. Ausaldo Armstrong and Co., Genoa, Italy. Eng. Pat. 16,807, Aug. 10, 1908.

SEE Fr. Pat. 392,960 of 1908; this J., 1909, 25.—T. F. B.

Metals and alloys; Processes for improving the physical properties of —. D. Lamon and T. H. Thomas, Denver, U.S.A. Eng. Pat. 12,452, June 9, 1908.

SEE U.S. Pat. 892,260 of 1908; this J., 1908, 815.—T. F. B.

Ores; Apparatus for separating — by flotation. A. J. F. de Bayay, Kew, Victoria. U.S. Pat. 912,783, Feb. 16, 1909.

SEE Eng. Pat. 25,858 of 1904; this J., 1905, 1238.—T. F. B.

Smelting ores; Method of —. J. T. Carriek, Assignor to B. S. Pattison, Johannesburg. U.S. Pat. 913,655, Feb. 23, 1909.

SEE Eng. Pat. 2971 of 1908; this J., 1908, 1209.—T. F. B.

Zinc; Separation of — from its ores or compounds. The Metals Extraction Corporation, Ltd. Fr. Pat. 394,867, Sept. 25, 1908. Under Int. Conv., Oct. 29, 1907.

SEE Eng. Pat. 23,901 of 1907; this J., 1909, 26.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Destruction of organic matter. Miorandi. See XXIII.

PATENTS.

Organic products; Process for the reduction and oxidation of — by electrolysis. H. Chaumat. First Addition, dated Dec. 19, 1907, to Fr. Pat. 393,561, Oct. 29, 1907 (this J., 1909, 148).

THE addition relates to the extension of the main patent to the reduction of substances in solution, and in particular to the reduction of sodium bisulphite in aqueous solution for the production of sodium hydrosulphite. A layer of coarse material is placed below the mass of powdered graphite with which the liquid is mixed, and the latter is drawn off from the bottom of the vessel, the material below acting as a filtering medium.—B. N.

Electrode for electric accumulators with alkaline electrolytes. Nya Akkumulator Aktiebolaget Jungner. Fr. Pat. 395,138, Oct. 10, 1908.

AN electro-active mass, consisting of finely divided metals, as iron, lead, etc., or of oxides or hydroxides of nickel, copper, silver, etc., is introduced in a suitable manner into the pores of artificial graphite. For instance, the latter is immersed in a solution of a salt of the metal in alcohol, or other convenient solvent, and by heating or by treatment with suitable reagents, the required electro-active mass is obtained and the solvent evaporated.—B. N.

Furnace, heated electrically by means of a resistance material composed of small fragments, for melting and boiling, especially for determining melting and boiling points. A. Deckert. Fr. Pat. 395,158, Oct. 12, 1908.

A CIRCULAR electrode fits into the bottom of an outer vessel of refractory material, and within the latter is placed a cylinder of similar material, into which is fitted a series of thin-walled refractory cylinders. Between these

and the inner crucible is placed the resistance material, a ring electrode slipping over the crucible and making contact with the resistance material. The height of the latter may be varied, as also the transverse section of the mass by the withdrawal of one or more of the cylinders, or, instead of these, a series of cylinders of different internal diameters, interchangeable with the cylinder fitting into the outer vessel, may be employed.—B. N.

Storage batteries; Process of charging lead peroxide-zinc —. R. Ziegenberg, Berlin. U.S. Pat. 912,351, Feb. 16, 1909.

SEE Eng. Pat. 14,762 of 1907; this J., 1907, 1146.—T. F. B.

Electric furnace. The Hoskins Co. Fr. Pat. 394,674, Sept. 14, 1908. Under Int. Conv., Sept. 19, 1907.

SEE U.S. Pat. 882,788 of 1908; this J., 1908, 452.—T. F. B.

Electric lamp filaments. Eng. Pat. 10,390. See II.

[Carbon] filaments. Fr. Pat. 394,302. See II.

Metallic filaments. Fr. Pat. 394,585. See II.

Electric lamps. Fr. Pat. 394,823. See II.

(B.)—ELECTRO-METALLURGY

PATENTS.

Electrolytic cells for separating the constituents of a mixture of metals or an alloy. Usine Genevoise de Dégrossissage d'Or, Geneva. Eng. Pat. 13,134, June 19, 1908. Under Int. Conv., July 11, 1907.

SEE Fr. Pat. 391,898 of 1908; this J., 1908, 1159.—T. F. B.

Electrolytic cell for separating constituents of a mixture of metal or an alloy. H. Lacroix, Assignor to Usine Genevoise de Dégrossissage d'Or, Geneva. U.S. Pat. 912,859, Feb. 16, 1909.

SEE Fr. Pat. 391,898 of 1908; this J., 1908, 1159.—T. F. B.

Metals; Method of precipitating — electrolytically. A. Ramén, Assignor to Helsingborgs Kopparverks Aktiebolag, Helsingborg, Sweden. U.S. Pat. 913,430, Feb. 23, 1909.

SEE Eng. Pat. 18,080 of 1906; this J., 1907, 24.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Butter fat, coconut oil, and their fatty acids; The distillation of —. K. S. Caldwell and W. H. Hurtley. Chem. Soc. Proc., 1909, 26, 73.

BUTTER fat, coconut oil, and their fatty acids were distilled in the vacuum of the cathode light. The lowest fraction obtained from butter fat distilled with the bath temperature at 250–270° and inner thermometer at 187–210°. Tributyrin distils rapidly with the bath temperature at 127° and inner thermometer at 107°. For this and other reasons, it is concluded that butter does not contain tributyrin. The iodine values yielded by the various fractions seem to indicate that there is little or no triolein in butter fat. Lauric acid forms at least 60 per cent. of the fatty acids in coconut oil, whilst it could not be detected in butter; this method of distillation enabled the authors to detect with ease the presence of 10 per cent. of coconut oil in butter. The presence of palmitic acid in coconut oil has been questioned by Ulzei (this J., 1899, 1133), but the authors isolated several grams of this acid from coconut oil.

Cottonseed products: Rapid determination of oil in —. C. H. Heity, F. B. Stem, and M. Orr. J. Ind. and Eng. Chem., 1909, 1, 76–81.

Cottonseed meal.—40 grms. are extracted with 100 c.c. of carbon tetrachloride in a 250 c.c. flask at about 60° C. for at least 15 minutes, the liquid cooled to the ordinary temperature, shaken, and the whole strained through wire gauze on to a folded filter, the clear extract being collected in a graduated tube. The tube is cooled to the ordinary temperature, and the specific gravity of the extract is then determined. The specific gravity found is deducted from that of carbon tetrachloride at the same temperature, and the difference divided by 0.00286 gives the percentage of oil. It was found that between 15 and 30° C. the sp. gr. of carbon tetrachloride decreases by 0.0018 for each rise of 1° C. The values for carbon tetrachloride adopted are: 15°, 1.6041; 20°, 1.5951; 25°, 1.5861; and 30° C. 1.5771. If the carbon tetrachloride used in the analysis has a different specific gravity, the difference must be added to, or deducted from, the observed sp. gr. of the extract, as the case may be. *Hulls.*—10 grms. of the hulls, freed from whole seed, are treated just as in the case of meal, except that it is not necessary to strain through wire gauze. *Meats or kernels.*—10 grms. of the sample are used and the values obtained are multiplied by four. *Seed.* The sample is crushed and passed through a "meat chopper." 40 grms. are used with 200 c.c. of carbon tetrachloride and the values obtained are multiplied by two.—A. S.

Rape oil: Phytosterols in —. A. Windaus and A. Welsch. Ber., 1909, 42, 612–616.

WINDAUS and HAUTH (this J., 1907, 69) separated the crude phytosterol from Calabar beans into stigmasteryl and sitosterol. In linseed oil (this J., 1907, 1150) only sitosterol was found. On the other hand, Matthes and his collaborators (this J., 1908, 632, 818) found in cacao butter and cocoanut oil a mixture of phytosterols behaving towards bromine like stigmasteryl and sitosterol. The authors have found that the crude phytosterol of rape oil consists of a mixture of substances resembling stigmasteryl and sitosterol. The acetylated crude phytosterol yielded an insoluble tetrabromide, the composition of which agreed with the formula, $C_{30}H_{48}O_2Br_4$. The alcohol, for which the name of *brassicasterol* is suggested, was prepared from the acetate. It crystallised in hexagonal plates (m.p., 148° C.) containing one mol. of water of crystallisation ($C_{30}H_{46}O + H_2O$). Its specific rotation was $[\alpha]_D^{18} = -64.25$, or considerably higher than that of stigmasteryl ($[\alpha]_D^{18} = -45$). Brassicasteryl acetate formed thin hexagonal flat crystals melting at 157–158° C. The propionate melted at 132° C., and the benzoate (crystalline needles) at 167° C., whilst stigmasteryl propionate melted at 122° C., and the benzoate (rectangular plates) at 160° C. The phytosterol resembling sitosterol, which was separated from the filtrate from the brassicasteryl acetate tetrabromide, melted at 142° C. (sitosterol, 136–137° C.), and had the probable composition, $C_{27}H_{46}O$. Its acetate melted at 134° C., and its propionate at 116° C.—C. A. M.

Elaeostearic acid: Constitution of —. R. Majima. Ber., 1909, 42, 674–680.

KAMETAKA (this J., 1903, 1138) obtained the same tetrabromide and tetrahydroxy acid (sativic acid) from elaeostearic acid as from linolic acid, and therefore concluded that the two acids were isomeric. To obtain further information of the constitution of elaeostearic acid, the author has used ozone as an oxidising agent in a similar manner to that employed by Harnes and Türk (this J., 1906, 1158) with oleic acid. He has found that elaeostearic acid absorbs 2 mols. of ozone, which supports the view that it contains 2 double linkages. The di-ozone was an amorphous yellowish, semi-solid substance with the composition, $C_{18}H_{22}O_6$. When boiled with water it was readily decomposed, the products of decomposition including *n*-valeric aldehyde, *n*-valeric acid, the semi-aldehyde of azelaic acid, and azelaic acid. A substance that appeared to be succinic di-aldehyde was isolated, but neither succinic acid nor its semi-aldehyde could be identified,

and if present could only have been there in small quantity. The nature of the decomposition products supports Maquenne's view that elaeostearic acid contains double linkages between the fifth and sixth and the ninth and tenth carbon atoms as represented in the formula— $CH_3(CH_2)_3CH:CH(CH_2)_2CH:CH(CH_2)_2CO_2H$. The elaeostearic acid prepared from tung oil by Kametaka's method distilled almost unchanged in a current of carbon dioxide at about 225° C. under a pressure of 12 mm., leaving in the flask an amorphous (probably polymerised) residue amounting to about $\frac{1}{2}$ to $\frac{1}{3}$ of the original substance.

—C. A. M.

Clupanodonic acid: Occurrence of — in dab and green turtle oils. M. Tsujimoto. J. Coll. Eng., Imp. Univ., Tokyo, 1908, 4, 177–179.

THE dab oil obtained from an unknown species of fish (probably *limnulus*) was a reddish-yellow liquid with a very unpleasant odour. It gave the following values:—Sp. gr. at 15° C., 0.9210; acid value, 0.83; saponification value, 185.32; iodine value (Wijs), 118.53; refractive index (20° C.), 1.4748; m.p. of fatty acids, 29° C.; brominated acids insoluble in ether, 18.66 per cent.; and oxidised acids (Fahrian), 0.72 per cent. Green turtle oil, obtained from *Chelonia midas* Linna., was a pale yellow liquid with a somewhat fishy odour. It gave the following analytical values:—Sp. gr. at 15° C., 0.9335; acid value, 1.27; saponification value, 193.80; iodine value (Wijs), 127.38; refractive index (20° C.), 1.4769; m.p. of fatty acids, 31.5° C.; insoluble brominated acids, 29.45 per cent.; and oxidised acids, 2.51 per cent. The insoluble bromide from the fatty acids of each oil turned black at 200° C., decomposed without melting, and had an elementary composition agreeing with that of clupanodonic octobromide (this J., 1906, 818, 819). The amounts corresponded to a proportion of 5.63 and 8.88 per cent. of clupanodonic acid in the respective mixed fatty acids.

—C. A. M.

Oils and fats, and especially marine animal oils: Cause of the odours of —. M. Tsujimoto. J. Coll. Eng., Imp. Univ., Tokyo, 1908, 4, 181–191.

A NOTION relationship may be observed between the amount of odour of an oil and the degree of unsaturation. The author attributes the disagreeable odour of marine animal oils largely to the presence of glycerides of highly-unsaturated fatty acids, especially those of the series $C_nH_{2n-8}O_2$. Thus, Japanese sardine oil, which contains a large proportion of clupanodonic acid, has a much more pronounced fishy odour than herring, whale, dab, or turtle oils, which contain less of that acid. This was supported by the fact that on treating a solution of the fatty acids from Japanese sardine oil with bromine, filtering off the insoluble octobromide, and reducing the brominated fatty acids in the filtrate, the acids obtained were practically free from the original unpleasant odour, though still possessing an odour. The precipitated octobromide was odourless, but when reduced with alcoholic hydrochloric acid and zinc dust, it yielded clupanodonic acid with the characteristic fishy odour of the oil. Future investigations of the problem of deodorisation of these oils should therefore aim at the complete removal of glycerides of the clupanodonic acid series or of their conversion into non-odorous compounds.—C. A. M.

Marine animal oils: Nature of the resinous substance deposited from the mixed fatty acids of — on keeping. M. Tsujimoto. J. Coll. Eng., Imp. Univ., Tokyo, 1908, 4, 193–195.

THE resinous deposits formed on keeping the fatty acids of Japanese sardine and whale oils were nearly insoluble in petroleum spirit, ether, and carbon tetrachloride, but more soluble in absolute alcohol and readily soluble in caustic alkali solution, yielding a dark brown liquid. When washed with petroleum spirit they were reddish-brown, nearly odourless, friable solids, heavier than water, and decomposing before their melting points were reached. The oils from which they had separated showed a great decrease in their iodine values and in the yields of octobromide. Analyses of the substances dried over sulphuric

acid gave results indicating the formula, $C_{18}H_{28}O_2$, O_4 , and it was concluded that they were oxidation products of chupanodonic acid or other acids of the series $C_nH_{2n-8}O_2$. On passing a current of air through the fatty acids of fresh Japanese sardine oil heated to about $80^\circ C$. for 5 hours daily for 10 days, the acids became turbid and thick, but did not yield a deposit.—C. A. M.

Marine animal oils; Oxidised fatty acids of ——. M. Tsujimoto. J. Coll. Eng., Imp. Univ. Tokyo, 1908, 4, 197—200.

CERTAIN marine animal oils, including Japanese sardine oil and cod-liver oil, yield insoluble compounds when kept, and this is still more marked in the case of their free fatty acids. Old marine animal oils or those bleached by sunlight gave brownish-black soaps on saponification. The effect of insolation (as frequently used in Japan for refining oils) is to render the colour lighter, change the odour, and increase the viscosity. The specific gravity and saponification value are distinctly increased, the acid value and refractive index slightly increased, and the iodine value and yield of octobromide distinctly decreased. The oxidised acids show a great increase (e.g., 2.57 and 2.13 per cent. were obtained after a week's exposure). The liberated oxidised fatty acids were brownish-black, viscous solids, drying to a dark brown film when exposed in a thin layer. After drying at $100^\circ C$. they only dissolved with difficulty in alcohol. They appeared to be mainly oxidation products of acids of the chupanodonic series, though not identical with the resinous substance deposited from the fatty acids on keeping (see preceding abstract). From a technical point of view the dark coloration of the soap yielded by marine animal oils containing as little as 0.27 per cent. of oxidised acids is important, and glycerides of fatty acids of the series $C_nH_{2n-8}O_2$ ought to be removed or converted into indifferent compounds if such oils are to be used in soap-making. The oxidised acids from linseed, perilla, or tung oils do not give such intense colorations on saponification.—C. A. M.

Wool waste saturated with boiled oil; Spontaneous combustion of ——. R. Nowicki. Glückauf, 1909, 45, 222—224.

THE boiled oil used in the author's experiments absorbed 10.33 per cent. of oxygen in 42 hours when exposed to the air in a thin film on glass, the greatest degree of absorption (1.345 per cent.) taking place in the first 2 hours. Weighed quantities of 40 grms. each of wool waste were impregnated with definite amounts of this oil and placed in a flask, the body of which was packed in a box of cotton wool. Air was drawn through the flask by means of an aspirator in such quantity that samples taken from the aspirator still contained 14 to 15 per cent. of oxygen. A thermometer was introduced into the middle of the impregnated material, whilst the pressure was regulated by means of a water manometer. It was found that risk of ignition began when the ratio of waste to boiled oil was as 2 : 1, and that ignition was certain to occur when the ratio was as 1 : 1. Under these conditions spontaneous combustion took place in 79 minutes when the temperature had reached $131^\circ C$. With proportions of 2 : 3 and 1 : 2, ignition did not take place below $180^\circ C$.—C. A. M.

Dust-laying oils. Heise. See XVIII B.

Emulsification. Marshall. See XXIV.

PATENTS.

Oils, fats, waxes, and their products; Impts. in, and apparatus for filtering ——. J. Doull. London. Eng. Pat. 10,277, May 12, 1908.

THE apparatus consists of a circular wrought-iron tank with a roof, and a perforated wooden floor, carried on iron girders and supported on an angle-iron ring. The floor is covered with canvas duck laid on cocoanut matting. There is a space beneath the floor, from which pipes lead away the filtered material, after its passage through the filtering medium. This may consist of fuller's earth, magnesium silicate, etc., and forms a layer about 2 ft. 6 in. thick above the canvas duck. Filtration is assisted by

means of a vacuum pump connected with the space below the floor of the filter. The filtering medium may be cleansed by washing with boiling water or steam, and subsequent calcination. Heat may be applied when necessary.—E. W. L.

Oil; Apparatus for decolouring, bleaching, and thickening ——. J. C. L. van der Lande, Deventer, Holland. Eng. Pat. 17,670, Aug. 22, 1908.

THE oil is heated and mechanically agitated in a circular boiler, whilst meanwhile subjected to the action of compressed air. The passage of this air upwards through the oil is retarded by means of a series of superposed partitions, attached alternately to the shaft of the agitator, and to the inside of the boiler.—C. A. M.

Fat-extraction apparatus. W. Schmücker. Ger. Pat. 205,423, May 22, 1906.

THE apparatus consists of two concentric vessels, communicating below by means of a filter. The material to be extracted is contained in the inner vessel, into which fresh solvent is introduced at the top, the solution of the fat being thus forced out at the bottom, through the filter, into the annular space between the two vessels. The solution is discharged from the annular space by means of a siphon.—A. S.

Fatty acids; Conversion of liquid — into solid fatty acids. P. Sabatier. Fr. Pat. 394,957, Dec. 12, 1907.

LIQUID fatty acids are converted into solid fatty acids by the action of hydrogen, or a gas rich in hydrogen, in the presence of finely divided metals kept at a suitable temperature ($200 - 100^\circ C$). The vapours of the resulting solid fatty acids are carried forward by the rapid current of gas and condensed, the excess of hydrogen being recovered and used again. The unconverted liquid fatty acids in the product are separated by expression and again treated with hydrogen.—C. A. M.

Soaps of every kind; Apparatus and process for making ——. L. Rivière. Second Addition, dated July 27, 1908, to Fr. Pat. 374,179, Jan. 12, 1907. (See this J., 1907, 769, 881.)

THE apparatus described in the original patent may be constructed in the form of an autoclave, so as to effect more rapid saponification at pressures above that of the atmosphere. In the decomposition of insoluble (calcium, barium, magnesium, etc.) soaps, carbonic acid under variable pressures may take the place of mineral acids. In the case of ordinary alkali soaps the process may be accelerated by the injection of ozonised air in place of ordinary air, the material circulating over the perforated diaphragms being thus thoroughly subdivided. Claim is also made for the separation under pressure of the glycerin, by means of superheated steam or otherwise, from the crude product circulating over the diaphragms.—C. A. M.

Soaps; Preparation of solutions of resinous —, with or without the addition of thickening or colouring matters. F. Arledter. Fr. Pat. 395,177, Dec. 19, 1907.

ROXIN soap is heated in a steam-jacketed reservoir until sufficiently fluid to pass into the solution tank. On the way the soap meets a current of hot water coming from a steam injector and carrying with it the thickening and colouring substances, and is mechanically mixed with it in a finely-divided state. Solution is thus rapidly effected without the soap having come into direct contact with steam.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

Lead chromate; A preliminary study of ——. E. E. Free. J. of Phys. Chem., 1909, 13, 114—137.

AFTER a review of the literature, the author describes experiments on the precipitation of lead chromate under

varying conditions. Although the size of the crystals of the precipitate increases continuously with decrease in the concentration of the solutions, the colour of the precipitate is lighter from the more concentrated and from the more dilute solutions, than from the intermediate solutions. The two most probable causes of the differences in the colour of the precipitates are varying basicity and varying size of crystal. The best conditions for the manufacture of chrome yellow should be attained by use of cold and concentrated solutions, mixed with rapid stirring and with precautions to prevent the formation of basic chromate. (See also this J., 1909, 30.)—A. S.

PATENTS.

Pigments; Process for producing — A. Moffatt, Assignor to Alba Manufacturing Co., Indianapolis, Ind. U.S. Pats. 911,832 and 911,833, Feb. 9, 1909.

(1). A PIGMENT consisting of co-precipitated barium sulphate and zinc oxide is prepared by adding barium chloride and zinc sulphate consecutively to a mixture of water and excess of calcium oxide, in proportions equivalent to the dissolved calcium oxide. The water is then allowed to become saturated once more with calcium oxide, and the operations repeated. (2). The precipitate obtained by the interaction of solutions of calcium oxide and zinc sulphate is treated with barium chloride solution.—C. A. M.

Also colouring matter. Eng. Pat. 28,272. See IV.

(B.)—RESINS, VARNISHES.

Rosin; Stability of — at slightly elevated temperatures. C. H. Rerty and W. S. Dickson. J. Ind. and Eng. Chem., 1909, 1, 68—69.

SCHWALBE (this J., 1905, 1214) found that American rosin decomposes when heated at 120°—140° C., with liberation of carbon dioxide. The authors find that if freshly-prepared American rosin be freed from traces of spirits of turpentine—which yields carbon dioxide on heating—it can be heated at 140° C. without any formation of carbon dioxide, provided oxygen and moisture be excluded, for instance in a current of dry nitrogen. With a commercial specimen of rosin, on the other hand, carbon dioxide was formed even on heating in dry nitrogen. The resin acids separated from the oleoresin of *Pinus heterophylla* also yielded carbon dioxide when heated in a current of dry nitrogen to just above the melting point.—A. S.

Japanese lacquer; Drying of — at a high temperature. K. Miyama. J. Coll. Eng., Imp. Univ., Tokyo, 1908, 4, 201—204.

A LAYER of urushiol or of the lacquer hardens within 5 hours at 100° C., within 30 minutes at 150° C., and within 10 minutes at 180° C. (see this J., 1908, 456). This method of drying at a high temperature is used in lacquering metal-work, glass, porcelain, papier-maché, etc., and yields a more durable layer than that obtained by the usual method of drying at the ordinary temperature. In practice, the best results are obtained by thinning the lacquer with turpentine oil or other solvent. As the layer turns brown at a high temperature, lacquers of light colour should be dried at 120°—150° C., and even in the case of dark lacquers the temperature ought not to exceed 180° C. Since the lacquer blackens most pigments, only a limited

number of coloured preparations is available. Of white pigments barium sulphate and bismuth oxychloride are used, the former being preferable when the drying is to be done at a high temperature. In any case the final colour is a greyish or yellowish white. Red lacquers are prepared with vermilion and red oxide of iron; blue with Prussian blue; yellow with cadmium sulphide, lead chromate, and orpiment; green, with chromium oxide; and black with lampblack or (to obtain a more brilliant layer) with iron powder or some compound of iron. A golden coating is obtained by lacquering the article with a mixture of 10 parts of finished lacquer, 1 to 3 parts of gamboge, and 5 parts of solvent, and drying it for about 2 hours in an air-oven at 120° C. Several organic lakes may be used in coloured lacquers, but they are decomposed when heated, and do not yield the proper colours when the coating is dried at a high temperature.—C. A. M.

Spontaneous combustion of wool waste saturated with boiled oil. Nowicki. See XII.

PATENTS.

Turpentine oil from pine oil; Process for the manufacture of resins — O. P. Pellnitz, Breslau, Germany. Eng. Pat. 19,833, Sept. 21, 1908. Under Int. Conv., Sept. 20, 1907.

SEE Ger Pat. 202,254 of 1907; this J., 1908, 1212.—T.F.B.

Extinguishing fires from turpentine. Eng. Pat. 17,156. See III.

(C.)—INDIA-RUBBER, &c.

Rubber; Exports of Pará — from Straits Settlements. Board of Trade J., March 11, 1909. [T.R.]

THE Registrar of Imports and Exports at Singapore reports that 3,659,906 lb. of Pará rubber were exported from Singapore and Penang in 1908, as compared with 2,089,777 lb. in 1907. The countries supplying Pará rubber were the Federated Malay States, Johore, Malacca, and Sumatra, and a small quantity was locally grown. The quantities sent to the various destinations are shown in the following statement:—

To—	1907.	1908.
	lb.	lb.
United Kingdom	1,625,583	3,004,833
Continent of Europe	155,296	310,847
United States of America	4,182	400
Ceylon	231,180	310,489
Australia	31,839	21,419
Japan	11,697	11,569
Total	2,089,777	3,659,906

Rubber exports from Pará, Brazil, in 1908. Board of Trade J., March 4, 1909. [T.R.]

THE exports of rubber from the Consular District of Pará in 1908 were as follows:—

	Fine.	Medium.	Coarse.	Caucho.	Total.
	kilos.	kilos.	kilos.	kilos.	kilos.
Pará	8,804,924	1,216,470	5,609,024	2,936,843	17,514,261
Manáos	9,410,375	1,876,325	2,345,556	4,195,792	17,556,048
Iquitos (transit)	454,800	460,532	209,294	734,458	1,859,093
Itacoatiara	80,800	5,639	48,253	22,363	157,055
Total	18,847,938	3,558,966	8,300,127	6,989,456	37,686,487

The total exports of rubber from the Pará district in 1907 amounted to 37,514,152 kilos, and in 1906 to 34,767,755 kilos.

PATENTS.

Rubber; Treatment of —. [Preparation from latex.] L. Norzagaray, London. Eng. Pat. 2787, Feb. 7, 1908.

RUBBER latex, to which formaldehyde or other preservative may be added in order to prevent premature coagulation or putrefaction, is poured into long trays, fitted in an outer case containing hot water. The latex is then coagulated by the addition of a dilute solution of pyroligneous acid, or of a mixture of acetic and carbolic acids. The coagulum forms a soft spongy mass, which is removed from the tray on to the endless canvas band of an apparatus consisting of two corrugated rollers, actuated by a crank or handle. On this band the rubber is carried between the rollers where it is pressed free from superfluous water. It is claimed that the rubber thus obtained is free from impurities, and contains only a certain percentage of water, which may be removed or not before packing.

—E. W. L.

India-rubber; Manufacture of sheet — and coating or facing fabrics with india-rubber. T. Gare, New Brighton. Eng. Pat. 3112, Feb. 12, 1908.

THE invention embodies a development of the process described in Eng. Pat. 12,454 of 1906 (this J., 1907, 539), and has for its object the production of sheet india-rubber, or of rubber-coated fabrics, in one continuous operation, from powdered or plastic materials (waste vulcanised rubber). The materials are fed in between two endless bands, preferably of steel, or between an inner steel band and the fabric to be coated; these bands are kept taut, and pass over two flanged drums, on the first of which the materials are merely subjected to pressure in order to form them into a compact sheet, and remove air from between the particles, whilst the second drum is provided with means whereby the rubber mass may be heated while still under pressure, and thus formed into a solid sheet, which after being cooled can be removed from between the bands and wound on a suitable contrivance.—E. W. L.

Pura rubber; Manufacture of artificial —. J. Blum and A. W. Carpenter. Fr. Pat. 395,027, Oct. 8, 1908.

SEE U.S. Pat. 904,470 of 1908; this J., 1908, 1214. For the preparation of the iron derivative used in the process, the disintegrated roots of plants of the Iris family are extracted with hot water, the solution treated with chlorine to form a hydrochloride of iron, and the latter converted into a nitrogenous compound by the addition of a suitable substance, preferably an amide. The resulting precipitate is separated after the addition of mineral salts, preferably a mixture of sodium bicarbonate and calcium carbonate.

—C. A. M.

Ebonite capable of resisting the action of chlorine; Manufacture of —. M. Wilderman. Fr. Pat. 395,101, Oct. 8, 1908. Under Int. Conv., Aug. 31, 1908.

RUBBER containing as little resin as possible (not more than 4 per cent.) is mixed with sufficient sulphur to form a product of the composition, $C_{10}H_{16}S_2$, and the mixture is vulcanised as far as possible without interfering with its physical properties. The unsaturated bonds of the poly-prene being saturated with sulphur offer much greater resistance to the action of chlorine. An addition of 5 to 15 per cent. of graphite to the mass before vulcanisation causes the final product to be practically unaffected by chlorine.

—C. A. M.

Elastic or plastic products; Manufacture of —. R. W. Wallace and G. Reynaud. Fr. Pats. 395,214 and 395,215, Dec. 20, 1907.

PRODUCTS resembling caoutchouc, etc., are obtained by placing carbohydrates, such as sugar, in a bath of vegetable oil heated above 200° C., and cooling the viscous mass that is immediately formed. The elasticity of the substance is greater in proportion to the temperature of the bath. To effect vulcanisation the products are incorporated with

sulphur while still liquid and at a temperature sufficient to melt the sulphur. The gum-resins extracted from the bark, etc., of trees belonging to the *Xanthorrhoea* family and of other plants yielding similar gum-resins, may be used instead of carbohydrates.—C. A. M.

Caoutchouc; Synthetic production of —. A. Heinemann. Fr. Pat. 394,795, Sept. 30, 1908. Under Int. Conv., Oct. 2, 1907.

SEE Eng. Pat. 21,772 of 1907; this J., 1908, 1075.—T. F. B.

Caoutchouc; Treatment of —. T. Cockerill. Fr. Pat. 395,181, Oct. 12, 1908. Under Int. Conv., Oct. 12, 1907.

SEE Eng. Pat. 21,441 of 1908; this J., 1909, 210.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Barks; Analyses of —. L. E. Levi and E. V. Manuel. Hide and Leather, Feb. 1, 1909.

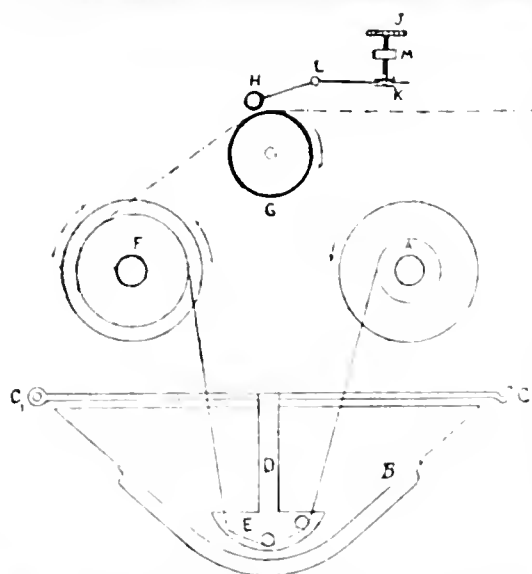
THE following are the results of analyses of a number of American barks:—

Kind.	Soluble solids.	Non-tannin.	Tannin.
	Per cent.	Per cent.	Per cent.
Ludington, Mich.—			
Soft maple	5.40	2.58	2.82
Hard maple	2.05	1.70	0.35
Basswood	2.22	1.60	0.62
Birch	1.61	0.49	1.12
Beech	3.22	2.18	1.04
Oshkosh, Wis.—			
Black ash	4.92	4.81	0.11
Nappanee, Ind.—			
White oak	3.64	1.36	2.28
New Orleans, La.—			
Cypress	1.60	1.10	0.50
E. Jordan, Mich.—			
White pine	3.07	2.08	0.99
Atlanta, Ga.—			
Yellow pine	2.73	1.86	0.87
Bayfield, Wis.—			
Northern spruce	10.69	4.11	6.58
Arizona, La.—			
Red oak	14.49	5.08	9.41
Red oak	16.07	4.95	11.12
Red oak	10.25	4.56	5.39
Red oak (green)	12.18	4.94	7.24
Red oak (green)	8.54	2.85	5.69
Sweet gum	12.00	4.43	7.57
White oak	8.42	3.31	5.11
White oak (green)	7.87	2.71	5.16
White oak (green)	11.60	4.42	7.18
White hickory	17.70	8.22	9.48
White hickory	16.96	7.13	9.83
White hickory	9.38	4.43	4.95
White hickory (green) ..	12.97	6.49	6.48
White ash	32.14	27.65	4.49
White ash (green)	10.05	5.32	4.78
Yellow pine (short leaf) ...	7.53	4.15	3.38
Yellow pine (short leaf) ...	8.02	2.35	5.67
Chestnut oak	7.57	3.02	4.55
Cypress	4.32	2.61	1.71
Burr oak (green)	9.00	3.38	5.62

Tanning extract; Testing of —. A. Gansser. Collegium, 1909, 37—41.

THE author points out that there is at present no reliable and sufficiently sensitive method for testing the colour of tanning extracts—an exceedingly important factor in the control of extract manufacture. (See this J., 1909, 101, 211.)

A new method is therefore suggested. If cotton is treated with hide substance or gelatin, an artificial product is obtained, which is coloured by tanning extracts the same tint as hide itself, but is far more constant than the latter and shows greater sensitiveness to small colour differences in an extract. This "animalised cotton" is prepared in the following way:—A cotton of fine texture, 1 mm. in thickness, is cut into strips, 11 cm. wide and 20 m. long, passed through boiling water, pressed, and then wound on a spool. This spool, A (see fig.), is placed in a frame above a jacketed tin vessel, B. On two parallel bars C, C₁, which lie on the inner wall of the



vessel, two rims, D, are fastened, from which three glass tubes, E, are suspended. The vessel is filled with a 1 per cent. formaldehyde solution, and the cotton is drawn from spool, A, under E and wound on to spool, F. The formaldehyde is then removed and replaced by a 6 per cent. solution of gelatin (mark I and K). The cotton is drawn four times through the gelatin solution, which is kept at a temperature of 60–65° C., and is then carried over a revolving copper cylinder, C. A smaller copper cylinder, H, is attached to a lever, HJK. By means of the screw, J, the roller, H, can be brought to bear against the cylinder, G. Between the two cylinders, two small pieces of copper plate are placed, the distance between them being adjusted to exactly 1 mm., so that all superfluous gelatin is removed from the cotton. After cooling, the cotton is laid horizontally on trestles and allowed to dry in a dust-free room. A colour test is carried out in the following manner:—10 c.c. of a tanning extract (25 B.) are dissolved in 20 c.c. of water, giving a liquor of about 6 B. The "animalised cotton" is cut into pieces weighing 2½ grms. each, and two of these are soaked in water at the ordinary temperature, rolled into a cylindrical shape, and placed in the liquor. After standing a short time, the cotton flattens out, and along with the liquor it is transferred to a glass cylinder. This is fixed into a frame revolving 25 times per minute and left to agitate for 12 hours. The completely tanned cotton is thoroughly rinsed in running water for 10 minutes, and then lightly pressed. The material is dried in the same way as leather, gradually increasing the temperature up to 30° C. By pressing the material when dry, a better finish is said to be obtained on the test sample.—S. H.

Locust bean. Lamb and Farrell. See V.

Partial hydrolysis of proteins. Abderhalden. See XVIII. J.

XV.—MANURES, &c.

Soil acidity in its relation to lack of available phosphates. C. W. Stoddart. J. Ind. and Eng. Chem., 1909, 1, 69–74.

It has been shown previously (Whitson and Stoddart, J. Amer. Chem. Soc., 29, 757) that, in general, acid soils need a phosphate fertiliser. In order to ascertain whether this lack of available phosphate in acid soils is due, at least in part, to the solution of phosphates by the free acid present, with subsequent precipitation as insoluble phosphates of iron and aluminium, samples of twelve soils were treated with: (1), a 1 per cent. solution of sodium hydroxide at 100° C.; and (2), N/5 nitric acid

at 40° C. Control experiments showed that the caustic soda solution dissolved from wavellite (basic aluminium phosphate), 99.4 per cent.; from dufrénite (basic iron phosphate), 90.4; and from apatite (calcium phosphate), 8.1 per cent. of the total phosphoric anhydride. N/5 nitric acid, on the other hand, dissolved 95.4 per cent of the phosphoric anhydride from apatite, 4.4 from dufrénite, and 9.1 per cent. from wavellite. The results of the experiments showed that acid soils contain more of their total phosphoric acid in the form of iron and aluminium salts and less in the form of calcium phosphate than do non-acid soils, and especially show a higher ratio of iron and aluminium phosphates to calcium phosphate than the latter. It is pointed out that N/5 nitric acid forms a good indicator of soil needs with respect to phosphates, owing to its action as a selective solvent for calcium phosphate. In the case of Wisconsin soils, if the percentage of phosphoric acid soluble in N/5 nitric acid is less than 0.015, then the soil will respond to phosphate manuring. It was also observed that as the amount of humus in a soil decreases, the percentage of phosphoric acid in the humus increases, apparently indicating that phosphoric acid in this form is unavailable to plants.—A. S.

PATENT.

Fertiliser: Production of a —. O. F. Carlson. Fr. Pat. 395,197, Oct. 13, 1908. Under Int. Conv., Nov. 9, 1907.

A MIXTURE of crude phosphate with calcium cyanamide, calcium dihydrazide or both, is treated with sulphuric acid, as in the manufacture of superphosphates, with the object of obtaining a fertiliser containing phosphoric acid soluble in water and nitrogen in a form readily assimilated by plants.—C. A. M.

XVI.—SUGAR, STARCH, GUM, &c.

Sugars: Colour reactions of indolic substances with —. J. Guezda. Compt. rend., 1909, 148, 485–487.

TEN c.c. of a concentrated aqueous solution of dextrose are heated to brisk ebullition and treated with 2 drops of caustic soda solution, 6–10 mgrms. of dry α -methylindole then being added at once. After thoroughly distributing the methylindole throughout the liquid, the whole is allowed to stand for 2 minutes, and then cooled rapidly. Two drops of fuming hydrochloric acid (sp. gr. 1.12, acid of this concentration being essential) are now added, and, when the liquid has become light in colour a further quantity of 3 c.c., or slightly more, of the same acid is added. The reaction yields a fine, green precipitate, which, if the operation has been carefully executed, consists of two green substances: if too much hydrochloric acid has been used, the precipitate also contains a resin. Attempts to isolate a body of definite melting point from the precipitate were unsuccessful. The author considers that the reaction should be of value in connection with the chemistry of chlorophyll, and describes the reactions obtained with various sugars, both at the ordinary temperature, and also when the hydrochloric acid is allowed to act on the liquid heated to at least 85° C. The following compounds yield green precipitates from cold solution:—*i*-Xylose, *i*-arabinose, rhamnose, dextrose, mannose, galactose, levulose, "gambiose," maltose, and lactose; under the same conditions, glucosamine (hydrochloride) gives a red precipitate. From the hot solution, rhamnose, dextrose, galactose, levulose, and lactose yield green precipitates, *i*-arabinose, "gambiose" and glucosamine (hydrochloride) yield red precipitates, whilst with *i*-xylose, mannose, and maltose, the colours of the precipitates are Bordeaux red, brown, and violet-grey respectively. Sucrose, raffinose, inositol, and amygdalin do not give precipitates either from cold or hot solution. Whilst in the hot solution, dextrose gives a green precipitate with α -methylindole, azure-blue, and brown precipitates are obtained with N-methylindole and β -methylindole respectively.—L. E.

Methylpentoses and pentoses; Detection of —. L. Rosenthaler. Z. anal. Chem., 1909, 48, 165—172.

SEVERAL methods have been proposed for detecting methylfurfural in the mixture of this substance and furfural obtained by distilling a mixture of methylpentose and pentose with hydrochloric acid. The Maquenne-Tollens method consists in heating the distillate with alcohol and sulphuric acid, a green coloration and absorption band between the green and blue indicating presence of methylfurfural; the same band is obtained by the Widtsch-Tollens method (this J., 1900, 172). It may also be obtained by merely heating the methylpentose with concentrated hydrochloric acid, and 0.44 mgrm. of rhamnose may thus be detected with certainty; in presence of much pentose, the test is less sensitive, but 0.44 mgrm. of rhamnose shows the reaction even in presence of 10 times the quantity of xylose. The following is another method for detecting methylpentoses in presence of pentoses:—The substance is heated for 10 minutes in a boiling water bath with about 10 c.c. of concentrated hydrochloric acid and about 1–2 c.c. of acetone: methylpentoses give a red colour and a band which covers the D-line and extends somewhat to right and left of it. The colouring matter can be extracted with a liquid phenol such as guaicol. By the above method (also applicable to detection of methylfurfural in distillates) 0.15 mgrm. of rhamnose can be detected even in presence of 10 times as much pentose. The latter, on heating with hydrochloric acid and acetone, gives a reddish colour at first, but, in the course of 10 minutes, brown liquids, with no characteristic spectrum, are produced. With prolonged heating, the colour and band characteristic of methylpentoses, gradually disappears. The author also describes another test for pentoses in presence of methylpentoses. The distillate obtained on heating with hydrochloric acid is treated with about an equal quantity of concentrated hydrochloric acid and a few small crystals of resorcinol, and at once examined spectroscopically. If sufficient furfural is present, it is observed that whilst the liquid gradually darkens, a large part of the right half of the spectrum becomes obscured, but an absorption band soon appears in the red, which, increasing in breadth, gradually fills the previously bright space in the centre: with a lower concentration of furfural, this extension may not occur. If the whole spectrum is obscured, a precipitate is gradually thrown out of solution; after the lapse of 10 minutes, the liquid is diluted with water and filtered, the precipitate is washed with water, and dissolved in glacial acetic acid; the filtered solution shows the absorption band between C and D. Pyrogallol acts similarly to resorcinol. The author has applied the above, and other tests, to various natural gums, gum-resins, and glucosides. The resorcinol-, aniline-, and phloroglucinol tests for pentoses all gave positive results in every case. The acetone reaction for methylpentoses was found to be less sensitive than the Maquenne-Tollens reaction, the latter being less sensitive than the Widtsch-Tollens reaction.—L. E.

PATENTS.

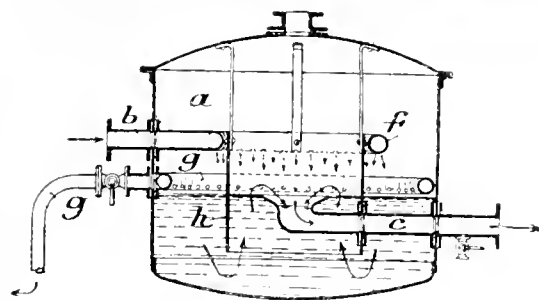
Sugar; Process of producing —. M. Altolaguirre and J. Zubillaga. U.S. Pat. 910,037, Jan. 19, 1909.

DRY, low-grade sugar (of about 86° polarisation) is mixed in a receptacle, provided with suitable stirring apparatus, with 4.5–10 per cent. of ordinary sugar syrup containing about 45 per cent. of water. The mixture is transferred to a vacuum pan, and syrup, similar to that before mentioned, is added, or the mixture may be introduced into the pan over a mass of grained or grained and concentrated contents and the syrup then added. As a result of this treatment, the crystals of the low-grade sugar increase in size and a product of high polarisation is obtained.

—L. E.

Sugar juice or similar liquids; Continuous refining and evaporating apparatus for —. F. Tiemann. Ger. Pat. 206,045, Oct. 17, 1907.

In order to remove the impurities which rise to the surface in the evaporation of sugar juice and similar liquids, a special separator is used (see Fig.). It consists of a



chamber, *a*, divided by the annular partition, *b*, into inner and outer compartments. The juice from the evaporator is introduced into the outer compartment by the pipe, *b*, *f*; the impurities rise to the surface, so that only clear juice enters the inner compartment, from which it flows away through the pipe, *c*. The impurities are removed through the pipe, *g*.—A. S.

Starch; Process for the production of soluble —. F. Fritsche, Assignor to Stolle und Kopke, Rumburg, Austria-Hungary. U.S. Pat. 910,521, Jan. 26, 1909.

SEE Eng. Pat. 1351 of 1908; this J., 1908, 869.—T. F. R.

Evaporating apparatus. Eng. Pat. 20,972. See 1

Filtration of liquids [sugar juice]. Ger. Pat. 206,408. See 1.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt extract; The increase in — produced by pre-mashing the malt. W. Windisch. Woch. f. Brau., 1909, 26, 93–97, 109–117.

THE influence of varying the length of time during which the malt lies in cold mash at the ordinary temperature has been investigated. Malts prepared from barley at different stages of growth, from chitting onwards, as well as commercial malts were employed. It was found that at the ordinary temperature the maximum yield of malt extract was obtained in nine hours when properly modified commercial malts were employed, and that the excess of yield obtained above that produced by the standard method of mashing was but small. With under-modified malts, and dried, partly germinated barleys, on the other hand, the yield continued to increase up to the limit of time, fifteen hours, allowed in the experiments, and the excess obtained amounted in the case of the chit-malt to 8 per cent. The influence of the heat at which the mash stood was examined in a commercial malt mashed at various temperatures from 15° C. to 90° C. allowing at each temperature "stands" of three and nine hours. The highest yields, 1.95 and 2.37 per cent. excess, were found with the 3 and 9 hour "stands" at 50° C., the yields increasing with rising temperature to this point and falling away when it was exceeded. The nature of the substances contributing to produce this increase in extract has been studied in several cases and the results show that the extra yield consists chiefly of protein, pentosans, and ash: a part only is due to additional solution of starch and to the solution gravity of the maltose which is produced as a consequence of the pre-mashing. The author regards the pre-mashing method as a continuation of, and partial substitute for, "flooring" in malt, and considers it affords a quick, simple, and economical method of obtaining complete modification of the barley endosperm, thus enabling maximum yields of extract to be obtained from very under-grown malts and reducing the malting time and loss. (See also this J., 1909, 34, 151, 213, 254.)—R. L. S.

Enzymes; Plant —. W. W. Bialosuknia. Z. physiol. Chem., 1909, 58, 487–493.

THE author has examined the seeds of various plants belonging to the Papilionaceae and Gramineae, for pro-

teolytic, oxidising, and amylolytic enzymes. The seeds, which were examined both in the ungerminated state and in various stages of germination, were ground to powder, and then dried *in vacuo* over sulphuric acid until the weight became constant. The experiments were carried out at 37.5° C., and under a-septic conditions.

(1) *Proteolytic enzymes*.—The experiments showed that neither the germinated nor the ungerminated seeds contain an enzyme capable of exerting any proteolytic action on egg-albumin. Fibrin was only digested (as shown by the biuret reaction) in presence of 0.2 per cent. solution of potassium hydroxide. With the exception of rye seeds, all the seeds examined, both ungerminated, and in a state of germination, were found to contain an enzyme capable of coagulating milk. The proteolytic enzymes of the seeds act very vigorously on vegetable proteins; they act on the proteins of oats and wheat both in acid and neutral solutions. Seeds of the *Papilionaceæ* contain stronger proteolytic enzymes than those of the *Graminaceæ*. (2) *Oxidising enzymes*.—Water and 10 per cent. glycerol were used for extracting the enzymes from the ground seeds. The experiments, in which various reagents for oxidising enzymes were used, indicated that different seeds vary in respect of the nature of their oxidising enzymes. Wheat was found to present the strongest reactions. (3) *Amylolytic enzymes*.—One per cent. starch paste was treated with the powdered seed. All the seeds examined were found to possess amylolytic power in varying degrees. The conversion of starch into dextrin (erythro-dextrin) was found to progress fairly rapidly at first, but it was also found that the original blue iodine reaction, which gradually turned to reddish-violet, subsequently reappeared again, finally disappearing after a shorter or longer time. Further experiments indicated that this reappearance of the blue iodine reaction is actually due to reversion of the saccharification, i.e., to a synthesis of starch. In the saccharification of starch with rye seeds, it was found that lactose and dextrose are formed.—L. E.

Fusel oil; Co-operation of bacteria in the formation of—. H. Pringsheim. *Biochem. Zeits.*, 1909, 16, 243–245.

Fusel oil ordinarily consists of *n*-propyl, isobutyl, and amyl alcohols, but the author found also isopropyl and *n*-butyl alcohols in a fusel oil prepared on a large scale from maize (see this J., 1908, 824). These latter alcohols are fermentation products of the ordinary butyric acid bacillus, and hence it was inferred that the fusel oil in question owed its formation to two distinct processes, i.e., (1), the action of yeast on the decomposition products of proteins, and (2), butyric acid fermentation. In support of this view, the author now draws attention to an analysis of fusel oil from potatoes, published by Rabuteau in 1878 (*Compt. rend.*, 1878, 87, 500); in this case also, both *n*-butyl and isopropyl alcohols were present in addition to the ordinary constituents of fusel oil.—A. S.

Benzene and salicylic acids in fermented beverages. Robin. See XXIII.

Disposal of liquid refuse from distilleries. Sixth Report of the Royal Commission on Sewage Disposal. [Cd. 4511.]

COMMENCING with some observations on the production of whisky from malt, the report deals with land treatment by pot ale; the destruction of the refuse by heat; its evaporation followed by torrefaction; purification in contact beds; purification by percolation filters; experiments to ascertain its effect on salmon; purification of refuse from grain distilleries; the attitude of riparian proprietors; and the question of standards.

The conclusions arrived at are:—

(1.) It is practicable to treat the waste liquids from distilleries either on land or on filters to produce a satisfactory effluent.

(2.) For treating these liquids, percolating filters are more efficient than contact beds, and it appears desirable first to dilute the waste liquids and then to treat them with lime before filtering them.

(3.) It is practicable to destroy pot ale by heat. For this purpose the waste heat of the works may be utilised,

but this alone is only sufficient to destroy about one-third of the pot ale produced.

(4.) It is practicable to evaporate pot ale and then to incinerate the syrup so as to produce manure which at present sells fairly well at about £5 per ton. The revenue from the sale of such manure falls far short of the expenditure required to produce it. There is some risk of atmospheric nuisances with these destructor and evaporation processes, as at present carried on, and the distillate from the evaporation process would be liable to cause a nuisance if discharged into a small stream.

(5.) The cost of the various methods of dealing with the waste liquids from distilleries would depend largely on local circumstances. Where suitable land was available at an agricultural price, land treatment would be the most economical process to adopt, but great care would be required to secure that the land is not overdone and that the waste liquids are properly distributed over it.

Of the artificial processes, the plan which has been carried out at Coleburn would be considerably cheaper than any of the destructor or evaporation processes, especially in view of the fact that these processes only deal with pot ale. So that where they are adopted further means must be provided for purifying the other waste liquids. Skilled supervision would be required in all cases, but especially in the case of the process which has been carried out at Coleburn.

(6.) The Central Authority, which the Commissioners recommended to be constituted, should be the final tribunal to determine all questions relating to standards.

(7.) In the case of distilleries situated in towns which are sewered, as a general rule, the liquid refuse should be allowed to enter the sewers. Its admission to the sewers should be subject to regulations and safeguards as recommended in the Third Report dealing with the relations between local authorities and manufacturers in regard to the disposal of manufacturing effluents.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Canned foods; Presence of tin [and determination] in certain—. G. S. Buchanan and S. B. Schryver. Local Government Board Report, No. 7, 1908, 1–130.

THE investigation was carried out for the purpose of ascertaining to what extent canned foods were contaminated with tin, and also the physiological effect of such quantities of tin as were found to be present. One of the authors took daily for one week a quantity of tin salt (the double tartrate of sodium and tin) equivalent to one grain of tin, during a second week two grains daily, and during a third week three grains daily, the doses being administered at meals. There was no evidence of accumulation of tin in the system at the end of the first week, but when two grains were ingested per day, some of the tin appeared to have been absorbed. When the amount taken reached three grains, about two grains were retained in the body during the week. By far the largest amount of the tin taken was excreted with the faeces.

The canned foods examined comprised flesh foods, fish, meat essences and soups, fruits, vegetables, puddings, and jams, the majority of the samples being from five to eight years old. The meat foods, as a class, appeared to have taken up comparatively little tin, the quantity being often less than 0.5 grain per lb.; in only one instance (canned tripe) did it reach 2 grains per lb. A sample of tomato soup contained 3.5 grains of tin per lb., and a sample of lobster 2.39 grains of tin to the lb. The meat extracts examined contained from 0.40 to 5.33 grains of tin per lb., and had absorbed considerably larger quantities of tin than had meats of the same age; it was noticed that large amounts of tin were found when the receptacle contained heads of solder resulting from defective soldering. The largest quantity of tin present in samples of canned pears, peaches, and apricots, which were about 2 years old, was 1.03 grains per lb. It was also

brought out by the investigation that the tin, after solution in the liquid contents of the can, becomes in course of time absorbed in, or chemically combined with, the solid contents (meat, fruit, etc.), so that the latter contain relatively larger quantities than the liquid itself.

From the results of the whole investigation, it is concluded that when food contaminated with tin is eaten, the larger portion of the tin does not become absorbed from the gastro-intestinal tract, and that accumulation of tin in the body under these circumstances takes place at a comparatively slow rate. Whilst it may be concluded that there is not much probability of serious risk of chronic poisoning by the absorption of relatively small quantities of tin as a result of a diet consisting largely of canned foods continued over considerable periods of time, it nevertheless seems clear that in any kind of canned goods, quantities of tin approximating to two grains to the pound are not only unusual but unnecessary, and must be regarded with grave suspicion in consequence of the risk of irritant action of the tin they contain.

It is suggested that sanitary officers, with the co-operation of the public analyst, should pay special attention to canned foods which there is reason to suspect to be of unusual age, e.g., more than one or two years, and, in particular, to such canned goods as are specially liable to act on tin. The presence, in the contents of a sample can, of tin in quantities approaching two grains per lb. may be taken to signify that the food has become potentially dangerous to health, and calls for further examination of other samples with a view to dealing with the consignment in accordance with the results obtained. Some provision for determining the date and place of preparation of canned goods, by means of marks, labels, or otherwise, would be an advantage from several points of view.

For the determination of the tin, 50 grms. of the substance were heated in a round-bottomed Jena flask with 50 grms. of potassium sulphate and 50 c.c. of concentrated sulphuric acid, more of the acid being added, if required to keep the contents of the flask in a fluid condition. When a colourless solution was obtained, it was cooled, diluted with water to about 600 c.c., treated with hydrogen sulphide, and set aside over-night. The mixed precipitate of sulphide, sulphur, and, in some cases, calcium sulphate, was then collected on a filter, washed a few times with water, and the tin contained in it determined as follows:—

Colorimetric process.—The sulphide was dissolved by boiling the precipitate and filter with 5 c.c. of concentrated hydrochloric acid, and the solution filtered into a test-tube, the residue being washed with 2.5 c.c. of concentrated hydrochloric acid. A current of carbon dioxide was next passed into the test-tube and a piece of zinc was added to the hot, acid solution; as soon as the last trace of metal had dissolved, 2 c.c. of the reagent were added, the current of carbon dioxide being continued meanwhile. The reagent was prepared by dissolving 0.2 gm. of dinitrodiphenylaminesulphoxide in 100 c.c. of *N*/10 sodium hydroxide solution, and filtering. After being boiled for a few minutes, the contents of the test-tube were diluted to a volume of 100 c.c., filtered, and the filtrate treated with a drop of dilute ferric chloride solution. The violet coloration produced was then compared with that produced by similarly treating known amounts of tin. This process was found to be useful for sorting purposes and for determining less quantities of tin than 1 grain per lb.; for larger amounts, the gravimetric process was preferred.

Gravimetric process.—The mixed precipitate was dissolved in a small quantity of hot 10 per cent. sodium hydroxide solution, and the sulphide re-precipitated by the addition of glacial acetic acid. The sulphide, thus freed from silica, etc., was then collected on a filter, washed with hot water, dried, oxidised, and weighed as stannic oxide.

—W. P. S.

Vinegar; Determination of mineral acids in — F. Repton. *Monit. Scient.*, 1909, 23, 172—173.

A PORTION of the sample of vinegar is titrated with a solution of calcium succinate, using phenolphthalein as indicator, in order to determine the total acidity. Another portion

of the sample is neutralised with sodium hydroxide free from carbonate, then acidified with phosphoric acid, and submitted to steam distillation until the distillate is free from acidity. The distillate is next titrated with calcium succinate, and, if the acidity thus found corresponds with the total acidity, free mineral acids are in all probability not present in the sample. If there be a difference, sulphuric acid and hydrochloric acid must be determined in separate portions of the sample in the usual way. Nitric acid is not likely to be present. Phosphoric acid is determined by treating a portion of the vinegar with calcium carbonate, evaporating the mixture to dryness, incinerating, and precipitating the nitric acid solution of the ash in the usual manner. The author considers that the process proposed by Richardson and Bowen (this J., 1906, 836) is open to the objection that the incineration converts appreciable quantities of sulphates and chlorides into carbonates, especially in the presence of an excess of an organic acid.—W. P. S.

Proteins; Partial hydrolysis of some — E. Abderhalden. *Z. physiol. Chem.*, 1909, 58, 373—389.

THE author partially hydrolysed edestin from cotton seeds, keratin from wool, elastin, and hæmoglobin by means of 70 per cent. sulphuric acid, and attempted to isolate definite compounds from the reaction products by means of precipitation-reactions with phosphotungstic acid, mercury sulphate, and silver nitrate. From edestin three substances of constant composition were isolated, which on complete hydrolysis yielded respectively: (1), glutamic acid and tryptophan; (2), tryptophan, glutamic acid, and leucine; and (3), tyrosine, glycocoll, and leucine. Attempts are now being made to prepare similar substances synthetically from the components in order to compare their properties with those of the products obtained from edestin. Substances were also obtained, but not in a pure condition, from elastin, hæmoglobin, and keratin of a simpler constitution than the proteins themselves. From the mother-liquor of *D*-alanyl-*L*-leucine from elastin (see Fischer and Abderhalden, this J., 1907, 1165), the author succeeded in isolating *L*-leucyl-*D*-alanine identical with the synthetic product.—A. S.

Benzoic and salicylic acids in milk. Robin. See XXIII.

PATENTS.

Flour; Process for bleaching and ageing — J. A. Wesener. Fr. Pat. 394,636, April 18, 1908. Under Int. Conv., April 20, 1907.

SEE U.S. Pat. 863,684 of 1907; this J., 1907, 1025.—T.F.B.

Coffee extract; Process and apparatus for making — W. Wislocki. Fr. Pat. 394,801, Sept. 30, 1908.

SEE Eng. Pat. 28,418 of 1907; this J., 1908, 587.—T. F. B.

(B.)—SANITATION; WATER PURIFICATION.

Dust-laying oils for the floors of printing and type-casting establishments; Composition, properties, and application of — R. Heise. *Arbb. Kais. Gesundh.-Amt*, 1909, 30, 93—177. *Chem. Zentr.*, 1909, 1, 699—700.

OF 31 oils examined by the author, 26 were insoluble in water, and 4 were soluble in, or formed emulsions with, water. Of the insoluble oils, 13 consisted wholly of mineral oil; the others contained besides mineral oil, certain quantities (up to 13.5 per cent.) of fatty oils (linseed oil, rape oil, and in one case lanolin), and also in some instances, perfumes, colouring matters, and disinfectants. In one sample, nitrobenzene was detected. A preparation intended for use on linoleum consisted of turpentine oil and paraffin wax; it left behind a solid residue possessing practically no dust-fixing power. The "soluble" oils contained from 46.2 to 82.6 per cent. of mineral oil, rendered soluble or emulsifiable by means of oleic acid soaps, rosin soap, or sulphonated fatty acids. One soluble preparation consisted of an aqueous solution of magnesium chloride and vegetable extractive substances. The author considers that according to present experience the most useful preparations are those consisting entirely of non-

drying oils: mineral oils are most satisfactory. The oil should have a viscosity between 30 and 40 at 20° C. referred to water at 20° C.—A. S.

Nitrites; New reaction for — in drinking water. A. Rochaix. *L'Union pharm.*, 1909, 50, 62—63.

The reagent employed is an aqueous solution of 0.2 gm. of the dyestuff, "neutral red" or "toluylene red" (symmetrical dimethyldiaminotoluphenazine hydrochloride) in 1 litre of water. To 20 c.c. of this reagent, 10 c.c. of the water are added, and 1 to 3 c.c. of 20 per cent. sulphuric acid solution. On agitating, the red to violet colour passes to clear blue in the presence of nitrites. The test is very sensitive; a distinct reaction is given with 0.05 mgrm. of nitrous acid in a litre of water. The sulphuric acid used should be diluted, as indicated, for strong acid would give a blue reaction in the absence of nitrites. Alkaline waters change the initial red tint to yellow, but this does not affect the ultimate appearance of the blue colour due to nitrites.—J. O. B.

PATENTS.

Water; Purifying — by the removal of sulphur [sulphates].

R. Reichling, Königshof-Krefeld, Germany. Eng. Pat. 20,591, Sept. 30, 1908. Under Int. Conv., Oct. 1, 1907.

The removal of sulphates from water is accomplished by the addition of barium carbonate in presence of carbon dioxide, either by allowing water, saturated with the latter, to flow through barium carbonate before adding it to the main body of the water, or by treating the whole of the water with carbon dioxide in presence of barium carbonate, or in other ways. The bicarbonates of calcium and magnesium formed in the process are precipitated by the addition of lime.—E. W. L.

Water; Process for removing sulphur [sulphates] from —. R. Reichling. Fr. Pat. 391,879, Sept. 29, 1908. Under Int. Conv., Oct. 1, 1907.

SEE Eng. Pat. 20,591 of 1908; preceding.—T. F. B.

(C).—DISINFECTANTS.

Disinfecting power of a mixture of spirits of turpentine, phenol, naphthalene, and ether. ("Essence of turpentine d'Oukraina"). E. S. Gribinouk. *Arch. sci. biol.*, St. Pétersb., 13, 470—482. Chem. Abs., 1909, 3, 453—454.

The mixture, used by the author in medical practice, consists of crystallised phenol (2 grms.), crude naphthalene (5 grms.), ether (25 grms.), spirits of turpentine (100 grms.). The naphthalene is dissolved in the ether, the phenol added, and after a complete solution of these, the turpentine is added. The bactericidal action of the mixture is greater than any of its constituents. The following organisms were killed by it, and in the following order:—*Cholera vibrio*, *B. typhi*, and *Staphylococcus albus*. Emulsions of 1:4.2—100 were used. Greater dilutions (1:500—1000), form better emulsions.

Emulsification. Marshall. See XXIV.

XIX.—PAPER, PASTEBOARD, &c.

Paper-making materials and their conservation. F. P. Veitch. U.S. Dept. Agric., Circular No. 41, Dec., 1908.

In the United States the exhaustion of the readily available supplies of pulp wood is within measurable distance. In 1907, 3,962,660 cords of wood were used, yielding 2,547,879 tons of pulp. Economies of the present supplies of wood and the development of other fibrous materials must therefore be considered. As a rule the cost of chemicals and the time of digestion are higher in the case of wood pulp than in the case of other fibres. On the other hand, wood is cleaner, can be dealt with in larger charges, and requires less beating than most other fibres. Good papers of medium grade can probably now be manufactured more cheaply from wood than from other fibres, so that the first cost of any "new" fibre, delivered at

the mill, must be correspondingly lower than that of raw wood. But besides the cost of the raw fibre and the cost of its treatment, the yield of paper obtained must be included in the calculation, and when all these factors are considered, such materials as cereal straws, maize stalks, bagasse, and cotton stalks must, except under special circumstances or for special purposes, remain in the background until cheaper sources are exhausted. Among such special circumstances, there would be included exceptional facilities for collection and transport of the materials to a centre where they could be worked economically. The author proceeds to indicate the materials which should, in his opinion, be developed immediately for relieving the threatened shortage of pulp wood. In the first place comes the "lumber waste," i.e., the trees and portions of trees too small for constructional purposes which are at present left in the forest in the felling of timber wood. Such wastes are estimated to be capable of yielding annually 12,000,000 cords of wood suitable for pulping. This would probably constitute the cheapest source of "new" paper-making material. Next, in a relatively small area of the Northern Central States, about 3,000,000 acres are under cultivation for flax, and at the rate of 1 ton of flax straw per acre, with a yield of 400 lb. of fibre per ton of straw, material for 480,000 tons of strong wrapping or even perhaps white papers should be readily collected. Again, if the "scutching waste" produced from the jute, manila, and sisal fibres imported into the United States could be collected and utilised, material for a further 120,000 tons of strong paper should be available. The total production of vegetable textiles (including ropes, etc.), in the United States is estimated to be 2,030,000 tons per annum. The waste textiles consumed by the paper mills amount to only 400,000 tons, of which 200,000 are imported. Of the balance of 1,800,000 tons, at least 1,000,000 tons should be capable of collection if only the importance of their conservation could be impressed on the people. Again, the annual production of paper in the States is 3,000,000 tons, of which 80 per cent. becomes waste in 3 or 4 years. But the paper mills of the country recover only 580,000 tons of waste paper annually for re-making. Here also there should be at least another 1,000,000 tons of raw material readily available. Only when these immediate and obvious sources fail, can the more costly "new" fibres come into prominence. When these supplies are no longer adequate, it may be necessary to cultivate certain quick-growing materials primarily for paper-making. Finally the author expresses the opinion that paper itself might be economised; that, on the whole, paper-makers fail to develop the full qualities of the fibres they consume. Most papers could be made from 10 to 20 per cent. lighter than they are without using better materials, and 2,250,000 tons of paper of better quality and lighter weight might be made to do the same service now performed by 3,000,000 tons.

—J. F. B.

Sulphite pulp; Determination of resin in —. E. Opfermann. *Z. angew. Chem.*, 1909, 22, 436.

For the estimation of resin in sulphite pulp the method used by the Königl. Materialprüfungsamt in Grosslichterfelde, which consists in extracting 20 grms. of air-dried material with ether in a Soxhlet apparatus for 5 hours and drying the residue at 98°—100° C. until constant in weight, should be adhered to, as if alcohol is used instead of ether, a considerably higher result is obtained.

—J. C. C.

Soda ash [from cellulose digestion]; Causticising of recovered —. W. Schacht. *Papier-Zeit.*, 1909, 34, 351—353.

The complications of the causticising process, when applied to the soda ash recovered from the digestion liquors in the manufacture of cellulose, are well known; they relate chiefly to the concentration of the solution treated and the presence of impurities, particularly the silicates and sulphur salts. The constitution of the precipitate formed (the so-called "lime-mud") is of primary importance as affecting the economy of the process. Denser

precipitates are obtained by the use of pure soft waters than with very hard waters, or waters containing humus matters. Very pure "fat" limes give a higher degree of causticity than "lean" limes, but the latter are more economical because they give a denser precipitate, from which the sodium salts are more readily washed out. It is of the highest importance to determine and employ that ratio between lime and sodium salts which gives the highest efficiency. The lime should be used in lump form and introduced into the soda solution after the latter has been heated to 80°—85° C. The temperature should be maintained at this point, since at lower temperatures the reaction is incomplete and at higher temperatures changes take place in the silicates which adversely influence the clarification of the lye. Strontium oxide gives a far more efficient causticisation than lime, but alone it is too costly. When used in the theoretical proportions, strontium oxide not only effects a far greater conversion of the carbonate than lime does in equivalent proportions, but it also causticises a larger portion of the silicates, as well as about three-fourths of the sulphate which is quite unattacked by lime. In spite of the higher cost of strontium oxide, a real economy can often be effected by performing the causticising operation in two stages, doing the bulk of the work with lime, decanting the liquor and adding to it the calculated quantity of strontium oxide necessary for the conversion of the residual non-caustic sodium salts.—J. F. B.

Cellulose hydrates. H. Ost and F. Westhoff. *Chem.-Zeit.*, 1909, 33, 197—198.

Cross and Bevan have applied the name of "hydrates" to those modifications of cellulose containing, in addition to hygroscopic moisture, which is dependent on atmospheric conditions, "water of hydration" which is dependent on their constitutional modification and is more firmly held than ordinary hygroscopic moisture. Thus they have indicated for mercerised cotton the formula $(C_6H_{10}O_5)_2 \cdot H_2O$, and for the cellulose regenerated from viscose the formula $(C_6H_{10}O_5)_n \cdot H_2O$. In the case of the hydrocelluloses, on the other hand, the cellulose has permanently entered into chemical combination with water to form new derivatives, and such products can be termed "hydrates" only in the same sense as the dextrins, maltose, etc., might be termed "hydrates of starch." Schwalbe (this J., 1907, 1291) has endeavoured to distinguish between hygroscopic moisture and water of hydration by assuming that the former is entirely expelled at 100° C., whilst the latter is only driven off at the temperature of boiling toluene; but such a distinction has been found to be invalid. The exact determination of hygroscopic moisture in members of the cellulose and starch groups is a very difficult problem. Small progressive losses of weight are recorded as the temperature of drying is increased from 100° to 130° C., no absolutely fixed point being reached in any case. A number of determinations carried out by the authors have led them to conclude that, at a temperature of 125° C., the true hygroscopic moisture may be determined with an error of ± 0.1 per cent. The best results are obtained by slowly increasing the temperature up to a maximum of 125° C., in a current of dry hydrogen or carbon dioxide. But under whatever conditions the desiccation be effected, it is universally recognised that the hydrated celluloses (mercerised cotton, viscose-cellulose, etc.) contain considerably more, and the hydrocelluloses rather less hygroscopic moisture than normal cotton cellulose. The authors, however, do not recognise the existence of "water of hydration," as distinct from hygroscopic moisture, as a constitutional component of these modified celluloses. They have proved by a large number of elementary analyses that, after the hygroscopic moisture has been expelled by drying at a temperature of 120°—125° C., mercerised cotton and the cellulose regenerated from viscose both possess the same empirical formula, $(C_6H_{10}O_5)_n$, as normal cotton cellulose. This applies only when the cellulose is regenerated from the viscose after a short time. In the case of "aged" or ripened viscose, the cellulose undergoes gradually a true hydrolytic change under the continued action of the alkali, with the result that, after 3—4 weeks, the regener-

ated cellulose no longer possesses the normal composition, but contains more hydrogen and less carbon, as in the case of the hydrocelluloses, to which group these degraded products presumably belong. It is noted that starch also undergoes hydrolysis under the prolonged action of alkalis, yielding an analogous series of products.—J. F. B.

PATENTS.

Bayasse; Treatment of — [to make paper pulp]. T. J. Hutchinson. Fr. Pat. 391,670, Sept. 11, 1908. Under Int. Conv., Sept. 11, 1907.

SEE Eng. Pat. 20,266 of 1907; this J., 1909, 105.—T. F. B.

Resin soap solutions. Fr. Pat. 395,177. See XII.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Senecio latifolius; The alkaloids of —. H. E. Watt. *Chem. Soc. Proc.*, 1909, 26, 68.

THE author has made a chemical examination of *Senecio latifolius* (N.O. *Compositæ*), a poisonous plant which grows in South Africa, collected before flowering and also after flowering, and has isolated two new alkaloids of the formulae, $C_{16}H_{27}O_8N$ and $C_{18}H_{35}O_7N$, respectively, for which the names *senecifoline* and *senecifolidine* are proposed. The proportion of these substances present in the plant before flowering is equivalent to 1.20 per cent., whilst in the mature plant it only amounts to 0.49 per cent. *Senecifoline* crystallises in colourless, rhombic plates, which melt at 194—195°, and has $[\alpha]_D = +28^\circ 8'$; it forms well-defined salts with nitric, hydrochloric, or hydriodic acids, and also an *aureichloride*. It can be decomposed by alkali into a hitherto undescribed dicarboxylic acid, $C_{10}H_{16}O_6$, which it is proposed to name *senecifolic acid*, and a new base, $C_8H_{11}O_2N$, for which the name *senecifolinine* is suggested. *Senecifolidine* crystallises in colourless, rhombic plates, which melt at 212°, and has $[\alpha]_D = -13^\circ 56'$; it differs considerably from *senecifoline* in other physical respects, and forms salts corresponding with those mentioned above.

Canadian hemp; The constituents of —. Part II. Cynotoxin. (Preliminary note.) H. Finckmore. *Chem. Soc. Proc.*, 1909, 26, 77.

THE aqueous solution of the alcoholic extract of the root of commercial *Apocynum cannabinum* (this J., 1908, 829) yields on extraction with chloroform, after removing the apocynin with ether (*loc. cit.*), a relatively small quantity of an intensely active substance (cynotoxin), which produces symptoms identical with those caused by the drug itself. *Cynotoxin*, $C_{20}H_{32}O_6$, is a well-defined, colourless substance, which crystallises in small, apparently rhombic pyramids, and melts and decomposes at about 165°. It is sparingly soluble in water and the usual organic solvents, and extremely bitter in taste. Pharmacological investigation by P. P. Laidlaw, has shown that it is an extremely potent drug of the digitalis class and that the pharmacological properties of apocynin (acetovanillone, *loc. cit.*) are negligible. The chemical and pharmacological properties of cynotoxin are still under investigation; it is already evident, however, that it is a dilactone, either of Kiliani's digitic acid, $C_{20}H_{32}O_8$ (this J., 1891, 567), or of a closely related isomeride.

Quinine and its associated alkaloids; Some notes on —. E. Goldsmith. *J. Franklin Inst.*, 1909, 167, 90—98.

A BRIEF account, chiefly historical, of the manufacture of quinine and associated alkaloids.—A. S.

Quinine; Determination of — in quinine tannate and ferrocitrate. E. Rupp and W. Calliess. *Apoth.-Zeit.*, 1909, 24, 159.

1.2 GRMS. of quinine ferrocitrate are warmed with 5 grms. of water; when cold, 5 grms. of sodium hydroxide solution of sp. gr. 1.165 are added and exactly 31 grms. of ether (sp. gr. 0.720); the containing flask is well corked and the contents thoroughly agitated for a few minutes; 0.5 grm.

of powdered gum tragacanth is then added, and agitation repeated, as before. The mixture is then set aside for 5 minutes to clarify, after which exactly 25.1 grms. of the clear ether solution are decanted into a tared capsule. After evaporating the ether, the residue is dried on the water-bath till of constant weight. It represents the amount of quinine in 1 gm. of the ferro-citrate. For quinine tannate the general process is the same as above, but 10 grms. of potassium carbonate solution of sp. gr. 1.330 are used to liberate the alkaloid; 30 grms. of ether are taken and 25.3 grms. of the ethereal quinine solution are decanted for evaporation. The residue, from 1 gm. of the original tannate, should not weigh less than 0.3 gm.

—J. O. B.

Nicotine silicotungstate and determination of nicotine. G. Bertrand and M. Javillier. *Bull. Soc. Chim.*, 1909, 5, 241—248.

The authors have obtained good results with silicotungstic acid as a reagent for the detection and determination of nicotine (see this J., 1899, 404). When dried at 30° C., nicotine silicotungstate has the composition, $12\text{W}(\text{O}_3)_2\text{Si}_2\text{O}_7 \cdot 2\text{H}_2\text{O} \cdot 2\text{C}_{10}\text{H}_{11}\text{N}_3 + 5\text{H}_2\text{O}$; it can be completely dehydrated by heating for 1 hour at 120° C. With a solution containing 1 part of nicotine in 300,000 and 0.1 per cent. of hydrochloric acid, a 5 per cent. solution of potassium silicotungstate produces an immediate turbidity; whilst in solutions containing 1 part of alkaloid per million and up to 8 per cent. of hydrochloric acid, a crystalline precipitate is produced after standing for one or more days. For the determination of nicotine in tobacco, 12 grms. of the sample are boiled for 30 minutes with 300 c.c. of 0.5 per cent. hydrochloric acid under a reflux condenser; the solution is then cooled, the insoluble matter removed in a centrifugal machine or by filtering, and 250 c.c. of the clear liquid treated with a 10–20 per cent. solution of potassium silicotungstate. The precipitate is collected, after 24 hours if the quantity of alkaloid be small, and washed with water to which has been added a little hydrochloric acid and a few drops of the precipitant. It is then mixed with calcined magnesia, and the liberated alkaloid removed by distilling with steam. In the distillate the nicotine is determined by titration with sulphuric acid.

—A. S.

Colechicum corn? Simple methods for the assay of —. A. B. Lyons. *Amer. Drugg.*, 1909, 54, 65.

TWENTY-FIVE GRMS. of colechicum corn, in moderately fine powder, are digested at 50° C. for 6 hours with 80 c.c. of distilled water and 15 c.c. of basic lead acetate solution. The mixture is then transferred to a funnel or percolator, and percolated so that about 2 c.c. pass per minute. When drained, more warm water is added in 20 c.c. portions, until 250 c.c. of percolate have been collected. Five grms. of powdered sodium phosphate are then added, and the precipitated lead phosphate is filtered off. 100 c.c. of the clear filtrate (= 10 grms. of drug) are shaken out successively with 25, 20, and 15 c.c. of chloroform, or enough to extract all the colechicine. The solvent is evaporated off, the residue being evaporated repeatedly with a little alcohol to carry off the last traces of chloroform, and then dried below 100° C. till of constant weight. An alternative volumetric method is that of Heikel (see this J., 1909, 106).—J. O. B.

Rhamnus cathartica, L. [*buckthorn*]; *Chemical examination of the berries of* —. N. Krassowski. *J. Russ. Phys.-Chem. Ges.*, 1908, 40, 1510–1569. *Chem. Zentr.*, 1909, 1, 772–774.

FOUR different methods were used:—(A). The aqueous extract of the berries was shaken with ether, the ethereal solution was evaporated, and the residue extracted with petroleum spirit. The matter insoluble in petroleum spirit was dissolved in alcohol. *Rhamnoxanthin* separated from the solution, and from the mother-liquor, after evaporation with hot toluene, *emodin* and *quercetin* were isolated; *rhamnnetin* was obtained from the residue. (B). The portion of the berries insoluble in water was extracted with ether; from the solution, an oil, *quercetin*, and a resin were obtained. (C). The berries were extracted

first with ether and then with 85 per cent. alcohol; from the solution *rhamnonigrin*, *glucosides*, *xanthorhamnin*, and several *sugars* were separated. (D). Ether extracted from the fruit, *shusterin*, *rhamnocathartin*, and *emodin-anthranol*, besides other substances. The characters of the substances isolated were as follows:—*Quercetin*, $\text{C}_{15}\text{H}_{10}\text{O}_7 \cdot 2\text{H}_2\text{O}$, small needles, m. pt. above 300° C.; *rhamnnetin*, $\text{C}_{15}\text{H}_8\text{O}_7 \cdot \text{CH}_3$, small, light yellow needles, m. pt. above 300° C.; *xanthorhamnin*, $\text{C}_{24}\text{H}_{42}\text{O}_{20} \cdot 7\text{H}_2\text{O}$, needles, m. pt. 220–221° C., yields on hydrolysis, 2 mols. of rhamnose and 1 mol. of galactose. *Emodin*, $\text{C}_{15}\text{H}_{10}\text{O}_5 \cdot \text{H}_2\text{O}$, orange-red needles, m. pt. 254°–255° C.; *rhamnoxanthin*, $\text{C}_{25}\text{H}_{20}\text{O}_9 \cdot \text{H}_2\text{O}$, m. pt. 243° C., yields on hydrolysis, *emodin* and a methylpentose. *Shusterin*, $\text{C}_{25}\text{H}_{30}\text{O}_{13} \cdot \frac{1}{2}\text{H}_2\text{O}$ (?), long, light yellow needles, m. pt. 229°–231° C., is probably a glucoside of *emodinanthranol*. *Rhamnocathartin*, $\text{C}_{27}\text{H}_{30}\text{O}_{14} \cdot \frac{1}{2}\text{H}_2\text{O}$, yellow plates, m. pt. 236° C., appears to be a glucoside of *emodin* and two mols. of a sugar. *Emodinanthranol*, $\text{C}_{15}\text{H}_{12}\text{O}_4$, colourless crystals, m. pt. 280° C., yields *emodin* on oxidation in alkaline solution. *Rhamnonigrin* is a black amorphous mass, yielding methylanthracene on reduction with zinc dust; it is probably a decomposition product of glucosides of *emodin*. The sugars isolated were dextrose, galactose, an unknown pentose, and rhamnose, the three last-named being present in the form of glucosides.—A. S.

Essential oils; Constituents of —. *Eksantalol. Enolisation of aldehydes.* F. W. Semmler. *Ber.*, 1909, 42, 584–591.

EKSANTALOL (this J., 1908, 589) was boiled with acetic anhydride, when tricyclic *enol-eksantalol* monoacetate, $\text{C}_{15}\text{H}_{14}\text{O}_2$, was produced. The pure product boils at 132°–135° C. at 10 mm., has the sp. gr. 1.023 at 20° C., and $n_D = 1.4881$. It has the optical rotation, $\alpha_D = -7^\circ 15'$ in a 100 mm. tube. On heating with dilute inorganic acids to 110° C., eksantalol was produced. Reduction with sodium and alcohol led to the formation of eksantalol, $\text{C}_{11}\text{H}_{14}\text{O}$. When the monoacetate was oxidised with ozone, tricyclic *nor-eksantalone*, $\text{C}_{10}\text{H}_{14}\text{O}$, was obtained, which boils at 101°–102° C. at 10 mm., and gives a semicarbazone melting at 216° C. When reduced with sodium and alcohol, the ketone gave *nor-eksantalol*, $\text{C}_{10}\text{H}_{14}\text{O}$, which boils at 116°–118° C. at 10 mm. *enol-Phenylacetaldehyde* monoacetate, $\text{C}_6\text{H}_5\text{CH}:\text{CH}:\text{O}:\text{C}(\text{OCH}_3)_2$, was produced by the interaction of phenylacetaldehyde and acetic anhydride. This substance boils at 119°–121° C. at 10 mm., has the sp. gr. 1.065 at 20° C., and $n_D = 1.5483$. On oxidation with ozone it yields benzoic acid and benzaldehyde, and on reduction, phenylethyl alcohol. On hydrolysis, it forms phenylacetaldehyde and acetic acid.

—F. SHDN.

Rose oil industry; New departures in connection with the —. G. Marpmann. *Z. Riech- u. Geschmackstoffe*, 1909, 1, 14–15.

LARGE quantities of rose-leaves have been allowed to spoil in Bulgaria owing to the fact that the stills are unable to cope with the leaves as rapidly as they are brought in during the season. Hence better distillation apparatus is needed. The rose-leaves should be collected before sunrise and laid in water. If more are collected than can be dealt with by the stills, they can be preserved by packing tightly in barrels with salt, 3 parts by weight of roses to 1 part of salt. On a larger scale, benzene or ether may be used to extract the oil. The author suggests the use of paraffin hydrocarbons, such as heptane, or a mixture of octadecane and heptane, for the extraction of rose oil.—F. SHDN.

Clove oil sesquiterpenes; A new constituent of —. E. Deussen and A. Loesche. *Z. Riech- u. Geschmackstoffe*, 1909, 1, 15.

IF the fraction of clove oil containing the sesquiterpenes be freed from eugenol and distilled slowly in a vacuum, a solid remains behind. This can be purified by dissolving in chloroform and precipitating by alcohol, and then has the appearance of a white amorphous powder. It gives no coloration with sulphuric acid and glacial acetic

acids. It melts at 146° C., and has the composition, $(C_{11}H_{30}O)_5$. It is present to the extent of about 0.1 per cent. in clove oil.—F. SHDN.

Pyrazine derivatives; New synthesis of — by the interaction of aromatic ortho-hydroxynitroso compounds and acetaldehyde in the presence of ammonia or primary amines. M. Lange. Ber., 1909, 42, 574—577. (See this J., 1908, 471.)

Two pyrazine derivatives have been prepared by the author. α -Nitroso- β -naphthol was suspended in water and dissolved by the addition of sodium carbonate. Commercial acetaldehyde and ammonium chloride were added, the mixture stirred for a time, and warmed. The substance, hydroxydihydronaphthopyrazine, which separated, was purified by dissolving in sodium hydroxide solution and precipitating by adding excess of alkali. On treating the sodium compound in solution with acetic acid, the naphthopyrazine, $C_{12}H_{10}N_2O$, separated in fine needles or minute prisms, which melted at 240° C. By using methylamine hydrochloride in place of ammonium chloride in the above reaction, methylketodihydronaphthopyrazine, $C_{13}H_{12}N_2O$, is produced. This substance, which is used in medicine, crystallises from water or dilute alcohol in colourless needles, which melt at 155.5° C., and dissolve in excess of mineral acids.—F. SHDN.

Hydrocyanic acid; Buignet's method for determining — [with cupric sulphate]; correction and modification. G. Guerin and L. Gouet. J. Pharm. Chim., 1909, 29, 234—236.

BUGNET'S method for the determination of hydrocyanic acid by titration with copper sulphate in presence of ammonia, has been long abandoned, owing to the difficulty of judging the final point of the titration. By the addition of sodium sulphite to the titration liquid, this difficulty is said to be overcome, and the process then becomes accurate and convenient. The standard solution is prepared by dissolving 30.81 grms. of copper sulphate in sufficient distilled water to make 1 litre; each 0.1 c.c. of this is equivalent to 1 mgrm. of hydrocyanic acid. The determination of hydrocyanic acid in cherry-laurel water is performed thus:—25 c.c. of cherry-laurel water, diluted with 75 c.c. of distilled water, are treated with 20 drops of sodium hydroxide solution (sp. gr. 1.332), and 10 c.c. of ammonia solution. In this mixture 0.5 grm. of pure, dry sodium sulphite is dissolved, and the solution is titrated with the standard copper solution until a permanent pale blue tint is evident when the liquid is observed against a white surface. Dilute hydrocyanic acid is similarly determined, but without the addition of sodium hydroxide, which is only used with cherry-laurel water to prevent the formation of hydrobenzamide. The reaction which takes place is represented by the equation: $CuSO_4 + 3NH_4CN = (NH_4)_2SO_4 + Cu(CN)_2 \cdot NH_4CN$.

—J. O. B.

Methyl salicylate. II. Solubility in water at 30° C. H. D. Gibbs. Philippine J. Science, 1908, 3, 357—359. (See this J., 1908, 1175.)

THE solubility of methyl salicylate in pure water at 30° C. is 0.074 grm. per 100 c.c.; in $N/10$ sulphuric acid at 30° C. it is 0.077 grm. per 100 c.c.—F. SHDN.

Chlorophenols; Identification of —. G. Denigès. Bull. Soc. Pharm. Bord., 1908, 328. Pharm. J., 1909, 82, 272.

FOR the identification and differentiation of the chlorophenols used for medicinal or dental purposes, the author makes use of their reactions with formaldehyde. 0.1 c.c. of a 10 per cent. alcoholic solution of the sample is mixed with 2 c.c. of sulphuric acid of sp. gr. 1.84, and then 2 drops of commercial formaldehyde solution are added from a burette made to deliver 40 drops per c.c. The whole is then shaken and the coloration observed. *p*-Chlorophenol gives a more or less greenish brown colour. *o*-Chlorophenol and phenol give an intense carmine; on adding 10 c.c. of

alcohol and shaking, the former gives a turbid, and the latter a clear yellowish-brown colour. If the test be carried out with 1 c.c. of water and 1 c.c. of sulphuric acid of sp. gr. 1.84, instead of with 2 c.c. of the acid, a turbidity or white precipitate is produced. In the case of *p*-chlorophenol this does not change on standing; in presence of *o*-chlorophenol it rapidly becomes feebly rose-coloured, and in the case of phenol, strongly rose-coloured. On now adding 2 c.c. of 90.95 per cent. alcohol and shaking, *p*-chlorophenol gives a clear solution, whilst in the case of *o*-chlorophenol and phenol, the mixture remains turbid. After addition of a further 5 c.c. of alcohol, and shaking, *o*-chlorophenol gives a clear solution, and phenol yields a persistent flocculent precipitate.

Phenol; The compounds which cause the red colour in —. H. D. Gibbs. Philippine J. Science, 1908, 3, 361—370.

IT has been shown that pure phenol is coloured red in the presence of moisture, oxygen, and light, or by oxidation with hydrogen peroxide. The author shows that the principal oxidation products are quinone and catechol, and the red colour of phenol is due chiefly to the presence of quinone or quinone derivatives in solution. The presence of the brilliant red condensation product, phenoguinone, is highly probable.—F. SHDN.

Alcohols; Oxidation of — by the simultaneous action of iron tannate and hydrogen peroxide. E. de Stoecklin. Compt. rend., 1909, 148, 424—426.

CONTINUING his researches (this J., 1909, 111) the author finds that methyl alcohol, and the normal three- and four-carbon homologues are oxidised by iron tannate and hydrogen peroxide, as are also many polyhydric alcohols (glycol, glycerol, sorbitol). *iso*-Propyl, *iso*-butyl, and the higher alcohols of the ethylic series are not attacked. The formation of aldehyde is not the only action which occurs; some of the aldehyde is oxidised to acetic acid, some is absorbed by the tannate, and, in presence of excess of hydrogen peroxide, some is probably transformed into aldehyde-peroxide. In the case of ethyl alcohol, the amount of aldehyde formed increases with the amount of iron present, though not regularly; the increase in the acetic acid is much more regular. When aldehyde is added at the beginning of the experiment, it is oxidised to acetic acid simultaneously with the formation of more aldehyde from the alcohol; this formation of acetic acid only occurs when iron tannate and hydrogen peroxide are both present. If one or other be present alone, a certain amount of aldehyde disappears which is not converted into acetic acid.—J. T. D.

Radioactive emanations [from thorium]; Absorption of — by charcoal. R. W. Boyle. Phil. Mag., 1909, 17, 374—389.

THE percentage absorption of thorium emanation, when mixed with air and led through a vessel filled with charcoal, is found to depend: (1), on the nature of the charcoal, being, for the same sized grains, least for wood, intermediate for animal, and greatest for coconut charcoal, especially for the softer and less dense and gritty kinds of the last; (2), on the velocity of the gas current, being decreased by increasing that velocity; (3), on the extent of the charcoal absorbing surface, increasing as this increases, that is, with the fineness of grain; and (4), on the temperature, following the law for ordinary gases, viz., that a lowering of the temperature of the charcoal causes an increase in the amount of absorption.—F. SHDN.

Determining hydroxyl derivatives. Hibbert. See XXIII.

Hypophosphorous acid; Catalytic oxidation by copper. Bongault. See VII.

Ferrous sulphate solutions; Resistance to atmospheric oxidation. Warynski. See VII.

Nickel sulphide; *Separating from aqueous solution*. Thiel and Ohl. See VII.

Bismuth hydroxide; *Behaviour towards alkalis*. Moser. See VII.

Bismuth halides; *Hydrolysis*. Hertz and Bulla. See VII.

Colloidal sulphur solutions and crystalloids. Svedberg. See VII.

PATENTS.

Phenacetin. *Process of treating — and product therefrom*. A. G. Meyer, San Francisco, Cal. U.S. Pat. 912,869, Feb. 16, 1909.

A PRODUCT consisting of a mixture of *o*-nitrophenacetin, cresote, and nitro-derivatives of cresote is obtained by mixing phenacetin with a suitable proportion of nitric acid to form a hardened mass, powdering this, mixing it with a suitable proportion of cresote, boiling the whole with water and, after separating from the water, drying and pulverising the residue.—T. F. B.

Phenylarsenious oxide and arsenobenzene. *Process for preparing derivatives of —*. Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 206,657, April 9, 1907.

By the reduction of *p*-aminophenylarsinic acid and its derivatives, with the exception of the dialkyl derivatives, compounds of the general types, $R_2As:O$, $R_2As:AsR$, and $R_2As(OH)As(OH)R$, are obtained, according to the reducing agent employed. The products destroy trypanosomes in more dilute solutions than atoxyl.—T. F. B.

m-Aminophenylarsinic acid (*Mehrsanilic acid*). *Process for preparing —*. Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 206,344, Dec. 1, 1907.

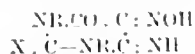
m-AMINOPHENYLARSINIC acid is obtained by reduction of the nitrophenylarsinic acid resulting from the nitration of phenylarsinic acid; the reduction may be performed by sodium amalgam in alcoholic solution, or the nitro compound is treated with ammonium sulphide and the sulphur removed by treatment with metallic oxides in alkaline solution.—T. F. B.

Arsenophenols; *Process for preparing —*. Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 206,456, Dec. 6, 1907.

ARSENOPHENOL and its homologues and derivatives are obtained by reduction of the corresponding hydroxyarylarsonic acids by means of tin and hydrochloric acid, stannous chloride, sodium hydrosulphite, etc. If, instead of these reducing agents, hydriodic acid is used, hydroxyarylarsonic oxides are obtained; these are readily reduced to the arsenophenols by means of sodium amalgam. The hydroxyarylarsonic acids may be obtained by decomposition of diazotised aminoarylarsonic acids. The arsenophenols are more toxic in their action towards trypanosomes than are the hydroxyarylarsonic acids. (Compare Ger. Pat. 206,057; preceding.) T. F. B.

4-Imino-5-isonitrosopyrimidin derivatives; *Process for preparing —*. Farbentfabr. vorm. F. Bayer und Co. Ger. Pat. 206,453, July 26, 1907.

ISONITROSOCYANOACETIC esters, obtained by the action of nitrous acid on cyanoacetic esters, are condensed, in presence of alkaline condensing agents, with urea or its derivatives or substitution products, such as thiourea, guanidine, dicyanodiamide, allophanic esters, etc.; the products are 4-imino-5-isonitrosopyrimidines of the general formula,



where R is hydrogen, alkyl, or aryl, and X represents O, NH, S, CN, etc.—T. F. B.

1-Aryl-2,4-dialkyl-3-halogenomethyl-5-pyrazolones; *Process for preparing —*. Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 206,637, Oct. 3, 1907.

By the action of halogens on 1-aryl-2,4-dialkyl-3-methyl-5-pyrazolones, addition products are obtained; by removing the elements of hydrohalogen acid from these, monohalogen derivatives are obtained, the halogen being attached to the 3-methyl group.—T. F. B.

1-Methyl-2-nitro-4-hydroxyphenazone (*o*-Nitro-*p*-cresol); *Process for preparing —*. Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 206,638, Oct. 24, 1907.

p-CRESOL carbonate is obtained by the action of phosgene on the alkali derivatives of *p*-cresol, by nitration and saponification of the product, *o*-nitro-*p*-cresol, of m. pt. 77° C., is obtained in good yield. It could formerly only be prepared by diazotisation of *o*-nitro-*p*-toluidine, and subsequent decomposition.—T. F. B.

Santalol esters. G. W. Johnson, London. From Verein. Chemfabr. Zimmer und Co., Frankfurt, Germany. Eng. Pat. 15,122, July 16, 1908.

SEE Ger. Pat. 204,922 of 1907; this J., 1909, 108.—T. F. B.

Fats; *Manufacture of stable iodine compounds of —*. B. R. Seifert, Edebeud, Assignor to E. Merck, Darmstadt, Germany. U.S. Pat. 913,311, Feb. 23, 1909.

SEE Eng. Pat. 3132 of 1906; this J., 1906, 653.—T. F. B.

Catechotannic acid; *Process for converting catechin into —*. W. Osborne and H. Schupp, Assignors to L. Sensburg, Munich, Germany. U.S. Pat. 913,426, Feb. 23, 1909.

SEE Eng. Pat. 18,004 of 1906; this J., 1906, 1231.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Metol [*metol* (*metol* *pyraminophenol* *sulphate*)]; *Analysis of —*. A. Nicolle. Monit. Scient., 1909, 23, 173.

COMMERCIAL metol may contain *p*-aminophenol sulphate which interferes with the keeping qualities of the developer, and the following test is described for detecting the presence of this substance. About 1 grm. of the sample is shaken with 3 c.c. of concentrated hydrochloric acid. If, after a few minutes, the solution is not perfectly clear, *p*-aminophenol sulphate is present. Mineral adulterants, such as sulphides, etc., may be detected by incinerating a portion of the sample; in no case should the ash exceed 0.5 per cent.—W. P. S.

PATENTS.

Flash lights; *Mixture for — and method of producing the same*. C. Bethge, Berlin. Eng. Pat. 14,692, July 10, 1908.

MIXTURES for producing flash-lights for photographic and similar purposes consist of a combustible metal such as powdered magnesium or aluminium, and an oxygen carrier composed of insoluble or difficultly soluble compounds of thorium with acids. A suitable mixture consists of 30 to 35 parts of magnesium powder and 70 parts of thorium chromate. A slower burning mixture for time-light exposures consists of 1 part of magnesium powder and 2 parts of thorium tungstate. The compounds of thorium peroxide with nitric, sulphuric, or perchloric acids may also be used. These compounds are obtained by dissolving thorium hydroxide in the corresponding acid, precipitating with an excess of hydrogen peroxide, heating to 60° C., and finally cooling rapidly. The compound thus obtained is mixed with magnesium powder in equal proportions.—A. T. L.

Multicoloured surfaces; Process for preparing — by direct dyeing. Verein. Kunstseidefabr. A.-G. Fr. Pat. 395,165, Oct. 12, 1908. Under Int. Conv., July 23, 1908.

If the surface of a substance such as gelatin or celluloid be partially coloured by immersion in a solution of a dye-stuff and then washed and dried, it is found that by a brief second immersion in a different solution, the uncoloured portion can be dyed, without the shade of the coloured part being affected. It is preferable after the second and any subsequent immersions in a dyeing solution, to wash the material at once in a medium in which it cannot be dyed. Thus celluloid, which cannot be coloured by an aqueous solution, should be rinsed with water, whilst a surface of gelatin or casein should be washed with alcohol. The process may be applied to the preparation of three-colour gratings.—P. F. C.

Light-sensitive surfaces and ferroprussiate papers containing molybdenum; Process for preparing —. Neue Photographische Ges. Ger. Pat. 206,320, May 9, 1907.

DIRECT copying papers are obtained by coating paper with molybdic acid in presence of oxalic acid; these papers are "developed," after exposure to light, by means of a ferricyanide which forms, with the molybdo-molybdate produced, an insoluble, stable, highly coloured image. 18 grms. of molybdenum trioxide are added to a solution of 20 grms. of oxalic acid in 400 c.c. of water; by crystallisation a mixture of oxalic acid and molybdic acid is produced, which can be coated on paper. For blue tones, the developer may contain ferric chloride, potassium ferricyanide, and oxalic acid; for brown tones, uranium nitrate, and for red tones copper sulphate is substituted for the ferric chloride. The sensitiveness of ferroprussiate papers is increased by addition of molybdic acid; thus, paper may be immersed in a solution of 3 grms. of molybdic-oxalic acid mixture, 2.5 grms. of potassium ferricyanide, 0.5 grm. of oxalic acid, 1 grm. of sodium chloride, 12 grms. of ferric ammonium citrate, and 3 grms. of gelatin in 100 c.c. of water; after exposure to light these papers are developed by water.—T. F. B.

Photography in colours; Process for preparing grained screens for —. C. L. A. Brasseur. Fr. Pat. 394,914, Oct. 3, 1908. Under Int. Conv., Oct. 4, 1907.

SEE Eng. Pat. 20,909 of 1908; this J., 1909, 260.—T. F. B.

Screens in two or more colours [for colour photography]; Process for preparing —. Verein. Kunstseidefabr. A.-G. Fr. Pat. 395,164, Oct. 12, 1908. Under Int. Conv., July 13, 1908.

SEE Eng. Pat. 21,839 of 1908; this J., 1909, 260.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Chlorate explosion; A peculiar —. G. C. Davis. J. Ind. and Eng. Chem., 1909, 1, 118.

THE author draws attention to the possible danger attending the use of secondhand kegs. On two different occasions explosions occurred in Philadelphia with kegs containing small metal castings. In one case it was proved definitely that the keg had been obtained from a dye-works and had contained potassium chlorate, some of which had evidently remained behind when the casks were cleaned, and formed an explosive mixture with the wood, which became ignited by a spark produced by jolting of the metal castings.—A. S.

White or ordinary phosphorus in the igniting composition of lucifer matches; Detection of —. T. E. Thorpe. Chem. Soc. Proc., 1909, 26, 73—74.

As the White Phosphorus Matches Prohibition Act, 1908, will throw upon Officers of Customs and the Inspectors under

the Factory and Workshop Act, 1901, the duty of sampling importations of matches and of materials in use in match factories, the author has examined the methods by which the presence of ordinary phosphorus in the igniting composition of lucifer matches containing phosphorus sesquisulphide may be established, and he finds that the most direct and most certain test is to isolate the phosphorus as such, which is conveniently effected by gently heating the composition in a vacuum, when the phosphorus sublimes and may be readily recognised by its physical characteristics.

PATENTS.

Explosive, and process of making the same. A. La Motte. Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 911,019, Jan. 26, 1909.

THE explosive is formed by mixing a molten organic nitro-compound or a mixture of such compounds with a solid inorganic oxidising agent, and adding a metallic sulphide to the solidified mixture. For example, a molten mixture of nitronaphthalene and nitrotoluene is mixed with ammonium nitrate, and after the mixture has hardened, a sulphide, such as pyrites, is added.
—A. T. L.

Nitro-hydrocarbon composition; Process of densifying a —. F. J. H. Roewer, Hamburg, Germany. Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 912,733, Feb. 16, 1909.

It is proposed to "densify" a nitro-hydrocarbon composition, for use in charging projectiles, by introducing it, in a molten condition, into a previously chilled receptacle. The material is thus subjected to sudden chilling and the pressure due to its own weight.—F. SOHN.

Smokeless powders. Société anonyme d'Explosifs et de Prod. Chim. Fr. Pat. 394,992, Dec. 13, 1907.

CLAIM is made for the use of nitro-derivatives of the fatty series in the manufacture of smokeless powders with a base of nitrocellulose or of nitrocellulose and nitroglycerin. In particular mononitromethane (b. pt. 99°—100° C.), may be used as the solvent in the preparation of powerful and very stable smokeless powders. When employed in admixture with nitroglycerin, these nitro-derivatives yield products of low freezing point. Thus nitroglycerin containing 10 per cent. of mononitromethane does not freeze at -15° C. They may also be used in admixture with other substances (e.g., alcohol, ether, acetone) to effect the gelatinisation of nitrocellulose.
—C. A. M.

Nitroglycerin; Process of manufacturing —. F. Aigner, Potsdam. Assignor to Dynamit A.-G. vorm. A. Nobel and Co., Hamburg. U.S. Pat. 913,653, Feb. 23, 1909.

SEE Fr. Pat. 351,454 of 1905; this J., 1905, 903.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUALITATIVE.

Ferrous salts; New colour reaction for — [with sodium phosphotungstate]. A. Richard and Bidot. J. Pharm. Chim., 1909, 29, 230—234.

A REAGENT is prepared with 25 grms. of sodium phosphotungstate, 5 c.c. of hydrochloric acid, and 250 c.c. of water. A few drops of this, added to a liquid containing minute traces of ferrous iron, and made alkaline with sodium hydroxide solution, develop a deep blue colour resembling that of Fehling's reagent. Ferric iron does not react, and free acids destroy the colour. The reaction is extremely sensitive.—J. O. B.

INORGANIC—QUANTITATIVE.

Arsenic; Precipitation of — by hydrogen sulphide. L. L. De Koninck. *Bull. Soc. Chim. Belg.*, 1909, 23, 88—93.

ARSENIC acid is reduced quickly, and the precipitation of arsenous sulphide accelerated, if, to the strongly acid hydrochloric solution of the arsenic acid, a small quantity of hydroiodic acid be added, before the hydrogen sulphide is introduced. The reduction and precipitation is still further hastened when the solution is heated. The arsenous sulphide is precipitated almost immediately, and the supernatant liquid remains clear; only after a time is sulphur precipitated. Potassium or ammonium iodide may be used in place of hydroiodic acid.—W. P. S.

Cyanous acid in copper. Cofletti. *See X.*

Nitrites in water. Rochaix. *See XVIII B.*

ORGANIC—QUALITATIVE.

Benzene and salicylic acids; Detection of — in fermented beverages and milk. L. Robin. *Ann. Chim. analyt.*, 1909, 14, 53—54.

THE author's test for the detection of benzoic acid in fats (this J., 1908, 1171), which depends on its conversion into *m*-dinitrobenzoic acid and then into ammonium *m*-aminobenzoate, is equally applicable for the detection of this preservative in beverages and milk. The test may be combined conveniently with the test for salicylic acid. In the case of wines, ciders, and beers, 50—60 c.c. of the liquid are treated with a little ferric chloride and hydrochloric or sulphuric acid. The liquid is then shaken with 40—50 c.c. of ether, the ethereal extract is separated and washed, and then divided into two portions. One portion is employed for the usual test for salicylic acid; the other half is shaken with 25 c.c. of an alcoholic solution of sodium bicarbonate. The alkaline solution is evaporated on the water-bath and the residue is tested for benzoic acid by the method described, *loc. cit.* In the case of milk it is necessary to remove the casein and cream. For this purpose, 10 c.c. of 5 per cent. sulphuric acid and 20 c.c. of 95 per cent. alcohol are placed in a beaker, and 50 c.c. of the milk are delivered into the mixture in a fine stream, the contents of the beaker being stirred continuously during this operation. The precipitate is allowed to stand for 5 minutes and is then poured on a filter, the filtrate being returned until it comes through perfectly bright. The filtrate is then placed in a separating funnel with 50 c.c. of ether. Since the mixture emulsifies very readily, it is advisable to fill the funnel completely by the addition of water before proceeding to shake. The ethereal extract is separated, washed, divided into two portions and tested for salicylic and benzoic acids respectively.—J. E. B.

Natural and artificial silks. Coppetti. *See V.*

Color reactions of sugars. Guezda. *See XVI.*

Methylpentoses and pentoses. Rosenthaler. *See XVI.*

Identifying chlorophenols. Denigès. *See XX.*

Analysis of metol. Nicolle. *See XXI.*

ORGANIC—QUANTITATIVE.

Organic matter; Experiments on Gasparini's electrolytic process for the destruction of — in chemical-legal analysis. M. Miorandi. *Gaz. chim. ital.*, 1909, 39, I, 175—179. (See this J., 1904, 952; 1908, 340.)

ATTEMPTS to substitute carbon electrodes (with an electrolyte containing hydrogen peroxide or ammonium persulphate) for the platinum electrodes used by Gasparini proved unsuccessful. Very satisfactory results were, however, obtained, using platinum electrodes, when nitric acid as oxidising agent was replaced by a super-

saturated solution (60 per cent.) of ammonium persulphate, the electrolysis being conducted at 56° C. with a current of 3.75 amperes. The use of ammonium persulphate offers the advantage that the solution remains alkaline during the greater part of the process.—A. S.

Hydroxyl derivatives in mixtures of organic compounds; Determination of —. H. Hibbert. *Chem. Soc. Proc.*, 1909, 25, 57.

HIBBERT and Sudborough's method (*Chem. Soc. Trans.*, 1904, 85, 933, and this J., 1904, 77) for the estimation of hydroxyl groups in carbon compounds can be applied with equal success to mixtures of hydroxyl derivatives with other organic compounds, for example, ketones, esters, nitriles, etc. It is necessary to take rather more of the Grignard reagent than is sufficient to combine with both substances. In this way the author has been able to estimate *n*-naphthol in presence of various ketones, ethyl benzoate, methyl hydrogen succinate, and acetonitrile, as well as chloral in a mixture of this with acetone.

Determining oil in cottonseed products. Herty and others. *See XII.*

Mineral acids in vinegar. Repiton. *See XVIII A.*

Tin [determination of] in certain canned foods. *See XVIII A.*

Resin in sulphite pulp. Opfermann. *See XIX.*

Quinine in quinine tannate and ferrocitrate. Rupp and Cadiess. *See XX.*

Nicotine determination. Bertrand and Javillier. *See XX.*

Assay of colebium cornu. Lyons. *See XX.*

Determining hydrocyanic acid. Guerin and Gouet. *See XX.*

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Emulsification; The theory of —. C. R. Marshall. *Pharm. J.*, 1909, 82, 257—266.

THE author made experiments on the emulsifying power of gum acacia, soap, saponin, condensed milk, sugar, and barium sulphate. A primary emulsion of almond oil, water, and the emulsifying agent was first prepared in a mortar, and further small quantities of oil were then added until the emulsion refused to take up more. After now incorporating a definite quantity of water, more oil was added, and these alternate additions of water and of oil were continued as long as desired or until the emulsion broke. The results are plotted in curves with the volumes of oil as ordinates and the volumes of water as abscissæ; in most cases the curves approximate to straight lines. As typical of the results obtained, it may be stated that to emulsify 200 c.c. of almond oil, there are required: 10 grms. of gum acacia and 23 c.c. of water, 1 gm. of soft soap and 3.8 c.c. of water, 0.2 gm. of saponin and 9.6 c.c. of water, 5 grms. of condensed milk and 20 c.c. of water. Also, 1 gm. of gum acacia and 4 c.c. of water will emulsify 21 c.c. of almond oil, 1 gm. of soft soap and 4 c.c. of water will emulsify 210 c.c. of oil, and 0.2 gm. of saponin and 4 c.c. of water will emulsify 90 c.c. of oil. All of the experiments were made at 13° C. In another set of experiments a definite percentage of oleic acid was added to paraffin oil and after running in excess of *N* 10 potassium hydroxide solution, and emulsifying by means of twenty strokes of a syringe, the mixture was allowed to settle, and the volume of emulsified paraffin oil observed. No differences were observed between oils containing 1 per cent. and 0.01 per cent. respectively of oleic acid. When the proportions of oleic acid were 0.01, 0.005, 0.0025, 0.00125, and 0.00065 per cent. respectively of oleic acid, and *N*/100 potassium hydroxide solution was used, the volumes of emulsified

paraffin oil were 3, 2.3, 2, 1.5, and 1.4 c.c. Oil of turpentine, owing to its low surface tension, is difficult to emulsify. It is practically impossible, for instance, to prepare an emulsion of turpentine oil and white of egg directly in a mortar. If, however, the white of egg be first diluted with water and emulsified with the turpentine oil by means of a syringe, then a large quantity of turpentine oil can subsequently be incorporated by means of a pestle and mortar in the ordinary manner. After discussing the views of Ramsden and Pickering (see this J., 1908, 88), the author points out that the theory adopted by Pickering, according to which the globules of the emulsified substance are enveloped in a coating of minute solid particles, does not possess sufficient experimental support to account for gum emulsions, emulsions of mercury with oil, and soap emulsions. With regard to de-emulsification, this does not appear to be caused by an increase of temperature within reasonable limits, although in many cases it is facilitated thereby, owing to the effect on the surface tension. The author does not believe that heavy trituration tends to retard emulsification owing to the heat developed by the friction.—A. S.

Gold chloride: Reaction of — with aluminium [colloidal gold]. Dauvé. J. Pharm. Chim., 1909, 29, 241.

WHEN a small piece of aluminium foil is immersed in gold chloride solution for some hours, a portion of the gold is displaced in the colloidal state, giving a fine purple solution when viewed by transmitted, but dull yellow with reflected light. Since iron is invariably present in aluminium, it may take part in the reaction. In presence of excess of aluminium chloride, no reaction occurs.—J. O. B.

Colloids: Apparent diffusion of —. Porosity of colloidal membranes. R. E. Liesegang. Z. Chem. Ind. Kolloide, 1909, 4, 62—63.

A SILVER chloride-collodion emulsion, containing a slight excess of lithium chloride, was prepared from silver nitrate and lithium chloride, spread in a thin film on glass and dried without warming. After some weeks the appearance of the film had completely altered: the silver chloride had become so coarse in grain that the film was opaque, and this coarse-grained silver chloride was entirely on the surface of the film, so that it could be wiped off with the finger. According to the author the pores filled with ether-alcohol in the original collodion had been filled by displacement with water containing a little lithium chloride. This had dissolved silver chloride and carried it to the surface; here the latter salt was deposited in granular form and the lithium chloride set free wandered back into the film and dissolved more of the finely-divided silver chloride, which, being more finely divided, had a greater solution-tension; the process was then repeated indefinitely.—E. F.

Freezing of jellies. G. Bruni. Ber., 1909, 42, 563—565.

COLLOIDAL jellies of isinglass, as a typical reversible colloid, and of silicic acid, a typical irreversible colloid, were frozen and remelted. The isinglass jelly thawed as a whole, and the thawed jelly showed no physical change. The silicic acid, on the other hand, was completely precipitated in small amorphous scales, as already described by Lottermoser (this J., 1908, 1224). These scales, as obtained from jellies containing from 2.9 to 17.72 per cent. of silica, vary in composition from $\text{SiO}_2 + 0.788\text{H}_2\text{O}$ to $\text{SiO}_2 + 3.67\text{H}_2\text{O}$. These figures correspond to the limits found by Van Bemmelen for the absorption of moisture by dehydrated silica. The amount of water in the precipitate obtained by freezing does not appear to stand in any constant relation to the amount of silicic acid in the original jelly, but appears to be affected by the age of the jelly.—E. F.

Light-reactions of white and yellow diphenyloctatetrene. H. Stobbe. Ber., 1909, 42, 565—568.

WHITE diphenyloctatetrene has been obtained by the condensation of cinnamic aldehyde and ethyl succinate in

presence of sodium ethylate; it melts at 124°C. Yellow diphenyloctatetrene has been obtained in a similar manner by the action of acetic anhydride on a mixture of cinnamic aldehyde and sodium succinate; it melts at 225°C. The author considers these compounds to be probably structural isomerides. The yellow compound is decomposed by light in presence of air with formation of a gummy mass, both in solution and in the solid state; in the latter case some benzaldehyde and benzoic acid are formed. In the dark it is unaffected by air. In the absence of air the yellow compound is partially converted into the white variety by the action of sunlight, both in solution (in chloroform containing iodine) and in the solid state. The white compound, when acted on by light in presence of air, is decomposed with formation of benzaldehyde and benzoic acid in the same manner as the yellow isomeride. In the absence of air it is not changed into the yellow variety on exposure to light.—E. F.

New Books.

DIE BEDEUTUNG DER KOLLOIDE FÜR DIE TECHNIK. Allgemeinverständlich dargestellt von Professor Dr. KURT ARNDT. Theodor Steinkopff's Verlag. Dresden. 1909. Price M L.

340 volume, containing table of contents, preface, and 34 pages of subject matter. The subjects chiefly treated of are as follows:—I. Colloid; definition of the term. II. Colloid solutions. III. Colloid metallic solutions. IV. Coagulation of colloid solutions. V. Reversible and irreversible colloids. VI. Ruby-red gold glass. VII. Milk glass, &c. VIII. Silver- and gold mirrors on glass. IX. Tungsten lamps. X. Colloids in the ceramic industry; in cements; and as glues and similar agglutinants. XI. Liquid absorbents. XII. Diaphragms and filters. XIII. Adsorption. XIV. Lake formation. XV. Dyeing. XVI. Tanning. XVII. Soap boiling. XVIII. Consistent machine fats. XIX. Purification of sewage. XX. Colloids and the cultivation of the soil.

SYSTEMATIC TREATMENT OF METALLIFEROUS WASTE. L. PARRY. The Mining Journal, London. 1909. Price 5s. net.

3vo volume, containing 121 pages of subject matter with eight illustrations. The text is subdivided and classified as follows:—I. General economic principles. II. Sources of supply. Kinds of waste. III. General chemical and metallurgical principles. IV. Partial or semi-refining. V. Smelting of lead ashes and the cleaning of tin slags. VI. Smelting of tin ashes and solder ashes. VII. Smelting of antimonial material. VIII. Separation of copper from tin, and lead from antimony. IX. Copper work. X. Miscellaneous. XI. Metal working and refining.

TABELLEN FÜR BERECHNUNG VON KALIANALYSEN. Herausgegeben von Dr. R. EHRHARDT. Wilhelm Knapp's Verlag. Halle a. S. 1908. Price M 3.00 net.

8vo volume, containing 69 pages of subject matter, which consists of tables for the calculation of analyses required in the potash-, caustic potash-, and nitre industries. There are in all seven tables of factors, and the mode of using them and the factors they contain, in the calculations required, is explained in the preface.

DAS AMMONIAK UND SEINE VERBINDUNGEN. Dr. J. GROSSMANN. Wilhelm Knapp's Verlag. Halle a. S. 1908. Price M 3.60.

8vo volume, containing 103 pages of subject matter, with seven illustrations and numerous tables, preface, and table of contents. The subject matter is classified as follows:—I. Ammonia. Historical and

theoretical. Occurrence, preparation, and purification. II. Ammonia solution. III. Liquid ammonia. IV. Ammonium carbonate. V. Ammonium sulphate. Waste gases and liquors in the manufacture, and their treatment, &c. VI. Ammonium chloride. VII. Ammonium nitrate. VIII. Ammonium phosphate, sulphide, fluoride, sulpho cyanide, and ferrocyanide.

THE DYEING AND CLEANING OF TEXTILE FABRICS.
A Handbook for the Amateur and the Professional.
F. A. OWEN. Based partly on notes of H. C. STANDAEE.
John Wiley and Sons, New York, 1909. Price \$2.00 net. Chapman and Hall, Limited, London. 88. 6d. net.

SMALL. 8vo volume, containing 241 pages of subject matter, and an alphabetical index. The matter may be designated a collection and classified selection of recipes for the cleaner, bleacher, and dyer of textile fabrics, as well as, to a certain extent, other materials. An alphabetical and classified index of all the principal dyestuffs is given and finally, other particulars are added in abbreviated form, as taken from Metz and Co.'s Year Book, 1907.

HEAT ENERGY AND FUELS. PYROMETRY COMBUSTION. ANALYSIS OF FUELS AND MANUFACTURE OF CHARCOAL, COKE, AND FUEL GASES. HANNS V. JÜPTNER, Professor, Imperial and Royal Tech. Inst., Vienna. Translated by OSKAR NAGEL, Ph.D. McGraw Publishing Company, 239, West 39th Street, New York, 1908. Price \$3 net.

LARGE. 8vo volume, containing 301 pages of subject matter, with 118 illustrations, and an alphabetical index. The subject matter is classified as follows:—INTRODUCTION: (i). General Remarks. (ii). Forms of energy. **HEAT ENERGY AND FUELS:** I. Measurement of high temperatures (pyrometry). II. Optical methods of measuring temperatures. III. Combustion heat and its determination. IV. Direct methods for its determination. V. Incomplete combustion. VI. Combustion temperature. VII. Fuels (generally). VIII. Wood. IX. Fossil solid fuels. X. Peat. XI. Lignite. XII. Bituminous and anthracite coals. XIII. Artificial solid fuels. XIV. Charcoal. XV. Peat-coal, coke, and briquettes. XVI. Coking apparatus. XVII. Liquid fuels. XVIII. Gaseous fuels. XIX. Producer gas. XX. Water gas. XXI. Dowson, and Blast-furnace gases, and Regenerator combustion gases. XXII. Apparatus for the production of Fuel Gases.

MINERAL RESOURCES OF THE UNITED STATES, 1907.
U.S. Geological Survey, Washington.

THIS is the Annual Report of the Geological Survey on the mineral resources of the United States. It is divided into two parts. Part I contains an account of the metals and metallic ores produced in 1907, and part 2 consists of details relative to fuels, structural materials, abrasive materials, chemical materials (e.g., arsenic, borax, salt, sulphur), pigments, and "miscellaneous" (including asbestos, graphite, etc.).

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

5285. Bristow and White. Apparatus for drying powdered or granular material. March 4.

5362. Herring. *See under X.*

5395. Soc. l'Air Liquide. Recovery of vapours of volatile liquids, particularly alcohol and ether, from their admixture with air. [Fr. Appl., March 6, 1908.]* March 5. 5619. Gill. *See under VII.*

5647. Griffin. Evaporating and distilling apparatus operated by the hot exhaust gases of internal combustion engines. March 9.

5735. Yates, and Matthews and Yates, Ltd. Centrifugal separators. March 10.

5931. Lévy. Separation of gaseous mixtures into their constituents. March 11.

COMPLETE SPECIFICATIONS ACCEPTED.

27,017 (1907). Hommel and others. *See under X.*

2029 (1908). Tavernier. Separation of gases of different densities, especially for increasing the proportion of oxygen in air. March 10.

5187 (1908). Schmatolla. Gas-fired kilns. March 17.

6253 (1908). Lewis, and High Moor Synd., Ltd. Apparatus for separating materials of different specific gravities. March 10.

14,444 (1908). Alford. Power filter press. March 10.

25,213 (1908). Leclaire and Hericourt. Filter. March 17.

27,245 (1908). Normac-Gie, Ges., and Kirner. Pyrometers. March 17.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

4973. McKay and Cheney. Water-gas generators. [U.S. Appl., Nov. 11, 1908.]* March 1.

5010. Rhenania Glühlicht Comp. Incandescent mantles for gas lighting. [Ger. Appl., Feb. 6, 1909.]* March 1.

5063. Robin. Manufacture of incandescent gas mantles.* March 2.

5260. Fellner (Oberfeldt und Co.). Incandescent gas mantles.* March 4.

5408. Collin. *See under VII.*

5412. Ward. *See under XXIII.*

5463. Severin. Manufacture of incandescent gas mantles.* March 6.

5836. Crossley. Incandescent gas mantles. March 11.

COMPLETE SPECIFICATIONS ACCEPTED.

4529 (1908). Maly. Gas generators. March 10.

11,688 (1908). Mueller. Regenerative coke ovens. March 10.

14,867 (1908). British Thomson-Houston Co. (General Electric Co.). Manufacture of incandescent lamp filaments. March 10.

17,596 (1908). Von Unruh. Manufacture of incandescent bodies for gas lighting. March 10.

17,620 (1908). Coolidge. Manufacture of refractory electric conductors suitable as filaments for lamps. March 17.

23,992 (1908). Knappich. Increasing the calorific value of coal-gas. March 17.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

5552. Luis. Enriched hydrocarbons. March 8.

5731. Adamson (Burmah Oil Co., Ltd., and Campbell). Treating or purifying paraffin wax. March 10.

6081. Claussen and Moore. Process for obtaining deodorised oil mixtures from naphtha, petroleum, or other mineral oils. March 13.

COMPLETE SPECIFICATION ACCEPTED.

27,335 (1907). Everett. Production of by-products from asphaltum, etc. March 17.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

4963. Newton (Bayer and Co.). Manufacture of dyestuffs of the galloxyaniline series. [Addition to No. 20,368 of 1908.] March 1.

5022. Smiles and Barnett. Dyestuffs obtained from nitrodiphenylamine sulfoxides. March 1.

5382. Newton (Bayer und Co.). Manufacture of derivatives of the anthracene series. March 5.

5383. Newton (Bayer und Co.). Manufacture of azo dyestuffs. March 5.

5558. Inray (Meister, Lucius, und Brüning). Manufacture of leuco-bodies of dyestuffs containing sulphur. March 8.

5786. Newton (Bayer und Co.). Manufacture of dyestuffs of the anthraquinone series. March 10.

5792. Soc. pour l'Ind. Chim. à Bâle. Manufacture of substantive azo dyestuffs. [Addition to No. 6814 of 1907. Fr. Appl. March 11, 1908.]* March 10.

5998. Newton (Bayer und Co.). Manufacture of derivatives of the anthraquinone series. March 12.

6086. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of monoazo dyestuffs. March 13.

COMPLETE SPECIFICATIONS ACCEPTED.

4624 (1908). Fowler. *See under A.*

4848 (1908). Bloxam (Chem. Fabr. Griesheim Elektron). Manufacture of brown sulphurised dyestuffs. March 10.

10,755 (1908). Newton (Bayer und Co.). Manufacture of red vat colouring matters containing sulphur. March 10.

20,003 (1908). Basler Chem. Fabr. Manufacture of vat dyestuffs. March 17.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

5075. Bartelt. Employment of sodium hypochlorite and analogous products for laundry purposes. March 2.

5575. Maly. Dyeing woollen yarn on bobbins.* March 8.

5721. Cuming. The dressing of vegetable fibres. March 10.

5734. Marshall. Apparatus for dyeing and similarly treating textile material on bobbins or the like. March 10.

5771. Rumpf. Production of a water- and soap-proof gloss on woven materials of cotton. March 10.

5859. Vandatte and Lagye. Electrical process and apparatus for removing the grease and yolk from wool.* March 11.

6034. Robertson. Calico printing machines. March 13.

COMPLETE SPECIFICATIONS ACCEPTED.

4624 (1908). Fowler. Dyeing and dyes for use therein. March 10.

6893 (1908). Kershaw, Abell, and Leach. Dyeing, scouring, and analogous machines. March 17.

9579 (1908). Claessen. Dressing fibres and fabrics, and manufacture of paper, wood pulps, etc. March 10.

11,314 (1908). Newton (Bayer und Co.). Printing. March 10.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

5293. Pape. Preparation of zinc oxide for education.* March 4.

5408. Collin. Recovering ammonia from coal gases. March 5.

5472. Bender. Manufacture of oxides of nitrogen. March 6.

5618. Gill. Manufacture of ferric oxide. March 9.

5619. Gill. Reverberatory furnaces for calcining hydrated oxides of iron and other materials. March 9.

5799. Cie. Gén. d'Electro-Chimie de Bozel. Manufacture of metallic silicides. [Fr. Appl., March 31, 1908.]* March 10.

5821. British Thomson-Houston Co. (General Electric Co.). *See under X.*

6009. Nielsen. Manufacture of carbonate of soda. March 12.

COMPLETE SPECIFICATIONS ACCEPTED.

2029 (1908). Tavernier. *See under I.*

4515 (1908). Rivière. Manufacture of hydrofluosilicic acid. March 10.

4750 (1908). Schäcke. Manufacture of hydrates of potassium and of sodium from recent eruptive stones. March 10.

6449 (1908). Morris. *See under XI.*

8959 (1908). May and Baker, Ltd., and Bates. Mercury compound and method of manufacturing the same. March 17.

12,743 (1908). Goldschmidt. Separation and concentration of chlorine. March 10.

12,812 (1908). Watson, Ashall, and United Alkali Co. Manufacture of copper sulphate. March 10.

14,707 (1908). Peniakoff. Manufacture of alkaline aluminates. March 10.

21,255 (1908). Oddo. Furnaces for the combustion of sulphur. March 17.

23,330 (1908). Sorger. *See under XX.*

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

5722. West and Lewis. Potters' kilns or ovens for firing bricks, tiles, etc. March 10.

6022. Nielsen. Washing and separating china and other clays, earth pigments, etc. March 12.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

5277. Hogg. Manufacture of Portland cement. March 4.

5908. Chisolm. Method of treating wood. March 11.

COMPLETE SPECIFICATIONS ACCEPTED.

4929 (1908). Chateau and Merklen. Impregnation and preservation of wood. March 10.

14,342 (1908). Berner, Frankl, and Mendelsohn. Manufacture of artificial stone. March 10.

X.—METALS AND METALLURGY.

APPLICATIONS.

5007. De Benedetti. Platinum solder. March 1.

5013. Taylor. Apparatus for separating gold and other metals from dust and other impurities. March 1.

5350. Hales. Manufacture of iron and steel. March 5.

5362. Herring. Carbonising and otherwise treating minerals or other substances. March 5.

5675. Boulton (Newell Manufacturing Co.). Metallisation of non-metallic articles.* March 9.

5712. Fennell and Sackett. Purification of molten metals.* March 9.

5802. Simpson and Oviatt. Metallurgy of iron and steel. March 10.

5821. British Thomson-Houston Co. (General Electric Co.). Reduction of oxides.* March 10.

6088. Aktiebolaget Electrometall. *See under XI.*

COMPLETE SPECIFICATIONS ACCEPTED.

27,017 (1907). Hommel, and Metals Extraction Corporation. Apparatus for use in solution and precipitation processes. March 17.

27,018 (1907). Hommel, and Metals Extraction Corporation. Furnaces for volatile metals. March 17.

27,020 (1907). Hommel, and Metals Extraction Corporation. Extraction of zinc from ores or zinc residues. March 17.

5515 (1908). Jones. Treatment of ores. March 17.

7584 (1908). Nodon. Recovery of tin from waste tinned metal, alloys, etc. March 17.

12,322 (1908). Boulton (Jones). Treatment of iron ore. March 10.

12,342 (1908). Holzapfel. Crucible furnaces. March 10.

12,750 (1908). Carrick and Pattison. Treatment of copper mattes. March 17.

18,523 (1908). Schmelzer. Metallurgical furnaces. March 10.

23,958 (1908). Souard. Cementation of iron, steel, etc. March 10.

531 (1909). De Ferranti. Manufacture of material suitable for the blading of turbines, compressors, etc. March 10.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

5958, 5960 and 5962. Gibbs. Producing metallic articles by electrodeposition. [Comprised in No. 4410. Feb. 27, 1908.] March 12.

6088. Aktiebolaget Elektrometall. Electric production of iron and steel and other metals and furnaces therefor. [Swed. Appl., Aug. 1, 1908.]* March 13.

COMPLETE SPECIFICATION ACCEPTED.

6449 (1908). Morris. Electrolytic production of aluminium oxide. March 17.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

4956. Gilbert and Ralph. Machines for cooling soaps, fats, etc. March 1.

5050. Bamberg. Hydrolysis. March 2.

5620. Macpherson and Heys. Detergent and emulsive agent. March 9.

5715. Budde and Robertson. Decomposition of fats and oils into fatty acids and glycerin. March 9.

5797. Common and Hull Oil Manufacturing Co. Manufacture of soya bean oil. March 10.

COMPLETE SPECIFICATIONS ACCEPTED.

16,642 (1908). Lanerman. Apparatus for extracting oil. March 17.

22,441 (1908). Rinze. Manufacture of albumose soap. March 10.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

APPLICATION.

6022. Nielsen. *See under VIII.*

COMPLETE SPECIFICATION ACCEPTED.

11,638 (1908). White. Production of oxide of iron pigments. March 10.

(B.)—RESINS, VARNISHES.

APPLICATIONS.

5709. Yaryan. Purification of resin.* March 9.

5978. Ogilvie and Mitchell. Obtaining oleo-resins from wood. March 12.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

COMPLETE SPECIFICATIONS ACCEPTED.

12,799 (1908). Nance. Process and apparatus for tanning and treating hides and skins. March 17.

14,256 (1908). Schmitt and Ahrens. Drying albumen. March 17.

XV.—MANURES, Etc.

COMPLETE SPECIFICATION ACCEPTED.

4753 (1908). Schäcke. Manufacture of manure from recent eruptive stones containing potassium protoxide and lime salts. March 10.

XVII.—BREWING, WINES, SPIRITS, Etc.

APPLICATIONS.

5395. Soc. l'Air Liquide. *See under I.*

5571. Ascoli. Medicinal preparation from yeast. [Addition to No. 21,820 of 1908.]* March 8.

5790. Haack. Maturing and purifying alcoholic liquors. [Fr. Appl., March 11, 1908.]* March 10.

6087. Valentin. Mashing malt for brewing. March 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1884 (1908). Breker. Brewing processes. March 10.

6396 (1908). McDougall. Distillation of whisky. March 17.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATION.

5562. Lamouroux. Process for obtaining vinegar from whey. March 8.

COMPLETE SPECIFICATION ACCEPTED.

14,256 (1908). Schmitt and Ahrens. *See under XIV.*

(B.)—SANITATION; WATER PURIFICATION.

APPLICATION.

5676. Schultze. Purification of water.* March 9.

XIX.—PAPER, PASTEBOARD, Etc.

COMPLETE SPECIFICATIONS ACCEPTED.

9579 (1908). Claessen. *See under V.*

25,183 (1908). Curtius und Co. Agent for use in sizing paper. March 10.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

4967. Penschuck. Production of a disemulsified extract of Casearia sagrada. March 1.

5050. Bamberg. *See under XII.*

5395. Soc. l'Air Liquide. *See under I.*

5571. Ascoli. *See under XVII.*

5773. Pharmazeutisches Institut L. W. Gans. Serum or antitoxin. [Ger. Appl., March 11, 1908.]* March 10.

COMPLETE SPECIFICATIONS ACCEPTED.

4712 (1908). Busch. Manufacture of soluble compounds of hexamethylenetetramine and mercuric salts. March 10.

8514 (1908). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of a pancreas preparation suitable for treating diabetes. March 17.

23,330 (1908). Sorger. Manufacture of therapeutically valuable iron salts. March 17.

3021 (1909). Meister, Lucius, und Brüning. Manufacture of optically active *o*-dioxyphenylalkamines. March 17.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

COMPLETE SPECIFICATION ACCEPTED.

20,971 (1908). Christensen. Manufacture of colour plates or screens for colour photography. March 10.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATION.

5412. Ward. Apparatus automatically indicating and recording the percentage of carbon dioxide in the combustion gases of boiler flues, etc. March 5.

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APRIL 15, 1909.

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Official Notices.

LIST OF COUNCIL, 1908-1909.

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 Dr. T. B. Wagner.
Chas. Wightman.
 R. C. Woodcock.

Ordinary Members of Council:

Prof. P. Phillips Bedson.
 Prof. W. Hodgson Ellis.
 Oscar Guttman.
 H. Hemingway.
 Prof. G. Henderson.
 Prof. W. R. E. Hodgkinson.

E. Grant Hooper.
 Dr. Charles A. Keane.
C. T. Kingzett.
Frank H. Tate.
Dr. Leonard T. Thorne.
 Harold Van der Linde.

Sectional Chairmen and Secretaries:

	BIRMINGHAM.	F. R. O'Shaughnessy.
<i>Harry Silvester.</i>	CANADIAN.	Alfred Burton.
Dr. Milton L. Hersey.	LIVERPOOL.	W. Roscoe Hardwick.
Max Muspratt.	LONDON.	Julian L. Baker.
Dr. J. Lewkowitsch.	MANCHESTER.	Julius Hübner.
—	NEWCASTLE.	Dr. F. C. Garrett.
C. J. Potter.	NEW ENGLAND.	Alan A. Clafin.
<i>F. E. Atteaux.</i>	NEW YORK.	Dr. H. Schweitzer.
Maximilian Toch.	NOTTINGHAM.	S. R. Trotman.
<i>Oliver Quibell.</i>	SCOTTISH.	Dr. G. B. Neave.
D. J. Playfair.	SYDNEY, N.S.W.	T. U. Walton.
Prof. J. A. Schofield.	YORKSHIRE.	Thomas Fairley.
Prof. W. M. Gardner.		

Honorary Treasurer:

Thomas Tyrer, Stirling Chemical Works, Stratford, E.

Honorary Foreign Secretary:

Dr. Ludwig Mond, F.R.S.

General Secretary: Charles G. Cresswell, 59, Palace Chambers, Westminster, S.W.*Telegraphic Address:* 59, Palatable, London.*Telephone Number:* 715 Victoria.

ANNUAL GENERAL MEETING.

NOTICE IS HEREBY GIVEN that the Annual General Meeting of the Society will be held in the Jehangier Hall, Imperial Institute Buildings, London, S.W., at 10.30 in the morning of Wednesday, May 26th next.

In accordance with the provisions of By-law 24, Notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Prof. Ira Remsen has been nominated to the office of President under By-law 20; Dr. G. Beilby, F.R.S., Mr. E. Grant Hooper, and Dr. R. Messel, have been nominated Vice-Presidents under By-law 21, and Prof. R. Meldola has been nominated a Vice-President under By-law 20. Mr. Thomas Tyrer has been appointed Hon. Treasurer, and Dr. L. Mond, F.R.S., Hon. Foreign Secretary, under By-law 35.

Members are hereby invited to nominate, on or before April 22nd next, fit and proper persons to fill four vacancies among the ordinary members of the Council under By-law 24. Forms for this purpose can be obtained, on application, from the Secretary of the Society.

By-law 23:—An ordinary member of Council shall be nominated by ten or more members upon Form B in

the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any member, but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:

- The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

- The nomination is not made on the authorised printed form or substantially not in the manner directed thereon.

- The nomination form is signed by less than ten members not disqualified or not ineligible to nominate as provided by the By-laws.

- The nomination form is not received before or upon the day appointed therefor.

- The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid shall receive notice thereof from the Secretary, and shall not be submitted for election.

Notice is also given under the provisions of By-law 38 that the Regulations set forth below will be submitted for consideration and confirmation by the members assembled at the same meeting.

CHARLES G. CRESSWELL,
 Secretary.

DRAFT REGULATIONS

TO BE SUBMITTED TO

THE ANNUAL GENERAL MEETING

FOR CONFIRMATION.

(Under By-Law 38.)

MEMBERS.

- At whatever period of the year a new Member may be elected he shall be required, unless the Council shall determine otherwise, to pay his subscription for that year; having done which he shall be entitled to receive all the numbers of the Society's Journal for that year. (*c.f.* By-law 7.)

- If a Member who has been duly elected, and has paid an Entrance Fee and one or more subscriptions, resigns under By-law 14, and later seeks re-election, the Council may re-admit him without further Entrance Fee.

ANNUAL GENERAL MEETING.

- When a ballot is required under By-law 26, then at such stage in the proceedings of the Annual General Meeting as shall be most convenient, the Members present shall hand their Ballot Lists to the General Secretary, or, in his absence, to such other person as the President may appoint. Members unable to attend the Meeting may send their Ballot Lists before the Meeting to the General Secretary in sealed envelopes. Each such sealed envelope must be marked "BALLOT LIST," and must, moreover, have written upon it the name of the Member sending it. The names written upon such sealed envelope having been compared with the Society's Register by the General Secretary, such sealed envelopes shall be opened at the Meeting by Scrutators appointed by the Meeting. The Scrutators shall see that the conditions of the Ballot are strictly fulfilled. Any Member shall be at liberty to strike out any name or names of Ordinary Members of Council printed on his voting paper.

COMMITTEES.

- No Special Committee, nor any Committee of a Local Section shall have any control over the funds of the Society, except to the extent to which funds for its use may be voted by the Council. An account of the manner in which any funds so voted for the use of any Committee have been expended shall be furnished to the Council on or before the 15th of November in each year.

LOCAL SECTIONS.

5. All elections to the Committee of a Local Section and all elections of Officers of the Section, with the exception of those to fill up unforeseen vacancies, shall take place so that they can be reported to the Council in time to be considered at the Meeting held under By-law 24 not less than two months prior to the Annual General Meeting; but the Members of Committee and Officers thus elected shall not take office and those whom they are to succeed shall not retire from office until the close of the Annual General Meeting aforesaid.

CHARLES G. CRESSWELL,
Secretary.

Canadian Section.

Meeting held at Montreal on Friday, January 22nd, 1909.

MR. ANTHONY MCGILL IN THE CHAIR.

THE INFLUENCE OF ENVIRONMENT ON THE COMPOSITION OF WHEAT.

BY FRANK T. SHUTT, M.A., F.L.C.

In 1908, the output of wheat from the three provinces, Manitoba, Saskatchewan, and Alberta, was 106,000,000 bushels from 6,000,000 acres, valued at \$87,000,000. In 1902 the acreage in wheat was 2,665,698 acres with a yield of 67,000,000 bushels. The estimate for 1909 is 12,000,000 acres in cereals, of which 7,000,000 acres will be wheat. At this rate of increase in the occupation of the Canadian North-Western lands, it might be asked, shall we not very soon exhaust the area available for wheat growing? I think not. There are in the three western provinces, it is estimated, about 170,000,000 acres suitable for cultivation, the greater part of which is undoubtedly adapted to wheat growing. Seeing that only between 5 per cent. and 6 per cent. of this area is at present under tillage, the possibilities for expansion in wheat production are enormous. Dr. Wm. Saunders, Director of the Dominion Experimental Farms, considers the possible wheat production of the three western provinces to be 800,000,000 bushels, one-fourth of the land only being devoted to this cereal annually. But this is not all. To the north of Alberta and Saskatchewan, within the boundaries of Athabasca and MacKenzie, are nearly 500,000,000 acres, and wheat can be grown successfully at a number of points throughout this large area. Wheat has been ripened, for instance, at Dunvegan and Fort Vermillion on the Peace River, the former 414 and the latter 391 miles north of the latitude of Winnipeg, and still further north at Forts Providence and Simpson on the MacKenzie River, within 5 degrees of the Arctic Circle. Last season 30,000 bushels of wheat were harvested at Fort Vermillion. All the evidence points to the Peace River country and much land even further north as capable of producing wheat of excellent quality.

The influence of environment on the composition of wheat, both as to nitrogen and ash content, is a question that has received much attention from agricultural chemists on both sides of the Atlantic. From the results of these experiments and a careful review of the evidence there seems but one conclusion to draw, that climate is far more potent than soil fertility in influencing the composition of the grain. The percentage of nitrogen—and hence the gluten—in the grain, while particularly susceptible to the influences of climate, is practically unaffected by differences in soil fertility, though, as will be pointed out presently, the soil indirectly, i.e., in its capacity for holding moisture,

may very materially modify the composition of the grain in this respect. Richness of the soil in nitrogen (and this is a distinguishing feature of our North-West soils) has but little effect on the percentage of nitrogen in the grain; many sandy loams of moderate nitrogen-content produce wheat of equal gluten-content with that from heavy loams rich in nitrogen. The researches of Lawes and Gilbert showed that manuring had but little influence on the composition of wheat, but that climatic condition was the chief factor affecting the character of the grain. The fertiliser plots of the Central Experimental Farm, Ottawa, have received now for 20 years all sorts of fertilisers, and, so far, these have not materially affected the composition of the grain. Climatic conditions influence the quality of wheat through the vegetative processes—by shortening or lengthening the time which elapses from the formation of the kernel until it is ripe—the shorter this period the higher the nitrogen content. High temperatures, long days and absence of excessive moisture during the ripening process, undoubtedly hasten the maturation of the grain and increase its percentage of gluten. These are the conditions that prevail in the North-West in those seasons which give the largest proportion of first quality wheat, and in these climatic conditions we have an asset, a factor, fully equal in value and importance towards the production of the finest wheat to that we possess in those fertile prairie soils. The proof for the statement that wheat improves in quality as it reaches its northern limit of growth is neither complete nor altogether satisfactory, but, in so far as it is true, the underlying cause is to be found in the high temperatures, long days and absence of heavy rains that characterise the midsummer months of these northern latitudes—the period when the grain is advancing from that of the "dough" stage to full maturity.

In that newly settled area of Manitoba, the Dauphin district, much of the land before ploughing and seeding must be cleared of scrub, i.e., small trees, shrubs, etc. This is known as "scrub" land, and it was found that grain grown on this newly cleared land was more or less soft and starchy in character. It was further found that as time went on and the land had been under cultivation for a number of seasons, the tendency was for the wheat to improve in quality. The change was, as a rule, gradual, but occasionally it was of a marked character. Apparently this change was in a measure influenced by the nature of the season; in some years there was but little difference between the grain grown on the older and newer lands—seed of the same description being sown on both; in other years the difference was so great as to disguise their common parentage. On the whole the evidence of this tendency to improve is very pronounced.

From the first set of samples from this district in this investigation, obtained in 1905, (a) the wheat as sown gave 11.11 per cent. of protein, (b) as grown as the first crop after "breaking," gave 9.93 per cent., and (c) as grown on soil that had been under cultivation for nine years, gave 12.62 per cent. The results show deterioration and improvement, compared with the parent wheat, confirming the opinion gained from an examination of the samples.

In 1906 the moisture content of the two classes of lands throughout the growing season was determined and a complete analysis of the two soils made. The result showed that the newly broken land contained a considerably higher percentage of moisture throughout the season and especially during the latter part of June and on until the crop was harvested.

In 1906 the parent seed wheat contained 9.93 per cent. protein; as grown on breaking, it gave 10.01 per cent., and as grown on old land, it gave 13.52 per cent. protein. Both the parent wheat and that grown on breaking would be termed soft or piebald; the difference between them in protein content is likewise insignificant, the data being practically within the limit of experimental error.

But between these wheats and that grown on the older land there is a great difference. The latter shows no starchy grains—all, or practically all, the kernels are hard, semi-translucent, and typical of a high grade wheat. And the difference in protein content is very considerable, amounting to 3.5 per cent. The moisture content of the two soils furnishes, I think, the explanation for this improvement.

Moisture content of soils to a depth of 8 inches, Valley River, Man., 1906.

Soil.	May 5th.	May 15th.	May 29th.	June 22nd.	July 13th.	August 2nd.	August 24th.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Breaking	32.96	36.49	33.45	30.49	35.23	30.37	32.84
Old land	22.45	23.39	23.39	21.70	21.24	13.24	18.28

The soil producing the softer wheat (breaking) was throughout the growing season more moist; its percentages of water ranged from 9 to 14 higher than those of the soil giving the harder grain. And it is further to be noted that there was no drying out in the "breaking" soil as the season advanced.

The two plots under experiment adjoined—they were part and parcel of the same area—and their soils would be classed as rich sandy loams. That designated as "breaking" had been cleared and deeply ploughed in the June previous. Throughout the remainder of the season (1905) the surface was frequently and thoroughly cultivated to induce decay of the vegetable fibre and prepare a favourable seed bed. This cultivation had the effect of conserving the moisture, and in a large measure no doubt accounts for the higher percentage of water in this soil during the succeeding season.

The other plot had been cleared and put under cultivation nine years previously. During this period the practice had been two years in grain with the third as summer fallow. Thoroughly representative samples to a depth of eight inches furnished on analysis the following results.

Analysis of (air-dried) soils.

	Breaking soil.	Soil 9 years under cultivation.
	per cent.	per cent.
Moisture	2.98	2.06
Organic and volatile matter	20.90	12.84
Insoluble residue (sand, clay, &c.) ..	51.74	65.07
Oxide of iron and alumina	5.50	10.52
Lime	10.25	3.47
Magnesia	2.44	1.63
Potash	0.14	0.19
Phosphoric acid	0.15	0.13
Soluble silica	0.02	0.02
Carbonic acid, &c., (undetermined) ..	5.88	4.07
	100.00	100.00
Nitrogen in organic matter	0.642	0.371
Available constituents—		
Phosphoric acid	0.0067	0.0067
Potash	0.0166	0.0069
Lime	1.306	0.93

The characteristic feature of these soils is their richness in vegetable matter and nitrogen, and it will be noticed that the percentages of these constituents are very considerably higher in the "breaking" soil. Why this should be so we need not now discuss, though therein lies a very important lesson, but this larger proportion of humus—considered in conjunction with the treatment the land had received during the previous season—readily explains the higher moisture content of the "breaking" soil, since humus enhances a soil's absorptive and retentive capacity.

In potash and phosphoric acid these soils present no striking differences, though in lime the newer soil is much the richer. The data, apart from the relation of humus to moisture content,—throw no light upon our problem. It is interesting, however, to observe that the soil with the higher nitrogen content produced the starchier wheat. This is not mentioned as an example of direct cause and effect, but rather to show that a highly nitrogenous soil does not necessarily mean a highly nitrogenous wheat.

To summarise my explanation—which is of course a tentative one—we may say that the larger amount of moisture in the "breaking" soil prolonged the vegetative processes of the wheat plant, delaying the maturation of the grain. This is probably the more marked on very rich (highly nitrogenous) soils such as we are considering than on soils naturally poor or exhausted by cropping. Early ripening of the wheat, such as is brought about by

the gradual lessening of the supply of the soil moisture (and which must mean the cutting off of the soil's food supply), tends, we are of the opinion, to the production of a hard glutinous wheat, which in a sense may perhaps be considered as in a degree immature or rather not fully developed. On the other hand, prolonged vegetative growth as induced by excessive moisture under the influence of favourable temperatures, defers ripening and allows the further deposition of starch, resulting in a more or less soft kernel.

Red Fife wheat was sown on two areas on the Experimental Farm, Lethbridge, Southern Alberta—a district of sparse precipitation, and consequently where the methods of the so-called "dry" farming are practised—and, where possible, irrigation is employed to obtain good yields. One of these areas was irrigated with the object of ascertaining what effect the added water might have on the quantity and quality of the grain. The season during the earlier months was unusually wet and consequently not favourable to the experiment in hand; nevertheless as the following data clearly show the irrigated soil with its higher water content during the period of the wheat's maturation produced the wheat with the lower percentage of gluten.

LETHBRIDGE, 1908 SERIES:—

	Protein. (N x 6.25.)
	per cent.
Red Fife—Original seed from Brandon, Man.	15.95
" " Grown on irrigated land	13.70
" " " " non-irrigated land	16.37
Between the wheats grown on irrigated and non-irrigated land we notice a difference of more than 2.5 per cent. protein, the richer wheat being from the soil that partially dried out during the ripening period.	
Kharkof, a winter wheat, gave the following data:—	
	Protein. (N x 6.25.)
	per cent.
Kharkof—Grown on irrigated land	12.11
" " " " non-irrigated land	13.12

Here we observe a difference of 1 per cent. protein in favour of the wheat from the non-irrigated land.

The soil moisture determinations made at intervals throughout the season are as follows:—

Moisture content of soils.

	"A" irrigated.	"B" non-irrigated.
	per cent.	per cent.
May 14th, 1908	16.56	15.61
July 15th "	8.78	8.11
August 17th "	10.37	6.38

The single irrigation of plot "A" was made directly after the collection of the soil samples on July 15th. The unusually heavy precipitation during the spring and early summer, already referred to, made irrigation prior to this date undesirable. It is worthy of note that while the moisture content of soil "A" increased, that of "B" decreased during the ripening period of the wheat.

In the case of both spring and winter varieties, therefore, the percentage of protein was considerably higher in the wheats from the soils that were the drier during the ripen-

ing of the grain, adding confirmatory evidence to that obtained in Northern Manitoba, the details of which we have discussed more fully.

From these considerations it seems evident that the quality of the wheat of any season may be largely determined by the character of that season. I think we may argue that if there is a sufficiency of moisture in the month of June to bring the wheat crop to maturity, then we may expect better quality grain if the weeks following are characterised by hot, dry weather, than if the weather during this period is cool and wet.

It would of course be impossible this evening to discuss every phase of this interesting problem; in this address it has been my purpose merely to show how the quality of the grain may be affected by the proportion of soil moisture present during the growth and more particularly the latter part of the growth or period of maturation of the wheat, especially under high temperatures such as usually prevail during the mid-summer and early autumn months in the Canadian North-West. There is, however, before closing, one matter to which I must refer in order to prevent any misunderstanding that might arise from what I have said regarding this falling off in quality of the grain under certain conditions. We must be careful to differentiate between quality of wheat and quality of gluten—the former may be influenced either by the proportion or the nature of the latter. We do not find from our chemical work or that of the cerealist, that the character of the gluten of any particular variety of wheat is materially affected by varying climatic conditions, provided of course the wheat reaches a fair degree of ripeness. It seems to me, therefore, that while the amount of gluten is largely a product of the season, the character of gluten is determined and fixed by the variety. In other words, heredity is the potent and dominating factor influencing quality and environment—using the term in its widest sense—the factor affecting its quantity. If further investigation establishes the correctness of this conclusion, the knowledge will prove of the greatest value, for it will enable us to work in the breeding of new wheats with more directness and better hope of success, and it will be of assistance to the wheat grower by indicating the best varieties to grow and the best methods of culture to follow.

Liverpool Section.

Meeting held at University on Wednesday, January 13th, 1909.

MR. MAX MUSPRATT IN THE CHAIR.

THE MOVEMENT OF GASES IN VITRIOL CHAMBERS.

BY HERBERT PORTER, F.I.C.

During the interval since I exhibited the Model Vitriol Chamber before the Manchester Section on the 30th of April, 1903, many manufacturers have adopted the bottom inlet and centre outlet at the end of chambers, and it has been satisfactorily proved, by practical working, that the results have been of considerable value by the increased make of acid.

The most usual increase is about 25 to 30 per cent., in one case as much as 50 per cent. more acid was made in the same chamber space. In mentioning these increased yields it will be understood that the existing conditions at the time of altering the inlets and outlets would largely affect the result. In some works the connections between chambers were in such a position as to render the efficiency of the chamber very low in acid production, and it is on that account that varying increased yields have been recorded. Another point of interest to be recorded is that from the movement of the gases as shown in the model some kind of data can be obtained as to the proper size of a vitriol chamber. If a chamber is 30 feet high the gases from a bottom inlet will rise about 60 feet from the end

and on reaching the top divide into two portions, one returning and one going forward, as seen in the model and as previously illustrated. It, therefore, shows that the length of a chamber should be about four times its height in order to give full play to the natural movement of the gases. It has been also practically proved that the proper place for admitting steam is under the inlet and over the outlet, and not at the sides of the chamber, where the cooler condensing acid gases are descending. With these inlets and outlets the chambers work more steadily and give indication of any irregularity in time to prevent a more serious disorganisation.

DISCUSSION.

The CHAIRMAN asked whether Mr. Porter had any data or any material for checking the result of water sprays instead of steam: the water being supplied in sprays instead of steam. The latent heat of the steam was so great that it was very difficult to imagine that the same conditions would hold when the water was introduced in the form of spray without any of the latent heat, as it was in the form of an ordinary steam jet. Did not the water spray modify the conditions of the chamber? They appeared to be on the brink of a very great economy in chamber space if they could combine the results of the water spray with a more scientific method of introducing the gases.

MR. EUSTACE CAREY asked if there was much difference in a vitriol chamber where the gases were not inert, and were undergoing rapid reactions; of course there was the evolution of a great deal of heat, which, he imagined, would rather interfere with the various currents. He would also like to know what was the capacity in cubic feet per lb. of sulphur burned per 24 hours, at the commencement and at the end of the make, in the cases where the output was increased from 60/70 to 120 tons a week.

MR. T. W. STUART said he had regularly observed the results of the working of about 100 separate sets of chambers, extending over many years, in which chambers of all sizes and forms were worked in sets of 2 up to 7, in a set tandem, with the connection from the Glover tower made at the top of the first chamber, the ends and the sides near the ends, and from 1 up to 6 steam pipes in each chamber, worked from 5 to 35 lb. pressure. Many manufacturers held strong views as to the importance of many of these details, but his experience was that the final working results were the same in each case, notwithstanding all the foregoing differences. If the burnt ore contained the usual 3 per cent. of sulphur, the burner gas 7 to 8 per cent. of sulphur dioxide, combined with reasonable chamber and Gay Lussac space, and a final escape of 1 grain of total acidity, the final results of working are all practically identical, notwithstanding the differences in the construction of the plant enumerated above.

MR. NORMAN HOLDEN said he had to work a set of chambers where they had had to put in the bottom inlets. There was no doubt that the chambers could then be worked with a less capacity of chamber space, but the trouble they had was, that when the fan was stopped occasionally for oiling purposes, they had great difficulty with the burners: that was noticeable immediately the fan was stopped. They were still working the second and third chambers with the tunnels, and they were getting a very great deal more vitriol made, and they were able to catch the plant when it showed signs of going back.

MR. ARTHUR CAREY said it seemed difficult to understand how the initial velocity of the entering gases could be high enough to carry the gases in a fairly straight line the full length of the chamber. In an ordinary vitriol chamber of plant making 150 to 200 tons a week, the gases enter the chamber at some 25 to 30 cubic feet a second; thus they would enter a two-foot square tunnel with an initial velocity of about 7 feet a second, entering a chamber perhaps 100 feet long, with about 400 sq. ft. cross section. Could Mr. Porter give any figures with respect to the comparative speed at which the gases enter, because if the initial velocity of his model was comparatively greater than on one of the large chambers, there must be some considerable modification. For instance, the steam jets entering travelled in the direction of their initial velocity for only a short distance. It would appear that the

initial velocity of those steam jets was considerably greater than the initial velocity of the gases entering the chamber.

Mr. PORTER, in reply, said he had found the water sprays an excellent thing in hot weather, but difficult in cold weather: the chambers got cold during the night and required some little assistance in the way of steam. There was the difficulty of freezing and the filtering of the water: if the jets got blocked instead of getting a spray they would get drops of water, thereby diluting the bottom acid. In reply to Mr. Carey, certain modifications would have to be allowed for in the case of a working chamber, but he did not think that the allowance was quite so great as might appear, because that actual model had been worked with steam and at a temperature in some cases up to 160°. He had made acid in the chamber, so much so that the bottom was actually burnt. Still, the movements of the gases appeared to be quite the same. In practice, where the bottom inlet had been adopted, they had proved that the hottest point was in the centre of the chamber, where the chamber was of reasonable length. Mr. Holden had not found it an advantage when the fan was stopped, but in that case the chambers were very long in proportion to their height and width. There was one large firm that wished to adopt the bottom inlet. They had two No. 1 and one No. 2, and all the other chambers in tandem; they also had several union chambers, mere boxes, the same height, about square. Acting on his advice, they cut out four of these unions and one chamber, and divided the others into two sets, and made more acid than they made before.

With regard to Mr. Carey's question with respect to the increase of 120 tons a week from 65 tons; the capacity had dropped from about 20 cubic ft. per lb. of sulphur to 15, in other cases to 14, 11, 10½, which was the lowest he knew; of course, where this increased work had come about, extra burners had been provided or switched on.

An advantage of keeping the chambers fully up to their work was that, when working a chamber 20 or 30 cubic ft., there was not always sufficient condensation in the back of the chamber to wet the entire surface of the chamber.

In reply to Mr. Arthur Carey, he thought the initial velocity was sufficient to carry the gases the full length of the chamber, but he had no figures from the model before them to give to demonstrate that. He based all his theories and calculations on the questions of temperature; where there was a top inlet taking the gases all along the top of the chamber, there was a very marked decrease at the sides as they come lower down. It appeared from such tests as though there was a straight current of hot gas running from the top of the chamber. It appeared from the temperatures taken at the sides, that the greater heat of the sun at the top and the gases running along the top, caused the gases at the top of the chamber to expand, the atmosphere became rarefied, and it probably deflected the incoming gas at the top, naturally making it work at a slightly lower level, and the hot gas would be lower in the hot weather than in the cold. It was quite simple to find the points at which the gas rose, somewhere about the middle of the chamber; the temperature of the gases coming in was known, and the temperature of the gases going out could be found. The velocity of the gases Mr. Arthur Carey had given at 25 to 30 ft. per second in an ordinary damper flue coming into the chamber, a very high velocity (Mr. Arthur Carey here corrected the velocity as stated by Mr. Porter, dividing the 25 to 30 ft. by the square of the opening into the chamber, and stating that the linear velocity was about 7 feet per second), and when they considered that the surrounding gases in the chamber were to a great extent at rest or dragged at by the incoming gases, that was a very big velocity for a small stream of gases into a big space. The gases hung to the sides of the chamber and the current would bore its way through a considerable distance.

With regard to steam. Whether it was the higher temperature of the steam that made it rise he did not know. That was the observation he had made, and he had carried out a number of experiments at Tennants' Works, with Mr. Hart. They did the experiments in the open air on a still day, and he was surprised at the short distance the steam travelled before it turned upwards; with 30 lb.

pressure, a half-inch nozzle, and the valve a third on, the steam only went 4 or 5 feet before it turned upwards, and the lateral strength of the steam was nothing like what one would suppose it to be. If that was so on a still day, in the open, it would be more so in the dense gases of a vitriol chamber. The conclusion was that the half-inch nozzle was much too coarse. As a rule, steam valves and steam pipes were put on far too large for the work they had to do.

Another most instructive model was one that he had made at Mr. Carpenter's suggestion, admitting the gases at both ends of the chamber, and taking them out at the middle. In that model, the gases worked in precisely the same way as in the one before the meeting, with this difference, that the gases from either inlet met in the middle of the chamber and returned: the fact that the outlet was at the side in the centre of the chamber in no way affected the movement of the gases in the manner shown.

If the gases were admitted at the top precisely the same thing happened as in his first model. They came along the top and met and formed dense banks. He believed that Dr. Hunter had stated that the gases might be taken out anywhere except near where they came in. Mr. Towers had suggested that that was just when the gases should be taken out, and it was quite feasible.

London Section.

Meeting held at Burlington House on Monday, March 1st, 1909.

DR. J. LEWKOWITSCH IN THE CHAIR.

SULPHUR AS A CAUSE OF CORROSION IN STEEL.

BY G. NEVILL HUNTLY.

A considerable amount of work has been published during the last few years dealing with the corrosion of iron and steel, attention having been chiefly concentrated on the effect of the presence or absence of carbon dioxide. An investigation into the cause of pitting in a standby boiler at the generating station of the London Electric Supply Corporation proved that the sulphur in the metal is also a factor that must be taken into account. In these boilers the pitting assumed serious proportions about two years ago, and an increase in the proportion of alkali, caustic soda, in the water proved to be useless in lessening the evil. On examining the boilers numerous blisters were seen, varying in size up to 30 mm. in diameter, the bulk of them being in the neighbourhood of the water level. On pricking the blisters each was found to contain a liquid with a fine black powder in suspension, and a pit was forming in the centre of each blister. As it appeared probable that the examination of this liquid might throw some light on the corrosion, a large number of the blisters were pricked, the fluid collected, and kept from contact with air. This liquid, which was strongly acid to litmus paper, was filtered in an atmosphere of carbon dioxide, and proved to consist of a solution of ferrous sulphate with a slight excess of sulphuric acid, the latter being either free acid or possibly ferric sulphate. The boiler water in which the blisters had been submerged was slightly alkaline, containing 0.635 lb. of caustic soda per 1000 gallons. As the blister fluid available only amounted to 25 grms., its complete analysis was not possible. It contained 2.315 grms. per litre of ferrous sulphate, and within the limits of experimental error practically all the iron was present as ferrous salt. The total sulphate, expressed as sulphuric acid, was 1.92 grms. per litre, the total sulphate in the boiler water being 0.0608 grm. per litre, the ratio of the concentrations in sulphate inside and outside thus being 31.5 to 1.

Assuming that the sodium sulphate was of the same strength inside and outside the blister, the excess of sulphuric acid would still amount to 0.27 grm. per litre.

It is clear that the sulphur could only come from the steel and the oxygen necessary for its oxidation from solution in the boiler water, and it seemed of interest to determine, if possible, how the oxidation takes place. It is well known that the sulphur in steel is present as manganese sulphide, ferrous sulphide only appearing when the quantity of manganese is insufficient. If the sulphide is directly oxidised to sulphate by the oxygen in solution and this precipitated by the alkali in the boiler water, the substance of the blister and the black precipitate in suspension should consist mainly of oxides of manganese. If, on the other hand, the sulphide on oxidation gives rise to free sulphuric acid, the corresponding amount of oxide of manganese remaining attached to the plate, then this acid will act on the whole portion of the metal within the blister, and the precipitate will contain the various constituents of the metal in proportions roughly corresponding to those existing in the boiler plate. This would also be the case if, a little ferrous sulphate once formed, oxidation to ferric sulphate took place at the expense of the incoming oxygen: this ferric sulphate would be reduced by the metal of the plate and the scale would have the same composition as in the attack by free acid.

The analysis of the scale gave the following figures:—Iron, 65.92 per cent.; manganese, 0.28; carbon, 0.50; phosphorus, 0.00; sulphate (SO_4), 3.71; silica, 0.65; calcium, 1.10; moisture, 3.40; oxygen (by diff.), 24.44 per cent. In spite of the precautions taken to exclude oxygen during the washing and drying, it is probable that some oxidation took place, increasing the proportion of ferric oxide. The above analytical figures are consistent with the following composition for the scale:— Mn_3O_4 , 0.39 per cent.; CaSO_4 , 3.74; Fe_3C , 7.56; SiO_2 , 0.65; FeSO_4 , 1.70; Fe_3O_4 , 18.00; Fe_2O_3 , 64.56; water, 3.40 per cent. (The water represents the amount left after drying in a vacuum at the ordinary temperature over phosphorus pentoxide.)

The proportion of manganese does not correspond with what would be expected if manganese sulphate were the first oxidation product, but the figures agree fairly well with the hypothesis of the action of dilute sulphuric acid or ferric sulphate, the products being then precipitated by the alkali of the boiler water. As in a standby boiler the liquid has periods of rest, the oxides deposit on the spot where they are formed, giving a coherent membrane. Under these conditions this acts as a sort of semi-permeable membrane, admitting oxygen but not alkali, thus giving rise to the anomalous effect of an acid corrosion going on inside an alkaline boiler water.

The presence of streaks of sulphide in the steel thus gives a complete chemical explanation of pitting in the case of a standby boiler, and may also serve to explain the corrosion of steel plates along definite lines in experiments in which the liquid has not been kept agitated. It was formerly supposed that provided the sulphur in steel was completely combined as manganese sulphide, the injurious effects on the strength of the steel were minimised. Metallographic evidence has lately been accumulating tending to prove that many fractures follow the lines of manganese sulphide: the facts noted above as to the chemical properties of manganese sulphide form an additional argument for excluding it from steel as far as possible.

It may be of interest to note that the substitution of an alkaline arsenite for caustic soda in these boilers completely stopped the trouble, no blisters having developed during the last two years, an effect possibly due to the oxidation of the arsenite by the dissolved oxygen.

DISCUSSION.

Mr. W. THOMSON asked if the skin formed over these blisters was magnetic oxide of iron. He thought it possible that peroxide might first form and the sulphur in the iron might be converted into sulphuric acid at the expense of the existing peroxide producing magnetic oxide, which was usually found in boilers, the sulphuric acid combining to form ferrous sulphate, leaving a skin of the magnetic oxide over the blistered part.

Mr. GRANT HOOPEE asked whether the author investigated the composition of the material actually forming the skin; and to what he attributed the formation of such a blister. It seemed to him to suggest the production of gas at that point.

Mr. W. C. HANCOCK understood the author to say that the addition of alkali to the water did not cause pitting; but at some works with which he was connected a water softening plant was installed; the first time the boilers were examined a considerable amount of pitting was found in places. This was attributed to the water softening plant, and it was found that after that plant was more systematically worked, with less excess of alkali, the pitting practically disappeared.

Mr. W. McD. MACKEY said that tannin materials seemed to have a good action in taking up the oxygen and preventing this pitting.

Mr. HUNTLY, in reply, said it was not possible to separate the substance of the blister from the suspended precipitate inside: the latter was relatively small in amount and probably had the same composition as the substance of the blister itself. Although every care was taken to keep the scale as far as possible out of contact with air (filtration in carbon dioxide and drying over phosphorus pentoxide in a mercury pump vacuum), it was probable that a certain amount of oxidation took place. Hence the original percentage of the oxide, Fe_3O_4 , might have been higher than that given in the paper, with a corresponding reduction in the amount of ferric oxide.

CELLULOSE AS A POLYSACCHARIDE: A BRIEF REVIEW OF OUR PRESENT KNOWLEDGE.

BY J. F. BRIGGS.

One of the first facts which a student of chemistry learns about cellulose is that, like starch, it belongs to the group of polysaccharides and that its constituent monose groups are composed mainly if not entirely of dextrose. This view was founded on experiments made as early as 1819 by Braconnot and elaborated subsequently by various observers, chiefly Flechsig, 1883, and Stern, 1895. It has received support by a large number of attempts made on an industrial scale to produce alcohol from cellulose or from its raw material—wood. It likewise appears justified *a priori* from the manner of the formation of cellulose in the plant from sugar, so far as this has been investigated, and further by analogy with the most typical and fully studied of the polysaccharides—starch. Thus the poly-dextrose nature of cellulose may be taken to be self-evident and perhaps there has been a tendency to accept it too much without question. A critical revision of the literature of the subject, however, shows that the amount of reliable evidence is extremely scanty, and that much of it is of a contradictory nature. So far as the reactions of the aggregate are concerned the properties of the two substances, starch and cellulose, are very similar. Both give a series of analogous esters, corresponding to the presence of 3 free hydroxyl groups, both possess the slightly acid functions towards alkaline bases characteristic of all the saccharides, and both are susceptible to a degradation of the aggregate under the hydrolytic action of acids. But when the manner of the hydrolytic degradation is studied we are struck by profound differences, which can only be accounted for by differences in the mode of association of the C_6 groups constituting the aggregates. A vast amount of work has been devoted to the dissection of the starch complex, with the result that the constitution of this substance as a complete poly-dextrose has been established beyond dispute. The enzyme diastase has been one of the most important instruments in this dissection, but unfortunately cellulose has resisted the hydrolytic influence of every enzyme hitherto brought to bear on it. We are obliged therefore to fall back on the more drastic action of hydrolysing acids, complicated as this is by collateral phenomena of esterification, internal structural transpositions, reverse condensation, humification, etc.

The first point we note then is that whereas starch is converted readily and almost completely into dextrose by digestion for 3—4 hours at 100° C. with 2 per cent. sulphuric acid, cellulose under the same conditions is structurally disintegrated, it is true, but yields only traces of soluble sugars. The ease with which hydro-cellulose is produced and the great resistance of the product to further hydrolysis, suggests the hypothesis that the cellulose aggregate contains at least two hydro-cellulose complexes united together by an ordinary anhydride linkage of the starch type, but that the condensed linkages of hydrocellulose itself are of a totally different order. By digestion with dilute acids at very high temperatures larger but variable amounts of sugars are produced, but it is extremely doubtful whether the saccharification of cellulose has ever been carried as far as 50 per cent.

The most complete study of the direct saccharification of cellulose is contained in a series of papers by Simonsen (*Zeits. angew. Chem.*, 1898, 195, 219, 962, 1007). He worked only on wood cellulose with the industrial objective of the manufacture of alcohol. He found the most favourable conditions for the saccharification of 40 grms. of cellulose to be a digestion for 2 hours at 6—8 atmospheres with 1680 c.c. of 0.5 per cent. sulphuric acid; longer digestion caused a serious destruction of sugar. From the best of his experiments (an exceptional case) he claims to have obtained 45 per cent. of sugar and 44 per cent. of residue. On treating the residue again in the same way it yielded 27 per cent. of sugar, but he does not appear to have followed up the series by a third treatment. Simonsen's results, which are admitted to be the most reliable, have recently been criticised by Körner (*Zeits. angew. Chem.*, 1908, 2353), who repeated some of his experiments. Körner points out that Simonsen's yields of sugar were determined only by the cupric reducing power of the extracts and that this is not always a legitimate measure. Simonsen's extracts were not completely fermentable, and it is doubtful whether the whole of the cupric reducing power could be credited as sugar, certainly not as dextrose. Körner, working on Simonsen's lines, obtained a yield of 12.8 per cent. of alcohol from wood cellulose, corresponding to, say, 26 per cent. of dextrose. From "hydro-cellulose" he obtained 18 per cent. of alcohol, but he does not indicate whether the hydrocellulose was prepared from wood or cotton cellulose. Both Simonsen and Körner limited their investigations by strictly utilitarian industrial conditions and their work consequently lacks the scientific value of a contribution to the theory of the constitution of the cellulose aggregate. Nevertheless, Körner concludes with the following remark:—"The yield of alcohol theoretically possible from 100 grms. of dry cellulose is 56.9 grms., but even in the most favourable cases, not more than 25 per cent. of the theoretical quantity was obtained by the simple hydrolysis of the cellulose. It is therefore conceivable that of the whole cellulose complex, $(C_6H_{10}O_5)_x$, only a portion is capable of hydrolysis and conversion into fermentable sugar."

Körner's work, however, hardly warrants such a conclusion, since being limited to industrial conditions, he made no study of the susceptibility of the residues from the first digestion to further hydrolysis with fresh acid.

Whilst the credit and debit account as between cellulose and dextrose by direct hydrolysis is unsatisfactory, the results shown for the hydrolysis of cellulose indirectly by way of its esters are no more complete.

Braconnot and his successors proceeded by employing sulphuric acid of such a strength that its first action in the cold is one of solution and esterification (see Stern, *Chem. Soc. Trans.*, 1895, 74). In this way the acid sulphuric esters of a series of dextrin-like bodies are obtained which on long boiling in presence of dilute sulphuric acid are gradually hydrolysed into dextrose. Stern has carefully fractionated these sulphuric esters, determining the cupric reducing power and the specific rotatory power for each fraction, and the series has a general aspect very analogous to that of a maltodextrin series of starch products. The gradual production of sugar on continued hydrolysis is accompanied by the splitting off of sulphuric acid from the ester. Neither Stern nor previous workers appear to have actually obtained any but quite insignificant

quantities of dextrose (say, 5 per cent.). Stern's "cellulose sulphuric acids" are non-reducing bodies, but his hydrolytic series are made up of potential dextrose groups. It is however to be carefully noted that the yields of soluble barium cellulose sulphates from which all Stern's deductions were made never accounted for more than 48 per cent. of the original cotton cellulose taken. Other chemists have examined other celluloses than cotton on similar lines; thus Lindsay and Tollens isolated 3.5 per cent. of crystalline dextrose from wood cellulose by this method. Ernest (this J., 1906, 388) obtained about 4 per cent. of a dextrose syrup from ramie cellulose in the same way.

A third line of attack was initiated in 1901 by Skraup (*Monatsh.*, 22, 1011). This chemist also dissected the cellulose by way of its esters, and by the action of acetyl chloride he obtained about 26 per cent. of the chlor-acetate of a biase sugar corresponding, say, to about 15 per cent. of the sugar itself. This sugar, cellobiose, is hydrolysed by boiling dilute sulphuric acid to dextrose.

So far as I can make out, observations of the above order constitute the chief evidence on which the poly-dextrose character of cellulose has been based, and the obvious criticism of this evidence is that at the best not more than one-half of the cellulose has been accounted for.

Hence there is a wide field of systematic research open for the complete determination of the position of cellulose in the group of polysaccharides. The number of possible methods of hydrolysis is by no means exhausted, and conditions must be found whereby the tendency to reverse reactions is restricted. In the case of the dissolved sulphuric acid esters of cellulose this restriction might be effected by carrying out the subsequent hydrolysis over long periods at the ordinary temperature instead of by boiling. In addition to sulphuric acid there is another acid, viz., syrupy phosphoric acid, which dissolves cellulose, so far as we know without esterification, the hydrolytic action of which has not been studied. It is interesting to note in this connection that whereas syrupy orthophosphoric acid dissolves cellulose completely, the glacial meta acid is entirely without action at the ordinary temperature.* Researches on the direct hydrolysis of cellulose by dilute acids should be carried out by repeated treatments for short periods in the autoclave, with frequent removal of the hydrolysed products from the sphere of action and full investigation of the resistant residues until the whole of the original cellulose has been converted. Skraup's line of research on the hydrolysis of the acetic esters of cellulose is capable of considerable development and extension since he has adopted the principle of cold hydrolysis extended over long periods of time. In all cases the possible lability of the constituent units of the aggregate must be taken into account and the influence of preliminary or simultaneous treatments likely to cause intramolecular transpositions should be studied.

When a method of total hydrolysis has been worked out in the case of the normal cotton cellulose, it should be extended to ascertain the possible changes of internal structure brought about by such treatments as mercerisation, oxidation, etc. Next it would have to be applied to the less homogeneous industrial forms of cellulose obtained from wood or grasses. It is known that these celluloses contain, either constitutionally or in the form of residual impurities from tissues other than the fibre walls, polysaccharides which yield monoses other than dextrose, e.g., pentosans and mannosans. These celluloses would have to be examined before and after fractionation by specific treatments, e.g., extraction with concentrated solutions of alkali hydroxides. Finally, the questions which remain to be answered are: Is cellulose a true and complete polysaccharide like starch? Can 100 parts of cellulose be accounted for in terms of 110 parts of dextrose? If not, what is the nature of the residue? Lastly, is the pure fibrous cellulose of wood constitutionally identical with the normal type of cellulose as we know it in the cotton fibre?

* In a recent paper by Hengoumeneg and Morel (*J. Pharm. Chim.*, 1908, 28, 486) the merits of hydrofluoric acid for effecting complete hydrolysis of proteins, without secondary reactions, are discussed; this acid might also be tried on cellulose.

New York Section.

Meeting held at the Chemists' Club on Friday, January 22nd, 1909.

MR. MAXIMILIAN TOCH IN THE CHAIR.

PRESENTATION OF THE PERKIN MEDAL.

The CHAIRMAN referred to the absence through illness in his family of Dr. Behr, the recipient of the Perkin Medal. After some remarks on the origin of the medal and the useful work of Dr. Behr,

Professor C. F. CHANDLER (Past-President), in presenting the medal to Dr. Nichols, on behalf of Dr. Behr, said:—"It is with deep regret that we are unable to have the pleasure this evening of the presence of Dr. Arno Behr, the distinguished chemist who has been selected by the representatives of our different chemical societies as most worthy of the honour of receiving the third issue of the Perkin medal. This honour could not have fallen upon a more worthy representative of successful effort in the application of chemical science to the industrial arts.

Dr. Behr came to this country in 1878, on the invitation of Mr. Matthiessen, of the firm of Matthiessen and Wiechers, and was engaged in chemical work in their sugar refinery in Jersey City. His first work, however, was largely of an experimental nature. Great interest was then shown in the manufacture of glucose directly from corn, a number of patents, having relation to such processes, being published at that time. The object was to cheapen and simplify the process by working on the whole corn, instead of first separating the starch. This would, of course, have decreased the cost of manufacture and would have increased the yield considerably. Mr. H. C. Humphrey originated the idea, and it was decided to carry out an experiment on a manufacturing scale. An old sugar refinery in New York was rented for that purpose. While watching this work, it occurred to Dr. Behr that a great deal of fat might be found concentrated in the residue. Actual tests confirmed this observation and led to the application for a patent, which was issued to Messrs. Humphrey and Behr, under date of September 30th, 1879 (U.S. Pat. 220,116), the title being: "A Process for extracting oil from the residuum in the manufacture of glucose." However, the process was never carried out, because it was found impracticable to convert the corn direct into glucose.

In 1880 Mr. E. A. Matthiessen, while travelling in Europe, saw a new process of making starch from corn in operation at Cervignano, near Trieste. The inventor was Professor Chiozza. Corn was steeped for one or two weeks in cold dilute sulphurous acid, cracked between rollers, and the magma brushed in revolving metallic sieves with the addition of water until the starch was all removed from the hulls, only hulls and germs remaining upon the sieve. These were dried and separated in a fanning mill. The starch was deposited on tables and separated from the gluten without the use of alkali. The process contained features far in advance of that practised in the United States, which induced Mr. Matthiessen to acquire the American patent. But it soon became evident that this process, which was carried out at Cervignano in a factory, the output of which did not exceed 200 bushels of corn, could not be applied in an American factory built for a daily capacity of 10,000 bushels, for this was the size of the factory agreed upon for the manufacture of glucose and grape sugar. Therefore, it became the task of Dr. Behr to modify and adapt the process to the conditions imposed by a large production. Dr. Behr tried to replace the action of Chiozza's brushes by beating the crushed corn with knives revolving at a high speed and set in a trough on a horizontal shaft. He did not fully succeed in his main object of loosening all of the starch, but after diluting the magma with water, he made the far-reaching discovery that by gently stirring, a layer of germs was formed, which floated on the surface of the liquid. This observation led to the introduction of one of the most important operations in a glucose and starch factory—the separation of the oil-bearing germ—

and furnishes a striking example of the applicability of laboratory experiments to large industrial processes. Dr. Behr secured a patent covering the process of separating the germs from the rest of the corn, which was obtained on September 30th, 1881 (U.S. Pats. 247,152 and 247,153). To test the process commercially an experimental factory was erected at the sugar refinery in Jersey City, and there several important details were worked out. One of the problems was the disposal of the gluten. This task was solved by converting it into a dry fodder, which, ever since its introduction, has occupied the foremost position among the concentrated animal feeding stuffs.

At this time crystallised, anhydrous grape sugar was being obtained by a patented process, originated by Professor Soxhlet. It was obtained by crystallisation from a methyl-alcohol solution and was a very beautiful product. Dr. Behr had been experimenting at that time with a view of obtaining such crystallised dextrose, but all his efforts were futile until he resorted to inducing crystallisation in the mother liquor by introducing crystals of anhydrous dextrose. He eventually worked out a method of crystallisation, by which the crystal was formed in such a way that the remaining mother liquor could readily be drained off. The sugar thus produced takes first rank among all the corn products, and the process is remarkable in that it enables the manufacturer to turn out commercially, in large quantities, a dextrose which is practically chemically pure. This important discovery of Dr. Behr's—the method for refining grape sugar without the use of alcohol—is secured by U.S. Patents 250,333 and 250,334, of December 6th, 1881; 256,622 and 256,623, of April 18th, 1882, and 259,794, of June 20th, 1882. A paper on the subject was published in the "Berichte der deutschen chemischen Gesellschaft" in 1882, as well as in the "Journal of the American Chemical Society" during the same year. In the meantime, a Company had been formed and the erection of a factory in Chicago had been started for the exploitation of the Chiozza-Behr process: the original intention was to manufacture glucose and the ordinary kinds of grape sugar, but the new crystallised, anhydrous grape sugar appeared so attractive that the factory was arranged for the sole manufacture of this product. This enterprise, however, proved unprofitable, as there was no market for such large quantities of the new sugar. After running from November, 1882, to February, 1883, never with more than one-seventh of its capacity, and more or less in an experimental way, the factory was closed in the spring of 1883, and Dr. Behr thereupon returned to Jersey City and resumed his duties with the Matthiessen and Wiechers Sugar Refining Co.

The Chicago factory, however, during the short time of its running, had demonstrated the practicability of the new processes, and the directors decided to operate it again, after providing a new installation for the manufacture of glucose, in addition to that of ordinary grape sugar and the anhydrous sugar. It was started in August, 1883, Dr. Behr being in charge as superintendent. At first only anhydrous sugar and its by-products (the latter also inventions of Dr. Behr) were manufactured; the former found a market with the wine-makers and the latter with the brewers. In January, 1884, the additional equipment for the manufacture of glucose was completed, and then came a strenuous time of work and competition with existing glucose factories, during which only the large profit made on the anhydrous sugar saved the Company from insolvency, as the manufacture of glucose and ordinary grape sugar had not as yet been worked out to such a degree as to make it remunerative. Dr. Behr gradually increased the grind from 2900 bushels per day in 1885 to 10,000 bushels in 1890. From the start the aim was to produce as many specialities as possible. With that end in view, Dr. Behr introduced the manufacture of mill starch, dextrin, British gum, caramel, so-called high converted sugar, climax sugar, and other products, which, although started in a small way, were in most cases brought up to a considerable output. There was, of course, keen competition in starch, dextrin, and British gum, but Dr. Behr succeeded in working out new and cheaper methods of manufacture, which enabled him to keep ahead of competition. During this time he also worked out a valuable method for manufacturing con-

fectioners' glucose, which is protected by U.S. Pat. 406,599, July 9, 1889.

In 1889 it was at last decided to commence the manufacture of corn oil, and the Behr method of separating the germs was thus put into actual operation. The production of corn oil has since then assumed large proportions, and the oil itself is to-day the highest priced product obtained from corn. The output of oil in the glucose and starch factories in this country approaches almost 200,000 lb. per day. In March, 1890, an explosion took place, which destroyed the starch and dextrin plants of the Chicago factory. The explosion was caused by the ignition of powdered starch in the dextrin department. Dr. Behr responded to a call for assistance, and while attempting to put out the fire, the explosion occurred and he was severely injured. Upon his recovery, a year later, he retired from the active management of the works and devoted himself exclusively to scientific research.

In 1893 Dr. Behr secured U.S. Pat. 491,234, for the recovery of the ingredients extracted from the corn during the steeping process. Thus, another valuable by-product was obtained, the monetary returns from which exceeded all expectations.

During the years following Dr. Behr worked out two interesting products, one a vulcanised corn oil, which, although not one of the large articles of manufacture, has nevertheless found considerable favour with the trade, and is manufactured quite extensively. The other product was a so-called "thin boiling starch," which is used especially by the confectioners in high-grade work. Besides these, there are various inventions and improvements discovered and worked out by Dr. Behr, which are not protected by United States patents.

After first developing the manufacture of the bulk products—glucose, grape sugar, and mill starch—Dr. Behr made their manufacture lucrative by his remarkable exploitation of the by-products. To him, more than anyone, the American industry of corn products owes an everlasting debt of gratitude.

It is a great satisfaction to all those who took part in founding the Perkin Medal that we are able to find as recipients of this medal such worthy followers and disciples of Dr. Perkin as Mr. Herreshoff and Dr. Arno Behr.

I take pleasure in placing in your hands, Dr. Nichols, as representing Dr. Behr, this beautiful Perkin Medal as a token of the appreciation in which he is held by the chemists of the United States.

Dr. NICHOLS (Past-President) said: Since the foundation of the Perkin Medal it has been my fortune to assume various attitudes in relation to it. I had the honour of presenting the first Perkin Medal to Sir William himself on the memorable occasion of his visit to the United States in 1906. The following year it was my privilege to participate in the presentation of the medal to my old friend and associate, Mr. J. B. F. Herreshoff.

In Dr. Behr's behalf I accept the medal for him, with a full realisation of the great honour which has been conferred, and with the hope that the encouragement which others will get in the future will be heightened by the knowledge that if what they are doing at the present time does not meet with immediate recognition, they can depend upon the chemical fraternity to see that in the case of really good work, time will be a benefit to them rather than a detriment. The fact that Dr. Behr has been away from us so long and at such a great distance, and yet has seen his work of years ago recognised, speaks volumes for the character of the profession which has to pass from year to year on the names presented for the Perkin Medal.

In his name I thank you most heartily for the honour.

THE AMERICAN INDUSTRY OF CORN PRODUCTS.

BY T. B. WAGNER.

The award of the Perkin Medal is an occasion of great moment to every chemist. This year the honour has fallen upon my friend, Dr. Arno Behr, whose life-work is identified with the development of the industry of corn products. It seems fitting, therefore, that on this occasion some account should be given of this great and typically

American industry. This task has been allotted to me, and I look upon it not only with keen pleasure, but as a great privilege.

Although corn is the principal cereal raised in the United States—"Corn is King"—comparatively little is known about its use in industry, to say nothing of its sowing and growing, harvesting and shipping, among people who live removed from the great corn belt of our Central and Western States.

Indian corn, or maize, is undoubtedly native to America, although for a long time it was claimed to be of Asiatic origin. But as this corn was not known in the old world until after it was found in the new, there can be hardly any doubt as to its original habitat.

At the time of the discovery of the new continent, Indian corn was one of the staples of agriculture from the La Plata Valley northward to the United States. It has names in all the languages. The natives planted it around their temporary dwellings where they did not form a fixed population. Indian corn was found as a common food when Europeans first landed in New York. Extensive fields of this grain were cultivated and the grain preserved for food. When, in 1535, Cartier visited Hochelaga, now Montreal, that town was situated in the midst of extensive cornfields. In 1620 the Pilgrims found extensive plantings near Plymouth, Massachusetts; and Columbus found it on the West India Islands about the end of the fifteenth century. The burial mounds of the natives of North America, who preceded those of our day, the tombs of the Incas, the catacombs of Peru, contain ears or grains of corn, just as the monuments of ancient Egypt contain grains of barley and wheat and millet seed. In Mexico, a goddess, who bore a name derived from that maize, answered to the Ceres of the Greeks.

The Smithsonian Institute at Washington has an ear of corn found deposited in an earthen vessel 11 feet under ground in a grave with a mummy in Peru.

Whether the true origin of Indian corn will ever be ascertained is doubtful, but so much is certain, that the white settlers of America early learned from the native Indians the use of corn as an article of food. Several Indian names for certain preparations, such as samp, hominy, succotash, have passed into the language of the American people.

Indian corn belongs to the gramineæ or grass family. Botanically, it is known as "*Zea Mays*," and is separated into six general groups, representing different species. These groups are as follows:—

1. *Zea tunicata*, the pod corns.
2. " *evecta*, the pop corns.
3. " *indurata*, the flint corns.
4. " *indentata*, the dent corns.
5. " *amylacea*, the soft corns.
6. " *saccharata*, the sweet corns.

The division, which is of supreme importance commercially, is that of the dent corn, *Zea indentata*.

Corn is the most valuable crop grown on American soil. In quantity and value it is greater than all the other cereal crops; in fact, it is this year nearly as large as the great crops of cotton, hay, and wheat combined, thus bearing out the prophecy of our illustrious statesman, James G. Blaine: "Corn will yet be the spinal column of the nation's agriculture."

In 1838 the corn raised in this country amounted to 377,531,875 bushels, whereas in 1908—seventy years later—the crop had increased to 2,643,000,000, or seven times that of 1838. The great importance of the crop may be better realised when it is stated that a fluctuation of a single cent in the bushel price of corn means a fluctuation in money value to the farmer of 26 million dollars. The value of this year's crop almost surpasses belief. It is \$1,615,000,000. This wealth, that is grown out of the soil in four months of rain and sunshine and some drought too, is enough to cancel the interest-bearing debt of the United States, and to pay for the Panama Canal and 50 battleships.

At the Paris Exposition, the United States exhibited 108 separate and distinct commercial products made from corn. It enters into the manufacture and composition of products in as wide a range as from rubber-shoes to our daily bread; from chewing gum to dynamite; from

bon-bons to battleships. In this day of commercial economy no particle of the corn plant is permitted to go to waste; the grain, the cobs, the husks, and the stalks all are utilized. Seven States of the Union—Illinois, Iowa, Kansas, Nebraska, Missouri, Indiana, and Ohio—comprise the territory familiarly known as the "Corn Belt." Illinois leads all the other States in the yield per acre, as well as the amount of acreage and production, the latter amounting approximately to one-fifth of the entire crop of the United States.

Of the total crop, however, only about 10 per cent. is consumed by the industries and employed in the export trade. Of this, the industry with which I am connected consumes approximately one-fifth or 50 million bushels per year, where two-fifths are required by the fermentation and milling industries, and an equal amount finds its way into the export trade of this country.

The corn plant is very pliable in the hands of skilful breeders. Cyril G. Hopkins has succeeded, through ten generations of breeding at the University of Illinois, in increasing the average protein from 10.92 per cent. to 14.26 per cent., and, on the other hand, in decreasing it to 8.64 per cent.; in the same way, the average percentage of oil has been increased from 4.70 per cent. to 7.37 per cent., and diminished to 2.66 per cent.

First, the farmer carefully selects the seed corn most suitable for his particular conditions and requirements. In the month of April the ground is ploughed, and then harrowed and re-harrowed until the soil is thoroughly pulverised. The proper time for the planting of corn is from the 1st to the 10th of May, but it can be planted to good advantage any time during the month of May, and even later if the season is favourable. The old-time method of planting by hand has been discarded in favour of automatic planting machinery. The prime object sought by the use of the corn planter is to get corn planted in the field in hills and a uniform number of kernels in each hill. It takes about ten days for the plant to show itself above ground, at which time the "cultivating" is immediately begun. The objects of cultivation are, first, to destroy weeds; second, conserve soil moisture, and, third, to aerate the soil. It is gone over with the cultivators usually three times, and is then, as it is called, "laid by." By this time the stalk is sufficiently high to shadow the ground to some extent and the weeds cannot get a start. The plant then grows without further attention. The great bulk of the corn crop requires four months to mature, although there is an early variety of corn, called a "ninety-day corn." The corn usually reaches a height of eight to ten feet, but a height of fifteen feet is not unusual.

After it is thoroughly matured, and if the corn is wanted for fodder, it is cut and preserved in shocks until it is needed for food. The rule, however, is to let the corn remain in the field and then to husk the ears from the standing stalks, which latter are allowed to remain in the field until spring, when they are broken, raked, and burned. In the Corn Belt States, however, the corn is harvested with binding machines, which cut and bind the corn;

these bundles are stacked together and then form the corn "shocks."

The latest in corn harvesting machinery is the corn harvester and sheller. It consists of a corn binder, in which the binding apparatus is replaced with a platform and windlass. The corn is cut but not bound. It collects on the platform until a shock of the desired size is secured. The machine is then stopped, the shock tied by hand, the windlass ropes adjusted and the shock deposited on the ground in an upright position. Where formerly the farmer was obliged to go through the fields and husk each ear separately, he now calls into service husking machinery. These machines, which are usually portable and are often employed on the co-operative plan, separate the ears from the stalks more neatly than any "hired" man could or would do.

The corn is now ready for the market. The farmer hauls it to the elevators, where it is "shelled" by machinery; in a great many sections it is shelled in the country by a portable sheller, and then delivered to the elevators. Here it is put aboard the cars and sent to market centres, and finally arrives at the factory, where the chemist takes the kernel in hand and from him we obtain this cross-section in which:

(a) Represents the husk, or skin, which covers the whole kernel; it consists of two distinct layers, the outer and inner, which, when removed, constitute the bran and contain practically all the crude fibre of the whole grain.

(b) A layer of gluten cells, which lie immediately underneath the husk; it is yellow in colour, and cannot be readily separated from the remainder of the kernel. This part is the richest of any in gluten.

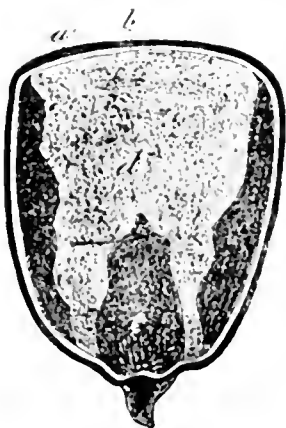
(c) The germ, which is readily distinguished by its position and form; it also contains gluten, though it is particularly rich in oil and mineral constituents.

(d) The endosperm, which is composed chiefly of starch; the dark colour indicates the yellow, flinty part, in which the starch-holding cells are more closely compacted.

These different parts have the following chemical composition:—

	Proportion of parts.	Ash.	Protein.	Fibre.	Nitrogen free Extract.	Fat.
Original kernel ...	100.0	1.7	12.6	2.0	79.4	4.3
Skin	5.5	1.3	6.6	16.4	74.1	1.6
Germ	19.2	11.1	21.7	2.9	34.7	29.6
Starchy and hard parts	84.3	0.7	12.2	0.6	85.0	1.5

The corn goes now through a maze of bewildering operations and manipulations, necessary to obtain the various products in the final state of perfection and purity, in which they reach the consumer. The corn bought by us is graded at the Corn Exchange and is almost exclusively of the +2 and +3 grades. To remove impurities, stone, dirt, dust, &c., the grain is passed through cleaning and separating machinery and the purified corn is then delivered to the corn bins and thence to the steeping tanks, wherein it is soaked in warm water, into which a slight amount of sulphur dioxide has been introduced. The steeping causes the corn to swell, brings about a softening of the grain, and facilitates the subsequent separation of the germ, which is effected after it has passed through a preliminary grinding, whereby the corn is split or cracked. This is done by attrition mills, usually the "Foss" mills. This mass is then conveyed to the so-called "separators," huge cast iron vats of semi-cylindrical shape, and in these the separation of the germ is effected with almost mathematical precision, the operation being at once an extremely simple and clever one. It is one of the early inventions of Dr. Behr, and has perhaps done more than any other invention towards making the glucose industry commercially possible, as it led to the production of corn oil, of all the ingredients of corn the one yielding the highest price. The process is based upon the observation of Dr. Behr, that the germs, which contain a large amount of oil, readily rise to the surface, when suspended in the mass of ground corn and starch milk. This is due, of course,



to the difference in specific gravity. The process is a continuous one, the ground mass being introduced at one end of the apparatus, while the germs are discharged at the top, and the ground corn plus the starch milk at the bottom of the opposite end. The germs, thus liberated, are repeatedly washed to remove any adhering starch; they are then delivered to the germ drying plant, where they are passed through revolving steam dryers and are then conveyed to the oil plant.

In the latter, the usual practice is followed of expressing the oil by hydraulic means, the same as in cotton-seed and linseed oil works, the resultant products being corn oil and a residue—corn oil cake, which belongs to the same class of animal feeding stuffs as cotton and linseed cake, but exceeds them in nutritive value, because of its digestibility. In a medium-sized glucose factory, the production of corn oil approximates 100 barrels a day, requiring about 25,000 bushels of corn. A bushel of corn contains about 80,000 kernels of corn and each kernel contains one germ; therefore 2,000,000,000 kernels of corn, or 2,000,000,000 germs are required, and must be handled to yield that output. Dr. Behr's invention permits this important step to be made with almost mathematical precision.

Corn oil is a very interesting product. Its ordinary uses are found in the manufacture of soaps, soap powders, in the tanning industry, in paints, etc., the bulk of the product being exported to Europe.

In corn oil we have the raw material for an auxiliary of natural rubber. When vulcanised, it forms an admirable material to be used with rubber in the manufacture of rubber-bands, rubber-boots, surgical instruments, tyres for automobiles and bicycles, oil cloths, rain-proof cloth, insulating wires, artificial sponges, and a great number of other products. This article, too, is a product of Dr. Behr's fertile mind.

More recently, we have succeeded in splitting corn oil into glycerin and fatty acids. The latter furnish the soap-makers with a superior stock at a lower cost; lower, considering the yield and the fact that for saponifying, soda-ash may be used in place of caustic soda; the glycerin enters chiefly into industrial use.

We have seen the germ removed from the ground corn, the latter now consisting of the bran, the gluten, and the starch itself. This mass is now ground fine, in so-called Buhr mills, the coarser part or bran being separated by running the mass over silk sieves, which move back and forth at a high rate of speed. The starch milk runs through the silk sieves, which in the factory are termed "shakers," and is collected in tanks for that particular purpose. Like the germ, the bran is removed from the shakers, washed, dried, and ground, and is put on the market in this form as a cattle food, the protein contents of which average about 14 per cent. The starch milk, containing the gluten, is now run over slightly inclined troughs called "starch tables," upon which, by a process of settlement, the starch is built up in a solid layer, whereas the lighter ingredients—gluten, fibre, etc.—are carried off in a current of water over the end of the starch tables. This gluten is concentrated, filter-pressed, and dried in the same fashion as the bran, and put on the market as gluten meal, the protein contents averaging over 40 per cent. It is now quite the practice to unite the two, that is, the bran and gluten, when still in a wet state and send the mass through the filter presses; then the concentrated liquid obtained from the steeping of the corn is added, and the moisture of the whole reduced in revolving steam dryers to approximately ten per cent. It is then ground fine, sacked, and put on the market as "gluten food," having the following average composition:—

	Per cent.
Water	10.36
Protein	25.95
Fat	2.18
Starch	18.09
Fibre	6.50
Ash	3.70
Nitrogen-free substances	33.22

The soluble substances in "gluten food" approximate 15.50 per cent.; the nitrogen-free substance contains 17—18 per cent. of pentosans.

The "gluten food" thus obtained varies in composition in proportion to the efficiency factor prevailing in the individual works; for instance, in a well-equipped and well-regulated factory, the amount of protein will usually run at 26 per cent., whereas in factories conducted less efficiently, the amount of protein may not exceed 18 per cent. The amount of starch in the feed will vary correspondingly.

Among the concentrated feeding-stuffs found on the American market, gluten food is conceded the first place, not only because of the high percentage of nutritive materials contained therein, but because of its palatability and its remarkable digestibility.

I have referred to the water in which the corn is steeped; it contains the most valuable ingredients of the corn. During the steeping, by far the largest amount of the mineral constituents, as well as the soluble organic matter, are leached out. These consist of the organic phosphorus compounds, albuminoids, sugar and other carbohydrates, potassium salts, etc. They are hygroscopic and frustrate all efforts to recover them in dry form. Recognising the great value of these materials, Dr. Behr devised ways and means of recovering them, which are described in U.S. Patent 491,234, issued February 7, 1893. Briefly explained, Dr. Behr recovered these constituents of the corn by evaporating the steep-water to a thick syrup, which contains these substances, partly in solution and partly in suspension. On a dry basis, the steep-water has the following composition:—

	Per cent.
Crude protein	38—43
Reducing sugars as dextrose	25—30
Phosphorus as P_2O_5	6—8
Potash	5—6
Magnesia	2—3

This syrup is added to the wet gluten feed and the mixture is then dried.

It is customary to place the products just described, that is, the oil, the oil cake, the bran, the gluten meal, and the gluten feed, in a group by themselves under the generic term, "by-products." However, the manufacture of these products, has, within the last ten years, undergone such remarkable and marvellous evolutions, that to-day the term "by-products" is hardly justified. These products form as integral a part of our manufacture as the bulk products—corn, syrup, and starch, and their preparation necessarily receives the same degree of watchfulness and care.

Let us now return to the principal part of the corn—the starch. We saw it on the "tables," practically free from the hull, the germ, and the gluten. In this condition it is called in the factory "green starch," and forms the raw material for the manufacture of corn syrup and corn sugars, for mill, laundry, and edible starch. Up to the time when the manufacturers of corn syrup entered upon the manufacture of mill starch, the textile trade depended for its requirements almost entirely upon potato starch, imported from European countries. The small starch factories located in this country contributed but a small share of the demand. The corn syrup manufacturer, because of his large grind, was able to produce commercial mill starch at such a low figure as to replace to a very large degree the European product. Again Dr. Behr, with keen foresight, was the first to commence the manufacture of this article, which has since grown into one of our most important products, some factories turning out as much as 500,000 pounds per day, most of which, either in "pearl" or powdered form, is consumed in cotton and other textile industries for stiffening or finishing the fabrics, and in the manufacture of paper; it is also used for sizings, pastes, and gums.

The "green" starch is removed from the "tables" and diluted with water until it forms a thin starch milk, which, in the case of corn starch, is refined very carefully by a number of well-regulated operations. It is then deprived of the bulk of water and the starch, containing now between 40 and 50 per cent. of water, is introduced into drying kilns of various descriptions, wherein it remains until the moisture is reduced to 10 per cent. It is then ground fine, run through revolving silk screens, and put up either in package form for home consumption, or in barrels and bags for the trade.

The oldest corn starch made for table use is Kingsford's, produced at Oswego, N.Y.

Up to the year 1842 wheat starch was the only starch produced in this country; about that time Thomas Kingsford, while superintending the wheat starch factories of William Colgate & Company, in Jersey City, N.J., conceived the idea that in Indian corn lay the source of an abundant starch supply. Experiments made on a small scale proved the feasibility of his project, yet all attempts to interest capital and the producers of wheat starch to manufacture this new starch resulted in failure. They were making money, and why should they not continue manufacturing starch from wheat instead of taking up a wild project? His idea continued to be ridiculed as impracticable and visionary; however, after numerous and tedious experiments, he was able to produce in 1842 his first marketable starch. Since then, this industry has seen a wonderful rise, and to-day everybody is familiar with the "corn starch" for table use, which has grown in popularity until it is now one of the best known staple food products.

When laundry starch is desired, the operations and chemical treatment are modified somewhat. There are a number of other commercial grades of starch—as, for instance, food and baking powder starch and thin boiling starch. The manufacture of the latter, also a production of Dr. Behr, has grown from what might be called a laboratory scale to a large commercial commodity, the principal consumers being the confectioners.

From the powdered starch, the dextrins are made by a process of "calcining," a number of grades being produced, verging in colour from a pure white to a dark yellow, such as white, canary and dark dextrins, British gums, etc. Some of the dextrins are made by injecting a spray of diluted nitric acid into the powdered starch. Most of the dextrins are used by the textile manufacturers and calico printers, the products being used as vehicles for colours. The dextrins are also used in the manufacture of paper boxes, oil cloth, wall-paper, and for all kinds of pastes and sizings. The chemically-pure dextrin, known as "American-gum"—another product of Dr. Behr's inventive mind—closely resembles gum arabic in its properties, and is used mainly in the manufacture of confectionery and specialties. Another new product, to which the trade name "Amidex" is being applied, is for all practical purposes a soluble starch, being almost entirely soluble in water of 60° Fahrenheit. It seems to be particularly suitable for the finer grades of textile fabrics. Another new article, "Cereal Flakes," is a product of a dextrin-like character, representing the first stages of the cleavage process of starch. It appears in snow-white flakes, is easily soluble in water, and readily converted into sugar by the diastase of malt. It is well adapted as a base for food specialties of all kinds, infants' foods and foods for convalescents; in many cases it takes the place of sugar of milk, over which, among other advantages, it has that of cheapness, and may, therefore, be employed where sugar of milk is now used, as, for instance, in the manufacture of pharmaceutical tablets, etc.

It is now almost one hundred years since Kirchhoff announced his epoch-making discovery that starch could be converted into a sugar, but while the manufacture of corn starch is an industry of long standing, it was not until after the Civil War that experiments were started to make sugar from corn, the cheapest source of starch in this country. These experiments were successful, and products called "Grape Sugar" and "Corn Syrup" were made, comparing favourably with the sugars and syrups made from potato starch in Germany. The industry grew rapidly, until in the year 1884 the importation of potato syrup and of potato sugar, or grape sugar, fell off to a very small amount, and the exportation of corn products assumed large proportions. Since that time it has grown until it is now one of our important industries. A few figures will serve as an illustration.

During the year 1907 about 50 million bushels of corn were used in the manufacture of corn starch, corn sugar, and corn syrup. The total exports of corn amounted to 83 million bushels. This means that this industry has bought from the farmers more than half the amount of

corn which was shipped for export. The value of corn products is double that of beet sugar or cane sugar produced in this country, the total business done in corn products of this character reaching the sum of 50 million dollars per annum.

The capital invested in the manufacture of corn products amounts to 90 million dollars. The industry gives employment to six thousand men, and expends in wages about 4½ million dollars. It consumes one million tons of coal per year. The total freight amounts to about 4 million tons.

This is a wonderful evolution of an industry, of which at one time it was possible to give the following pathetic account: I am quoting from a standard publication:—

"The manufacture of glucose, or grape sugar, from starch has been a prominent American industry for about thirty years. In March, 1865, Dr. Goessling made glucose under a patent he had procured. The sample exhibited led to the formation of a stock company, which purchased of Goessling, Bradley and Briggs their patent for manufacturing sugar and syrup from Indian corn. The company began the manufacture of glucose in the old sugar refinery in Rose Street, New York. Unfortunately, Dr. Goessling, the German chemist, who was to superintend the manufacture of glucose, died before the first lot of glucose was marketed, and with him perished some of the secrets of manufacture. The small stock of glucose made was stored in the refinery, where later, upon examination, it was found in a solid condition, which alarmed the stockholders, for they knew of no use for grape sugar, the name given to starch sugar in its solid form. Neither knew they how to manufacture the glucose as a liquid substance. Their main dependence, Goessling, was gone, and there seems to have been a lack of push, courage, and foresight on the part of the officers and stockholders of the Union Sugar Company, in that they failed to secure expert chemists to work out the secrets of a process known only to Goessling. The few barrels of glucose the company owned, were sold to the Tribune Association for a nominal sum, for use in the printing rooms, after which the company came to grief, having paid \$600,000 for the patents, subject to a right to manufacture, that belonged to a man named Fox. In 1877 the receiver of the Union Sugar Company sold for \$2.50 the patents it controlled."

Coming now to the manufacture proper of corn syrups and corn sugars, in the works the conversion is carried out by stirring the green starch with a large body of water and subjecting this mixture to high heat under pressure, the process being a hydrolytic one, that is, the starch molecule takes up a molecule of water under formation of dextrose. We add to the water a very small amount of pure hydrochloric acid, for the purpose of inciting and facilitating the catalytic action. I should like to call attention to the incorrect description of the manufacture of glucose, as found in most text books on chemistry, the statement being made universally that the starch is converted into glucose by hydrochloric acid. The fact is, however, that the acid plays only the rôle of a catalyser. The conversion of the starch is performed in large vessels six feet in diameter and about twenty feet high, made of hammered copper one inch in thickness, and called "converters."

By varying the temperature and the time, the action of the starch is changed at will and different products result. As soon as the "test" is obtained, indicating that the conversion has been carried to the desired point, further conversion is arrested by releasing the pressure and neutralising the traces of hydrochloric acid in the mixture with soda ash, practically to the neutral point. By the neutralising, sodium chloride or ordinary table salt is formed, which in no wise affects the taste of glucose, as it is present, of course, only in extremely small quantities. In the case of glucose, the test is obtained in less than ten minutes; in the case of 70 sugar, 80 sugar, or anhydrous sugar, the time has to be lengthened considerably. From the neutralisers, the converted starch, now an almost white "liquor," is run through filter presses, which retain such impurities as proteid matter, fibre, etc. The filter-pressed liquor is run through an evaporator, wherein the gravity is reduced approximately to 30 degrees B \acute{e} .

From here, the liquor is transferred to the filters, which are filled with bone char.

Each batch is run successively over three filters. These filters are 10 feet in diameter and 24 feet in height, and contain approximately 70,000 pounds of bone char each. It will be seen from this that the liquors are run over bone black, representing a height of 72 feet. This is one of the most important operations in the manufacture of dextrose products. The liquors receive a much greater amount of bone char treatment than is the custom in cane sugar refineries. The remaining traces of acid are completely neutralised by the bone char, and the resultant liquor has now a brilliant crystal white appearance.

After a batch of glucose or sugar liquors has been run over the bone char, the latter is thoroughly washed and steamed, then dropped into the kilns, which are maintained at a high temperature, either by oil or coke. During this heating, all foreign carbon is burned off and the bone char emerges from the kilns in a "revivified" condition. It is then conveyed through reels in order to remove the dust, which is produced by the grinding of the particles of the char, and is then transferred to the bins, ready for the filters. Enough fresh bone char is added to make up for the loss occasioned by the powdering in transit.

The glucose and sugar liquors are now sent to the vacuum pans, where they are concentrated to the required density, varying from 42 to 45 degrees Beaumé. The evaporated glucose forms a viscous syrup, whereas the sugar liquors, after cooling, crystallise to white sugars, such as the No. 70 sugar, or to the yellow No. 80 sugar. By a most elaborate process, pure dextrose is obtained in the form of crystallised anhydrous grape sugar. This latter is made by the original process discovered by Dr. Arno Behr, and permits of producing this beautiful product in crystallised form, without the aid of alcohol.

The average composition of these products is as follows:—

	Corn syrup.	70 sugar.	80 sugar.	Anhydrous sugar.
	per cent.	per cent.	per cent.	per cent.
Water	19.0	19.7	11.2	4.0
Dextrose	38.5	70.2	79.9	94.6
Dextrin	42.0	9.3	8.0	0.7
Ash	0.5	0.8	0.9	0.7

The ash consists principally of chlorides.

Corn syrup is sold in tank cars and in barrels, the barrels containing usually about 600 pounds net. It is used principally in the manufacture of confectionery and table syrups. It is used extensively in making preserves, jellies, jams, and marmalades, for which it is preferable in many respects to sugar or cane syrup. The confectionery trade requires corn syrup, not to manufacture a cheaper product, but to manufacture a high grade product. Goods made from corn syrup are not likely to "grain," and creams made from corn syrup will remain smooth and will not granulate like those made from sugar. Gum-drops are made almost entirely of corn syrup.

The No. 70 and No. 80 sugars are employed in the brewing of ales and porters, their use imparting the keeping qualities which are so essential, since these beers are shipped to all parts of the world. The principal consumption of these sugars is, therefore, in Great Britain. Caramel or sugar colouring is also made from these sugars. Anhydrous sugar is used in the after-fermentation of beers necessary to produce carbonic acid gas, the so-called "kraeusening" of beers. It is the best material for that purpose, because, being pure dextrose, it does not contaminate the product in any way whatsoever. It is also used in the wine industry for petiotising wines deficient in sugar.

The use of corn syrup for table purposes has assumed large proportions. These table syrups are usually prepared by mixing corn syrup with a certain amount of cane syrup or refiners' syrup, or molasses or sorghum, the operation being carried out in tanks holding about 100 barrels of syrup. A few statistics will give a fair idea of the magnitude of this particular industry. These data are taken from an address, which I delivered in 1903

at the St. Paul meeting of the National Association of State Food and Dairy Departments. I said at that time:—

"The production of cane syrups in the Eastern and Southern sugar refineries is estimated at 346,000 barrels per annum. Of this, 60 per cent. is sold for export, leaving 40 per cent. for home consumption, equivalent to 138,400 barrels; deducting from this 20 per cent. for syrups used for manufacturing purposes, we find that 110,720 barrels represent the total amount of the home consumption for table syrups from this source.

"Louisiana's output is estimated at 400,000 barrels, which is equally divided between table syrups and manufacturing purposes.

"Add to the above the cane syrup from Georgia, the sorghum from Ohio, Missouri, Kansas, Iowa, and Kentucky, all in all about 80,000 barrels, the table consumption of cane syrups and sorghum will be found to be a little less than 400,000 barrels per year.

"Against this the production of corn syrups for table use aggregates a total of 1,350,000 barrels per annum. These syrups contain on an average about 10 per cent. of cane syrup, equivalent to 135,000 barrels; deducting this from the total of 400,000, we have left 265,000 barrels of cane and sorghum syrups against 1,350,000 barrels of corn syrups, or, in other words, for every barrel of cane syrup and sorghum there are sold five barrels of corn syrup.

"These observations lead to the following conclusions:—

First. The demand for table syrups exceeds by far the supply furnished by the cane sugar and sorghum refineries.

Second. Corn syrups meet this demand.

Third. Corn syrup is a superior table syrup of recognised merit, and a necessary commercial commodity."

That was five years ago; since then the sales of corn syrups have shown a marked increase, so that it seems more correct to state, that for every barrel of cane and sorghum syrups there are sold almost ten barrels of corn syrup.

This syrup business has grown to such an extent that it has been found necessary to build two factories for the manufacture of tin cans and in that way the old, cumbersome method of handling and storing cans is avoided, the object in installing can factories being, not only to reduce the cost of the packages, but to have at all times a ready supply of cans, independent of the manufacturer and the railroads. The Syrup Department also maintains its own printing establishment.

I have attempted to give an insight into an industry, attractive because of the multitude of its products and the almost unlimited possibilities of their further development. Much has been done to bring it upon the high plane it occupies to-day, and much remains to be done. What has been accomplished in this wonderful industry fills one with pride, because it is a great American creation, a typical American industry.

I have indicated that the course of the glucose industry did not always "run smooth." There have been few food products about which more mis-statements have been made than glucose. This may have been due, in a measure, to its somewhat mystifying name "glucose," the derivation of which from the Greek word "glycus" is not known to the layman. Glucose used to be looked upon as an adulterant, if not a poison, and, therefore, destructive to health; the lack of public information in regard to this product was relied upon to propagate an adverse opinion among the masses. The Press has been used unsparingly; even legislative aid was invoked, not excluding Congress, to crush this great and growing industry. But investigation furnished such overwhelming proof of the great value of this manufacture to the people and the country at large, that prohibitory action could never have been justified; as a matter of fact, these misrepresentations have finally resulted in the greatest vindication of glucose.

The investigation referred to was conducted in 1883 by the National Academy of Sciences, a national institution, as you may know, chartered by Congress, the committee appointed for the purpose consisting of the following scientists:—

Professor Geo. F. Barker, University of Pennsylvania.

Professor Wm. H. Brewer, Yale University.
 Professor W. Gibbs, Harvard University.
 Professor Chas. F. Chandler, Columbia University.
 Professor Ira Remsen, Johns Hopkins University.

In their lengthy and thorough report they gave expression to the following conclusions:—

"The starch sugar thus made and sent into commerce is of exceptional purity and uniformity of composition, and contains no injurious substance. Though at best having only about two-thirds the sweetening power of cane sugar, yet starch sugar is in no way inferior to cane sugar in healthfulness, there being no evidence before the committee that maize starch sugar, either in its normal condition or fermented, has any deleterious effect upon the system, even when taken in large quantities."

Although the corn products interests were foremost among the food manufacturers of this country in securing the enactment of a National Pure Food Law, and although they spent large sums of money in improving their processes, so as to meet even the strictest requirements of food laws, the industry found itself, as recently as last year, face to face with the grave situation that after it had established the healthfulness and wholesomeness of its products, the very name of its principal product was now made the subject of an attack. It is hard to understand why the name "Corn syrup" should not give satisfaction to everybody: it certainly satisfies the consumer, who is the principal party to be considered, as it tells him exactly of what the product is made. The main reason advanced why this name was not considered proper was, that far back in 1842 experiments were being conducted in this country for the purpose of extracting from the stalks of the corn a syrup belonging to the sucrose class. It would seem that such a product, if actually made, should be called a "Corn stalk syrup," as the name "corn" applies only to the grain and not to the stalks. "Corn stalk syrup" was the name applied to it in the early reports of the Commissioner of Patents, and the very fact that the experiments were conducted over 60 years ago, and did not lead to any commercial success, clearly prove that they cannot be considered other than abandoned experiments. It is gratifying to note, however, that the highest authorities under the Food and Drugs Act, namely, the Secretaries of Agriculture, the Treasury, and the Department of Commerce and Labour, after a most careful examination of all the testimony submitted in an official promulgation, designated as "Food and Drug Inspection §87," proclaimed corn syrup as the proper name for the product, obtained by a partial hydrolysis of the starch of the corn.

While I have emphasised the importance of corn syrup as a food product, I do not wish to neglect the technical uses to which corn syrup is put. They are innumerable, and it would exceed the scope of this address were I to enumerate them. I do wish, however, to call the attention of my brother-chemists, engaged in technical pursuit, to the great versatility of this product, and I feel that it is not as yet fully appreciated, as perhaps too little was known about its merits, apart from being a food product. The corn products interests always have made it a policy to encourage and foster experiments, looking to a greater consumption of corn syrup and corn sugars in technical fields.

The corn products industry has undergone great changes. Factories have come and factories have gone. What once was considered the best, was later found to barely meet the average. Where once a 500-bushel works was looked upon with awe, a factory grinding 15,000 bushels arouses no special attention to-day. The factory built in Chicago in 1882 was a landmark of that city: it was also looked upon as a model plant: it was perhaps the only factory ever built in this country, having a height of 14 storeys. The idea governing the erection of a works of such huge height was to operate it upon the gravity plan: that is, the corn was elevated to the top floor and from there gradually worked its way down to the warehouse and shipping floors, from where the finished goods were loaded into the cars. It has been amply demonstrated, however, that this method can no longer be considered good engineering, at least not in our industry. The strain on the building, the wear and tear, are too great, and the cost of mainten-

ance becomes too burdensome. Thus it happened that within the last year the old "refinery," as it was known, was razed to the ground, and with it is gone a part of old Chicago and memories of days of toil and effort, of failure and success. "*Sic transit gloria mundi!*"

All that remains, and only for a little while longer, are the tall smokestack, reaching almost 250 feet into the skies, and a few minor buildings, in which some of the specialties are still being manufactured.

In its stead, however, rises Phoenix-like, a new industrial city on the banks of the Drainage Canal, which forms a link of the proposed waterway between the Great Lakes and the Gulf of Mexico. Where, only a year ago, the country in that section was still given over to farming and was full of charming woods, the situation to-day is very different. The prairie is being rapidly transformed into the seat of a great industry. The trolley-car, the great civiliser, has arrived on the scene; contractors have been at work digging and excavating, building foundations and tunnels, and gradually the chaos begins to assume shape. Huge steel buildings rise in the different parts; the latest style of building—re-enforced concrete, can be seen all over. Great difficulties had to be encountered, as, for instance, the raising of the main line of the Chicago and Alton Railroad a height of ten feet in order to reach the docks situated on the Drainage Canal. A view from the Administration Building shows the vastness of the enterprise. This plant, which led to the founding of a new city, called "Argo," will have ultimately a capacity of 60,000 bushels of corn a day. It will cover an area of 120 acres, and will give employment to thousands of men. It is the climax of the development of the industry of corn products: a proud monument to American enterprise, American skill, American ingenuity, American perseverance. It is a monument to the keen foresight of the progressive management of the "Great American Industry of Corn Products," and is no less a monument to the pioneers of this industry, who have made such evolution possible. If a memorial tablet were to be placed on one of those magnificent buildings, among the names inscribed thereon would be found those of H. C. Humphrey, Dr. Giesecke, Thomas Gaunt, my lamented friend and co-worker Lee Harrison, Charles Pope, Dr. Firmenich, the Hamblins, the Matthiessens, and, above all, the name of the man in whose honour we are assembled to-night, Dr. Arno Bicht.

Scottish Section.

Meeting held at Glasgow on Tuesday, March 2nd, 1909.

DAVID J. PLAYFAIR IN THE CHAIR.

THE DETECTION AND ESTIMATION OF DAMMAR RESIN IN KAURI RESIN.

BY SAMUEL STEWART, F.I.C.

Dammar resin, or gum dammar is the product of certain species of *Dammara* and *Hopea*, which grow in Southern India, Borneo, etc., and is obtained from living trees. It comes into the market in various forms, the finer qualities being in large pieces of a clear yellow, and others brownish or reddish. The lower grades are in the form of grains.

The classification of some of the resins is very defective and confusing, as, for example, Manila copal from *Vateria Indica* is known as "white dammar" and kauri copal from *Dammara Australis* is known as "New Zealand dammar." There are thus classed as "dammar" the products of widely different trees and the resins possess very different properties.

In a paper by Robert D. Thomson, M.D., read at a meeting of the Philosophical Society of Glasgow* on 15th March, 1843, it is mentioned that specimens of both

* Transactions Vol. I., p. 124.

trees, *Dammara Australis* and *D. orientalis* were to be seen in the Botanic Garden there, and he evidently looked upon them as giving resin of similar qualities.

Kauri resin, or *gum kauri*, is the produce of a conifer, which is indigenous to New Zealand, and may be "Bush Gum" from living trees, but much more generally is "Fossil Gum," dug out of the ground where old trees once flourished, but now lie buried and decayed. It comes into the market in a great variety of qualities ranging from large clear pieces through all grades to grains and dust. In the lower qualities a considerable amount of what is known as "Swamp Gum" is present, being the original resin greatly altered by the action of air and water into a porous mass.

It is practically impossible to distinguish by the appearance between some of the kinds of dammar and kauri, especially between the kauri chips and red dammar. Both resins are used in varnish making, but the use of kauri gum as an ingredient of the "cement" for linoleum manufacture is that with which the writer is concerned. The relative values of the various grades of kauri for this purpose will not be touched upon in this paper, nor will the question of whether dammar or other resins be more or less suitable for such a purpose be discussed.

The kauri used for this purpose is generally one of the lower grades, as transparency, &c., necessary in varnish making, are not essential. It consists of pieces of varying sizes from dust upwards to chips. In order to obtain as fair a sample as possible for analysis, a quantity of about 1 lb. is taken and passed through three sieves of different mesh. It scarcely matters what the exact meshes be, but, so as to get uniformity, pieces of the wire cloth used in the trade for sorting out into different grades were procured and are used for this purpose. The proportion of the four various grades thus obtained is ascertained by weighing and calculating to per cent., and then 20 grammes in these proportions weighed out and ground together.

About four years ago the question of the possibility of detecting the presence, and if possible, estimating the proportion, of dammar resin in kauri resin became an important one, as it was suspected that a large parcel of gum just received was not genuine kauri; and the great difference in price—about £60 per ton for kauri against about £20 for dammar—was a serious one.

A considerable amount of information as to the sources and general properties of gum resins of all kinds is to be found in various dictionaries and text books, more especially as to their uses for varnish making, and the action of solvents upon them, the latter being generally given as "soluble," "partially soluble," or "insoluble," no indication of the proportions of insoluble and soluble being given. Specific gravity and melting points are also given in some cases, but, although the latter varies considerably for the various resins and might be useful to some extent in assisting to identify definite resins, especially when in a comparatively pure state, it can be of little use in dealing with mixed samples.

A better line of investigation was indicated by such workers as Mills*, who recorded the results of his experiments on bromine absorption and potash absorption, as applied to resins. Since then a great number of determinations of acid, saponification and iodine values have been determined by Schmidt and Erban, Williams, Bottler, Dieterich, &c., and may be found recorded in various publications and collected in a form suitable for reference in "Analysis of resins, balsams, and gum resins," by K. Dieterich.

Confining attention to the question of differences between dammar and kauri resins, a search was made through all available literature on the subject, and it was found that no satisfactory method of determining the presence, and still less the proportion, of these resins in an unknown mixture presented itself. Thus, although K. Dieterich† gives 20—30 as the acid number for dammar, and Williams‡ 6.42 as potash absorption (hot) for kauri as against 2.85 for dammar, and 130.62 as iodine absorption for kauri as against 99.40 for dammar, and Lippert and

Reissiger* acid value: kauri, 64—81; dammar, 33—35; Lewkowitzsch,† on the other hand, gives

For kauri: acid value 37.39, sap. v. 53.84 & I.V. 90.99
For dammar: " " 35.22 " 32.73 & I.V. 127.5.

which shows that such methods of distinguishing these resins are very uncertain. Worstall‡ goes more thoroughly into this determination, and gives his results as follows:—

TABLE I.

	Kauri.		Dammar.
	lumps.	dust.	
Acid value	72	142	24 to 55
Iodine value	170	74	124 to 103

thus recognising the influence of oxidation on these substances. A sample of rock dammar from Burma tested at the Imperial Institute§ showed acid value 31.5, sap. value, 37.1, and it was noted that it was completely soluble in turpentine and partially soluble in alcohol. Any iodine values which the writer has determined have been so erratic that he prefers not to refer to them. As these figures pointed to great uncertainty as to the definite determination of whether a sample of resin could be certified as kauri or dammar or an admixture, no steps were taken to follow on these lines. This being so, it was seen that the whole question would have to be gone into *de novo*, and the most promising line of investigation was that founded upon the observation that nearly all workers noted that some solvents acted differently on kauri and dammar. In turpentine, for example, dammar was noted as soluble, and kauri, often confused with the true dammar, is sometimes mentioned as partially soluble, or insoluble. In alcohol it was noted that kauri was soluble more or less completely according to the strength of the alcohol, whereas dammar was "partially" soluble, and so on with other solvents.

In order to carry out this investigation, samples of recognised genuineness were obtained and about 100 grammes ground and passed through a 40-mesh sieve. The suspected sample was similarly prepared. Working first on the genuine resins, 1 gr. of each was shaken up (cold) with 20 c.c. of the following solvents, and the results are:—

TABLE II.

	Turpentine (Amer.)	Benzol.	Gasoline.
Kauri	Nearly insol.	Largely sol.	Practically insol.
Dammar	Nearly all sol.	Nearly all sol.	Partially sol.

In attempting to take advantage of the marked difference in behaviour towards turpentine the following experiments were made:—

The ground samples were first heated to 100° C., then 1 gr. shaken up with 20 c.c. American turpentine in graduated tubes, and after settling, 10 c.c. of the clear liquid drawn off, evap. at 100° C., adding ether and then absolute alcohol, and the residual extracts weighed:—

TABLE III.

	Results per cent.
Kauri	66.6
Dammar	142.0
Suspected sample	104.0

It was observed that the turpentine had become resinified and was not expelled at this temperature. The increase in weight of the extract from the suspected sample, in view of the very great increase in the case of the dammar, is noteworthy as probably indicating the presence of the latter resin. Had this sample been pure kauri, it is to be expected that it would have given

* This J., 1885, 97, and 1886, 222.

† This J., 1897, 829.

‡ This J., 1898, 1158.

* This J., 1900, 1123.

† This J., 1901, 372.

‡ This J., 1903, 1139.

§ This J., 1904, 551.

a figure less than 100. The method is obviously quite useless, however, but is given here, as it was in the course of carrying out this experiment that the method finally adopted was discovered. It was noticed that on adding the ether all the extracts dissolved to clear solutions, but that on adding the absolute alcohol a copious white precipitate was produced with the dammar, a distinct

adding a little absolute alcohol to the residue, and drying at 100° C., the white substance is obtained. It is extremely soluble in chloroform and, after adding the alcohol to the extract, it very soon reaches a constant weight by heating as above. The results shown in Table IV. have all been obtained by the process just described.

Samples shown:—Kauri, 1; dammar, 2; Sample K, 4.

TABLE IV.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
	Kauri.	Dammar.	Kauri (1) 80% & Dammar (2) 20 %	Sample K.	Dammar from 4.	Sample G.	Dammar from 6.	Sample G.	Sample G.	Sample F.	Sample F.	Sample Grains.	Sample G.	Sample F.	Dammar from 14.
Soluble in absolute alcohol	91.56	58.28	85.82	81.16	50.22	81.72	50.95	81.00	81.72	82.20	85.08	81.04	89.84	86.00	61.24
Insoluble in absolute alcohol, soluble in chloroform	none	36.40	7.30	13.88	49.28	0.72	48.05	10.80	8.80	4.52	4.80	0.48	1.60	7.84	38.56
Vegetable matter, non-resinous,	3.28	3.24	2.38	1.48	0.38	2.70	0.70	2.84	2.68	3.68	4.48	9.28	3.12	2.68	0.08
Mineral matter	5.16	2.08	4.50	3.48	0.12	5.86	0.30	5.36	6.80	0.60	5.64	9.20	5.44	3.48	0.12
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of dammar (calculated)	—	—	20.05	28.16	—	20.23	—	21.60	17.60	0.04	0.60	0.96	3.20	20.33	—
March—July, 1905.												Feb. 1906.	Mar. 1907.	Jan. 1909.	

one with the suspected sample, and *none* with kauri. This was confirmed by treating some kauri and dammar with ether and then adding absolute alcohol, when the kauri remained clear, the dammar gave a large white precipitate, and the suspected sample a distinct precipitate. The presence of this white substance, insoluble in alcohol, in the dammar resin and its absence in the kauri pointed unmistakably to a probable method of detecting the former in admixture with kauri. All the samples of kauri and dammar, which had been received at various times as specimens, were tested in this manner, and *without exception* the results were the same—the kauri remained clear and the dammar gave the white curdy precipitate. This reaction was tested by applying it to various mixtures of dammar and kauri in known and unknown proportions, and in every case the presence of dammar could be decided definitely. When trying to apply this reaction to a quantitative estimation of the amount of white substance present it was found that chloroform was a much better solvent than ether, the dammar dissolving completely and rapidly in it, and the kauri giving a pasty mass as with ether. The process as then carried out and still in use is as follows:—2.5 gr. (a convenient quantity) of the sample of resin, finely ground, is weighed out in a tared, pleated, filter paper, the open end tied up with string, placed in a Soxhlet tube, the space being filled up with small glass balls (to admit of a minimum quantity of solvent being used), extracted in the usual way with absolute alcohol, and the extract collected in a tared flask. After several hours it will be found that, if the sample be pure kauri, the filter paper will contain only organic matter (vegetable fibre, &c.), and mineral matter (clay, &c.). By drying and weighing the filter and contents and then igniting and weighing the mineral matter the percentage of these may be found, and the difference noted as kauri resin (pure). Of course, the alcoholic extract may be heated at 100° C. and weighed, but, as a variable amount of volatile matters are expelled, this is not more accurate than estimating it by difference. If the sample be dammar, or a mixture containing it, it will be found that the filter paper will contain, besides the vegetable and mineral matters, some white particles. In this case all that is necessary, after first driving off at a gentle heat the alcohol adhering to the filter, is to replace it in the Soxhlet apparatus and extract with chloroform, collecting the solution in a tared flask. On distilling off the chloroform,

After the results from the first samples of kauri and dammar were obtained, a mixture of these two identical samples was made and analysed by this process. The result, which was very satisfactory, is shown in column 3. As it was likely that different lots of dammar would contain varying amounts of this white substance, it was desirable, whenever possible, to obtain some of the actual dammar resin found to be present in the suspected sample, and in order to do this, the following method was adopted:—

Some of the larger pieces of the resin were picked out, and each tested by rubbing with a drop of chloroform on a glass plate, and on adding a drop of absolute alcohol it was at once seen whether the piece gave the dammar reaction or not. When a sufficient quantity was thus obtained, the pieces were ground up and analysed as usual. From the percentage of white substance found the amount of dammar in the sample was calculated. The figures for dammar resin given in columns 4, 6, and 14 were thus ascertained. The kauri and dammar pieces from sample 4, the alcoholic extracts from 6 and 7, the chloroform extracts (white dammar substance) from 2, 4, 6, 7, and 12 are exhibited. It is obvious, of course, that this method is not applicable in the case of grain or dust gum. In such cases, if dammar be discovered, it is sufficient to consider dammar resin as containing 50 per cent. of the white substance, and by this means the percentage of adulteration is most likely understated. The figures for dammar resin in columns 8, 9, 10, 11, 12, and 13, were so calculated.

This method of testing is convenient for the rapid identification of samples. Recently 17 samples of all grades of kauri and 12 samples of dammar were thus tested, and in every case the results were as anticipated.

A third method of applying the test, which serves as a qualitative one, and also for estimating small amounts of dammar (under 1 per cent.), is carried out as follows:—

0.5 gr. of the finely ground sample is treated in a porcelain crucible by stirring up with chloroform, filtering through a small filter into a test tube, washing once and then adding absolute alcohol. If the sample consists of kauri only, the solution will remain perfectly clear, but if dammar be present a cloudiness or precipitate will appear according to the amount. To render this method available for estimating small percentages of dammar, a mixture of kauri and dammar resin is prepared to contain 1 per cent. of the white substance and on

quantities of this being weighed off and tested in above manner a fairly accurate estimation of the dammar present in an unknown mixture can be made by comparing the amounts of white precipitates obtained. In this connection two instances can be cited, one of which gave a precipitate equal to that given by 0.3 of the 1 per cent. mixture, or 1.2 per cent. dammar, and the other equal to 0.05 mixture, or 0.2 per cent. It was ascertained subsequently that it was quite probable that a small counter sample of dammar had been thrown amongst the lot of kauri in the warehouse.

The thanks of the writer are due to Messrs. Michael Nairn & Co., Ltd., Kirkcaldy, in whose laboratory the investigation was made, for their courtesy in permitting these results to be published.

Yorkshire Section.

Meeting held at Bradford on Monday, March 22nd, 1909.

PROF. W. M. GARDNER IN THE CHAIR.

THE ACCURACY OF THE METHOD OF DETANNISATION OF THE INTERNATIONAL ASSOCIATION OF LEATHER TRADES CHEMISTS.

BY HENRY R. PROCTER.

Considerable doubts have been thrown on the accuracy of the present official method of the I.A.L.T.C. by some German chemists, and especially by the Association of German Extract Manufacturers, who have consistently opposed its adoption, and by implication have thrown doubts on the *bona fides* of the American and English chemists who claimed to obtain exact results. Such complaints were perhaps natural with an unaccustomed process, and especially with an empirical one where absolute adherence to the prescription is essential; and I have hoped that, with experience, the difficulties, and with these the objections of German chemists would disappear. This hope has been largely justified with individuals, but as the German Extract Manufacturers maintain their attitude of opposition, I feel that it is now time, not only to prove the extreme accuracy of the method in capable hands, but to give the fullest possible details of the means by which this can be obtained.

In the first place I will deal with the chroming and washing of the powder, and the obtaining of blank results in which the dry residue of 100 c.c. of water shaken with the powder should be under 5 mgr., as prescribed by the regulations, a figure which several chemists have asserted it was impossible to attain. The following is a full description in detail of the method adopted in my own laboratory for the determination by blank tests of the solubles in chromed and washed hide-powder.

The hide-powder is weighed, its acidity adjusted, and chromed for one hour according to the I.A.L.T.C. regulations.

The chromed hide-powder is then thrown upon a clean piece of linen in the perforated vessel of a screw-press,* or in a funnel, the portions remaining on the sides of the bottle being washed on to the linen with distilled water. The liquid is allowed to drain away, and the powder and linen removed from the press, squeezed by hand, returned to the press, and pressure applied. The more liquid removed at this stage the quicker the powder is freed from chlorides, but care must be taken that pressure is not applied too suddenly, or the linen will burst. The linen with the powder is then removed, and the latter, remaining in the linen all the time, is well broken up by rubbing the cloth between the hands and returned to the press, which is filled up with distilled water. The powder is thoroughly stirred with a glass rod until all the water has

run out, and is squeezed again. It is very essential to keep the powder well stirred, otherwise channels will be formed, through which the water will run with very little washing effect. This process is repeated about five times, 50 c.c. of the last portion of wash-water which can be removed from the powder by pressing being tested for chlorides. It is advisable after having tested the washings, and found them to comply with the I.A.L.T.C. regulations, to give one more washing, before the final squeezing to reduce the water to the necessary quantity ready for weighing. The washing process should be continuous, and on no account should the powder be left to stand. A quantity sufficient for four analyses in duplicate (about 60 grms. air-dried powder) can be washed free from chloride in about 30 minutes, provided the process is continuous. The powder is now ready for weighing, and is transferred from the linen with a spatula to a basin or other convenient vessel for weighing. The last traces of powder may be removed by holding the four corners of the linen together and beating it upon the bench, when the powder will collect in the centre of the cloth. The remaining manipulations are precisely as for tanning analysis, but using 100 c.c. of distilled water instead of tanning liquor.

The following causes tend to too high residues when carrying out blanks:—

1. *Impurities in the distilled water used.*—The distilled water should leave no weighable residue on evaporation of 100 c.c. to dryness.

2. *Soluble matter from the hands* when squeezing the liquid away from the powder after detannisation. The powder in the linen might be pressed against the side of the funnel with a spatula to expel the last of the liquid.

3. *Soluble matter from linen* used after final churning. The cloths should be washed with water alone, nothing in the nature of soap being used, and finally in distilled water before drying.

4. *Imperfect insolubility of the kaolin used.* This has caused serious errors, and the kaolin should be tested before use.

5. *Presence of dust* with the residue in the basin.—The evaporation should be carried out with as little access to dust as possible, and the basin should be transferred to the drying oven as soon as possible after evaporation is complete.

The following table gives the results of such blank experiments with different powders. The determinations in columns I. and II. were executed by various assistants, and those in column III. by students doing tannin analysis for the first time. The results are not selected for accuracy, but contain the whole of the determinations executed at that time under the respective heads. It was subsequently found that the distilled water was not quite satisfactory, but left a residue of 0.0004 gm. which should be deducted from each determination. Similar experiments were made with a sample of Freiberg powder with less satisfactory results, which are not quoted, as no doubt the quality of the powder has since been improved.

Residue from 100 c.c. of Blank Experiments.

American powder. I. grm.	Vienna powder. II. grm.	Vienna powder. III. grm.
0.0023	0.0003	0.0042
0.0026	0.0000	0.0042
0.0013	0.0020	0.0036
0.0006	0.0036	0.0040
—	0.0030	0.0048
—	0.0020	0.0040
—	0.0023	0.0046
—	0.0036	—
—	0.0026	—
0.0017	0.0022	0.0042 average.

The importance of giving at least one additional washing and squeezing after the powder is freed from chlorides sufficiently to answer the prescribed chromate test is shown by the following results. Probably if the amount of N/10 silver nitrate allowed were reduced from 4 to 2

*The ordinary German fruit-press costing 15s., and holding about 1 litre is found to be very satisfactory. It is convenient to have one or two of the inner vessels varying in size for different quantities of powder.

drops per 50 c.c. sufficient washing would always be attained*.

	After chlorine test.	1 additional washing.	2 additional washings.
Residue from.....	0.0060	0.0033	0.0030
100 c.c. of distilled ..	0.0063	0.0023	0.0016
Water shaken with powder	0.0040	0.0010	0.0013
	0.0054 grm.	0.0022 grm.	0.0020 grm.

As regards concordance of analyses, the following figures may be given with regard to 31 analyses carried out in the University Laboratory by various analysts to test whether any difference in results existed between American and Vienna powders. These analyses were done in the course of ordinary commercial work with no greater attempt at accuracy than is made with every analysis which is executed, and each figure represents a complete pair of duplicate analyses, such as are always done for commercial purposes; and they include the whole of the analyses done to compare the powders without selection or rejection, and embrace sumach, lentiscus, mimosa and mangrove barks, chestnut, and oakwood extracts.

They are therefore in no sense "parade analyses."

hide-powder according to the I.A.L.T.C. prescription is a method of great accuracy, and quite as exact as any ordinary chemical determination such as that of moisture by drying, and that two different hide-powders of good quality separately chromed and washed and brought to the same standard of acidity will give absolutely identical results. Now this detannisation is the only point in which the present official method differs from the old one, and so far as my experience goes, it is impossible to produce a series of the same concordance by the filter method with any powder, however carefully prepared.

It may be urged that all this does not prove that different analysts with different samples will get results of corresponding accuracy; and I agree that it does not. No imaginable method will avoid the frequent errors which arise from inexact sampling by clients, and no method will prevent the carelessness and incompetence of unconscientious chemists, but the results quoted show that such differences are avoidable by skill and careful work, and do not depend on differences of hide-powder, or any cause beyond the control of the chemist.

It has been suggested, that while analyses done by a chemist as duplicates show a satisfactory concordance, it is difficult for him to repeat the result at some future time; and it is impossible to prove that this is not the case, especially if a new sample must be drawn, since few extracts remain constant in strength, but differ in

Results with American and Vienna powders. Non-tannin Residues from 60 c.c.

Material.	Grms. per litre.	American powder.	Vienna powder.	Differences to Vienna.	American powder.
Sumach	15	0.1210	0.1210	+	—
"	15	0.1192	0.1198	—	—
"	15	0.1246	0.1230	0.0016	0.0006
"	15	0.1224	0.1220	0.0004	—
"	15	0.1246	0.1232	0.0014	—
"	15	0.1194	0.1194	—	—
"	15	0.1242	0.1236	0.0006	—
"	15	0.1268	0.1270	—	0.0002
"	15	0.1166	0.1188	—	0.0022
"	15	0.1170	0.1192	—	0.0022
"	15	0.1190	0.1204	—	0.0014
"	15	0.1196	0.1190	0.0006	—
"	15	0.1194	0.1196	0.0004	—
"	15	0.1210	0.1212	—	0.0002
"	15	0.1220	0.1230	—	0.0010
Lentiscus	24	0.2206	0.2310	—	0.0014
"	25	0.2410	0.2418	—	0.0008
Mimosa	11	0.0534	0.0548	—	0.0014
Natal Mimosa	10	0.0758	0.0746	0.0012	—
"	8	0.0760	0.0730	0.0030	—
"	0	0.0772	0.0774	—	0.0002
"	8	0.0728	0.0756	—	0.0028
Mangrove Bark extract	6	0.0788	0.0794	—	0.0006
Oakwood extract	16	0.1438	0.1418	0.0020	—
"	16	0.1362	0.1356	—	0.0004
"	14	0.0468	0.0464	0.0004	—
"	15	0.1214	0.1212	0.0002	—
"	15	0.1128	0.1128	—	—
"	15	0.0928	0.0910	0.0018	—
"	15	0.0876	0.0872	0.0004	—
Chestnut extract	13	0.0504	0.0500	0.0004	—
Total No. 31 analysis ..	—	3.5132	3.5142	0.0144 =	0.0154
				Sum	0.0298
				Difference	0.0010
				Mean	0.00006

To sum up results, it may be observed that the greatest divergence in any pair is 3 milligrams, which in an oakwood extract corresponds to about 0.13 per cent.; the mean difference is under 1 milligram, including errors both ways; and the total sum of the differences, subtracting those on one side from those on the other, is under 1 milligram. This proves that detannisation by shaking with

*The test of 4 drops of AgNO_3 amounts to about 2.3 mgr. NaCl on 50 c.c. of the wash-water. No doubt on making a blank test by shaking with only 100 c.c. of water, a larger proportion would be obtained. In case of doubt it is therefore wise to make such a blank test on the actual powder which is afterwards used for analysis.

solubles and tannin by fermentation and by settling of the difficultly soluble constituents, so that no two samples taken at different times can be guaranteed to be absolutely alike. Solid extracts also vary in moisture and possibly in solubility, and fair sampling even with the greatest care is by no means easy.

The following non-tannin determinations, however, in which analysis of the same solution was conducted by different assistants, each chroming their own hide-powder and in ignorance of each other's results, prove that the determination of non-tannins at least will agree if performed on identical materials. Here again all results good and bad of a series are quoted.

Results of repeat analyses carried out by independent operators.

Material.	Grs. per litre.	Per cent.		Operator.
Sumac "40"	15	0.1216 = 16.21 0.1214 = 16.18	0.1212 = 16.16 0.1210 = 16.13	H. Br. W. J.
Extract "54" contains Fichtenholz extract	14	0.0636 = 9.08 0.0624 = 8.91	0.0632 = 9.02 0.0616 = 8.80	S. H. H. Br.
Extract "333"	14	0.0666 = 9.51 0.0660 = 9.42	0.0658 = 9.40 0.0662 = 9.45	S. H. W. J.
Quebracho extract (solid) "262s"	6	0.0318 = 10.60 0.0330 = 11.00	0.0308 = 10.26 0.0332 = 11.06	S. H. W. J.
Quebracho extract solid "2563"	6	0.0312 = 10.40 0.0322 = 10.73	0.0318 = 10.66 0.0306 = 10.20	S. H. W. J.
Swedish Fir Bark extract	22	0.2336 = 21.23 0.2336 = 21.23	0.2334 = 21.12 —	W. J. W. J.

As a further test of the comparative accuracy of the official determination of non-tans, I applied to a number of English extract manufacturers and large dealers whom I knew to have been making extensive tests of the concordance of the results of different chemists under the new method, for information as to the results obtained; and received in all, details of the analysis of 20 different extracts each determined by two or three different chemists, of whom in many cases I do not even know the names. In order to determine the degree of concordance attained the average result on each material was determined, and the sum of the differences from these averages was taken without regard to whether + or —. One set of three analyses was rejected on account of an obvious clerical error in one analysis which added to 102.3. Of the remaining 51 analyses the average difference from the mean was 0.39 per cent. In order to compare to some extent the accuracy of the work and sampling, the water determinations of the same extracts were similarly compared, and showed an average error of 0.31 per cent. As a further check, the non-tannin results of the 66 analyses by the filter method with Prof. Paessler's "lightly chromed powder" carried out by Messrs. Arnoldi, Bösch, Moll, Philip, Siehling, Seidel, and Veit for the German Analysen-commission, and published in the report by Prof. Paessler (Collegium 218 *et seq.* 1908), were similarly treated; and showed an average error of 0.42 per cent. As in this case the samples were sent out as identical by Prof. Paessler himself, together with an identical hide-powder, and the names given preclude the supposition of careless or incompetent work, while those by the shake method were by ordinary commercial chemists, with commercially drawn samples, and any hide-powder, the comparison of the results is interesting.

Most of these extract manufacturers now admit that present results by the shake method show better concordance than the former with the filter, and several of the more important are warm supporters of the change; and complaints now centre rather on the defects of colour-testing than on the actual tannin determination.

In conclusion I may say that the evidence I have brought seems to me absolutely to establish the superior accuracy (or at least concordance) of results of the shake-method as compared either with the old filter-method, or with Dr. Paessler's with lightly chromed powder, and though, as Chairman of the Commission, I shall be glad to discuss any improvements which may be suggested either in accuracy or rapidity of execution, I consider that the controversy as regards the superior accuracy of the old filter method is now closed so far as I am concerned.

SOME INDIGO PRODUCTS FROM NORTHERN NIGERIA.

BY A. G. PERKIN, F.R.S.

In a previous communication (this J., 1907) an account was given of the investigation of the so-called "Gara-plant" which had been forwarded by the authorities of Sierra Leone to the Imperial Institute for an examination

of its dyeing properties. This product, which consisted of the dried and fermented stems and leaves of the *Loncho-carpus cyaneus*, a woody climber of from 10 to 40 feet in length, contained indigotin to the extent approximately of 0.65 per cent. Somewhat more recently Prof. Dunstan forwarded to me two other indigo products also from West Africa, but this time from Northern Nigeria, one of which closely resembled the Gara plant of Sierra Leone, whereas the second consisted of specimens of indigo in the lump form.

For the examination of the former, which consisted of a mixture of leaf and stem of a dull greenish-blue colour, 200 grms. of the material was repeatedly extracted with boiling water, which removed (as had also been the case with the (Gara plant) a very large quantity of a brown substance. The residue was then steeped in a large bottle repeatedly with alkaline hydrosulphite solution, the yellow extract oxidised by means of air and to render the colouring matter thus precipitated in a more granular form, the mixture was boiled and treated with an excess of salt. The product was collected, washed, first with water, and then with boiling dilute hydrochloric acid, and after removal of the acid was allowed to dry at the ordinary temperature, so that the substance thus obtained was in a porous condition and was easy to powder. For purification it was extracted with boiling nitrobenzene, and the crystals collected and weighed. By operating in this manner an approximate idea of the colouring matter present in the material was obtained, though this value is probably a little too low.

Found Indigotin = 1.3035 grms., which is equivalent to 0.65 per cent., a result curiously enough identical with that which was previously given by the "Gara" plant.

Somewhat recently the authorities of the Imperial Institute obtained for the author some quantity of the air-dried leaves of the *Loncho-carpus cyaneus* from Sierra Leone, in order that a chemical examination of the indigo-yielding principle contained in the plant could be carried out, and also that a better knowledge could be obtained of its commercial possibilities. Unfortunately, however, the leaves on arrival were found to be devoid of colouring principle, and as they contained some indigotin it was evident that the former substance had been hydrolysed by fermentation. It is quite possible, of course, that the indigo-yielding substance of this plant may consist of the isatin which has been shown by Beyerinck (Proc. K. Akad. Wetensch. 1900, 3, 101) to exist in wood, and which differs from the better known indican of the *Indigofera*, by its instability, which has not yet permitted of its isolation in a pure condition. Should such be the case, an effective chemical examination of this plant can only be made on the spot. The specimen was, however, useful for reference, for as there was a considerable similarity between this and the Northern Nigerian product, it seemed likely that they were identical, and a comparison of the samples very kindly carried out by Prof. V. H. Blackman of the Leeds University, leaves little doubt that this is the case. Thus it was found by an examination of the materials in question, that the stems of both possessed a similar arrangement

of epidermis, selenchymaring, vascular bundles and pith, and that in the leaves the well-marked arrangement of hairs (characteristic of the *L. cyanescens*) was present. The form and arrangement of the stomata, and of the veins and the structure of the upper and lower epidermis of the leaf was also identical in the two cases, and as a result Prof. Blackman states:—"The unnamed plant must therefore be *L. cyanescens* or some very closely related form." The specimens of indigo above referred to, and which consisted of small pyramids, weighed on the average about 7 grms., possessed in parts a coppery lustre, and were of a friable nature. For the analysis of this product in regard to its percentage of indigotin and indirubin, a somewhat novel method devised by W. P. Bloxam and the author was employed. As certain experiments which are being carried out by this process are not fully completed, the details are reserved for the full communication which will shortly be made on this subject. In addition to the amount of colouring matter which was present, a determination of the mineral matter soluble in hydrochloric acid, of the substances dissolved by alkali after this treatment, and of the amount of other impurities contained in the indigo was carried out. The results are embodied in the following table.

	I. Per cent.	II. Per cent.
Moisture.....	5.38	—
Indigotin.....	21.47	21.65
Indirubin.....	1.33	1.10
Brown matter (indigo brown) soluble in sodium hydroxide.....	12.15	—
Organic matter, soluble in HCl.....	10.83	—
Organic matter (plant debris) insoluble in Nitrobenzene.....	9.59	—
Inorganic matter soluble in HCl.....	19.20	—
" " insoluble in HCl.....	29.10	—
	100.05	

A complete analysis of the mineral matter (39.3 per cent.) was not performed, but it was ascertained that whereas the portion insoluble in hydrochloric acid was quite colourless and consisted almost entirely of silica, the dissolved matter contained iron and calcium salts, the latter in considerable quantity. The existence of this very considerable amount of inorganic substances in the indigo naturally suggests adulteration, but on the other hand it is possible that this may have been added as a crude lime preparation during the process of manufacture, to assist both in the more rapid oxidation of the fermented plant solution, and to complete the precipitation of the indigo thus formed. The presence of indirubin supports this latter contention, as this colouring matter is always formed to some extent when indoxyl is oxidised in the presence of lime water, or indeed under any other faintly alkaline conditions.

To be certain that the colouring matter present in this product was in reality indigotin, and not some closely allied derivative, a nitrogen estimation of the substance isolated in the usual manner by means of nitrobenzene was carried out with the following result:—

Found N = 10.75.

$C_{16}H_{10}N_2O_2$ requires N = 10.69 per cent.

With regard to the botanical origin of this indigo, no information could be given by the Imperial Institute, but it was stated that in Northern Nigeria indigo is produced not only from the *Loucho-carpus cyanescens*, but probably also from certain species of *Indigofera*. This is in harmony with the following extract taken from the "Miscellaneous Trade Notices" of this Journal, 1889, p. 584: "Yoruba land* is famous among West Africans for its blue dyeing. Over it are found many botanical species that yield the indigo of commerce."

Fortunately, however, one of the cakes of this indigo was found to contain some fairly large fragments of stem, and these it was only reasonable to anticipate were derived from the plant which had been employed for the manufacture of this colouring matter. The examination of these was again very kindly undertaken by Professor Blackmann, who pronounced them to be very similar and probably identical with the leaf stems of the *Loucho-*

carpus cyanescens, and there is thus practically no doubt that these samples of indigo had been derived from this plant.*

It is thus interesting to find that both in Sierra Leone and Northern Nigeria, districts of Western Africa which are several hundred miles apart, the same plant *Loucho-carpus cyanescens* is employed for the manufacture of indigo. In Bancroft's "Philosophy of Permanent Colours" (Vol. I, 1813, 168) mention is made of the introduction of the "Taroom akkar," which grows in Sumatra and is probably the *L. cyanescens*, into Sierra Leone, so that whether it is really native of this part of West Africa does not seem to be certain.

A point of some interest is afforded by the occurrence of brown matter in both these West African indigo products derived from the *Loucho-carpus cyanescens*, for such appears to be always present in natural indigos, whether produced from the *Polygonum tinctorium*, the various species of *Indigofera*, or the wood plant, *Isatis tinctoria*. It has long been considered likely that these brown substances represent a "waste" of colouring principle, and recent work in the University of Leeds indicates as probable that indigo brown itself may originate in this manner. That indigo derived from such distinct varieties of plant should invariably contain indigo brown certainly lends support to this view.

In an earlier paper, "Notes on West African Indigo," by Rawson and Knecht (Jour. Soc. Dyers and Colourists, 1888, 66; this J., 1888, 429) an account has been given by these authors of some indigo products which had been sent to this country by Sir T. Goldie, Governor of the Royal Niger Co. These consisted of the leaves of a plant in ball form which contained indigotin to the extent of 0.51 per cent, and (b) small conical masses of indigo which on analysis were shown to possess the following composition:—

Indigotin, 39.12. Indirubin, 4.75 per cent.
Foreign organic matter, 29.17. Ash, 19.66 per cent.

Unfortunately the botanical origin of these specimens was lacking, and in view of the statements that indigo is produced in Nigeria from a variety of plants, it is impossible to conjecture whether these indigo samples of Rawson and Knecht had also been derived from the *L. cyanescens*. It is interesting to note in connection with the leaf product described by these authors, that it contained a large quantity of a brown substance† soluble in boiling water, and the presence of this they considered was probably due to changes which had involved a loss of colouring matter.

Finally, it is to be remarked that with the exception of a patent taken out by Calmette (this J., 1902, 38) for the production of indigo from the *L. cyanescens*, the author has been unable to discover any allusion to this plant in the literature, and information appears to be entirely lacking, as to its capabilities in this respect, as compared with those of the better known indigo plants.

ADDENDUM.

Since the communication of this paper, it has been possible, owing to the courtesy of Prof. W. Gardner, to carry out a botanical examination of the leaf product described by Rawson and Knecht, samples of which had been preserved in the museum of the Bradford Technical College. As a result it has been found that these leaf fragments possessed the same structure as those of the *L. cyanescens*, and there can thus be little doubt that they have also been derived from this plant. On the other hand, the "ball" form of this product has a very distinct appearance from the "Cora ball" of Sierra Leone, previously described (*loc. cit.*), and indicates that in Nigeria a different process of native manufacture is employed.

*Prof. Blackman states, "I see no reason for believing that it is other than the *L. cyanescens*."

†There is evidence that in such crude fermented preparations of indigo yielding plants, the presence of this brown matter is usual. A somewhat similar product to those derived from the *L. cyanescens*, and which is known as "Aidama" indigo, and is produced from a perennial lush cultivated in Southern Japan, has been examined by the author, and found to contain very large quantities of such an impurity.

* Yoruba land is a district of Nigeria.

DISCUSSION.

Prof. W. M. GARDNER said it was uncertain whether natural indigo would or would not be entirely superseded by synthetic indigo. A great deal might still be done to improve the production of natural indigo, to which end an examination of indigo-producing plants from all parts of the world would be of service. Plants yielding better supplies of the product might still be found and the possibilities of improvement by proper selection of seed and cultivation of wild species should be investigated.

Mr. F. W. RICHARDSON asked if any analytical figures were forthcoming to show the relationship between the amount of indigotin, indirubin, and brown colouring substance at different periods in the growth of the plants. Wastage by conversion of the indigotin to the brown colouring substance seemed probable and such a series of figures would locate this loss.

Mr. A. G. PERKIN, in reply, said that experiments carried out some years ago by Rawson showed that the

quantity of colouring principle present in the leaf of *I. Sumatrana*, varied according to the season; thus in one instance the leaves yielded in May 0.30 per cent. of indigotin and in August 0.76 per cent., whereas in November the quantity had fallen to 0.25 per cent. With regard to the formation of brown products during the manufacture of indigo, which appeared to represent a loss of colouring matter, a very large quantity of pure indican had been prepared in order to study this point, and it was found that though indoxyl when oxidised by air was converted mainly into indigotin, certain secondary reactions took place at the same time. From the work of Mr. Bloxam and his colleagues, there was evidence that in southern India the indigo plant contained more indican than that growing in the more northern districts. It was probable that the natural indigo industry would hold on for some time, and there was no immediate prospect of it dying out. Natural indigo might yet be more economically produced, though it appeared to him to be doubtful if synthetic indigo could be made much more cheaply than it was at present.

Journal and Patent Literature.

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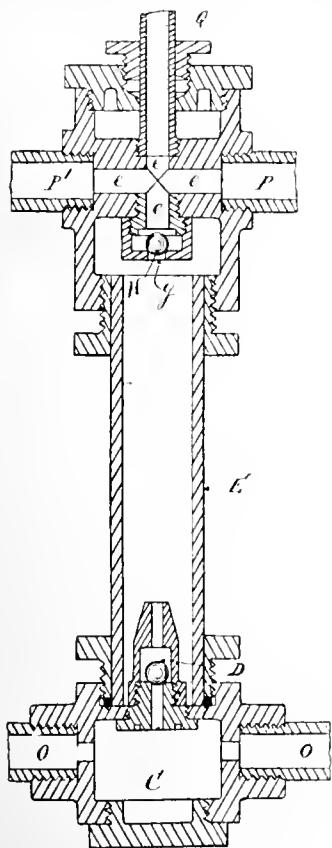
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I.—PLANT, APPARATUS, AND MACHINERY.

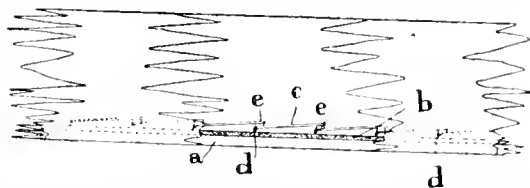
PATENTS.

Drawing liquids through other liquids of greater density, and viewing same in their passage. R. Wood, Bolton, Eng. Pat. 4834, March 3, 1908.



The lighter liquid (*e.g.*, oil or ether) enters by the pipes, O, into the box, C, and passes upwards past the ball-valve D, into the transparent sight tube, E, which is filled with the heavier liquid (*e.g.*, water), the latter being prevented from escaping from the tube, E, by the ball-valve, D. The lighter liquid rises through the water and can be seen, and the quantity passing judged, through the transparent tube, E. From the top of E, the lighter liquid escapes through the passage, g, past the ball-valve, H, to the passages, c, P, P', Q, which are connected to spaces in which there is a slight vacuum.—W. H. C.

Separating materials of different specific gravity. H. L. Lewis, Lammeston, and The High Moor Syndicate, Ltd., London. Eng. Pat. 6253, March 20, 1908.



The materials to be separated are fed along with water into the upper end of a long sluice-box, *a*, on the bottom of which a layer of coconut matting, *b*, is spread. Above the matting a number of perforated plates, *c*, are arranged step fashion, the front of each plate overlapping the back of the next, but supported a little distance above it, so as to leave a space, *e*, through which the water can flow. The back of each plate is bent over or has an angle-piece fastened to it to form a weir, *d*. The solids are carried down by the flow of water, pass through the perforations, and are caught behind the weirs, the water flowing on. When sufficient material has collected, the plates are taken out and the solids removed, the heavier bodies being found nearer to the upper and the lighter bodies nearer to the lower end of the sluice-box.—W. H. C.

Printing inks and the like: Moving-stirrer apparatus for mixing —, E. and H. Bush, Leeds. Eng. Pat. 8623, April 18, 1908.

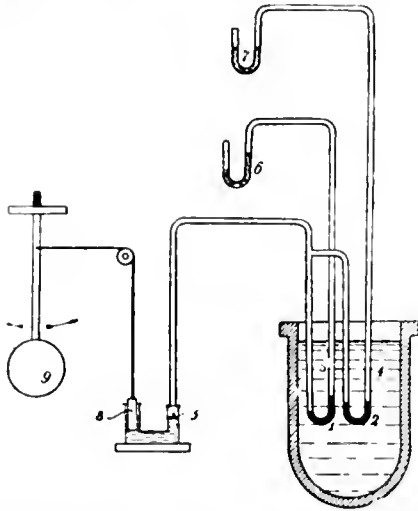
The vertical shaft by which the stirrer-blades are rotated in the mixing pan is made in two parts and passes through

a bracket supported above the pan, being rotated by gearing from above. The two parts of the shaft are connected by a coupling or sleeve which is attached to a hand lever. On raising the lever, the coupling is lowered over the junction and the scraper is rotated. On depressing the lever, the coupling is raised, thus exposing the joint so that the lower portion of the shaft can be removed. —W. H. C.

Pyrometers, or apparatus, for ascertaining, or measuring high temperatures. A. W. Dixon and E. Middleton, Sheffield. Eng. Pat. 13,360, June 23, 1908.

The radiations from the hot body are focussed by a lens and thrown upon a cell formed of selenium or other light-sensitive substance. The selenium cell is connected to a galvanic battery, a rheostat, and a galvanometer by which the change in resistance of the cell due to the radiations is indicated. —W. H. C.

Pyrometer. J. Kirner. Fr. Pat. 395,229, Oct. 14, 1908.



Two or more U-tubes, 1, 2, are immersed in the vessel the temperature of which is to be ascertained. The bend of each tube is filled as shown with an alloy or mixture of salts having different fusion points. One branch, 3, 4, of each tube is connected to a manometer, 6, 7, filled with liquid, and the other branches are connected to the apparatus, 5. On causing the pendulum, 9, to oscillate, the plunger, 8, is alternately raised and lowered, and the pressure of the air in the chamber, 5, rapidly alternates. If the substance in the U-bend is molten, then the alternations of pressure are communicated to the manometers, 6, 7, and are rendered visible, but if the substance is solidified, then the alternations of pressure are not transmitted, and the liquid in the manometers remains stationary. By observing the behaviour of the liquid in the manometers, it is possible to ascertain which of the substances in the U-tubes is melted and which is solid, and consequently the limits between which the temperature of the vessel must lie. —W. H. C.

Strainer; Continuous. — Aktiebolaget Separator, Stockholm, Sweden. Eng. Pat. 16,017, July 28, 1908. Under Int. Conv., Aug. 1, 1907.

The fluid to be strained is fed into a horizontal cylinder within which a horizontal cylindrical strainer is rotated. The liquid passes through the strainer into the interior, from which it is discharged through one of the trunnions by which the strainer is supported and rotated. The solids are continuously removed from the surface of the strainer by scrapers mounted on a frame and rotated relatively to the strainer. The scrapers cause the solids to move along the interior surface of the stationary cylinder to the opposite end from that through which the liquid escapes. The solids then enter an enlarged portion of the cylinder within which a bucket-wheel is rotated, by

which they are elevated and discharged on to a trough passing through the upper part of the end of the enlargement. —W. H. C.

Separating minerals or other crushed solid materials from liquids. A. J. Arbuckle and A. Osborne. Fr. Pat. 393,990, Sept. 5, 1908.

The mixture of solids and liquid is fed continuously into a conical vessel and the solids which settle to the apex of the cone are continuously withdrawn from an opening at the bottom by one or more rotating drums. —W. H. C.

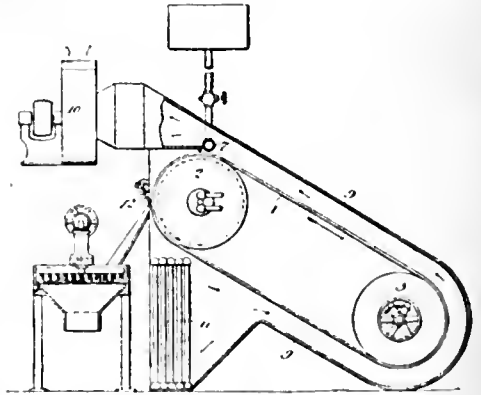
Steam and compressed air pipes, joints, and the like; Process for the treatment of — and a composition to be employed therein. P. McCarthy, Blaengwynfi, and Tuck and Co., Ltd., Cardiff. Eng. Pat. 18,636, Sept. 5, 1908.

A MIXTURE of about 96½ parts of cylinder oil, 3 parts of finely-ground graphite and ½ part of steatite is introduced, by a device similar to a sight-feed lubricator into the steam or air mains at a point near their commencement. The mixture is said to be carried along by the steam or compressed air, and is spread over the interior surface of the main, forming a coating which preserves the pipes from rust or corrosion and fills up any small cracks or leaks. —W. H. C.

Introducing gases into liquids; Apparatus for —. S. P. A. Wenström, Oskarshamn, Sweden. U.S. Pat. 913,596, Feb. 23, 1909.

The gas is introduced through a hollow, perforated, rotating shaft which is mounted horizontally within the vessel containing the liquid. Curved baffle-plates are mounted transversely across the shaft, and inclined thereto, and are rotated with it for the purpose of breaking up the streams of gas as they issue from the perforations. —W. H. C.

Desiccating fluid substances; Apparatus for —. W. S. Osborne, Hyde Park, Mass. U.S. Pat. 913,760, March 2, 1909.



The liquid to be desiccated is spread as a thin film by the spraying device, 7, upon the surface of the endless metal belt, 1, which passes round the drums, 2, 3, and is enclosed in the casing, 9. The drum, 3, is rotated and the drum, 2, is heated internally. Air heated by the apparatus, 11, is drawn by the fan, 10, over the surface of the belt as indicated by the arrows in the opposite direction to that taken by the belt itself. The desiccated material is removed from the belt by the scraper, 12. —W. H. C.

Drying-machine. J. H. Ryan and J. F. O'Toole, Pittsburg, Pa. U.S. Pat. 913,774, March 2, 1909.

The material is allowed to fall through a chamber in which a number of "flue-pans" are supported one above the other, and a current of drying medium is caused to pass upwards through the chamber. Each "flue-pan" has rows of parallel A-shaped partitions on its upper surface, spaced apart, leaving openings through which the material falls, the upper edges of the partitions in one pan being directly beneath the openings in the pan above. —W. H. C.

Filter-press plate. J. W. Biles, Louisville, Ky. U.S. Pat. 914,476, March 9, 1909.

The plate is formed of a central web with vertical ribs on each face extending beyond the periphery of the web. A rim is secured to the ends of the ribs and extends beyond the periphery of the web. Openings are provided for the exit of the filtrate by extending some of the ribs to the edge of the rim.—W. H. C.

Distilling apparatus. S. Hamburger. Ger. Pat. 203,902, July 21, 1907.

In column stills of the usual type, instead of the pipes through which the steam (or vapour) rises being fixed tightly in the plates, they are inserted loosely, with a free annular space, through which the liquid being distilled flows downwards instead of through the usual overflow pipes. In this way, it is claimed, a more intimate contact between the vapour and liquid is attained. The apparatus is stated to be especially useful in the preparation of formic acid.—A. S.

Latent heat of vaporisation of liquids; Regeneration of —. E. Nobel and S. Bessonoff. Fr. Pat. 395,108, Oct. 9, 1908.

The vapour given off in a tubular evaporator is aspirated by a pump, compressed, and returned through the casing surrounding the tubes of the heater, where it gives up its latent heat to liquid circulating through the tubes. The pump is worked by a heat engine, the exhaust gases being circulated through a separate tubular heater in the evaporator to utilise their heat.—W. H. C.

Evaporation of liquids in vacuo; Apparatus for the —. M. Töpfer. Ger. Pat. 207,152, June 15, 1907.

In apparatus of the type in which a heated rotating drum dips into the liquid to be evaporated, contained in an outer casing from which the air can be exhausted, it is proposed to use a trough, which can be readily removed from the casing for cleaning, etc., for holding the liquid. The trough is mounted on rollers which run on rails fixed in the outer casing. Gutters are provided around three sides of the trough to catch any condensed liquid falling back from the drum, and to prevent oil from the bearings supporting the drum from running down into the trough. The trough is connected with a vessel, outside the casing, which contains the liquid to be evaporated and is provided with a float, whereby the flow of liquid to the trough is regulated.—A. S.

Filter press; Power —. E. H. Alvord, Seattle, Wash., U.S.A. Eng. Pat. 14,444, July 7, 1908.

SEE U.S. Pat. 894,996 of 1908; this J., 1908, 886.—T. F. B.

Separating comminuted ores or other solid matter from liquids; Means for —. A. J. Arbuckle and A. Osborne, Belgravia, Transvaal. Eng. Pat. 17,756, Aug. 24, 1908.

SEE Fr. Pat. 393,990 of 1908; preceding.—T. F. B.

Separating solid bodies from liquids by cooling; Apparatus for —. P. Porges, Vienna, and R. Neumann, Brünm-Königsfeld, Austria. U.S. Pat. 914,183, March 2, 1909.

SEE Fr. Pat. 390,816 of 1908; this J., 1908, 1101.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Sampling coal; Accuracy in —. E. G. Bailey. J. Ind. and Eng. Chem., 1909, 1, 161–178.

It is pointed out that coal can never be satisfactorily bought and sold on the basis of analyses unless detailed conditions of sampling are rigorously fixed and adhered to, as otherwise errors due to sampling will frequently overshadow variations in quality. By the present methods of sampling, errors of 3–5 per cent. in the amount of ash are of ordinary occurrence and errors of from 15 to 30 per cent. are frequently encountered. The deviations of the results of individual determinations of ash from the average result closely follow the probability curve, and hence the error of sampling by a given method can be

calculated by the method of least squares. The most important factor to be considered in sampling coal is stated to be the "size-weight" percentage, *i.e.*, the percentage of the largest pieces of slate, etc., to the total weight of the sample previous to its last division or quartering. The weights of pieces of slate and coal of various sizes (4-in. bar screen to 80-mesh sieve) were determined and are given in a table and in curve-diagrams. From a knowledge of the relation existing between the "size-weight" percentage, the amount of ash due to slate, and the possible error, it is stated to be feasible to take a sample of any coal with an assurance that the results will be accurate within certain limits. A series of experiments with a semi-bituminous coal containing about 5 per cent. of ash in the form of slate and other impurities in addition to the ash of the coal itself, showed that if a maximum error of 2 per cent. is not to be exceeded, and the probable error is to be less than 0.4 per cent., the "size-weight" percentage must be less than 0.1, whilst it must be as low as 0.01 per cent. if the maximum error is not to exceed 1 per cent., with a probable error of nearly 0.2 per cent. With a gradual increase of the "size-weight" percentage, the maximum and probable errors rise rapidly. The results all point to the importance of taking a large initial sample, and the following data are given, based on a "size-weight" percentage of 0.01 and a coal containing 5 per cent. of ash in the form of slate and other impurities.

Size of slate.	Weight of largest piece of slate.	Original sample should weigh.
inches.	lb.	lb.
4	6.7	39,000
3	2.5	12,500
2	0.75	3,500
1½	0.38	1,900
1¼	0.24	1,200
1	0.12	600
¾	0.046	230
½	0.018	90

With respect to the size to which the sample should be broken before quartering or dividing, the figures given are: 7500 lb. sample, 2 ins.; 3800 lb., 1½ ins.; 1200 lb., 1 in.; 460 lb., ¾ in.; 180 lb., ½ in.; 40 lb., 2-mesh; 5 lb., 4-mesh; ½ lb., 8-mesh; ¼ lb., 10-mesh. If the laboratory sample is crushed to 2-mesh size, it should not be divided to less than 8300 grms.; 4-mesh size, not less than 1100 grms.; 8-mesh, 120 grms.; 10-mesh, 55 grms.; and 20 mesh, not less than 3 grms.—A. S.

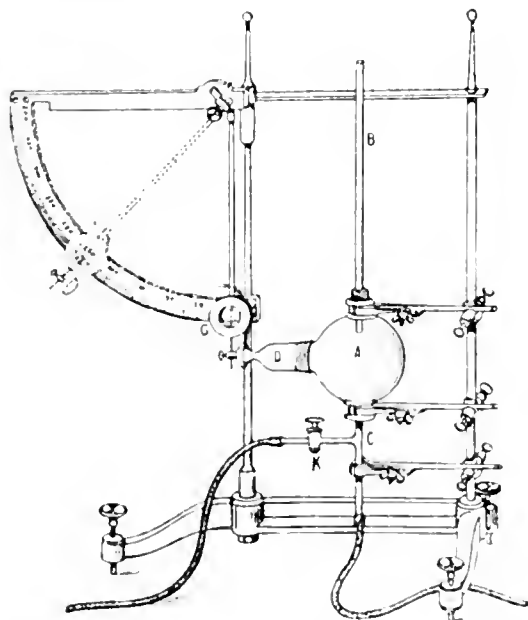
Sulphur in coal and coke; Determination of —. M. Holliger. Z. angew. Chem., 1909, 22, 436–449, 493–497.

The author has made a comparative study of the methods in common use for the determination of sulphur in coal and coke. The conclusions arrived at are: (1). Eschka's method for total sulphur is liable to be inaccurate with coals containing more than 2 per cent., and the process of Hundeshagen (this J., 1893, 465, 1062) gives results which are no better. (2). Sauer's method of determining the so-called volatile sulphur should, especially with coals yielding much gas, be modified as follows:—The combustion tube is constricted to 5–7 mm. for 3–5 cm. of its length near the centre, the space being filled with pieces of platinum wire, and this contact substance is strongly heated before the boat is pushed into the tube; the gaseous products are passed through bromine water or 1 per cent. hydrogen peroxide solution, the stream of oxygen being very carefully regulated. This is regarded as the most reliable method of determining volatile sulphur; that of Pfeiffer (this J., 1905, 943) is only suitable for obtaining rapid approximations. (3). The sodium peroxide method of determining total sulphur (this J., 1901, 4131) may be used where speed rather than absolute accuracy is essential; a stout platinum wire should however be used for the ignition instead of an iron wire; a more dilute chromate solution should be employed; and the liquid containing the chromate, after neutralisation by ammonia, should be transferred to a graduated cylinder and an aliquot part of the clear liquid titrated. (4). Accurate values are rapidly obtained with the calorimetric bomb, but sulphur

may remain in the ash, if the proportion of this be high, and it is sometimes necessary to add a substance capable of raising the temperature of combustion, in order to ensure complete oxidation of the sulphur. (5). Brunck's method (this J., 1905, 1086) in all cases gives accurate results, and the author considers this the most suitable method for determining total sulphur, but it should be modified as follows:—Platinum is used as a contact substance in the combustion tube and hydrogen peroxide solution as an oxidising absorbent; after combustion, the contents of the platinum boat are treated at once with hydrochloric acid and the mixture evaporated to dryness on the water-bath, the hydrogen peroxide solution being made alkaline, boiled to decompose excess of the reagent, and added to the residue; the whole is then acidified with hydrochloric acid and filtered from the silica, and the sulphuric acid determined gravimetrically, titration being inadmissible. The determination of volatile sulphur is looked upon as of little practical value, since its amount depends on the conditions of burning, and results obtained by combustion in oxygen cannot, therefore, indicate what would obtain in an ordinary furnace. The sulphuric acid produced in the above processes of determination may in most cases be titrated, either by the benzidine method, as modified by Friedheim (this J., 1907, 116) or by Bruhn's modification of the chromate method, which should be carried out in the following manner:—An aqueous emulsion of barium chromate, precipitated from boiling solution, is prepared so as to contain about 0.05 gm. of barium chromate per c.c., and 5 c.c. of this well-shaken mixture diluted with 50–100 c.c. of water, are acidified with 1 c.c. of strong hydrochloric acid, and added to the boiling solution to be tested; boiling is continued for some time, and then the excess of barium chromate is precipitated with ammonia, the excess of ammonia boiled off, and the filtered liquid cooled in a closed flask; 20 c.c. of strong hydrochloric acid and 20 c.c. of 10 per cent. potassium iodide solution are then added, the solution made up to 500 c.c., and, after half an hour, titrated with thiosulphate.

F. SOHN.

Lighting gas: Determination of the heating and illuminating power of —. N. Teclu, J. prakt. Chem., 1909, 79, 165–171.



Since the heating power of illuminating gas and the expansive force of a mixture of the gas and air when exploded, both depend essentially on the temperature produced by combustion of the gas, the author makes use of the relation between the two effects mentioned in order to obtain a measure of the heating power of the gas.

The apparatus used is shown in the figure. The glass globe, A, holds 1 litre. It has three openings, 2 cm. wide: in the upper one the glass tube, B, is fixed airtight; in the lower one, the tube, C, 1 cm. wide, is placed loosely, whilst over the third opening, fits loosely the aluminium cap, D, which is fixed to the pendulum, G. In using the apparatus, the tap, K, is closed, and the illuminating gas is passed into the apparatus through the tube, C; the gas escaping at B is, after a time, lighted. After 30 seconds the gas supply is cut off. The flame immediately becomes smaller, and air is drawn into the globe through the lower and side openings; subsequently the luminous flame becomes blue and then splits into two cones in the known manner, the outer one burning at the mouth of the tube, whilst the other travels down into the globe and explodes the mixture of gas and air therein. The effect of a definite aliquot portion of the force of the explosion is registered by the movement of the pendulum. Experiments of this kind showed that different samples of illuminating gas had a heating power greater by from 0.36 to 9.65 per cent. than that of a mixture of equal volumes of hydrogen and methane. The method may also be used for obtaining a measure of the illuminating value of the gas, by observing the time which elapses between cutting off the gas supply and the explosion. This time depends upon the difference between the sp. gr. of the gas and of the air, and in general the illuminating power of gas increases with its sp. gr., the constituents valuable as illuminants being heavy hydrocarbons. If the proportions of carbon monoxide and dioxide be greater than normal, the sp. gr. is increased, and the illuminating power diminished, but in such cases the ratio between the heating power and the illuminating power, which is otherwise tolerably constant, is altered.—A. S.

Copper blast-furnace gases. Schorr. See X.

PATENTS.

Briquetting fine coal and the waste materials thereof; Apparatus and process for —. G. B. Damon, Glenside, Pa. U.S. Pats. 914,247 and 914,248, March 2, 1909.

THE fine coal or waste is first thoroughly dried and then the incombustible matter is separated. The dust is next removed by suitable machinery and the fine, dustless coal is briquetted. The separated portions are converted into gas in a producer and the gas is utilised to dry the coal and work the machinery.—W. H. C.

Coke ovens. H. W. Seymour, Leeds. Eng. Pat. 1409, July 21, 1908.

THE horizontal side heating flues are connected at either end, by vertical flues, with one or other of two horizontal flues situated beneath the sole of each oven. The opposite end of one horizontal sole-flue is connected with the left hand regenerator beneath the battery and the opposite end of the other sole-flue with the right hand regenerator. In one phase of the working, the air enters the regenerator on one side and passes thence through one of the sole-flues under each oven, to the vertical flue at one side, from which it is distributed to the air-inlet chambers, issuing therefrom to meet the gas for heating the flues. The waste gas passes from the opposite end of the flues into a similar set of air-chambers from which it is conducted by a vertical flue and the other sole-flue to the opposite regenerator. Dampers are provided by means of which the directions taken by the waste gas and air can be reversed.—W. H. C.

Coke-ovens. The Coke-Ovens and By-Products Co., Ltd., and S. N. Wellington, London. Eng. Pat. 6017, March 18, 1908.

THE claim is for an inclined coke-oven heated by producer gas generated in a furnace situated beneath the ovens on the charging side, each furnace serving for three or more ovens. The ovens have vertical heating flues and each oven has an inclined chequer-work regenerator directly beneath it. Each regenerator has an air heating flue on each side and a gas heating flue is arranged between each pair of air heating flues. The air and gas mix and enter at the base of alternate vertical flues, pass upwards, and

return down the next vertical flue to the regenerator. The vertical flues on each side of the oven are connected in pairs by an arched flue passing over the top of the oven. The gas is taken off by a series of vertical passages spaced apart in the top of each oven and connected by an external pipe which conducts the gas to the main.—W. H. C.

Coke-ovens; Regenerative — J. Mueller, Heme, Germany. Eng. Pat. 11,688, May 29, 1908. Under Int. Conv., May 29, 1907.

In a horizontal coke-oven each oven wall contains a series of vertical heating flues connected in pairs at their upper ends, and inlets for gas and hot air are provided at both ends of each flue. The odd-numbered flues receive gas and hot air at their lower ends, the combustion products pass through the connecting passages to the even-numbered flues and there receive a fresh supply of gas and hot air, and the combustion products finally pass to a sole-flue beneath one of the adjacent oven chambers leading to one of the regenerators. After reversing, the hot air from this regenerator is admitted along with gas at the bottom of the even-numbered heating flues, and the combustion products finally pass from the odd-numbered heating flues to a sole-flue beneath the other of the adjacent oven chambers, leading to the other regenerator. The hot air passes to the upper tuyères through passages in the walls separating adjacent heating flues. The tuyère bricks are formed with a central gas orifice surrounded by an annular air orifice, and the wall which separates the air and gas orifices is provided with four air passages inclined in the direction of the gas current and admitting air tangentially into the gas orifice to give the gas a rotary motion and so promote intimate mixing.—A. T. L.

Gas; Manufacture of — S. N. Wellington and A. S. Everest, London. Eng. Pat. 8186, April 13, 1908.

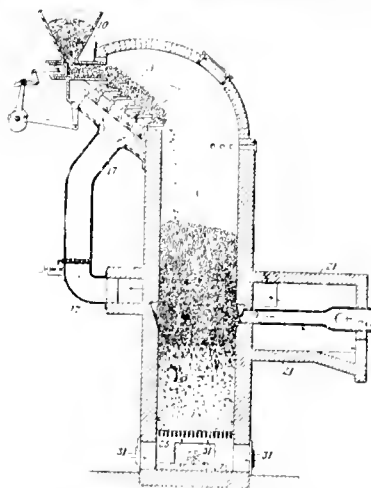
CARBON dioxide evolved by heating a "calcareous material" in a retort is mixed with superheated steam and passed through a retort containing carbon or coke and heated externally in a furnace. The carbon dioxide and the steam are decomposed by the incandescent carbon into carbon monoxide and hydrogen. The mixture (water-gas) is then passed through a carburettor for the purpose of enriching it with oil vapours.—W. H. C.

Gas-producers for use in melting, heating, etc., in the manufacture of steel. C. E. Scooby-Smith, Bolton, Lancs. Eng. Pat. 12,856, June 16, 1908.

THE gas-producer is provided with a rotatable hopper supported on rollers running in a water-trough formed in the top-plate of the producer. The hopper comprises a hopper-plate, provided with a water-trough for cooling, carrying a square casing which forms the body of the hopper and is provided with a sand-sealed cover. The hopper-valve or tongue is a rectangular plate hinged along one side of the casing and bearing, in its closed position, against the opposite side of the casing and also against adjustable sloping ledges of triangular cross-section fixed along the two other sides of the casing. A heavy poker with detachable prongs at its lower end passes through the hopper-plate and is suspended by a swivel link from an overhead horizontal girder which is free to rotate about the axis of the producer. The poker may be lowered on to the fuel and rotated by means of a "tommy-bar," and the hopper, hopper-plate, and poker may be rotated together about the axis of the producer between successive chargings.—A. T. L.

Gas-producer and process of generating gas. C. E. Lucke, New York. U.S. Pats. 914,663 and 915,034, March 9, 1909.

FUEL is fed in regulated quantities from the hopper, 10, on to the vibrating step-grate, 3, where the volatile constituents are gasified by a regulated stream of air introduced through the conduits, 21, 17. The incandescent non-volatile portion of the fuel is dropped on to the lower fuel bed supported on the grate, 25, where it is gasified by air introduced through the apertures, 31. The completely oxidised volatile constituents of the fuel



pass downwards through the lower incandescent fuel bed and escape along with the gases generated there through the gas pipe, 29, 28.—W. H. C.

Gas manufacture; Process for obtaining the by-products of —, with simultaneous purification of the gas. K. Burkheiser. Fr. Pat. 394,926, Oct. 5, 1908. Under Int. Conv., Oct. 14, 1907, and Feb. 11 and Sept. 14, 1908.

A PROCESS for obtaining ammonium sulphate and sulphite in the purification of crude coal-gas, coke-oven gas, and similar gases consists in passing the gas, previously freed from tar, over a heated oxidising substance such as bog-iron-ore, and causing the oxides of sulphur which are produced to combine with free ammonia. A part of the ammonia is present in the gas which passes over the oxidising substance, and a further quantity of ammonia is obtained by treating the liquor, collected in separating the tar, with slaked lime. This latter supply of ammonia is mixed with hot air or gas, and in one method of working is passed through the chamber containing iron oxide along with the crude gas containing sulphuretted hydrogen. In another method of working, the air or gas containing the ammonia obtained from the liquor, and the gases containing oxides of sulphur are passed alternately through a single washer, or these two currents of gas are passed continuously through separate washers through which the same liquid is circulated.—A. T. L.

Gases; Apparatus for purifying and cooling — H. Uhlmann. Ger. Pat. 207,169, Aug. 6, 1907.

THE apparatus is for the purification and cooling of gases intended for use in gas engines. It consists essentially of a chamber, open at the bottom, which dips into an outer receptacle containing water, and is provided with a depending partition movable vertically. At its lower end the partition carries an arched plate disposed horizontally. The outer receptacle has an overflow pipe for the cooling water, and the inner chamber is provided at the top with inlet pipes for the cooling water and the gas to be purified, and with a pipe leading to the gas-engine. During the suction stroke of the engine, a partial vacuum is produced in the space above the water in the inner receptacle, thus causing the water to rise to the level of the arched plate; the gas is forced to pass through the cooling water under the arched plate. On the completion of the suction stroke, the water level falls, rising again during the next suction stroke of the engine.—A. S.

Incandescence mantle; Metallic — for lighting and heating purposes. H. Reeser, London, and H. E. Bray, Woolwich. Eng. Pat. 13,828, June 30, 1908.

THE patent is for a mantle having its threads or filaments composed of an alloy of tungsten and molybdenum, or composed of a silver core coated with such an alloy. The alloy contains for ordinary purposes 80 per cent. of tungsten and 20 per cent. of molybdenum, but these

proportions may be varied according to the shade or intensity of the light required. The mantle may be of any of the usual forms, and its edge or edges are strengthened by holding them in a ring or bar of U section.

A. T. L.

Electric incandescent lamp filaments: Manufacture of —. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 11,867, July 13, 1908.

ORDINARY metallised carbon filaments, made by flashing smooth "base filaments" in hydrocarbon vapour, and then firing the filaments packed in graphite in an electrically heated graphite tube, consist of a carbon core and a surrounding shell or skin which is not firmly fixed to the core, so that stripping or flaking may occur. The invention consists in roughening the "base filament" before flashing in order to lock the metallised shell or coating securely to the core, and so increase the life of the filament. The roughening is effected by heating the base filament in air by a momentary electric current, so that the resistance of the filament is increased by about 25 per cent. A. T. L.

Electrical glow lamps with metal filaments. T. McKenna, London. From Glühlampenwerk Anker, Ges.m.b.H., Berlin. Eng. Pat. 9,118, Sept. 11, 1908.

SUPPORTS for metal filaments in incandescence electric lamps are made of metal coated for about half its length by a special process with a low oxide of tantalum or of niobium. The support is first coated with colloidal tantalic or niobic acid, then slowly dried, and finally heated in a china tube to 1300° C. in an atmosphere of hydrogen. To obtain the tantalic or niobic acid in the colloidal form, a 5 per cent. solution of the potassium salt, obtained from the pure double fluoride of potassium and the rare metal by precipitating with ammonia and treating the precipitate with caustic potash, is poured into a 1 per cent. solution of sulphur dioxide. The colloidal acid is purified by dialysis and finally evaporated to a syrup.—A. T. L.

Coke ovens: Continuous heat-interchanging arrangement for —. E. Solvay, Brussels. U.S. Pat. 914,525, March 9, 1909.

SEE Eng. Pat. 16,786 of 1907; this J., 1908, 11. T. F. B.

Gas generators. J. Maly, Dresden, Saxony. Eng. Pat. 4529, Feb. 28, 1908.

SEE U.S. Pat. 906,812 of 1908; this J., 1909, 82. T. F. B.

Incandescent bodies for use in incandescent gas lighting: Manufacture of —. M. von Ullrich, Charlottenburg, Germany. Eng. Pat. 17,596, Aug. 21, 1908.

SEE Fr. Pat. 393,587 of 1908; this J., 1909, 132. T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

PATENTS.

Benzene or its homologues: Producing — from petroleum. E. A. Starke, Berkeley, Cal. U.S. Pat. 913,780, March 2, 1909.

THE "distillate of petroleum which contains a benzene nucleus" is agitated and heated with concentrated sulphuric acid until the evolution of sulphur dioxide ceases. The mass is then allowed to settle until the sulphonic acids have separated from the petroleum and the benzene is recovered from the sulphonic acids by distillation.

—W. H. C.

Chlorinated compound and process of making same, and apparatus for utilising chlorine. J. W. Aylsworth, East Orange, N.J., Assignor to Fireproof Products Co., N.J. U.S. Pats. 914,223 and 914,224, March 2, 1908.

CHLORINE gas is forced through a suitable liquid organic substance, e.g., naphthalene, which is heated under pressure. An apparatus for effecting this consists of a closed chamber

containing the organic material and having inside it a series of inverted pan-shaped partitions. These partitions are arranged one above the other, the uppermost one being below the level of the liquid to be chlorinated. The chlorine gas is introduced into the chamber underneath the lowest partition, and, after flowing across it, then ascends to the second partition, and so on until it has reached the surface of the liquid. Another apparatus comprises a series of chlorinating chambers which are placed in communication with one another. Through these chambers the gas and the substance to be chlorinated are made to flow in opposite directions. Both forms of apparatus are provided with devices for separating and collecting the hydrochloric acid produced during the reaction.—P. F. C.

Chlorinating organic bodies: Process of —. C. Ellis, White Plains, N.Y., and K. P. McElroy, Washington, D.C., Assignors to Fireproof Products Co., New Jersey. U.S. Pat. 914,251, March 2, 1909.

CHLORINE, obtained by electrolysis of a suitable chloride, is caused to act upon a hydrocarbon of the aromatic series (e.g., naphthalene) in either the liquid or solid condition to obtain the desired organic chloride.—W. H. C.

Aromatic nitro-compounds: Process for preparing —. Chem. Fabr. Griman, Landshoff and Meyer, A.-G., Ger. Pat. 207,170, Feb. 2, 1908.

NITROGEN oxides diluted with air are absorbed by zinc oxide, copper oxide, or similar oxide of low basicity; the resulting product is heated in an iron tube to 290° C., when a mixture of air and benzene vapour is passed through the tube, the temperature being increased; formation of nitrobenzene begins at 300° C., but above 350° C. it is decomposed. The product consists of fairly pure mononitrobenzene, the yield being practically quantitative, as calculated from the nitrogen oxides used. When toluene is similarly treated, a mixture of about 11 per cent. of *m*- and 89 per cent. of *o*-nitrotoluene results.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Safranin: Constitution of —. Studies in the azine series. Part I. J. T. Hewitt, S. H. Newman, and T. F. Winnill. Chem. Soc. Proc., 1909, 26, 86.

PHENOSAFRANINE has the composition of a salt (chloride) of phenylphenazonium. According to Bernthsen the two amino-groups are symmetrically situated, whilst Witt supposed that one was in the phenyl group, only one being attached to the phenazine nucleus. The question was apparently decided in favour of Bernthsen's formula by Körner and Schraube, who obtained identical dialkylsafranines by the oxidation of (a) one molecule of *as*-dialkyl-*p*-phenylenediamine with two molecules of aniline, and (b) one molecule each of *p*-phenylenediamine, aniline, and its dialkyl derivative. More recently, P. Barbier and P. Sisley (Ann. Chim. Phys., 1908 (viii.), 13, 96, and this J., 1908, 17) have stated that phenosafranin, as prepared by oxidising *p*-phenylenediamine with aniline, consists essentially of the asymmetric compound mixed with small amounts of an isomeride having the structure given by Bernthsen. The present authors find that the hydroxyaphosafranone obtained from safranin is identical with that prepared by Jaubert's method from nitrosophenol and *m*-hydroxydiphenylamine (Ber., 1895, 28, 273), since the acetyl derivatives prepared from both specimens melt at 271° (uncorr.) whether alone or mixed (Fischer and Hepp give 265–268°. Ber., 1897, 30, 101).

The synthesis of an asymmetric phenosafranin by oxidation of aniline with 2:4'-diaminodiphenylamine described by Barbier and Sisley (*loc. cit.*, p. 102) could not be realised, any safranin obtained by them probably owing its origin to admixed 4:4'-diaminodiphenylamine, since potassium bichromate converts 2:4'-diaminodiphenylamine into aminophenazine whether aniline be present or not.

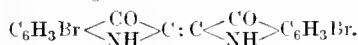
The experiments recorded are only compatible with the symmetrical (Bernthsen's) formula for phenosafranin.

Flavonol derivatives; Remarks on Herzig and Hofmann's paper on completely methylated — N. Walschko. Ber., 1909, 42, 726—728.

THE author points out that Herzig and Hofmann's method of preparing pentamethylquercetin (Ber., 1909, 42, 155) by treating quercetin with a large excess of alkali and dimethyl sulphate whereby a yield of 25 per cent. of the theoretical was obtained is not so suitable as his own which was published in 1904. Trimethylquercetin is prepared by dissolving 4 grms. of quercetin in 200 c.c. of hot methyl alcohol, adding to the partly cooled solution 8 grms. of dimethyl sulphate and then, gradually, 3.6 grms. of potassium hydroxide dissolved in a little alcohol. The reddish-brown liquid soon resumes its original yellow colour and then the same quantities of dimethyl sulphate and potassium hydroxide are added and the whole left overnight. The resulting crystalline precipitate is washed with water and recrystallised from alcohol, whereby rather more than 50 per cent. of the theoretical yield of trimethylquercetin is obtained. Pentamethylquercetin is prepared by triturating the potassium salt of trimethylquercetin with an excess of dimethyl sulphate and, after standing overnight, treating with water and recrystallising the residue from methyl alcohol. The yield is quantitative. —J. C. C.

Dyestuff of the antique purple from Murex brandaris. P. Friedlaender. Ber., 1909, 42, 765—770.

THE author has continued the investigation of this dyestuff (this J., 1907, 1003) and finds it to consist of 6:6'-dibromo-indigo.



Its identity was proved by a comparison with the synthetic dyestuff prepared as follows: *p*-Bromo-*o*-toluidine is converted into 4-bromo-2-aminobenzoic acid; this, when treated with chloroacetic acid furnishes bromophenylglycine-*o*-carboxylic acid, which is condensed with acetic anhydride and sodium acetate to acetyl bromoindoxyl. Both the natural and the synthetic dyestuff give a pale yellow vat from which cotton is dyed in fast, reddish-violet shades. —J. C. C.

Indigoid dyestuffs as oil colours. Eibner. See XIII.4.

PATENTS.

Vat-dyestuffs; Manufacture of new sulphurised — of the anthraquinone series. O. Imray, London. From Soc. of Chem. Ind. in Basle, Switzerland. Eng. Pat. 20,094, Sept. 24, 1908.

By heating 2-methylbenzanthrone with sulphur or alkali polysulphides, dyestuffs are obtained which dye unmordanted cotton in an alkaline hydrosulphite vat, in blue-green to green-black shades of good fastness to washing, light, and chlorine. By heating 10 parts of methylbenzanthrone with 50 parts of sulphur at 200—240° C., until the evolution of hydrogen sulphide ceases, a product is obtained which when purified forms a black powder, dissolves in alkaline hydrosulphite yielding an olive-coloured vat, and dyes cotton in blue-green shades. The dyestuff obtained by heating 10 parts of methylbenzanthrone with 40—50 parts of sulphur at 300—330° C., yields an olive-coloured vat in which cotton is dyed a deep black. When heated with sodium tetrasulphide for 1 hour at 200—240° C., methylbenzanthrone yields a dyestuff which gives a blue vat in which cotton is dyed in green-blue shades. —F. M.

**o*-Hydroxyazo dyestuffs; Process for preparing chrome* —. Basler Chem. Fabr. Ger. Pat. 206,698, July 27, 1907.

THE diazo derivative of 1-amino-2-naphthol-3-carboxylic acid or of its mono-nitro derivative is combined with resorcinol, naphthols or their sulphonic acids, or other suitable components for *o*-hydroxyazo dyestuffs. According to the component used, a wide range of shades is obtainable after chroming. —T. F. B.

Indoxylcarboxylic acid and indoxyl; Process for preparing —. Kalle und Co., A.-G. Ger. Pat. 206,903, Feb. 6, 1908.

o-NITROPHENYLCYANIDE is reduced by iron and acetic or hydrochloric acid to *o*-aminophenylexamide; chloroacetic acid converts this into *o*-cyanophenylglycine, which is readily converted into indoxyl or indoxylcarboxylic acid by heating with aqueous solutions of alkali hydroxides. —T. F. B.

Indigoid dyestuffs; Process for preparing —. Kalle und Co., Akt.-Ges. Ger. Pat. 207,097, Jan. 9, 1908.

DYESTUFFS which resemble indigo, giving red-violet, deep blue, and deep green dyeings from the vat, are obtained by the condensation of α -isatin derivatives (e.g., α -isatin chloride or anilide, thioisatin, α -methylisatin) with substituted phenols or naphthols, which have at least one *o*-position to the hydroxyl group free. For example, 17.4 kilos, of 1:4-dihydroxynaphthalenemonomethyl ether, 22 kilos, of α -isatin anilide, and 50 kilos, of acetic anhydride or 120 kilos, of benzene are heated under a reflux condenser. The dyestuff crystallises on cooling, and dyes wool fast blue shades from the vat. These dyestuffs are fast to alkalis, whereas those from α -isatin derivatives and unsubstituted phenols or naphthols are not. —T. F. B.

Dyestuff [from dinitrosorcinol]; Process for preparing a brown —. K. Sunder. Ger. Pat. 207,465, Sept. 11, 1907.

RESORCINOL (100 parts) is nitrated, and the dinitro-compound obtained is made into a paste with water, and stirred for some time with 20 per cent. ammonia solution (1000 parts), at the ordinary temperature; at first a brown solution is produced, but gradually a green, crystalline compound is precipitated, which is filtered off, washed with a solution of salt, and dried. It contains no free ammonia, and is soluble in cold water, and readily in warm water. When its aqueous solutions are suitably thickened and printed on fabrics, even without mordants, and then steamed, brown shades very fast to soaping and light are produced. It can also be applied in conjunction with various acid and basic dyestuffs, with or without a mordant. —T. F. B.

Colouring matters containing sulphur [Thioindigo dyestuffs] and capable of dyeing from a vat; Manufacture of red —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,755, May 18, 1908.

SEE Fr. Pat. 390,352 of 1908; this J., 1908, 1015. —T. F. B.

Azo dyestuff and process of making same. C. Immerheiser, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 914,144, March 2, 1909.

SEE Fr. Pat. 393,580 of 1908; this J., 1909, 137. —T. F. B.

Azo dyestuff and process of making same. P. Julius and E. Fussenegger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 914,146, March 2, 1909.

SEE Fr. Pat. 391,155 of 1908; this J., 1908, 1148. —T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Silk; Determination of weighting in —. P. Heermann. Färber-Zeit., 1909, 20, 75—78.

MOST recent processes for the estimation of weighting in silk fabrics depend upon the extraction of the weighting substance. In spite of the success of many of these methods, especially that of Ristenpart for Monopol Blacks (this J., 1908, 329), much can still be said for the estimation by nitrogen determination. Sisley, by his investigations (this J., 1907, 605) proved that extraction methods only

gave uniform results under certain definite conditions and that slight variations from these conditions led to quite different results being obtained. The author finds that soft, slightly weighted or tender silks give erroneous results by extraction methods on account of the action on the material of the reagents employed. This is especially true of the alkali-treatment in Ristenpart's method. By substituting for the $N/1$ -potassium hydroxide used in this method, a mixture of equal parts of $N/1$ potassium hydroxide and glycerin of 28° B., this action on the fibre is very considerably reduced. On applying this modification of Ristenpart's method to silks weighted with iron compounds, it was found that the alkali-glycerin solution dissolves Prussian blue quantitatively from the fibre if the extraction is effected at 80° C., and from the solution obtained, the Prussian blue can be precipitated by acidification. Any iron present as oxide or gallate remains of course on the fibre. If a silk be heavily weighted with say tin oxide and tin phosphate in addition to Prussian blue, it is necessary, after once extracting with the alkali-glycerin solution, to treat the material with cold hydrochloric acid (20 per cent.), and finally to repeat the extraction. By this means the tin phosphate is removed by the acid, and the Prussian blue by the alkali-glycerin solution, whilst the tin oxide remains on the fibre.—P. F. C.

Treating cellulose. Berl. See XIX.

Electrolytic bleaching. Fraass. See XIX.

PATENTS.

Cellulose and albuminoids [artificial silk]; Process for strengthening materials composed of —. X. Eschaler, Second and Third Additions, dated Oct. 7, 1908, to Fr. Pat. 374,724, April 24, 1906. (See this J., 1907, 821; 1908, 157.)

THE aldehyde and the dehydrating agent which are employed for strengthening artificial silk may be applied to the material either alternately or simultaneously. The following process gives good results. The material to be treated is impregnated with a solution of lactic acid and alum, of such a concentration that the fibre retains 5–6 per cent. of its weight of each reagent. It is then placed in a closed vessel containing a dehydrating agent such as sulphuric acid at 50–60° C. Through an opening in the wall of the vessel, 10–25 parts of a 40 per cent. solution of formaldehyde are introduced for each 100 parts of material. The opening is then sealed and the apparatus is heated to 50–60° C. for a further 5 or 6 hours. The material is then removed, washed, and dried. Fibres which have been treated in the manner described in this patent, exhibit an increased affinity for dyestuffs if treated with a solution of sodium or potassium hydroxide. If a concentrated solution be employed, the time of action must be short or the strength of the fibre will be affected and its length will be diminished. Oxidising agents such as hypochlorites may be added to the solution.—P. F. C.

Cellulose products [fibres, etc.] from cellulose-cuprammonium solutions; Process for preparing —. P. Friedrich, Ger. Pat. 206,883, Aug. 27, 1907.

SOLUTIONS of cellulose in ammoniacal copper solutions, containing 6 per cent. of cellulose, are forced through suitable orifices into a coagulating bath consisting of 25 kilos. of sodium chloride and 4.5 kilos. of sodium hydroxide in 100 litres of water, preferably warmed. The threads are washed in the usual manner and dried under tension.

—T. F. B.

Textile and other materials; Treatment by liquid processes of —. G. Malard, Tourecoing, France. Eng. Pat. 759, Jan. 13, 1908.

THE invention is described as applied to an apparatus for scouring and degreasing wool. The wool is carried on an endless band above a vat divided into compartments. Fresh scouring liquor is introduced into a compartment at one end, and the liquor charged with wool grease is withdrawn from the last compartment at the other end. The object of the invention is to provide means for transferring a portion of the liquor from one compartment to the

next in a direction opposite to that in which the wool travels. From each compartment the liquor is forced by a pump or the like through an ascending pipe ending in a sprinkler, through which it is discharged on to the wool. In each compartment also is a float, the one in the first compartment being connected to the tap controlling the pipe through which fresh liquor is supplied. The other floats are connected to oscillating trays above the compartments and directly below the sprinklers, and these work in such a manner that of the liquor withdrawn from a given compartment and forced through the sprinkler, the first portion which drains through the wool and which is hence most highly charged with wool grease, flows from the oscillating tray into the next compartment nearer the outlet end, and then as the float in this compartment rises, the tray is gradually tilted in the opposite direction, and the latter portion of the liquor flows back into the compartment from which it was withdrawn.

—A. S.

Wool-scouring and other liquors; Apparatus for burning the evil-smelling distillation gases produced in working-up —. O. Zahn. Ger. Pat. 206,747, April 16, 1907.

THE gases are passed through a combustion chamber in which fuel gas is burnt with the least possible quantity of air. Separate inlets, fitted with dampers, are provided for supplying air for the combustion of the fuel gas and of the distillation gases respectively. The inlet for the air for burning the distillation gases is disposed above the other air inlet, so that the air is preheated by passing through the fuel gas flame.—A. S.

Chlorine gas [for bleaching]; Method of treating and utilising —. E. C. Paramore, Philadelphia, Pa., Assignor to Electro-Bleaching Gas Co., New York. U.S. Pat. 908,126, Dec. 29, 1908.

CHLORINE gas is dried, cooled say to 0° C., then suddenly heated by passing it through a porcelain tube heated, for example, to 500° F., next electrified, and afterwards again cooled and liquefied. The electrification of the gas is effected by passing it through an annular glass chamber surrounding an iron core on which is wound a primary coil connected to a source of electric current of an "extremely high-tensioned oscillatory character"; the glass chamber itself is wound with a secondary coil of fine wire, which acts in a similar manner to the step-up coil of a transformer. It is stated that after this treatment the chlorine gas has little or no odour, whilst its bleaching properties are improved. (See also Eng. Pat. 2039 of 1901 and U.S. Pat. 786,595 of 1905; this J., 1901, 1002; 1905, 503.)—A. S.

Washing and bleaching liquid; Process for the preparation of a —. M. Vogtherr and H. Knorr. Ger. Pat. 207,258, Jan. 11, 1908.

A WASHING and bleaching liquid, which has no injurious action on the fibre, is prepared by leading chlorine into a solution of sodium carbonate until evolution of carbon dioxide begins, then adding caustic soda, and finally leading in carbon dioxide, until the liquor contains only sodium bicarbonate in addition to sodium hypochlorite and sodium chloride.—A. S.

Dyeing machine. R. P. Smith and G. E. Drum, Philadelphia, Pa. U.S. Pat. 905,473, Dec. 1, 1908.

THE material to be dyed is placed in a rectangular cage, which is divided into compartments by means of perforated, hinged partition walls. The top and bottom of the cage are also perforated, and the side walls project a little beyond them so that when the receptacle is lowered into the dye-vat, these extensions engage in grooves and the circulating dye-liquor is forced to pass through the cage, which fits over a perforated false bottom in the dye-vat. The space below this false bottom is in communication with two cylindrical chambers fixed to the side of the vessel and the upper parts of these are in communication with channels in the perforated cover of the machine. Screw propellers work inside the cylinders and circulate the dye-liquor, forcing it up through the material or over the cover of the dye-vat which distributes

it evenly over the material. Upon completion of the dyeing operation, the cage is lifted out of the dye-vat.

—F. M.

Textile materials; Apparatus for the boiling, dyeing, impregnation, etc., of —. F. F. Gebauer. Ger. Pat. 206,708, June 15, 1907.

IN apparatus of the type in which the liquor is circulated continuously through the system, a high-pressure turbine-pump is inserted in the circuit, and suitable connections and valves are provided, whereby this pump first sets in action a water-jet pump in order to produce a vacuum in the receptacle in which the treatment of the textile material is performed, then causes the liquor to circulate through the system, and finally when the treatment is completed, causes cold water to pass through the apparatus.

—A. S.

Crape-like effects on cotton tissues; Process for the production of —. C. Schimmel, jun. Ger. Pat. 207,372, May 14, 1907.

IN the production of crape-like effects on cotton tissues by spraying them with hot water, the effect produced depends upon the temperature of the water. According to the present patent, a suitable substance, e.g., calcium chlorate, is added to the water in order to allow of its being used at a higher temperature than hitherto.—A. S.

Fireproof material [fibre]. J. W. Aylsworth, East Orange, N.J., Assignor to Fireproof Products Co., N.J. U.S. Pat. 914,222, March 2, 1909.

THE fibre is impregnated with a chlorinated derivative of naphthalene (see U.S. Pat. 914,223, page 360.), which contains about 68 per cent. of chlorine, is soluble in chloroform, carbon tetrachloride, and naphtha, has a sp. gr. about 1.85, m. pt. 262° F., and is waxlike in appearance.—P. F. C.

Wood; Process of freeing raw — from its yolk and grease by electrical means. J. M. Baudot, Tourcoing, France. U.S. Pat. 914,368, March 2, 1909.

SEE Fr. Pat. 375,237 of 1906; this J., 1907, 963.—T. F. B.

Printing [fabrics, etc.]; Impts. in —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,314, May 25, 1908.

SEE Fr. Pat. 390,979 of 1908; this J., 1908, 1110.—T. F. B.

Dressing fabrics and fibres, manufacture of paper, wood pulps, hctographic compositions and inks, printing rollers, plastic masses and the like [Use of polyglycerins]. C. Claessen, Berlin. Eng. Pat. 9579, May 2, 1908.

SEE Ger. Pat. 198,711 of 1907; this J., 1908, 803.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

PATENT.

Wood; Colouring —. W. A. Hall, New York, Assignor to American Mahogany Co., Maine. U.S. Pat. 913,128, Feb. 23, 1909.

THE wood is first subjected to the action of a vacuum in order to remove the air and render the wood absorbent, and it is then treated, under high pressure, with a hot aqueous ammoniacal solution, containing a suitable colouring matter which dissolves in, but is not injured by, an ammonia solution.—B. N.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Caro's acid (monosulpho per-acid); Synthesis and formula of —. H. Ahrlé. J. prakt. Chem., 1909, 79, 129—164. (See this J., 1909, 172, 278, 671, 777; 1901, 578; 1902, 343, 913.)

THE author first discusses the literature and shows that upon theoretical grounds the most probable formula for Caro's acid is $\text{SO}_3\text{H}\cdot\text{O}\cdot\text{OH}$. (The $\text{O}\cdot\text{OH}$ group is

written as shown in order to avoid discussion of the nature of the linking of the O_2 group in peroxides.) A study of the kinetics of the reaction between hydrogen peroxide and sulphuric acid confirmed this view. The formation of Caro's acid (monosulpho per-acid) in this way may thus be expressed by the equation: $\text{H}_2\text{O}_2 + \text{H}_2\text{SO}_4 = \text{H}_2\text{SO}_3 + \text{H}_2\text{O}$. Attempts were also made to prepare the acid synthetically from anhydrous hydrogen peroxide (see this J., 1902, 986) and sulphur trioxide, and small quantities of the acid of a concentration as high as 92 per cent. were obtained in this way. In one or two cases crystals of the acid were produced which began to melt far below 0°C . The high percentage Caro's acid is a tolerably mobile liquid at the ordinary temperature and rapidly decomposes. In presence of bright platinum, or of the finely-divided metal, or of powdered manganese dioxide, or finely-divided silver, decomposition occurs with explosive violence. Lead dust, zinc dust, magnesium powder, and wood charcoal have no noteworthy effect on the decomposition. Iron dust alone is also without appreciable effect, but in presence of a trace of manganese dioxide, causes a vigorous reaction. Wool and cellulose are carbonised nearly instantaneously by the acid. If a drop of the acid be placed on cotton, no action is observed at first, but after a few seconds a pale yellow flame is produced and the cotton takes fire.—A. S.

Magnesite; Analysis of —. Determination of small quantities of calcium in the presence of much magnesian. F. Hundeshagen. Z. öffentl. Chem., 1909, 15, 85—93.

ONE gm. of the powdered magnesite is boiled with 80 c.c. of 5 per cent. hydrochloric acid for 15 minutes, and the solution is filtered; the filtrate is evaporated to dryness, and the residue is dissolved in 30 c.c. of warm water containing 4 grms. of sodium sulphate. Forty c.c. of 90 per cent. alcohol are then added, with constant stirring, and the mixture is set aside at a temperature of from 17.5° to 20°C . for 5 hours, when the crystalline precipitate of calcium sulphate is collected on a filter, washed with 50 per cent. alcohol, dissolved in hot dilute hydrochloric acid, and the calcium then determined in the usual way as oxalate, after precipitation of the small quantity of iron oxide which is thrown down with the calcium sulphate. The dilute alcoholic filtrate containing the magnesium salts is evaporated to remove the alcohol, and the iron and magnesium determined in the residual solution as usual. Having ascertained the quantity of calcium present as described above, another portion of the magnesite may be dissolved, and the calcium and magnesium precipitated together as phosphates after removal of iron and aluminium; the precipitate is collected on a filter, ignited, and weighed, and the amount of calcium phosphate deducted in order to obtain the quantity of magnesium. The magnesium and calcium may also be determined together by titration, using methyl orange as indicator; for this purpose the magnesite is dissolved in a known excess of standard sulphuric acid and the excess titrated back with standard sodium carbonate solution. After subtracting the alkalinity due to calcium, the difference represents the magnesium present in the form of oxide, hydroxide, and carbonate. The hydroxide is determined by taking the loss on heating the dry sample to a temperature of 300° — 350°C ., and the carbonate by further heating the sample to redness. On deducting the quantity of magnesium hydroxide and carbonate, the actual amount of magnesium oxide in the sample is obtained.—W. P. S.

Chlorates; Detection and colorimetric determination of —. J. F. Virgili. Ann. Chim. analyt., 1909, 14, 85—91.

WHEN about 1 c.c. of a solution of a chlorate, or about 1 gm. of the salt, is treated with 4 c.c. of a 5 per cent. solution of aniline hydrochloride in hydrochloric acid of sp. gr. 1.12, a violet coloration is produced immediately; the colour rapidly turns blue and, after some time, fades, a greenish-blue precipitate being formed. If hydrochloric acid of sp. gr. 1.45 be employed in preparing the reagent, the colorations produced are more intense, but more fugitive. By means of the test as little as 0.00002 gm. of a chlorate can be detected with certainty, but other

substances, such as chlorine, hypochlorites, hypobromites, bromates, iodates, hydrogen peroxide, peroxides, chromates, bichromates, permanganates, vanadates, and ferricyanides also give the reaction. As the coloration, in the case of pure chlorates, is proportional to the amount of the salt present, the quantity of chlorate in an unknown solution may be ascertained by comparing, after 25 minutes, the coloration obtained with that produced by known quantities of chlorate. It is essential that exactly the same proportion of aqueous solution to reagent be used both in the test solution and in the standards.—W. P. S.

Reducing action of electrolytic hydrogen on arsenious and arsenic acids when liberated from the surface of different elements. W. Thomson. Proc. Roy. Soc. Edinburgh, 1908—1909, 29, II., 84—95.

Using the apparatus described previously (this J., 1904, 790), the author has determined the velocity with which arseniuretted hydrogen is evolved at different cathodes from solutions of arsenious acid and arsenic acid respectively. With this apparatus, 0.0000005413 grm. of arsenic can be detected, and this quantity was taken as a "unit." In each experiment, 5 c.c. of a solution containing 50 "units" of arsenic and diluted to 30 c.c. with dilute sulphuric acid (1:6 by vol.) were used. It was found that the current density employed had little influence on the results. With a current of 3 amperes the following results were obtained, which show that Chapman and Law's suggestion that the reducing efficiency of hydrogen depends largely upon the supertension of the cathode at which it is liberated (see this J., 1906, 137) does not hold good.

Relative amounts of arsenic removed as arseniuretted hydrogen from (a) arsenious acid and (b) arsenic acid from 100 parts introduced, in 25 minutes.

Cathode.	(a) Arsenious acid.	(b) Arsenic acid.	Supertension (volts).
Lead	100	98.5	0.64
Zinc	100	41	0.70
Cadmium	100	27	0.48
Tin	100	18.5	0.53
Silver	100	0	0.15
Graphite	100	4	—
Iron	93	40.5	0.08
Platinum	88.5	0	0.09
Aluminium	82	0	—
Gold	74	4	0.02
Cobalt	43.5	0	—
Nickel	42.5	0	0.21
Palladium	38	0	0.46

The cathodes in the table are arranged in the order in which they are capable of removing arsenic as arseniuretted hydrogen from a solution of arsenious acid.

A study of the velocities with which arseniuretted hydrogen was liberated in successive periods of 2½ mins., showed that the reduction of arsenious acid with lead, zinc, cadmium, tin, and silver cathodes, is practically a unimolecular reaction.—A. S.

Calcium phosphide; Manufacture of amorphous —. C. E. Munroe. J. Ind. and Eng. Chem., 1909, 1, 178—181.

The phosphide was prepared in crucibles made from wrought iron pipes welded at one end, 7 in. long outside and 6 in. inside; outside diameter, 5½ in.; inside, 5 in. The crucibles were provided with grooved lids, ¼ in. thick and 6 in. outside diameter, fitted with asbestos gaskets, and the lids were held in place by wedge-shaped keys which passed through slotted lugs welded on the sides of the crucibles. A wrought iron feed pipe, 12 in. long and 1 in. diameter, passed through the lid, and was fitted outside the crucible with a wrought-iron cap. Each crucible was charged with 1400 grms. of burnt lime in lumps 1—1½ in. diameter, the cover was fastened on, and the whole placed in an ordinary crucible furnace and heated to between a dark and cherry redness. 200 grms. of phosphorus were then introduced through the feed pipe and the cap immediately replaced. When fuming ceased, the crucible was removed from the furnace. The cost of

the phosphide thus produced, including labour and materials, was 20 cents (10d.) per lb., and the same pots were used for 8 years without repairs. The phosphide was very active, yielding immediately a spontaneously inflammable gas on contact with water. It is suitable for use as an attachment to life-belts, and also to torpedoes for the purpose of locating them after they have sunk; and when mixed with calcium carbide is useful in other ways in naval warfare.—A. S.

Metatungstates; Nature of — and existence of rotatory power in crystals of potassium metatungstate. H. Copaux. Compt. rend., 1909, 148, 633—636.

The author considers that the generally accepted formula for the alkali metatungstates, *viz.* $(4WO_3)_2M_2O + aq.$, gives a very imperfect idea of the nature of these compounds, and that the formula $(3H_2O, 24WO_3, 6M_2O + aq.)$ is more rational. Barium metatungstate (ordinary formula $(4WO_3)BaO + 9.5H_2O$) and borotungstate are completely isomorphous; this isomorphism is accounted for if the formula, $(3H_2O, 24WO_3, 6BaO + 54H_2O)$, is assigned to the metatungstate, since the author has previously shown that the borotungstate has the formula $B_2O_3, 24WO_3, 5BaO + 54H_2O$. The objection that these salts differ, in that one contains six, whilst the other contains only five BaO -groups, is met in the following way: When crystallised at a low temperature, potassium metatungstate forms quadratic octahedra, $(4WO_3)_2K_2O + 8H_2O$. At a slightly higher temperature, hexagonal prisms, $(4WO_3)_2K_2O + 6.5H_2O$, are obtained; these crystals are not only completely isomorphous with those of potassium boro- and silicotungstate, but like the latter, they are optically active and all dextro-rotatory. The formula $3H_2O, 24WO_3, 6K_2O + 36H_2O$ is therefore assigned to this metatungstate, those of potassium boro- and silico-tungstate being $B_2O_3, 24WO_3, 5K_2O + 36H_2O$, and $Si_2O_5, 24WO_3, 4K_2O + 36H_2O$. The analogy between these formulae is also in accordance with the fact that the metatungstates and the complex tungstates have certain general properties in common. These compounds constitute a series represented as follows:—

Metatungstates, $3H_2O, 24WO_3, 6M_2O + aq.$
 Borotungstates, $B_2O_3, 24WO_3, 5M_2O + aq.$
 Silicotungstates, $Si_2O_5, 24WO_3, 4M_2O + aq.$
 Phosphotungstates, $P_2O_5, 24WO_3, 3M_2O + aq.$

—L. E.

Pyrosulphuryl chloride. W. Prandtl and P. Borinski. Z. anorg. Chem., 1909, 62, 24—33.

THE physical constants and chemical characters of pyrosulphuryl chloride as given by different observers differ so widely as to suggest that the pure substance has not always been obtained. The authors' investigations show that this is the case, and that all who have worked with the substance, except Konowaloff, have really had in their hands a mixture of pyrosulphuryl chloride and sulphuryl hydroxychloride. They find that the best method of preparation is to react with sulphur trioxide on carbon tetrachloride. The least trace of moisture produces some sulphuryl hydroxychloride; and fractional distillation of the product separates it into pure pyrosulphuryl chloride, boiling at $150^\circ C.$, and a mixture, $SO_2(OH)Cl + 2$ or $3S_2O_5Cl_2$, boiling at about $137^\circ C.$ If the latter be treated with cold water, the sulphuryl hydroxychloride is decomposed, and on separating the liquids, and drying and distilling the denser layer, an additional quantity of pyrosulphuryl chloride is obtained. This is a clear, colourless, mobile liquid, very slightly fuming in moist air, of sp. gr. 1.876 at $0^\circ C.$, 1.844 at $18^\circ C.$, and boiling at $150.7^\circ C.$ under a pressure of 730.5 mm. Its vapour density is 7.27 (calculated 7.43). It is very slowly decomposed by water ($S_2O_5Cl_2 + 3H_2O = 2H_2SO_4 + 2HCl$), whilst sulphuryl hydroxychloride is decomposed rapidly and violently; and it gives, unlike sulphuryl hydroxychloride, no coloration with selenium or tellurium.—J. T. D.

Silicon, amorphous; Action of hydrochloric acid gas on —. A. Bosson and L. Fournier. Compt. rend., 1909, 148, 555—557.

THOUGH graphite or crystalline silicon, heated in a stream of hydrochloric acid, yields only silicon tetrachloride and

silicon chloroform, amorphous silicon, when similarly treated, is acted on at a lower temperature, and yields the compounds, SiH_2Cl_2 and SiH_3Cl . These are colourless liquids, boiling at 12°C . and -10°C . respectively; very mobile, having high coefficients of thermal expansion, readily decomposed by water or alkalis with evolution of hydrogen, and forming explosive mixtures with air. They are very difficult to condense from the excess of hydrochloric acid gas and the hydrogen which accompany them at their formation.—J. T. D.

PATENTS.

Nitrous vapours: Process for the absorption of —. Norsk Hydro-Elektrisk Kvaelfstofkieselskab, Ger. Pat. 206,949, Nov. 20, 1907.

NITROUS fumes, such as are obtained, for instance, by the electrical oxidation of atmospheric nitrogen, are absorbed by means of a metallic cyanamide, preferably calcium cyanamide, a mixture of ammonium nitrate and a metallic nitrate (calcium nitrate), valuable as a fertiliser, being produced. It is stated that the nitrous fumes are absorbed readily and completely by calcium cyanamide.—A. S.

Nitrogen oxides: Apparatus for moving and conveying hot —. W. Ostwald, Ger. Pat. 207,154, Nov. 13, 1906.

NICKEL-STEEL is not attacked by hot gaseous nitrogen oxides, and elaim is made for the use of this alloy for all parts of apparatus which come in contact with such hot gases. Care must be taken to prevent any condensation of the nitrous gases.—A. S.

Nitric acid from calcium nitrate: Process for the preparation of —. Chem. Werke vorm. Dr. H. Byk, Ger. Pat. 208,134, Oct. 6, 1907.

CALCIUM nitrate or a solution of calcium nitrate in concentrated nitric acid is treated with the requisite quantity of concentrated sulphuric acid, and the nitric acid formed is separated from the calcium sulphate by filtering and pressing, or by means of a centrifugal machine.—A. S.

Separation of gases of different densities, more particularly intended for increasing the proportion of oxygen in atmospheric air. A. Tavernier, Puteaux, France, Eng. Pat. 2029, Jan. 29, 1908.

THE air is compressed and cooled by being passed through a coil or other cooling device and then passed through an ozonising apparatus to increase the difference in density between the oxygen and the nitrogen. From the ozoniser the air, still under pressure, enters a turbine driven by an electric motor where the gases of different densities are separated by centrifugal force. The denser gas escapes from the periphery and the lighter gas from the axis of the turbine into two separate vessels from which the separated gases can only escape when the pressure is sufficient to open the spring-controlled outlet valves.—W. H. C.

Hydrogen: Composition of matter for generating —. G. F. Brindley, Niagara Falls, Canada, Assignor to The Roessler and Hasslacher Chem. Co., New York, U.S. Pat. 909,536, Jan. 12, 1909.

AN alkali or alkaline-earth metal, for example sodium, in a finely-divided state, is mixed with a crude hydrocarbon oil or similar substance which will temporarily prevent oxidation of the metal, and with an inert substance such as infusorial earth, and the mixture is compressed into tablets or briquettes, which when brought into contact with water, will generate hydrogen. In order to increase the yield of hydrogen, a metal (aluminium, silicon) which forms a hydroxide, the hydrogen of which can be replaced by an alkali or alkaline-earth metal, is also incorporated in the mixture.—A. S.

Silicon carbide: Manufacture of —. F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y., U.S. Pat. 913,324, Feb. 23, 1909.

THE claim is for dense, compact silicon carbide, prepared

by heating a mass of porous carbide in proximity to "commingled vapours of substances containing carbon and silicon" to a temperature sufficient to cause the carbon and silicon to combine throughout the pores of the silicon carbide mass.—O. R.

Calcium oxalate: Manufacture of —. W. A. Dyes, Manchester, From A. Hempel, Leipzig-Plagwitz, Germany, Eng. Pat. 3302, Feb. 21, 1908.

AN alkali formate is heated with slaked lime or a calcium salt, either at ordinary pressure at a temperature of about 360° to 420°C . or under pressure at the same range of temperatures (with consequent acceleration of the reaction), or under diminished pressure at 240° to 300°C . Calcium oxalate and caustic alkali are formed and the latter is removed by boiling with water, preferably under pressure.—O. R.

Oxalic acid: Manufacture of —. W. A. Dyes, Manchester, From A. Hempel, Leipzig-Plagwitz, Germany, Eng. Pat. 3304, Feb. 21, 1908.

ACIDS or acid salts of strong acids are added in small portions to oxalates of alkali or alkaline-earth metals, heated to about 100°C . under diminished pressure, and oxalic acid is sublimed into a receiver.—O. R.

Hydrofluosilicic acid: Manufacture of — [and treatment of molasses]. L. Rivière, Paris, Eng. Pat. 4515, Feb. 28, 1908. Under Int. Conv., Feb. 28, 1907.

SEE Fr. Pat. 385,139 of 1907; this J., 1908, 584.—T. F. B.

Nitric oxides and nitric acid: Process of producing —. O. Dieffenbach and W. Moldenhauer, Darmstadt, Germany, U.S. Pat. 914,813, March 9, 1909.

SEE Fr. Pat. 389,500 of 1908; this J., 1908, 981.—T. F. B.

Hydrate of potassium and hydrate of soda from recent eruptive stones: Process for manufacturing — by boiling with quick-lime and water, without or with over-pressure. F. Schäcke, Köln, Germany, Eng. Pat. 4750, March 2, 1908.

SEE Ger. Pat. 198,481 of 1905; this J., 1908, 808.—T. F. B.

Aluminium compounds: Process of manufacturing —. E. L. Rinman, Gottenborg, Sweden, U.S. Pat. 914,187, March 2, 1909.

SEE Fr. Pat. 367,756 of 1906; this J., 1906, 1147.—T. F. B.

Alumino-silicate or artificial zeolite. R. Gans, Pankow, Assignor to J. D. Riedel A.-G., Berlin, U.S. Pat. 914,405, March 9, 1909.

SEE Eng. Pat. 8232 of 1907; this J., 1907, 1091.—T. F. B.

Sodium sulphide: Process of making infusible —. W. Hasenbach, Mannheim, Germany, U.S. Pat. 914,271, March 2, 1909.

SEE Addition of Feb. 11, 1908, to Fr. Pat. 383,136 of 1907; this J., 1908, 856.—T. F. B.

Red oxide of iron and zinc sulphate: Process of preparing —. G. Evans, London, U.S. Pat. 914,649, March 9, 1909.

SEE Eng. Pat. 11,338 of 1907; this J., 1908, 684.—T. F. B.

Chlorine: Process for the separation and concentration of —. Th. Goldschmidt, Essen on Ruhr, Germany, Eng. Pat. 12,743, June 13, 1908. Under Int. Conv., Aug. 5, 1907.

SEE Ger. Pat. 206,104 of 1907; this J., 1909, 243.—T. F. B.

Air mixture of a high ratio of oxygen: Process and apparatus for producing — from the atmosphere. O. H. U. Brünler, Brussels, Eng. Pat. 15,554, July 22, 1908.

SEE Fr. Pat. 391,213 of 1908; this J., 1908, 1112.—T. F. B.

Nitrogen from air: Process of obtaining —. O. P. Hurford, Chicago, U.S. Pat. 914,279, March 2, 1909.

SEE Fr. Pat. 394,557 of 1908; this J., 1909, 243.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Impregnated timber used for mines; Properties (especially strength) of —. D. Stens. Gluckauf, 1909, 45, 317—323.

THE author has compared the strengths of a number of samples of mine timber, impregnated by various processes, with that of non-impregnated timber. The results are not regarded as final, but the general conclusion is drawn that impregnation, excepting with tar oils, reduces the strength of timber, especially where a high temperature is used in the process of impregnating. Tar oils however make the wood very inflammable, volumes of dense black smoke being evolved during burning; whereas impregnation by solutions of salts, as a rule, has the effect of making the wood difficult to burn.—F. SONS.

Calcium aluminate; Effect of — on mortars (and natural cements). H. S. Spackman. J. Franklin Inst., 1909, 167, 186—204.

CALCIUM ALUMINATE was found to have a decided accelerating effect on the setting time and to increase the ultimate strength of lime mortars and natural cements. Clay and shale, which were devoid of binding properties when used by themselves, developed cementitious and hydraulic properties when mixed with calcium aluminate. Practically any desired setting time could be obtained by proportioning the amounts of calcium aluminate, used as accelerator, and of calcium sulphate, used as retarding agent. The strength of mortars made with such mixtures could be increased above the strength of Portland cement at the earlier periods of setting, by using a sufficient quantity of the accelerator. The addition of small proportions of calcium aluminate to hydrated lime alone, gave valuable wall-plaster compositions having quick hardening and increased spreading properties. Larger proportions of aluminate gave strongly hydraulic compositions of great strength. The author publishes the results of a large number of tests made with mortars containing calcium aluminate, of which the most striking is a comparison of the tensile strengths of two series of natural cement mortars at various periods. The one series, (a), had as basis, natural cement containing 10 per cent. of added aluminate, and the other, (b), untreated cement. The tensile strengths in lb. per sq. in. after 24 hours, 7 days, 28 days, and 3 months respectively were: for (a), 155, 229, 329, and 437; and for (b), 43, 88, 173, and 237 respectively. The author concludes that judicious mixtures of natural cement clinker, with calcium aluminate and calcium sulphate may yield slow-setting and quick-hardening cements, which, by reason of their low cost and ease of manufacture may compete seriously with Portland cement.—O. R.

Cement; Recrystallisation and formation of colloids during the setting of —. H. Ambrom. Tonind.-Zeit., 1909, 33, 270—272.

THE behaviour of cement during setting was studied under the microscope. The cement was placed as a very thin layer on slides, which were moistened, covered as usual, and kept under bell-jars containing water to prevent drying of the cement. During the first few days, the individual particles of the cement were seen to become surrounded by a large number of exceedingly fine needles and hexagonal plates, the latter being easily mistaken for the former owing to their more or less oblique position. A good light is required to see the needles. Both needles and plates show negative double refraction. After a few days a third kind of crystal was developed, also consisting of hexagonal plates showing double negative refraction, but with a diameter of up to about 0.5 mm. These plates may enclose whole groups of cement particles. If the slides were not protected from air, a fourth kind of "biscuit-shaped" crystals, consisting of calcium carbonate, was also formed. These crystals eventually changed into rhomboids of calc spar. Finally, after some time, the fine needles and plates, as well as unchanged particles of cement, became covered with a transparent, colloidal

envelope, which at first appeared in the form of minute drops, and later coalesced until it completely surrounded the crystals and particles.—A. G. L.

Cement mortar; Efflorescence on —. H. Urbach. Tonind.-Zeit., 1909, 33, 306.

WITH many Portland cements, after hardening, an unsightly efflorescence of calcium carbonate appears on the surface. The author has tried the addition of trass for the purpose of removing the objectionable white calcium salts. A cement was taken which gave a great deal of efflorescence, and pats were made with 1 part by volume of the cement to 2.5 parts by volume of building sand. Pats were also made with 1 volume of cement, 0.5 volume of trass, and 2 volumes of building sand. After setting, the pats were laid in a room, the atmosphere of which was nearly saturated with moisture, and once a day the whole surfaces of the pats were moistened with water from a small syringe, but little pools of water were not allowed to form in any depressions, these conducting very much to the deposition of salts. On the fifth day a slight trace of salt appeared on the pats without any addition of trass, and increased from day to day, although the pats were washed with water every second day. This was discontinued on the twentieth day, and then a uniform milde-w-like skin formed. The pats to which trass had been added showed a slight layer on the twelfth day, which, after careful washing, did not recur, and after 90 days no change was observed, except a general change in colour. Pats to which 0.2 and 1.0 part by volume of trass had been added gave similar results, but some pats to which trass of a different origin was added did not give quite such satisfactory results. It may be that in these latter experiments the alkalis played an important part as conditioning agents, but were modified in their action by the silicic acid, or that the trass used was not suitable for the purpose on account of its composition.—W. C. H.

PATENTS.

Kilns for burning bricks, pipes, pottery, and the like; Regenerative gas fired —. D. Hadlington and E. Webster, West Bromwich. Eng. Pat. 3255, Feb. 13, 1908.

A SERIES of small gas producers and regenerators are arranged alternately side by side along each side wall of the kiln. Primary air flues admit air to the gas producers, and secondary air flues admit secondary air to the regenerators. The secondary air flues have dampers so arranged that the secondary air passes through one half of the regenerators alternately, into a common hot air passage serving for all the regenerators. Uptakes lead the hot secondary air from the common hot air passage to the outlets from the gas producers into the kiln. Instead of a series of small producers, the gas may be generated in a single external producer, and led from it by means of flues into a series of gas chambers.—O. R.

Lime kilns. J. Ward and The Barnstone Blue Lias Co., Ltd., Barnstone. Eng. Pat. 3740, Feb. 19, 1908.

A CONTINUOUS, vertical, shaft kiln, consists of two main divisions, the upper part containing the raw material, and the lower part the burning and burnt limestone. The two portions are separated by two obstructing arches, disposed at right angles to one another, and intersecting at the top, so as to form a skeleton dome. The fuel is delivered into the kiln immediately below the obstructing arches by way of a series of inclined shoots, which pass through the walls of the kiln and of the arches themselves, thus allowing the fuel to be fed symmetrically and at various points of the burning zone, both in the centre and also nearer to the walls of the kiln. Air is drawn through two wickets at the base of the kiln, and is pre-heated in its upward passage by the descending burnt material. The main body of the kiln is composed of an outer wall of concrete and an inner brick lining, the space between the two being utilised to form subsidiary flues, which supply air to and effect the thorough combustion of the smoke.—O. R.

Kilns for burning brick and the like; Construction and building of continuous — W. Laverty, Belfast. Eng. Pat. 4579, Feb. 29, 1908.

AN oblong brick kiln of the continuous type, divided into chambers, is provided with main vapour flues in its outer walls to draw off hot vapours from the chambers, and also with a central main hot air flue. The vapour flues and the hot air flue are connected at one or both ends of the kiln, and the joint flue opens into the chimney stack at a level above the entry of the smoke flue. The different flues are provided with the usual transverse connections for each chamber, and with dampers.

—A. G. L.

Cement; Process for making — E. J. Winslow, Chicago, Ill. U.S. Pat. 913,794, Mar. 2, 1909.

A "RELATIVELY water-proof cement" is obtained by grinding together a dry powdered cement and about 2 per cent. of an anhydrous water-proofing compound containing an inorganic alkaline substance, e.g., a mixture of lime and an oleaginous substance.—A. G. L.

Wood; Process for the impregnation and preservation of — J. Chateau and J. Merklen, Paris. Eng. Pat. 4929, March 4, 1908.

SEE Fr. Pat. 386,441 of 1908; this J., 1908, 686.—T. F. B.

X.—METALS AND METALLURGY.

Magnetite; Determination of ferrous iron in — R. B. Gage. J. Amer. Chem. Soc., 1909, 31, 381—385.

HALF a gram of ore is weighed into a 50 c.c. platinum crucible which is fitted, as closely as possible, into an opening in an asbestos board. The ore is thoroughly moistened with water and a couple of coils of platinum wire added to prevent bumping. A cold mixture of 10 c.c. of hydrofluoric acid and 15 c.c. of dilute sulphuric acid (1:3) is added and the crucible quickly covered with a tightly fitting lid. A 6 in. funnel, coated inside with paraffin wax and connected to a carbon dioxide generator is placed over the crucible and its junction with the asbestos board made air-tight by pouring a little water round it. In a few minutes, the air is completely expelled by the carbon dioxide and decomposition started by heating the contents to boiling and maintaining at gentle ebullition. When decomposed, i.e., after a little more than 5 min., the crucible is allowed to cool and when the steam inside has condensed, the crucible, with the lid held tightly on, is placed in a beaker containing 400—500 c.c. of cool boiled distilled water. The contents of the crucible are quickly mixed with the water, a solution containing sufficient calcium phosphate to precipitate the excess of hydrofluoric acid added and the solution titrated, as rapidly as possible, with a standard solution of potassium permanganate, the first permanent coloration being taken as the end point. Control determinations should also be made. Duplicate assays should agree within 0.1 c.c. of permanganate. The strength of the permanganate solution is such that 1 c.c. is equivalent to 0.0025 grm. of iron. The calcium phosphate solution for 0.5 grm. of ore is made by suspending 5 grms. of calcium carbonate in 50 c.c. of distilled water and slowly stirring in 10 c.c. of 85 per cent. orthophosphoric acid. The excess of sulphuric acid remaining after decomposing the ore is sufficient for titrating but should not be enough to prevent the precipitation of the calcium fluoride.—F. R.

Chrome-iron ore; Smelting of — in a blast-furnace with air enriched in oxygen. P. Monnartz. Metallurgie, 1909, 6, 160—167.

SMALL working scale experiments were made to smelt a chrome-iron ore in a model blast-furnace. The ore used contained 55.60 per cent. of chromic oxide and 15.21 of iron oxide. It was mixed with sand, marble, coke, and tar, and formed into briquettes, which were carbonised. The fluxes were calculated so as to give a ratio of silica to bases in the slag of about 0.7. The furnace used was first heated to a red heat, and the briquettes and coke then fed in. A blast was used containing 35 per

cent. of oxygen at a plus pressure of 115 mm. In the most favorable experiment, 12 kilos. of briquettes were smelted in 35 minutes, giving 3 kilos. of a metal containing 60.5 per cent. of chromium, 31.5 of iron, 6.2 of carbon, 1.0 of silicon, and 0.82 of manganese; together with about 12 kilos. of slag containing 9.4 per cent. of chromic oxide. The slag was sufficiently liquid to separate readily from the metal.—A. G. L.

[Gold] Cyaniding of sand; Use of the vacuum pump in the — W. A. Caldecott. J. Chem. Met. and Min. Soc., S. Africa, 1909, 9, 240—241.

THE vacuum pump was used in the early days of the cyanide process, but did not prove satisfactory, owing to its having been mainly employed with slimy charges in which the high resistance to percolation caused the solution to flow in paths of least resistance. At the Simmer Deep-Jupiter plant, vacuum pumps have been installed and found to be entirely satisfactory with the modern charges of sands free from slimes. The solutions are first allowed to drain by gravitation, the vacuum pumps being used to accelerate the flow of the last, slowly draining portion of the liquid, and to reduce the amount of solution retained by the sands. Suction is further continued in order to draw air into the charge, and thereby increase the solvent action of the cyanide. In addition to effecting a considerable saving of time, the more complete draining of the charge, at each stage, reduces the amount of wash solutions necessary, and enables a more thorough removal of the dissolved gold to be effected.—F. R.

[Gold] Precipitation from cyanide solutions by zinc shavings and dust; A comparison of results and costs. A. J. Clark. J. Chem. and Min. Soc., S. Africa, 1909, 9, 222—224.

COMPARISONS between the results obtained by the various methods employed for the precipitation of gold and silver from cyanide solutions, frequently lose much of their value owing to the fact that such comparative tests, on a working scale, are seldom made in the same plant. At the Homestake Mine, the practice has been to precipitate the solutions of greater strength and value by means of zinc dust, and the weaker solutions by shavings in the ordinary zinc boxes. These weaker solutions are now being precipitated with zinc dust, and the author gives data comparing the two methods over periods of 12 and 9 months respectively. It was found that the precious metals in solutions containing less than 0.03 per cent. of potassium cyanide, were not completely precipitated by zinc shavings and it was therefore necessary to increase the strength of such solutions before passing them through the zinc boxes, but when using zinc dust for precipitation, solutions containing as little as 0.015 per cent. of cyanide can be successfully treated. The following are the monthly averages and costs:—

	Zinc shavings.	Zinc dust.
Cost of precipitant	\$129.56	\$51.15
Precipitant used per ton of solution, lb.	0.1724	0.1284
Per cent. of precious metals precipitated	91.7	94.4
Value of precipitate, per lb.	\$2.35	\$4.03
Cost per dollar recovered	0.1608	0.0449

—F. R.

Gold bullion; Determination of silver in — E. H. Taylor. Eng. and Min. J., 1909, 87, 543.

THE method used at the Great Boulder Perseverance Mine, W. Australia, is to fuse, in a porcelain crucible, 0.5 grm. of bullion with 1.5 grms. of metallic cadmium, using sufficient potassium cyanide to completely cover the metals during the fusion. The fusion should be complete in about 5 minutes, and after cooling, the cyanide is dissolved out with water and the button of alloy placed in a flask with 20 c.c. of water. The water is boiled and four successive additions of 10 c.c. of nitric acid are made, and the boiling continued for an hour. The solution is

diluted to 150 c.c., 10 c.c. of iron alum indicator added, and the silver titrated with a standard solution of ammonium thiocyanate, containing 1.6 grms. of the pure salt to the litre. The thiocyanate solution is standardised against pure silver, each c.c. being equivalent to about 4.483 parts of silver per 1000. A "check" is run at the same time, a preliminary fire assay being made to ascertain the approximate composition of the bullion.—F. R.

Gold; Determination of — in copper bullion. F. F. Hunt. Eng. and Min. J., 1909, 87, 465.

When dissolving copper bullion in concentrated sulphuric acid, enough cuprous sulphide is formed to interfere with cupellation, unless preceded by more than one scorification. Most of the sulphide is formed at the beginning of the action, but if acid containing copper sulphate is used to dissolve the bullion, very little sulphide is formed. *Assay*.—Heat a mixture of 80 c.c. of concentrated sulphuric acid and 25 c.c. of a 16 per cent. solution of copper sulphate, and when hot enough to commence immediate action, add 1 assay ton of the borings. When action ceases, cool and add while stirring, 400 c.c. of water, just boil and filter. Dry the residue, ignite the paper and scorify together with 35 grms. of lead and 1 grm. of silica, then cupel and part. If silver is also to be determined, the filtrate is oxidised with potassium permanganate and 1 c.c. of a saturated solution of sodium chloride and 10 c.c. of a 10 per cent. solution of lead acetate added and well stirred. After standing over night, the precipitate is collected, and added to the gold residue, the two being scorified together.—F. R.

Lead button in cupellation; Temperature of the —. R. H. Bradford. J. Ind. and Eng. Chem., 1909, 1, 181—184.

The temperature of the lead button and of the interior of the cupel during cupellation was determined by means of a Le Chatelier pyrometer, the couple at the hot junction being protected by a thin coating of fireclay. It was found that before "driving" commenced, the temperature of the molten lead rose to 900° C. or above—approximately the melting point of litharge. Temperature determinations at different stages showed that when once the lead commenced to oxidise rapidly, the temperature of the button rose owing to the heat of oxidation of the lead, this heat being sufficient to keep the litharge melted even when the cupel was drawn forward to a cooler position in the muffle. Cupellation proceeds so long as the heat developed is sufficient to keep the litharge melted, and this can be attained by maintaining the temperature at 650°—750° C. about $\frac{1}{4}$ in. above and near the front of the cupel and working with a gentle draught through the muffle. The formation of "feathers" of litharge is due to the temperature of the air surrounding the cupel falling well below the melting point of litharge.—A. S.

Copper blast-furnaces gases; Power from —. R. Schorr. Eng. and Min. J., 1909, 87, 459—460.

At the Krüg-Hütte in the Mansfeld district, Germany, the waste gases from the copper smelting furnaces, instead of only being used for raising steam and heating the blast as at the other works in the district, are utilised for running gas engines which have a total rated capacity of 4650 h.p. The engines are directly connected to three-phase generators of 50 cycles and 3000 volts, the power being distributed by underground cables. The ore smelted consists of a bituminous copper schist containing from 1.8 to 3.7 per cent. of copper, and a lime-stone containing small quantities of copper, the average value of the charge being 2.8 per cent. of copper and 0.0155 per cent. of silver. About 630 tons of ore are smelted daily, with an approximate consumption of 20 per cent. of coke, the furnaces producing between seven and eight hundred thousand cubic feet of gas per hour. The furnaces are cut off from the mains during charging but the supply of gas is kept fairly constant by only cutting off one furnace at a time. The gases, after being washed to remove dust, sulphur, arsenic, etc., contain 9 to 11 per cent. of carbon dioxide and 19 to 24 per cent. of carbon monoxide, the remainder being nitrogen. They

have a calorific value of about 68 B.T.U. per cu. ft., or about two-thirds that of an average iron blast-furnace gas. On account of the fluctuation in the proportion of carbon monoxide and dioxide a special gas generating plant has been installed to enrich the gas when necessary. The total expenditure in 1907 for operating and fixed charges, amounted to about £6000, equivalent to a third of a penny per kilowatt-hour.—F. R.

Iron in brasses and bronzes; Determination of —. I. M. Bregowsky and L. W. Spring. J. Ind. and Eng. Chem., 1909, 1, 187—188.

It is pointed out that in general the iron content of brasses and bronzes is given as a trace, or rarely as more than 0.2 per cent. The authors cite a number of analyses in which the content of iron in different brasses and bronzes ranged from 0.34 to 1.47 per cent. Unless the iron content is exceptionally high, about one-half of it will be found in the ignited stannic oxide, and may be recovered by fusing the latter with sodium carbonate and sulphur, treating with water, precipitating any dissolved ferrous sulphide by addition of ammonium chloride, and determining the iron in the ferrous sulphide by titration or gravimetrically. The remainder of the iron may be precipitated with ammonia either before or after the separation of the copper.—A. S.

Iron; Action of steam on —. J. A. N. Friend. Chem. Soc. Proc., 1909, 26, 90.

The author has studied the action of steam on iron at temperatures ranging from 100° to a red heat. It is found that pure steam free from carbon dioxide, has no action on pure iron until those temperatures are reached at which the steam begins to dissociate, when a black oxide (presumably Fe_3O_4) is produced. The conclusion is drawn that the usual statement that steam is decomposed by red-hot iron is not true. The reaction really takes place in two stages, involving (i.) the dissociation of the steam, and (ii.) combination of the iron with the dissociated oxygen.

Manganese ore discovery in Cape Colony. Bd. of Tr. J., Mar. 25, 1909. [T.R.]

The "Cape Times" of 27th February reports a discovery of manganese ore in the Devil's Peak (Table Mountain). The deposits, which are believed to be rich, cover an extent of about 1000 acres, stretching from the first peak of the Devil's Peak on the Cape Town side, right through to the side above Groot Schuur. The quality of the manganese is stated to be very good, but until the deposit is developed it is difficult to compute what quantity of ore it may contain, though it is apparent that the reef is many feet in thickness. The prospectors have already dug out about 120 tons of first-class ore.

Carbon monoxide; Action of — on chromium, nickel, manganese, and their oxides and alloys. G. Charpy. Compt. rend., 1909, 148, 560—561.

CARBON monoxide at 1000° C. is practically without action on nickel. It reduces nickel oxide at that temperature completely to metal. Manganese and rich ferromanganeses absorb the gas at 1000° C. and later evolve part of it again; no carbon dioxide is formed, but a mixture of manganous oxide and carbon is left in the boat. Trimanganic tetroxide is reduced by carbon monoxide at 1000° C. to monoxide, which is absolutely stable in the circumstances of the experiment. Chromium similarly furnishes a mixture of chromium sesquioxide and carbon; carbon monoxide is without action on the sesquioxide. In chrome-steels similarly treated, the carburisation of the iron (this J., 1903, 911) and the oxidation of the chromium go on together as though the metals were separate and independent.—J. T. D.

Common metals; Gases occluded in —. B. Delachanal. Compt. rend., 1909, 148, 561—563.

The author describes experiments made many years ago by Dumas and himself, but hitherto unpublished. The metals were heated to redness in a porcelain retort in *vacuo*, and the evolved gases collected. Blank experiments

showed that there was no diffusion of the furnace gases through the substance of the retort.

The following results were obtained :—

Metal.	Weight.	Gas obtained.				
		Hydrogen.	Methane.	Carbon monoxide.	Carbon dioxide.	Nitrogen.
	grms.	c.c.	c.c.	c.c.	c.c.	c.c.
Aluminium	200	88	—	—	—	—
Magnesium	20	12.0	—	4.1	—	—
"	40	35.06	—	2.44	—	—
Zinc	100	18.15	—	1.65	0.50	—
Tin	1000	3.25	2.80	2.05	1.94	1.56
Platinum	144	0.47	2.67	4.05	0.70	1.31
Iridioplatinum ..	146	3.65	0.87	3.60	0.60	1.08
	150	2.64	0.31	3.19	0.51	0.55

The gases from spongy platinum consisted almost entirely of carbon dioxide and uncombustible gas.—J. T. D.

Aluminium; Influence of impurities on the thermo-electric properties and electrical resistance of —. H. Pécheux. Compt. rend., 1909, **148**, 627—628. (See also this J., 1907, 1147).

THE impurities found in commercial aluminium are iron, silicon, and carbon. The author has found that the thermo-electric E.M.F. of aluminium-copper couples prepared with samples of aluminium containing various small quantities of these impurities, are nearly the same, but that they are increased by the presence of iron. Silicon appears to have an effect similar to that of iron. Both impurities increase the electrical resistance of aluminium. Recently fused aluminium was used by the author in his experiments. He points out that the purity of this metal may be ascertained with certainty from its thermo-electric properties and resistance.—L. E.

Metals; Application of the microscope to the study of —. W. Rosenhain. J. Roy. Soc. Arts, 1909, **57**, 349—356.

Quartz combustion tubes for the determination of carbon in steel. Blount and Levy. See XXIII.

Nickel crucible for determination of carbon in steel. Ruppel. See XXIII.

Determination of uranium. McCoy and Bunzel. See XXIII.

PATENTS.

Drying [air] blast for metallurgical furnaces. F. W. Harbord, London. Eng. Pat. 4424, Feb. 27, 1908. (Compare Eng. Pats. 25,112 of 1906, and 10,525 of 1907; this J., 1907, 1282; 1908, 287).

THE air-blast is dried by leading it through a chamber containing bricks or lumps of dried peat impregnated with calcium chloride and ferric chloride. The peat is prepared by saturating it with a strong solution of calcium chloride, preferably mixed with 5 to 10 per cent. of a solution of ferric chloride of equal strength, and then drying the saturated peat. Three chambers containing the prepared peat are used in connection with each blowing plant. The air-blast is dried in one of the chambers, and is then led through a second chamber in order to cool the drying material which has just been dehydrated, while the contents of the third chamber are being dehydrated by passing air at about 210° C. through, and circulating hot gases round the outside of the casing. Each chamber in turn serves to dry the blast.—A. T. L.

Steel; Process and apparatus for the manufacture of —. Dellwik-Fleischer Wassergas Ges.m.b.H. Fr. Pat. 395,131, Oct. 10, 1908.

IRON ore is charged into the upper of two chambers, from which it falls, from time to time, through a trap, into the

lower chamber. This lower chamber is surrounded by an annular space, communicating with both chambers, and provided with passages through which air is blown in. Water-gas is forced into the lower chamber near the top, reduces the iron ore to spongy metallic iron, and emerges at the bottom of the chamber into the annular space, where the excess of combustible gases is burnt, the products passing upwards through the ore in the upper chamber, thus preheating it. It is essential that the ore in the lower chamber should be at a temperature of about 700° C. before the water-gas is introduced, as otherwise, below this temperature, decomposition of carbon monoxide into carbon and carbon dioxide would take place, and the resulting iron would be too rich in carbon for steel-making. At the end of the reduction, the temperature of the lower chamber is raised to 900°—1000° C. for a short time. The resulting spongy iron, which is no longer pyrophoric, is charged into baths of molten steel or iron, which engulf it at once and prevent oxidation of the finely-divided metal.—A. G. L.

Silver, plate, and the like; Electro-chemical process for cleaning —. A. M. Kohler, London. Eng. Pat. 15,962, July 27, 1908.

THE article to be cleaned is immersed in an aqueous solution of one or more alkalis (e.g., sodium hydroxide), in contact with an aluminium alloy, e.g., an alloy consisting of 80 per cent. of aluminium, 10 of barium, 8 of calcium, 1 of sodium, and 1 of silicon and other impurities. The alloy dissolves in the alkaline solution with evolution of hydrogen at the surface of the silver or plated article, which then only requires rubbing to render the surface bright.—A. G. L.

Iron from tin-plate scrap; Process of preparing merchantable —. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 906,321, Dec. 8, 1908.

THE tin-plate scrap is placed in a perforated vessel, which is immersed in a boiling solution of caustic alkali to remove fat, etc. The scrap is next washed by immersing the vessel in a tank of water, and is then freed from solder by passing it through a highly-heated furnace chamber. The scrap next passes between mangling rolls, preferably moving in opposite directions at different speeds, and provided with teeth. The shredded scrap is then compressed, a little at a time, into a number of billets, which, from their construction, possess a laminated structure. These billets are evenly placed along the walls of a number of (e.g., five) perforated vessels, which are then placed, one above the other, on a frame-work carried by a central shaft revolving on a ball-bearing in a chamber provided with valved entry pipes for hot air and chlorine, and valved exit pipes leading to two condensers. The billets are heated in this chamber whilst under centrifugal strain, by passing hot air through the chamber and revolving the shaft; this treatment opens up the billets along their lines of lamination; the billets may also be heated and cooled alternately. Chlorine is next admitted to the chamber, the stannic chloride vapours being condensed alternately in the two condensers. The last traces of stannic chloride are removed by heating the billets strongly in hot air, after which they are washed in a solution of caustic alkali to prevent rusting of the iron. If necessary, the porous black iron-scrap so obtained is consolidated by hammering or pressing before smelting.—A. G. L.

De-tinning; Process of —. H. M. Fernberger, Dollar Bay, Mich., and W. W. Murray, Philadelphia, Pa. U.S. Pat. 913,275, Feb. 23, 1909.

TINNED metal is treated with a solution of chlorine in anhydrous carbon tetrachloride. The carbon tetrachloride removes grease, etc., and dissolves the stannic chloride which is formed. The solution is separated from the residue, and the stannic chloride is precipitated by adding water.—A. T. L.

Metallurgical process. G. Moore, New York. U.S. Pat. 913,535, Feb. 23, 1909.

IN order to separate metals from their ores, the ores are heated with a salt which reacts to form a volatile com-

pound of the metal, and this volatile compound is separated by forcing steam through the heated mass and finally condensing the steam.—A. T. L.

Metals; Process of separating — in solution. H. H. Dow, Midland, Mich., and W. S. Gates, Worthington, Canada, Assignors to The Ontario Nickel Co., Ltd., Worthington, Canada. U.S. Pats. 913,708 and 913,709, March 2, 1909.

To a solution containing a number of dissolved metals, a reagent is added capable of producing more or less insoluble compounds with these metals, the compound of one of the metals being slightly less soluble than those of the others. The reagent is added in quantity equivalent to the amount of this metal present, and the resulting precipitate is agitated with the liquid until the more soluble compounds first precipitated have been redissolved, when the precipitate is separated from the liquid, and the operation repeated so as to separate the remaining metals. Or else, the quantity of reagent first added is less than that corresponding to the least soluble metal; the precipitate and liquid are agitated as above, and the precipitate is separated; after which a further quantity of the reagent, equivalent to, or somewhat in excess of, that needed to precipitate the remainder of this metal, is added, the second precipitate removed, and the operation repeated as before.—A. G. L.

Precious metals from ores; Process of extracting —. J. Kitzee, Philadelphia, Pa. U.S. Pat. 913,735, Mar. 2, 1909.

Precious metals are extracted from their ores by means of cyanide in the presence of the anolyte resulting from the electrolysis of a nitrogen compound, this anolyte containing an oxide of nitrogen.—A. G. L.

Gold and silver from slimes; Extraction of —. A. F. Crosse, Fr. Pat. 395,230, Oct. 14, 1908. Under Int. Conv., Mar. 2, 1908.

The slimes are treated with an extracting (cyanide) solution, thorough extraction being ensured by blowing air into the mass, which is contained in a conical separator. This separator is provided in its upper part with an internal conical partition, leaving an annular space inside the walls of the separator, from which clear liquid only overflows into a pipe leading to a vessel in which the solution is freed from the gold and silver it contains by means of zinc. The solution then flows into an intermediate vessel, from which it is returned by means of a pump to the separator, extraction with the same liquid being continued until the slimes are exhausted. The liquid may be brought up to proper strength by the addition of cyanide at any time.—A. G. L.

Antimony ores; Process and apparatus for the treatment of —. E. Chatillon. First Addition, dated Oct. 2, 1908, to Fr. Pat. 382,504, Oct. 3, 1907 (this J., 1908, 287).

The capacity of the furnace previously described is increased by inserting in each chamber 4 or 5 pipes or, preferably, vertical gas retorts of fireclay or cast-iron. The lower ends of these pipes or retorts are partly open and partly closed, and are supported on the inner walls of the chambers; the upper ends pass through the roof of the furnace into the open, and are provided with removable covers. The pipes or retorts are charged with a mixture of antimony oxide and carbon; the reduced antimony melts and falls into the main bath of the chamber. Removal of cinders from the chambers is facilitated by continuously moving the grills, which may form endless bands. Condensation of antimonial vapours in the escaping gases is now effected by forcing the gases to pass upwards through a number of vertical compartments placed in a tower, water being allowed to drop down through the compartments, each of which is further provided with a number of horizontal partitions, the spaces between these partitions being half filled with bundles of wood, etc.—A. G. L.

Minerals of all kinds; Treatment of — to obtain the metal they contain. B. Junquera, Fr. Pat. 394,719, Sept. 26, 1908. Under Int. Conv., Feb. 8, 1908.

The mineral is mixed with carbon and fluxes, powdered, and, if necessary, formed into nodules, and introduced into the upper end of a rotatory kiln, 20–30 m. long, and inclined at 3°–5°. Coal dust and air are injected into the lower end of the kiln, which is surrounded by a fixed crucible-shaped chamber. In its passage down the kiln, the mineral is first reduced to metal, which is fused in the lower part of the kiln, and collects in the fixed chamber. For those metals (e.g., iron) which are so difficultly fusible that the quantity of hot reducing gases produced is far in excess of that required for the reduction of the ore, the kiln is divided into three parts, an upper rotating kiln in which reduction takes place, a lower rotating kiln in which the reduced metal is fused, and an intermediate fixed chamber connecting the two rotating kilns, and provided with a flue regulated by a damper through which the excess gases are allowed to escape.—A. G. L.

Agglomeration of small finely divided ores; Process for the —. A. P. Foniakoff, St. Petersburg. Eng. Pat. 4142, Feb. 24, 1908.

SEE Fr. Pat. 387,427 of 1908; this J., 1908, 815.—T. F. B.

Iron ore; Method of treating —. A. J. Boulton, London. From J. T. Jones, Iron Mountain, Mich., U.S.A. Eng. Pat. 12,322, June 6, 1908.

SEE U.S. Pats. 891,705 and 899,405 of 1908; this J., 1908, 815, 1024.—T. F. B.

Crucible furnaces. W. J. Holzapfel, Scottdale, Pa., U.S.A. Eng. Pat. 12,342, June 6, 1908.

SEE U.S. Pat. 891,256 of 1908; this J., 1908, 815.—T. F. B.

Metallurgical furnaces. L. S. Hughes, Joplin, Mo., U.S.A. Eng. Pat. 16,521, Aug. 5, 1908.

SEE Fr. Pat. 392,991 of 1908; this J., 1909, 27.—T. F. B.

Zinc and other analogous furnaces; Means for charging the retorts of —. E. Dor-Delattre, Liege, Belgium. U.S. Pat. 914,339, March 2, 1909.

SEE Eng. Pat. 13,822 of 1908; this J., 1909, 206.—T. F. B.

Ores; Method of reducing —. N. Wikström, Högfors, Russia. U.S. Pat. 914,622, March 9, 1909.

SEE Fr. Pat. 387,080 of 1908; this J., 1908, 814.—T. F. B.

Smelting zinc ore, galvaniser's dross, and the like; Apparatus for use in —. E. H. Hopkins, Addlestone. U.S. Pat. 914,839, March 9, 1909.

SEE Eng. Pat. 25,099 of 1907; this J., 1908, 905.—T. F. B.

Gas producers for steel manufacture. Eng. Pat. 12,856, See II.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(1.)—ELECTRO-CHEMISTRY.

Reducing action of electrolytic hydrogen. Thomson. See VII.

Electrolytic bleaching. Fraass. See XIX.

PATENTS.

Ozone; Generation of —. J. S. Goodwin and W. Burgess, London. Eng. Pat. 5502, March 11, 1908.

Air is passed between the plates of a Wimshurst or similar machine from which the collectors have been removed; several pairs of these plates may be arranged in a suitable box with air inlet and a fan.—T. F. B.

Ioniser or apparatus for producing gaseous ions. L. I. Blake, Denver, Colo. U.S. Pat. 913,941, March 2, 1909.

The ioniser consists "of dielectric plates adapted to be charged alternately to opposite potentials." The

plates are separated by air spaces, and the opposing surfaces are covered with a solid dielectric, such as glass wool, in "fragmentary or filar form."—B. N.

Furnace; Electric —, and method of operating. P. L. T. Héroult, La Praz, France, Assignor to Soc. Electro-Metallurgique Française, Froges, France. U.S. Pats. 913,888 and 914,346, March 2, 1908.

(1). THE material is supplied through tubes in an open shaft to a point in the shaft above which the burning gases will heat the charge as it passes through the tubes, without direct contact of the gases with the charge. From the bottom of the shaft, the material passes into a lower chamber, in which the charge is maintained with inclined faces. The electrodes enter the lower chamber at the sides and are fixed opposite to the inclined faces of the charge, means being provided for moving the inclined faces towards or away from the electrodes. (2). The method is claimed of maintaining a charge in a vertical column with inclined faces, to which the current is passed from stationary electrodes, the distance between the charge and the electrodes being varied in order to alter the resistance.—B. N.

Electrolytic process of producing compounds. C. E. Acker, Niagara Falls, N.Y. U.S. Pat. 914,100, March 2, 1909.

A MOLTEN compound of a metal is continuously electrolysed, the separated metal being alloyed with a cathode metal. The alloy is removed and cooled; an intermediate compound is produced and by reacting on this at a higher temperature, with "nitrogenous and carbonaceous reagents," the desired compound is produced, and the residual metal is returned to the cathode. (See following abstract)—B. N.

Nitrogen compounds; Electrolytic process of producing —. C. E. Acker, Niagara Falls, N.Y. U.S. Pat. 914,214, March 2, 1909.

THE molten alloy (see preceding abstract) is treated with a nitrogenous gas by injecting the gas in a compressed condition, thus cooling the alloy and producing the compound required. The products of the reaction are separated, heat being transferred from another portion of the molten alloy to the residual metal, and the latter returned in a heated condition to the cathode.—B. N.

Electrodes; Storage-battery —. T. A. Edison, Llewellyn Park, Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 914,343, March 2, 1909.

GRANULAR material is coated with conducting metallic films or scales, the mass being compressed to obtain coherence, and form a cellular or honeycomb structure. This is then subjected to a welding temperature in hydrogen gas, in order "to secure integrity of the films or scales."—B. N.

Thin metallic flakes [of cobalt and nickel]; Process for making —. T. A. Edison, Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 914,372, Mar. 2, 1909.

GRANULES composed of two or more metals, e.g., cobalt and nickel, each in the form of "a substantially integral sponge-like structure" and intimately engaging each other to form a continuous solid mass (see preceding abstract), are subjected to successive rolling operations, the mass being annealed in an indifferent gas after one or more of the rolling operations.—A. G. L.

Electric battery. L. P. Basset, Enghien, France. U.S. Pat. 913,936, March 2, 1909.

SEE Fr. Pat. 370,170 of 1906; this J., 1907, 209.—T. F. B.

Electric lamp filaments. Eng. Pat. 14,867. See II.

Electrical glow lamps. Eng. Pat. 19,118. See II.

Treating chlorine gas. U.S. Pat. 908,126. See V.

(B.)—ELECTRO-METALLURGY.

Electrolytic iron; Preparation, composition, and thermal properties of —. A. Müller. Metallurgie, 1909, 6, 145—160.

SEVERAL hundred grams of nearly pure electrolytic iron were obtained in a comparatively short time by proceeding in two distinct stages. In the first stage, a good steel or wrought iron is used as anode in an electrolyte consisting of a 30 per cent. solution of ammonium ferrous sulphate, working either according to Burgess and Hambuechen's process (this J., 1904, 667) but at ordinary temperatures, with N.D.₁₀₀=0.8 ampère at 1.5 volts, or according to Maximowitsch (this J., 1905, 140) with N.D.₁₀₀=0.5 ampère at 0.8—1.2 volts. The anodes were contained in porous earthenware cells, and were cleaned every day by brushing with hydrochloric acid; the anolyte was renewed daily; the catholyte was protected from dust by a layer of paraffin, and was not stirred. The cathodes consisted of carefully cleaned tin-plate or lead foil. The electrolytic iron so obtained which contained 0.08—0.10 per cent. of total fixed impurities (of which carbon amounted to about 0.07 per cent.) was then further purified by two further electrolyses, using concentrated ferrous chloride solution as electrolyte, with N.D.₁₀₀=0.7 ampère at 1—4 volts. The precautions taken were similar to those mentioned above, except that the anolyte was used over again, after daily precipitation with barium chloride and removal of sulphate and dirt by filtration in the morning. The electrolytic iron so obtained contained silicon, 0.0040—0.0042 per cent.; phosphorus, 0.0032—0.0041; sulphur, trace; manganese, trace to 0.0045; carbon, 0.0230—0.0440; total, 0.0311—0.0542 per cent. of fixed impurities, in addition to 0.018—0.112 per cent. of hydrogen and 0.014—0.018 per cent. of nitrogen. The current efficiency varied from 66—98 per cent. Microscopic examination under moderate powers showed a lamellated structure; larger magnification showed a star-like structure. The iron was melted in a magnesia crucible placed in a specially constructed electrically heated vacuum furnace. After melting once it still contained 0.011 per cent. of nitrogen, and it required fusing seven times to free it from hydrogen, as shown by the disappearance of the spontaneous evolutions of heat during the heating, which are caused by hydrogen. The most marked of these heat evolutions occurred at 1210° C. The melting-point was found to lie between 1485° and 1525° C. Arrest points were observed at 894° and 766°—759° C. during cooling, and 917° and 765°—774° C. respectively during heating.

—A. G. L.

[Iron and chromium] Passivity in acid solution. Part II. J. Alvares. Z. Elektrochem., 1909, 15, 142—144.

IN continuation of Sackur's work (this J., 1908, 986), the author has investigated the passivity of iron and chromium by the same method. In general the passivity of these two metals resembles that of nickel. In the case of iron, however, the critical strength of current rises, with increased dilution, to a maximum and then falls. Addition of chlorine ions to the acid has no effect on the critical strength of current. The author's experiments confirm the well known observation that a rise in temperature hinders the assumption of the passive state. Chromium resembles nickel in that the critical current strength sinks with increasing dilution of the electrolyte. It is rendered passive more easily than iron, for it becomes passive in moderately concentrated hydrochloric acid in which iron and nickel remain active.—J. C. C.

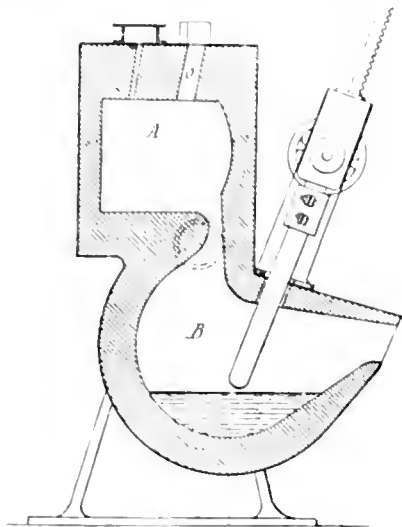
PATENTS.

Electroplating; Apparatus for —. G. A. Lutz, Plainfield, N.J., U.S.A. Eng. Pat. 21,243, Oct. 8, 1908.

THE hollow article to be plated is supported as the cathode in a tank, and suitable anodes are arranged inside and outside of the article. One terminal of a generator is connected to both the inner and outer anodes, and a make and break mechanism, controlled by hand or by clockwork, is arranged in the inner anode circuit. The

latter may thus be broken without interfering with the outer anode circuit, so that the deposition of metal on the outside of the article is carried on for a greater length of time, thus avoiding the thicker inner coating which is obtained when the current passes for the same period through both anode circuits.—B. N.

Furnaces: Electric —, with electrodes, serving for the manufacture of homogeneous iron and steel. T. Levoz. Fr. Pat. 395,084, Oct. 8, 1908.



The furnace is divided into two receptacles, A and B, the former having an acid lining, and the latter a basic one of magnesia or dolomite. It is supported upon two trunnions, one of which is hollow for the supply of air to the compartment, A. The electrodes are withdrawn from the chamber, B, and the vessel is turned through an angle of 90°, so that the blast pipe is at the side of the chamber, A. Molten cast iron is introduced into A through the opening, O, and a charge of scrap iron or mild steel is placed in the chamber, B. The cast iron is blown, as in a Bessemer converter, for the production of pure iron, and the flames passing into B serve to melt the material in this chamber. The furnace is then rotated into its original position, so as to pour the metal from A into B, and the metal is refined by a further electric heating. The electrodes are lowered into B, and the arc is enlarged by means of a solenoid placed as a shunt across the arc, the intensity of the magnetic field being increased or diminished by means of a regulator. A regulator is also arranged in the electrode circuit, in order to prevent an abrupt load being placed on the machine when starting the current, and to automatically cut out the current when the arc is broken.—B. N.

Metal: Electrolytic deposition of — on hollow articles. E. Friedheim, Paris. Eng. Pat. 4744, March 2, 1908. Under Int. Conv., March 4, 1907. Addition to Eng. Pat. 7563 of 1907; dated March 30, 1906.

SEE Addition to Fr. Pat. 364,737 of 1906; this J., 1907, 1018.—T. F. B.

Electroplating the interior and exterior of hollow articles: Process and apparatus for simultaneously —. American Circular Loom Co. Fr. Pat. 395,083, Oct. 8, 1908.

SEE Eng. Pat. 21,243 of 1908; preceding.—T. F. B.

Tin: Process for preparing, smelting, and utilising various products containing —, particularly the metallic sponge and slime obtained in the electrolytic removal of tin from tin-plate scrap. H. Mennicke, Rheinau, Germany. Eng. Pat. 16,428, Aug. 4, 1908.

SEE Fr. Pat. 393,364 of 1908; this J., 1909, 146.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Cotton seed "foots": Composition of —. H. Wagner and J. Clement. Z. Untersuch. Nahr. Genussm., 1909, 17, 266—268.

Two samples of "foots" obtained in the refining with alkali of two cotton-seed oils from Egyptian seed had the following respective composition:—Water, 42.67 and 34.35; mineral matter, 10.52 and 8.34; unsaponified oil, 10.55 and 23.70; saponified oil, 31.56 and 33.18; and unsaponifiable matter, 2.30 and 1.91 per cent. The unsaponifiable matter (crude phytosterol) in the original impure oil was 0.884 per cent., whilst the purified oil contained 0.595 per cent. Hence during the purification a considerable proportion of the crude phytosterol is thrown down with the "foots." The phytosterol from these samples of "foots," purified by the method of Windaus and Hauth (this J., 1907, 69, 1150), melted at 137.5°–138° C., and formed an acetate melting at 126° C. The acetate was saponified with sodium hydroxide solution and the phytosterol recrystallised from alcohol, but no substance of higher m.p. than 138.6° C. could be obtained. Hence in the light of these experiments the phytosterol of cottonseed oil must be regarded as consisting of an individual substance. This conclusion was also arrived at by Heiduschka and Gloth (this J., 1908, 1161), who examined the phytosterol by the method of Windaus and Hauth. On the other hand fractional crystallisation from alcohol of the crude phytosterol, previously purified by means of petroleum spirit, gave a different result. The substance was thus separated into a phytosterol melting at 139° C., and a smaller quantity of a phytosterol melting at 132°–133° C., and yielding an acetate (m.p. 120° C.) and a bromide (m.p. 114°–115° C.). The authors therefore conclude that the phytosterol of cottonseed oil consists of at least two distinct phytosterols. The crude phytosterol was contaminated with a brown oily substance containing 0.556 (and 0.584) per cent. of sulphur.—C. A. M.

Glycerol: New, highly sensitive reactions for detection and identification of —. G. Denigès. Compt. rend., 1909, 148, 570—572.

For the detection of appreciable quantities of glycerol, the following reactions, based upon its conversion into dihydroxyacetone, are described. Glycerol (0.08–0.10 grm., or 1 c.c. of a 10 per cent. solution) is heated with 10 c.c. of freshly prepared bromine water (0.3 c.c. of bromine dissolved in 100 c.c. of distilled water) for 20 minutes in boiling water, boiled to expel all the bromine, and allowed to cool. The solution is then submitted to the following tests:—*Colour reactions.*—The reagents are codeine, resorcinol, thymol, and β -naphthol, the method being the same as that previously described (this J., 1909, 219) save that instead of the solution of dihydroxyacetone there mentioned, 0.4 c.c. of the test solution (with the codeine reaction, 0.2 c.c. + 0.2 c.c. of water) is used; in the resorcinol and thymol reactions the mixture is not heated. The colours obtained are similar to those previously described. *Colour reactions in presence of potassium bromide.*—The reagents are 5 per cent. alcoholic solutions of salicylic acid and guaiacol; the method is the same as that previously described (this J., 1909, 219), save that, as above, 0.4 c.c. of the test solution is used. Salicylic acid gives an intense violet red colour; with guaiacol, the colour is deep blue. *Hydrazine reactions.*—(1) The test solution (0.5 c.c.) is mixed with 0.5 c.c. of a reagent prepared by dissolving 1 c.c. of liquid phenylhydrazine in a mixture of 4 c.c. of acetic acid and 20 c.c. of a 10 per cent. solution of crystallised sodium acetate. The whole is heated for 20 minutes in boiling water and left to cool for an hour. An abundant yellow precipitate of glycerosazone consisting of twisted stellate needles and rounded yellow granules is thus obtained. (2) Five c.c. of the test solution are distilled with 1 c.c. of sulphuric acid, 1.5–2 c.c. of distillate being collected. One c.c. of this distillate is treated with 1 c.c. of the above-described hydrazine reagent, a crystalline precipitate of methylglyoxalosazone being slowly formed.

Reduction reactions.—The test solution (0.5 c.c.) is treated with 0.5 c.c. of Nessler's reagent; after 2 minutes, mercury is precipitated. With Fehling's solution and Fehling's solution treated with ferrocyanide, cuprous oxide and cuprous ferrocyanide respectively are obtained under the same conditions. To detect very small quantities of glycerol, the material must be extracted; a quantity of less than 0.10 grm. of the residue from this extract being treated as above described.—L. E.

Cholesterol and allied bodies; Occurrence and distribution of — in the animal kingdom. C. Dorée. *Bio-Chemical J.*, 1909, 4, 72—106.

ENTIRE animals typical of the great subdivisions of the animal kingdom were examined by the author, the finely divided material being mixed with plaster of Paris and sand, dried, coarsely powdered, and extracted with ether, and the cholesterol, etc., in the ethereal extracts separated by the usual methods. From the results the author concludes that cholesterol is invariably present in vertebrata, whilst in invertebrata it is widely but not uniformly distributed, its place being sometimes taken, e.g., in insects and echinodermata, by closely-allied substances. It is probable that each species of sponge is characterised by containing a different member of the cholesterol group. All the animal cholesterols examined, with the possible exception of *spongosterol* from the sponge *Suberites domuncula*, were isomeric with and possessed properties similar to those of ordinary cholesterol.—C. A. M.

Butter fat and coconut oil. Monhaupt. See XVIII.A.

PATENTS.

Oil from cotton-seed or other oleaginous material; Process for extracting —. J. E. Mills, Chapel Hill, N.C. Assignor to H. B. Battle, Montgomery, Ala. U.S. Pat. 913,751, Mar. 2, 1909.

THE cotton-seed, or other material, is introduced into a vertical column, at about half the height of the latter, while hot carbon tetrachloride is introduced at the top of the column. The oil seed rises through the carbon tetrachloride which extracts the oil, and the exhausted material, after passing through a layer of water above the carbon tetrachloride, is removed by suitable means at the top of the column. The carbon tetrachloride containing the dissolved oil is drawn off at the bottom of the column, and the solvent and oil are separated and recovered by a process of distillation.—W. P. S.

Soap; Process for the manufacture of albumose —. P. Runge, Hamburg, Germany. Eng. Pat. 22,441, Oct. 22, 1908. Under Int. Conv., Sept. 24, 1908.

A CLARIFIED alkaline solution of albumose obtained from casein in the usual way is treated with the exact amount of a fatty acid or mixture of fatty acids required to neutralise the alkali, and the resulting solution of albumose soap is concentrated *in vacuo* or otherwise. Or the albumose may be dissolved in a solution of an alkali, or an alkaline-earth, or it may be a "sulpho-alkaline solution of albumose." The proportions preferred are such as to yield a product containing from 33½ to 50 per cent. of albumose.—C. A. M.

Esparto grass; Recovery of by-products from —. C. F. Cross and D. Russell. Fr. Pat. 395,250, Oct. 14, 1908. Under Int. Conv., Apr. 14, 1908.

THE cuticle of the esparto grass contains a wax of industrial importance; a portion of this cuticular wax is removed mechanically in the process of dusting the grass prior to its conversion into paper pulp, whilst another portion passes into the alkaline boiling-liquor, from which it may be separated during the process of concentration by skimming or straining. The wax may be prepared in a pure condition from either of these sources by digestion with nitric acid or other equivalent oxidising agent, or by extraction with volatile solvents in a continuous extraction apparatus.—J. F. B.

Esparto grass; Treatment of by-products [wax] from —. C. F. Cross, London, and D. Russell, Markinch, N.B. Eng. Pat. 8268, April 14, 1908.

SEE Fr. Pat. 395,250 of 1908; preceding.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

Indigoid dyestuffs; Application of — as oil colours. A. Eibner. *Chem.-Zeit.*, 1909, 33, 229—230, 243—244, 254.

THE author's experiments were made with synthetic Indigo, the symmetrical Thioindigo B and BA and Vat Red, and the unsymmetrical Thioindigo Scarlet R. When used as water colours the Thioindigo colours remained unaffected after exposure for 1 year and 7 months. When mixed with linseed oil and with a white pigment, the symmetrical Thioindigo colours, on the other hand, were completely bleached in some cases in less than 2 days; the rapidity of the bleaching was independent of the white pigment used (white lead, zinc white, lithopone free from zinc oxide, and barium sulphate). Bleaching occurred also in the dark, though less rapidly than in the light. The symmetrical Thioindigo BA mixed with zinc white was also bleached with more or less rapidity when used with various drying and non-drying fatty oils, oil of turpentine, and copaiba oil, whereas under similar conditions synthetic Indigo and the unsymmetrical Thioindigo Scarlet R gave satisfactory results. From the experiments with the fatty oils it would appear that there is some relation between the ease with which the oils become rancid and the rapidity of bleaching of the colour. It is probable that the bleaching is due, at least in part, to aldehydic compounds, formed when the oils become rancid. Experiment showed that formaldehyde solution was capable of bleaching Thioindigo BA. This cannot be the sole cause however, for mixtures of Thioindigo BA, zinc white, and pure vaseline were also completely bleached in 8 days. With dammar and mastic varnishes as vehicles, the symmetrical Thioindigo colours remained unaffected after exposure for 6 months, and the author considers that, especially for dark shades, these dyestuffs could be used in practice with a turpentine oil varnish as vehicle. They can also be used in the form of lakes, the pink aluminium lake of Thioindigo BA when used with linseed oil remaining unaffected after exposure for 30 days.

—A. S.

Oxide of iron; U.S. Customs decision. Bd. of Tr. J., March 25, 1909. [T.R.]

OXIDE of iron or hematite iron ore, which is in a powdered state resulting from a process of grinding and levigation, and which is used in the manufacture of paint and in colouring leather board, &c., is dutiable as a colour or pigment under Par. 58 of the Tariff at 30 per cent. ad val.

PATENTS.

Vegetable black; Treatment of brine or other chemical to be concentrated, evaporated, or distilled, and manufacture of —. C. W. B., F., and R. A. Davey, Ditton, Lanes. Eng. Pat. 5685, Mar. 13, 1908.

OIL, crude naphthalene, or other substances rich in carbon and hydrogen are burned, instead of coal, at very low temperatures in the furnaces below salt pans, or other concentrating, evaporating, or distilling apparatus, and the smoke produced is drawn away through chambers provided with baffle-plates and circuitous passages. The amorphous carbon is deposited in the chambers and passages, and is removed from them periodically.

—E. W. L.

Pigments; Process for producing oxide of iron —. A. H. White, Hornsea, Yorks. Eng. Pat. 11,638, May 28, 1908.

THE oxide or other salt of iron (e.g., ferrous sulphate) is mixed before calcination with borax or boric acid in such proportion as to give a product of the required shade of red or yellow. If desired, a portion of the added soluble salt may be subsequently removed by lixiviation.

—C. A. M.

(B.)—RESINS, VARNISHES.

PATENTS.

Condensation product [of phenol and formaldehyde], and method of making the same. L. H. Baekeland, Yonkers Township, N.Y., U.S.A. Eng. Pat. 21,566, Oct. 12, 1908. Under Int. Conv., Oct. 15, 1907.

PHENOL, or phenolic substances can be made to react with a molecular proportion of formaldehyde in the presence of a basic condensing agent such as ammonia, aniline, sodium hydroxide, etc. The proportion of base used is never more than one-fifth of that required to convert the phenol completely into a phenolate. If the condensation is carried out at moderate temperatures, the product is oily, and soluble in alcohol or acetone. Heat and pressure convert it into a solid body, insoluble in alcohol, acetone, or in acid or alkaline reagents. (See Fr. Pats. 386,627 and 386,628 of 1908; this J., 1908, 686, 690.)—F. SHDN.

Condensation products from o-cresol and formaldehyde; Process for preparing resinous. — F. L. Blumer. Ger. Pat. 296,904, Dec. 7, 1907.

A CLEAR, odourless, resinous product, easily soluble in alcohols, ketones, and ether, but sparingly soluble in turpentine oil, hydrocarbons, and fatty oils, is obtained by the condensation of pure o-cresol with formaldehyde in presence of alkalis. 80 kilos. of potassium hydroxide solution (50° B.) are added to a mixture of 100 kilos. of o-cresol and 100 kilos. of formaldehyde: the mixture is kept boiling for two hours, preferably with exclusion of air, and the product is precipitated by dilute sulphuric acid; it melts to a clear mass in boiling water.—T. F. B.

Mixing printing inks. Eng. Pat. 8623. See I.

(C.)—INDIA-RUBBER, &c.

Rubber production in Ceylon. Bd. of Tr. J., March 25, 1909. [T.R.]

RUBBER generally in the low country, where planted in suitable soil, is a success. Some of the drier districts suffered somewhat last year from the abnormally dry weather, but, generally speaking, the growth was good. A much smaller acreage was opened during 1908 than for four years past, owing to the fall in prices. A new method of tapping, which promises to be a success, should greatly economise labour and cost of working.

Raw rubber; Cause of "tackiness" in —. D. Spence. Z. Chem. Ind. Kolloide, 1909, 4, 70—76.

AMONGST the causes which have been suggested in explanation of the production of "tackiness" in raw rubber, is the action of micro-organisms. This view merits further investigation, but it should be borne in mind that bacterial action occurs not on the rubber itself, but in the rubber on the various impurities present. The effect of bacterial activity upon the rubber itself, if any, can only be indirect. Enzymes may possibly also have an indirect effect. The author's experiments deal with the action of sulphuric acid in bringing about "tackiness," and lead to the conclusion that the change undergone by the rubber is one merely affecting the physical (or possibly the chemical) state of aggregation. Such a change is known to occur in the cases of certain sorts of Maranhao and Matto-Grosso rubber, which have been coagulated with sulphuric acid. *Funtumia elastica* latex, which is not coagulated by small quantities of sulphuric acid, was selected for the purposes of the investigation. 100 c.c. of the latex were dialysed for a whole day in running water, then "pasteurised" by heating for 10 minutes at 80° C., and filtered into a sterile flask. 50 c.c. of this completely sterile, homogeneous latex were transferred to each of two Erlenmeyer flasks, and to the one were added 10 c.c. of N/10 sulphuric acid, whilst to the control flask, 10 c.c. of sterile water were added. Both flasks were kept in an incubator at 35° C. for about one month, and their condition noted from time to time. At the end of this period the latex to which sulphuric acid had been added was found to be completely coagulated, whereas in the other sample the globules had

merely coalesced to a cream, which was readily broken up on shaking. The rubber was precipitated in each case by the addition of 100 c.c. of absolute alcohol, and subsequent heating. The rubber from the two tests differed very greatly; that from the acidified latex was very soft and plastic, and was destitute of tensile strength and "nerve." The other was a very good sample of rubber. Further examination showed that:—(1), the weight of the two samples of rubber was the same, within narrow limits; hence no appreciable oxidation could have occurred in the case of the acidified sample; (2), the resin content of the two samples was the same within the limits of experimental error (8.43 and 8.50 per cent.); (3), the viscosity of solutions of the two rubbers differed greatly, that of the solution of the rubber from the acidified latex being much the lower of the two; (4), the elementary composition of the rubber "hydrocarbon" was the same in each case, both samples containing about 3 per cent. of oxygen; (5), the bromides obtained from the two samples of rubber by Budde's method were identical in properties and composition, containing 66.13 and 66.17 per cent. of bromine respectively, instead of the theoretical 70.17 per cent. The change in properties of the rubber must therefore be due merely to some change in the physical state of aggregation of the colloidal particles, or in the degree of molecular complexity of the caoutchouc molecule. The author briefly discusses the bearing of these results on the question of the durability of vulcanised rubber, referring to the markedly destructive action of traces of free sulphuric acid, and suggesting care in the use in mixings of rubber coagulated by means of "Purub" (hydrofluoric acid) (see this J., 1908, 1029, 1074).—E. W. L.

PATENTS.

Rubber, bonite or vulcanite; Method of manufacturing goods of — [from waste rubber]. O. C. Immisch, Finchley. Eng. Pat. 3659, Feb. 18, 1908.

WASTE rubber, ground into the form of crumb, is mixed with a volatile oil which is not deleterious to rubber, for example, cajeput oil, in the proportion of about 0.1 per cent. of the mass. The mixture is subjected, while under slight pressure in a mould, to a temperature of 220°—280° F., in order to volatilise the oil and expel all air from the interstices of the rubber waste. The mass is then compressed and afterwards cooled. The operations of heating, compressing, and cooling may be repeated in order to attain greater density.—E. W. L.

Rubber, bonite, or vulcanite; Method of manufacturing goods from —. O. C. Immisch, Finchley. Eng. Pat. 3940, Feb. 18, 1908.

WASTE rubber in the form of crumb (hard or soft), and advantageously mixed with a volatile, non-deleterious oil (e.g., cajeput oil), having a boiling point slightly lower than the temperature employed in the subsequent process, is placed in a mould of slightly greater volume than that of the article to be produced. The mould is closed under pressure, heated to from 220° to 280° F., and while still hot submitted to such pressure that the volume of the contents is reduced to approximately that of the article to be produced. The pressure is maintained while the mould is cooling, and when cool, the latter is clamped and reheated to the same temperature, after which it is put under pressure again to cool. By the repetition of this series of operations, an article of greater density than that of the original rubber can be produced.—E. W. L.

Resilient material for use as a filling for elastic tyres and for other purposes and a method of and means for making and applying the same. R. A. Morris, Rossendale. Eng. Pat. 3816, Feb. 20, 1908.

RUBBER or a mixture of rubber with boiled oil, resin, or similar substances is well mixed with a mineral oil solvent, preferably spindle oil, and then a solution of a vulcanising agent (sulphur chloride) in spindle oil is added. After thorough mixing, the mass is run into a mould or other object designed to receive it, and subjected to pressure. The mass sets in about 30 minutes.—A. S.

Rubber; Process of reclaiming devulcanised —. E. E. A. G. Meyer, New Brunswick, N.J. U.S. Pat. 913,218, Feb. 23, 1909.

RUBBER waste, which has been devulcanised by treating it with a mixture of two solvents, of which one is a rubber solvent, while the other is not, is "depolymerised" by heating it at temperatures exceeding 120° C. with a neutral resinous soap, and subjecting the mass to a high mechanical pressure during this treatment. The neutral soap may be prepared from the resin of natural rubber.—E. W. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

PATENTS.

Quebracho extracts; Process for treating —. A. Redlich and L. Pollak. First Addition, dated Oct. 6, 1908, to Fr. Pat. 388,855, March 10, 1908.

SEE Eng. Pat. 21,483 of 1908; this J., 1908, 1214.—T. F. B.

Ossein; Treatment of —. E. A. A. Vallée and A. Helbronner, Paris. U.S. Pat. 914,996, March 9, 1909.

SEE Fr. Pat. 361,796 of 1905 and Addition thereto; this J., 1906, 1227, and 1907, 214.—T. F. B.

XV.—MANURES, &c.

Nitrates; Colorimetric determination of — in soil solutions containing organic matter. W. A. Syme. J. Ind. and Eng. Chem., 1909, 1, 188—189.

50 c.c. of the dark-coloured solution are heated to 60°—70° C., mixed with 1 c.c. of dilute sulphuric acid (1:5), and excess of a dilute solution of permanganate added. After heating on the water-bath for 15 mins., the solution is filtered, the filtrate made slightly alkaline with sodium carbonate, and evaporated to dryness. The residue is treated with water, filtered, and nitrate determined in the filtrate in the usual manner with phenoldisulphonic acid and ammonia. Control experiments showed that no nitrate nor nitrite is produced by the action of the permanganate on the organic matter.—A. S.

Export of phosphate of lime from Christmas Island. Bd. of Tr. J., March 25, 1909. [T.R.]

THE export of phosphate of lime from Christmas Island reached, in 1908, 109,097 tons, being 1278 tons less than in the previous year. The whole quantity was sent to Japan, the continent of Europe, Australia, and New Zealand, none being sent to the United Kingdom.

PATENTS.

Fertilizers; Manufacture of —. D. Shields, Edgeworth-borough, Pa. U.S. Pat. 913,922, Mar. 2, 1909.

CARBONACEOUS material (coal) is mixed with a non-eauistic alkaline solution, and the mixture is heated; the coal is thus rendered absorbent without being disintegrated. A solution containing a mineral fertiliser is then added, the mass is again heated, and dried without being allowed to ferment.—W. P. S.

Manure from recent eruptive stones containing protoxide of potassium; Process for manufacturing — and compounds of lime. F. Schäcke, Cöln, Germany. Eng. Pat. 4753, March 2, 1908.

SEE Fr. Pat. 386,512 of 1908; this J., 1908, 821.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Juice [Sugar]; Boiling of thick — in cane sugar factories. H. C. Prinsen-Geerligs and H. E. Weitkamp. Reports of the Experimental Station for the Java Sugar Industry, No. 8; Z. angew. Chem., 1909, 22, 203.

THE authors deal with the various boiling processes used in Java. Masecuite from cane juice granulates much more readily than that obtained from beet juice. In Java, the molasses can be desaccharified to such a

degree that the apparent purity only amounts to 27—28 per cent. (actual purity 38—40 per cent.). With beet molasses, the lowest purities are 51 to 52 per cent. (actual purity 54—55 per cent.). Contrary to former usage, boiling the juice until it becomes stringy is now only applied to the working up of mother syrups of low purity. —L. E.

Sucrose in bagasse; Determination of —. H. C. Prinsen-Geerligs. Reports of the Experimental Station for the Java Sugar Industry, No. 7; Z. angew. Chem., 1909, 22, 202—203.

THE method recommended by the author in Java for determining sucrose in bagasse, consists in extracting the material with boiling water for 10—12 minutes. On the basis of results obtained in Egypt, Pellet and Nais have stated that this method gave values which were much too low, and they recommend the Zamaron process (see also this J., 1909, 253). The author has shown that if bagasse, freed from sugar by alcoholic extraction, is treated with boiling water, a dextro-rotatory, gummy or hemicellulose-like substance is dissolved, as a result of which, the values obtained by the Zamaron method are too high. The strikingly low sugar-content of the bagasse from several of the recently cultivated varieties of cane, is due to the small proportion of parenchyma in these canes; in the bagasse, the parenchyma contains more water than do the vascular bundles or rind; consequently with a low proportion of parenchyma, the bagasse is drier and therefore poorer in sugar.—L. E.

Sucrose and hydrated maltose; Optical determination of mixtures of —. J. Pieraerts. Bull. Assoc. Chim. Sucr. et Dist., 1909, 26, 650—652. (See also this J., 1906, 716; 1909, 253.)

THE mixture (2.5 grms.) is dissolved in 40—50 c.c. of tepid water, the cooled solution being made up to 100 c.c. (solution A). (1). Twenty-five c.c. of solution A are treated with 2 c.c. of alumina cream and 2 drops of strong ammonia, made up to 50 c.c., filtered, and polarised in a 200-mm. tube at 20° C. (2). Fifty c.c. of solution A are treated with 10 c.c. of a freshly prepared 20 per cent. solution of citric acid in a round-bottomed flask of 1-litre capacity. Some fragments of porous material are added, the flask is fitted with a reflux condenser, and the solution heated to boiling as rapidly as possible on a wire gauze. Boiling is continued for exactly 8 minutes, the solution is then cooled rapidly and transferred to a 100 c.c. flask, treated with 2 c.c. of alumina, made up to volume, filtered, and polarised in a 200-mm. tube at 20° C. If α and α' are the readings in angular degrees before and after hydrolysis, the amounts of sucrose (x) and hydrated maltose (y) in 1.25 grms. of the mixture may be found from the equations,

$$2 \frac{66.5}{100} x + 2 \frac{130}{100} y = \alpha$$

$$\text{and } -2 \frac{19.80}{95} x + 2 \frac{130}{100} y = \alpha'$$

whence $x = 0.57246(\alpha - \alpha')$
and $y = 0.384615\alpha - 0.2928363(\alpha - \alpha')$

THE author has analysed mixtures of known proportions of sucrose and hydrated maltose by the above-described method. The results show that the use of citric acid under the given conditions insures the complete hydrolysis of the sucrose whilst the maltose is quite unaffected.

—L. E.

Cane sugar [sucrose] and maltose; Inversion of — by ferments. A. E. Taylor. J. Biol. Chem., 1909, 5, 405—407.

THE author finds that the inversion of sucrose follows the course of a monomolecular reaction and is proportional to the concentration, thus confirming the work of O'Sullivan and Tompson (this J., 1890, 816, 1049) and of Hudson (this J., 1908, 1076). The author's work also shows that the same holds true for the inversion of maltose.—J. A.

Starch and its constituents; Progress of oxidation and hydrolysis of — by the action of hydrogen peroxide. Z. Gatin-Gruzewska. *Compt. rend.*, 1909, 148, 578—580.

ONE per cent. solutions of amylopectin, amylose (this J., 1908, 415), and starch, on heating to 131° C. for 20 minutes, present similar opalescent appearances, and give ultramarine- or indigo-blue colorations with iodine. These solutions (100 c.c.), on treatment with hydrogen peroxide (5 c.c.), behave as follows:—*Amylopectin*.—In 24 hours, the solution is quite clear; it is coloured intensely red by iodine, and is precipitable by large quantities of alcohol. The intensity of the iodine reaction gradually decreases, and disappears in about 7—8 days, and at this stage, the solution yields scarcely any precipitate with alcohol. The acidity increases till about the fifteenth day and then remains constant at a value equivalent to 1.2 c.c. of $N/10$ alkali. The reducing power attains a maximum on the third day and then decreases. *Amylose*.—In 24 hours the liquid is opalescent and gives a violet-blue colour with iodine (the colour becomes intensely blue if alkali is added to the liquid and the whole is neutralised; this shows that reversion-amylose is present). On the fourth day, a clear liquid and a flocculent precipitate separate; the former is coloured a faint red (by iodine) and is precipitated by much alcohol; the latter gives the reaction of reversion-amylose. The acidity curve is similar to that of amylopectin, save that the constant value is somewhat less; the maximum reducing power is attained somewhat later than in the case of amylopectin. *Starch*.—The behaviour is similar to that of a mixture of amylopectin and amylose. The reversion to amylose, even in very concentrated solutions of starch, is never so great as in solutions of pure amylose. The amylopectin and the erythro-dextrin appear to act as a solvent towards the amylose. This should explain the importance of complete liquefaction of the starch paste in diastatic actions. Amylopectin and amylose present distinct differences in behaviour under the action of enzymes and of hydrogen peroxide. The decomposition of the "micelles" of amylopectin appears to be simultaneous, whilst that of the "micelles" of amylose appears to be successive. Both amylose and amylopectin pass through the (erythro-) dextrin stage. It may be that in nature, other peroxides can produce these reactions; if so, the reactions would be of great biological importance. —L. E.

Cellobiose and its osone; Behaviour to enzymes. Fischer and Zemplan. See XXIV.

PATENTS.

Sugar; Process of making —. G. W. McMullen, Chicago, Ill. U.S. Pat. 913,758, March 2, 1909.

THE sugar-producing plants (e.g., beet) are first cut into slices or small pieces and then dried until they become brittle. The dry, brittle pieces are next crushed or ground, moistened, and the sugar extracted by percolation or diffusion. Finally the sugar is recovered from the resulting solution by evaporation.—W. H. C.

Starch from wheat flour. Eng. Pat. 19,726. See XVIII.A.

XVII.—BREWING, WINES, SPIRITS, &c.

Fermentation with yeast; Influence of ethyl alcohol on —. M. Kochmann. *Biochem. Zeits.*, 1909, 16, 391—398.

THE author has made comparative experiments on the influence of ethyl alcohol on the fermentation of dextrose with yeast, and has found, that at concentrations of 1:300—1:500, the alcohol accelerates the fermentation. In this, as in many other cases, the product of metabolism exerts a stimulating influence on the activity of the organism. It is highly probable that this stimulating action of the alcohol consists in an increased production of zymase; the investigations of various workers have shown that alcohol does not appear to exert a favourable influence on the enzyme itself. At somewhat higher

degrees of concentration, the final influence of the alcohol consists in a retardation of the decomposition of the sugar, though initially, the stimulating influence on the cell-activity is still perceptible.—L. E.

Unmalted cereals; Application of diastases present in — to the preparation of alcohol and "amé." Y. Tanaka. *J. Coll. Eng., Imp. Univ., Tokyo*, 1908, 4, 205—217.

RYE is the only grain which contains sufficient diastase to enable it to be used industrially, without the assistance of malt, for the manufacture of spirit (this J., 1908, 134). Other grains, such as wheat or barley, contain a diastase which has a powerful saccharifying action but is deficient in starch-liquefying power. The author has shown, on the other hand (this J., 1908, 462), that millet and other small-grained cereals secrete a diastase which has a high liquefying power but weak saccharifying action. Consequently a combined extract of both kinds of grain is capable of being used as a substitute for malt in the saccharification of gelatinised starch. The extract is prepared by mixing a 10 per cent. infusion of wheat-bran with a 10 per cent. infusion of ground millet in equal proportions. The most favourable temperature for saccharification is 50°—55° C.; the time depends on the quantity of diastatic enzymes present, but with a proportion of about 10 per cent. of the mixed diastatic grains on the weight of the material, saccharification is well advanced after 3—5 hours. "Amé" is a sweet yellow syrup prepared in Japan by the action of malt on steamed rice. The author has prepared this substance without malt by the action of 360 c.c. of the 10 per cent. infusion of mixed cereals on 300 grms. of "glutinous" rice, previously gelatinised, for 4 hours, and evaporation of the filtered wort. The product differed from the commercial "amé" only in the fact that it gave a red reaction with iodine owing to the presence of erythro-dextrins. Otherwise the composition and the ratio of maltose to dextrin were very similar. The author has also applied the mixed diastatic extracts to the preparation of alcohol, on the experimental scale, from rice, other Japanese grains, and potatoes, without the assistance of malt. The results, when compared with those obtained by the use of malt, showed practically identical yields of alcohol. The sweet mashes obtained without malt showed the reaction for erythro-dextrin, but this disappeared in the course of fermentation. Since the cereals which have served for the preparation of the diastatic infusions may be mixed and steamed with the next main batch of starchy material, there is no waste of starch and the economy, as compared with the malting process, is very considerable.—J. F. B.

Caramel; Detection of — in wine, cognac, and beer. A. Jägerschmid. *Z. Untersuch. Nahr. Genussm.*, 1909, 17, 269.

ONE hundred c.c. of the sample are mixed with albumin solution (equal parts of fresh white-of-egg and water) and heated with continual stirring until the albumin coagulates. The filtrate is evaporated on the water-bath to the consistence of a syrup, and divided into two portions, one of which is mixed with ether and the other with acetone. Portions of the ethereal solution are allowed to evaporate spontaneously on porcelain, and the residues tested with one or two drops of a freshly-prepared solution of resorcinol in hydrochloric acid (1 gm. to 100 c.c.). In the presence of caramel, a persistent cherry-red coloration is immediately obtained. The acetone solution is filtered, if necessary, and mixed in a test-tube with an equal volume of concentrated hydrochloric acid. A carmine red coloration indicates the presence of caramel.—C. A. M.

Wines; Volumetric determination of total sulphurous acid in —. C. Blarez and L. Chelle. *Bull. Assoc. Chim. Sac. et Dist.*, 1909, 26, 690—693.

RIPPER's method for determining the total (free and combined) sulphurous acid in wine is not very exact; the results are nearly always higher than those obtained by the method proposed by Haas. The latter method is accurate, but it is intricate and takes much time. The following process does not take more than 20—25 minutes, and gives results agreeing well with those obtained by the

method of Haas. Two c.c. of syrupy phosphoric acid and some ignited pumice are placed in a flask of about 250 c.c. capacity heated on a water-bath. The flask is fitted with a tap-funnel (of at least 50 c.c. capacity), and a jacketed delivery tube; the other end of this tube passes through a rubber stopper fitted into one neck of a double-necked receiver containing 20 c.c. of 4 per cent. solution of sodium hydroxide. The other neck of the receiver is fitted with a rubber stopper and stopcock, the latter communicating with an air-pump. The apparatus is evacuated to a pressure of 20–30 mm., and the pump is cut off. Fifty c.c. of the wine are slowly introduced from the tap-funnel into the distilling flask, the funnel being subsequently rinsed with a little water; care must be taken that air does not enter the apparatus. Throughout these operations, the flask is heated on the water-bath. Distillation is continued until the residue is pasty. The tap-funnel is then opened to admit air, the receiver is detached, the distillate is acidified with 10 c.c. of dilute (1:3) sulphuric acid, and titrated with $N/20$ or $N/50$ iodine with starch paste as indicator.

—L. E.

Inversion of sucrose and maltose. Taylor. See XVI.

Starch and its constituents. Gatin-Gruzewska. See XVI.

Compressed yeast. Bryan. See XVIII.A.

PATENTS.

Yeast; Desiccation of — G. F. Humphrey, London. Eng. Pat. 3166, Feb. 12, 1908.

YEAST, having the consistence of cream is brought in contact with an inert, sterilised and vesicular absorbent material, and the mixture is then dried by a current of dry, cold, sterilised air. A suitable absorbent is prepared by fermenting a dough composed of ordinary wheat flour to which is added about 25 per cent. of gelatinised rice. The dough is made up into large loaves which are then thoroughly baked and sterilised. This absorbent bread may be used either in the form of crumbs or slices, which are thoroughly dried and mixed or sprinkled with the yeast-cream. The quantity of bread required amounts to about 70 per cent. of the weight of pressed yeast which itself contains 70–75 per cent. of moisture.—J. F. B.

Saccharification; Converters for — G. Dupont. Fr. Pat. 394,838, Oct. 2, 1908.

THE conversion vessel is provided with a cover forming a convex basin which is perforated with holes around its periphery. At the centre of the cover is a vertical chimney, which possesses a grilled opening in its wall at a certain height. The froth produced by the ebullition of the liquid rises up the chimney until it reaches the opening; it is there condensed by contact with the cold air as it emerges, and it then falls back on the outside of the cover whence it returns to the pan by way of the peripheral holes. The gases and vapours collected by a hood ascend further up the chimney, and the liquid which condenses in the upper part is collected in a channel which conveys it away from the apparatus.—J. F. B.

Fermented beverages; Composition of matter for use in preparing — M. Wallerstein, New York. U.S. Pat. 908,630, Jan. 5, 1909.

THE composition is more particularly intended for the preparation of brewing waters, and consists of 75 parts of precipitated calcium sulphate, 20 parts of potassium chloride, and 5 parts of magnesium sulphate. If the nature of the water to be treated is such that other salts are also required, the same are added to the mixture, and the composition of the latter altered accordingly.—W. P. S.

Beer and other liquids; Filtering — H. Wanderscheek, Rixdorf, Germany. Eng. Pat. 3837, Feb. 20, 1908.

THE material of which the filter is composed, for instance, cotton, linen, jute, wood, straw, etc., is treated with benzene, ether, or other solvent, and afterwards with a very dilute solution of an alkali. The material is then

boiled with a suitable acid and, if desired, is again treated with the solvent. The treatment completely removes fatty substances which impart a disagreeable taste to the beer or other liquid. (Reference is directed to Eng. Pats. 397 of 1886 and 801 of 1892; this J., 1887, 39; 1893, 133.)—W. P. S.

Alcoholic liquids; Process for distillation and rectification of — V. Slavicek. Fr. Pat. 394,949, Oct. 5, 1908.

THE crude vapours are split up into two parts, and the phlegms, after being deprived of the head products, are sprayed into the other portion of the crude vapours, which has been subjected directly to rectification, being deprived of its head products but containing the "tail" products. The two portions thus mixed at the boiling point become saturated with "tail" products without being saturated with alcohol. The vapours so obtained are purer than usual, the concentration in the rectifying column is lower and consequently the column of tail products is not so high. All the impurities existing after rectification are treated together at as high a concentration and temperature as possible and are returned for the purpose of heating the head products purifier. The columns receive automatically sufficient phlegms and alcoholic vapours to maintain the zone of tail products at a constant height, and all the parts of the columns which communicate with each other are maintained under the same pressure. The crude vapours passing from the distillation column to the rectifying column are caused to ascend a wide pipe so that no spray from the wash can be carried through.—J. F. B.

Brewing processes. H. Breker, Cologne, Germany. Eng. Pat. 1884, Jan. 28, 1908. Under Int. Conv., Jan. 29, 1907.

SEE Fr. Pat. 378,154 of 1907; this J., 1907, 1156.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(A.)—FOODS.

Flours; Chemically treated — E. F. Ladd, H. P. Bassett, and H. L. White. Chem. News, 1909, 99, 110–112, 126–129, 133–136. (Compare this J., 1909, 157.)

NITRITES and nitrates are among the products formed in flour as the result of bleaching with nitrogen peroxide. In the flour for one loaf (373 grms.) as much as 1.313 mgrms. of sodium nitrite were found. Bread made from this flour contains from one-third to one-half this quantity. The oil from unbleached "patent" flour, properly extracted and purified, contains no nitrogen, that from bleached flour gives a strong nitrogen reaction. The oil of unbleached flour has an iodine value of 101; the same flour when bleached yielded an oil with an iodine value of 84. Obviously the bleaching agent acts on the fat of the flour. It has been claimed that artificial bleaching brings about results similar to those of natural ageing, but the authors find that the oil from flour aged for nine months shows no reduction in iodine value, whereas oil from the same flour bleached and aged showed a reduction of 17 units. The proportion of nitrates in the bread increases as the nitrites decrease, the amount of nitrite destroyed depending on the method of baking and being least in products in which baking powder or "soda" is used. Gluten from the unbleached flour was digested by pepsin and hydrochloric acid in about 5 hours; that from the bleached flour required nearly twice as long under the same conditions. Baked glutes from the same flours showed similar variations, but were digested much more quickly; the same is true for the bread made from such flours. The gluten, baked gluten, or bread from unbleached flour was digested more quickly by pancreatic ferments than that from the same flour bleached. Bread made with bleached flour possessed greater keeping qualities. Apparently the bleaching agent does not act to form a low-nitrated nitro-starch product, but it acts on some part of the gluten, forming compounds which give a diazo reaction liberating nitrogen when treated with acid. Experiments with rabbits show that toxic bodies are

produced in flour as the result of bleaching. The alcoholic extract of unbleached flour was without effect on rabbits, that of bleached flour caused their death within a few hours; that of over-bleached flour caused their immediate collapse and death. Aqueous extracts behaved similarly. The death is not due to acidity, as the neutralised aqueous or alcoholic extracts of over-bleached flour caused death within a few hours.—E. F. A.

Gluten; Physical state of — T. B. Wood and W. B. Hardy. *Proc. Roy. Soc.*, 1909, B., 81, 38—43.

THE authors' experiments deal with the influence of electrolytes upon the physical state of gluten. It is shown that very dilute acid destroys the cohesion of gluten and causes it to be dispersed into an opaque colloidal solution or hydrosol. If, however, the strength of the acid is increased, a critical point is reached at which the gluten remains as coherent as in distilled water. The concentration at which the gluten retained its coherence was as follows in the case of different acids:—Sulphuric acid, 0.017 *N*; nitric acid, 0.02 *N*; hydrochloric acid, 0.05 *N*; oxalic acid, 0.15 *N*; and phosphoric acid, 2.00 *N*. Gluten is dispersed when repeatedly washed with distilled water owing to the influence of the carbonic acid present. The addition of a small proportion of salt to a hydrosol precipitates the gluten, and salts therefore reduce the disintegrating effect of acids and alkalis upon the cohesion of gluten, and in sufficient concentration completely neutralise their action. The action of alkali upon the cohesion is similar to that of acid, except that the protein in the resulting hydrosol is negatively charged, whereas in that formed by acids the electric charge is positive. Alkali added to a hydrosol not only neutralises any acid present, but also reacts with the protein, and is neutralised, with the formation of new ions. The general conclusion arrived at is that the physical state of gluten depends upon the potential difference between the fluid and the particles of protein. The development of this potential difference may be explained by the hypothesis that it is due to differences in the speed of the ions of electrolytes present, the colloid particles being, as it were, charged with an excess of the most rapidly moving and penetrating ions. Or it may be accounted for by the chemical hypothesis that proteins are amphoteric electrolytes, reacting with acids and alkalis to form salts, the nature of which depends upon conditions of temperature, concentration, and inertia due to internal surfaces within the solution becoming electrified. Experimental facts against the first view are brought forward.—C. A. M.

Yeast; Carbon dioxide value of pure compressed — alone and mixed with starch. T. J. Bryan. U.S. Dept. Agric., Bureau Chem., Bull. No. 116, 25—28. *Chem. Abs.* (Amer. Chem. Soc.), 1909, 3, 555—556.

THREE test yeasts were prepared, a pure yeast, a mixture of 10 lb. of maize starch, 70 lb. of yeast and 16 lb. of water, and a mixture of 10 lb. of potato starch, 70 lb. of yeast and 19 lb. of water. These preparations were allowed to act for 24 hours on 100 c.c. of 10 per cent. sugar solutions to which 75 c.c. of water had been added in a suitable flask provided with calcium chloride tubes. The loss in weight owing to the carbon dioxide expelled was ascertained hourly. This was repeated daily until the yeasts were 14 days old. Tables are given showing the comparative loss in each test; the results are uniformly low in the case of the yeasts mixed with starch. When run for 24 hours the potato and maize starch preparations gave an average yield, on samples 1—14 days old, of 83.4 per cent. and 86.2 per cent. respectively of the loss where pure yeasts were used. When run for 12 hours only, the loss was 79.5 per cent. and 83.1 per cent. respectively. Baking tests were also made, dough containing 650 grms. of flour, 500 grms. of water and 10 grms. of yeast mixtures being used. Pure yeast yielded a greater volume of bread in each case; the average on 5 trials made when the yeasts were 2, 5, 12, 13, and 14 days old was for pure yeasts 2439 c.c., and for maize starch yeast 2240. The conclusion is drawn that starch does not improve the keeping quality of yeast and is to be considered merely an adulteration.

Milk treated with bichromate; Action of light on — A. Gascard. *Compt. rend.*, 1909, 148, 580—582.

SEVERAL workers have pointed out the objections to potassium bichromate as a means of preserving milk intended for analysis (see this J., 1909, 36). The author has found, however, that milk, which has been treated with bichromate, may be kept for a considerable period before analysis without suffering serious alteration, provided that it is protected from light. Thus, 2 samples of the same milk, containing 1 gm. of potassium bichromate per litre, were kept for 2 months, one exposed to light, the other in darkness. At the end of this period, the samples presented very different aspects. In the former, a greenish-white coagulum was suspended in a rose-grey liquid, the fat had separated in small compact masses, and the acidity was high; the sample was no longer suitable for analysis. The latter was golden yellow in colour, and had not coagulated; its acidity had increased slightly; the fat readily underwent emulsification in the cold, and the sample could still be used for analysis.—L. E.

Butter fat; Determination of — in the presence of cocoanut oil. M. Monhaupt. *Chem.-Zeit.*, 1909, 33, 305—306.

FOR the determination of small amounts of butter fat in the presence of large quantities of cocoanut oil, the author recommends the following modification of Kirschner's method of separating the volatile insoluble fatty acids by means of silver sulphate (*Z. Untersuch. Nahr. Genussm.*, 9, 65):—The neutralised Reichert-Meissl distillate is treated with 0.5 gm. of silver sulphate, and filtered after standing for some time at 15°—18° C. 100 c.c. of the filtrate are mixed with 20 c.c. of dilute sulphuric acid and 30 c.c. of water, and, after the addition of a little pumice stone, distilled in Polenske's apparatus, until 110 c.c. have been collected. This is filtered and 100 c.c. titrated with *N*/10 alkali solution. The number of c.c. required multiplied by 1.21 gives the *Kirschner value*. Experimental results with mixtures containing from 10 to 35 per cent. of cocoanut oil and 1 to 2 per cent. of butter fat show that the amount of the latter may be calculated from the ratio of the Polenske value to the *Kirschner value*. A valuable means of detecting and determining such small quantities of butter fat is based upon a combination of the methods of Dons (this J., 1908, 176) and of Kirschner:—5 grms. of the fat are saponified with glycerin-sodium hydroxide solution, and the soap treated with 90 c.c. of recently-boiled water and 50 c.c. of dilute sulphuric acid and heated on the water-bath at 80° to 90° C. under a reflux condenser until a clear layer of fatty acids is obtained. The contents of the flask are then vigorously shaken, cooled, and filtered, the filtrate distilled in Polenske's apparatus, and 110 c.c. of the distillate collected and filtered. 100 c.c. of the filtrate are titrated with *N*/10 alkali, the number of c.c. consumed multiplied by the factor 1.1 giving the "new Reichert value." The neutralised distillate is then used for the determination of the "new *Kirschner value*" as described above. Both values increase steadily with an increase in the amount of cocoanut oil in a mixture of fats containing cocoanut oil and butter fat, but the increase in the new Reichert-Meissl value (due to the extracted caprylic acid) is greater than that in the new *Kirschner value*, which is to be attributed to the caproic acid. The following empirical table illustrates the relationship between the values:—

Cocoanut oil.	Butter fat.	New Reichert-Meissl value.	New Kirschner value.
Per cent.	Per cent.		
15	0	0.50	0.24
15	1	0.72	0.39
15	2	0.99	0.62
25	0	0.88	0.30
25	1	0.99	0.55
25	2	1.21	0.69
35	0	1.10	0.36
35	1	1.32	0.63
35	2	1.50	0.81

By using 20 grms. of the fat instead of 5 grms., the differences between the new Kirschner values of fats containing butter and free from butter are correspondingly increased. (See also this J., 1909, 157.)—C. A. M.

Caffeine; Determination of — in coffee. K. Lendrich and E. Nottbohm. Z. Untersuch. Nahr. Genussm., 1909, 17, 241—265.

The authors' experiments have shown that the caffeine may be quantitatively extracted by 3 hours' extraction with carbon tetrachloride from 20 grms. of coffee whether the latter be previously moistened with 2.5, 5, 7.5, or 10 c.c. of water. An addition of 50 per cent. of water is advisable, however, since the amount of soluble substances (other than caffeine) extracted is less than when a smaller proportion of water is used. Raw coffee requires to be left in contact with the water for 2 hours before the extraction, and in this respect the authors' experience differs from that of Gorter (this J., 1908, 242), who found 30 minutes' treatment sufficient. The following method is recommended as applicable to every kind of coffee:—20 grms. of the sample, ground to granules about 1 mm. in diameter and sifted, are mixed with 10 c.c. of water and allowed to stand for 2 hours (1 hour for roasted coffee) with occasional stirring. The mass is then extracted for 3 hours with carbon tetrachloride, the extract mixed with about 1 gm. of paraffin wax and evaporated, and the residue extracted first with 50 c.c. and then with three portions of 25 c.c. each of hot water. The aqueous extract is cooled and filtered, and the filtrate decolorized by the addition of 10 c.c. (30 c.c. for roasted coffee) of a 1 per cent. solution of potassium permanganate, followed, after 15 minutes, by a 3 per cent. solution of hydrogen peroxide containing 1 c.c. of glacial acetic acid per 100 c.c., which is added drop by drop. The liquid is next heated for 15 minutes on the water-bath and filtered whilst hot. The filtrate and washings are evaporated to dryness, and the residue dried for 15 minutes at 100° C., and taken up with hot chloroform. The filtered solution is evaporated, and the residue of caffeine dried for 30 minutes at 100° C., and weighed. The caffeine may also be quantitatively separated by extracting with chloroform the aqueous solution after the treatment with potassium permanganate. In cases where extreme accuracy is required, the nitrogen in the residual caffeine should be determined, and the amount of alkaloid calculated from the result. Gorter (this J., 1908, 242, 464) attributed the defective extraction of caffeine by chloroform in the absence of water to the alkaloid being present in the form of potassium-caffeine chlorogenate, which was not decomposed by anhydrous organic solvents. The authors show, however, that the tissue of the coffee bean possesses a pronounced adsorptive capacity for caffeine. Thus in experiments in which the residues previously freed from caffeine were mixed with a definite amount of pure caffeine solution, dried, and extracted for 3 hours with chloroform, benzene, or carbon tetrachloride, only traces of the alkaloid were recovered, whereas after moistening the mass with water, the caffeine could be quantitatively recovered.—C. A. M.

Export of tinned provisions to Japan. Percentage of lead in solder. Bd. of Tr. J., March 25, 1909. [T.R.]

THE Japanese Police Authorities are now enforcing Art. III. of the Regulations respecting Receptacles for Provisions and Beverages issued by the Home Office in 1900. This Article provides that solder which is in contact with the contents of the tinned goods must not consist of an alloy with more than 20 per cent. of lead, while receptacles must not be lined with an alloy of tin and lead which contains more than 5 per cent. of lead. In soldering the outer portions of tins which contain, or are to contain, provisions, no alloy must be used which consists of more than 50 per cent. of lead. Up to the present, several tins of provisions of American and French manufacture have been found to be in contravention of the last clause and have therefore been confiscated.

PATENTS.

Margarine; Manufacture of — [addition of bananas]. H. A. Snelling. London. Eng. Pat. 8279, April 14, 1908.

To every 1 cwt. of margarine are added 15 lb. of banana fruit, 2 drms. of banana essence, or 9 drms. of banana oil; where two or more of these banana constituents are employed, the quantity of each is proportionately reduced. The addition is made at the point where the fat is churned with milk; the temperature of the mixture is raised until the whole is fluid, and it is then cooled while being constantly stirred. The bananas are prepared by peeling the fruit, soaking it in water for 12 hours, and then drying and grinding it to a powder. The bananas may be baked or boiled before use.—W. P. S.

Wheat flour; Recovery of starch and protein from —. E. A. V. Klopfer, Dresden, Saxony. Eng. Pat. 19,726. Sept. 19, 1908. Under Int. Conv., Oct. 4, 1907.

In Eng. Pat. 11,159 of 1907 (this J., 1907, 1289) a saline solution was claimed for the purpose of loosening or opening up the cellular tissue of the flour. In the present invention, the structure of the protein cells is loosened by the action of an aqueous extract of green malt or malt flour, and the denaturing action of the salt is avoided. The proportion generally used corresponds to 1—3 parts of dry malt substance per 100 parts of flour, the action being carried out at the ordinary temperature, in presence of about 140 lb. of water. The action of the malt extract is due to the proteolytic enzymes contained therein, and other proteolytic extracts, e.g., papain, may be substituted for the malt. The starch is then separated by centrifugal action.—J. F. B.

Flour; Apparatus for preparing gaseous mixtures for bleaching — and similar operations. J. A. Wesener. Chicago, U.S.A. Eng. Pat. 27,218, Dec. 15, 1908. Under Int. Conv., May 14, 1908.

THE invention relates to apparatus for diluting nitrosyl chloride with air in order to form a bleaching agent for flour (see U.S. Pat. 863,684 of 1907; this J., 1907, 1025). A pump supplies a current of air at a pressure lower than that at which the nitrosyl chloride escapes from its reservoir; the escape of the nitrosyl chloride is regulated by a valve which is raised automatically by the working of the pump. The movement of the valve is capable of minute adjustment so that the quantity of nitrosyl chloride escaping at each movement can be regulated exactly.—W. P. S.

Milk; Process of pasteurising —. J. Willmann, Shelton, Conn. U.S. Pat. 913,600, Feb. 23, 1909.

A CONTINUOUSLY flowing body of milk is maintained at a temperature of from 140° to 152° F. for such a length of time as will suffice to kill the bacteria present without coagulating the albumin of the milk. The milk is then cooled.—W. P. S.

Butter manufacture. E. Schou, London. U.S. Pat. 913,920, March 2, 1909.

SEE Eng. Pat. 5810 of 1908; this J., 1908, 872.—T. F. B.

Wheat flour; Process for extracting starch and gluten from —. F. A. V. Klopfer. Fr. Pat. 394,802. Sept. 30, 1908. Under Int. Conv., Oct. 4, 1907.

SEE Eng. Pat. 19,726 of 1908; preceding.—T. F. B.

Desiccating yeast. Eng. Pat. 3166. See XVII.

(B.)—SANITATION; WATER PURIFICATION.

Lead water pipes; Action of impure surface-water on —. K. Aschoff. Z. öffentl. Chem., 1909, 15, 93—94.

THE author has recently examined a lead water-pipe which had lain for some 15 years in a sandy clay soil. The outside of the pipe was very corroded and yielded considerable quantities of lead, chlorine, nitric acid, and traces of ammonia when treated with hot water. The surrounding soil had a feeble alkaline reaction, was saturated with impure surface-water, and contained

appreciable quantities of lead derived from the pipe. Whilst most of the compounds formed by the action of the wet soil on the lead pipe were soluble and were consequently removed as the water percolated slowly through the soil, some lead carbonate was present on the pipe. The author considers that where it is necessary to employ lead pipes in such soils, the pipes should be coated with asphaltum.—W. P. S.

PATENTS.

Furnaces for destroying refuse. W. P. Hayes, West Bridgford, Notts. Eng. Pat. 9031, Apr. 25, 1908.

The furnace consists of a number of combustion chambers above which are placed drying chambers in which the refuse is dried before it is admitted to the actual furnace. The refuse is contained in a chamber at the top of the furnace, from which it is delivered by measuring hoppers into the drying chambers; a hot air channel is provided along the front of the drying chambers and openings in the wall between this channel and the chambers allow hot air to mingle with the refuse. The bottom of the drying chamber is shaped like a hopper, and by means of sliding doors, worked from the outside, the charge of dry material is admitted to the furnace proper, a fresh supply of refuse being admitted, in a similar manner, to the drying chambers. The hot air channel is in connection with the ashpits of the furnaces to which a forced draught of air is supplied.—W. P. S.

Water; Purification and clarification of —. W. McMurtrie, New York. U.S. Pat. 913,034, Feb. 23, 1909.

The process consists in adding to the water, equivalent quantities of calcium acid phosphate and a basic substance, so as to produce a precipitate of bicalcium phosphate.—W. P. S.

Water; Process of purifying —. H. Korten, Assignor to F. Y. Nichols, Chicago, Ill. U.S. Pat. 913,827, Mar. 2, 1909.

The process relates to the purification of feed water. The water is caused to flow through a tortuous passage between electrodes in order to precipitate the soluble impurities. The precipitate is drawn off, and the water is then passed through mercury so as to remove any of the precipitate which remains in suspension in the water.—W. P. S.

(C).—DISINFECTANTS.

Cresol soaps; Valuation of solutions of —. O. Schmatolla. (Chem.-Zeit., 1909, 33, 284.

The author points out that the use of acetic acid in determining the amount of water in cresol soaps proposed by Spaltcholz (this J., 1909, 256) had already been tried by him (Pharm. Zeit., 1903, No. 56), but that the different behaviour of different preparations of about the same percentage composition, and the fact that they are prepared from alkaline, neutral, or acid soaps render the process purely empirical. The author's method of analysis (this J., 1903, 885), however, is sufficiently rapid and gives very accurate results. The solvent power of a soap for cresol is best obtained from a determination of the amount of fatty acids. In order to obtain a clear solution miscible in all proportions with water, at least 19 parts of fatty acids to 50 parts of anhydrous cresol are required. If the soap was neutral, very concentrated aqueous solutions of the product solidify to a clear gelatinous mass. Too great an excess of fatty acids, as, e.g., in lysol, which contains 30 per cent., is a drawback for surgical use, since the instruments become coated with a thin film of soap. The old *liquor cresoli saponatus*, which contained about 21 per cent. of linseed oil fatty acids, gave the best results. The oil ought to be freshly saponified, however, with strong (about 25 to 33 per cent.) potassium hydroxide lye, to form a neutral soap. In concentrated solution this dissolves cresol very rapidly, and the requisite water is added subsequently. This method ensures the cresol being present in a free and active condition, and not in the form of potassium cresylate, which gradually becomes inactive.—C. A. M.

XIX.—PAPER, PASTEBOARD, &c.

Electrolytic bleaching of cellulose; comparison with the bleaching effect of bleaching powder solution. B. Fraass. Papier-Fabrikant, 1909, 7, 232—235, 257—260.

The experiments were carried out on a small scale in two vessels of the same capacity. Sulphite wood pulp was used as the material to be bleached; in one vessel it was bleached by bleaching liquor produced by the electrolysis of a solution of common salt and in the other vessel by the liquor produced by dissolving bleaching powder. The experiments were performed side by side in order to assist the comparison of the bleaching effects of the two liquors, and a common temperature was maintained. The results show that the electrolytic liquor, whether acid or alkaline, gives a better white than a solution of bleaching powder containing the same amount of chlorine per litre.—S. H. H.

Cellulose for technical purposes; Preliminary treatment of —. E. Berl. Z. ges. Schiess- und Sprengstoffw., 1909, 4, 81—83.

ALTHOUGH the molecular weight of cellulose cannot be determined, it is generally admitted that the viscosities of its solutions under comparative conditions vary in the same sense as its molecular complexity, and that the lowering of viscosity produced by chemical treatment corresponds to a depolymerisation of the cellulose. In technical operations the preparation of solutions of moderate concentration with moderate viscosity is frequently desirable, and the molecular weight of the original cellulose must be suitably reduced. Such depolymerisation may take the form of a separate preliminary treatment, as in the case of mercerisation prior to solution in cuprammonium, or regulated hydrolysis prior to acetylation, or it may proceed simultaneously with the reaction adopted for the conversion of the cellulose into a soluble derivative, as in the preparation of soluble pyroxylin by nitration at elevated temperatures. The former principle possesses the advantage of being capable of more exact control than the latter. In addition to the caustic alkalis and mineral acids, oxidising agents, such as bleaching powder, also attack the cellulose molecule, and depolymerisation accompanies the production of oxycellulose. A similar change also takes place when the cellulose is heated in presence of air at 100° C. The production of oxycellulose, however, has an undesirable effect on the mechanical properties of the product. In certain cases depolymerisation may be effected after the conversion of the cellulose into a soluble compound, as for instance, by heating a stabilised nitrate in presence of an inert gas at a temperature of 130° C. The regulation of the solubility or viscosity of a pyroxylin by increasing the temperature of the nitrating acid has the drawback of increasing the amount of the cotton which dissolves in and contaminates the acid. In Ger. Pat. 199,885 (this J., 1908, 937) a process was described for controlling the viscosity by a preliminary treatment of the cellulose, nitration being subsequently effected under the most favourable conditions. This treatment consists in heating the cellulose for a long time (e.g., 60 hours) at 100° C. in presence of a dry inert gas such as carbon dioxide or hydrogen. This treatment is under exact control and can be varied according to the condition of polymerisation of the original cellulose. In the artificial silk industry such a treatment is most advantageous for obtaining a strong flexible filament with economy of solvent and chemicals and increased output. It may substitute mercerisation in the cuprammonium process and hot nitration in the collodion process. In the preparation of sporting powders the preliminary treatment affords a more complete gelatinisation with less solvent; the process may also be adopted in the preparation of nitrocellulose for gelatinising nitroglycerin explosives.—J. F. B.

PATENTS.

Paper; Agent for use in sizing —. Curtius and Co., Duisburg, Germany. Eng. Pat. 25,183, Nov. 23, 1908. Under Int. Conv., July 15, 1908.

A MIXTURE of aluminium sulphate and magnesium sulphate in, say, equal proportions is used in place of pure aluminium sulphate in the sizing of paper.—C. A. M.

Wood-pulp and process for making same. C. Bache-Wüg, Berlin, N.H. U.S. Pat. 913,679, March 2, 1909.

"WOOD, in the form of blocks," is treated "with a solution of sodium chloride to soften (but not to remove) the lignin" it contains "to a substantial depth." The entire blocks are then ground up and the pulp thus obtained contains both treated and untreated fibres.—P. F. C.

Celluloid [non-inflammable], and process of making the same. W. J. Stevens, London. Eng. Pat. 4390, Feb. 26, 1908.

THE celluloid is prepared from a mixture of nitrocellulose, 150 parts, anhydrous zinc chloride, 100 parts; camphor, 70; amyl acetate (or an acetate of any alcohol that will not mix with water), 150; sodium carbonate, 15; all by weight. An alternative mixture consists of nitrocellulose, 150 parts; methylated spirit, 100 parts; zinc chloride, 100; camphor, 60; amyl acetate, 200; and sodium carbonate, 15. The machine in which the ingredients are mixed is heated and must be encased to prevent absorption of moisture from the atmosphere. Suitable pigments may be added to the mixture, and the above-mentioned proportions may be varied.—W. P. S.

Celluloid, horn, ebonite, etc.; Manufacture of a substitute for —. W. H. Story. First Addition, dated Sept. 29, 1908, to Fr. Pat. 353,995, May 5, 1905 (this J., 1905, 1081).

IN the preparation of condensation products of phenols and formaldehyde, the use of an accelerator of the reaction is claimed, for example alkalis and alkaline-earths and their salts, such as carbonates, phenolates, sulphophenolates, or their equivalents. When the reaction-product has attained the consistence of a thick fluid, it is poured into moulds in which it is maintained at a temperature below 100° C., for a sufficient time to allow the moisture to escape gradually. The gelatinous mass is then cautiously heated further until it is converted into a horny substance. Accelerators may also be added to the partially thickened mass in the second stage of the process. Lacquers may be prepared by the addition of alcohol or other solvent to the gelatinous mass before it is finally hardened.—J. F. B.

Cellulose products. Ger. Pat. 206,883. See V.

By-products from esparto grass. Fr. Pat. 395,250. See XII.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Cinchona alkaloids. IX. Oxidation of cinchona alkaloids to ketones. P. Rahe. Annalen, 1909, 364, 330—352.

THE author has obtained a ketone from several cinchona bases, thus supporting the view that the hydroxyl contained by them is of the nature of a secondary alcohol group. Cinchonidine was oxidised with chromic acid in the same way as, previously, cinchonine had been oxidised (this J., 1907, 1158). The substance produced from both alkaloids is cinchoninone, $C_{19}H_{26}ON_2$, m.pt. 126°—127° C. Quinine and quinidine by a similar oxidation process yield a ketone termed quinonine, $C_{20}H_{28}N_2O_2$, which is soluble in acids or alkalis, melts at 101° C., and has the rotation, $[\alpha]_D = +73.79^\circ$ in absolute alcohol at 23° C. Hydrocinchonine on oxidation yields hydrocinchoninone, $C_{19}H_{26}ON_2$. This substance crystallises from alcohol in bright yellow crystals, melting at 138° C.; $[\alpha]_D = +76.22^\circ$ at 19° C. The above ketones are being examined pharmacologically.—F. SUDN.

Essential oils. Ronre-Bertrand fils. Chem. Zentr., 1909, 1, 921—922.

Oil of linaloe seeds has an odour distinguishable from that of oil prepared from the wood of the tree, but it showed a slight dextro-rotation, whereas the latter is strongly laevo-rotatory. The oil from the seeds had the sp. gr. 0.8858 at 15° C.; $[\alpha]_D = +1.30^\circ$ at 20° C.; $n_D = 1.4655$ at 18° C.; acid value, 3.4; ester value, 30.9. It was

soluble in 1.5 vols. of 70 per cent., 2.25 vols. of 65 per cent., or 4 vols. of 60 per cent. alcohol. It contained methylheptenone, linalool, geraniol, nerol, and *l*-terpineol, its content of esters, calculated as linalyl acetate, being 10.8 per cent. *Grasse peppermint oil* had the characters shown in the following table:—

	Sp. gr. at 15° C.	d _D .	Menthol.	Menthyl acetate.
1907 oil, crude..	0.9210	—13.4'	Per cent.	Per cent.
1907 oil, rectified	0.9198	—17.6'	49.8	13.5
1908 oil, crude..	0.9156	—19.28'	53.5	13.7
1908 oil, rectified	0.9159	—16.50'	52.2	13.4
			54.9	13.3

Java patchouli oil.—The characters of eight different specimens of the oil of *Pogostemon patchouli* are shown in the following table. I. was obtained from fresh plants of the Singapore variety, cultivated in Java; II. and VIII. from dry plants of the same variety; III. was the first distillate and IV. the second distillate from fresh plants of the Java variety; V. was from dry plants of the Java variety; and VI. and VII. were from slightly and strongly fermented plants respectively of the same variety. Oils I. to VII. were distilled at Buitenzorg, Java, and VIII. by the author at Grasse.

	Sp. gr. at 15° C.	Optical rotation.	Saponif. value.	Saponif. value after acetylation.
I.	0.9662	—52.2'	2.7	20.7
II.	0.9677	—51.32'	0	12.5
III.	0.9112	+ 0.52'	4.1	33.4
IV.	0.9457	+15.18'	2.7	43.8
V.	0.9174	+ 3.24'	3.4	13.9
VI.	0.9217	+ 2.40'	2.7	34.1
VII.	0.9233	— 0.8'	2.1	32.1
VIII.	0.9888	—65.4'	3.5	24.3

I. dissolved to a clear solution in $\frac{1}{2}$ vol. or in 5 vols. or more of 90 per cent. alcohol, but between these limits yielded a turbid liquid. II., V., and VII. were soluble in 8 vols. of 90 per cent. alcohol, III. in 8.5 vols., and VIII. in $\frac{1}{2}$ vol. of 90 per cent. alcohol. IV. yielded a clear solution with $\frac{1}{2}$ vol. or with 3.5 vols. of alcohol, but a turbid liquid between these limits. VI. dissolved to a slightly opalescent solution in 12 vols. of 90 per cent. alcohol. *Oil from white Bulgarian roses* had the sp. gr. 0.8723 at 15° C., optical rotation, —2° 54'; saponification value, 11.14 (corresponding to 3.9 per cent. of citronellyl acetate); saponification-value after acetylation, 22.24 (corresponding to 7.44 per cent. of alcohols of the formula, $C_{10}H_{20}O$). The oil became solid at 14° C.; it was soluble in an equal volume of 90 per cent. alcohol and from the solution a solid paraffin hydrocarbon separated. The odour of the oil was somewhat inferior to that of the oil from red roses. *Ylang-ylang oil from Réunion* had the sp. gr. 0.9492 at 15° C., optical rotation, —30° 8'; esters (as linalyl acetate), 33.6 per cent.; total alcohols (as linalool), 40.3 per cent. It was soluble in 0.5—1 vol. of 90 per cent. alcohol, but the solution soon became slightly opalescent.—A. S.

Essential oils and the international congress for prevention of the adulteration of foods. E. Perrot. Chem. Zentr., 1909, 1, 933.

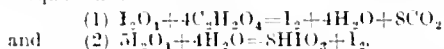
AT the congress held in September, 1908, under the auspices of the "Soc. univ. de la Croix Blanche de Genève," the following definitions were fixed. *Essential oils* are exclusively products of an extraction of the aromatic or odoriferous constituents of plants; they are given the names of the plants from which they are derived. *Oil of yellow sandalwood.*—The oil is obtained from yellow sandalwood (*Santalum album*, L.) by distillation with steam. It is colourless or light yellow, soluble in 5 parts of 70 per cent. alcohol at 20° C., and has the sp. gr. 0.975—0.985 at 15° C., and optical rotation, —10° to —20° in a 100 mm. tube. It must contain not less than 90 per cent. of santalol, and its saponification value must not be above 25. *Anise oil* is obtained from the fruits of *Pimpinella anisum* by distillation with steam. It

should have the sp. gr. 0.980–0.990 at 15° C., solidification point, 15°–19° C., and should not be dextro-rotatory (α =about -1° 50' in a 100 mm. tube). Star-anise oil which differs only in odour and taste must not be substituted for anise oil. "*Fruit essences*" must be products, in the pure condition or in alcoholic solution, obtained from the plants whose names they bear. If the essence is obtained from more than one plant, it must be termed a "compound essence," and bear the name of its chief constituent. Essences prepared from or containing synthetic products must be termed "artificial fruit essences."—A. S.

Iodine dioxide. M. M. Pattison Muir. Chem. Soc. Proc., 1909, 26, 88.

REFERENCE was made to the work of Millon, in 1844, and of Kämmerer, in 1861, on an oxide of iodine said to be composed of iodine and oxygen united in the ratio of 1:20, none of which work satisfactorily proved the existence of the compound.

The compound, IO_2 , or I_2O_4 , has been prepared by the dehydration and partial deoxidation of iodic acid by heating that acid with concentrated sulphuric acid. Two methods of analysing iodine dioxide were described. It was shown that the interactions of this oxide and oxalic acid, in the presence of sulphuric acid, at 100°, and with boiling water, are severally represented by the equations:



Iodine dioxide is a pale yellow, crystalline solid of specific gravity 4.2; it is decomposed at about 130° into iodine and oxygen. The molecular weight of the compound has not been determined. The reactions of the oxide with acids and with various reagents were described; in most of these interactions, iodine pentoxide and iodine are produced. Iodine dioxide is slightly soluble in cold concentrated sulphuric acid; 100 c.c. of the acid dissolve 1.54 grms. of the oxide at 15° to 20°. Inasmuch as iodine dioxide forms a compound with sulphur trioxide having the composition, $\text{I}_2\text{O}_4 \cdot 3\text{SO}_3$, the oxide has slightly basic properties. This compound is not decomposed by heating to 100°, but begins to give off iodine, oxygen, and sulphur trioxide at about 120°. Incidentally, it was shown that iodic anhydride and sulphur trioxide combine, when heated together at 100°, to form a compound which has the composition, $\text{I}_2\text{O}_5 \cdot 2\text{SO}_3$. The slightly basic characters of the two oxides of iodine emphasise the connexion between iodine and manganese.

Glycerophosphate of lime; U.S. Customs decision. Bd. of Tr. J., March 25, 1909. [T.R.]

GLYCEROPHOSPHATE of lime, which, though occasionally dispensed medicinally in its imported form, is almost always used in combination with other drugs in the preparation of elixirs, is not a medicinal preparation within the meaning of paragraph 67 of the Tariff, but is dutiable as a chemical compound under par. 3 of the Tariff at 25 per cent.

Monobromobenzene; Note on some commercial samples of —. J. H. Coste, Analyst, 1909, 34, 98–99.

A SAMPLE of so-called pure monobromobenzene, examined recently by the author, was found to have a somewhat wide range of boiling point, and to leave a crystalline residue when distilled to a temperature above the boiling point of the pure compound (155° C.). Another sample, also supposed to be pure, yielded fractions having very different boiling points. On re-distilling the fractions boiling between 153° and 159° C., a distillate boiling at 153°–154° C., and amounting to 80 per cent. of the volume of the original sample, was obtained. The lower-boiling fractions of the distillation contained unbrominated benzene, and a crystalline residue of dibromobenzene, amounting to about 3 per cent., remained in the distillation flask.—W. P. S.

Caffeine in coffee; Determining —. Lendrich and Notthohm. See XVIII.A.

Detecting glycerol. Denigès. See XII.

The sale of poisons. Times, April 1, 1909. [T.R.]

THE Poisons and Pharmacy Act, 1908, came into force on April 1st. The Privy Council has drafted regulations for the purpose of carrying Section II. into effect. This section empowers local authorities to grant licences under certain conditions to shopkeepers, other than registered chemists, to sell sheep dips, weed killers, insecticides, and the like. The draft regulations provide that in granting these new licences preference shall be given to nurserymen, florists, seedsmen, and other persons whose business is specially connected with horticulture. The local authority must be satisfied that the licensee is a fit and proper person to be entrusted with the sale of poisons. The licence is to be an annual one, the fee for which may not exceed 2s., and 2s. 6d. for renewal.

The regulations have not yet been approved, and in the meantime suggestions for their amendment have been submitted by various public bodies in the direction of making some provision for notification to the public of all applications for licences, and providing for the right of the general public to appear before the local authority with reference to the applications.

As regards Section V., by which, for the first time, conditions are made respecting the precautions which must be observed by retailers of sulphuric acid, nitric acid, hydrochloric acid, and the soluble salts of oxalic acid, the Privy Council is also empowered to make regulations other than those provided in the Act, but no further regulations have as yet been issued. The penalty for infringement of any of these provisions may not exceed £5.

PATENTS.

Sulphur compounds [Dithiodiglycollic acid, etc.]; Manufacture of —. T. S. Price, Birmingham. Eng. Pat. 9003, April 25, 1908.

DITHIODIGLYCOLLIC acid compounds or derivatives are prepared by subjecting to electrolysis the product of the reaction of a thiosulphate on a halogen acetic acid compound or derivative. Organic disulphides are prepared by treating a halogenised hydrocarbon or substituted derivative thereof with a thiosulphate, and subjecting the products to the action of an alkaline reagent. In particular, the *o*-, *m*-, and *p*-dinitrobenzyl disulphides are claimed, prepared by the action of sodium thiosulphate on the corresponding nitrobenzyl chlorides in dilute alcohol, and treating the products with sodium carbonate.—J. F. B.

Bacillus bulgaris culture; Method of preparing — for therapeutic purposes. C. Löloff, Breslau, Germany. Eng. Pat. 19059, April 25, 1908.

EIGHT parts of malt extract are dissolved in 92 parts of water, the solution is sterilised, cooled, and decanted from the sediment after the lapse of about 15 hours. The solution is filtered through a sterilised filter, again sterilised, and cooled to a temperature of about 45° C. The solution is then inoculated with a mixture of lactic acid bacilli, amongst which is contained *Bacillus bulgaris*, and the whole is kept at 45° C. for 15 hours. The *Bacillus bulgaris* develops rapidly, and prevents the other lactic acid bacilli from growing. The culture thus obtained is stored in small sterilised bottles.—W. P. S.

Salicylic acid derivatives; Manufacture of —. G. W. Johnson, London. From C. F. Boehringer und Söhne, Wadthof, Germany. Eng. Pat. 11,457, May 26, 1908.

WREN salicylic acid or one of its salts is treated with a condensing agent in quantity sufficient to split off only one molecule of water from two molecules of acid, salicylo-salicylic acid, $\text{C}_6\text{H}_4(\text{OH})\text{CO}_2\text{O}\text{C}_6\text{H}_4\text{COOH}$, is produced. This substance melts at 147–148° C., and crystallises from benzene in coarse crystals. It is soluble in hot alcohol and ether, and has therapeutic properties resembling those of salicylic acid. As condensing agents, phosphorus trichloride, phosphorus oxychloride, thionyl chloride, and others may be used.—F. SHOX.

Camphene; Process for preparing —. Act.-Ges. f. Anilinfabr. Ger. Pat. 206,386, Feb. 14, 1907.

GOOD yields of camphene are obtained by heating pinene hydrochloride with α - or β -naphthylamine at 180°—

200° C., for short periods, in open vessels. At higher temperatures the camphene produced is rapidly decomposed.—T. F. B.

Oxidation of organic compounds; Process for the — by means of compounds of nitric acid with aldehydes or ketones. A. A. Schukoff. Ger. Pat. 206,695, June 16, 1907.

THE compound to be oxidised is treated, at the ordinary temperature, or with moderate heating, with compounds of nitric acid with aldehydes or ketones, either alone or in presence of nitric acid. These compounds are prepared by dissolving the aldehyde or ketone (cinnamic aldehyde, camphor, menthone, benzaldehyde, acetophenone) in nitric acid, in molecular proportions or in presence of a slight excess of the acid, then cooling the solution, and separating the resulting crystals by suction.—A. S.

Cotarnine cholate; Process for preparing —. F. Hoffmann-La Roche und Co. Ger. Pat. 206,696, Sept. 29, 1907.

COTARNINE cholate is obtained by the interaction of molecular quantities of cotarnine and cholic acid in the cold, in presence of a suitable solvent such as water; it is readily soluble in water and alcohol, but insoluble in benzene and petroleum spirit. It melts at 118°–120° C., with decomposition.—T. F. B.

Bismuth salts of bromine substitution products of catechol; Process for preparing —. Chem. Fabr. von Heyden A.-G. Ger. Pat. 207,544, April 11, 1908.

THE bismuth salts of di-, tri-, or tetra-bromo-catechol are obtained by the usual methods for preparing organic salts; they are tasteless and odourless, and when taken internally, do not cause the burning sensation which is felt with the bismuth salt of tribromophenol (xeroform). All these compounds are for use as substitutes for iodoform.—T. F. B.

Hexamethylenetetramine and mercuric salts; Manufacture of soluble compounds of —. A. Busch, Brunswick, Germany. Eng. Pat. 4712, March 2, 1908.

SEE Ger. Pats. 196,060 and 204,932 of 1907; this J., 1908, 833; 1909, 161.—T. F. B.

Formates and oxalates; Manufacturing —. W. A. Dyes, Manchester. From A. Hempel, Leipzig, Germany. Eng. Pat. 4897, March 4, 1908. Addition to Eng. Pat. 3429, Feb. 15, 1908.

SEE Fr. Pat. 389,038 of 1908; this J., 1908, 958.—T. F. B.

Hydroxyarylgarsenoxide and arsenophenol. P. Ehrlich and A. Berthelm, Frankfurt, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pats. 907,978, Dec. 29, 1908, and 909,380, Jan. 12, 1909.

SEE Ger. Pat. 206,456 of 1907; this J., 1909, 327.—T. F. B.

Homologues of p-aminophenylarsinic acids; Manufacture of —. L. Benda, Frankfurt, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 913,940, March 2, 1909.

SEE Eng. Pat. 14,937 of 1908; this J., 1909, 107.—T. F. B.

Phosphoric acid; Official preparation of —. J. Nicolaidi, Paris. U.S. Pat. 914,175, March 2, 1909.

SEE Eng. Pat. 15,118 of 1905; this J., 1906, 608.—T. F. B.

Alpha-halogen-isovalerylurea and process of making the same. E. Saam, Assignor to Knoll und Co., Ludwigshafen on Rhine, Germany. U.S. Pat. 914,518, March 9, 1909.

SEE Eng. Pat. 942 of 1907; this J., 1907, 1163.—T. F. B.

Animal serum; Obtaining —. R. H. Deutschmann, Hamburg, Germany. U.S. Pat. 914,644, March 9, 1909.

SEE Eng. Pat. 17,825 of 1906; this J., 1907, 487.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic development; The retarding action of bromides on — as a colloid-chemical process. Lippocramer. Z. Chem. Ind. Kolloide, 1909, 4, 92—94.

WHEN over-exposed photographic plates are developed (with ferrous oxalate, glycin, metol, etc.) in presence of large quantities of soluble bromides, the resulting image is a clear grey in colour, instead of the normal black. If these negatives be fixed in solutions of silver bromide in sodium thiosulphate, to which potassium metasilphite has been added, the image is greyish white, whereas the image of a normally exposed plate, developed without the use of bromide, is black; the former is also much more readily dissolved by acid solutions of ammonium persulphate, the normal image being very slowly attacked. It is also found that silver bromide precipitated from aqueous solutions, when reduced with ferrous oxalate in presence of bromide, gives a brighter silver than when bromide is absent. These observations tend to show that the retarding action of bromides on development is a colloid-chemical rather than a purely chemical action. (See this J., 1908, 959, 1041).—T. F. B.

PATENTS.

Photo-engraving or photo-etching; Preparation of surfaces suitable for —. A. Payne, Whitley Bay. Eng. Pat. 28,415 of 1907. Date of application, June 22, 1908.

A METAL plate is coated with a protective layer of collodion, bitumen, resin, etc., and then with a sensitive emulsion. After exposure and development of the image, and reversal if necessary, the plate is treated with a solution of bichromate and washed, the exposed portions of the protective coating being then dissolved away. The plate is now ready for etching in the usual manner.—T. F. B.

Screens or coloured surfaces for colour photography; Manufacture of —. L. Dufay, Chantilly, France. Eng. Pat. 11,698, May 29, 1908. Under Int. Conv., June 4, 1907.

THREE bichromated gelatin films are exposed behind suitably ruled or dotted screens, developed, stained with the three colours desired for the ultimate screen, and then coated with some black fatty ink, which only adheres to the colourless portions of the films. A gelatin-coated surface is applied to one of these films, and the print is coated with an alcohol varnish; when the varnish is dry, the print is treated with a solvent, such as turpentine oil, which will remove the varnish-coated ink lines. The print will now consist of a series of coloured lines covered by varnish, and a series of transparent lines with no covering. It is then applied to each of the other films in the same way, and varnished as above, the lines in each case being at a suitable angle to the existing lines, so as to produce a three-colour screen, which is finally cleared of varnish.—T. F. B.

Toning reagents and processes for toning photographic prints. H. E. Smith, London. Eng. Pat. 12,341, June 6, 1908. Addition to Eng. Pat. 22,218, Oct. 8, 1907 (see this J., 1908, 1178).

PHOTOGRAPHIC prints on gelatino-chloride or albumin papers are fixed, with or without previous washing or treatment with salt solutions, in solutions of sodium thiosulphate, ammonia, or sodium sulphite, and then toned in solutions of thionolylates or thionogstates. They are then washed, and, if desired, treated with ammonia solution. The tones obtained are purple-brown to black.—T. F. B.

Photographic silver prints into pigment prints; Process for converting —. Neue Photographische Ges. Ger. Pat. 207,319, April 20, 1907.

SILVER bromide prints are coated with a layer of pigmented gelatin, and the resulting sheet is treated with a solution of an alkali bichromate and ferricyanide and potassium

bromide, when it can be developed (see Eng. Pat. 17,067 of 1905; this J., 1906, 655). The silver print can be coated with the pigmented gelatin before fixation, in which case the silver is dissolved out of the combined film after the treatment. If desired, the gelatin may be pigmented in differently coloured areas, so as to give a print in several colours.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Cellulose and nitrocellulose from Agave. A. Carneiro. Z. ges. Schiess- und Sprengstoffwesen, 1909, 4, 103—105.

ANALYSES are given of fibres obtained from the flower stem of various species of *Agave*. The cellulose content varied from 71.4 to 80.6 per cent., and the ash from 2.64 to 2.80 per cent. Samples of the fibre were finely divided, purified by boiling with sodium carbonate, and then bleached. The dried material was nitrated with acid mixtures, consisting of strong sulphuric acid and nitric acid in proportions varying from equal quantities of these acids to from 2 to 3 parts of sulphuric acid and 1 part of nitric acid. The nitrogen content of the resulting nitrocellulose varied from 11.5 to 12.4 per cent.

—G. W. McD.

Detecting and determining chlorates. Virgili. See VII.

PATENTS.

Explosive compound and process of producing the same. G. Izinsky, New York. U.S. Pat. 909,915, Jan. 19, 1909.

A FINELY powdered mixture of about 2 parts of rosin and 1—3 parts of a cereal, such as wheat, is mixed with just sufficient nitric acid of 36°—42° B. to yield a porous cake, which is dried and finely pulverised. If necessary the reaction is started by the application of heat. To one part of this nitrated product, which is non-explosive, and contains 20—50 per cent. of matter soluble in water, 3 parts of potassium chlorate are added, and sufficient water to form a homogeneous mixture, which is moulded into sticks, cakes, grains, or the like, and then dried. As the product is not resistant to water, the dried sticks, etc., are coated with paraffin wax or similar substance.

—A. S.

Explosives; Manufacture of —. W. H. Palmer. Fr. Pat. 394,833, Oct. 2, 1908.

THE claim is for a non-hygroscopic, stable, powerful, and rapid explosive suitable for use in mines, containing 50 per cent. of ammonium perchlorate, 14 of dinitrotoluene, 31 of sodium nitrate, 5 of aluminium powder, and 5 per cent. of paraffin wax of melting point not less than 48° C. The sodium nitrate may be replaced by an equivalent quantity of potassium nitrate. The proportions of the ingredients may be varied, but those given are recommended. The rapidity of action may be increased by adding a small quantity of charcoal.—J. W. G.

Matches; Process whereby oily or resinous woods or those having a close texture may be used in the manufacture of —. A. Thielenberg. Fr. Pat. 394,870, Sept. 26, 1908.

It is proposed to treat woods, that are unsuited for direct impregnation with paraffin, by immersing the splints held by their "head" ends in alkaline, acid, or other baths of a kind and strength determined by the kind of wood. It is claimed that by this means the wood is freed from resinous matter and softened.—J. W. G.

Gunpowder. C. P. H. Claessen, Berlin. U.S. Pat. 914,113, March 2, 1909.

SEE Addition of Aug. 30, 1906, to Fr. Pat. 364,413 of 1906; this J., 1907, 167.—T. F. B.

Treating cellulose. Berl. See XIX.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Quartz combustion tubes; Use of — especially for the direct determination of carbon in steel. B. Blount and A. G. Levy. Analyst., 1909, 34, 88—95.

TUBES of clear quartz (silica) were found to be well-suited for use in organic combustions, and to be much longer-lived than glass tubes. Silica withstands the action of copper oxide, lead chromate, etc., very well unless the temperature be excessive; at about 900° C., however, copper oxide attacks and destroys quartz tubes. The tubes are also suitable for the determination of oxygen in copper by fusion in hydrogen; the authors heat the tube electrically by passing a current of suitable strength through a long strip of platinum, or iridium-platinum, which is wound round the tube and surrounded by a coating of asbestos cloth. For the determination of carbon in steel, the quartz tube was surrounded by two separate sections of stout iridium-platinum foil at a short distance from each other, each section being enclosed in two fireclay semi-cylinders which, in turn, were covered with asbestos cloth. The sections were so wired, that the current could be passed through either section, or both. The steel to be analysed was placed in a boat surrounded by a piece of iridium-platinum foil rolled into the form of a tube in order to prevent injury to the quartz by the sparks of oxidised metal. The boat itself was protected from the action of the burning steel by placing a layer of ignited alumina in the bottom. Since steel, when burning in oxygen, suddenly absorbs a large quantity of oxygen, means have to be provided for supplying a sufficient quantity of the gas at the moment that it is required. For this purpose, the supply of oxygen to the combustion tube is passed through a Y-tube, one arm of which communicates through a trap with the open air. The oxygen is passed into the tube at such a rate, that, before the steel begins to burn, a portion escapes into the air, the rate of the gas passing through the potash bulbs at the other end of the combustion tube being controlled by the action of an exhaust pump. When the steel burns, the escape of oxygen into the air ceases, and air itself is drawn into the combustion tube, mixing with the oxygen and passing through the same purifying apparatus. The oxidation of the carbon monoxide evolved during the combustion, is effected by packing the exit end of the combustion tube with a mixture of platinised quartz and platinum scrap, and a supplementary supply of oxygen is admitted to this end of the tube through a side tube which ends just in front of the oxidising mass. A piece of silver foil, placed just before the boat, protects the rubber stopper from the intense radiation characteristic of quartz tubes. The results obtained agree well with each other, and differ by less than 0.02 per cent. from those given by the solution method.—W. P. S.

Nickel crucible for the determination of carbon in steel. H. E. K. Ruppel. J. Ind. and Eng. Chem., 1909, 1, 184—187.

THE author recommends the use of a nickel crucible instead of a platinum one. The crucible described, is of a somewhat similar kind to the platinum crucible of Shimer (see this J., 1899, 863), being provided with a water-cooled bronze cover and a separate bronze water-jacket round its upper part. The results obtained agree closely with those obtained by use of a platinum crucible.—A. S.

INORGANIC—QUALITATIVE.

Detecting chlorates. Virgili. See VII.

INORGANIC—QUANTITATIVE.

Silver; Determination of — as silver chromate. F. A. Gooch and R. S. Bosworth. Amer. J. Sci., 1909, 27, 241—244.

THE authors have shown previously (this J., 1908, 838) that chromium may be determined as silver chromate, and they now give the conditions under which silver is precipitated quantitatively, as silver chromate, from its solutions.

By adding potassium chromate solution to silver nitrate solution, and boiling the mixture, the silver is precipitated completely; the precipitate may be collected on a filter directly, or dissolved in ammonia, and re-precipitated by evaporating the solution to a volume of about 15 c.c. This treatment yields a crystalline precipitate which filters readily. In either case, the precipitate is washed first with dilute potassium chromate solution, and then with the minimum quantity of water, before being dried and weighed. Potassium bichromate cannot be used as the precipitant, as a small proportion of the silver present remains in solution. Should the silver nitrate solution contain free nitric acid, sufficient potassium chromate must be added to take up the nitric acid with formation of bichromate, as well as to form the silver salt.—W. P. S.

Uranium; Speed of oxidation, by air, of uranous solutions, with a note on the volumetric determination of —.
H. N. McCoy and H. H. Bunzel. *J. Amer. Chem. Soc.*, 1909, **31**, 367—373.

THE simplest volumetric method for the determination of uranium, is to convert the uranium into uranyl sulphate, reduce it with zinc and sulphuric acid to uranous sulphate, and titrate with standard potassium permanganate. The determination is, however, complicated by the rapidity with which uranous solutions oxidise in air and by the fact that the reduction with zinc and sulphuric acid generally goes somewhat beyond the uranous stage, 1 or more per cent. being reduced to the tervalent form. It was found that the over-reduced uranium was very rapidly oxidised by air to the uranous state, but further oxidation proceeded at a slower rate and was greatly retarded by the presence of an excess of sulphuric acid. In ordinary practice the amount of sulphuric acid in the reduced solution, diluted with the wash water, is equivalent to about 1.5N. At 25° C. such a solution, saturated with air, would oxidise at the rate of about 0.3 per cent. per minute. If, however, 3N-sulphuric acid be used instead of water to wash the zinc and to dilute the solution, the oxidation of the uranous salt by the air is practically negligible, while the over-reduced salt is entirely converted by the air into the uranous condition. The separation of uranium from the elements which usually accompany it in minerals is probably best accomplished by precipitating it as phosphate.
—F. R.

Thallium; Volumetric determination of —. W. J. Müller. *Chem.-Zeit.*, 1909, **33**, 297—298.

THE author shows that thallium can be determined volumetrically with great accuracy by a combination of two previously suggested methods. The solution containing the thallium in the thallous condition is first titrated with permanganate in presence of hydrochloric acid according to Wilm's method (see Marshall, this J., 1900, 994). Either the permanganate must be standardised with metallic thallium, or 0.4 per cent. must be deducted from the result to compensate for the action of the hydrochloric acid on the permanganate (compare this J., 1908, 247), if the latter has been standardised with oxalic acid. After the titration, the solution is boiled to destroy the excess of permanganate, and the thallium determined iodometrically by the method of Thomas (this J., 1902, 501), the titration with permanganate replacing the oxidation with potassium chlorate and hydrochloric acid described by that author. The percentage of thallium is taken as the mean of the values obtained in the two titrations.—A. S.

Analysis of magnesite. Determining small quantities of calcium in presence of much magnesium. Hundeshagen. See VII.

Determining chlorates. Virgili. See VII.

Reducing action of electrolytic hydrogen on arsenious and arsenic acids. Thomson. See VII.

Ferrous iron in magnetite. Gage. See X.

Gold in copper bullion. Hunt. See X.

Silver in gold bullion. Taylor. See X.

Temperature of lead button in cupellation. Bradford See X.

Iron in brasses and bronzes. Bregowsky and Spring. See X.

Nitrates in soil solutions. Syme. See XV.

PATENT.

Phosphoric acid; Estimation [Determination] of — [in urine]. R. Weiss. London. Eng. Pat. 9725, May 5, 1908.

TEN c.c. of the urine and 3 c.c. of "ammonia-magnesia" solution are mixed in a tube, and the volume of the precipitate formed is read off at the end of 24 hours, one end of the tube being narrow and graduated for this purpose. The volume of the precipitate is a measure of the phosphoric acid in the urine.—W. P. S.

ORGANIC—QUALITATIVE.

Reducing sugars; Reagent for the detection of —. S. R. Benedict. *J. Biol. Chem.*, 1909, **5**, 485—487.

It has been shown that for the detection of dextrose a copper solution which is made alkaline with sodium carbonate is more delicate and specific than the solutions more generally used containing sodium hydroxide. The reagent of this nature previously suggested (this J., 1907, 1102), containing copper sulphate, Rochelle salt, and sodium carbonate, is highly satisfactory when fresh, but rapidly deteriorates and becomes useless. This fault has been overcome by using a solution containing 17.3 grms. of copper sulphate, 173 grms. of sodium citrate, and 100 grms. of sodium carbonate (anhydrous), with distilled water to make 1000 c.c. This reagent is more sensitive to dextrose, either in pure solution or in urine, than Fehling's solution and is not reduced by uric acid. It is also highly permanent, as samples of the solution kept for a year in partially filled bottles, exposed to light and heat, had not suffered spontaneous reduction nor were they reduced on being heated for 24 hours in a bath of boiling water. Freshly prepared Fehling's solution on being heated in the same way showed a marked precipitation in three hours, and the precipitate increased with further heating. Since the new solution contains no strongly dehydrating agent, the reduction product is frequently yellow or green, rather than red, as in Fehling's test. The solution is used in the same way as Fehling's solution, but it is desirable to boil for from one to two minutes and then allow the tube to cool.
—J. A.

Detecting glycerol. Denigès. See XII.

Caramel in wine, etc. Jägerschmid. See XVII.

ORGANIC—QUANTITATIVE.

Sampling coal. Bailey. See II.

Sulphur in coal and coke. Holliger. See II.

Weighting in silk. Heermann. See V.

Sugar in bagasse. Prinsen-Geerligs. See XVI.

Determining sucrose and maltose. Pieraerts. See XVI.

Sulphurous acid in wine. Blarez and Chelle. See XVII.

Butter fat and coconut oil. Monhaupt. See XVIII.A.

Caffeine in coffee. Lendrich and Nottbohm. See XVIII.A.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Chemical change; Influence of moisture on —. H. B. Baker. *Chem. News.*, 1909, **99**, 126—127.

A SUMMARY is given of the chemical actions which have been shown to be dependent on the presence of moisture. Ionisation is also effective in causing chemical action. Mercury vapour under ordinary conditions contains only

atoms which exhibit little tendency to combine with oxygen. In the mercury vapour lamp, however, the mercury vapour is ionised, and when the current is cut off and oxygen admitted, the mercury becomes covered with a layer of mercuric oxide. This ionisation is regarded as the splitting off of an electron from the atom as distinct from a molecule and the charged atom then enters into union with oxygen. The combustions of carbon bisulphide and of cyanogen in oxygen which are apparently unaffected by the absence of moisture are due to the formation of charged atoms capable of direct union with oxygen when these gases are heated, both being readily broken up into their elements. Radium bromide which is able to produce ionisation in very dry air does not cause chemical action between mixtures of hydrogen and oxygen or carbon monoxide and oxygen. Hence ionisation cannot of itself produce chemical action, though it can increase the rate of union of two gases under conditions which would otherwise produce a slow chemical action. The reaction between nitrous oxide and hydrogen at 530° C. in presence of moisture, is quickened by the presence of lime, more so by the presence of thoria, while the gases in contact with radium bromide combine with explosion. In the absence of moisture, increasing the ionisation has no effect. The same gases dried in a tube containing thoria showed no combination when heated. When a small open tube of radium bromide was placed in a mixture of sulphur dioxide and sulphuretted hydrogen, the whole of the gases condensed in the tube in the form of sulphur and water. What happens is that the water vapour condenses in liquid drops on the ionised particles in the radium tube, and in these drops the reaction between the two gases is completed. In the other chemical changes at high temperatures, it is conceivable that condensation to some form approaching the liquid state might take place. If action is to take place, ions and water vapour (or some similar substance) must both be present in a mixture of gases.—E. F. A.

Crystallisation; Spontaneous——R. Marcelin. *Compt. rend.*, 1909, **148**, 631—633.

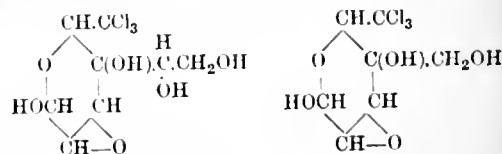
WHEN the temperature of a superfused liquid is decreased sufficiently, a certain number of centres of crystallisation are spontaneously formed at different points in the liquid. The spontaneous power of crystallisation is defined by the number of nuclei formed in unit time in unit volume. From a large number of experiments on lead acetate, the author concludes that, other things being equal, (1), the power of spontaneous crystallisation decreases with the total period during which the substance has been kept in the liquid state, but is independent of the number of crystallisations which divide this total period of fusion; (2), this power decreases with increase of the temperature at which the liquid has been maintained. The author ascribes the phenomena observed in respect of spontaneous crystallisation to the presence of suspended foreign particles (which undergo coagulation or the reverse process during fusion) on which the nuclei are formed. In certain cases he has observed particles at the centre of crystallisation, and he has also found that filtration decreases the number of nuclei, and that addition of particles of foreign matter increases them. Powdered zinc oxide, powdered manganese dioxide, and especially spongy platinum, inhibit supersaturation very strongly, whereas mercury, platinum in the massive state, and wood charcoal, have little effect; it appears therefore, that the added substance is more active in the powdered form (large surface and high curvature), than in mass. If crystals possess capillary tension, spontaneous crystallisation must be regarded as being very closely related to the condensation of vapours; the suspended foreign particles produce a true physical catalysis, the mechanism of which is probably explained by the theory of capillarity. Particles of gamboge which do not coagulate in potassium nitrate solution (and which, therefore, possess a low capillary constant in this medium) do not inhibit the supersaturation of this salt; colloidal silver, on the other hand, which does coagulate, inhibits supersaturation.—L. E.

Tyrosinase. A. Bach. *Ber.*, 1909, **42**, 594—601.

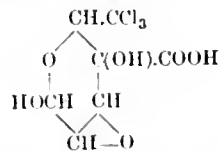
THE oxidising action of oxydases or the system, peroxydase hydrogen peroxide, is non-specific; it does not depend on the nature of the body oxidised, but merely on the presence of labile hydrogen groups. Tyrosine is not oxidised by such agents, but requires a specific ferment, tyrosinase. In order to explain this peculiarity, Gonnermann has suggested that tyrosinase is primarily not an oxidising, but a hydrolytic enzyme, and that the tyrosine is converted under its action into products of hydrolysis which are readily oxidisable (this *J.*, 1900, 1125). The author has tested this hypothesis in several ways but finds it quite untenable. Previous digestion of tyrosine, whether by tyrosinase in absence of air or by trypsin, had no effect on the specific reaction. Neither were synthetic mixtures of the possible products of hydrolysis of tyrosine affected by tyrosinase in such a way as to yield the characteristic black oxidation product. The author finds that in no case does tyrosine undergo the characteristic oxidation, whether in presence of peroxydase, hydrogen peroxide, or a plant extract, unless active tyrosinase be present. A purified neutral preparation of a peroxydase, with or without hydrogen peroxide, has a retarding influence on the oxidation of tyrosine by purified tyrosinase; this fact was established by quantitative determination, by the permanganate method. If the plant-extract or tyrosinase preparation contain a reducing or other inhibitive substance, the presence of peroxydase and hydrogen peroxide may produce a temporary accelerative effect on the oxidation, but subsequently the retarding influence of the peroxydase is manifested. Thus the action of tyrosinase is of a very different order from that of ordinary oxydases. Tyrosinase apparently belongs to a special class of oxidising ferments the oxidising action of which extends to bodies with less labile hydrogen groups.—J. F. B.

Chloralic acids. M. Hanriot. *Compt. rend.*, 1909, **148**, 487—489. (See also this *J.*, 1893, 372; 1894, 755).

THE author has already described, under the name of chloraloses, the compounds which he has obtained by the action of chloral on various hexoses and pentoses, and has shown that they correspond to formulae such as the following:—



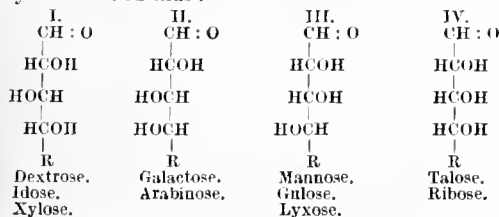
Two isomeric chloraloses are formed in the reaction and the author has isolated them in most cases. He now describes the following chloralic acids, obtained by oxidising the chloraloses with (1) potassium permanganate and sulphuric acid, (2) nitric acid:— α - and β -Dextrochloralic-, β -galactochloralic-, α - and β -arabinochloralic-, and β -xylochloralic acids. All these acids contain seven atoms of carbon; hence, in the case of the hexochloraloses, an atom of carbon must be split off in the form of carbon dioxide during oxidation. These acids should have the following constitution:—



β -Dextrochloralic and xylochloralic acids are identical, and the same applies to galactochloralic and β -arabinochloralic acids. The chloralic acid derived from mannose is immediately converted into the lactone when liberated from its salts, and unlike the above-mentioned acids, mannochloralic lactone contains eight atoms of carbon; it may be that the immediate formation of lactone, protects the side chain against further oxidation.—L. E.

Sugars; New method for determining the constitution of the —. M. Hanriot. Compt. rend., 1909, 148, 640—643. (See preceding abstract.)

THE stereoisomerism of the chloralic acids, apart from that due to the OHCH-group (which is derived from the aldehyde group of the sugar, and the isomerism of which is responsible for the existence of α - and β -chloraloses and chloralic acids) must be due to the 3 carbon atoms derived from the 3 CHOH-groups, adjacent to the aldehyde group in the original sugar. The sugars in question may be classified thus:—



In these formulæ, R represents a CH_2OH -group in C_5 -sugars, and a $\text{CHOH}-\text{CH}_2\text{OH}$ group in C_6 -sugars. The sugars belonging to any one group should give the same chloralic acid; the author has verified this for dextro- and xylochloralic acids (group I.) and for galacto- and arabinochloralic acids (group II.). The constitution of an aldopentose or aldohexose may thus be determined completely or partially. The sugar is combined with chloral, and the less soluble chloralose isolated; if this is identical with a chloralose already known, the question is determined. If the sugar is a new one, an examination of the chloralic acid derived from it, will show to which of the above groups the sugar belongs; this suffices to identify an aldopentose, and in the case of an aldohexose the choice is limited to two isomerides. For the identification of ketoses the method does not appear to be of much value.—L. E.

Cellobiose and its osone; Behaviour of — towards some enzymes. E. Fischer and G. Zemplen. Annalen, 1909, 365, 1—6.

THE authors have found that cellobiose (this J., 1902, 144), a disaccharide of dextrose, is easily hydrolysed by emulsin, but is not attacked by yeast extract, and thus resembles gentiobiose (*ibid.*, 1902, 1251) and isomaltose (*ibid.*, 1905, 1246), and somewhat resembles lactose. These results indicate that cellobiose, gentiobiose, and isomaltose possess the same configuration in respect of the coupling of the two dextrose residues, whilst maltose differs from them. If emulsin which decomposes β -glucosides, be assumed to be a specific reagent for the β -configuration, the three disaccharides decomposed by it may be regarded as dextrose- β -glucosides. The authors point out, however, that this assumption must not be regarded as beyond doubt; it involves the supposition that the same enzyme hydrolyses both alcohol-glucosides and dextrose-glucosides, and this cannot be proved by the use of complicated mixtures such as emulsin or yeast extract. Cellobiose is not hydrolysed by either extract of *Aspergillus niger*, or Kephir lactase. The authors prepared cellobiosone by a method previously described (Ber., 1902, 3141; this J., 1902, 1302); this compound is hydrolysed by emulsin to dextrose and dextrosone.—L. E.

Imperial College of Science and Technology. Times, April 5, 1909. [T.R.]

At a meeting of the governors of the Imperial College, held on April 2, it was decided, subject to the approval of the King in Council, to recognise the metallurgical department of the University of Sheffield as being in association with the Imperial College of Science and Technology for the advanced metallurgy of iron and steel, as provided for in the charter, Article V. The architect was instructed to prepare the necessary plans and quantities and to obtain tenders for the new building for mining, metallurgy, and geology to be erected in Prince Consort Road, and also to prepare plans for the extension of the engineering departments of the City and Guilds College in Exhibition

Road and Prince Consort Road. The erection of the new mining building is expected to begin almost at once, and steps are being taken in connection with the foundation-stone ceremonial.

Trade Report.

Mineral production of Canada in 1908. Eng. and Mining J., Mar. 13, 1909.

Product.	Quantity.	Value.
METALLIC.		
Copper	Lb. 64,361,636	\$8,500,885
Gold	Lb. —	9,550,274
Pig iron from Canadian ore	Tons. 99,420	1,664,302
Lead	Lb. 45,725,886	1,920,487
Nickel	Lb. 19,143,111	8,231,538
Cobalt	Lb. 1,853,286	112,253
Silver	Oz. 22,070,212	11,667,197
Total value, metallic	—	\$41,655,936
NON-METALLIC.		
Arsenic	Tons. 699	38,054
Asbestos	Tons. 65,534	2,547,507
Asbestic and asbestic sand	Tons. 25,239	25,829
Calcium carbide	Tons. 6,864	417,150
Chromite	Tons. 7,225	82,008
Coal	Tons. 10,904,466	25,567,235
Corundum	Tons. 1,039	100,389
Felspar	Tons. 7,877	21,099
Graphite	Tons. 251	5,565
Grindstones	Tons. 3,843	45,128
Gypsum	Tons. 340,964	575,701
Limestone for flux in iron furnaces	Tons. 418,661	289,705
Magnesite	Tons. 120	840
Mica	Tons. —	101,602
Mineral pigments—		
Barytes	Tons. 4,091	18,265
Ochres	Tons. 4,746	30,440
Mineral waters	Tons. —	109,391
Natural gas	Tons. —	1,012,080
Petroleum	Bbl. 527,987	747,102
Phosphate (apatite)	Tons. 1,596	14,794
Pyrites	Tons. 47,336	224,824
Quartz	Tons. 27,134	32,277
Salt	Tons. 79,975	378,798
Talc	Tons. 1,076	3,048
Tripolite	Tons. 30	195
Total value, non-metallic	—	\$2,479,006
STRUCTURAL MATERIAL AND CLAY PRODUCTS.		
Cement, natural	Brls. 1,044	815
Cement, Portland	Brls. 2,665,289	3,709,063
Flagstones	No. 4,000	3,600
Sand and gravel (exports)	Tons. 298,954	161,387
Sewer pipe	—	514,042
Clay products, stone, lime, &c., est.	—	8,500,000
Total structural and clay products ..	—	\$12,888,967
Estimated value of mineral products not reported	—	300,000
Total value, 1908	—	\$87,323,849

Mineral production of the United Kingdom in 1908. Bd. of Tr. J., Mar. 18, 1909.

I.—Output of minerals under the Coal Mines Regulation Acts.

	1907.	1908.
	Tons.	Tons.
Barium (compounds)	10,297	5,217
Coal	267,812,852	261,506,370
Clay and shale other than fire-clay and oil shale	320,989	292,981
Fire-clay	2,890,097	2,814,411
Igneous rock	146	404
Iron pyrites	7,394	7,212
Ironstone	8,236,118	7,890,814
Limestone	22,366	15,416
Oil shale	2,675,779	2,891,564
Sandstone (including "ganister") ..	128,103*	110,513*
Total	282,104,141	275,534,911

* The quantity of ganister obtained was 120,193 tons in 1907 and 106,477 tons in 1908.

II.—Output of minerals under the Metalliferous Mines Regulation Acts.

	1907.	1908.
	Tons.	Tons.
Barium (compounds)	30,343	32,074
Clay and shale	114,525	123,911
Gold ore	12,978	7,123
Gypsum	198,919	190,497
Igneous rock	69,871	67,627
Iron ore	1,802,946	1,549,469
Lead ore	31,304	29,097
Limestone	470,263*	500,517*
Rock salt	216,020	209,904
Sandstone	156,324†	195,568†
Slate	116,570	104,050
Zinc ore	20,082	15,189
Other minerals	117,819	99,371
Total	3,388,924	3,124,397

* Including 8,363 tons of calc spar in 1907 and 2,655 tons in 1908.

† Including 11,864 tons of ganister in 1907 and 7,922 tons in 1908.

The above figures do not represent the total production of the minerals. Large quantities of several important minerals, such as iron ore, limestone, sandstone, slate, clay, &c., are obtained from quarries under the Quarries Act and from other open workings, the returns from which are not yet available. The totals for coal, and the ores of copper, lead, and zinc may, however, be regarded as substantially complete.

New Book.

TABLES OF CASES OF INDUSTRIAL POISONING, FATAL AND NON-FATAL ACCIDENTS, AND DANGEROUS OCCURRENCES IN FACTORIES, WORKSHOPS, ETC., DURING 1908. [Cd. 4518.] Wyman and Sons, Fetter Lane, London, E.C. Price 1d.

THESE tables show the number of cases of poisoning, accidents, etc., which occurred in premises under the Factory and Workshop Act, during 1908. The total number of cases of poisoning was 727, and 40 deaths from poisoning are recorded: The figures for 1907 were 653 and 40 respectively. In 1908, there were 646 cases of lead poisoning, 10 due to mercury, 1 to phosphorus, and 23 to arsenic. With regard to fatal accidents, 23 occurred in the printing, dyeing, and bleaching industries; 6 in connection with glass; 45 in chemical industries, and 3 from explosives.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

6211. Martin. Filter presses and the like. March 16.
 6277. Wiart. Automatically superheating vapours. [Fr. Appl., March 16, 1908.]* March 16.
 6408. Boulton (Egyetemes Kiserlető Intézet Vegyészeti Orvosi). Lixivating crystalloids from parts of plants and other organic substances.* March 17.
 6533. Dieker (Oesterr. Chem. Werke, and Löwenstein). Fractional condensation of vapours.* March 18.
 6557. Kirkham, Hulett, and Chandler, Ltd., and Blake. Apparatus for cooling and condensing gases, vapours, etc. March 18.
 7154. Wiegand. Evaporating apparatus. March 25.
 7185. Kamm. Charging cylinders or steel bottles with oxygen and other gases. March 25.

COMPLETE SPECIFICATIONS ACCEPTED.

- 5969 (1908). Cottrell. Separating suspended particles from gaseous bodies. March 24.
 6036 (1908). Boulton (D'Arloux). Tunnel kilns. March 24.
 17,589 (1908). Langlet and Rinman. Method of producing pulverulent precipitates. March 31.
 18,956 (1908). Bromham. Centrifugal drying machines. March 24.
 27,473 (1908). Pauling. Simultaneously distilling and concentrating liquid mixtures. March 31.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

6163. Morris. Manufacture of artificial fuel. March 15.
 6167. Ernst. Cleaning gases. [U.S. Appl., April 15, 1908.]* March 15.
 6181. Jarrett (Graf). Manufacture of gas. March 15.
 6196. Harrop and Soper. Manufacture of incandescent gas mantles. March 16.
 6279. Zirfas. Coke ovens. March 16.
 6515. Schmidt. Purification of gases.* March 18.
 6556. Muller and Bonnet. Manufacture of incandescent gas mantles. [Fr. Appl., March 20, 1908.]* March 18.
 6845. Von Bauer. Coke ovens. [Comprised in No. 6575, March 24, 1908.] March 22.
 6936. Westinghouse Metal Filament Lamp Co. (Lederer). Manufacture of metallic filaments for incandescent electric lamps. March 23.
 7092. Heinrich. Manufacture of non-carbon incandescent filaments from refractory metals or their compounds.* March 24.
 7400. Gower. Production of semi-water gas. March 27.

COMPLETE SPECIFICATIONS ACCEPTED.

- 6191 (1908). King and Workman. Gas producer plant. March 24.
 6204 (1908). Stewart. Gas producers. March 24.
 6223 (1908). Coke-Ovens and By-Products Co., and Wellington. Coke ovens. March 31.
 13,753 (1908). Jabs. Gas producers. March 24.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATION.

7427. Coulson. Treatment of tar.* March 27.

COMPLETE SPECIFICATION ACCEPTED.

- 22,122 (1908). Thompson (Lingner). Manufacture of water-soluble compounds of the condensation products of wood tar and formaldehyde. March 31.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

- 6270 and 6272. Chem. Fabr. vorm. Sandoz. Manufacture of blue to violet dyestuffs of the gallocyanine series. [Ger. Appls., Sept. 24 and Oct. 31, 1908.]* March 16.
 6727. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of a monoazo dyestuff for chrome-mordanted wool. March 20.
 6728. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of yellow mono-azo dyestuffs. March 20.
 6831. Newton (Bayer and Co.). Manufacture of 1,8-diaminonaphthalene-4-sulphonic acid. March 22.
 6991. Johnson (Badische Anilin und Soda Fabrik). Manufacture of substituted phenylglycino-o-carboxylic acid compounds. March 23.
 6992. Johnson (Badische Anilin und Soda Fabrik). Manufacture of halogenated indigo colouring matters. March 23.

COMPLETE SPECIFICATIONS ACCEPTED.

- 11,867 (1908). Newton (Bayer und Co.). Manufacture of a sulphonic acid of celestine blue. March 24.

15,352 (1908). Imray (Soc. Chem. Ind. in Basle). Manufacture of permanent printing colours and their application in printing fabrics. March 24.

25,311 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. March 31.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

6486. Dean. Vats for dyeing and like purposes.* March 18.

6876. Meister, Lucius, and Brüning. Production of colour effects on textile fabrics. [Ger. Appl., March 27, 1908.]* March 22.

6975. Warburton. Appliances for bleaching or dyeing yarn in the cop, cheese, or other dense form. March 23.

7129. Castle. Material for use in textile and other manufactures. March 24.

COMPLETE SPECIFICATIONS ACCEPTED.

7605 (1908). Matter. Removal of lye from textile materials. March 31.

9432 (1908). Hall. Machines for scouring, bleaching, and dyeing fibrous materials. March 31.

12,416 (1908). Johnson (Badische Anilin und Soda Fabrik). Production of white or coloured resist effects on textile fibre. March 24.

13,020 (1908). Hart. Rendering ramie and other fabrics water-repellent and permanently colouring them. March 31.

14,337 (1908). Johnson (Badische Anilin und Soda Fabrik). Bowking material which has been dyed or printed with vat dyestuffs. March 24.

15,009 (1908). Vidal. *See under XIV.*

15,352 (1908). Imray (Soc. Chem. Ind. in Basle). *See under IV.*

19,216 (1908). Siefert-Schwab. Printing fabrics. March 24.

22,549 (1908). Bloxam (Chem. Fabr. Griesheim Elektron). Reserving woollen threads in dyeing union goods with sulphurised dyestuffs. March 31.

270 (1909). Cassella und Co. Dyeing union fabrics. March 24.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

6115. Peniakoff. Manufacture of bicarbonate of soda. March 15.

6294. Freeth. Manufacture of ammonium nitrate. March 16.

6411. Jones. Purifying and revivifying spent or waste lime.* March 17.

6415. Mackenzie. Concentration of sulphuric acid and apparatus therefor.* March 17.

6822. Pearlman and Pearlman. Recovering zinc compounds and ammonia.* March 22.

7125. International Salt Co., Ltd., and Tee. Purification or treatment of sodium nitrate or potassium nitrate. March 24.

7307. Sinding-Larsen and Ellestad. Manufacture of silicon nitride. [Appl. in Norway, March 27, 1908.]* March 26.

COMPLETE SPECIFICATION ACCEPTED.

22,029 (1908). Berry. Process for obtaining tartaric acid. March 31.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

6195. Higginbottom. *See under IX.*

6560. Weber. Manufacture of liquefiable masses from clays, porcelains, etc.* March 18.

6573. Boosé (Stern and Boosé). *See under XIII.A.*

7112. British Thomson-Houston Co. (General Electric Co.). Apparatus for treating refractory materials. March 24.

7293. Klein (Dard). System for disintegrating and cleansing clay, kaolin, etc. March 26.

COMPLETE SPECIFICATIONS ACCEPTED.

8049 (1908). Ford and Hill. Decoration of pottery, earthenware, china, etc. March 24.

23,968 (1908). Imray (Window Glass Machine Co.). Drawing glass. March 24.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

6195. Higginbottom. Treatment of cements, china clay, earths, ores, etc., in a granular form. March 16.

6299. Berglund. Manufacture of fireproof stone.* March 16.

6315. Cartwright and Cartwright. Artificial stone. March 16.

7197. Brearley and Moorwood. Manufacture of silica bricks and ganister. [Addition to No. 14,619 of 1908.]* March 25.

COMPLETE SPECIFICATION ACCEPTED.

15,556 (1908). Polifka and Hacker. Impregnation of wood. March 24.

X.—METALS AND METALLURGY.

APPLICATIONS.

6138. Steinweg. Soldering aluminium and metals rich in aluminium.* March 15.

6195. Higginbottom. *See under IX.*

6276. Norddeuts. Affinerie A.-G. Refining gold or gold alloys. [Ger. Appl., Sept. 21, 1908.]* March 16.

6461. Osborne and Carnegie. Apparatus for extracting sulphur dioxide and other gases from metal melting furnaces. March 18.

6529. Ruthenburg. Treatment of manganese and chromium ores containing iron.* March 18.

6684. Potter. Manufacture of nut iron, steel, or other metals. March 20.

6821. Reid. Separating and refining metals.* March 22.

6898. Batchelor and Batchelor. Detinning tin plate. March 23.

6993. Johnson (Chem. Fabr. Griesheim Elektron). Magnesium castings. March 23.

7014. Angel. Reduction of complex sulphide and other ores. March 24.

7101. Ford. Extraction of gold. March 24.

7340. Bennett. Apparatus for distilling mercury from gold amalgam. March 26.

7432. Ashcroft. Manufacture of aluminium.* March 27.

COMPLETE SPECIFICATIONS ACCEPTED.

5841 (1908). Sébillot and Maclaure. Extraction of gold from its ores. March 24.

6511 (1908). Hommel, and Metals Extraction Corporation. Treatment of sulphide ores or products. March 31.

15,192 (1908). Von Zelewski. Mechanical roasting furnaces. March 31.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

6278. Marriott and Grover. Electric insulating and waterproofing compositions. March 16.

6398. British Thomson-Houston Co. (General Electric Co.). Manufacture of refractory electric conductors. March 17.

6820. Reid. Electric furnaces. [U.S. Appl., Aug. 22, 1908.]* March 22.

6872. British Thomson-Houston Co. (General Electric Co.). Electrolytic cells. March 22.

7338. Nya Ackumulator Aktiebelaget Jungner, and others. Active mass for electrodes of elements with alkaline electrolyte.* March 26.

7396. Grunwald. Electric induction furnaces. [Ger. Appl., Aug. 15, 1908.]* March 27.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATION.

6934. Kayser. Detergent compositions.* March 23.

COMPLETE SPECIFICATION ACCEPTED.

6304 (1908). Irving. Manufacture of washing compounds or soaps. March 24.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

6531. Ely and Rollason. Manufacture of carbon. March 18.

6573. Boosé (Stern and Boosé). Manufacture of metallic paints and enamels from ores. March 19.

COMPLETE SPECIFICATION ACCEPTED.

14,338 (1908). Johnson (Badische Anilin und Soda Fabrik). Production of pigments. March 24.

(B.)—RESINS, VARNISHES.

APPLICATION.

6917. Johnson. Purification or refinement of gums, gum resins, resins, and balsams. March 23.

COMPLETE SPECIFICATION ACCEPTED.

23,429 (1908). Marks (Suter). Varnish and its manufacture. March 31.

(C.)—INDIA-RUBBER.

APPLICATIONS.

7302. Soc. Franç. de la Viscose. Manufacture of a new product from cellulose and caoutchouc. [Fr. Appl. March 28, 1908.]* March 26.

7433. Smith. Manufacture of indiarubber.* March 27.

COMPLETE SPECIFICATIONS ACCEPTED.

28,365 (1907). Immisch. Manufacture of ebonite and vulcanite. March 31.

3572 (1908). Wallace and Reynaud. Manufacture of elastic products similar to indiarubber. March 24.

27,328 (1908). Hayley (Northway). Obtaining indiarubber or caoutchouc. March 31.

28,159 (1908). Immisch. Manufacture of ebonite and vulcanite. March 31.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

APPLICATIONS.

6739. Stannard. Tanning and like processes. March 20.

7207. Glasel. Tanning drums. March 25.

COMPLETE SPECIFICATIONS ACCEPTED.

6142 (1908). Marter. Substitute for bone, ivory, etc. March 24.

15,009 (1908). Vidal. Treatment of hides and leathers, hair, furs, feathers, yarns, and threads. March 24.

XV.—MANURES, Etc.

COMPLETE SPECIFICATION ACCEPTED.

5999 (1908). Goeckeler. Method of treating manure. March 24.

XVI.—SUGAR, STARCH, GUM, Etc.

APPLICATION.

6917. Johnson. *See under XIII B.*

XVII.—BREWING, WINES, SPIRITS, Etc.

APPLICATIONS.

6397. Naeck. Maturing and purifying alcoholic liquors. [Fr. Appl. March 21, 1908.]* March 17.

7419. Sherman and Lutyens. Sterilising and cleaning brewers' casks, vats, and other vessels contaminated by putrefaction products. March 27.

COMPLETE SPECIFICATION ACCEPTED.

27,956 (1908). Breker. Production of brewers' wort. March 24.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

6143. Little. Treatment of flour. March 15.

6178. Tildesley, Ritchie, and Watkins. Process for improving flour. March 15.

COMPLETE SPECIFICATION ACCEPTED.

6444 (1908). Frye. Process for making butter. March 31.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

6349. Thresh. Water purification. March 17.

6399. Thomson. Treatment of waste liquors. March 17.

6935. Payne and Staynes. Purification of water.* March 23.

COMPLETE SPECIFICATION ACCEPTED.

12,711 (1908). Pulsford. Water purifying apparatus. March 31.

XIX.—PAPER, PASTEBOARD, Etc.

APPLICATIONS.

6554. Schloss, and Fürst Guido Donnersmarck'sche Kunstseiden und Acetatwerke. Manufacture of solutions of cellulose acetate. March 18.

7206. Green. Manufacture or treatment of paper. March 25.

7302. Soc. Franç. de la Viscose. *See under XIII C.*

COMPLETE SPECIFICATION ACCEPTED.

5963 (1908). Pidelaserra y Brias. Manufacture of copying paper. March 24.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

6114. Ransome. Compound for use in medicine and pharmacy. March 15.

6173. Fa weather (Valentiner und Schwarz). Producing a sulphur compound of quinine.* March 15.

6408. Boulit (Egyetemes Kísérlető Intézet Vegyészeti Orvosi). *See under I.*

7094. Justice (Boehringer). Manufacture of lactic acid.* March 24.

7315. Zimmermann (Chem. Fabr. auf Actien vorm. E. Schering). Catalysis for the hydrogenation or dehydrogenation of organic compounds. March 26.

7322. Kondakow. Manufacture of bornylene from dextro-pinene.* March 26.

COMPLETE SPECIFICATIONS ACCEPTED.

17,139 (1908). Meister, Lucius, und Brüning. Manufacture of acid derivatives of aminoarylsarsinic acids. March 31.

21,820 (1908). Ascoli. Yeast preparation suitable for hypodermic injection. March 31.

24,072 (1908). Hoffmann-La Roche und Co. Guaiacol compounds. March 24.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATION.

7000. Triepel. Production of pigment prints, etc.* March 23.

COMPLETE SPECIFICATION ACCEPTED.

5641 (1908). Donisthorpe. Photographic sensitive surfaces. March 24.

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The Council of the Society of Dyers and Colourists has presented to the Society a bronze replica of a design for a medal in memory of the late Sir William Perkin, by F. W. Pomeroy, R.A. The presentation was made on April 23rd by Prof. W. M. Gardner, on behalf of the Society of Dyers and Colourists, and acknowledged by Sir Boverton Redwood on behalf of the Society.

Canadian Section.

Meeting held at Toronto, on Thursday, February 25, 1909.

PROF. W. LASH MILLER IN THE CHAIR.

THE STASSFURT POTASH SALTS.

BY R. LESLIE EMSLIE.

Geology of the potash deposits in North Germany.—At the time of the formation of the immense Stassfurt salt beds, wherein lie cradled the valuable potash salts, the German Fatherland presented a different appearance from that of to-day. Then a great salt lake stretched itself over their land, being bounded on the west by a mighty mountain range, the remains of which we can recognise in the hills of the Rhine valley and the mountains of Great Britain. Also to the north this salt lake was hemmed in by another mountain range, the remains of which we find in the mountains of Scandinavia. To the east of the salt lake stretched a wide plain, of what we must suppose was desert land, for the plains of Russia have been little disturbed by volcanic upheavals. The prevailing climate at the time of the salt bed formations was varied. At first a decided desert climate prevailed, which practically prohibited all forms of vegetable life. Again we find climatic conditions which favoured the existence of *Dolicholum* shell fish. In the south the salt lake, which stretched over the whole of present-day Germany towards a mediterranean sea, became more or less completely cut off from that sea. It is probable that an island bar, extending from the neighbourhood of Geneva, over Basle, Munich, Regensburg, and Passau to near Vienna, formed this sea bar, and that the narrow, shallow channels located in the neighbourhoods of Geneva and Vienna, permitted the flow of the mediterranean sea into the salt lake.

Salt layers in process of formation are to-day only to be found in bodies of water having no outlet in desert rainless climates. In such the flow of water is directed towards the lowest levels, carrying thence the salts which it has dissolved out from the salt-bearing rocks on its course. When, under such circumstances, the evaporation exceeds the inflow of water, the salt solution becomes more and more concentrated until the salt is precipitated. On the grounds of these observations Prof. Johannes Walther, of Halle, expressed the opinion that the Permian salt beds are not the result of sedimentary deposits, caused by the cutting off by a bar of an internal sea, as most geologists held, but that they have been formed in a desert region.

Rock salt belongs to no particular geological formation; it may occur from Silurian times up to the present, wherever the necessary conditions for the formation of the same are fulfilled. The salt beds in North Germany, which are exceptional for their manifold forms of potassium and magnesium salts, belong either to the Permian, or they lie on the border of the Diassic and Triassic formations.

In North Germany the depth of the salt layers has been determined by deep boring. At Spereenberg, south of Berlin, boring was conducted to a depth of 1194 m. through the salt without reaching the bottom layer. In boring at Unseburg, near Stassfurt, the rock salt, underlying the potash bearing salts, was reached at a depth of only 80 m., the lower layer being reached at 1250 m. Under these salt layers anhydrite, black shale, and bituminous limestone were bored through and again, at a depth of 1280—1290 m., rock salt was struck; at 1295 m. boring ceased in grey anhydrite. The immensity of the rock salt deposit here may be realised from the fact that taken perpendicularly, the measurement is 990 m., the beds lying at an angle of 35° to 45°. Near Bernburg, the older rock salt only gave a measurement of 150 m. In this case bituminous limestone was reached at 592 m. and rock salt again at 630 m.

The deposition of the salt layers took place by the evaporation of the salt water. But since the usual quantity of sodium chloride (3—4 per cent.) present in sea water, would not nearly suffice to cause such a large precipitation, there must have been a constant influx of salt water during the period of evaporation. This influx of the salt solution must have been from salt bearing springs, or from the sea through a narrow channel, which had been so shallow that a backward flow of the concentrated solution was impossible. This theory of the formation of the salt deposits was brought forward as early as the middle of last century by Hugh Miller and Lyell, and was further elaborated by Oehsenius in his work, "Die Bildung der Steinsalzlager," in 1877.

The influx of salt solutions from salt-bearing springs could have occurred in various ways. The salt content might have been the result of the weathering of such eruptive rocks as lava, basalt, and granite, or the salt springs may have been caused by the dissolving out of salt-bearing mountain strata, which had originally become separated from sea water. This manner of formation may at the present day be observed where the Jordan flows into the Dead Sea, and in many locations in desert places. It is probable, however, that the immense salt deposits in North Germany were formed by the influx of sea water into the salt lakes, where the potash salts were laid down. At the same time considerable quantities of salt solutions from salt-bearing rocks may also have found their way there.

Considering the great variety of salts found in the potash mines, the study of the salt deposits may be looked upon as a science by itself, presenting an extensive field for investigation. The excellent and classical work of van't Hoff throws much light on the subject, showing the necessary degrees of concentration and temperature for the formation of the various minerals occurring in the potash layers, and the conditions under which they can exist. The investigations conducted by van't Hoff took into consideration the chemical and physical conditions necessary for the precipitation of the salts, but omitted the geological conditions. But since the geological occurrence of the potash salts presents the greatest general interest, in the following remarks geology will occupy the foreground.

Geological and mineralogical description of the anhydrite, polyhalite, and kieserite regions.—The salt layers near Stassfurt are interspersed at fairly regular intervals of from 8—9 cm. with a stratum of anhydrite averaging 7 mm. in thickness and known as "annual rings." If we take the depth of the beds at Unseburg (900 m.), then according to the number of anhydrite strata, taking them as annual rings, a period of some 10,000 years was necessary for the formation of the salt deposits there. It was formerly supposed that each year during the winter season or during a rainy season the deposition of the annual rings of anhydrite took place and that in the warm season, when the water evaporation would be considerable, the rock salt was deposited from the concentrated salt solution. This theory, however, seems to be incorrect; on the other hand, it is probable that the anhydrite was deposited during the warm period and the rock salt during the cold period, since for the precipitation of the anhydrite from a salt solution, a high temperature was necessary. Precht assumes that the sodium chloride

remained in solution during the warm period, and after the precipitation of anhydrite had ceased, the salt was deposited. If, for example, there was a difference of 15°C . temperature between the cold and warm periods—say the highest temperature was 70°C . and the lowest 55°C .—this would give a difference in the solubility of the sodium chloride of some 5 parts in 100 of water. In order to precipitate a salt layer of 9 cm. thickness it would have been necessary to lower the temperature of the salt water 15°C . with a depth of approximately 18 m. of water. Since next by evaporation the less soluble calcium sulphate and the sodium chloride would be precipitated, a concentration of the other lesser component parts of sea water, *i.e.*, salts of potassium and magnesium, would take place, and from these substances a rich mother lye would be formed, as we observe in salt pans, the great salt lakes, etc. If now the further influx of sodium chloride through sea channels be cut off, the mother lye will gradually become precipitated in various forms by the constant process of evaporation. The calcium sulphate yet present in sea water, next forms with potassium sulphate the "polyhalite strata," from which the second 60 m. thick zone of the salt deposits, the "polyhalite region," takes its name.

The border between the anhydrite and polyhalite regions is not very sharply defined. On the border the thin layers consist partly of anhydrite and partly polyhalite. In the middle layers of the polyhalite region the mineral has the following composition, $2\text{CaSO}_4 \cdot \text{MgSO}_4 \cdot \text{K}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$, and is recognised as an amorphous mass in the crystallised rock salt of which 92–93 per cent. is present in the polyhalite region. The limit of the polyhalite region is formed by the concentration of the magnesium chloride in the solution combining with the magnesium sulphate and being deposited as kieserite and the potassium as a double salt of potassium and magnesium chlorides (carnallite). In the mines in the vicinity of Stassfurt the polyhalite region is characteristically formed, but in the province of Hanover and in Thuringen it is much less extensive. Only a small part of the potash becomes deposited in the form of polyhalite, the greater part being found in the carnallite.

According to van't Hoff's investigations, at temperatures under 73°C . with increasing concentration of the salt sea, next carnallite and later kieserite become deposited. Potassium chloride could not, therefore, be formed with kieserite under 73°C . Above 73°C . we find other conditions, and it is possible that part of the potassium chloride may be deposited as sylvine with the kieserite. The calcium sulphate still present in the solution must again be precipitated as anhydrite since the limits of the polyhalite region are passed.

In corroboration of the van't Hoff investigation, Precht has recently determined that above the polyhalite region the rock salt is interspersed with strata consisting of anhydrite, carnallite, and kieserite, and that not until later, with increased concentration of the mother lye salts, does the pure kieserite become deposited. One must therefore separate the heretofore recognised kieserite region into a lower anhydrite-carnallite-kieserite region and an upper carnallite-kieserite region.

In former years there were differences of opinion regarding the formation of the kieserite. Bischoff expressed the opinion that magnesium sulphate was precipitated from the mother lye as a salt with 7 molecules of water ("bitter salts"), thereafter gradually losing water. He says: "After the whole of the salt layers had been deposited some force must have been at work which was capable of causing the gypsum and 'bitter salts' to lose their water of crystallisation, but which did not disturb the carnallite and tachydrate of the upper layers." On the other hand, Precht gave his opinion as follows: "The formation of the kieserite was dependent on the very hygroscopic properties of the magnesium chloride present in large quantity in the mother lye, which through its water absorbing action hindered the crystallisation of this salt, in its usual form, with 7 molecules of water of crystallisation." That Precht's theory was correct appears from the investigations of van't Hoff, who determined the degrees of temperature and concentration of the magnesium chloride solution

necessary for the precipitation of the magnesium sulphate as kieserite.

To become deposited simultaneously with kieserite the potassium chloride must be precipitated below 73°C . as carnallite and above 73°C . as sylvine. In order to determine the temperature at which the Stassfurt salt beds were formed, Precht recently investigated the occurrence of the kieserite and carnallite on the border of the polyhalite region, and thereby found in several layers a quantity of kieserite, carnallite, and anhydrite, and draws therefrom the conclusion that the formation took place at a temperature of from 70°C . to 80°C .

The transition from polyhalite to kieserite is not sharply defined. The kieserite and the first layers of carnallite appear directly over the polyhalite, likewise in thin seams, while the rock salt still predominates, but gradually the salt layers, with decreasing sodium chloride content, become richer in kieserite and carnallite. Since the formation of the kieserite is specially favoured by warmth it must be supposed that, as in the case of the precipitation of anhydrite and polyhalite, that the kieserite in the warm season and the carnallite in the cold season become crystallised out. The kieserite is present as a hard mineral, which draws water from the atmosphere and becomes converted into "bitter salt." In water it falls into a fine crystal powder while a partial solution takes place. The decomposition does not occur in a saturated solution of "bitter salt," since the latter prevents a partial solution of the kieserite. On the other hand, a saturated solution of sodium chloride acts on the kieserite in much the same manner as water. The whitish-grey kieserite is dense but transparent, possesses a spec. gravity of 2.517, and consists of 86.56 per cent. of magnesium sulphate with 13.04 per cent. water.

Carnallite and the overlying layers.—The carnallite region is a seam some 25 m. thick, extending over the whole salt deposits and is the particular layer in which the potash salts are mined. The average composition of the carnallite deposits is 55 per cent. carnallite ($\text{KCl} \cdot \text{Mg}(\text{Cl} \cdot 6\text{H}_2\text{O})$), 26 per cent. rock salt, 17 per cent. kieserite, and 2 per cent. of other substances (anhydrite, clay, boracite, etc.). Carnallite when absolutely pure is transparent and colourless; in salt mines it appears in its purest form as a whitish dense salt mass, whose plane of cleavage is not so uneven as that of rock salt. The cleavage surface is conchoidal and the specific gravity is 1.618. Carnallite is composed of 26.76 per cent. of potassium chloride, 34.5 per cent. of magnesium chloride, and 38.74 per cent. of water. In a moist atmosphere it is deliquescent, is easily soluble in water, and is only formed from solutions of potassium and magnesium chlorides which contain at least 25 per cent. of magnesium chloride. In nature pure carnallite is seldom found; it is, as a rule, streaked with rock salt. Even the purest piece which it is possible to find in the primary carnallite layers always contains sodium chloride, and likewise the secondary carnallite, which has recrystallised, is not free from rock salt. In the primary salt layers, carnallite is as a rule coloured; the colour varies greatly, sometimes being greyish from organic substances and clay, but in most cases red, due to peroxide of iron. The red colour is not observed in the carnallite which borders on the polyhalite region. Then it is free from iron, and only in the kieserite region does the iron content gradually appear, as in the original salt lakes the concentration of the solution become intensified. The peroxide of iron was not originally present as such, but, according to Precht's investigations, as a double salt of ferric chloride and out of which, through oxidation and decomposition of the crystallisation water of the carnallite hydrogen and peroxide of iron have been formed. Precht has named the iron chloride-potassium chloride "Donglasit." It is similar to carnallite in composition, and as a result of the simultaneous crystallisation of both double salts carnallite derived its iron content, while the rock salt and kieserite, occurring in fine layers between the carnallite, are free of iron.

The carnallite formation was interrupted by the deposition of a large salt-clay layer, some 8 m. in thickness, which was partly mechanically deposited from suspended slime, and partly by chemical means from the concen-

trated potassium chloride and magnesium chloride mother lye. In this way a cover was formed protecting the mother lye salts from being washed out by a subsequent inundation. The salt-clay, which in the western deposits occurs in three layers, contains, according to Precht's investigation, in the lower layer principally calcium sulphate, in the middle layer magnesia and aluminium hydroxide, and in the upper layer, besides clay, 40–50 per cent. of magnesium carbonate.

Overlying the salt-clay is anhydrite, formed by a renewed flooding of the basin, after the latter had been for a considerable period entirely cut off from the sea. The lower layers of the new red sandstone are formed by anhydrite, but partly occurring between both layers, is yet a younger rock salt layer, which was first discovered in New Stassfurt after the Stassfurt mines had been 15 years in operation.

The younger rock salt.—The younger rock salt differs from the older in its greater degree of purity; the former contains on the average 97.5 to 98.5 sodium chloride and the annual rings of polyhalite, which can hardly be perceived, are as much as 30 cm. apart. According to Precht the formation of the younger rock salt occurred in places where the older rock salt was not protected by an impervious layer; the latter became dissolved and again crystallised in the lying parts. This theory has been supported by more recent observations in the Hanover potash mines where the younger rock salt is present in immense masses, and here also the secondary potash salts are found. The formation of the younger rock salt is closely connected with that of the secondary potash salts, which will be referred to later. The younger rock salt is not found in all the mines in the neighbourhood of Stassfurt; it is lacking in the oldest Prussian mine, and also in Leopoldshall, while it is present in normal formation of some 80–120 m. in thickness in the Achenbach, New Stassfurt, and the Ludwig II. mines. In the vicinity of Stassfurt potash salts are not found in the younger rock salt layers, but in the province of Hanover, particularly in Salzedetfurth, where the beds are 200–300 m. thick, sylvinites and carnallites of remarkable purity are present. In the salt mines of North Germany rock salt is mined in large quantity, all being taken from the younger rock salt layers. The older rock salt is not mined any more for that purpose, but is used for filling in old workings in the potash mines.

The present profile of the potash beds.—All the salts were originally deposited in horizontal layers or with only slight deflection from the horizontal, due to unevenness of the sea bottom. In this position they are seldom found at the present day, being unusually inclined at a considerable angle. The breaking of the earth's surface through volcanic upheavals and the contraction of the earth's crust have thrown them into every conceivable position. In the neighbourhood of Stassfurt in the upper workings of the mines, in consequence of the upheaval of the Stassfurt-Egeln oolitic saddle, the potash salts are found at an angle of from 45°–70°, while in the lower levels they lie almost horizontally. To the east and south of Stassfurt, at Bernburg and Aschersleben, they are found very little inclined, whereas to the north of Stassfurt at Westeregeln, the degree of inclination is usually very high. In the province of Hanover, the salt beds have been generally very much disturbed. At Vienenburg they are almost perpendicular, and in the profile of Justice von Volprichausen, between the Leine and the Weser, one may recognise the action of mountain pressure in the lower levels of the salt mine. Interesting experiments by Rinne have shown how rock salt and sylvine in a plastic state may be remodelled by the application of pressure, similar to observations frequently made in salt mines. The profile of the salt layers of Jessenitz in Mecklenburg, show serpentine lines running up and down which were doubtless formed by lateral pressure of mountain masses. One recognises in these profiles widely varying conditions, but one cannot draw the conclusion that all the salt beds in Hanover and Braunschweig were subjected to the same crushing force, for in individual mines the layers are often regular. The potash salts in the salt basins between the Harz and the

Thüringer forest and the south-west of the latter, on the Werra, show generally regular layers, but through the influx of water and the consequent formation of secondary salts, they are much changed.

The potash salts of secondary formation: Sylvinites, hartsalz, and kainite.—The oceanic potash deposit of primary formation, the carnallite, is almost exclusively used in the potash factories in the preparation of potassium chloride and other potash containing products and is employed only to a small extent in its raw ground state in agriculture. But the aforementioned potash salts of secondary formation, which have been produced from the primary deposits through the action of water, are for the most part ground and used directly as potash fertilisers.

Sylvinites is a mixture of pure sylvine (potassium chloride) and sodium chloride; it is mostly free from magnesium sulphate, or contains only negligible quantities thereof. The potassium chloride content of the sylvinites fluctuates between 20 and 60 per cent.; in several places it has even been found as high as 90 per cent., but such an occurrence is rare, and the quantity small. The sylvinites is white in appearance and scarcely to be distinguished from rock salt. In hardness it is the same as rock salt, but the specific gravity is less dependent on the amount of potassium chloride, since pure potassium chloride has a sp. gr. of 2.0 and sodium chloride a sp. gr. of 2.2. In most cases sylvine contains, besides the rock salt, also kieserite, and is then named "Hartsalz" on account of the great hardness of the kieserite. Its composition is approximately 20–22 per cent. sylvine, 10–15 per cent. kieserite, and some 60 per cent. rock salt.

Kainite in a chemically pure condition is a white, finely crystallised mineral, but seldom occurs as such, being as a rule, mixed with about 30 per cent. rock salt; the other substances are insignificant, so that the commercial article is usually a mixture of kainite and rock salt. Pure kainite may be considered as a crystallisation of potassium sulphate, magnesium sulphate, and magnesium chloride, with a formula, $K_2SO_4 \cdot MgSO_4 \cdot MgCl_2 \cdot 6H_2O$. It may also be considered a crystallisation of potassium chloride with magnesium sulphate, having the formula, $KCl \cdot MgSO_4 \cdot 3H_2O$. In commerce the first formula is generally used, and according to it the composition of kainite is, 24 per cent. potassium sulphate, 16.5 per cent. magnesium sulphate, 13 per cent. magnesium chloride, 14 per cent. water, 31 per cent. sodium chloride, and 1.5 anhydrite and clay. Kainite in crystals is also found as a mineralogical curiosity.

The secondary salts are recognised as products of the metamorphosis of the primary carnallite layers. This metamorphosis has taken place in various ways, and Precht distinguishes between the formation of secondary salts on the original and on extraneous beds. The first manner of the formation on the original beds followed in this wise: Water acted on the carnallite layers, dissolved the magnesium chloride and left the less soluble salts behind, the latter being rock salt, kieserite, and the potassium chloride which had been dissolved out of the carnallite. This "Hartsalz" had been formed at a temperature above 73° C., so that kainite at that geological period was not capable of existing. The formation of the kainite followed much later, likewise on the original beds, but according to investigations of van't Hoff at a temperature below 73° C. In the formation of kainite as in that of "Hartsalz" the magnesium chloride must have been dissolved out from the carnallite and at the same time a magnesium or calcium sulphate solution must have been introduced in order, through the interchange with potassium chloride, to produce this mineralogically interesting mineral.

The secondary formation on extraneous beds followed through the solution and recrystallisation of the older primary salt layers, in the same way as with the younger rock salt, and, since besides rock salt carnallite could also be dissolved, it stands to reason that in the younger rock salt layers, potash salts would also be formed on secondary beds. One can represent this process in many ways.

Suppose a salt layer, composed of rock salt, carnallite, and kieserite, were dissolved, kieserite as the least soluble ingredient would remain behind, and from the concentrated brine solution, which has flowed to the lower lying points, the rock salt would next crystallise out, then sylvinit, and lastly white secondary carnallite. If through atmospheric precipitation, the carnallite salt at the higher lying points became quite dissolved, and again crystallised out in lower situation, then with renewed water action rock salt solutions could form, which, likewise, would flow to lower levels and there crystallise out. It is therefore possible to explain the occurrence of secondary carnallite, re-covered by a rock salt layer. But this sodium chloride solution could again decompose the already deposited secondary white carnallite and convert it into sylvinit, and in this way it is not difficult to find an explanation of the sylvinit layers overlying those of carnallite. Regarding the geological age of the secondary formation, Precht divides the time into three periods: The first period of the carnallite decomposition commenced soon after the carnallite formation, partly before and partly after the laying down of the salt-clay, as soon as the salt layers were accessible to the influence of water or dilute salt solution. During this period, Hartsalz layers were formed almost free from iron, since the formation occurred at a time when the ferric chloride, contained in the carnallite, had not yet become oxidised. The ferric chloride was washed out with the magnesium chloride and, therefore, in Precht's opinion the peroxide of iron content of Hartsalz depends on the period of its formation. The secondary potash salts of the oldest period of formation became covered by the later deposited salt-clay and anhydrite, and then the second period of the secondary formation commenced in which, before the formation of the new red sandstone, the younger rock salt was formed by the solution and recrystallisation of the older salt layers. With the younger rock salt the secondary potash salts, sylvinit, and white carnallite, also formed on extraneous beds. One must imagine in this period of formation, North Germany as a great salt desert, where through solution or recrystallisation of the salt beds the multitudinous changes took place the evidence of which we find at the present day in the potash mines. As the third period, Precht marks the later secondary formations, which occurred after the new red sandstone was laid down. The chief product of this period is the kainit, and therefore it may be designated the kainit formation period. The formation of kainit resulted from the access of water to the carnallite layers, through cracks in the earth, dissolving magnesium chloride and effecting the aforementioned changes. This period reaches far back into the more recent geological ages, perhaps as far back as the tertiary formation, as the temperature of the earth's surface was even then so reduced that the formation of kainit was possible. The geological occurrence of kainit indicates that it was never of primary formation, but always a secondary product. These observations support Precht's theory that the primary salt beds were formed at temperatures over 73° C.

The Hartsalz of the first period on the original beds is widely distributed. It occurs extensively in the lower levels of the oldest mines in the neighbourhood of Stassfurt, also in Aschersleben and in the Deutschen Solyay mines. It is also found in large quantity between the Harz and the Thüringer Forest, and particularly in the potash mines on the Werra, where the Hartsalz is largely found as the carnallite salt. In the province of Hanover the mines are provided with large layers of either Hartsalz or carnallite: Justus and Hohenfels have only Hartsalz, while in most of the others in Hanover Hartsalz and carnallite are both encountered. The secondary formations of the second period, on extraneous beds, occur less seldom. Sylvinit is found most extensively and also in purest condition in Viernburg and Salzdetfurth. Also in the mines south of the Harz Mountains the secondary potash layers are recognised as sylvinit, although not altogether free from magnesium sulphate. The kainit of the third period occurs in largest quantity in the Magdeburg-Halberstädt salt basins, while it is seldom found in the province of Hanover and has never been discovered in the mines south of the Harz and on the Werra. Kainit

has usually a fine crystalline structure and is easily distinguished from carnallite, but kainit is sometimes found in coarse crystals and is then difficult to distinguish from the former. For instance, in Braunschweig there is kainit, which in outward appearance closely resembles carnallite. In order to determine the presence of kainit, especially in a mixture of kainit and carnallite, Precht's method of analysis will serve: this is founded on the solubility of the magnesium chloride of the carnallite in absolute alcohol, while all non-carnallite salts of commerce, kainit included, contain no magnesium chloride soluble in alcohol. By titration of the alcohol-soluble chlorine, this method of analysis, which is prescribed by the Kalisendikat, is easily and quickly carried out. The carnallite occurs in all North Germany salt in large quantities, as the secondary salt of all three formation periods.

Of the great number of minerals which are encountered in the potash mines, there are yet a few also of secondary formation worthy of mention.

Schönit ($K_2SO_4 \cdot MgSO_4 \cdot 6H_2O$) presents itself in the various mines of the Magdeburg-Halberstädt salt basins on the kainit beds and is mixed along with the kainit. Likewise *Krugit* ($K_2SO_4 \cdot MgSO_4 \cdot 4CaSO_4 \cdot 2H_2O$), which was discovered by Precht in the younger rock salt layers, is mined in small quantities. Of those most recently discovered minerals *Langbeinit* ($K_2SO_4 \cdot 2MgSO_4$) is most frequently met with. It was found by Zuckschwerdt, in 1891, in the bore hole at Wilhelmshall, after Precht in 1881 had demonstrated the formation of this insoluble double salt of potassium and magnesium sulphates at the factory. Langbeinit is usually found in a Hartsalz layer, particularly under the Hartsalz, where in primary deposits the kieserite is met with. It is usually so streaked with rock salt that its mining is unprofitable and only in individual places is it worth mining.

The following secondary minerals have only a scientific interest:—*Astrakanit* (Bloedit), $Na_2SO_4 \cdot MgSO_4 \cdot 4H_2O$; *Bischofit*, $MgCl_2 \cdot 6H_2O$; *Glaserit*, K_2SO_4 ; *Glauberit*, $CaSO_4 \cdot Na_2SO_4$; *Loewit*, $Na_2SO_4 \cdot MgSO_4 \cdot 2H_2O$; *Reichardt*, $MgSO_4 \cdot 7H_2O$; *Tachhydrit*, $CaCl_2 \cdot 2MgCl_2 \cdot 12H_2O$; *Vanthoffit*, $3Na_2SO_4 \cdot MgSO_4$.

Stassfurt a salt market in mediæval times.—Stassfurt, the centre of the potash industry, has been noted for its saline springs from very early times, and in the year 800 A.D. was, we are told, the site of an important salt market. According to tradition, the saline springs were discovered by a leader of the Wends in North Germany, who was taken prisoner by Charlemagne. At first the ownership of the springs was divided amongst the burghers of the town, there being then about 30, but in the 15th century the salt springs were already in the hands of a company the members of which formed part of the Stassfurt Municipal Council. The industry was of very great importance to the locality and formed the chief means of livelihood of the inhabitants. After the commencement of the 18th century, through lack of improved methods of production, the industry gradually fell off, and eventually in 1797 the company sold their rights to the Prussian Government for the sum of 85,000 Taler. With the introduction of new improvements, including boring, the salt mining industry was carried on by the Government into the sixties of last century. In 1851 the first two shafts were sunk with the object of mining the rock salt, and in 1857 the output of salt in this form commenced. At first only the rock salt was used, but the overlying layers of impure "Abraumsalze," whose presence created surprise, soon aroused the interests of scientists. When it was discovered that the "Abraumsalze," or waste salts, which were encountered in mining the rock salt, contained potash, the attention of scientists was turned to these potash bearing salt layers, and very soon factories were established to manufacture potassium chloride. The "Abraumsalze" which had accumulated in large heaps near the pit heads, were soon used up.

Liebig's discovery of the value of potash salts in agriculture was made in the early sixties, and from that period the output has steadily increased until it has reached its present immense proportions, but by no means its limit.

The following figures show the increased consumption of the more important potash salts for agricultural purposes since 1903 :—

	1903.	1907.
	Tons.	Tons.
Potassium chloride—		
Total output	206,347	291,248
North America	71,279	111,852
Potassium sulphate—		
Total output	38,407	56,253
North America	19,747	28,453
Potassium-magnesium sulphate—		
Total output	22,296	31,503
North America	11,944*	15,545
Potash manure salt—		
Total output	153,415	255,810
North America	59,655	60,252
Kainit and sylvinit—		
Total output	1,466,839	2,207,226
North America	243,704	379,449
Germany	979,986	1,456,824

* 1906.—20,666 tons.

Mining and refining the salts.

Mining.—The sinking of the first shafts named "von der Heydt and von Mantenfel" by the Prussian Fiskus near the Bode River at Stassfurt was carried out with little difficulty. They were not built up with stone but remained wood-lined and had notwithstanding only a small water influx. Likewise the two first shafts of the Ducal-Anhalt salt mine at Leopoldshall were put down without difficulty and this is very fortunate for the potash industry, for if in the sinking of the first shafts the same difficulties had been encountered, as have since been met with, the mining of potash salts would have commenced much later. In many of the more recently opened shafts the inflow of water was so great that the sinking could not be conducted in the usual way, by manual labour, and recourse was had to other methods. The cost of shaft sinking varies very greatly and many companies have sunk large sums of money. Shafts with wood lining are now scarcely to be found. Should the water inflow not be strong the shaft is lined with stone or brick cement work, but where the inflow is great and the shaft deep iron tubing is used in order to prevent the inflow as much as possible. All the older potash mines have several shafts, which in most cases are connected underground, but are often separated by safety guard walls in order to protect in reserve some of the workings should water break in. All the younger mines possess only one shaft. The depth of the shaft at present varies from 300 to 800 m., one in New Stassfurt being that depth; almost one half mile.

The mining of the potash salts in the Royal-Prussian and Ducal-Anhalt mines during the period between 1860 and 1886 was conducted on several levels, which extended in both directions along the horizontal for several kilometers. The workings were at right angles to the former with a breadth of 9 m., while the height of the same varied according to the distance apart of the levels (from 8 to 14 m.). Between the workings, a column of 6 m. thickness remained standing, and between the levels a ceiling of from 6 to 8 m. strength, which served as a support for the overlying layers. The length of the workings was regulated by the angle of the potash layers. Although in this way only 40 per cent. of the carnallite was mined and 60 per cent. remained, still this method did not prove sufficiently durable, since in Leopoldshall and Stassfurt the slanting levels collapsed. These subsidations in the mines have made themselves noticeable by depressions on the surface and have led to very heavy damages being collected from mine owners. The inflow of water is partly caused by the collapse of the columns and ceilings in the pure carnallite workings, carnallite not being a very compact substance, and the subsequent depression of the surface, which aids the access of water to the mine; it may also be caused by pushing the workings too far in the upper levels and coming too near the water bearing earth strata. These unfortunate experiences led both the fiscal mines to make extensive

alterations in their mining methods, especially to enforce the systematic filling in of the old workings with rock salt from the layers of the older rock salt or with residue from the factories, ashes, etc. The old rock salt is specially mined for this purpose. It is not considered necessary to fill in the excavations (Bergmühlen) made in mining the old rock salt, the latter being a more stable substance than the carnallite. By this precaution the loss of workings, by the falling in of the ceilings between the levels, was considerably lessened. The principal tramways were also laid along the lower levels in the kieserite region (consisting chiefly of rock salt and kieserite), instead of along the upper level as formerly. In the mining of the salts explosives are always employed. Boring is performed either by hand, compressed air, or electric drills, the latter being operated by means of a transportable motor, protected in a box with flexible shafting. A slow working powder is used in blasting the potash salts, containing chiefly sodium nitrate with about 15–20 per cent. of potassium nitrate. In the hard firm salt beds a quick-acting powder has been used with good effect. In the Hartsalz layers the bore is filled three-quarters with ordinary gunpowder and lastly with a dynamite cartridge. With the discharge of the dynamite the mass is loosened, so that on the subsequent ignition of the gunpowder a larger amount of material is dislodged.

Carnallite, kainit, and Hartsalz are partly separated from worthless salts—kieserite and rock salt—by hand picking in the mine, so far as this is possible. They are then removed in the small tram waggons, the individual capacity of which is from 1200 to 1600 lb. The hauling is partly done by manual labour, partly by endless rope, or by overhead electric wire haulage. In recent time electric haulage has become very general for the long distance tramways. The salts are usually ground at the pit head, in which process stone crushers and so-called "coffee mills" besides fine powder mills are employed. The first mills deliver a coarse product which is afterwards reduced to the required fineness by means of mill stones, etc.

Manipulation of the crude potash salts in the factory in the preparation of potassium chloride and sulphate, "potash manure salt," and kieserite blocks.

Experiments in the preparation of potassium chloride from carnallite were made in several chemical factories in Germany in 1860 and 1861, but those more remote from Stassfurt soon gave up the manufacture, since on account of high freight charges they could not compete with other factories, meantime opened at Stassfurt. In Stassfurt the first potassium chloride factory was founded by Frank in the year 1861. The number of the factories quickly increased on account of the high price obtained for the product, and in 1864 they were already twelve in number, which, however, led to overproduction, and had the effect of greatly reducing the price. After the recovery from this first crisis, the manipulation of the salts kept pace with the output, and soon many more factories were established in Stassfurt, Leopoldshall, and the surrounding neighbourhood. The production of potassium chloride depends on the crystallisation of this salt from a hot saturated carnallite solution, during cooling, whereby magnesium chloride remains in solution. Although this crystallisation process appears very simple, yet little by little, after much experience, important improvements have been introduced. The manufacture may be divided into the following operations:—1. Dissolving the crude salt. 2. Steaming the mother lye. 3. Dissolving the artificial carnallite. 4. Purifying the crystallised chloride. After the crude salt has been ground it is placed in elevated, solvent bottles of about 12 cubic meters capacity, containing a boiling solution of magnesium chloride. By simultaneous admission of steam, potassium chloride and magnesium chloride are dissolved, while the rock salt and kieserite remain undissolved. The resultant hot solution is then allowed to clarify from the suspended ingredients (kieserite and clay slime) in special receptacles, thereafter being admitted to iron crystallisation vats, in which on cooling, after 3 or 4 days, a mixture of potassium chloride and common salt crystallises out. The mother lye may not contain

more than 21 per cent. of magnesium chloride, since with a higher concentration, after the crystallisation of the potassium chloride, artificial carnallite would also be deposited, whereby the purification of the potassium chloride, by covering with water, would be rendered more difficult. In order to reclaim the potassium chloride in the mother lye the latter is steamed in vacuum to that degree of concentration, when carnallite in the form of artificial carnallite crystallises out, only 5 per cent. remaining in the solution. The artificial carnallite is dissolved in hot water or lye and on the solution cooling, a second crystallisation of potassium chloride is obtained. The potassium chloride from both crystallisations is purified from magnesium chloride and partly from sodium chloride by washing with water at the ordinary temperature. It is then steam heated in the calcinating ovens, passed through rotating cylinders and other drying apparatus, whereby it is made ready for export. It then contains 50 per cent. of actual potash. The remaining lye and washing waters are employed in dissolving the crude salts or the artificial carnallite. Of the potassium chloride present in the crude salts, 85 to 92 per cent. is extracted while the rest is lost in the residual solution and sediment. The sediment, according to the quality of the crude salts employed, may be very rich in potash, so that it sometimes pays to calcine this residue and use it in the preparation of "potash manure salts."

Potassium sulphate is now chiefly prepared by the action of magnesium sulphate on potassium chloride in a dilute solution. Its formation does not take place quantitatively but is dependent on the quantity and the conditions of the two salts, and on the concentration of the solution. The reaction, in presence of magnesium chloride, formed therewith, may even go in the opposite direction, and therefore, as a rule, potassium-magnesium sulphate is first formed, since with the formation of a double salt the backward action is less to be feared. The preparation of potassium sulphate then follows from the potassium-magnesium sulphate, under the action of potassium chloride in excess.

The factory process is as follows:—The estimated quantity of double sulphate is dissolved in hot water and stirred in a tossing tub with an excess of potassium chloride, the potassium sulphate forming as a fine crystalline pulp. To prevent the precipitation of potassium chloride the temperature must not fall below 50° C. The deposited potassium sulphate is then separated from the mother lye by tip-buckets, covered with water and calcined. It is put on the market with 90 to 95 per cent. of potassium sulphate and not exceeding 2½ per cent. of chlorine, or with 96 per cent. of potassium sulphate and not exceeding 1 per cent. of chlorine, the former being used for industrial purposes and the latter finding an extensive application in agriculture.

Glauber salt, bromine, and magnesium chloride.

The manufacture of Glauber salt, which is confined to the winter season, is based on the reaction which takes place at temperatures below freezing point, in a dilute solution containing sodium chloride and magnesium sulphate. The residue from the manufacture of potassium chloride is dissolved in hot water and the resulting concentrated lye, after clarifying, is exposed to the winter cold in elevated shallow wooden cooling tanks. With moderate cold the crystallisation is accomplished in one night. The Glauber salt produced in this way is very pure, being free of iron, and therefore especially suited for the preparation of white glass.

The large quantities of final lye from the manufacture of potassium chloride partly serve for the production of bromine and are then run into the rivers, or they may be used in the manufacture of magnesium chloride. The bromine distillation takes place from the heated lye by means of manganese dioxide and sulphuric acid in granite or sandstone vessels, or by the introduction of gaseous chlorine. Now electrolytic methods are also employed in bromine production, but liquid chlorine is mostly used on account of its present low price.

Magnesium chloride is produced by steaming the final lye, whereby the iron present is deposited, and then running the clarified, somewhat cooled solution into

iron or wooden vessels. It is employed in the textile industry, but also in the preparation of flooring. For this purpose it is worked into a mass with water, burned magnesia, and a filler, is stroked over in the same way as ordinary cement and quickly hardens.

Industrial application of the potash salts.

The preparation of *caustic potash* and *potashes* employs about one half of the potassium chloride used in industry. Both are chiefly employed in soap manufacture. Potashes are also employed in glass and paper manufacture, in the preparation of colours, in printing and photography.

The next important product is *salt-peter*, in the manufacture of which one-third of the total industrial potassium chloride is used.

The three products, caustic potash, potashes, and salt-peter, used up five-sixths of the industrially employed potassium chloride. The remaining sixth part is divided amongst a few other products, of which the more important is *potassium chlorate*, claiming one-eighth of the total potassium chloride. Its chief use is in the preparation of matches, and since there is a growing tendency to produce matches free of sulphur and phosphorus, its use is on the increase. For example, in 1889 8000 tons were prepared for this purpose, and in 1903, 14,000 tons.

In the manufacture of *potassium chromate* one-twentieth of the industrial potassium chloride is employed. This is used in the textile and colour industries and in modern photographic printing and reproduction processes.

In 1880, rather more than half the total production potash salts was still used for industrial purposes; in 1885 the agricultural was equal to the industrial consumption. In 1888 53 per cent. of the potash salts was used in agriculture, in 1905 84·3 per cent., until at the present day industries use less than 15 per cent. of the total production of potash.

London Section.

Meeting held at Burlington House on Monday, April 5th, 1909.

MR. E. GRANT HOOPER IN THE CHAIR.

BOGHEAD CANNEL OR "TORBANE HILL MINERAL," AND OTHER SO-CALLED "BITUMINOUS COALS."

BY WATSON SMITH.

(ABSTRACT.)

After exhibiting a fine specimen of this now extinct coal given him by the late Dr. Jas. Young, F.R.S., and after a brief historic and chemical description, the author pointed out that whereas in the celebrated trial of 1853, it was decided that the mineral in question was a coal, immediately afterwards, a similar trial conducted in Berlin under the auspices of the Zollvereindirection yielded just the contrary result, so that whereas in Britain the substance was "coal," in Germany it was regarded as "a bituminous substance, but not coal." He then drew attention to the fact that not only is "coal" a term involving some ambiguity, as being strictly a commercial or trade term, but so likewise, even to a greater extent, is the word "bituminous" as applied to coal, the amounts of actual bituminous matter soluble in benzene and similar solvents in the richest cannel, being mostly below 1 per cent. and too small to appreciably affect the physical properties of the mineral. Among all the known coals, a great exception is the Japanese Miike coal (a lignite), with 9·5 per cent. of bitumen (this J.L. 1892, 591; also 1891, 976). In this case the physical properties are affected by the presence of so much bitumen, for the coal yields volumes of intensely black smoke when it is used for firing up. The term "bituminous" has doubtless been chiefly applied in the past to cannel and caking coals, etc., because of the external pitchy or bitumen-like appearance they have been thought to present, and because in burning, certain of them undergo a kind of semi-fusion, with decomposition. To remove a dangerous

ambiguity which might, in contracts, etc., give rise to disputes, the author proposed the entire abolition of the term "bituminous" as applied to coals.

DISCUSSION.

Mr. O. GUTTMANN said that this mineral played at one time a certain part in connection with the manufacture of explosives. The early dynamite was absorbed by kieselguhr, and between 1865 and 1870, it was thought that silica played an important part in the constitution of dynamite. During the siege of Paris, when it was required to produce dynamite, the necessary silicious material was obtained in the ashes of Boghead coal.

VAPOUR-GALVANISING.

BY S. COWPER-COLES.

Vapour-galvanising is distinctive from all other forms of galvanising inasmuch as the vapour of zinc is employed for coating metal surfaces instead of dipping them into molten zinc or into an aqueous solution through which a current of electricity is passed.

Vapour-galvanising can be subdivided under two heads, namely, the zinc dust process and the molten zinc vapour process.

Zinc dust, which is an essential feature of the first process, is the product formed during the distillation of zinc from its ores, but, as the demand now exceeds the supply obtainable, by the ordinary process of distillation from the ore, it is made by distilling zinc from the crude metal. Zinc dust usually contains about 80 per cent. of metallic zinc, coated with a film of oxide, which prevents the metallic zinc from running into a molten mass when heat alone is applied. It is therefore

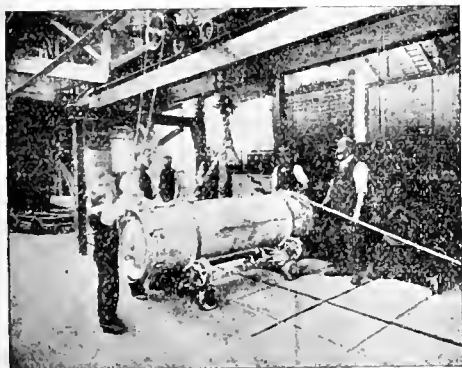


FIG. 1.—Furnace for vapour-galvanising.

particularly suitable for the process about to be described, as all risk of fusing and coating the iron under treatment with molten zinc is thus obviated. Zinc dust volatilises at a low temperature, due no doubt to its unstable physical condition. This fact was observed when some experiments were being made in connection with the annealing of cast iron in 1902. Zinc dust, when in contact with another metal, such as iron or copper, volatilises at a much lower temperature than it would otherwise; a piece of iron placed in zinc dust and heated to a temperature several hundred degrees below its melting point is quickly coated with zinc; if a similar piece of iron is suspended just above the zinc dust, no deposit of zinc takes place. In the former case an electric current is generated which probably reduces the volatilising point.

The process of vapour-galvanising with zinc dust in practice is carried into effect in the following manner:—The zinc dust and the iron articles to be coated are placed in an air-tight iron drum, which is heated in a gas-fired furnace, as shown in Fig. 1, to obtain a temperature within the drum of about 600° F., that is to say, the zinc dust is brought to about this temperature. The length of time at which the drum is kept at this temperature depends

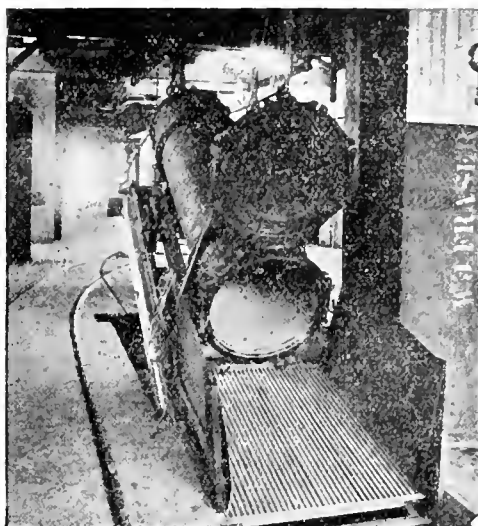


FIG. 2.—Method of discharging contents of drum.

on the thickness of the coat required, a few hours usually sufficing. The drums are emptied over an iron grid, Fig. 2, which retains the zinc-coated articles and allows the zinc dust to fall into a receptacle from which it is carried by a bucket elevator to a bin ready for recharging the drums. The iron articles, when cleaned from the zinc dust by means of a steam jet, are found to be coated with an even distribution of zinc which is alloyed with the iron surface, as shown in Fig. 3, the depth of the alloy depending both on the temperature and the length of time the minimum working temperature is maintained. The zinc iron alloy is non-corrosive, and does not rust even when the zinc surface has been removed by abrasion.

A complete apparatus for coating small articles such as bolts, nuts, and screws, is shown in Fig. 4, and consists of an iron drum, heated by gas and rotated by hand, or by suitable gearing. It is found in practice that the iron drum does not become coated with zinc even after being in use for several years, due to the high temperature of the drum as compared with the temperature of the zinc dust. When it is desired to obtain a thin even distribution of zinc, as for instance on thin steel plates, which are being used in place of lithographic stones, it is advantageous to mix the dust with some inert material such as finely-divided silica, excellent results being obtained with 9 parts of silica to one of zinc dust. The amount of zinc oxide present can vary considerably and yet give good results, the percentage can readily be controlled by adding hydrocarbon, by greasing some of the articles to be zinc-



FIG. 3.—Photomicrograph of zinc-iron alloy.

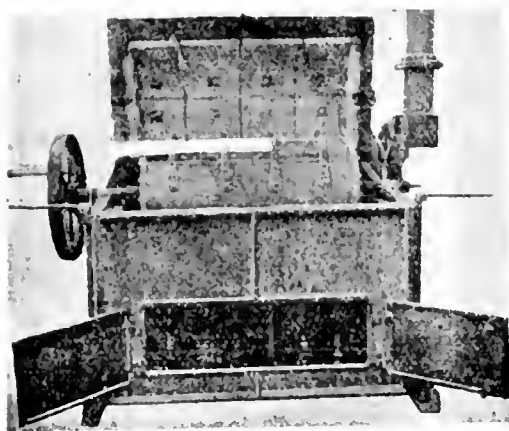


FIG. 4.—Gas-heated furnace for small articles.

coated, or by adding finely-divided carbon to the zinc dust.

It was at one time thought that zinc dust containing carbon might have a detrimental effect on the nature of the deposit, due to the retention of small portions of carbon setting up galvanic action in the presence of moisture; the microscope did not reveal any particles of carbon on the zinc surface. The carbon required for reducing any excess of oxide is more efficacious if added in the form of a hydrocarbon instead of in the form of finely-divided carbon.

The advantages of vapour-galvanising are that it is cheaper than the ordinary hot-galvanising, forms a better protection and at the same time enables screw threads and machine work to be coated with an even distribution of zinc, so that the parts fit together and work quite freely, proper allowance having been made for the required thickness of the zinc.

In vapour-galvanising sheets, they are placed in a drum rotating in a furnace; each time the drum is rotated the sheets, which are held between knife edges, take up a different position, thus ensuring the plates being free from flaws and weak places in the zinc coating.

The surfaces obtained by hot-, electro-, and vapour-galvanising are different in each case, so much so they can be readily distinguished by anyone conversant with the three processes. In the case of hot galvanising, the surface is spangled, or, if not spangled, has the appearance of cast metal. In the case of electro-galvanising, the surface is free from spangles, but has a matted or frosted surface, which is uniform if the work has been well executed. Vapour-galvanising is again distinctive from the two former processes, the general appearance resembles more that of electro-galvanising than hot-galvanising, but is more lustrous and metallic and the coating is more uniformly distributed over the whole surface than in the case of hot and electro-galvanising processes.

The copper sulphate tests, known as Preece's test, namely, one minute's immersion in a saturated solution of copper sulphate, is not applicable as a comparative test of the thickness of zinc applied by the vapour or electro-zincing processes, for the following reasons:—On applying Preece's test to vapour-galvanised articles and hot-galvanised articles coated with an equal thickness of zinc, the former require from three to four times the number of immersions which suffices to remove the zinc from the latter. When hot-galvanised articles are placed in a saturated solution of copper sulphate, the copper is precipitated in a loose form, but when vapour-galvanised or electro-zinc-dipped articles are similarly treated the copper adheres firmly to the zinc and no fresh surface is exposed, apparently due to the deposit of zinc applied by the electro-zincing and vapour-galvanising processes having a fine matted surface.

It would appear from these observations that the apparently great resistance to corrosion of vapour-

galvanised iron when subjected to Preece's test is due to the protection of the zinc by the deposited copper, therefore, experiments were made with a solution of ferric sulphate, which dissolves zinc without forming a precipitate on the zinc coating. To test this, known areas of vapour-galvanised and hot-galvanised plate were exposed to the action of ferric sulphate solution for an equal period and the amount of ferrous salt formed by the reducing action of the zinc determined. The column headed "Weight of zinc dissolved" shows the relative corrosions:—

No.	Sample.	Zinc, per sq. ft.	Weight of zinc dissolved.
		grms.	grms.
1.	Vapourised (zinc dust process)	26.908	0.080
2.	" " " "	26.908	0.074
3.	" " " "	22.93	0.057
4.	Hot galvanising	22.12	0.058
5.	Vapourised (zinc dust process)	31.116	0.03

Sample No. 2 was moistened with water and allowed to dry, the oxide formed appeared to protect the zinc, and this protection is more marked if water is allowed to act for a longer period than was done in these experiments. The variations in the results are probably due to the amount of zinc iron alloy formed, dependent on the temperature employed. Sample No. 5, vapourised copper, although the zinc coating was the heaviest, yet the corrosion was in this case the least, due no doubt to the amount of brass coating formed beneath the comparatively thin zinc coating. On testing this sample, as in the other cases, with copper sulphate solution, instead of a brown precipitate of copper, a bright metallic deposit was obtained and no further action seemed to occur. From the results of these experiments and other tests, it may be concluded that vapourising offers equal and probably greater resistance to ordinary corrosive influence than hot-galvanised iron coated with an equal weight of zinc, and the resistance is considerably increased by repeated moistening and drying, so as to form an oxide which renders the surface less soluble.

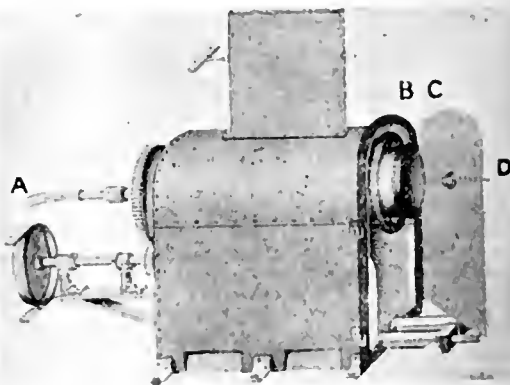


FIG. 5.—Apparatus for vapour-galvanising with metallic zinc.

The second process referred to at the beginning of the paper, namely, the molten zinc vapour process, does not necessitate the use of zinc dust, nor are the materials to be coated brought into contact with the molten metal or any of its compounds; they are placed in a separate chamber filled with zinc vapour or placed above the molten zinc. A convenient form of apparatus is shown in Fig. 5. It consists of an inner drum, C, composed of wire netting or gauze, in which the articles to be galvanised are placed. This cage or hollow drum is slowly rotated inside an outer cylinder, B, composed of wrought iron, in which the metallic zinc is heated by means of gas or an electric furnace or any other suitable means, to a temperature

sufficiently high to volatilise the zinc. Hydrogen or other suitable gas is forced into the apparatus through the tube, A, and a pilot of hydrogen is kept burning through a small hole in the door, D, which makes a gas-tight joint when closed. The apparatus for vapourising has to be modified to suit various requirements, but, in almost all cases it is necessary to move the objects to ensure their being evenly coated with zinc.

A modification of the vapour process is applied to the inlaying and decorating of metallic surfaces. The *modus operandi* briefly consists in coating the article to be decorated with a stopping-off composition, these portions which are to be inlaid being left exposed. The stopping-off composition is applied by hand or by stencils or the whole of the surface is coated, and those portions which are to be inlaid removed with a suitable tool. The metal object thus prepared is then placed in an iron



FIG. 6.—Furnace for ornamenting and inlaying metallic surfaces.

receptacle containing the metal which is to be inlaid in a powdered form or subjected to metallic vapour by the process just described. If the zinc is the metal to be inlaid, zinc dust is the powder employed. When the article has obtained the desired depth of inlay and onlay, it is allowed to cool and then removed and brushed with a stiff brush to remove the stopping-off composition. A useful type of furnace for this class of work when using the zinc-dust vapour process is shown in Fig. 6, and a specimen of the results obtained in Fig. 7.

The vapour process enables a variety of effects to be obtained and a number of metals to be blended together

which hitherto has been impossible, and alloys of many colours and tints to be obtained in the one operation. The thickness and depth to which the metals are to be inlaid and onlaid can be controlled at the will of the operator. This vapour process of burning in and blending metals enables very beautiful colour effects to be obtained, the colours ranging from silver-white to yellow brass and bronzes of various shades graduating to red copper. A great charm about this new process of inlaying metals, and one that is unique, is that the inlay has not the sharp line of demarcation essential to damascening and similar processes, but a soft transition from the inlaid metal to the surrounding metal. For instance, in the case of inlaying zinc in copper, the zinc is surrounded by a band or halo of a golden-coloured alloy. This process of inlaying is not confined to zinc and copper; it has been successfully applied to such metals as nickel, cobalt, antimony, and aluminium.

In conclusion, I venture to express the hope that this new process of galvanising and blending metals may prove of some interest and benefit to the metal industries of England.

DISCUSSION.

The CHAIRMAN said he was much struck by the statement that this process was cheaper than the comparatively simple one of dipping, and that, as he understood, it was unnecessary that the articles should be carefully cleaned before being subjected to the process. He should like to know whether he had correctly understood the author in that respect, and also if it was a fact that the process did actually compete in point of cost with the ordinary one of galvanising. As he gathered the operation took several hours, during which a considerable temperature had to be maintained, and a certain amount of plant was necessary, all of which meant cost. It was also remarkable that there were two such distinct variants of the process, one in which zinc dust was used, and the other in which molten zinc was employed. In neither case was the temperature high enough to reach the volatilisation point of zinc, but he imagined that the passage of the hydrogen through the molten metal was essential for the coating of the articles where molten zinc was used. Although the author had stated that this was a metallurgical rather than a chemical paper, yet there was one special portion of the subject in which chemists would find matter for discussion, namely, a consideration of what was known as Preece's test as a suitable means of ascertaining the actual amount of zinc deposited on an article submitted for examination.

Mr. PHILIP said that the beauty with which extremely minute details of designs were reproduced by the zinc vapour process, as shown in the photographs exhibited, was astonishing. He was not able to grasp the author's meaning when he referred to the existence of some electric action as accounting for the deposition of the zinc on metal from zinc powder, heated below the vapourising point. He (Mr. Philip) suggested that this action was rather analogous to the passage of carbon into iron in the cementation process at temperatures far below the melting point of either the iron or the carbon. He agreed with the Chairman that it was astonishing that a method requiring so much special apparatus and so long a time for completion could compete in cost with the ordinary rapid hot galvanising process, but it was probably partly due to the fact that the cost involved in keeping large tanks of zinc melted for long periods and the depreciation of the tanks and of the zinc itself by absorbing iron, handicapped the older process, whilst, on the other hand, the new process was carried out at a temperature which did not affect the temper of steel, and permitted the zincing of accurately machined articles without their dimensions being sensibly altered, and thus possessed advantages over the old hot galvanising process, which could not compete with it in these respects. Mr. Cowper-Coles had found that Preece's test did not yield satisfactory comparative tests with the electro-galvanised iron and vapour galvanised iron. In his own experience he had found that electrolytically deposited zinc withstood Preece's test better than hot galvanised iron for the same

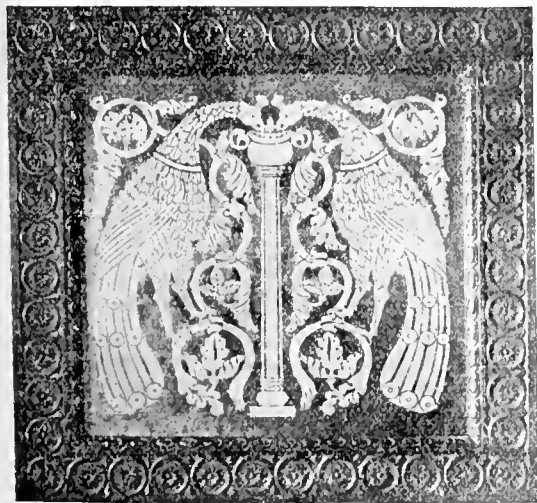


FIG. 7.—Copper panel inlaid with zinc.

weight of zinc per surface area, and he attributed this to the purity of the zinc deposit. Preece's test had to be very carefully carried out to be of any value. The article under test was plunged in a saturated copper sulphate solution at a temperature of 70° F. for one minute, it was then taken out and shaken in a rapid stream of water, if this removed all the copper deposit the test was repeated until an adherent layer of copper was obtained which could not be removed from the metal surface by running water. When this point had been reached the underlying iron or steel had become exposed, and the number of dips required to reach this point was a measure of the satisfactory protective nature of the zinc covering. The use of ferric sulphate solution as a substitute for copper sulphate in a modified Preece's test as proposed by the author appeared to him to be fallacious, for metallic iron itself reduced such a solution. The author stated that the vapour galvanised steel or iron did not resist Preece's test so well as hot galvanised or electrolytically galvanised material, but on the other hand it resisted corrosion due to rusting better, and he explained this as being due to the formation of a protective zinc-iron alloy on the surface of vapour galvanised articles. It was not clear whether this superior resistance to rusting of the zinc-iron alloys was an observed fact or was merely a theory. If it was a matter of experience it settled the question, but the formation of these zinc-iron alloys always took place on the surface of iron or steel galvanised by the ordinary hot process. The amount of iron present in such zinc-iron alloys ranged from a trace up to about ten per cent.

Mr. J. W. HINCHLEY said, having the technical supervision of this process in the United Kingdom, he might perhaps throw a little light on some of the points which seemed obscure. The author had described the processes as "vapour galvanising," but the greater part of the paper was concerned with the process known all over the world as "Sherardising," in honour of the discoverer of the process, Mr. Sherard Cowper-Coles himself. In the process of "sherardising," the vapour of zinc had, if any, a very secondary action. He could give numerous facts from practical working, and also from laboratory tests, to support this contention. To give one instance, in "sherardising" articles produced by "punching"—as was common in this country, punches were used which were not sharp, so that the fibres of the steel or iron were torn out, forming fine fissures—invariably those fissures were not "sherardised"; but there was no reason why they should not be, were the process a vapour process merely. The author had entirely neglected perhaps the most important consideration, the percentage of metallic zinc in the zinc dust: it was by regulating that, that the process became a commercial one and capable of control. The regulation of the temperature only was of no value, because the heat could not be controlled sufficiently exactly for practical purposes. He had been unable to get a deposit which was comparable to "sherardising" from vapour only. He could get a deposit, but which had not the slightest resemblance to "sherardising," and was practically and commercially useless, and further required an extremely high temperature for its production. As to the protective value of the process, five or six years ago, in its early days, pulley blocks were "sherardised" which had been in use in the open air ever since, and which were as good to-day as when they left the factory, with the exception of the wear and tear on the chains. They had been exposed every winter and summer to all changes in the weather. The question of cost was simple. A quarter of an ounce of zinc per square foot, applied to an article by the "sherardising" process, was more effective than two ounces applied by wet galvanising, so that the saving in zinc alone was enormous. Again, when properly carried out, the amount of waste was practically nil. During the last year at the Willesden Works the amount of zinc lost was only that occasioned by handling, and in the crannies of the factory, which was swept up and sold as sweepings. Other items of cost were the pickling of the goods and the putting into the drums. The pickling must be carried out far more carefully than had been suggested, and although in the laboratory it was possible to get a coating on greasy goods, they were always par-

ticularly careful to remove any oil, unless it were an extremely small amount, because, although it might not interfere with the process so far as getting a coating, it produced a bad colour and quickly spoilt the zinc dust for future use. The temperature required, depended largely on the character of the steel or iron; for cast iron it must be higher than for wrought iron and mild steel. "Sherardising" began at 160° C. with mild steel, but 200° C. was generally necessary for cast iron. There was another important point with regard to this process; it showed mechanical faults in the articles. If a bad weld were present, or a crack in a tube, the process showed the existence of these faults; so that he would suggest to engineers who wanted to be sure of permanence and excellent goods, that they should specify this process. Another interesting thing was that owing to the time character of the process, a slow rise of temperature followed by a slow cooling, the articles were extremely well annealed, and the result was that chains and such articles as were struck from a bar, or bolts or nuts which were struck in a machine and immediately cooled by a flow of water, were actually stronger and would stand work much better after the process than before. In fact, in the case of chains, and many other goods, the strength increased about 5 per cent. Springs also could be "sherardised" without their temper being affected, and large quantities of springs were so treated for exposure out of doors.

Mr. BRYAN CORCORAN said that in galvanising by the wet process the coating was apt to crack off and the surface was very easily rusted. He should like to know whether plates dealt with in this way could be bent better and whether wire could be woven, and especially whether wire so treated could be afterwards drawn so as to leave it with a good surface and a good coating that would not come off in the process of weaving.

Mr. WALTER F. REID said there seemed to be some doubt as to what it was that deposited the zinc on the surface of the iron. For the present, he preferred to take the opinion of the author, and to consider that the zinc volatilised; but the interesting problem was how did it volatilise? Did it volatilise because of the carbon monoxide that perhaps permeated the walls of the cylinder in which it was heated? That might account for the fact that the zinc did not deposit itself on the internal walls of the cylinder, which themselves were made of the same material as that on which the zinc was deposited. Another interesting point was the use of zinc dust for the purpose, which contained a certain percentage of oxide. They all knew that zinc dust, if not exactly a waste product, could, at any rate, be obtained at a lower price than spelter, and possibly that might obviate the increase of cost, if there were any, in the process. But there were losses in connection with the ordinary hot galvanising which ought to be borne in mind, for instance, the alloy of iron and zinc, which formed in that process, was clear evidence that the coating was more efficient than in wet galvanising, where no such intermediate alloy was formed. In the hot process one of the difficulties was that a large percentage of the alloy with iron might be formed if the temperature were kept too high. It seemed to him that the intermediate coating was not only protective to some extent, but it also made the zinc adhere as well as it did to the article. Mr. Corcoran was quite correct in saying that zinc deposited by the ordinary cold process was apt to flake off, which was, he thought, because that intermediate coating was not formed. With regard to the percentage of zinc oxide, he should like to ask the author if he had tried the maximum percentage of oxide which could be used, mixed with the metallic zinc dust. Zinc oxide was now being produced on a very large scale in Upper Silesia, and he had the pleasure of associating in some experiments there a short time ago, where zinc oxide was being produced in a very large quantity from the old residues of the mines. There were more than a million tons of these residues from which was produced an oxide of zinc, slightly contaminated with iron, and that percentage of iron rather reduced the value of the product, because it interfered with the colour when the zinc oxide was used for making paint. It seemed to him that in such a process as this, an oxide of that kind might be very well

available for galvanising, and could be produced very cheaply.

Dr. G. T. MORGAN asked whether zinc dust vaporised more readily than the massive metal, and whether at the temperature of the process zinc dust had any appreciably different vapour pressure to zinc itself.

Mr. COWPER-COLES, in reply, said the first question raised was that of cost. Undoubtedly, the cost of vapour galvanising was less than that of hot galvanising, the chief reasons being that no zinc-iron alloy was formed, and the whole of the zinc dust was consumed, and there was no waste. If the zinc dust deteriorated at all, it could always be renovated by the addition of carbon. The temperature required for vapour galvanising was very low as compared with hot galvanising; it never need exceed 600° F., and was quite workable even at 500° F. In the case of hot galvanising, a large mass of metal had to be kept molten day and night; the molten zinc was continually working on the iron tanks to form a zinc-iron alloy, which was only saleable at a considerably reduced cost. Another saving effected by vapour galvanising was that the cleansing had not to be carried out to the same degree of nicety as in the ordinary hot process or in electro-zincing. The next question raised was that of the temper of the articles treated and their elasticity. Among the specimens exhibited, would be found files and watch springs coated by the vapour process, which had not lost their temper in any degree. Specimens of iron plate which had been vapour galvanised and then rolled and drawn, were also exhibited.

With reference to the maximum amount of zinc oxide which could be present in the zinc and yet give satisfactory results, he had not the figures with him, but he had carried out experiments extending over many months, using the same zinc dust and adding only a sufficient quantity each day, to make good the actual metallic zinc vaporised. It was found that the zinc became more oxidised each day, as the drums were opened when the zinc dust was still hot. If he remembered rightly they found they could get good results with only 40 per cent. of metallic zinc present, although it took somewhat longer to obtain the same weight of zinc per square foot on the iron articles under treatment.

New York Section.

Meeting held at Chemists' Club on Friday, February 19, 1909.

MR. MAXIMILIAN TOCH IN THE CHAIR.

LITHOPONE.

BY HERMAN S. RIEDERER, PH.D.

The earliest reference which can be found for the production of lithopone, known also as Ponalith, Griffiths' White, Graves' White, and Zincolith, was J. B. Orr's English patent of Feb. 10, 1874, for an Improved Zinc White. Theoretically it is a molecular mixture of zinc sulphide and barium sulphate, but the products which are on the market contain other substances as well. The advantages claimed for it are, that it is not affected by sulphides and has high covering power, and its disadvantages, due to particular methods of manufacture, are, that on exposure to sunlight it often turns grey and becomes chalky.

To make it, solutions of barium sulphide and zinc sulphate are mixed in molecular proportions. The resulting precipitate of zinc sulphide and barium sulphate is then dried, heated in a furnace, ground, washed, and re-dried. The greatest care is necessary to obtain sufficiently pure solutions, as metals which form black or coloured sulphides would give the pigment a grey, yellow, or brown tint.

Barium sulphide is obtained by roasting ground barytes with coal or other carbonaceous material in a reducing atmosphere. Two types of furnaces are used, viz., flat bed reverberatory and rotary kiln (Bruckner); either is

equally good. Lixiviation of the product of the roasting gives a solution of sufficient purity for the next stage of the process.

For the zinc sulphate solution any zinc bearing material may be used. Spelter and dross leave little or no zinc in the insoluble residue, but zinc ashes usually leave so much mud in the solution tanks that the unit of zinc in this material is not so valuable. As regards impurities the sulphide metals cause little trouble. Arsenic and antimony either disappear as arsine and stibine where metallic zinc is used, or are precipitated with the copper and cadmium by adding some barium sulphide solution. Iron and manganese are usually removed by boiling with bleaching powder. A more powerful oxidising agent and longer boiling are usually necessary when manganese is present.

The two solutions in proportionate quantities are then mixed to produce the molecular precipitate, which is then filterpressed and dried. Vacuum dryers are now coming into use in place of hot air rooms. The dried precipitate is white, but lacks body; this is produced by the burning. Over-burning converts some of the zinc sulphide into oxide, which reduces the value of the pigment both as to strength and yield; under-burning gives a pigment without body. Some zinc oxide is always found in lithopone, but it should be kept below 2 per cent.; it ranges between 0.5 per cent. and 12 per cent. After the burning, the red hot pigment is at once quenched and ground fine, after which it is thoroughly washed, dried, disintegrated, and packed. Pebble mills are now being tried to replace the older buhr stone mills.

Ordinary lithopone contains about 29.5 per cent. zinc sulphide. A higher grade, containing from 45 per cent. to 48 per cent. sulphide, is produced by replacing part of the barium sulphide by sodium sulphide, and washing out the resulting sodium sulphate. Lower grades are also made by replacing part of the zinc sulphate by sodium sulphate.

There is much diversity of opinion as to why lithopone turns grey on exposure to sunlight, and many patents have been taken out for the manufacture of a light-proof product. But the real causes have not been definitely determined, though lack of purity in the product seems the most probable cause. Zinc salts other than the oxide and sulphide are often found, but 1 per cent. to 2 per cent. of these are not usually considered objectionable. The production of lithopone is increasing.

MANUFACTURE AND PROPERTIES OF MILD PROCESS WHITE LEAD.

BY DR. C. D. HOLLEY.

The "Mild process" for manufacturing white lead is the only one in practical operation in this country which does not require the use of acids, alkalis, or other chemicals in the process of manufacture, every trace of which should be removed from the finished product, necessarily involving certain purifying processes which in themselves are expensive and costly, and if incomplete will cause a marked deterioration in the quality of the lead produced. This process derives its name from the fact that it is the mildest, simplest, and most natural process possible for the manufacture of white lead—metallic lead, air, water, and carbon dioxide being the only substances required. There are no impurities to be removed, no off grade lead which must be blended in, or sold at a much reduced price, no by-products of any kind. This process results in the production of one uniform product, a pure basic lead carbonate of approved chemical and physical constitution and of a whiteness, density, and covering power not exceeded by that of any other make of white lead.

Numerous attempts have been made to reduce lead to a granulated form and then by attrition and agitation in the presence of water and carbon dioxide secure conversion into white lead, among which may be mentioned those of Welch and Evans of Philadelphia in 1814, in which granulated lead was placed in lead-lined barrels, which were made to revolve. The barrels were partly filled with water, and the particles of lead removed by attrition, were oxidised by oxygen from the air, and this

oxide carbonated by the introduction of carbon dioxide produced from burning charcoal; also that of Smith Gardner, of New York, in 1840, in which granulated or small pieces of lead were introduced into vessels lined with sheet lead, and partially filled with water, and so arranged that they could be revolved or manipulated in such a manner as to subject the lead to continual attrition. The vessels were kept closed, and during the process carbon dioxide and air were introduced. Owing to a lack of knowledge of the correct principles by which this process must be conducted, all of these earlier attempts failed, and it remained for Mr. Willson H. Rowley, of St. Louis, Mo., to put this type of process into successful operation on a large scale. Rowley conceived the idea of atomising or disintegrating the lead with the aid of a current of high pressure superheated steam, thus obtaining the lead in a very fine state of division, affording a very large surface for attack. His experiments were successful, and the several patents covering the processes of manufacture were granted in 1902 and 1903; and immediately thereafter a plant of about 1000 tons annual capacity was equipped and placed in operation. The product found immediate favour and a ready sale. In 1906 the process was taken over by the owners of the Acme White Lead and Color Works and a 10,000 ton plant was made in Detroit, embodying numerous improvements in machinery and equipment.

In this process the corroder is not obliged to use the extremely highly refined lead used in the Dutch process but may use an ordinary good grade of lead; some of hard grades of lead, however, do not suffer conversion as easily as the softer varieties, although there is apparently little or no difference in the colour and quality of the product obtained, provided the silver content is kept below 1 oz. per ton.

The lead is melted in large kettles holding about 5000 lb. each, from the bottom of which it is conveyed through heated pipes to the "atomisers," which are similar in principle to the ordinary laboratory blast lamp; in the atomisers the molten lead comes in contact with a current of steam superheated to a temperature higher than the melting point of the lead. The expansive force of the steam disintegrates the lead into exceedingly minute particles which, in the course of their descent, solidify. Each of the four atomisers in the present plant has a capacity of 1500 lb. of atomised lead per hour, or a combined capacity of 6000 lb. per hour. The streams of atomised lead are directed downwards in a large steel room or chamber two stories in height, in the bottom of which is about two feet of water. On the floor below the atomisers, about half way between the top and bottom of the blow chamber, is an opening through which a large spatula can be inserted so as to collect a small quantity of the atomised lead, so that the fineness of the particles can be readily ascertained and the atomisers regulated accordingly. Once the valves are correctly adjusted very little regulation is needed. By means of a drag and screw conveyor, the lead, in the form of a heavy soft mud, is delivered from the bottom of the blow basin or blow chambers, to the pump-feeder, which keeps the particles suspended in the water, so that the material can be readily and conveniently handled by a rotary pump, which forces the lead and water through a pipe line to the float boxes, where the lead is deposited in the desired compartments; these, having a higher level than the bottom of the blow chamber, are piped back, so that the water returns again to the blow basin, which insures against any loss of lead. There are five float boxes in each of the two lines, and when filled each line has a capacity of 250,000 lb. of atomised lead. By means of gate valves the lead is discharged into the oxidisers directly underneath, 6000 to 10,000 lb. to the oxidiser as desired. The requisite amount of water is added, a current of air under low pressure from a fan introduced, and the contents agitated mechanically for 24 to 36 hours. The particles of lead during the atomising process have already become coated with a thin pellicle of suboxide, which renders the lead very active chemically, so that within a very few hours after the beginning of the agitation a strong chemical action sets in, accompanied by a marked rise in temperature, resulting in the formation of any of several

basic lead hydroxides as may be desired, which will vary in colour from greenish yellow, through the different shades of yellow, orange, to a brownish orange; these results are secured by varying the amount of water, air, agitation and control of the temperature. Some of these basic hydroxides are much more suitable for white lead making than others. At the expiration of 24 to 36 hours, according to the size of the charge, about 80 per cent. of the lead will have been converted, and the oxidisers are discharged into a trough emptying into the float system on the floor below where, by means of an inclined drag, two agitator tubs, and a float-table, the metallic lead is completely separated from the basic oxide, automatically conveyed to the small pump-feeder, from which the pump returns it to the float boxes, there to be added as a small increment to fresh charges of atomised lead in the oxidisers, which secure a practically complete conversion of the returned lead. The separated basic hydroxide, after flowing over the table, runs into a tank, from which it is conveyed by means of another rotary pump to the fourth floor, where it is deposited in a series of large tanks, the water being returned to the separating system, thus avoiding any mechanical loss of lead. The above-mentioned tanks also act as a storage for the basic hydroxide which is drawn as required into the carbonators located on the floor below, it having been reduced to the desired consistency. The carbonators are large wooden cylinders somewhat similar to the oxidisers in construction, but of less capacity; in them the basic lead hydroxide is agitated in the presence of carbon dioxide, which, by means of scrubbers, has been thoroughly cooled, desulphurised, and freed from soot particles.

The carbon dioxide used, is produced by the combustion of a selected grade of coke, very low in sulphur and volatile matter. The furnace is so constructed that 90 to 95 per cent. of the oxygen of the air entering the grate is converted into carbon dioxide, and the combustion so controlled that there is practical absence of carbon monoxide. The efficiency of the furnace is therefore very high. The heat produced is utilised as indicated in assisting the production of steam for power purposes. The gas drawn from the furnace by the fan, passes through a cooling chamber, then up through the scrubbing towers, two and one-half stories in height, which cool the gas to room temperature and free it from any traces of sulphur dioxide and hydrogen sulphide, in a manner similar to that used in the purification of illuminating gas. The gas as it comes from the top of the towers is thoroughly freed from all impurities, and has a carbon dioxide content averaging 19 per cent.; it is conveyed to the carbonators through a large pipe with a lateral branch to each carbonator. During the first 18 hours, no apparent change is noticed in the colour, but during the next 18 hours the change is very rapid and is accompanied by a considerable increase in volume of the mass, the carbonators requiring to be watered at short intervals, both on account of the swelling of the mass and the chemical combination of the water with the lead. In approximately 36 hours the carbonation is complete, resulting, if the operation has been properly conducted, in an exceedingly white, basic lead carbonate of very nearly the theoretical composition. As there are no impurities present, no washing or floating is necessary, and the thin semi-paste mass is drawn from the carbonators by the pump and pumped directly on to the drying pans and dried in the usual manner. When dry, the white lead crumbles instantly under the slightest pressure into a very fine amorphous powder.

The "Mild process" is under a much more complete control than any other process, as any slight variation that may take place in the chemical actions involved can be easily corrected and counterbalanced. The gas is tested at regular intervals, and the changing conditions of the lead carefully noted. The completion of the carbonation is very clearly indicated by certain distinctive characteristics of the lead and its behaviour at that time, so that, contrary to expectation, there is no danger of over-carbonation under competent supervision.

At first sight it might seem that a white lead produced in the manner described would consist largely of a mechanical mixture of hydroxide and normal carbonate,

but such is not the case, as may be demonstrated both by a microscopical examination and by a study of the process of formation of the white lead. The composition of the hydroxide formed in the oxidisers indicates a hydration of 10 to 12 per cent., or only about one-third of the combined water to be found in the finished white lead. Therefore, the larger part of the hydroxide portion of the white lead molecule is formed during the carbonating process, and has much to do with the large apparent increase in volume exhibited during the carbonating, which in itself serves as a close check on the completion of the carbonation.

From a manufacturing standpoint this process has much to commend it, especially as regards the following items:—The process is not restricted to a specially refined lead; it is under complete control: it results in conversion into white lead of all of the lead entering the process, avoiding any ultimate metallic residues whatsoever; the white lead obtained is of a uniform grade with no tailings, sandy or crystalline lead being produced; there are no mechanical losses of lead, as the same volume of water is used over and over again. Manual labour is reduced to a minimum, the conveying of material in the process being accomplished entirely by gravity and pumps. The workmen do not come in contact with the lead either through handling or from dust in any part of the process from the time the pig lead is put into the melting kettle until the white lead is removed from the pans.

The white lead produced by this process is very similar to that produced by the older process as regards the amount of oil thinners required for grinding and for reducing to painting consistency. Under the brush it works more easily than any other white lead.

Practical experiments, in which different kinds of wood, painted with three coats various brands of white lead, and exposed for two years, indicated the superiority as regards covering power of "Mild process" white lead: as regards opacity of the coating, all appeared to be of equal merit after three coats had been applied. As compared with other white leads, "Mild process" is of equal whiteness, and the particles are of a very uniform fineness. Although very soft and chalky in appearance and "feel," "Mild process" lead is as dense and does not require any greater quantity of oil in the grinding and little, if any, more in reducing to painting consistency than other leads. Under the brush it works very easily, and owing to the uniform fineness of the particles it covers a large amount of surface with great opacity, and its entire freedom from lead acetate and other impurities ensures for it a maximum wearing or service value.

DISCUSSION.

In reply to a number of questions,

Dr. HOLLEY said he had found hydrated hydroxides containing as little as 2 per cent. of lead hydroxide, and some as high as 24 per cent. Some of them could not be converted into white lead; that is to say, the product would be pink, instead of white. The essential part of the process was to cause hydration. If the carbonation were forced too rapidly incomplete hydration took place.

Measurements made by Dr. Knap, of Chicago, indicated that the particles were very small and more uniform in the "Mild process" sample than in the "Old Dutch process." There was no more pressure during carbonation than could be produced by an ordinary fan, possibly three or four ounces. During certain stages of the process, when the carbonators were at 55°–58° F., the gas entered with a 19 per cent. carbon dioxide content and came out with 4 per cent. or 5 per cent. of carbon dioxide. In the latter part of the process, the gas entering at 19 per cent. will come out 16 per cent. or 17 per cent., when the temperature in the carbonators ranged from 98°–103° F. The reason for this was that the carbon dioxide did not act by contact on the lead particles, but by being dissolved in the water, wherefore the amount dissolved by a warm carbonator was very slight. They were using a great deal of Missouri pig lead, and also what might be regarded as "corroders" lead; they were not inferior grades of lead, nor did they contain any considerable amount of impurities.

SUBLIMED WHITE LEAD.

BY L. F. HUGHES.

In describing a product in the manufacture of which we are personally engaged, it is perhaps difficult to avoid making an *ex parte* statement, but it appears to me that this attitude should be as far as possible avoided. If, therefore, I say little or nothing in praise of sublimed white lead as a pigment, it is because my purpose is not to advertise or extol this or any material, but merely to submit the essential chemical and physical data of its manufacture and properties.

Lead sulphate when finely divided and submitted to the action of an oxidising flame undergoes an abrupt combustion directly to the basic sulphate of lead, $2\text{PbSO}_4 \cdot \text{PbO}$, which passes off as a vapour, and if conducted through a super-heated chamber can be maintained in a state of gaseous dissociation. Upon condensation it appears as an intensely fine, white powder, non-crystalline even under the polarising microscope (a marked difference from the lead carbonate pigments), and highly opaque. The reaction resulting in the production of this compound was discovered by E. O. Bartlett, a zinc oxide manufacturer, about 1866, and was by him developed into a commercial process, briefly as follows:—

Pulverised galena is fed into an open coke fire, and the furnace gases and fumes are drawn into a series of settling chambers in which the dust and non-volatile impurities are deposited. Draught is supplied by a suction fan placed at the farther end of the settling and cooling pipes and through this fan the now condensed and purified fume passes and is delivered into an ordinary cloth filter system or "bag room," very similar to those used in the manufacture of zinc oxide. The settling and cooling train employed in actual practice is about 1000 feet in length with an average internal diameter of about eight feet. It is in part exceedingly narrow and is in places distorted into abrupt curves with interrupting "baffles." The development and elaboration of this purifying train proved in practice a most intricate problem and it was largely worked out by actual change and experiment. A discussion of the developments and the phenomena disclosed by these experiments would be very interesting, but the manufacturers naturally feel that these are trade secrets.

As the ores used contain no volatile bases in addition to the lead, except a little zinc, the pigment collected on the filter screens requires no subsequent treatment, and it is packed directly from the "bag room" hoppers. The composition of sublimed lead as it exists on the market varies from the theory in two ways:—(1) It contains as an admixture a little zinc oxide from the combustion of sphalerite in the ore. (2) It contains somewhat more sulphur than accords with the formula $\text{Pb}_3\text{S}_2\text{O}_6$. The latter variation is due to a secondary reaction from the oxidation of free sulphur dioxide in the furnace flues. A portion of this gas is converted into sulphur trioxide and combines with the basic compound, probably converting its equivalent into the neutral salt. This secondary reaction can be avoided, but it has not so far proved commercially advantageous.

The commercial product has a specific gravity of 6.2, and diameter of particle of $1/35,000$ th inch. Its analysis varies within narrow limits: it consists approximately of lead sulphate, 75 per cent.; lead oxide, 20 per cent.; zinc oxide, 5 per cent. There should be no other bases present save in traces. There have been frequent assertions that the lead oxide present is free litharge, but as this statement has been completely refuted by competent and disinterested investigators, it is unnecessary to do more than cite the fact of the assertion and its incorrectness.

At present, sublimed white lead is, I believe, made only in the United States. There have been several sporadic attempts to conduct its manufacture in Great Britain, but they have been unable to maintain the rather delicate adjustment of furnace conditions which alone yields a white pigment by this process. As an instance of the unfortunate efforts made abroad, I will mention that one concern, at least, abandoned all endeavours to purify the sublimate mechanically and resorted to digestion with sulphuric acid to dissolve out the discolouring

impurities. This treatment did produce a white pigment, but it destroyed three of the chief essentials of quality in a pigment: fineness, basicity, and opacity.

So much for the production of the material in its dry form as the paint manufacturer receives it. In a paint it exerts no extraordinary or characteristic influence; and this fact might be predicted from its chemical nature. Chemically it may be regarded as entirely inert in the mix, and it is therefore almost free from the action upon tinting materials which characterises the chemically unstable lead pigments. For the same reason it is highly resistant to the action of gases, even hydrogen sulphide having little discolouring effect upon the paint coat under service conditions.

The extreme fineness of division which characterises all amorphous sublimates gives sublimed white lead an advantage over mechanically ground or precipitated pigments in that it stays in suspension better. This same fineness necessitates a very thorough grinding unless the paint contains a proportion of coarser particles. A loose mill will do no more than separate the pigment into tiny aggregates encysted by oil—a condition not conducive to either smooth working or durability. An appreciably coarser pigment in the mix, however, effects an easy and complete dispersion of the particles. This quality of fineness, however excellent in effecting the production of an impervious and durable coat, is found somewhat objectionable from a commercial standpoint. Some painters have a preference for a paint made with only one pigment, and no amount of demonstration will convince them that the addition of another ingredient is for the purpose of improvement. Now, as has been well pointed out by one of our best chemists, a paint coat is better made with three sizes of particles than in any other way. It brushes better, takes naturally a more uniform thickness, and, he considers, offers a more nearly impermeable layer. In a sublimate there is, of course, only one size of particle, and for that reason a straight sublimed white lead paint does not brush so easily as one containing from ten to fifteen per cent. of a coarser material. This admixture may be fibrous magnesium silicate, silica, or Dutch process white lead; named in the order of their influence on the brushing character of the mix. It is quite true that the straight pigment makes a good paint, and some grinders are putting out the single pigment in oil; but I believe such a mixture as I have suggested or, better still, one containing a small addition of zinc oxide to give hardness to the coat, is better than the straight paint. There is not, in my opinion, any pigment which for general work gives the best results when used alone. Straight zinc oxide is too fine and makes a very hard coat; sublimed white lead is also too fine; lead carbonate is chemically too unstable; and so through the entire list of painting materials, we find for each substance certain deficiencies which can be remedied by addition of other ingredients possessing the particular characteristic desired. This property of fineness is no detriment. The finer the better is an invariable rule for the major pigment in any paint, but there is an undoubted advantage in having present a minor proportion of coarser particles. The selection of the particular type of coarse particle

is a matter for the judgment of the paint compounder, but it is worth notice that those mixtures which are generally giving the best service are characterised by the presence of a crystalline ingredient of sharp angularity and chemical stability. The function of crystalline pigments has of late been a subject for discussion in legislative as well as technical circles, and it is evident that it has not received the careful consideration which it deserves even among paint men. Otherwise, it is hard to account for the opposition to materials on the ground of crystallinity by advocates of corroded white lead, when besides the presence of visibly angular fragments of cerussite, that pigment shows itself anisotropic to polarised light and must therefore be regarded as entirely crystalline. It is quite true that a paint made from coarse crystals only will not give satisfaction, but it is equally true that no entirely amorphous substance exhibits perfection.

This apparent digression from my text was for the purpose of supplying a possibly superfluous explanation of my advocacy of the valuable but much abused reinforcing pigments.

To summarise, it may be said of sublimed white lead that it is characterised by extreme fineness, chemical stability, high opacity, and is unique among lead pigments in that it is amorphous. Paint coats made from it alone or without any large admixture of chemically unstable compounds are noticeably free from discolouration and exhibit a characteristic wear from the surface without development of cracks or checks. Its faults have been elaborated above.

DISCUSSION.

MR. G. W. THOMPSON considered that "Sublimed lead" was the proper name for the product and not "Sublimed white lead," as it was called by the author. White lead could be used alone as a pigment; sublimed lead could not.

MR. EVANS replied that the product was lead, as Mr. Thompson had said, that it was white, and was sublimed. The Picher Lead Co. also made a blue product, which was sublimed, called "Sublimed blue lead." The white paint had been called "Sublimed white lead" since the inception of the company, thirty-five years ago.

Meeting held at Chemists' Club, on Friday, March 19th, 1909.

MR. MAXIMILIAN TOCH IN THE CHAIR.

DUTCH PROCESS WHITE LEAD.

BY G. W. THOMPSON.

The general method of manufacture of "Dutch process white lead" has been so fully described that it is unnecessary to further describe it, but certain points in connection with its manufacture deserve consideration.

Corroding Pig Lead.—In the Dutch process a very pure pig lead is needed, as the more objectionable impurities are not eliminated to an appreciable extent at any step in the process of manufacture. There are few, if any, metals that can be found in commerce as pure as the best grades of corroding lead. This is shown in the following table:—

COMPOSITION OF AMERICAN PIG LEADS.

	South-East Missouri undesilverised.	South-East Missouri desilverised.	South-West Missouri undesilverised.	Ordinary common.	Ordinary corroding, or refined.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Silver.....	0.0070	0.0004	0.0005	0.0005	0.0005
Arsenic.....	trace	trace	trace	trace	trace
Antimony.....	0.0030	0.0030	0.0020	0.0100	0.0050
Tin.....	none	none	none	none	none
Bismuth.....	0.0030	0.0030	0.0030	0.0800	0.0500
Copper.....	0.0000	0.0003	0.0100	0.0006	0.0006
Cadmium.....	none	none	none	none	none
Iron.....	0.0015	0.0015	0.0015	0.0015	0.0015
Zinc.....	trace	trace	trace	trace	trace
Cobalt and nickel.....	0.0080	none	0.0018	none	none
Manganese.....	none	none	none	none	none
Total impurities.....	0.0825	0.0082	0.0278	0.0926	0.0576
Lead.....	99.9175	99.9918	99.9722	99.9074	99.9424

Silver and copper are the most objectionable impurities in corroding pig lead: neither of them should exceed 0.0010 per cent. By zinc desilverisation—the Parkes process—both silver and copper are removed well below this limit. Bismuth is not removed by the Parkes process, but can be eliminated by the electrolytic or Pattison processes. Bismuth, however, only occasionally imparts a gray tint to white lead containing it. Iron does not alloy with lead appreciably, so that, in melting pig lead to cast it into buckles, the iron, which may have been present in the pig lead as a mechanical impurity, is eliminated. The maximum solubility of iron in lead is about 0.0015 per cent.

While a very pure pig lead is needed for the manufacture of white lead by the Dutch process, this does not necessarily operate against the process as an element of cost, as the refining of lead is a desilverising process—the silver recovered generally paying for the cost of refining.

Acetic acid.—The amount of 28 per cent. acetic acid used in the corrosion of white lead by the Dutch process seldom exceeds 1 per cent. of the lead set. Some of this acetic acid is carried away in the flue gases and is lost, some is eliminated in the wash-water, and the remainder stays with the white lead, combined in some form of insoluble acetate. Ordinarily, the amount of acetic acid present is about 0.08 per cent. There is no evidence, based on practical experience, that this acetic acid is objectionable. There is strong evidence that a very much larger percentage of acetic acid may be present without appreciable injury to the product. Very carefully conducted painting tests, which have been made by me, show no difference in durability between the ordinary Dutch process white lead and one to which lead acetate equivalent to 0.5 per cent. of glacial acid, had been added.

Fermentation.—The oxidation of the tan bark in the early stages of the corroding action is due to fermentation produced by micro-organisms, but when the heat has reached a certain point, the oxidation is in the nature of slow combustion in which micro-organisms have little or no part.

Pulp-mixed white lead.—White lead in water can be mixed with linseed oil, with the result that the oil displaces the water and combines mechanically with the white lead. The basis of pulp-mixed white lead is that its manufacture is more sanitary than dry grinding. It is somewhat whiter than dry-ground, because there is less overheating in the mills, and some of the mechanical impurities, such as tan bark, etc., go off with the water eliminated. The amount of water left in pulp-mixed lead seldom exceeds 0.5 per cent., and usually is much less than this. There is no evidence that this water injures the paint prepared from it, nor that pulp-mixed lead is inferior in any respect to the old-fashioned lead ground in chasers and then through burr mills. There is evidence, on the other hand, that pulp-mixed lead is equal in all its qualities to dry-ground, and, in addition to that, it works somewhat better for "flat" work inside.

The name white lead applies properly only to a compound consisting of lead carbonate and hydroxide in chemical union, or $2\text{PbCO}_3 \cdot \text{Pb(OH)}_2$.

The evidence that there is a definite compound of this composition is found in the following facts:—

If carbon dioxide is passed into a solution of basic lead acetate, a precipitate is obtained which, at first, may contain a large percentage of basic lead acetate in more or less insoluble form. As the solution becomes more nearly neutral, however, the composition of the precipitate approaches that given above. The basic lead acetate which has been precipitated with the white lead is dissolved in the more nearly neutral acetate solution. The indications are that the chemical process in the corrosion of white lead by the Dutch process involves, at the start, the oxidation of the lead and the formation of basic lead acetate; that this basic lead acetate is decomposed by the carbon dioxide present, the basic lead being precipitated as white lead, and that

the neutral lead acetate again acting upon more metallic lead is changed into the basic form ready to be acted upon again by carbon dioxide. The precipitation of white lead, therefore, from solutions of basic lead acetate corresponds to the formation of white lead in the stacks after the metallic lead has become oxidised.

Any one who is familiar with the Dutch process of corrosion can, on visiting the corroding stacks, isolate definitely, to his own satisfaction, white lead of theoretical composition. His examination of white lead in the stacks is similar to the examination of the mineralogist who selects pure crystals, which he analyses and finds to have definite composition. Other formulae for white lead have been suggested, but apparently only by those who have analysed commercial samples and who have not been familiar with the process itself. It is true that commercial white leads may contain a higher percentage of lead carbonate than that shown by the theoretical formula; this is due to the fact that the corroding operation is not under complete control. At times, carbonic acid will be in excess, and it will then in the conditions in which the white lead exists, act upon the white lead, converting it to neutral carbonate.

There is no evidence that a limited excess of lead carbonate in white lead is objectionable. Some advocate a percentage higher than the theoretical. It would appear proper, however, that some reasonable limit should be placed upon this excess. What this limit should be can be determined only by thorough physical and practical tests.

It is thus apparent that white lead is not a mechanical mixture of lead carbonate and hydroxide. It is possible that lead hydroxide can be mixed with lead carbonate and be made to combine, but there is no evidence that the properties of white lead are the properties of the two constituents separately considered.

The question has arisen as to the proper chemical name for white lead. It may be questioned as to whether it is desirable in all or many cases to use chemical names for commercial products. Commercial products are seldom even approximately composed of a single pure chemical constituent, and by using a chemical name for a commercial product we presuppose approximate purity. Chemists, of course, in making their analysis, obtain chemically pure precipitates, etc., but, in the case of mechanical mixtures, the results obtained by analysts are of value in proportion as they are expressed in percentages of the original proximate constituents, and, in so far as possible, in commercial terms.

Now, especially is this true in the case of white lead, for there is no thoroughly satisfactory chemical name current for even pure white lead. The most common name is "basic lead carbonate," but this is not satisfactory in that it is not sufficiently descriptive. It is possible to have anhydrous basic compounds. The name "hydrated basic lead carbonate" is equally unsatisfactory for the reason that the word "hydrated" may refer to water of crystallisation, as in the case of so-called "fully hydrated calcium sulphate." Probably, the best name for chemically pure white lead is "lead monohydrate dicarbonate," which is exceedingly cumbersome and not likely to be substituted for the simple name, white lead, which will probably continue to be used as answering all practical purposes.

The value of white lead as a pigment.—Some of the reasons that have been assigned for this superiority of white lead are untenable. The commonest is that it enters into combination with linseed oil, forming a lead soap, and that this gives it its working qualities. As a supplement of this theory, it has been asserted that it is the lead carbonate that gives to white lead its body. There is little ground, however, for the belief that white lead combines with linseed oil, except to an almost inappreciable extent. Hannay, some years ago, found that he could extract from white lead paste practically all the linseed oil it contained in its original form. Hannay's work has been repeated by me on many occasions, confirming his results and conclusions. It is true that white lead can be made to react on linseed oil at about the boiling point of water, but even then the reaction is only slight, unless the heating is prolonged

for some time. White lead contains about 31 per cent. of lead hydroxide. Figuring from the saponification value of linseed oil, which we put at 190, 100 lb. of white lead would require 76 lb. of linseed oil to combine with this lead hydroxide. It is seen therefore, that, in a white lead paste containing 10 per cent. of linseed oil, there is a large excess of base which should insure the complete saponification of the oil if such a reaction did take place.

On extracting white lead paste with ether, it is found that the linseed oil obtained contains a very small percentage of lead. The lead soaps obtained by precipitating the fatty acids of linseed oil with a lead compound dissolve readily in ether, with the exception of the lead soaps of the saturated fatty acids, so that practically all lead compounds would be dissolved by the ether. White lead adds to the drying qualities of linseed oil with which it is ground to the extent of this very small amount of lead, which combines with the linseed oil and dissolves in it.

As linseed oil paste does not show a combination of the white lead with the linseed oil, so it is also found that where an excess of oil is used there is no appreciably greater amount of combination between the lead hydroxide present and the linseed oil. Whether there is any combination between oxidised linseed oil and white lead after a paint has been applied is not definitely known. We have, however, no evidence that such a combination takes place, and it seems improbable that it does.

The conclusion thus is, that white lead is a relatively inert pigment, entering into combination to only a slight degree, if at all, with linseed oil or any of its constituents, when mixed with it as a paint.

The merit of white lead is largely due to its physical qualities. White lead has a remarkable latitude in the amount of oil it will take for thinning, so that it can be worked stiff or thin as the conditions demand. Its fluidity apparently increases the more it is brushed. This describes its working qualities. When thinned properly for painting it has a covering power greater than that of any other single white pigment.

The physical qualities of white lead are, to some extent, disclosed by a microscopical examination. This microscopical examination cannot be satisfactorily made unless the particles are first classified according to their sizes. We have been successful in constructing a classifier in which we can divide the particles up into groups, differing in a regular manner from each other in size. This classifier is a floating apparatus in which the particles are subjected to floating with successively varying speeds. The floating medium selected has been kerosene, on account of the high wetting power it possesses. In the apparatus which I have used, the particles float through four cones, which increase regularly in size, so that the diameters of the particles which settle out in these cones should vary regularly in size. This classification is, of course, not absolute, but it gives good practical results.

Dutch process white lead is composed of particles varying in size to an infinite degree.

CLASSIFICATION TEST ON DUTCH PROCESS WHITE LEAD.

	Per cent.
Ia Cone 1	3.42
" " 2	6.47
" " 3	6.61
" " 4	8.72
Finer than 4	74.84

100

It would lead too far to discuss the general question of the physical characteristics of a good pigment. Arguments, however, have been advanced to the effect that the pigment in a good paint should be composed of three sized particles. The theory is that the mixture of pigments having three different sized particles has the lowest percentage of voids. Good reasons have not been given, however, for assuming that the variations in size of particles should be limited to three. It is found that, taking spheres, an equal number of three different sized spheres can be figured out as giving a lower percentage of voids than where one size of sphere only is used, but unfortunately, it is found that those three sizes of spheres

differ from each other in their individual volumes as shown in the following table:—

Diameter.	Volume.	Per cent.
1.0	1.0	92.39
0.4142	0.0710	6.56
0.2247	0.0113	1.05

A pigment made up of 92 per cent. of comparatively coarse particles, 6 per cent. of medium sized particles, and 1 per cent. of comparatively fine particles would, in practice, hardly make a good paint. No calculations, as far as I know, have been made as to what still smaller sized spheres would have to be in order to still further reduce the voids. The indications are, however, from the study of those figures, that, in the case of spheres, an infinite variety would give the greatest reduction in the percentage of voids.

In conclusion, we offer this theory for consideration:—The pigment, the particles of which tend to fit together so as to give the smallest percentage of voids, is, *other things being equal*, the best pigment. Inventors of white lead processes have not recognised this sufficiently, and, for that reason, the many attempts that have been made to make a white lead to take the place of Dutch process white lead have been unsuccessful and wasteful of time and money.

DISCUSSION.

The CHAIRMAN said that what Mr. Thompson had said concerning the three sizes of pigment in a paint, producing the best results, originated some months ago, in the U.S. Paint Manufacturers' Association, which published a pamphlet to demonstrate that a film of paint should be composed of three sizes of grain, in order that the stress and strain of the film might be of greater value. Concrete was composed of three sizes of grain, and the assumption was that the strength of the concrete was due to the three sizes of its constituents. This was not borne out, as concrete was not composed of three sizes, for the larger pieces of aggregate, such as broken stone, were put in to concrete merely for economy's sake, and added no strength. Furthermore, the broken stone of the third aggregate in concrete might be composed of one hundred different sizes, ranging from 200 mesh up to 2 in. or 3 in. in diameter, and it was fallacious to argue from that analogy, that a paint film should be composed of three different sizes of grain in order to produce the best results. The strength of a film of white lead might be due to the variability of its grains, but there was no comparison between the structure of a film of paint and the structure of concrete.

THE INFLUENCE OF CHEMISTRY ON THE UTILISATION OF QUEBRACHO.

BY E. C. KLIPSTEIN.

The story of quebracho is one of the most remarkable in the annals of industry. Thirty years ago the word "Quebracho" was practically unknown, and only a few tanners in France and the Argentine Republic understood imperfectly the properties of quebracho wood. To-day it has forced itself into the tariffs of nations; millions of dollars have been invested in the manufacture of quebracho extract and in steamships for its transportation, while the civilised world is walking on quebracho tanned leather. This wonderful development is due to two facts: First, that the entire wood of the quebracho tree (not the bark only) yields from 18 to 20 per cent. of tannic acid, thus rendering the supply so enormous and its manipulation so easy as to make it the cheapest known tanning material. Two quebracho logs, weighing one ton each, will yield 1,200 lb. of an extract that will tan as much leather as the bark from five acres of hemlock timber (taking the percentage of tannin in hemlock bark as 8 per cent). Secondly, the discovery of a chemical treatment of quebracho tannin which makes it equal to the best vegetable tannic acid known. In consequence of this important discovery quebracho extract so treats

has become not only the cheapest but also the best tanning material known, and the standard of value for all other tanning materials.

"Quebracho" is a Portuguese word meaning "axe-breaker," and was applied to the tree on account of the extreme density and hardness of its wood. The species furnishing the extract is the Quebracho Colorado (*Loxopterygium Lorentzii*). It flourishes in Central South America. It does not grow in continuous forests like oak and hemlock, but stands alone or in groups surrounded by other hardwood trees, above which its peculiar "V" shaped top or crown towers many feet, forming a distinctive feature of the landscape, quite characteristic of the Chaco. These groups or clumps of trees, called in Spanish "Islands," extend for miles in strips, separated by much wider strips of alkaline prairie, covered with coarse grass. These alternate strips of woodland and prairie extend in a uniform north-easterly direction, like the Alleghany Mountains, from the Province of Santa Fé through the Grand Chaco of Argentina into Paraguay and Southern Brazil. Owing to this peculiar disposition of the forests, transportation becomes the most costly and difficult part of quebracho lumbering operations. The logs must be hauled long distances, in wagons drawn by oxen, through a roadless wilderness, sometimes as far as twenty miles, to the nearest factory or railroad or landing on the Parana River or its branches. The best organised extract plants have built narrow gauge railroads from a port on the Parana across the strips of woodland for fifty miles into the wilderness, in order to lessen the cost of transportation. It was the high cost of transportation which forced the building of extract plants in subtropical alkaline prairies from 600 to 1000 miles north of Buenos Aires. It was cheaper and more rational to transport machinery and skilled labour six thousand miles from Europe to the Chaco, and thereby have only one ton of extract to transport the same distance back, than to pay freight on four tons of wood over the same distance for the purpose of making one ton of extract in Europe or in the United States.

According to an Argentine legend, the use of quebracho for tanning leather was discovered by a German tanner in Buenos Aires. Observing that the water near a saw-mill was coloured red by the quebracho sawdust, it occurred to him that this might be due to tannic acid. Experiment proved the correctness of his supposition, and he became the first quebracho tanner. However this may be, in the month of April, 1875, a French firm in Buenos Aires shipped a sample log of quebracho to E. Dubose, the well-known dye-wood extract maker of Havre, France. In November of the same year, Dubose imported eleven logs more for further experiment, and the following year took out a French patent for quebracho extract as a substitute for catechu, gambier, etc. He at once began a propaganda, which finally resulted in the introduction of quebracho extract as a tanning material in France, Germany, Russia, and other countries of Europe. In 1883, Dubose induced the writer to bring over samples of quebracho extract to the United States, but without results, owing to its high price as compared with hemlock extract. On a subsequent visit to Dubose in 1887 he was so enthusiastic about the new extract that it was decided to make a second attempt to introduce it into the United States, but without success, because it could not be sold at 6c. per lb. against hemlock extract at 2½ c. Five years later, in 1892, a third and successful attempt was made, and the price having gone down to 5c. for the liquid extract, we succeeded in establishing the use of quebracho in the United States. Meantime, Casado, a wealthy land owner of Paraguay, erected the first extract plant in South America. He was followed by H. Renner & Co., in Hamburg, Germany, and by several other small plants in France and Germany, and finally by a second small plant at Peguabon on the Parana River in Argentine. All these plants were small, the quantity of extract produced was also small, but more than sufficient to keep up with the slow progress of extending its use, as was proved by the fact that Casado discontinued operations. A consignment of a few hundred tons made by Casado to a firm in New York about the year 1893 remained largely unsold until 1898. It is safe to say that the world's annual production of

quebracho extract between the years 1890 and 1897—twenty years after its introduction—would not equal one month's consumption of the United States alone at the present time. In the year 1895 a contract was made with H. Renner & Co., of Hamburg, for 150 tons of liquid extract at the low price of 2½ c., duty paid in New York, but the tanner to whom the extract was resold suddenly cancelled his orders because the finished leather had turned red in the warehouse, and there was great difficulty in finding buyers for the balance of the contract. This slow and halting progress in the use of quebracho extract was due to the peculiar character of its tannins. It contained an unusually large proportion of "resinous and difficultly soluble" tannins, called by chemists "insolubles," and an unusually small proportion of non-tannins, almost totally lacking in glucosides. Furthermore, its soluble tannins differed from those of oak and hemlock in that they were much more sensitive to changes of temperature and were readily precipitated by the sour liquors of the tan-vat. As is well-known, tannins are complex bodies existing in all plants. The tannins of no two plants are alike and even the tannins of the same plant vary greatly as to solubility in water. When tan-barks or tan-woods are treated with boiling water, and the extract is cooled down to the temperature of the air or cold water, all those portions of the tannic acid which are "difficultly soluble in cold water" fall out of solution as precipitates and are technically termed "insolubles" or "reds." The scientific name for them is "phlobaphenes" or tannins, which are resinous and soluble in warm or boiling water, but not in cold water, and therefore not available for producing leather. In consequence of this fact, every chemical analysis of a tanning material must show three things, (1) the "available" tannin which remains soluble in cold water; (2) the "non-tannins" or soluble salts and glucosides; (3) the "reds" or insolubles. All three of these constituents play a rôle in the tanning process. The available tannins combine with the hide substance to produce leather. The non-tannins ferment to form acids, which make the tan liquors sour and swell up or "plump" the hide so that the available tannins can penetrate the hide substance to form leather. This plumping effect is absolutely necessary. Finally the "reds" or insolubles, when not too great in quantity, are so held in suspension by the non-tannins that they are carried to a slight degree into the surface of the hide and render the leather firm and impervious to water. Now the proportions of these various constituents vary greatly in different plants and consequently in different tanning extracts. By the ordinary method of analysis a solid valonea extract, showing 64 per cent. of soluble tannin, will also show 25 per cent. of non-tannins and only 1.25 per cent. insolubles. By the same analysis, liquid extract gives soluble tannins 26 per cent., non-tannin 41 per cent., insolubles only 0.50 per cent. On the other hand, ordinary quebracho extract, containing 64.50 per cent. soluble tannins, will only show 7.50 per cent. non-tannins, while the insolubles amount to 8 per cent. or more than one-eighth as much as the soluble tannins.

A perfect tanning material, that is, a tanning material such as hemlock bark, which, by itself, will produce leather, contains nearly as much non-tannins as available or soluble tannins—more specifically, hemlock bark contains 8 to 10 per cent. soluble tannins and 6 to 7 per cent. non-tannins. The proportion of non-tannins is large enough to furnish, by fermentation, sufficient acid to plump the hide for absorption of the soluble tannins.

Quebracho wood, on the other hand, contains 20 per cent. soluble tannin, and only 2½ per cent. non-tannins (composed chiefly of soluble salts), and is totally wanting in glucosides. Quebracho liquors, therefore, do not sour and in consequence cannot be used alone for making leather. It is absolutely necessary to mix quebracho with some material containing a large proportion of non-tannins in order to get the acidity necessary for plumping the hide, and it was at this point in the use of quebracho extract where the trouble began in practice. It was found that when mixed with the acid liquors resulting from other extracts a large proportion of the soluble tannins were precipitated, together with all the "reds" of the quebracho, as a sticky slime on the hide. This slime hindered the

penetration of the tannins remaining soluble, left a deposit on the hide which could not be removed, and finally caused the finished leather to turn red on exposure to the air. The actual loss, including the original insolubles, was fully 25 per cent. of the quebracho extract used.

The analysis just given shows that quebracho extract contains one part of insoluble to every eight parts of soluble tannin. It was these insolubles which first attracted the tanner's attention. They not only represented a loss of more than 10 per cent. of extract but spoiled his leather. He did not know, and comparatively few tanners even now know, that in addition to the loss of the actually insoluble tannin there was a still greater loss of the really soluble tannins when mixed with the sour liquors of the tan-vat, but he knew enough to make him very chary of using quebracho extract, and in consequence, the manufacturers and handlers of quebracho at once set to work to get rid of the "insolubles." It would be tedious to enunciate all the different methods adopted for this purpose. I will mention only a few. The German tanner avoided the difficulty by not using extract at all. He went to the expense of bringing quebracho logs six thousand miles from Argentina, rasping them into "Loh Schnitt," and adding this "Loh Schnitt" directly to the cold tan-vat—by so doing he avoided the extraction of the "resinous and difficultly soluble" tannins, and was therefore not troubled by them. He threw them away. The extract maker did the same thing by leaching at a low temperature. He also tried "settling out" the thin liquor before concentration and throwing away the "insolubles" as mud. He tried precipitation with alum, precipitation with albumen, and precipitation with lead acetate; in every case the precipitate was thrown away as a useless nuisance. Extracts made by these processes were sold as "decolorised" or "clarified." They were more costly and but little better than the ordinary extract, because their soluble tannins were still precipitated by the sour liquors of the tan-vat. Practically they were but little used. The only recognition of the value of the "difficultly soluble tannins," and the only attempt to save them by solution, was that which was originally made, we believe, by some Italians, who dissolved the insoluble quebracho in an alkali, preferably borax. This method seemed so rational that we, ourselves, actually paid a royalty on several hundred barrels of extract so treated, and at least one American tanner used the process for several years in his tannery. But the high cost of borax, the necessity for after treatment with sulphuric acid, and the very justifiable prejudice of the tanning world against alkaline liquors finally gave the "coup de grace" to an impractical process. Such an important problem, however, was bound to find a solution. The honour is due to Italy. Two Italian chemists, Lepetit and Tagliani, after long experimenting, discovered that the sulphurous salts of the alkali metals, such as sodium sulphite, bisulphite, or hydrosulphite, would so perfectly dissolve the "reds" of quebracho extract as to keep them soluble, not only in cold water, but in the acid liquor of the tan-vat. They found also that these salts so acted on the soluble tannins of quebracho extract as to prevent their precipitation in sour liquors; in short, they found that by treating quebracho extract with sodium bisulphite or other sulphites under suitable conditions, all loss of soluble tannin was prevented and all the insoluble or "difficultly soluble tannins" were made available by solution.

The application of this discovery to quebracho extract eliminated all of its objectionable properties, made its use possible under all tanning conditions and in combination with the sour liquors of all other tanning extracts, thereby adding fully 25 per cent. to its value by saving and utilising the tannins which had previously been precipitated and thrown away. In fact, it is not going too far to characterise this discovery as one of the most important ever made affecting the leather industry.

The effect of the treatment with sulphites is shown by the two following analyses:—According to J. Gordon Parker, an ordinary solid quebracho extract has the following constituents:—Water, 21.10 per cent.; soluble tannins, 61.60 per cent.; insolubles, 10.00 per cent.; non-tannins, 7.30 per cent. According to the same

authority, the solid argam extract, which has been treated by the sulphite process of Lepetit, shows the following results:—Water, 21.50 per cent.; soluble tannins, 65.70 per cent.; insolubles, 0.00 per cent.; non-tannins, 12.80 per cent. It appears, therefore, that the sulphite treatment has increased the amount of soluble tannin from 61.50 per cent. to 65.70 per cent., and that of the non-tannins from 7.30 per cent. to 12.80 per cent., while the insolubles have totally disappeared, the moisture remaining the same in both cases. It is true also that 100 lb. of ordinary extract yield 110 lb. of treated extract, and that the treated extract is unaffected by the sour liquors of the tan-vat, but this, of course, is not shown by the ordinary analysis.

Their success with quebracho led the inventors, Lepetit and Tagliani, to try the same treatment on other tanning extracts. To their surprise, they found exactly opposite results. They found that the sulphite treatment has no good effect on chestnut extract and mimosa bark extract, their tannins remaining practically unaltered. It actually decomposed and partially precipitated the extracts of oak bark, sumac, valonea, myrobalans, and pine bark. After most thorough experimenting they found quebracho extract to be the only one employed in tanning that is practically benefited by treatment with the salts of sulphurous acid, and hence they confined their claims in U.S. Patent No. 799,246 specifically to the treatment of quebracho extract.

Years ago Foley took out a patent for preserving hemlock extract by treatment with bisulphites, so that fermentation would not take place during transportation. He succeeded too well, for he also prevented fermentation in the tan-vat, and thereby rendered the hemlock extract absolutely useless. His process was never practically applied on that account, and so far as my information goes, there is not now a sulphited hemlock extract on the market and never has been.

Lepetit and Tagliani patented their discovery in Germany and other European countries in 1896. The United States Patent was not issued until 1905, but in the meantime they arranged with H. Renner & Co. to use their process in Germany, with the right to sell the product in the United States. On Dec. 4th, 1900, Renner & Co. sent us the first sample of liquid quebracho extract, treated by Lepetit's process in a slightly modified form. It seemed to be what we had been looking for, and we at once ordered 10 tons for practical trial, which were invoiced April 27th, 1901. With the exception of a few casks shipped by Messrs. Lepetit, Dolfuss, and Gansser, of Milan, on March 11th, 1897, for the Durio Experiments in Newark, N.J., I believe this to have been the first "sulphited" quebracho extract imported or used in the United States. The trials were successful, and we continued importing the liquid extract in increasing quantities, in spite of the high specific duty of $\frac{1}{2}$ c. per lb.

In January, 1902, we received from Renner & Co. the first sample of "Krone" or sulphited quebracho extract in solid form, and at once ordered 30 tons, which were shipped on Feb. 24th, and was the first solid sulphited extract used in the United States. The quality proved so acceptable that on April 22nd, 1902, we contracted with Renner for 400 tons of the same extract, and we continued buying in steadily increasing quantities until Sept., 1903. Meanwhile we had contracted in October, 1902, for 7,800 tons of the same extract, to be made in South America. We received the first shipment on this contract on Aug. 31st, 1903, and commenced selling the Krone or sulphited quality of "argam" extract. We are selling the same extract to-day.

In 1901, before Lepetit's discovery came into practical use, the entire consumption of quebracho extract in the United States did not exceed 5000 tons of solid quality. In 1907, six years later, it was over 50,000 tons, chiefly sulphited. In 1909, it will probably be nearly 70,000 tons. How the production of extract in the wilderness of Argentina kept pace with the consumption brought about by the sulphite process has been almost marvellous. About twenty-five years ago, two young tanners, Carlos and Albert Hartenack, came to Argentina and becoming interested in quebracho, began exporting the wood to Havre, and in the course of time made long and arduous

explorations of the Argentine wilderness known as the "Chaco." Eventually they made extensive purchases of the best quebracho producing lands in Argentina. In conjunction with Renner in Hamburg they erected an extract plant with the best and most modern equipment at Calchaquí, in the heart of the quebracho forests of Santa Fé, with a capacity of 10,000 tons solid extract yearly. They commenced shipping ordinary extract in April, 1900, and continued to do so during the years 1901 and 1902 to the extent of about 5000 tons yearly. In 1904 the Messrs. Harteneck took into association with them the Brothers Portalis, of Buenos Aires, large owners of quebracho lands, and formed the "Compania Forestal del Chaco," to operate the Calchaquí works and build a new plant with a capacity of 20,000 tons yearly, some 300 miles north of Calchaquí, and still further in the heart of the Chaco wilderness. Not only an extract plant, but a town, and 50 miles of railroad, had to be built also. In May, 1905, this new Villa Gullermina began shipping extract to the United States, whose requirements meantime had increased to 18,000 tons yearly. In 1906 a third plant was erected in Gallareta, with a yearly capacity of 7000 tons, while the United States consumption went up to 30,000 tons of Argentine extract, in addition to the liquid extract made by the two American factories. Since then the Forestal Company has been merged into the "Forestal Land, Timber, and Railways Co., Ltd.," with a capital of nearly two million pounds sterling. The 7000 ton works at Puguahó have been purchased by this Company, and the capacity of Calchaquí increased to 14,000 tons. At present the Forestal Land, Timber, and Railways Co. operates four plants, with a capacity of 50,000 tons of extract yearly.

To supply these plants with wood and market their products requires 100 miles of railway, a fleet of boats on the Parana River, 1500 men in the factories, and 5000 men in the forests, working with 12,000 oxen and 1000 waggons.

I have gone into these details because in the last five years eight other extract plants have been erected in Argentina and Paraguay for the manufacture of unsulphited or "ordinary" extract only. Although they have a capacity of 40,000 tons yearly, they have probably never turned out more than 25,000 tons in one year, and even this quantity they have been unable to market at a profit. In consequence of the panic of 1897, the duty paid price of their extract in this market declined from 4 c. to 3 c. per lb., and even at this price the bulk of what was sold was afterwards sulphited either by dealers or the consumers themselves. Meantime the price of treated extract has scarcely varied, and is to-day at the maximum figure ever reached. No better proof of the value of the chemical treatment of quebracho extract by the sulphite process could possibly be furnished than this commercial fact.

DISCUSSION.

Mr. YOCUM said that the author had not described any method of treating quebracho extracts to make them soluble. Failures had attended the use of these extracts that were not soluble, and, latterly, success had attended the use of those that were soluble. It took years to find out that they were made soluble by treatment with sulphites.

The great difficulty with tanning chemists was that their measure of tanning values was empirical. They considered everything that was absorbed by hide, under the conditions of the test, was tannin. But other materials were absorbed which did not precipitate gelatin, such as glucose, and these did not tan leather. The ultimate determination of the value of a tanning extract must rest with the tanner himself through experiment, and while analyses might indicate the percentage of material present which would combine with the hide, the tanner himself must determine how much of this he could utilise under the methods he pursued.

Prof. ROGERS said that about a year ago, he had occasion to examine a substance called "T. Glutriu," a refuse of the sulphite process. This contained 25 per cent.

of tannic acid. It would tan leather, but the leather afterwards was like blotting paper. Had the author had occasion to use this product, and with what results?

REINFORCED CONCRETE INDUSTRIAL BUILDINGS.

BY J. P. H. PERRY.

The purpose of this paper is not to go into the history of concrete nor into the theory of the calculation and design of reinforced concrete, but rather to take up, one by one, the questions which owners of manufacturing plants raise in regard to this material.

Perhaps the most common point which is raised in connection with the construction of reinforced concrete buildings is the possibility of attaching shafting and piping in their proper place economically; and, also, in regard to making changes in the lay-out of these most necessary parts of the average plant. The illustration shows different methods of hanging shafting and machinery in reinforced concrete buildings. It is apparent from a study of the various schemes included in this figure, that piping or transmission lines can be provided for in concrete structures quite simply. A valuable comment on this topic is the fact that many industrial executives have not hesitated to duplicate reinforced concrete factories in the same material. Five large mill and manufacturing concerns have awarded six and more contracts for reinforced concrete buildings in the past four years. This would indicate positively that they had experienced no serious difficulties with shafting or piping. In fact, reinforced concrete construction tends to maintain shafting in position better than most other types of buildings. One large manufacturer of paper goods in New York has stated that his reinforced concrete factory saves him annually about \$5000.00 in repairs to his machinery and shafting, due almost wholly to the fact that the shafting or the machines once set in position on concrete beams or floors remain immovable, which, of course, results in less wear on bearings and moving parts. Shafting may be shifted easily in concrete buildings if proper provision has been made in the design of this structure. The cast iron spool sockets or the pipe holes through the top of the beam or the anchor plates may be placed in the beams at intervals of say five feet at the time the concrete is poured, thus providing means of supporting the shafting wherever desired. If no supports have been placed in the ceilings at the time of construction, the rearrangement of piping or shafting is accomplished most conveniently by setting expansion bolts in the sides of the beams and using iron hangers as shown in the figure.

Not infrequently the reinforced concrete advocate is told by a prospective builder that concrete is too strong. If the owner wants to build additions or to make alterations in his plant, the cost of ripping out concrete walls is so much greater than with brick walls that he will not authorize the use of concrete construction. It is undoubtedly true that concrete walls are more difficult to remove than brick. In the ordinary building the basic idea is to put up a permanent structure. Where, however, there is a probability of having to remove partitions or walls, it is possible to erect a reinforced concrete structural frame consisting of columns and floors and fill in the walls with brick or terra cotta. There are a great many plants in this country where all the buildings are of brick or stone, occasionally of the same general architectural treatment. The owner does not wish, in erecting his new building, to put up a white concrete building, which would contrast sharply with the rest of his establishment. To meet this condition, concrete buildings are designed much the same as structural steel, a skeleton framework being run up, and light non-self-supporting curtain walls of material similar to the exterior of the surrounding buildings being built in afterwards, or if there is a prejudice against concrete appearing anywhere in the exterior of the building the wall columns can be veneered. For the more typical factory construction reinforced concrete is to be recommended for the floors, beams, girders, and columns, and either brick or terra cotta walls—non-self-supporting—put in temporarily, so that in event of

extensions they can be removed without effecting the structural part of the building. The cost of a concrete wall compared with a brick wall under such conditions is dependent upon the thickness of the wall. Generally, unless local building laws interfere, good practice dictates the use of an 8 in. concrete wall in place of a 12 in. brick wall. In this case the cost of the concrete wall is slightly less than the brick. Where, however, the concrete wall has to be the same thickness of the brick, the brick, on the present market conditions in America, is cheaper.

Sometimes the question is raised that there is liable to be considerable vibration in reinforced concrete buildings. On what basis this idea is founded it is difficult to understand, because there are practically no cases known to reinforced concrete engineers and constructors where the vibration set up in reinforced concrete buildings was serious, and certainly not as bad as it would have been in other types of buildings. Where a long series of heavy presses or similar machines are set in position on one floor, all working in the same direction, there is likely to be a sway of the whole building, but this is true of any type of structure. The majority of owners of concrete plants are well satisfied that they get less vibration with this kind of construction than with any other kind of building. This is due primarily to the homogeneous and rigid form of construction. A reinforced concrete building properly designed and erected is monolithic and solid to an extreme degree. Heavy machinery may be set in place on the upper floors of an eight or nine story building and operated at full speed without producing any effect in the lower stories. A particularly striking instance of this may be cited in a building in Brooklyn, where the general offices are on the eighth floor, and under one desk, about the middle of the building, on the ceiling below, is bolted a 40 h.p. electric motor. The superintendent of this factory states that he doubts if the man at the desk over the motor is aware that the machine is directly under him. Certainly, unless he has been told of its existence, he would have no cause for knowing that it is there. This question of vibration in concrete buildings is one of the main reasons which have led to its adoption for structural purposes in so many industrial plants in this country. The absence of vibration reduces the repairs on machinery and permits of their operation at higher speeds than the more conventional class of building.

Reinforced concrete floors are occasionally objected to, because of the imaginary difficulty of cutting through them in event of having to run pipes or belting or wiring in places not originally intended. A concrete floor is, of course, hard to cut through, but the task is not insurmountable, and when compared to cutting through terra-cotta or brick floor arches, it is less serious in its results. Owing to the reinforcement running through floor slabs, generally in both directions, it is possible to cut through a floor at any point, except directly over beams or girders, without endangering the strength of the floor. It is hard to imagine cutting a hole of any magnitude through a terra-cotta floor or a brick arch without making some provision to take care of any loads which might be applied near the hole. Reinforced concrete floors are generally, in conservative practice at least, designed as simple beams, where as actually there is continuous beam action and not infrequently plate action, so that stresses are taken care of by the transverse or longitudinal reinforcement, when cutting has to be resorted to, in a manner not originally depended upon in the calculations. The experience of several large reinforced concrete construction companies, extending over a period of seven or eight years, and covering probably from 1000 to 1500 buildings erected of this material, shows no especial complaint on the part of the owners or architects on this score.

It is not often that there is much question as to the load-carrying capacity of reinforced concrete floors, but in case there is doubt in the minds of some industrial men as to the strength of reinforced concrete construction, it may be proper to cite a few instances showing the great efficiency of this character of construction along this line. Reference was made in the previous paragraph to the basis of design of floors, taking account of only the most conser-

vative stresses. A factor of safety of four is used, based upon rather low ultimate strengths of the material, so that reinforced concrete as erected is a great deal stronger than the calculations would indicate. There is no better proof of this statement than that furnished by an embossing press weighing 16 tons, resting on a base 3 ft. wide by 6 ft. long, having an area of 18 sq. feet. The load produced by this press is, therefore, but slightly under 1 ton per sq. ft. This press is located about in the centre of a column bay on the seventh floor of the Robert Gair Company Building in Brooklyn, the floors of which building were designed for a live load of 250 lb. per sq. ft. There has been no provision made to distribute the excessive load of the embossing press, nor has any bracing been resorted to in the floor below. This floor consists of a 4 in. reinforced concrete slab spanning between 7 in. by 15½ in. reinforced concrete beams spaced about 5 ft. 6 in. on centres. This press has been in position now for something over 18 months without there having been any noticeable deflection and without cracks showing. Another case of extreme loading without injury to the reinforced concrete is to be found in the J. B. King & Co. plaster mills at New Brighton, Staten Island, where floors designed for 600 lb. live loads, carry from 1200 to 1500 lb. over large areas. There are many other structures that might be cited where the loads sustained by the concrete run three or four times in excess of the figures used in the design. There need be no hesitancy on the part of the prospective builder to adopt concrete where his requirements call for the very heaviest loading. Certain grain elevators in Buffalo have reinforced concrete floors designed for 5000 lb. per sq. ft., and hardware storage houses in the North-West carry loads of 2000 lb. per sq. ft. Such strength as this is, except in the rarest instances, more than sufficient for industrial buildings.

There is a general idea that concrete walls are damp. Very probably this is due to the experience of many house holders with poorly made concrete blocks. It does not apply to properly constructed reinforced concrete industrial buildings. The company with which the writer is connected, has constructed probably one hundred buildings of this material during the past seven years, and has had no complaints on the score of dampness penetrating through the walls. The normal thickness of walls of this material is from 8 in. to 12 in. When made of wet concrete, as is customary, they are homogeneous and very nearly impervious after having dried out. This drying out takes, depending upon the weather, from three to six months, and is generally accomplished by the time the building is ready for occupancy. As a comparison between brick and concrete for wall construction, it is interesting to note that in several instances where buildings have been erected with both concrete and brick walls, each 12 in. thick, neither walls being water-proofed, the brick walls have shown dampness after storms while the concrete walls have given no trouble whatsoever. Condensation is experienced with concrete, and for residential work would be a serious fault, but for the ordinary industrial building the trouble is not grave. In plants where dryness is essential—such, for instance, as piano factories, where the wood stock is exceptionally dry and must be kept so, the slightest dampness being fatal—concrete buildings have been found to give excellent service. There is less condensation on concrete walls 12 in. thick, owing to the extreme non-conductivity of the material, than there is on brick walls of similar or slightly greater thickness. In typical reinforced concrete industrial buildings condensation appears only on the under side of the roof. The walls, being about 12 in. thick, remain at a fairly uniform temperature on the inside, whereas the 3 in. or 4 in. roof slab changes with exterior weather conditions. Usually slight condensation under the roof is of no importance, but if it were, a hanging ceiling could be installed at low cost.

In certain industries wooden floors may be necessary. This condition does not interfere with the selection of reinforced concrete as the structural material for many new buildings. The bearing slab between the concrete beams and girders would be constructed as in the ordinary reinforced concrete building. Instead, however, of giving this bearing slab a granolithic finish, it would be left rough

and when hardened a cinder concrete fill would be laid on top and wooden sleepers imbedded therein. The maple flooring would then be put in position. The most common reason for specifying wooden floors is the possibility that the operatives will object to standing on a concrete surface. This dislike of concrete on the employee's part was always a matter of prejudice and now is very largely overcome. There are so many mills and factories having concrete floors whose managers experience no complaint on the part of their working force, that the majority of new buildings of this type do not have wooden floors.

With regard to this question of floors in concrete buildings, attention may be called to the sanitary conditions set up in reinforced concrete buildings. Where wet processes are used or where washing of floors is necessary, concrete surfaces are easily the best for the purpose. Wood when wet frequently tends to decay and offers a harbouring place for vermin. Concrete buildings are notable for the absolute elimination of this pest. Concerns whose products or whose raw materials are perishable have found a considerable annual saving due to the absence of mice, rats, and bugs in their concrete buildings.

Reinforced concrete construction has very generally become accepted as fireproof in a high degree. Little discussion of this feature is necessary. San Francisco and Baltimore tested the material and found it good. Smaller fires, such as those at Dayton and Bayonne, subjected concrete to even more severe conditions, and those under the eyes of keen observers. The result is best expressed by insurance rates. The most alive insurance companies, as represented by the Mutual concerns of New England, advocate reinforced concrete construction enthusiastically and state they will write lower rates on buildings of this type than on any others. For instance, on a large paper factory in Brooklyn, made of reinforced concrete, the rate on the building is 12.2 c. per \$100 of insurance, and on the contents, 29.6 c. Across the street, belonging to the same company, is a first class mill constructed building. Under the same conditions of occupancy, use, hazard, and protection the building rate is 21.4 c., and on the contents 65.6 c. is asked. The annual saving is apparent.

After a fire, speed of construction is the first consideration. Reinforced concrete under no other condition so well fills the requirements. Work can be undertaken as soon as the ruins of the old structure are cleared away, and while footings are being placed the detail plans can be worked up and the building carried up to completion at a speed equal to or faster than with any other type of fireproof construction. With structural steel the columns and other members have to be designed in detail, rolled, fabricated, and delivered to the job before work can be prosecuted at full speed. Small steel bars for reinforcing purposes are always to be found in stock and need no assembling before shipment. Cement likewise can be started jobwards on short notice. Lumber, sand, and stone are locally obtainable. The advantage thus secured at the start of the new building more than overcomes a subsequent higher rate of speed with steel construction. The comparison applies somewhat similarly to mill construction. The large size wooden members essential to this slow burning construction are getting more difficult to procure and take valuable time before delivery. That concrete can be erected rapidly may be news to some, but when such speed as the roof on the seven story and basement Mason Warehouse in 48 days after the completion of the excavation; and the roof on the Bush Factory No. 3—600 ft. by 75 ft.—six stories and basement—in 63 days; and the roof on the ten story and basement Rogers and Pyatt Factory—60 ft. by 70 ft.—in 47 days after the foundations were in place, are cited, the facts must be recognised.

To those who have studied concrete or who are familiar with its properties, any doubt as to its durability seems unwarranted. Scepticism is sometimes expressed, however, on this point, and, also, as to the reliability of the material. In answering the first of these questions reference is generally made to the use of concrete in Egypt, Crete, or in the Peninsula of Yucatan, but the writer prefers to cite structures which he personally has seen. At Amalfi, Italy, there is a small foot bridge which was built by

the Turks in about the fifth or sixth century. The concrete of which this little arch is built is in a good state of preservation to-day and speaks eloquently for the lasting qualities of this material. In Rome, the Pantheon Dome is unmistakably concrete, and constitutes the most striking object lesson in this subject that there is to be found. When consideration is given to the fact that the cement used in those days was a natural cement of irregular composition and uncertain quality, little fear need be maintained for the concrete structures of the present day, which are made of Portland cement with uniform composition and careful manufacture. Belief in the reliability of reinforced concrete construction has perhaps been shaken in the minds of some people by certain failures of buildings erected of this material in different parts of the United States. The number of failures, however, in proportion to the amount of successful concrete work, is very small, and when investigated, these failures have all been traceable to ignorance, inexperience, and faulty design, not to any inherent fault of the material or to the method of construction. When a steel building collapses or a great bridge fails, when brick walls crack or masonry structures fall, those structural methods or materials are not decried, nor are they assailed as being dangerous, experimental, and unworthy of use. Reinforced concrete is a new material, one which has great possibilities and therefore attracts many contractors and builders who lack proper experience in its use. Mistakes under such conditions are bound to occur, but where experienced, skilful companies are employed, ideal buildings are the result.

The final consideration in the selection of the type of the new building is the question of cost. Briefly, under present market conditions in this country, reinforced concrete industrial buildings will cost from 10 to 20 per cent. less than the same building erected in structural steel fireproofed, and will cost from 5 to 20 per cent. more than first class mill construction. These percentages are not theoretical; they are based upon facts. For example, a large warehouse in Brooklyn was begun in May, 1908. At that time new construction work was scarce, and all contractors, both in the concrete and steel lines, figured very closely in order to secure the job. The successful reinforced concrete figure on this particular building was \$30,000.00 lower than the best bid received on the same plans executed in fireproofed structural steel. A large factory in Philadelphia was designed in steel and estimates received on the original plans. The architects considered an alternative in reinforced concrete construction and saved the owner \$60,000.00. A large publishing house and loft building was recently completed in Springfield, Mass., of reinforced concrete throughout, thereby saving \$40,000.00 over the probable cost in steel. These three instances represent respectively savings of 12, 25, and 10 per cent. In competition with mill construction the percentage depends almost entirely upon the size of the building. For structures costing \$40,000.00 and less, and of a height of four stories or less, the brick and wood construction will run about 15 per cent. less than concrete. On larger size buildings, however, concrete gets closer to the cost of the mill construction. The designers of a very large hardware building in Minneapolis took estimates on both reinforced concrete and mill construction. They were surprised to find that the concrete figures were slightly under those of the mill construction. A similar case occurred in Toledo, Ohio. Both of these propositions, however, exceeded \$250,000.00 in value.

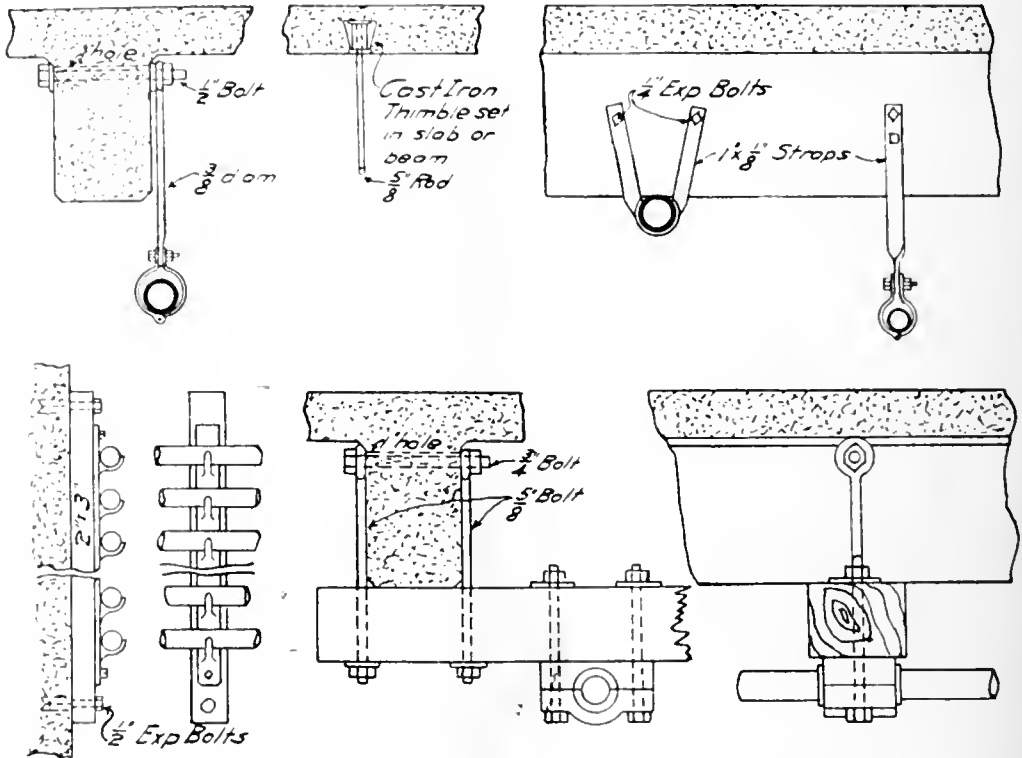
In considering the costs of different types of construction the initial cost should not be the only criterion. There are certain fixed charges which enter into the relative values of buildings. These may be briefly summarised as follows:—Insurance, maintenance, depreciation, amount of light available, freedom from vibration, elimination of vermin, and the assurance that a fire cannot destroy the building. It is difficult to put an exact monetary value on these different items. Each plant manager would have his own views on the subject and local conditions would alter materially any assumptions. If, however, due consideration be given to the saving which can be obtained on each of these items by the use of a reinforced concrete building, it will generally be found that even though

the concrete structure cost complete 10 per cent. more than if mill construction had been used, there will be a saving annually of from $1\frac{1}{2}$ to 2 per cent.

In deciding to adopt reinforced concrete construction the owner will not be making an experiment. Reinforced concrete is an established material of recognised merit. Its development has been rapid, but, like that of another great modern art, viz., the electrical industry, it has been from the laboratory and scientist to the practical man, and not haphazard practice first and investigation afterwards. When the great Quebec bridge collapsed a short

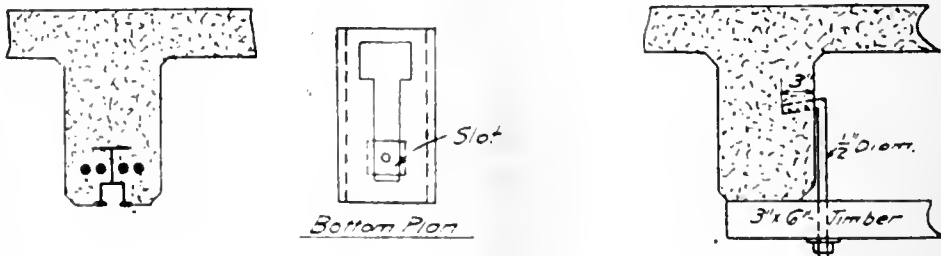
time ago the engineering profession awoke to the fact that it knew little or nothing about steel columns from actual experiments and tests. Reinforced concrete has received rigid examination, and this careful study led Professor Burr, Consulting Engineer on the Panama Canal, to state publicly in writing that more was known about reinforced concrete as structural material than was known about steel. The number of monumental concrete structures which are going up all over America to-day preclude any experiment on the part of a man selecting reinforced concrete for his new building.

Pipe Hangers & Shafting Supports



Pipe Radiator Bracket

Shafting Supports



Bottom Plan

Shafting Supports

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

Special drying plant wanted for India. From Director-General of Commercial Intelligence, 5, Clive Street, Calcutta, India, 1909. [T.R.]

In the rainy season certain industries in India suffer from the difficulty of drying their products or materials. At times the air is saturated or nearly so, so to get it to take up more moisture high temperatures must be used, which are not permissible in certain cases.

An example of this is furnished by the flour-milling industry in India. Before wheat in a dirty state can be milled, it must be not only screened and scrubbed but washed, and the process of subsequent drying is troublesome, costly, and at times injurious. The usual method is that the wet wheat, after passing through a centrifuge, is discharged into the head of a vertical shaft containing baffles, and as it descends it meets an ascending current of increasingly hot air from gills that are heated by steam. This method is successful except in the rains; but during the rains the wheat must be let go with an excessive percentage of moisture, seeing that an indefinite intensification of the heat results in destruction of the starch globules and consequent injury to the flour.

The tanning industry would also gain greatly by an appliance that would dry the air in the monsoon without reliance on condensation processes. In one large tannery in India no attempt to dry hides is made during two months of the year. In some parts of the country the most serious difficulty is that of retarding the drying of the hides during the hot weather. At other seasons drying is artificially and very slowly effected by the use of steam pipes. The hides are suspended over and about these pipes; but the saturation of the atmosphere is such that the drying process occupies a number of days. During that time the hides have to be frequently wiped to free them from the moulds that grow profusely under such conditions; but those moulds work considerable mischief, and although they be superficially removed they may leave their spores in the leather to germinate so soon as favourable conditions recur, as they frequently do in India.

In the manufacture of sugar, deterioration in colour results from the creation of invert sugar during drying. The drying of sugar after it leaves the centrifuge is commonly effected by means of a cylinder that is heated by steam and rotates upon an inclined axis. But when the air is virtually saturated a disproportionate expenditure of heat is necessary to impart to it any drying power. So also in the drying of copra and in the desiccation of plantains for meal and of various substances for the production of starch. Several of these substances are not only peculiarly liable to decomposition and discolouration through prolongation of the process of drying, but are also sensitive as regards excessive heat. In all these cases the drying is conducted or attempted by raising the temperature of a damp air to such a point that it may be enabled to assimilate more moisture. But in proportion as the humidity of the air increases, any increment in temperature becomes more injurious. It would therefore be preferable to desiccate the air and pass it over the goods to be dried.

The desiccation of air for use in blast furnaces is conducted by lowering the temperature of the air so as to precipitate a proportion of the moisture it contains, as follows:—Pure liquid ammonia is contained within the ammonia expansion pipes in the air cooler, and by the action of the compressor pump a reduction of pressure is main-

tained within them causing the ammonia to pass off in the form of gas, and in so doing it takes up heat from the air in the cooler in which the pipes are placed, so reducing the temperature to any desired extent. The gas containing the heat thus abstracted enters the pump, and is passed by it into the condenser tubes where, by the action of the condensing water passing over them, and the pressure of the gas within the same, maintained by the action of the pump, liquefaction takes place, at the same time giving up the heat it contained to the current of condensing water passing over the condenser. The liquefied gas returns to the ammonia expansion pipes by a small pipe, and is controlled by a regulator. The whole action is automatic and controlled by the speed at which the compressor pump is worked.

Now, air so desiccated, if to be used for drying goods, would be raised to the highest non-injurious temperature in order that it might carry off a large quantity of moisture. This process is open to several objections. In the first place moisture is eliminated from the air merely by the elimination of the faculty of retaining the moisture, and therefore by the sacrifice of the power of acquiring moisture or performing any function of drying. In other words the latent heat is lost at each operation and has to be replaced at the cost of fuel. This defect is inherent in the process, but in India other difficulties peculiar to the climate are encountered. Not only do the high temperature and humidity encountered in India complicate the primal operation of desiccation, but they enormously increase the difficulty of subsequently liquefying the ammonia or other similar substance used. In the presence of approximate saturation of the air, the temperature of water in the open approximates to that of the atmosphere; and, since the high humidity also prevents any material reduction of the temperature of that water by evaporation while passing over the condenser tubes, it is a matter of difficulty to restore the ammonia to a liquid state.

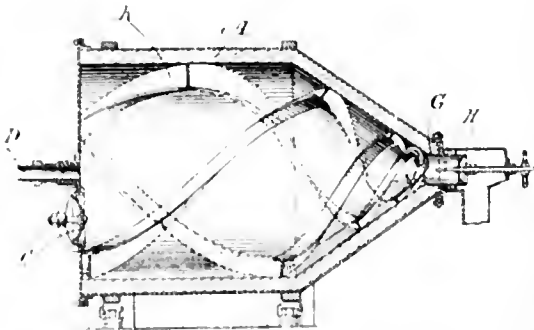
The solution of the difficulty might be found in the employment of high temperatures to drive off the water of crystallisation from a substance that is not injured by heat, the air being thereafter dried by contact with that substance in its anhydrous condition, and then employed to desiccate at low temperatures such commodities as would not themselves stand heat. Such a substance must be highly hygroscopic and yet yield its water of crystallisation fairly easily. These properties are possessed by copper sulphate and by calcium chloride. The former develops at high temperatures a tendency to decompose and form basic sulphates, while it would be necessary to apply it as a "filling" of a porous vehicle such as coke. But such a vehicle could scarcely carry copper sulphate of more than 25 per cent. of its weight, or 20 per cent. of the whole, and great loss of power would be incurred by the repeated heating and cooling of a mass of which 80 per cent. was inert. On the other hand calcium chloride would be apt to deliquesce and disintegrate alternately during a process such as is suggested; but this might offer a positive convenience inasmuch as the substance in a liquid state would fall to the base of a suitable apparatus and might be drawn off for heat evaporation independently of any inert matter.

These facts and considerations are recorded in the hope that an engineering firm interested in the question may be induced to investigate it practically. As affording some indication of the extent to which a field already exists in India for an appliance such as is here outlined, it may be added that there are 30 flour mills, 15 sugar

factories, and 5 tanneries, in which the respective industries are conducted on a considerable scale. There are also other processes, such as wool-washing and the scrubbing of seed lse, to which an apparatus of the kind in question might be applied with advantage.

PATENTS.

Solution and precipitation processes; Apparatus for use in —. W. Hommel and The Metals Extraction Corporation, Ltd., London. Eng. Pat. 27,917, Dec. 6, 1907.



THE solids are introduced into the rotatable drum, A, through the manhole, C, and liquids through the pipe, D. Spiral channels, K, formed of angle-irons are arranged as indicated within both the cylindrical and conical portions of the drum to assist in the mixing. When sufficiently mixed, the materials are discharged through the valved opening, G, H. In some cases it is preferred to introduce the liquid through a perforated pipe which penetrates into the drum after passing through a stuffing-box. The perforated pipe is provided with a brush rotated with the drum to keep the perforations clear.

—W. H. C.

Kilns; Gas fired —. E. Schmatolla, Berlin. Eng. Pat. 5187, March 7, 1908.

THE heating chambers are arranged in a double row with a double gas flue constructed below the ground in the passage between the ovens. The flues are supplied with gas from a producer at each end and the ends of the flues can be opened to facilitate cleaning. The transverse branch pipes by which the gas is conducted into the heating chambers are not directly connected to the gas flues, but the connection is made by movable boxes and the flues are shut off by movable slabs which can be arranged from without. The flues which conduct the waste gases to the stack are similarly arranged.—W. H. C.

Retort and shaker and cooler; Combined —. J. S. Guibbini, Benicia, Cal. U.S. Pat. 915,428, March 16, 1909.

A RECEPTACLE is mounted on a shaker frame within a horizontal retort, provided with heating and cooling pipes, and supported on guides and springs. The movement of the shaker is effected by a reciprocating rod which passes through a stuffing-box in one end of the retort and which is operated by gear from without.—W. H. C.

Furnace. U. Wedge, Ardmore, Pa. U.S. Pat. 916,234, March 23, 1909.

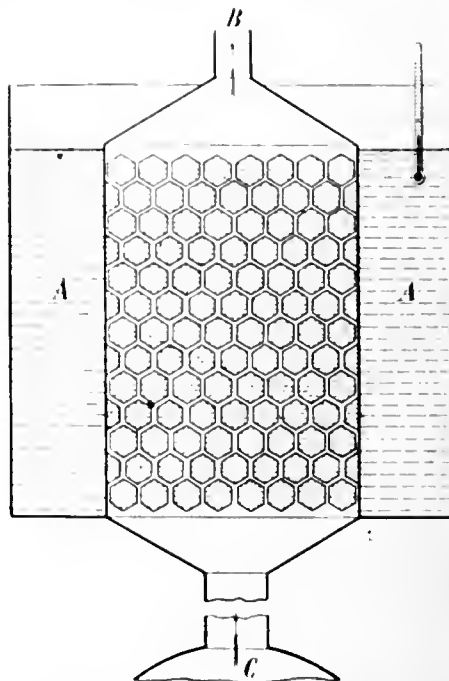
THE claim is for a rotary furnace having several superposed stationary hearths and a central hollow rotating shaft. Each hearth is provided with one or more hollow stirrer arms, through which a current of air flows from the central shaft and from which the air passes to independent outlets.—W. H. C.

Evaporator. T. Suzuki, Sunamura, Japan. U.S. Pat. 916,054, March 23, 1909.

THE liquid to be evaporated is allowed to flow over the outer surface of a vertical corrugated cylinder and is received in a shallow pan placed below. The heating is

effected by the products of combustion from a furnace which pass upwards into the interior of the cylinder, over a centrally disposed, vertical baffle-plate and return downwards to the inlet of the next evaporator.—W. H. C.

Rectifier for distilling apparatus. E. Bonnel. Fr. Pat. 395,040, July 24, 1909.



THE apparatus consists of a system of hexagonal tubes immersed in the vessel, A, which is filled with water or other suitable liquid. The spaces between the walls of adjacent tubes are less than 0.5 mm. The vapours from the still, C, pass upwards between the tubes and are cooled by the water or other liquid which circulates in A, and in the tubes. The vapours of higher boiling point are condensed and flow back to the still and these of lower boiling point pass through B, to the condenser. The object of the invention is to obtain a large cooling surface without unduly increasing the size of the rectifier.

—W. H. C.

Gaseous bodies; Art of separating suspended particles from —. F. G. Cottrell, Berkeley, Cal., U.S.A. Eng. Pat. 5969, March 17, 1908.

SEE FR. PAT. 388,238 OF 1908; THIS J., 1908, 946.—T. F. B.

Tunnel kilns. A. J. Boulton, London. From R. M. d'Arleux, Paris. Eng. Pat. 6036, March 18, 1908.

SEE FR. PAT. 385,744 OF 1907; THIS J., 1908, 629.—T. F. B.

Drying machines; Centrifugal —. F. J. H. Bromham, Brussels. Eng. Pat. 18,956, Sept. 9, 1908.

SEE FR. PAT. 393,415 OF 1908; THIS J., 1909, 77.—T. F. B.

Filter by means of which the solid matters deposited are separated and continuously discharged. C. Leclair and A. G. Hericourt, Paris. Eng. Pat. 25,213, Nov. 23, 1908.

SEE FR. PAT. 394,450 OF 1907; THIS J., 1909, 236.—T. F. B.

Filter; Vacuum drum — for separating solid substances from liquids. H. Hencke, Charlottenburg, Germany. U.S. Pat. 915,436, March 16, 1909.

SEE ENG. PAT. 19,431 OF 1907; THIS J., 1908, 436.—T. F. B.

- Desiccating apparatus.* J. McCreedy and D. M. A. G. Hawes, London. U.S. Pat. 915,303, March 16, 1909.
 SEE Eng. Pat. 1479 of 1906; this J., 1907, 110.—T. F. B.
Vapour; System for producing a — by a liquefied gas. J. B. Fournier, Paris. U.S. Pat. 915,583, March 16, 1909.
 SEE Fr. Pat. 338,706 of 1903; this J., 1904, 708.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

- Pitch in coal-briquettes; Colorimetric determination of —.* K. Leo. Chem.-Zeit., 1909, 33, 359—360.

THE method described is applicable only if samples of the pitch and coal used in making the briquettes are available. It consists in treating 1 gm. of the finely-powdered and dried sample of the briquettes with 200 c.c. of boiling benzene in a flask attached to a reflux condenser, cooling the solution so obtained, rapidly filtering a portion through two filter-papers, and comparing the colour of 20 c.c. of the filtrate with that of a solution produced in a similar manner by the extraction of a mixture of 0.95 gm. of the dried coal with 0.05 gm. of the pitch. As a check on the results, which are accurate to 0.05 per cent., a second standard solution may be prepared from a 7 per cent. pitch-coal mixture.—A. G. L.

- The incandescence gas mantle industry.* Times, Eng. Suppl., April 14, 1909. [T.R.]

THE manufacture of incandescence mantles in Germany reached its highest point in 1906-7, and has recently declined, owing to the fact that England, France, the United States, and other countries have established factories. The industry, however, is still to a great extent in German hands, and the majority of the more important factories are established near Berlin. Competition between German manufacturers has lowered the prices of mantles until it now seems impossible to supply a really good article at a lower price; but the difference between a first-class mantle and one of an inferior quality is very marked. At present the maker who uses only the best material and most skilled labour, in order to supply a good article, suffers, because the public does not appreciate this difference in quality. The annual production of mantles for the whole world is distributed as follows, the figures referring to millions of mantles:—Germany, 100; America, 55; Great Britain (including Colonies), 35; France, 15; Austria, 3; Italy, 2; Belgium, 2; Russia, 1.

- Oxidation of hydrogen and carbon monoxide.* Orlow. See VII.

PATENTS.

- Bituminous binders and compositions; Producing —.* W. S. Wilkinson, Wytheville, Va. U.S. Pat. 915,260, March 16, 1909.

THE pitch or other binding agent is very finely ground and mixed with water or some other liquid in which it is not soluble. The resulting mixture is then incorporated with the coal so as to distribute the pitch thoroughly over the particles of coal, and the mass is dried, heated, and briquetted.—W. H. C.

- Coke-oven.* W. B. Smith, sen., Pittsburg, Pa. U.S. Pat. 915,630, March 16, 1909.

THE oven is built upon a framework of girders which supports it at some distance above the floor level. The bottom of the oven is detachable and is normally held in position by an elevator which is locked when the bottom is in contact with the oven. The oven is charged through an opening in the top and when the charge is coked, the elevator is lowered with the oven bottom on which the coke rests. When level with the floor the elevator tilts the bottom of the oven and the latter moves sideways on rails, carrying the coke with it clear of the oven structure. The coke is then removed and the oven bottom

is hauled back into position beneath the oven, raised into contact by the elevator and the latter locked, leaving the oven ready for the next charge.—W. H. C.

- Electric conductors suitable as filaments for lamps; Manufacture of refractory —.* W. D. Coolidge, Schenectady, U.S.A. Eng. Pat. 17,620, Aug. 21, 1908. Under Int. Conv., Aug. 24, 1907.

IN the manufacture of metallic filaments, the process of heating the filaments by the passage of a current in order to shrink and sinter them has hitherto required the separate treatment of each filament. The invention consists in connecting a number of filaments in parallel and treating them simultaneously with the current. The filaments are first partially shrunk by baking them so that the conductivity will not alter greatly during the treatment with the current; in cases where it is not desirable to bake the filaments to this extent, automatic regulating means are provided for maintaining the proper current through the individual filaments. In carrying out the process the partially shrunk filaments are mounted between spring clips supported on two conducting rails in a cylindrical treating vessel, the rails forming the leads to the filaments; an adjustable resistance is provided in the circuit. When regulating means are necessary for the individual filaments, one of the supporting rails is non-conducting, and each filament is connected in series with two or more iron wire resistances, having a positive temperature coefficient, such as are used in Nernst lamps. During the treatment of the filaments, as the conductivity of a filament increases, the resistance of the iron wire in series with it also increases and prevents the passage of an excessive current.—A. T. L.

- Incandescent body for electric glow lamps.* W. V. Bolton, Charlottenburg, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 915,657, March 16, 1909.

SEE Fr. Pat. 321,412 of 1902; this J., 1903, 206.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- Wood; Destructive distillation of — with superheated steam.* G. Büttner and H. Wislicenus. J. prakt. Chem., 1909, 79, 177—234.

THE authors studied the destructive distillation of wood (red and white beech) and cellulose (filter-paper) with superheated steam, and also the distillation of cellulose with direct heating. In distilling with superheated steam, the material (wood, cellulose) was placed in one-half of a wrought iron tube, the other half of which served as steam superheater; the iron tube was heated in an electric furnace or in a gas furnace. In each test the yields of acetic acid, methyl alcohol, reducing substances (as acetaldehyde), ketones (as acetone), charcoal, tar, and gas were determined. The acetic acid was determined by acidifying with sulphuric acid, distilling with steam, and titrating the distillate with N/10 sodium hydroxide, using phenolphthalein as indicator; the methyl alcohol by Stritar and Zeidler's method (this J., 1904, 841); the reducing substances by heating with ammoniacal silver solution and ascertaining the amount of silver reduced; and the ketones by a modification of Denigès' method (this J., 1899, 179), hydrogen peroxide being added to the liquid before precipitation. It was found that cellulose when distilled under ordinary conditions or with superheated steam yields no methyl alcohol, but up to 2.5—2.8 per cent. of acetic acid. In the distillation of wood, acetic acid is formed from both the cellulose and the lignin, but methyl alcohol only from the latter. By using a sufficiently high temperature, cellulose can be completely decomposed by means of superheated steam leaving a residue of ash. The yield of reducing substances is about twice as high with superheated steam as with direct heating. In the distillation of wood with superheated steam, it is not advantageous to work at too high a temperature, so that the steam acts

exclusively chemically, as under such conditions, the yield of gas is increased at the expense of the charcoal and the liquid distillation products. It is preferable to use the steam rather as a medium which ensures the uniform distribution of the heat throughout the wood, thus avoiding local overheating. It is then possible to obtain excellent charcoal and a higher yield of acetic acid (about 10 per cent. on the dry wood) but less methyl alcohol than with direct heating. By heating rapidly to the distillation temperature, it is possible materially to shorten the time of distillation, but the yield of charcoal is diminished; the yields of reducing substances, tar, and gas increase, and that of acetic acid remains practically unaffected. It is possible to avoid excessive dilution of the distillation products by heating the wood gently before introducing the steam, and by collecting the products in

fractions; the fraction distilling between 240° and 300° C. contains nearly the whole of the valuable products. Destructive distillation of the wood begins at 240° C. The reaction is exothermic, but all danger of explosion can be avoided by blowing steam through so as to displace the air just before the temperature of decomposition (240° C.) is reached. By treating the distillate with oxidising agents such as hydrogen peroxide, the reducing substances are oxidised, and the yield of acetic acid increased. By using air as oxidising agent, however, either during or after distillation, the yield of acetic acid is diminished. Attempts to use heating with superheated steam on the large scale gave unsatisfactory results, but in view of the excellent results obtained on the small scale, the authors consider further work in this direction worthy of attention.—A. S.

Table showing the results of an examination, by the usual process of fractional distillation, of samples of seven different brands of petrol.

Serial number	1	14	2	5	8	17
Trade name	Anglo "760."	Anglo "760."	Shell.	Shell.	Shell.	Shell.
Specific gravity of sample	Sp. gr. 0.739	Sp. gr. 0.736	Sp. gr. 0.717	Sp. gr. 0.716	Sp. gr. 0.716	Sp. gr. 0.719
Distillation.						
Began to distil at	70° C.	70° C.	65° C.	65° C.	63° C.	60° C.
Distillate below 100° C.	39.0 0.722	48.0 0.727	65.5 0.708	69.0 0.707	65.0 0.704	67.0 0.706
" between 100° C & 120° C ..	40.0 0.748	37.0 0.747	26.5 0.742	22.0 0.743	20.0 0.742	21.0 0.742
" " 120° C & 133° C ..	7.5 0.757	11.5 0.762	4.5 0.754	4.5 0.751	5.0 0.753	6.0 0.750
" above 133° C.	3.5 0.767	2.5 0.767	2.5 0.760	3.0 0.770	2.5 0.772	4.5 0.770
Loss	1.5 —	1.0 —	1.0 —	1.5 —	1.5 —	1.5 —
Calorific value.						
Calories per litre	8240	—	8068	—	—	—
" kilo.	11162	—	11252	—	—	—
British thermal units per 10 gal.	14848	—	14522	—	—	—
Sulphur " " lb.	20092	—	20254	—	—	—
Sulphur	0.03%	—	0.06%	—	—	—

Serial number	3	6	15	16	11	4
Trade name	Pratt's motor spirit.	Pratt's motor spirit.	Pratt's motor spirit.	Pratt's motor spirit.	Pratt's "Perfection."	Carless Capel "Standard."
Specific gravity of sample	Sp. gr. 0.717	Sp. gr. 0.711	Sp. gr. 0.715	Sp. gr. 0.712	Sp. gr. 0.710	Sp. gr. 0.700
Distillation.						
Began to distil at	65° C.	60° C.	63° C.	63° C.	58° C.	56° C.
Distillate below 100° C.	70.0 0.710	66.0 0.700	59.0 0.701	62.0 0.699	68.0 0.699	86.5 0.692
" between 100° C & 120° C ..	24.0 0.744	24.0 0.731	28.5 0.736	25.0 0.730	22.5 0.736	11.5 0.739
" " 120° C & 133° C ..	3.0 0.753	6.5 0.741	7.0 0.750	7.0 0.742	6.5 0.750	—
" above 133° C.	1.5 0.769	2.5 0.762	4.0 0.765	5.0 0.758	2.0 0.763	0.5 —
Loss	1.5 —	1.0 —	1.5 —	1.0 —	1.0 —	1.5 —
Calorific value.						
Calories per litre	8051	—	8017	—	—	7911
" kilo.	11220	—	11260	—	—	11302
British thermal units per 10 gal.	14492	—	14431	—	—	14240
Sulphur " " lb.	20212	—	20268	—	—	20344
Sulphur	trace	—	—	—	0.07%	0.06%

Serial number ..	7	9	10	18	12	13	19
Trade name ...	Carless Capel "Movril."	Carburine.	Carburine	Carburine.	P. G. R. "720—725."	P. G. R. "705—710."	Russian petrol.
Specific gravity of sample	Sp. gr. 0.718	Sp. gr. 0.717	Sp. gr. 0.717	Sp. gr. 0.717	Sp. gr. 0.715	Sp. gr. 0.705	Sp. gr. 0.705
Distillation.							
Began to distil at	63° C.	65° C.	65° C.	62° C.	58° C.	55° C.	60° C.
Distillate below 100° C.	59.0 0.704	64.0 0.705	68.0 0.705	67.5 0.708	58.0 0.700	73.0 0.697	74.0 0.696
" between 100° C & 120° C ..	20.0 0.742	26.0 0.740	23.0 0.743	22.0 0.742	24.5 0.733	17.5 0.736	15.5 0.736
" " 120° C & 133° C ..	8.0 0.755	6.5 0.754	5.5 0.755	5.5 0.758	9.5 0.749	5.0 0.751	5.0 0.745
" above 133° C.	3.0 0.768	2.5 0.770	2.5 0.773	3.5 0.770	6.5 0.770	3.0 0.768	4.0 0.764
Loss	1.0 —	1.0 —	1.0 —	1.5 —	1.5 —	1.5 —	1.5 —
Calorific value.							
Calories per litre	8042	—	—	8021	8056	7959	7919
" kilo.	11200	—	—	11187	11267	11289	11232
British thermal units per 10 gal.	14476	—	—	14438	14501	14326	14253
Sulphur " " lb.	20160	—	—	20137	20281	20320	20218
Sulphur	—	0.07%	—	—	0.07%	—	0.06%

Naphthalene; New method of preparing β -halogen derivatives of —. G. Darzens and E. Berger. *Compt. rend.*, 1909, 148, 787—788.

SODIUM (1 atomic proportion) is pulverised by agitation with dry, boiling toluene, β -naphthol (1 mol. proportion), dissolved in dry toluene, then being added. Evolution of hydrogen proceeds smoothly, the mixture being finally heated on the water-bath until all the sodium has dissolved. Slightly more than the theoretical quantity of phosphorus trichloride or tribromide, diluted with toluene, is then added little by little; heat is evolved during this operation. The mixture is heated on the water-bath for an hour, then taken up with water and steam-distilled. β -Chloro- or β -bromonaphthalene is thus obtained in a state of fairly high purity. The yields are: β -chloronaphthalene, 55; β -bromonaphthalene, 38 per cent. With phosphorus pentachloride and pentabromide, the yields are only 3 and 21 per cent. respectively; with phosphorus oxychloride, no β -chloronaphthalene is formed, and with the oxybromide, the yield of β -bromonaphthalene is only 0.6 per cent. An attempt to prepare chloro-benzene and the chlorotoluenes by this method was unsuccessful.—L. E.

International Petroleum Testing Commission. Oil, Paint, and Drug Rep., April 5, 1909. [T.R.]

THIS International Petroleum Testing Commission will hold a meeting in connection with the International Congress of Applied Chemistry in London, beginning May 24, and meeting at intervals during the course of this Congress up to June 5. At this meeting the first work will be to make certain members responsible for the comparison of various methods of testing viscosity, determination of sulphur in oils, determination of flash-points, fire tests, determination of paraffin wax and asphaltum, etc., so that there will be as little as possible of duplication in work. Each oil-producing country is entitled to two representatives on the Commission, although a country has only one vote in the final decisions.

Petrols; Composition of commercial —. B. Blount. *Inst. Automobile Engineers*, March 10, 1909, 1—6.

SAMPLES of seven well-known brands of petrol were bought at different places in London in the ordinary way in sealed cans. The samples were submitted to the usual examination, the results obtained being given in the annexed table. The calorific value was determined in a bomb calorimeter, Berthelot's method for volatile liquids being used. This consists in placing the petrol in a relatively deep platinum cup, which is entirely enclosed in a "sack" of celluloid. Without this device it is impossible to ensure complete combustion of the petrol, although the explosion is very violent. It appears from the table that the calorific value for a given weight of fuel is nearly the same in all cases. Consequently, as petrol is sold by volume, there is an appreciable advantage in using the heavier grades, which have a higher calorific value per unit volume, provided that they can be burnt as efficiently. The percentage of sulphur is insignificant in all cases. As regards the figures given on fractionation, three of the brands examined, "Pratt," "Shell," and "Carburine," sufficiently resemble each other to make it possible to draft a specification for petrol of this grade which shall include all three brands. The other brands differ too widely to permit of useful grouping, but even the heaviest, "Anglo 760," with a sp. gr. of 0.735—0.740, has only a small proportion of distillate above 133°C. The lightest brand is "Carless Standard," with 98 per cent. distilling below 120°C. It is probably similar to the petrol of earlier days. (See Table, page 418.)

Trinidad asphaltum; Proximate composition and physical structure of —. C. Richardson. *Proc. Amer. Soc. for Testing Materials*, 1908, 6, 509—518.

TRINIDAD asphaltum, composed of bitumen in intimate admixture with clayey matter and a thermal water, is extremely uniform in its proximate composition. The usual method of analysis consists in drying at 100°C. for the determination of the water, treating with cold carbon bisulphide for the extraction of the bitumen, and

igniting the residue for the estimation of the mineral matter. The total so obtained, whether on the crude or the refined asphaltum, leaves about 7 per cent. unaccounted for and this deficiency, hitherto assumed to be "organic matter not bitumen," has been found to consist of the volatile constituents (combined water, alkalis, etc.) of the mineral matter, with a small percentage of bitumen retained by the absorptive or adsorptive power of the solvent-treated residue and expelled during ignition. The addition of tricalcium phosphate before ignition prevented loss of inorganic salts and resulted in an increase of 2 per cent. in the amount of mineral matter found, while the quantities of combined water and absorbed bitumen held by the solvent-treated residue corresponded respectively to 4.2 and 0.3 per cent., thus accounting for practically the whole of the deficiency observed in the results of the ordinary routine analysis. The strongly absorptive action of clays, etc., upon bitumen in carbon bisulphide solutions was found to be selective also: the higher hydrocarbons of the bitumen are absorbed in preference to the lower, the process being similar to that which takes place when crude petroleum is passed through clay for refining purposes.

As regards the physical structure of Trinidad asphaltum, the observations made and experiments described show that the water is held by the clayey matter, the definite ratio of water and clay being due to the capacity of the mineral matter for water; and that the deposit has been formed by the bitumen coming into contact with the original clay-mud of the Trinidad Lake. The definite ratio of mud and bitumen is accounted for by assuming that the mud has a definite capacity for taking up and holding bitumen.—W. E. F. P.

Hatchettin from Bonarka near Cracow. J. Morozewicz. *Anz. Akad. Wiss. Krakau*, 1908, 1067—1072. *Chem. Zentr.*, 1909, 1, 1113.

A VERY pure deposit of hatchettin has been discovered in a cretaceous marl at Bonarka, near Cracow. The mineral which consists of a solid paraffin of the composition, $C_{33}H_{78}$ (octatriacontane), occurs in small clusters of flaky structure and of a pearl-white colour with a tinge of yellow. It melts at 79.4° and solidifies at 78.9°C.; sp. gr., 0.961; hardness, 1.—A. S.

PATENTS.

Condensation products of wood-tar with formaldehyde; Process for the manufacture of —. W. P. Thompson, Bradford. [From K. A. Lingner]. *Eng. Pat.* 25,318, Nov. 24, 1908.

By the condensation of wood-tar with formaldehyde in presence of acid condensing agents, an almost odourless product is obtained, which does not colour the skin, is neither irritant nor poisonous, and possesses in increased measure the characteristic curative properties of wood-tar. According to the present patent, this condensation product is prepared in presence of an alkaline condensing agent. A mixture of 140 kilos. of wood-tar, 30 kilos. of soda lye of 40° B., and 80 kilos. of 40 per cent. formaldehyde is heated gently. When the reaction is complete, the viscous product is diluted with water and poured into a mixture of 500—600 kilos. of water and 18 litres of 25 per cent. sulphuric acid. The condensation product separates as light brown flakes, which are washed and dried.—A. S.

Tar oils; Process for purifying —. W. Feld. *Ger. Pat.* 208,190, May 15, 1907.

WHEN hydrogen sulphide and sulphur dioxide interact in presence of tar oils (see *Fr. Pat.* 387,438 of 1908; this *J.*, 1908, 810), the recovered sulphur is discoloured. This can be avoided if the tar oils are treated, either simultaneously or separately, with sulphur dioxide and hydrogen sulphide, and then distilled. The resulting oils smell of hydrogen sulphide; this is no disadvantage if they are to be used for the solution of sulphur, but if they are needed for other purposes, the odour can be removed by warming, or by passing air or sulphur dioxide through the oils, or by treating them with alkalis or alkaline-earths in presence of metallic salts, or with

metallic oxides or hydroxides. Instead of the treatment with sulphur dioxide and hydrogen sulphide, the oils may be treated before distillation with polysulphides or salts of thio-acids in presence of acidic compounds, such as mineral acids, carbon dioxide, phenols, etc.—T. F. B.

Bye-products from asphaltum and the like; Production of —. S. Everett, London. Eng. Pat. 27,335, Dec. 11, 1907.

THE claim is for the production of oils and other products from asphaltum by distilling the material placed in thin layers in long, wide and shallow retorts heated to a temperature of about 800° F. The heating is stopped when oil ceases to distil over and the residue is withdrawn.—W. H. C.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indigo; A new isomeride of —. A. Wahl and P. Bayard. Compt. rend., 1909, 148, 716–719.

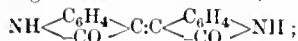
OXINDOL condenses with aromatic aldehydes yielding well crystallised, coloured compounds, for example, with piperonal a bright yellow compound, m. pt. 228°–229° C.,

of the constitution, $\text{NH} \begin{array}{c} \text{CH} \\ \diagup \quad \diagdown \\ \text{CO} \end{array} \text{C}_6\text{H}_4 \begin{array}{c} \text{O} \\ \diagup \quad \diagdown \\ \text{O} \end{array} \text{CH}_2$,

is formed. As this reaction seems to be general the authors suggest the name *iso-indogenide* for compounds

of the general formula, $\text{NH} \begin{array}{c} \text{C}_6\text{H}_4 \\ \diagup \quad \diagdown \\ \text{CO} \end{array} \text{C}_6\text{H}_4 \text{R}$. The

condensation of oxindol with isatin gives rise to a new isomeride of indigo and is carried out as follows: A solution of 1.35 grms. of oxindol and 1.5 grms. of isatin in 30 c.c. of acetic acid containing 0.5 c.c. of concentrated hydrochloric acid is heated on the water-bath. The solution turns brown and the dyestuff crystallises out. After 2 to 3 hours the reaction is finished and the dyestuff is washed with alcohol and ether and recrystallised from acetic acid, when it is obtained in brown red needles with a yellow reflex. This *iso-indogenide* of isatin, or 3:3-bisindolindigo, has the constitution,



it is insoluble in water, slightly soluble in the ordinary organic solvents in the cold but more readily when hot. From methyl alcohol it crystallises in flat garnet-red needles. Its solutions are brownish-orange with a red tint. It is insoluble in alkaline solutions of hyposulphite (hydrosulphite) but its acetic acid solution is decolourised by zinc powder. Similarly by condensing isatin chloride and oxindol by the process already published (this J., 1909, 238) Indirubin was prepared.—J. C. C.

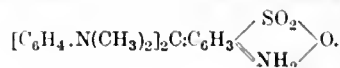
Azo-dyestuffs derived from the aminosulphonamides; A series of —. G. T. Morgan and F. M. G. Micklethwait. J. Soc. Dyers and Col., 1909, 25, 107–111.

THE authors have prepared benzenesulphonyl-*p*-phenylenediamine, toluene-*p*-sulphonyl-*p*-phenylenediamine, and toluene-*p*-sulphonyl-*m*-phenylenediamine by heating the appropriate nitraniline (*p*- or *m*-) with benzene- or toluene-*p*-sulphonic chloride for 4–5 hours in boiling toluene. (Toluene-*p*-sulphonic chloride is obtained as a by-product in the manufacture of saccharin.) After removal of the solvent the condensation product is extracted from the residue with aqueous sodium hydroxide and the solution acidified. The precipitated nitro-compound on reduction yields the base required (e.g. $\text{C}_7\text{H}_7\text{SO}_2\text{NH}\cdot\text{C}_6\text{H}_4\text{NH}_2$) or if first methylated and then reduced, the corresponding aminosulphon-methylamide (e.g. $\text{C}_7\text{H}_7\text{SO}_2\text{N}(\text{CH}_3)\cdot\text{C}_6\text{H}_4\text{NH}_2$) is obtained. The diazo-chlorides obtained from these six bases are stable and sparingly soluble in water; azo-dyestuffs were obtained by combining them with β -naphthol-6-sulphonic acid, β -naphthol-3:6-disulphonic acid, α -naphthol-4-sulphonic acid, H acid, and chromotropic acid. From a comparison of these dyestuffs with

those obtained from the same naphthol acids and ordinary diazo-compounds, the following conclusions are drawn: (1). The introduction of an arylsulphonyl group, $\text{NH}\cdot\text{SO}_2\text{R}$, into the para-position with respect to the azo-group produces an effect on the colour of the dyestuff comparable with that induced by the nitro-group in the same position. (2). The effect is somewhat diminished by the replacement of hydrogen by methyl in this group when occupying the para-position. (3). The presence of the arylsulphonyl group in the meta-position to the azo-group has no appreciable effect on the tinctorial properties of the dyestuff. (4). Considered as wool dyestuffs, the azo-sulphonamides and their methyl derivatives resemble the standard azo-dyestuffs in their fastness to light and scouring; they are, however, more completely removed from the dye-bath than the ordinary azo-dyestuffs containing the same phenolic residue. (5). As silk dyestuffs these azo-sulphonamides and azo-sulphonmethylamides are superior in their fastness to soap to the ordinary azo-dyestuffs containing the same phenolic residue. (6). The azo-sulphonamides and their methyl derivatives possess in a marked degree the tendency to assume the colloidal condition.—J. C. C.

Dyestuffs; Preparation of new, primary products for —. Report of sealed packet No. 746 (deposited Oct. 10, 1903) of J. Walter, by E. Noelting. Bull. Soc. Ind. Mulhouse, 1909, 79, 30–32.

NOELTING reports that, by oxidising Sun Yellow, Walter has isolated a benzaldehydesulphonic acid which is probably a mixture of the nitro-, azo-, azoxy- and possibly also the nitroso-derivatives. This acid condenses with dimethylaniline and gives, on oxidation, a green dyestuff. If it is first reduced to the leuco-base and this is oxidised, a blue dyestuff results which has the constitution,



—J. C. C.

Sulphinic acids; Isolation of the —. J. Thomas. Chem. Soc. Trans., 1909, 95, 342–345.

IN the preparation of aromatic sulphinic acids from diazo-compounds by means of sulphur dioxide and finely-divided copper according to Gattermann's method (this J., 1899, 675), the sulphinic acids are generally separated from the solution and the copper residue by extraction with ether. The author finds that separation can be effected much more simply by means of the ferric salts of the acids. All the aromatic sulphinic acids tried are precipitated quantitatively as orange-coloured ferric salts from strongly acid solutions on addition of ferric chloride. On decomposition with alkalis, the ferric salts yield ferric hydroxide and a solution of alkali sulphinate, from which the free sulphinic acid can be precipitated by addition of concentrated hydrochloric acid. A solution of the sulphinic acid in sodium carbonate when treated with sodium hypochlorite yields the corresponding sulphonyl chloride, and the sulphonamide may be obtained by decomposing the ferric sulphinate with ammonia, and then treating with sodium hypochlorite.—A. S.

PATENTS.

Dyestuffs; Manufacture of brown sulphurised —. A. G. Bloxam, London. From Chem. Fabrik Griesheim Elektron, Frankfurt a/M., Germany. Eng. Pat. 4848, Mar. 3, 1908.

By heating aromatic meta-dinitro compounds, or derivatives thereof which contain no hydroxyl groups, with polyhydric alcohols, or carbohydrates, and alkali polysulphides, dyestuffs are produced which dye unmordanted cotton in brilliant brown shades. That the polyhydric alcohols take part in the reaction, is evidenced by the fact that some of these meta-dinitro compounds yield olive-green dyestuffs when heated alone with an alkali polysulphide.—F. M.

Leuco-hydroxyanthraquinones; *Process for preparing* —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 207,668, Jan. 26, 1908. Addition to Ger. Pat. 148,792, Feb. 1, 1903.

p-AMINOHYDROXY- or *p*-diaminoanthraquinones, either unsubstituted or with only heteronuclear substituents, are reduced by means of alkaline reducing agents to the corresponding leuco compounds, which are then converted into leuco-hydroxyanthraquinones by heating with dilute acids.—T. F. B.

Mono-aryldio-galloylanines; *Process for preparing leuco derivatives of* —. Farbwerke vorm. L. Durand, Huguenin, und Co. Ger. Pat. 207,670, March 11, 1908. Addition to Ger. Pat. 207,669, Aug. 1, 1907.

INSTEAD of reducing galloylanine arylides by aid of heat, in presence of excess of acid, as in the original patent (see Fr. Pat. 394,136 of 1908; this J., 1909, 239), the reduction may be carried out in the cold, in acid solution, by means of suitable reducing agents, e.g., zinc.—T. F. B.

Benzaldehyde-m-azo-2-naphthylamine-5.7-disulphonic acid; *Process for preparing a colourless reduction product, which cannot be diazotised, from* —. L. Cassella und Co. Ger. Pat. 207,935, Sept. 11, 1907.

THE yellow dyestuff, obtained by combining diazotised *m*-aminobenzaldehyde with 2-naphthylamine-5.7-disulphonic acid, is converted by treatment with mineral acids, into a reddish compound which, when reduced by means of zinc dust, stannous chloride, hydrosulphites, etc., preferably in presence of a bisulphite, forms a colourless substance, only slightly soluble in hot water and which cannot be diazotised. It can be used in the preparation of azo dyestuffs; for example, when melted with alkali hydroxides it gives valuable hydroxyl derivatives.

—T. F. B.

Vat dyestuffs of the anthracene series; *Process for preparing* —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 208,162, Feb. 6, 1908.

SUBSTITUTED dianthraquinone-imines, which dye blue, violet, and blue-black shades from the vat, are obtained by the condensation of halogenated anthraquinone derivatives with aminoanthraquinones in presence of metallic salts, the anthraquinone derivatives containing auxochrome groups which are in the *o*- or *m*-position to the imino-group in the resulting compounds. Thus, 6 kilos. of 1-hydroxy-3-bromoanthraquinone and 2.5 kilos. of 1.4-diaminoanthraquinone are dissolved in 60 kilos. of nitrobenzene, and heated for 6 hours at 180° C., after addition of 4 kilos. of sodium acetate and 500 grms. of cupric chloride; the dyeings are violet.—T. F. B.

Vat [thioindigo] dyestuffs; *Process for preparing* —. Kalle und Co. Ger. Pat. 208,343, Sept. 20, 1907.

By oxidation of arylthioglycolic acids in alkaline solution by means of chlorine, arylsulphoxyacetic acids,



are obtained. By treating such of these acids as have a free *o*-position to the sulphoxyacetic group, with concentrated sulphuric acid, monohydrate, or sulphuric acid chlorohydrin, with or without other substances assisting condensation (e.g., boric acid), vat dyestuffs of the thioindigo group are obtained. The yields vary considerably; whilst phenylsulphoxyacetic acid gives very small yields of dyestuff, some of its derivatives, especially the halogen derivatives, give much higher yields.—T. F. B.

Sulphonic acid of Celestine Blue; *Manufacture of a* —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,867, June 1, 1908.

SEE Fr. Pat. 391,241 of 1908; this J., 1908, 1107.—T. F. B.

Vat dyestuffs; *Manufacture of* —. Basler Chem. Fabrik, Basle, Switzerland. Eng. Pat. 20,003, Sept. 23, 1908. Under Int. Conv., Oct. 17, 1907. Addition to Eng. Pat. 344 of 1908, dated Jan. 16, 1907.

SEE Addition of Sept. 14, 1908, to Fr. Pat. 385,920 of 1908; this J., 1909, 238.—T. F. B.

Vat dyestuff and process of making same. A. Grob, Assignor to Basle Chemical Works, Basle, Switzerland. U.S. Pat. 915,346, March 16, 1909.

SEE Addition of Sept. 14, 1908, to Fr. Pat. 385,920 of 1908; this J., 1909, 238.—T. F. B.

Mono-brom-trichlor indigo and process of making same. G. Engi, Assignor to Soc. Chem. Ind. in Basle, Basle. U.S. Pat. 915,338, March 16, 1909.

SEE Eng. Pat. 19,563 of 1908; this J., 1908, 1200.—T. F. B.

Vat [anthracene] dyestuff; *Brown* — and *process of making same*. A. Schaarschmidt and B. Mayer, Assignors to Soc. of Chem. Ind. in Basle, Basle. U.S. Pat. 915,385, March 16, 1909.

SEE Eng. Pat. 13,057 of 1908; this J., 1909, 85.—T. F. B.

Vat [anthracene] dyestuffs; *Gray* — and *process of making same*. J. Hoffmann, Assignor to Soc. Chem. Ind. in Basle, Basle. U.S. Pat. 916,154, March 23, 1909.

SEE Eng. Pat. 13,057 of 1908; this J., 1909, 85.—T. F. B.

Azo dyestuffs and process of making same. C. Jagerspacher, Assignor to Soc. Chem. Ind. in Basle, Basle. U.S. Pat. 916,161, March 23, 1909.

SEE Fr. Pat. 390,223 of 1907; this J., 1908, 1015.—T. F. B.

Vat [thioindigo] dyestuffs and process of making same. A. Schmidt and E. Bryk, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Main, Germany. U.S. Pats. 916,029 and 916,030, March 23, 1909.

SEE Eng. Pat. 8162 of 1907; this J., 1908, 680.—T. F. B.

Indiges; *Highly brominated* — and *process of making same*. A. Schmidt, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Main, Germany. U.S. Pat. 916,031, March 23, 1909.

SEE Eng. Pat. 25,513 of 1907; this J., 1909, 17.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Sisal hemp; *Composition and utilisation of pulpy waste from the stripping of* —. A. Hébert and F. Heim. Compt. rend., 1909, 148, 513—514.

IN stripping the fibres of the *Agave rigida Sisalana* for the preparation of sisal hemp, a large proportion of the weight of the leaf is left in the form of a pulpy waste composed of the fleshy and epidermal tissues. The dried pulp contains about 12 per cent. of mineral matter and 11 per cent. of total sugars calculated as dextrose. The question of fermenting the pulp for the manufacture of alcohol deserves consideration, but the obvious and immediate application of this waste is to return it to the land in the form of manure. The harvesting of 100 kilos. of fresh leaves removes from the soil: 0.24 kilo. of phosphoric acid, 1.14 kilos. of lime, 0.62 kilo. of potash and 0.16 kilo. of nitrogen. Analyses of the dried fibres and dried pulp gave the following results:—

	Fibres.	Pulp.
	per cent.	per cent.
Mineral matters	8.02	12.11
Phosphoric acid	0.41	0.16
Lime	1.94	3.57
Potash	1.06	1.22
Total nitrogen	1.78	3.79

Unless these fertilising constituents are returned to the soil as far as possible, the plantations will tend to become exhausted. One hundred parts of green leaves yield 27.7 parts of dry pulpy waste. If this waste be used as a manure, it will only be necessary to compensate for the fertilising matters removed in the fibrous portion of the crop.—J. F. B.

Acid Magenta printed upon sulphur bleached wool; Development of — when exposed to direct sunlight. D. Paterson. J. Soc. Dyers and Col., 1909, 25, 112—113.

WHEN Acid Magenta, without the addition of any acid, is printed on worsted yarn, the resulting faint, undeveloped colour becomes, on exposure to sunlight, a full Magenta if the yarn has been bleached with sulphurous acid. A non-sulphured yarn does not show this reaction. The author points out that sulphured yarns retain sulphur dioxide even after prolonging washing and drying, and considers that the development of colour observed is due to the oxidation under the influence of sunlight of the sulphur dioxide to sulphuric acid. A similar effect is noticed in the case of wool which has been printed with lead acetate and steamed; the brownish drab shade produced is quite fast to sunlight, but if sulphured wool has been used, the sulphuric acid developed turns this grey and ultimately white, the lead sulphide (to which the colour is due) being converted into lead sulphate.—J. C. C.

Starches: Determination of the value of —. A. Binz and T. Marx. Chem. Ind., 1909, 32, 167—169.

MANY investigations upon starch paste have been published, dealing chiefly with the viscosity, or adhesive power of comparatively thin pastes. These points are of interest to the calico-printer, but are not of such moment in finishing or in the laundry, where it is the filling or stiffening power of the paste which is important. The values of starches in this respect are compared by determining the resistance which the paste offers to the removal of a plate of a given size, embedded in it at a certain depth. The paste is prepared by stirring 33 grms. of starch with 50 c.c. of cold water and adding 350 c.c. of boiling water. A round brass plate, 22 cm. in diameter, with a brass rod fixed to its centre, is then lowered into the liquid so that it lies 3 cm. below the surface. The paste is left to cool for about 20 hours, being covered with a thin layer of olive oil to prevent the formation of a "skin." The rod attached to the plate is connected to the arm of a balance and sand is gradually poured into the scale pan suspended from the other arm until the plate is lifted vertically out of the paste. The weight of the sand serves as a measure of the stiffness of the paste. The results obtained with stiff pastes from rice starch are useful as to the comparative values of these for finishing and laundry purposes; for calico-printing thinner pastes would have to be compared. The apparatus, as described, is not suitable for the comparison of pastes made from potato and wheat starches.—F. M.

Carrageen moss. E. Hastaden. Färber-Zeit., 1909, 20, 107—109.

CARRAGEEN or Irish moss is an alga of the Atlantic Ocean which is collected on the shores of Ireland and Scotland; it has been confounded by some writers with Iceland moss, a land lichen, which is totally different and is scarcely adapted for textile finishes. Carrageen moss is not sufficiently adhesive for laundry purposes, but for certain textile finishes it is capable of giving most valuable effects at a very low cost. It does not give hard finishes. For goods which have to be calendered under heavy pressure, Irish moss is of no practical importance, since the finish breaks down in the calendering, but for very lightly dressed goods, such as sateens, lanellas, zephyrs, etc., it has recently come considerably to the fore in producing the so-called "natural finish." It imparts a bulky "handle," with a high degree of softness and an absence of a "papery" effect. A 0.75 per cent. decoction of Irish moss is particularly good for dressing raised goods like flannelettes in which heavier dressings tend to lay the nap and to dust out during the raising process. As the jelly mixes readily with all the other finishing materials, its scope of usefulness is very wide. It has the advantage of preventing to a large extent the bleeding of the dyestuffs in washing. The temporary unpopularity of Irish moss was probably largely due to unsuitable methods of preparing the jelly and the lack of suitable antiseptics. The best qualities are nearly white in colour, the inferior grades being dark grey; the latter give an inferior yield of jelly, a large proportion being insoluble.

A good quality of moss should be selected, steeped for 12 hours, and boiled for 2 hours; inferior qualities require twice as long at both stages. The jelly requires an antiseptic to overcome its liability to putrefaction; suitable proportions are 3–5 grms. of salicylic acid or 33 grms. of formaldehyde per 100 litres of decoction.—J. F. B.

PATENTS.

[Artificial threads, etc.]. Albuminoids; Process of dissolving — and its industrial applications. H. L. J. Chavassieu. Fr. Pat. 395,402, Dec. 27, 1907.

PROTEINS such as fibrin, casein, etc., are dissolved by means of caustic alkalis, and the solution treated with carbon bisulphide. The xanthates so obtained are used, either alone or mixed with cellulose xanthate, for the preparation of artificial threads, etc.—A. S.

Dyeing and dyes [dyestuffs] for use therein. C. Fowler, Liversedge. Eng. Pat. 4624, Feb. 29, 1908.

CLAIM is made for a process of dyeing union fabrics (cotton and wool, cotton and silk) in one bath, the vegetable fibre being dyed in one shade and the wool or silk in another. The dyestuff is made by mixing a direct cotton dyestuff with one which dyes wool, for instance, in a neutral bath, or with a dyestuff which dyes the wool in an acid bath. The dyestuffs chosen must, however, not react with or mutually precipitate each other. They may be used alone or in conjunction with one or more of the acids and salts usually employed in dyeing.—F. M.

Dyeing, scouring, and analogous machines. C. R. Kershaw, J. H. Abell, and B. Leach, Leicester. Eng. Pat. 6893, Mar. 28, 1908.

AN endless brattice conveyor, arranged at the delivery end of a dyeing or scouring machine, is supported along its length by side arms which in turn are mounted by means of pivots on fixed frames so that one end of the conveyor can be lowered into the vat of the machine. The brattice is also provided with projecting fingers which, when the conveyor is in action, pick up the material contained in the vat, carry it to the end of the path of the conveyor and deliver it into a suitable receiver. (See Eng. Pats. 1923 of 1862, 12,919 and 18,966 of 1891, and 12,545 of 1905; this J., 1906, 632.)—P. F. C.

Dyeing yarn; Apparatus for —. C. Corron, St. Chamond, France. U.S. Pat. 915,939, March 23, 1909.

THE skeins of yarn suspended from reels mounted eccentrically on shafts carried by a frame and driven by electric motors, are alternately lowered into and raised out of dye-baths by an automatically controlled hydraulic ram.

—W. H. C.

Organic substances; Process for the reduction and oxidation of — by electrolysis. H. Chaumat. Second Addition, dated Dec. 28, 1907, to Fr. Pat. 393,561, Oct. 29, 1907.

THE process described in the main patent (this J., 1909, 148) and in Fr. Pat. 379,041 (this J., 1907, 1196) for the reduction of indigo, is now applied to the reduction of indanthrene dyestuffs, especially indanthrene and flavanthrene, for the purpose of preparing vats for dyeing purposes. By applying the process to mixtures of indigo and flavanthrene in varying proportions, vats can be prepared yielding different shades of green. It is stated that in this process of reduction, the quantity of alkali used can be so diminished, that it becomes possible to use the indanthrene colours for dyeing wool.—A. S.

Dithionalkylthioindigo dyes on vegetable fibres; Process for treating —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pats. 206,567, July 30, 1907, and 206,568, March 3, 1908.

VEGETABLE fibres dyed with dithionalkylthioindigo dyestuffs deteriorate after long exposure to light; this tendering may be avoided by treating the dyed fibres with solutions of copper salts or iron salts, which treatment also increases the fastness of the dyeing considerably. The dyestuffs are obtained, for example, from *p*-amino-

nitrobenzoic acid, which is converted by means of the diazo reaction into ethylthionitrobenzoic acid; this is reduced, the amino-acid treated with chloroacetic acid, and the product melted with alkali and oxidised to 6,6'-diethylthioindigo.—T. F. B.

Printing with gallocyanine dyestuffs; Process for —.
Anilinfarben und Extrakt-Fabr., vorm. J. R. Geigy.
Ger. Pat. 207,323, March 5, 1908.

GALLOCYANINE dyestuffs have formerly been used for printing only in the form of their bisulphite compounds or leuco-derivatives. It is now proposed to use them in their solutions in presence of aromatic sulphonic acids or their salts, e.g., naphthalenesulphonic acids.—T. F. B.

Drying, cooling, etc., of textile fabrics, warp yarns, etc.; Method of and means for the —. J. Charlesworth, Huddersfield. Eng. Pat. 4992, Mar. 5, 1908.

THE invention relates to apparatus for forcing hot or cold air against or through the fabric, warp yarn, etc., whilst this is passing through one, two, or more chambers. Each chamber is supplied centrally with a fan for circulating the air, and the heated or cooled air is forced to pass through the material as this is led around the fan. In the case of fabrics, these are held at full width by pins or clips on endless chains, which pass around a pair of revolving discs arranged in each chamber at a suitable distance apart. Or, as in the case of warp yarns, the material may be supported by laths, bars, or rollers, which fit into sockets in these revolving discs.—F. M.

Bowling material which has been dyed or printed with vat colouring matters. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 14,337, July 6, 1908.

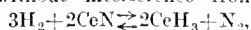
SEE Fr. Pat. 392,858 of 1908 this J., 1909, 89.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Ammonia; Synthesis of — from its elements. J. Lipski. Z. Elektrochem., 1909, 15, 189—206. (Compare this J., 1905, 545.)

THE yield of ammonia, prepared synthetically with the aid of cerium nitride or hydride, is considerably greater than has hitherto been obtained by similar processes, the volume of ammonia in the gas stream easily reaching 1 per cent., as against 0.1 per cent. or less by other methods. The reactions,

$3\text{H}_2 + \text{CeN} = \text{CeH}_3 + \text{NH}_3$ and $\text{N}_2 + \text{CeH}_3 = \text{CeN} + \text{NH}_3$, take place at atmospheric pressure, and at low or medium temperatures without interference from the reaction.



although at high temperatures, when the dissociation pressures of the nitride and hydride are greater and the stability of ammonia is small, the last reaction predominates; the temperature most favourable to the formation of ammonia by this process is 200°—300° C. The gases used must be absolutely pure and dry, traces of moisture or oxygen affecting the surface of the material and rendering it useless, but the nitride or hydride may be prepared either from the pure metal or from commercial material. By employing nitrogen and hydrogen alternately, a continuous production of ammonia takes place, but the material becomes exhausted eventually and requires time for its recovery. The maximum dissociation pressure of cerium nitride at 600°—700° C. is 34—40 c.m., but equilibrium is retarded by a slow, continuous increase of pressure, which appears to depend partly on the formation of a solid solution of cerium and its nitride, and partly on lack of homogeneity and the age of the sample.—F. SODN.

Potassium perborate. C. von Girsowald and A. Wolokitin. Ber., 1909, 42, 865—869.

A 75 per cent. solution of potassium metaborate containing an excess of potassium hydroxide is added to

10 times its volume of 3 per cent. hydrogen peroxide; after eight hours the liquid is filtered and to the filtrate is added nine-elevenths of its volume of methyl alcohol. The precipitated salt is filtered off after twelve hours, washed twice with ice-cold water, and dried in the air. It has the composition represented by $2\text{KBO}_3 \cdot \text{H}_2\text{O}$; is but slightly soluble in cold, rather more so in warm water. The solution behaves like a mixture of borate and hydrogen peroxide, and loses oxygen slowly in the cold, more rapidly on warming. The salt is insoluble in alcohol or ether. If 30 per cent. hydrogen peroxide be used instead of the 3 per cent. solution, a salt of the composition, $2\text{KBO}_3 \cdot 11\text{H}_2\text{O}$, is obtained, similar in general properties to the other.—J. T. D.

Barium carbide; Action of nitrogen on commercial —.
O. Kühling and O. Berkold. Z. angew. Chem., 1909, 22, 193—197.

THE authors have already shown that addition of barium chloride has only a slight influence on the absorption of nitrogen by a heated mixture of barium carbonate and carbon (see this J., 1908, 121). Similar experiments with commercial barium carbide have now shown that addition of barium chloride (10, 20, and 30 per cent.) neither reduces the initial temperature of nitrogen-absorption appreciably, nor causes much increase in the total quantity of nitrogen absorbed, and that this salt appears to cause an increase in the yield of cyanide at the expense of cyanamide. The interpretation of the results is rendered much more difficult by the impurity of the carbide used, which had the following composition:—Barium, 49.86; calcium, 17.11; iron and aluminium, 2.62; carbide carbon, 7.62; sodium, 0.85; chlorine, 0.18; portion insoluble in hydrochloric acid, 9.76; phosphorus, sulphur, oxygen, and carbon dioxide, 12.0 per cent. The authors conclude that the material was not free from calcium carbide. Moissan showed that even at so high a temperature as 1200° C., pure barium carbide absorbs scarcely any nitrogen. With the crude carbide used by the authors, absorption began at 500°—600° C., the maximum absorption being attained at 920°—930° C. Since the added chloride is inactive, the catalytic action of the oxides must be considered, though which of these are especially active cannot be decided at present. To prevent risk of explosion, the following modification of the usual method was adopted for determining the carbide carbon in the barium carbide used:—About 20 grms. of the dry carbide were placed in a vacuum flask (of about 1 litre capacity), the bottom of which was covered with previously ignited sand. The side tube of this flask was connected by a thick-walled rubber tube to a stop-cock tube fitting the upper outlet of an aspirator (of about 6 litres capacity) filled with acetylene water; the lower outlet of this aspirator was connected by a thick-walled rubber tube with a second aspirator. The neck of the vacuum flask was fitted with a rubber stopper carrying a dropping funnel. After adjusting the level of the liquid to a mark on the neck of the first aspirator, the stop-cock tube was joined to the rubber tube leading to the vacuum flask, and the second aspirator was placed in as low a position as possible; 50 c.c. of 96 per cent. alcohol and then 100 c.c. of 80 per cent. alcohol (previously saturated with acetylene) were now added from the dropping funnel, the flask being shaken towards the end of the reaction, and the volume of gas evolved subsequently determined. For the determination of cyanide in the product, Feld's method (Ber., 1907, 40, 314) was found to be not directly applicable owing to the acetylene in the distillate; the method used was as follows:—The material (0.5—0.6 gm.) was distilled with 30 c.c. of saturated lead nitrate solution and 80—100 c.c. of water (Feld), the distillate being collected in 25 c.c. of N/1 sodium hydroxide. The alkaline solution was treated with excess of ammoniacal silver solution. After about 10 minutes, the silver acetylide was filtered off; nitric acid was added, drop by drop, to the filtrate, which was stirred throughout this operation (any rise of temperature being avoided), until all the silver cyanide was precipitated and the solution was just acid. The precipitate was washed with cold water, dried at 100°—110° C., and weighed. It was found that in determining the cyanide

in the products obtained between 570° and 730° C., a yellow, nitrogen-free, highly explosive substance, only partially soluble in cold, concentrated nitric acid, was obtained on treating the alkaline solution with ammoniacal silver solution.—L. E.

Cuprous oxide; Electrolytic precipitation of —. D. Miller. *J. Physical Chem.*, 1909, **13**, 256–261.

By the electrolysis of hot solutions of sodium chloride between copper electrodes, precipitates consisting of cuprous oxide and hydroxide, in varying proportions, are obtained, the intense red forms being nearly pure cuprous oxide and the yellower varieties containing more of the hydroxide. The colour of the precipitate also depends on the size of its particles, the larger the particles, the darker being the colour. The larger particles are obtained at the higher temperatures and by slow precipitation; the same general rules of precipitation hold therefore whether a substance is precipitated chemically or electrolytically. Addition of glycerin to the electrolyte causes the cuprous oxide to be precipitated in the amorphous form, the colour varying from brownish-red to greenish-yellow.—F. Sodx.

Ferric nitrates at 25° C. F. K. Cameron and W. O. Robinson. *J. Physical Chem.*, 1909, **13**, 254–255.

Ferric nitrate solutions of various concentrations were shaken with freshly precipitated ferric hydroxide at 25° C. for 4 months, at the end of which time the clear solutions and the precipitates with adhering solution were analysed; the acid branch of the isotherm was also studied in like manner, starting with ferric nitrate and varying amounts of nitric acid. The results, examined in the light of the phase rule, show that there are no definite basic nitrates formed at this temperature, the so-called basic salts being solid solutions of ferric oxide, nitric acid, and water, but that, when the nitric acid is in excess (more than 30 per cent. of nitric anhydride), the normal nitrate, $\text{Fe}_2\text{O}_3 \cdot 3\text{N}_2\text{O}_5 \cdot 18\text{H}_2\text{O}$, is formed. On two occasions, with concentrations approaching 55 per cent. of nitric anhydride, crystals of an acid salt, $\text{Fe}_2\text{O}_3 \cdot 4\text{N}_2\text{O}_5 \cdot 18\text{H}_2\text{O}$, were obtained.—F. Sodx.

Titanium nitride. O. Ruff. *Ber.*, 1909, **42**, 900.

In preparing titanium nitride by Wöhler's method from titanium dioxide and ammonia, a temperature of at least 1000°–1100° C. is necessary, and it is preferable to work at 1400°–1500°. Even then, 4 to 6 hours are required before the conversion into nitride is complete. Pure titanium nitride cannot be completely decomposed by boiling with potassium hydroxide solution; the nitrogen is best determined by Dumas' method, the substance being burnt with cupric oxide in a porcelain tube at 1000° C. in a stream of carbon dioxide.—J. T. D.

Hydrogen and carbon monoxide; Pyrogenetic oxidation of — by contact action. G. Orlov. *Ber.*, 1909, **42**, 895–897.

HYDROGEN and air were passed in different proportions and at different speeds over platinum or copper, heated to the temperature at which combination begins, and then kept at that temperature by the heat evolved in the reaction. The initial concentrations of hydrogen and oxygen being called, c and c_1 , respectively, and that of the steam formed, c_2 , the experiments show that $c^2c_1/c_2 = 0.55$ approximately, whatever the speed of passage of the gases. In the case of carbon monoxide and air, the ratio of carbon dioxide to carbon monoxide in the issuing gases varies inversely as the cube of the speed of passage.—J. T. D.

Chlorine prepared from hydrochloric acid and potassium permanganate. Purity of —. E. Wedekind and S. J. Lewis. *Chem. Soc. Proc.*, 1909, **25**, 59.

CHLORINE, prepared from hydrochloric acid and potassium permanganate by Graebe's method (this *J.*, 1902, 284), is completely absorbed by mercury and gives the same value on titration as the gas obtained from hydrochloric acid and manganese dioxide; it is therefore considered to be free from other gases. The absence of traces of

the oxides of chlorine may be shown by acidifying the liquid remaining after titration with potassium iodide and thiosulphate, when no further liberation of iodine takes place, unless the permanganate contain chlorate.—F. Sodx.

Sulphur; Flames of phosphorescence and combustion of —. L. Bloch. *Compt. rend.*, 1909, **148**, 782–783.

It has previously been shown that phosphorescence, ionisation, and ozone-formation, accompany the oxidation of phosphorous anhydride to phosphoric anhydride, but not that of phosphorus to phosphorous anhydride (*Compt. rend.*, 1908, **147**, 842). The author has now found that ozone is formed during the phosphorescence of sulphur, and at a temperature at which this gas (ozone) is generally said to decompose (200°–250° C.). The production of ozone is much greater with sulphur than with phosphorus during phosphorescence. If the temperature is not too high, the gases leaving the tube containing the phosphorescent sulphur possess a strong odour of ozone but none of sulphur dioxide. At temperatures below that of phosphorescence, the gases possess a camphor-like odour. It was found that the phosphorescence is due, not to the combustion of a lower oxide of sulphur to sulphur dioxide, but to the combustion of sulphur vapour; the above-mentioned camphor-like odour appears to be due to sulphur vapour. The author confirms the statement of Elster and Geitel that the phosphorescence of sulphur is not accompanied by ionisation. At a temperature of about 360° C., phosphorescence gives place to the blue flame of burning sulphur; this flame does not produce ionisation, but does produce numerous centres of condensation. The oxidation of sulphur dioxide to sulphuric anhydride by atmospheric oxygen in presence of spongy platinum does not produce ionisation. The author concludes from this that with reference to ionisation, there is no analogy between the two degrees of oxidation of sulphur and of phosphorus. Seeing that the phosphorescence of phosphorus is accompanied by ionisation, whereas the flame of sulphur is perfectly non-conducting, it seems that the ionisation of ordinary flames is not due to high temperature, but to particular chemical actions.—L. E.

Manufacture of synthetic ammonia. Bronnert. *See XV.*

Determining alkali iodides. Rupp and Pfenning. *See XX.*

Mineral production of Germany, and Chemical industry of Norway. *See Trade Report.*

PATENTS.

Sulphur; Furnaces for the combustion of mineral —. G. Oddo, Pavia, Italy. *Eng. Pat.* 21,253, Oct. 8, 1908. *Under Int. Conv.*, Oct. 8, 1907.

Two furnaces are claimed. The first is a hand-operated furnace comprising five superposed storeys forming an upward zigzag path for the air and sulphur gases. The sulphur is fed into the central storey, the hearth of which contains a passage for the circulation of cold air, in order to prevent excessive rise of temperature and the decomposition of calcium carbonate with consequent loss of sulphur as calcium sulphide and sulphate. The residue is worked through the lower storeys of the furnace so as to heat the air, which is admitted to the lowest storey, in order that the sulphur gases may be hot enough for the regular working of the Glover tower. The other furnace is adapted for mechanical operation. The furnace is circular and comprises four storeys. The sulphur is fed automatically from a hopper by an external conduit to the second storey from the bottom, and is worked through the lowest storey by radial rotating arms mounted on a vertical spindle. (See also this *J.*, 1908, 222.)—A. T. L.

Copper sulphate; Manufacture of —. D. Watson, T. Ashall, and The United Alkali Co., Ltd., Liverpool. *Eng. Pat.* 12,812, June 15, 1908.

By causing sulphuric acid to run at intervals over divided copper, or copper shot, carried upon an inclined bed heated

from beneath by steam, the production of copper sulphate solution is rapidly effected, and the process can be carried out with a much smaller stock of copper, said to be one-sixth of that required in the ordinary tower process.—H. H. S.

Aluminates; Manufacture of alkaline ——. D. A. Peniakoff, Selzaetes, Belgium. Eng. Pat. 14,707, July 10, 1908. Under Int. Conv., Jan. 29, 1908.

IN manufacturing sodium aluminate by the calcination of bauxite, sodium sulphate, and carbon or sulphides, the sulphurous acid evolved is so diluted with air and fire-gases that it is difficult to utilise for the recovery of sodium sulphate or the manufacture of sulphuric acid. The patentee finds that the greater the mass under treatment, the more continuous the operation of calcining, the more the masses are kept in motion during calcination, and the more completely that combustion is effected in contact with the mass, the less will be the quantity of fuel necessary and the more sulphurous acid will be in the resulting gases. He achieves these conditions by a furnace comprising a long revolving tube which is heated by burning powdered coal or gas or oil therein.—H. H. S.

Aluminium oxide; Process for the electrolytic production of ——. F. W. Morris, Victoria, B.C., Canada. Eng. Pat. 6449, March 23, 1908.

SEE U.S. Pat. 890,084 of 1908; this J., 1908, 750.—T. F. B.

Iodine; Process of extracting ——. E. Herrmann, Assignor to Cie. Internat. La Norgine, Paris. U.S. Pat. 915,959, March 23, 1909.

SEE Fr. Pat. 361,499 of 1905; this J., 1906, 884.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Glasses and minerals; Action of oxidising and reducing gases on the colour of ——. W. Hermann. Z. anorg. Chem., 1908, 60, 369—404. Sprechsaal, 1909, 42, 172—173.

A NUMBER of coloured glasses were prepared by dissolving small quantities of metallic oxides in borax or in sodium-potassium silicate. Copper oxide gave two blue glasses, a light blue and a darker blue. Manganic oxide gave brown to red-violet colours. Cobalt oxide gave a blue borax glass with a tinge of red, but pure blue silicate glasses. Potassium bichromate gave a grass-green, ferrous oxide a grey-green, and ferric oxide a yellow glass. A mixture of ferrous and ferric oxide with very little manganic oxide gave a fine sky-blue colour on heating for some time in a Bunsen flame. Uranium oxide (1.5—2 per cent. of U_2O_3) gave a pure yellow borax glass, and a greenish-grey silicate glass. Cerium oxide gave a yellowish glass, titanium oxide a light yellow. Titanium oxide also gave an amethyst-violet colour to microcosmic salt, probably due to titanium nitride; the same colour was obtained on adding titanium oxide and ammonium chloride to a borax bead. The above glasses and a number of minerals were heated to dull redness in currents of air, oxygen, coal-gas, sulphur vapour, hydrogen, nitrogen, ammonium chloride vapour, and ammonia. The glasses suffered no change in colour on heating in air. Heating in oxygen rendered the ferrous oxide glasses darker and nearly black; the presence of both ferrous and ferric oxide was shown microscopically; the ferric oxide and uranium oxide glasses became paler, the cerium oxide glasses darker; the titanium oxide glass was decolorised with separation of grey particles at the edges. Heating in coal-gas rendered all the iron oxide glasses black, and manganic and chromium oxide glasses lighter in colour. Heated in sulphur vapour, the iron oxide glasses became black, and the chromium oxide glasses yellow-grey-green. Heated in hydrogen, the ferric oxide and cerium oxide glasses became darker, the ferrous oxide glass black, the manganic oxide glass received a dark red tint, and the uranium oxide glass became paler. Heating in nitrogen and ammonium chloride produced practically no change; heated in ammonia, the ferrous oxide glass became paler,

and the chromium oxide glass nearly decolorised. As regards the minerals, heating in air rendered the green zirconos light grey, with rust-red spots; the brown zirconos and hyacinths became paler or colourless, or remained unchanged. Grey quartz, "citrin," and amethyst became colourless. Yellow corundum became darker on heating, but regained its colour on cooling. Dark yellow topaz was decolorised on heating, but became rose-red to red-violet after cooling. Blue and violet Stassfurt rocksalt became colourless, dark violet and blue-green fluorspar showed green fluorescence on heating, and became colourless at a low red heat. Nearly the same results were obtained on heating the minerals in oxygen. Heated in coal-gas, the green zirconos, pyropes (Bohemian garnet), and almandin (red garnet) became darker; the yellow hyacinths paler or reddish-violet; amethyst, citrin and grey quartz, colourless; Zillerthal garnet, dark brown; beryll, grey; emerald, paler; epidote, light green; rocksalt and fluorspar behaved as in air. Heating the minerals in sulphur vapour, hydrogen, nitrogen, ammonium chloride vapour, and ammonia gave nearly the same results as heating in coal-gas. From the above results the author forms conclusions as to the impurities which determine the colours of the minerals. Thus the colour of the green zirconos is probably due to ferrous oxide and chromium; the presence of chromium has also been shown spectroscopically. The two oxides of iron also cause the colours of corundum, spinell, epidote, and beryll, and probably of quartz, tourmaline, and topaz. Chromium and manganese oxides influence the colours of zircon, corundum, garnet, tourmaline, and probably quartz and topaz. The rare elements, uranium, cerium, etc., only affect the colours of minerals to a slight extent. Organic substances, e.g., hydrocarbons, constitute the colouring matter of some minerals.—A. G. L.

PATENTS.

Glass; Method of and apparatus for drawing ——. O. Imray, London. From Window Glass Machine Co., Pittsburg, Pa., U.S.A. Eng. Pat. 23,968, Nov. 9, 1908.

IT is found that, by adjusting the pot and drawing tool relatively to each other in a lateral direction, so that the draw can be started from any particular point on the surface of the molten glass, a more uniform thickness in the cross-section of the article can be obtained. In this way irregularities, arising from differences in the surface tension of the glass at various distances from the sides of the pot, can be overcome. Thus if the glass be at a lower temperature at one side of the bath than at the opposite side, the blowpipe is moved towards the hotter portion. In the arrangement provided, the blowpipe with the bait is arranged on a support which is itself capable of moving horizontally on a square travelling frame by means of arms fitting into threaded sleeves in the latter. By means of a cable attachment a vertical movement can be imparted to the whole frame. It is also provided that the pot itself can be adjusted in position if necessary, and, to that end, it is mounted on bearings which, by means of screws, can be moved in any direction. Finally it is claimed that the invention extends to any other method of controlling the surface tension of the glass such as adjustment of the level of the fused mass in the pot.—C. A. W.

Sheet glass; Apparatus for the manufacture of ——. F. M. Oppermann, Namur, Belgium. U.S. Pat. 915,879, March 23, 1909.
SEE Fr. Pat. 369,986 of 1906; this J., 1907, 203.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Iron concrete; The cause of the disappearance of rust in ——. Rohland. Tonind. Zeit., 1909, 33, 382—383.

SOME time ago the author called attention to the disappearance of rust in iron concrete, and suggested that it might be due to the action on the ferric oxide of the calcium hydroxide, set free during the mixing of the

concrete, but by itself the hydroxide does not act upon the ferric oxide. Besides calcium hydroxide, colloidal aluminium hydroxide and silica have to be considered, but the latter has no solvent action upon ferric oxide, which is also unattacked by calcium and aluminium hydroxides. Any carbonic acid derived from the air would only dissolve ferrous oxide, but not ferric oxide. The author has found, however, that ferric oxide is acted upon by basic carbonates, solutions of which contain the HCO_3 -ion, and still more energetically by acid sulphates, solutions of which contain the HSO_4 -ion. Gypsum, a solution of which contains the SO_4 -ion, does not act upon ferric oxide. Iron can be detected in solution, when ferric oxide has been in contact for a few hours with an aqueous solution of carbonic acid to which some normal sodium or potassium sulphate has been added. In the same way ferric oxide is acted upon by a solution of calcium hydroxide, to which an aqueous solution of carbonic acid has been added, in sufficient quantity to redissolve the carbonate first formed. The disappearance of rust in iron concrete can be thus explained, and the necessary conditions occur in the setting and hardening of cement. During the mixing, setting, and early stages of hardening of cement, atmospheric carbon dioxide is absorbed by the water used for mixing, and then adsorbed by the colloidal silica and aluminio-ferric hydroxide set free. At the same time lime is set free and gives rise to an acid carbonate or to the HCO_3 -ion, and as all Portland cements contain gypsum and some alkali sulphate, presumably HSO_4 -ions are also formed. The iron oxide is slowly dissolved by these reagents. The rate of reaction is slow, because the ions have to be formed from a gas and a liquid, carbon dioxide and water, and have then to react with a solid, ferric oxide. Even after 24 hours' contact with a slow-setting cement, the rust on some badly corroded rods became thinner, and some parts were cleared. The same rods were placed in a new cement, and when withdrawn, it was found that the loosely adherent ferric oxide had decreased, and beneath it was a thin black coating of magnetic oxide. After several days' contact with new cement, the whole of the rod was freed from rust, except between the points of contact of the iron and cement, where oxygen had access. Hence the reaction between the acid calcium carbonate, or the HCO_3 -ion, and the ferric oxide occurs during the mixing with water, the setting and the early stages of hardening. Of the base metals, iron alone can form a non-corrosive union with cement, because it remains unoxidised in contact with alkaline liquids, whereas the other base metals are oxidised, and a strong alkaline reaction is developed in cement on mixing. Clean iron consequently is protected from oxidation by cement, and any rust present diminishes in time, and in this way iron concrete is entirely protected.—W. C. H.

PATENTS.

Cement. T. Jones, Acme, Tex., Assignor to Acme Cement Plaster Co., Illinois. U.S. Pat. 916,165, Mar. 23, 1909.

The cement is prepared by calcining a mixture of gypsum and normal aluminium sulphate at a red heat, and then mixing it with the product (in the form of a dry powder) obtained by the action of sulphuric acid on potassium bisilicate dissolved in water. The final composition of the cement is: Calcium sulphate, 1020 lb.; basic aluminium sulphate, 30; dry gelatinous silica, 14; and potassium sulphate, 11 lb.—A. G. L.

Wood; Impregnation of — J. Polifka and B. Hacker, Budapest, Hungary. Eng. Pat. 15,556, July 22, 1908.

SEE FR. Pat. 392,554 of 1908; this J., 1908, 1205.—T. F. B.

X.—METALS AND METALLURGY.

Cast iron; The air-furnace process of preparing white cast iron for the production of malleable — H. M. Howe and E. Touceda. Bull. Amer. Inst. Min. Eng., 1909, 317—326.

The removal of metalloids from the iron, and the alteration of the composition of the slag at various stages of the

process are shown both by tables and graphically. The curves obtained are discussed with special reference, in the case of the metal, to the constancy of the silicon-content (0.89 per cent. after 2½ hours to 0.87 per cent. after 5½ hours). It is pointed out that the low temperature should have favoured the removal of silicon, and that the acidity of the slag was not great enough to explain its slow removal. The authors consider that this constancy of the silicon content is due mainly to the low percentage of silicon in relation to that of carbon. In support of this view a large number of data from the open-hearth process are given, showing that in all cases where the removal of silicon between two successive samples was very small, the silicon-content was also very small, either absolutely or relatively to the carbon content. The details of the process are given in an appendix.—A. H. C.

Grading assays and grinding efficiencies. A. Yates. J. Chem. Met. and Min. Soc. S. Africa, Dec. 19, 1908. [Advance proof.]

The paper deals with the value of grading assays in connection with estimating the crushing efficiency and relative merits of machines, in addition to their use in checking extraction results in the cyaniding of gold ores. The crushed material is graded by passing it through a series of sieves of known aperture, and the "efficiency number," representing the relative surface exposed, is obtained by dividing the weight of each product by the average diameter of the particles. The "efficiency number" for the whole crushing is the sum of the efficiency numbers of the products. In order to make the figures more readily comparable in cases where the power and tonnage vary, the relative efficiency is calculated by multiplying the grading efficiency by the tonnage and dividing by the horse power. A number of tables are given showing the relative efficiencies of stamp batteries with and without tube mills in conjunction, and also the effect of varying the aperture of the battery screens. A number of tables showing the practical use of grading assays are also included.—F. R.

Copper ores; Basic converter process for — F. Schreyer. Metallurgie, 1909, 6, 190—197.

ATTEMPTS have been made during the last few years to use converters with basic linings for copper ores, the silica necessary to slag the ferrous oxide being added in the form of sand. The advantage claimed for the process consists in greater rapidity of working, but the higher temperature necessary to render the basic slag produced sufficiently liquid necessitates the use of air enriched in oxygen, or at least of air under high pressure. Even so, the loss in copper, due to mechanical inclusion of copper sulphide in the viscous slag, is considerable. The author determined the melting-points of solutions of ferrous sulphide in mixtures of ferrous and ferric oxides, the mixtures containing about 5 per cent. of sulphur; such mixtures are more easily fusible than the oxides alone, but their melting-points still lie above 1300° C. Moreover, in practice it would be difficult to obtain such slags with a constant percentage of sulphur. When working with air considerably enriched in oxygen, the iron of the ore is oxidised to a state approximating to magnetic oxide; with lower percentages of oxygen in the air used, the iron oxide formed approximates to the formula, $\text{FeO} + \text{Fe}_3\text{O}_4$ (possibly Fe_4O_5); below this stage of oxidation the iron oxide has little action on the undecomposed sulphides of the ore. Probably the basic converter process will be useful only to obtain a regulus from poorer ores, not for the smelting to metallic copper.—A. G. L.

Corroded metals. W. P. Jorissen. Chem. Weekblad, 1909, 6, 150—153. Chem. Zentr., 1909, 1, 1050—1051.

A SAMPLE of "Delta metal" which had been exposed for a long time to the action of sea-water, was found to contain 52.7 per cent. of copper, 41.1 of cuprous oxide, 1.4 of water, 2 of substances insoluble in nitric acid, and 2.8 per cent. of other substances soluble in nitric acid, consisting of compounds of lead, iron, and zinc, and residual salts from the sea-water. The action of the

sea-water had thus resulted in the practically complete removal of zinc from the original alloy, which consisted of 45—55 per cent. of copper and 40—45 of zinc, together with small proportions of lead, iron, and manganese. Copper immersed for two years in sea-water became coated with cuprous oxide. In a piece of iron which had lain in the soil for several years, there was a distinct difference between the outer and inner layers of the metal. The former (sp. gr. 2.11), on treatment with hydrochloric acid, left a residue of 45.4 per cent., of which 19.6 per cent. was dissolved on treatment with chromic anhydride and sulphuric acid, whilst for the inner layer (sp. gr. 2.53) the corresponding figures were 35.1 and 16.1 per cent. respectively.—A. S.

Mercury imports, exports, and prices. A. S. Pickering, London, April, 1909. [T.R.]

	1906.	1907.	1908.	1909.
IMPORTS.				
March .....bottles	5586	5252	752	6464
January—March .. „	5691	15,880	11,706	11,919
EXPORTS.				
March .....bottles	789	2665	1291	1312
January—March .. „	8376	10,230	7637	3602
AVERAGE PRICE.				
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
March	7 5 6	6 17 0	8 2 6	8 5 0

Mineral production of Germany in 1908, and Chemical industry of Norway. See Trade Report.

Analysis of nickel coins. Van Heteren and Van der Waerden. See X.

PATENTS.

Furnaces for volatile metals. W. Hommel and The Metals Extraction Corporation, Ltd., London. Eng. Pat. 27,018, Dec. 6, 1907.

THE furnace consists of a chamber divided by a horizontal partition of refractory material, extending nearly the whole length. Ore is fed into the front part of the upper chamber, and means are provided for shifting it along to the back where it falls into the lower chamber and is shifted to the front, into a rectangular blowing hearth, fitted with a grate, and rotatable on a horizontal axis. The ore is preheated on its way to the blowing hearth, by the gases passing to the flues. When the hearth has been freshly charged, a suitable quantity of coal is added, and air blown through the grate into the furnace chamber. At first highly carbonaceous gases are given off which are allowed to escape to the stack, but when the zinc or other metals are volatilised and burnt to oxide, the flue leading to the stack is closed and that leading to the condensing chamber opened. The blowing hearth is discharged by partly rotating it on its axis.—F. R.

Zinc; Extraction of — from ores and zinc residues. W. Hommel and The Metal Extraction Corporation, Ltd., London. Eng. Pat. 27,020, Dec. 6, 1907.

ZINC ore, preferably roasted, is mixed with a certain proportion of zinc works residues, which contain a large proportion of coke or carbonaceous matter with varying amounts of zinc, lead, etc., and ignited in a furnace or blowing hearth, the zinc being blown off as oxide. The impure oxide is treated with sulphurous acid to form zinc bisulphite, from which the zinc is precipitated as mono-sulphite and then calcined to zinc oxide. The patent is a modification in detail of Eng. Pat. 23,901 of 1907 (this J., 1909, 26).—F. R.

Gold; Extraction of — from its ores, and apparatus therefor. A. M. G. Schillot and L. Maclaure, Paris. Eng. Pat. 5841, Mar. 16, 1908.

THE ore is reduced at the outset to the condition of slimes which will pass through a screen having a mesh of some

thousandths of a millimetre. It is stated that the portion of the metal which remains behind in the mortars and accumulates can afterwards be removed in the metallic state without the use of mercury. The cyaniding apparatus for the slimes comprises an inclined channel of semi-circular cross-section which diminishes in radius from one end to the other. This channel is divided into compartments by partitions, these last being arranged to support a horizontal shaft which runs along the whole length and carries the stirrer arms. The latter are of special design, being fitted at the ends with wooden spoons so that, in the revolution of the shaft, bubbles of air are imprisoned and forced down into the body of the solution. The slimes, introduced near the top of the channel, pass down the slope through the compartments, meeting on the way the cyanide solution as the latter is forced upwards. The exhausted ore is finally collected in boxes at the bottom, whilst the solution of gold passes away over the inclined plane at the top.—C. A. W.

Precious-metal bearing material; Process of treating —. S. S. Sørensen and G. C. Westby, Murray, Utah. U.S. Pat. 914,680, March 9, 1909.

THE precious metals contained in solutions, obtained in the treatment of copper ores in the wet way, are precipitated by bringing the solution into contact with crushed iron or copper mattes.—F. R.

Furnaces for metallurgical purposes. P. Schmelzer, Metz. Germany. Eng. Pat. 18,523, Sept. 3, 1908. Under Int. Conv., Nov. 4, 1907.

THE invention consists in providing auxiliary means of heating furnaces by building into the walls, preferably below the level of the molten bath, composite plates connected to a source of electricity. The plates are composed of an ordinary conductor faced with a refractory material, not attacked by the charge in the furnace, and which is a conductor of electricity at high temperatures. The refractory facings to the plates become highly heated owing to their electrical resistance, which, together with the heat caused by the passage of the current through the bath, augments the temperature produced by the principal source of heat. It is suggested that this principle might also be advantageously adapted to Bessemer converters.—F. R.

Furnace; Ore-smelting —. J. T. Jones, Iron Mountain, Mich., Assignor to Jones Step-Process Co., Minnesota. Re-issue, No. 12,928, March 16, 1909, of U.S. Pat. 890,232, June 9, 1908.

THE furnace consists of a combination of a carbonaceous fuel burning furnace and an adjoining chamber having an ore stack of smaller cross-sectional dimensions, rising out of its roof, and through which ore is charged into the chamber. A flue the walls of which are formed of solid carbonaceous material, leads from about the middle of the fuel furnace to a point in the ore chamber near to its junction with the ore stack.—F. R.

Ore-smelter. E. A. Mathers, Assignor to D. H. Harner, Philadelphia, Pa. U.S. Pat. 916,176, Mar. 23, 1909.

A FURNACE is arranged with a rotary roaster above it and a rotary smelter alongside the furnace. The smelter is provided with a stationary part, close to which both roaster and furnace discharge their products. The roaster is cone-shaped, with the long axis horizontal, the small end receiving the ore, and the large end discharging into a conduit leading to the smelter.—A. G. L.

Ore; Process of roasting and sintering —. A. S. Dwight, Assignor to F. Bennitt, Joliet, Ill. U.S. Pats. 916,396 and 916,397, Mar. 23, 1909.

ORE containing combustible material is roasted and sintered by causing it to move continuously in a layer in a horizontal direction. The ore is supported both at top and bottom by endless bands of perforated material. The ore is ignited at a point near the entry end, the combustion being supported by air entering through the lower supporting band and escaping through the upper. The supporting bands may also carry relatively large

fragments of rock or ore, which help to retain the finely-divided ore. In this case the large particles on the lower band are caused to agglomerate with the sintered product.—A. G. L.

Iron, soft steel, cast steel, and the like: Cementation of —. E. Jourard, St. Ouen, France. Eng. Pat. 23,958, Nov. 9, 1908.

THE pieces or articles to be hardened are placed in the casing ordinarily used for cementation and bedded in an intimate mixture of potassium ferrocyanide, 25; potassium bichromate, 10; ammonium chlorate, 5; chimney soot, 30; and horn powder, 30 per cent.; and maintained at a constant temperature of about 850° C. for the necessary amount of time. A file, with a layer of 5 mm. of the mixture, will be hardened to a depth of 1 mm. for each hour it is heated.—F. R.

Steel [vanadium alloy]. H. D. Booth, Assignor to The Midvale Steel Co., Philadelphia, Pa. U.S. Pat. 914,633, March 9, 1909.

THE steel contains 0.5–1.5 per cent. of copper and 0.1–0.6 per cent. of vanadium.—A. G. L.

Ores; Treatment of [finely divided] —. A. L. Dean, Queenstown, Tasmania, Assignor to The Mount Lyell Mining and Railway Co., Ltd., Melbourne, Australia. U.S. Pat. 914,391, Mar. 9, 1909.

FINELY divided sulphide or arsenide ores are screened and mixed. A portion of the ore is then charged on to a bed of previously ignited carbonaceous fuel. When this portion of the ore has become thoroughly ignited, the remainder is added, and the combustion continued "until the fire has penetrated the mass uniformly," the resulting mass being then removed from the furnace, and broken up into sizes suitable for further treatment in a blast-furnace.—A. G. L.

Wire and metal cleaning bath. J. C. Bencker, Pueblo, Colo. U.S. Pat. 914,916, March 9, 1909.

THE claim is for the use of an acid "pickling" bath containing arsenious oxide, with the result that iron and steel articles cleaned therein are coated with a protective film of metallic arsenic.—F. R.

Refining; Process of —. F. von Kugelgen and G. O. Seward, Holcombs Rock, Va., Assignors to Tin Products Co., New York. U.S. Pat. 915,029, Mar. 9, 1909.

TIN scrap is treated in a closed vessel with dry chlorine so as to form stannic chloride. By controlling the admission of chlorine and by cooling the vessel, the temperature is kept so low that the iron is not attacked and the volatilised stannic chloride is condensed within the vessel, the liquid formed being finally drained from the residue of iron scrap.—A. G. L.

Aluminium and aluminium alloys; Process of, and mould for, making castings of —. E. Blough, Parnassus, Pa., Assignor to Aluminium Co. of America, Pittsburgh, Pa. U.S. Pats. 915,727 and 915,728, Mar. 23, 1909.

TO increase the heat conductivity of the mould, the latter is made from ordinary foundry sand mixed with about 15 per cent. of finely-ground and dense carbonaceous material, which must be difficultly oxidisable and substantially non-volatile at the temperature attained, and which must not destroy the binding properties of the sand.—A. G. L.

Ores; Method of and apparatus for treating —. J. T. Jones, Iron Mountain, Mich., U.S.A. Eng. Pat. 5515, March 11, 1908. Under Int. Conv., May 22, 1907.

SEE U.S. Pat. 880,799 of 1908; this J., 1908, 339.—T. F. B.

Tin; Process and apparatus for the recovery of metallic — from wash-tinned metal, mixtures and alloys of tin and lead, and similar waste. A. Nodon, Bordeaux, France. Eng. Pat. 7584, April 6, 1908. Under Int. Conv., April 11, 1907.

SEE Fr. Pat. 386,499 of 1907; this J., 1908, 692.—T. F. B.

Copper mattes; Treatment of —. J. T. Carriek, Johannesburg, Transvaal, and B. S. Pattison, Johannesburg. Eng. Pat. 12,750, June 13, 1908.

SEE Fr. Pat. 394,133 of 1908; this J., 1909, 236.—F. R.

Alloys of silicon; Manufacture of —. H. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 915,172, March 16, 1909.

SEE Ger. Pat. 201,567 of 1907; this J., 1909, 97.—T. F. B.

Smelting furnace. A. Koch, Hanover-List, Germany. U.S. Pat. 915,192, March 16, 1909.

SEE Addition of June 12, 1907, to Fr. Pat. 367,470 of 1906; this J., 1907, 1283.—T. F. B.

Gold, platinum, silver, nickel, copper, etc.; Process of extracting —. A. Seigle, Lyon, France. U.S. Pat. 915,705, March 16, 1909.

SEE Fr. Pat. 363,039 of 1906; this J., 1906, 816.—T. F. B.

Metals, such as steel or steel alloys; Method of treating —. C. J. Grist, London. U.S. Pat. 916,302, March 23, 1909.

SEE Eng. Pat. 1259 of 1907; this J., 1908, 231.—T. F. B.

Ores; Apparatus for roasting, sintering, and desulphurising —. A. S. Dwight, Joliet, Ill., and R. L. Lloyd, Cananea, Mexico, Assignors to F. Bennett, Joliet. U.S. Pats. 916,391 to 916,394, March 23, 1909.

SEE Eng. Pat. 25,985 of 1907; this J., 1908, 1024.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(I.)—ELECTRO-CHEMISTRY.

Storage batteries; Red lead for —. H. C. Frey. Electrical World, 1909, 53, 274.

RED-lead made by the old process (from metallic lead, in oxidising furnaces) is crystalline, dense, and liable to contain as much as 40 per cent. of litharge. The nitrite process yields an amorphous, and less dense red oxide, containing generally less than 10 per cent. of litharge. For accumulator electrodes the presence of 10 per cent. of litharge appears to be advantageous.

Electrolytic precipitation of cuprous oxide. Müller. See VII.

PATENTS.

Furnace; Electric —. S. F. Hall, Niagara Falls, N.Y., Assignor to Norton Company, Worcester, Mass. U.S. Pat. 914,489, March 9, 1909.

THE furnace consists of a furnace chamber, separable from the hearth, and containing spaced electrodes of opposite polarity hanging vertically and parallel to one another. The electrodes are separated by interior double walls, forming an open well, in order to obtain a more uniform temperature in the furnace.—F. R.

Electrolytic apparatus. O. Meyer, Richmond, Va. U.S. Pat. 914,856, March 9, 1909.

IN an electrolytic cell consisting of an upright cylinder closed at its extremities with caps, one electrode is wound round the exterior of a porous cylindrical vessel which stands within the cylinder, the top projecting through the upper cap. The other electrode consists of a tube passing downwards through the porous vessel nearly to its bottom, and which also serves to convey the electrolyte from a suitable container to the cell. Discharge outlets, to permit the escape of the products of electrolysis, are provided in the porous vessel and the outer cylinder.—F. R.

Electric accumulators; Process for regenerating —. C. Luckow, Cologne, Germany. U.S. Pat. 915,989, March 23, 1909.

SEE Eng. Pat. 11,353 of 1905; this J., 1905, 1072.—T. F. B.

Electric conductors. Eng. Pat. 17,620. See II.

(B.)—ELECTRO-METALLURGY.

Furnace; New electrical hardening —. E. Sabersky and E. Adler. Trans. Faraday Soc., March 30, 1909. [Advance proof.]

THE furnace consists essentially of a fire-clay crucible, in which a bath of molten salt, or salts, is heated by means of an alternating electric current, transmitted to the bath by two iron electrodes, the articles to be hardened being immersed in the bath. The salts being conductors of the second class (i.e., only conductors of electricity at high temperatures), when once the current has been started, the entire bath forms a conductor of decreasing resistance as the temperature rises, the latter being easily controlled by varying the voltage. The composition of the bath is varied according to the temperature required, a mixture of sodium and potassium nitrates being used for temperatures between 200° and 580° C., sodium and potassium chlorides from 650°–900° C., potassium and barium chlorides from 750°–1100° C., barium chloride from 1050°–1350° C., and calcium or magnesium fluorides from 1500°–1600° C. The uniformity of temperature throughout the bath, renders the indications of the pyrometer more reliable than when it is used on furnaces having an outside source of heat, and definite temperatures may more certainly be obtained and retained. This is of great importance in the case of modern high-speed tool steel, which may easily be spoilt by relatively small overheating. Another advantage of the furnace is, that although the thin edges of articles and portions having small cross-sections are heated more rapidly, the temperature of the bath prevents their overheating while the mass of the article is attaining the necessary temperature. The crucible is surrounded by asbestos and insulated, the whole being contained in a cast-iron case. Radiation losses are so small that the outer case only registers 30°–40° C. after the furnace has been working at 1350° C. for ten hours. The authors claim that, though the working costs are somewhat higher per hour than the ordinary gas-fired furnaces, the cost of treatment is considerably less on account of the increased output.—F. R.

Copper, lead, and silver; Effect of the presence of certain "addition-agents" upon the density and the coherence of electrolytically deposited —. R. P. Jarvis and E. F. Kern. School of Mines Quarterly, 1909, 30, 100–129.

THE well-known fact that the addition, to certain electrolytes, of small quantities of such substances as gelatin, tannin, etc., increases the density and coherence of the metallic deposit has been investigated by the authors. The electrolytes experimented with were cupric sulphate, cuprous chloride and cupric fluosilicate, lead nitrate and lead fluosilicate, and silver nitrate and silver fluosilicate. The electrodes used consisted of plates of the pure metal in each case, and the "addition-agents" employed were gelatin, resorcinol, pyrogallol, and tannin. It was found that the smoother and more coherent deposits tend to form when low current-densities are employed; that rise in temperature up to 60° C. tends to produce dense and coherent deposits; and that the deposits of lead, silver and copper formed in the fluosilicate electrolytes are more coherent than those produced in the nitrate electrolytes of lead and silver, or in the sulphate or chloride electrolytes of copper. The effect of the "addition-agents" was found to be as follows:—*Lead*.—In the nitrate electrolyte (nearly neutral) crystallisation of the deposited metal was restrained when an "addition-agent" was present to the extent of 1 part in 250 by weight, tannin having the greatest effect; but with this electrolyte the deposits obtained were in all cases unsatis-

factory. In the fluosilicate electrolytes, the presence of an "addition-agent" to the extent of 1 in 5000 caused the lead to deposit as a smooth, dense, coherent mass. Resorcinol was found to be unsuitable, while of the remaining "addition-agents" gelatin was the most, and pyrogallol the least, effective. *Copper*.—With sulphate electrolytes, pyrogallol was found to be unsuitable, causing the deposited copper to be dark in colour. In the presence of tannin, resorcinol, or gelatin a smooth, bright deposit was produced, tannin and gelatin being respectively the most and least effective. In the fluosilicate electrolyte, tannin, pyrogallol and gelatin improved the smoothness and brightness of the deposit, tannin giving the best result. The deposit of copper from the cuprous chloride electrolyte was not improved by the presence of any of the "addition-agents" or by elevation of temperature. *Silver*.—Gelatin, to the extent of 1 part in 10,000 or 14,000, produced shorter and smaller crystals in the metallic deposit, which was consequently more dense and coherent. Pyrogallol, tannin, and resorcinol were found to be unsuitable. 40° C. was found to be the most suitable temperature for the deposition of silver.

—W. E. F. P.

PATENTS.

[*Tin-plating iron.*] *Electrolytic process.* H. L. Hollis, Chicago, Ill. U.S. Pat. 916,155, Mar. 23, 1909.

AN electrolyte is first prepared, by passing a current from a tin anode through a solution of hydrofluosilicic acid in water to a suitable cathode, until the solution has become sufficiently rich in tin. The iron sheets to be tin-plated are then immersed in the solution as cathodes, and the passage of the current continued. A colloid may be added to the solution.—A. G. L.

[*Electric furnace for the treatment of metals.* W. Schemmann and J. Bronn, Rombach, Germany. U.S. Pat. 915,488, March 16, 1909.

SEE Eng. Pat. 25,400 of 1907; this J., 1908, 944.—T. F. B.

Electro-deposition of metal on hollow articles. E. Friedheim, Paris. U.S. Pat. 915,846, March 23, 1909.

SEE Fr. Pat. 364,737 of 1906; this J., 1906, 994.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Irvingia butter. E. Bontoux. *Matières Grasses*, 1908, 1276–1278.

THIS vegetable "butter" or fat comes from the kernels of two Indo-Chinese trees of the family *Rutaceæ* or *Irvingiæ*; especially the *Irvingia Oliveri* (*I. Harmandiana*); and in Cambodia, the *I. malayana Oliv.* A tree of the same family growing on the west coast of Africa produces dika butter. The *Irvingia* flower in April; the fruit matures in July or August and is an oval drupe with fibrous mesocarp and woody endocarp; the size is that of a lemon, but the ripe fruit after losing its outer skin is a large almond-size. The pulp prepared from the kernels is twice extracted with steam and pressed. The fatty matter is allowed to cool, if intended for candles, in bamboo tubes provided with wicks. The press-cake is used for fodder, fertiliser or fuel. Five kilos. of nuts yield 1 kilo. of kernels and 430 grms. of the fat. Vignoli erroneously stated that this fat contained 30.2 per cent. of oleic acid and 68.5 per cent. of solid fatty acids including stearic acid. Hecker considered the fatty acids to consist of 30 per cent. of myristic and 70 per cent. of lauric acid. The author examined two samples of the butter made in Cochin China (II. and III.) and one prepared by himself in the laboratory from the fruit (I.). Sample I. was whitish, acid value 0.86; sample II. cream colour, acid value 23.5; sample III., pink, acid value 34.9. The acidity is not excessive, considering the age

of the samples, indicating good keeping qualities. Other characteristics are as follows:—

	Sample I.	Sample II.	Sample III.
Fat.			
Sp. gr. at 40°/10° C.	0.9133	0.9128	0.9130
Freezing point.....	31°	31.2°	31.8°
Melting point (capillary)	39.7	38.2	38.4
Unsaponifiable matter	0.42%	0.16%	0.19%
Saponification value...	235.3	236.3	237.4
Iodine value.....	6.7—6.8	4.1—4.2	4.0—5.1
Reichert-Meissl value.	0.62	0.75	0.70
Fatty Acids.			
Insoluble unsaponifi-			
able acids.....	91%	93.4%	93.2%
Titer value.....	39.6	—	36.4
Melting point.....	38.8	—	39
Neutralisation value...	250.2	—	253.0
Mean molecular weight	224	—	222

The methyl esters of the fatty acids were prepared and isolated by fractional distillation according to Haller's method; from the results of this test the composition of the butter is given as 5 per cent. of olein, 30—35 of laurin and 60—65 of myristin; it is thus similar to dika butter. The production is small at present, for though the butter makes excellent candles and white soap and is suitable for chocolate making or as edible vegetable butter, the great bulk of the fruit makes it difficult to handle.

Soaps: Detergent action of — W. Spring. Z. Chem. u. Ind. Kolloide, 1909, 4, 161—168.

From the results of experiments with purified lampblack and soap solutions the author concludes that carbon (lampblack) promotes the decomposition of fresh soap solutions in water. An acid salt (soap) is produced and the carbon combines with this to form an adsorption compound. When a soap solution is subjected to the action of an electric current, the soap is slowly decomposed, and particles of acid soap gather about the anode, whilst lampblack suspended in water travels towards the cathode. The constituents of the carbon-soap compound have thus a different electrical polarity in water. Lampblack, in the dry state or suspended in water, forms a more or less stable adsorption compound with solid substances and especially with cellulose. The colloidal combination between the carbon and cellulose is not decomposed by pure water. Thus, when an aqueous suspension of lampblack is filtered, the water passes through clear, and then, on reversing the filter-paper so that the lampblack is outside it is not possible to remove this lampblack from the paper by washing with water. On the other hand, lampblack suspended in aqueous soap solutions passes through filter-paper without blackening the paper. In the author's opinion, based on these and similar observations, the detergent action of soap must be attributed to a process of substitution due to the soap having a greater affinity for the dirt (lampblack) than the latter has for solid substances (e.g. cellulose). Thus, in the case mentioned, the adsorption-compound of the lampblack and cellulose (filter-paper) would be decomposed, the soap uniting with the lampblack.—C. A. M.

PATENTS.

Oil: Apparatus for extracting — V. J. Lauerman, Mineral Wells, Texas, U.S.A. Eng. Pat. 16,612, Aug. 7, 1908. Under Int. Conv., Aug. 7, 1907.

CLAIM is made for an apparatus consisting of a cylinder surrounded by a steam jacket and containing a rotatable shaft carrying spikes and blades, the latter parallel to its axis. Between these movable blades and the shaft are fixed blades against which the oil-seed is thrown and thence projected against the spikes. The material is thus thoroughly mixed and uniformly heated during its passage through the cylinder.—C. A. M.

Oil seeds: Process and apparatus for pressing — A. Austerlitz, Győr, Hungary. Eng. Pat. 7224, April 1, 1908. Addition to Eng. Pat. 10,860, May 9, 1907.

SEE Addition of April 1, 1908, to Fr. Pat. 381,350 of 1907; this J., 1908, 1120.—T. F. B.

Fatty substances: Process for extracting — from fresh (unbroken) oil fruits, moist raw wool, and the like. F. Frank, Berlin. U.S. Pat. 915,169, March 16, 1909.

SEE Fr. Pat. 341,341 of 1904; this J., 1904, 829.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

PATENTS.

Carbon black from peat: Process for obtaining — J. E. Smith, Clinton, Iowa, Assignor to National Peat Products and Chemical Co., South Dakota. U.S. Pat. 916,049, March 23, 1909.

THE claim is for the process of obtaining from peat a carbon black that will readily mix with water. The peat is first dried by subjecting it to the direct action of steam in a closed vessel under pressure. It is then heated in a retort and when the volatile constituents have been driven off, the residue is pulverised and sifted. —W. H. C.

Pigments: Production of — [from anthracene dyestuffs]. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 14,338, July 6, 1908.

SEE Fr. Pat. 392,859 of 1908; this J., 1909, 31.—T. F. B.

Lithopone: Process of rendering — more stable against light. W. Ostwald, Leipzig, Germany. U.S. Pat. 916,001, March 23, 1909.

SEE Eng. Pat. 7819 of 1906; this J., 1906, 768.—T. F. B.

(B).—RESINS, VARNISHES.

Caucasian copal. E. Pyhälä. Chem. Rev. Fett- u. Harz-Ind., 1909, 16, 72.

FOSSIL resins discovered in 1907 in the vicinity of Schuscha in South Caucasus were found to contain copal resin. The fragments were either transparent and of about the size of a nut, or larger, more irregular in form, and opaque. They varied in colour from yellowish-brown to dark brown. The resin was very hard, and had a sp. gr. of 1.0574 at 18° C. It was devoid of odour or taste, but emitted an aromatic odour when burned. It began to melt above 200° C., but did not fuse completely below 250° C. Between 180° and 200° C. it became plastic. On dry distillation the transparent modification yielded 62.14 per cent. of distillate between 240° and 330° C., and left a residue of 18 per cent. of coke, whilst water and loss amounted to 19.86 per cent. The opaque modification yielded 58.75 per cent. of distillate, 26.25 per cent. of coke, and 15 per cent. of water (including loss). All the distillates separated by fractional distillation had an aromatic odour. The copal resin was insoluble in petroleum spirit, alcohol, and methyl alcohol; it dissolved with difficulty in turpentine oil; but was readily soluble in chloroform. The distillates from the dry distillation dissolved with difficulty in 95 per cent. alcohol, but were readily soluble in petroleum spirit, benzene, turpentine oil, and chloroform.—C. A. M.

Kauri copal: Solubility of — C. Coffignier. Bull. Soc. Chim., 1909, 5, 289—296.

FOUR types of Kauri copal from New Zealand are known in commerce. Pale Kauri or fossil copal is found in large masses varying from yellowish-white to clear yellow in colour. It has an aromatic smell, brilliant fracture, and is easily pulverised, forming a white powder. It has the sp. gr., 1.036; m. p., 165° C.; acid value, 70.9;

saponification value, 73. Brown Kauri is a fossil copal of a yellow brown or deep yellow hue; it is difficult to powder, has a conchoidal fracture, and an aromatic camphor like odour. It has the sp. gr. 1.053; m. p., 185° C.; acid value, 78.8; saponification value, 89.7. Bush Kauri is obtained at the foot of trees in irregular amber-like masses; it is easily powdered to a yellow powder with an aromatic odour. It has the sp. gr. 1.03; m. p., 150° C.; acid value, 83.1; saponification value, 78.5. Bush Kauri gathered from the trees themselves has a vitreous fracture; it has sp. gr. 1.038; m. p., 125° C.; acid value, 81.8; saponification value, 87. The behaviour of these copals towards a number of solvents, has been tested. In the following table the figures denote the percentage insoluble in the boiling solvent:—

Solvent.	Pale Kauri.	Brown Kauri.	Bush Kauri.	Gathered bush Kauri.
Ethyl alcohol	46.6	35.8	12.3	4.2
Methyl alcohol	46.9	61.9	47.3	34.2
Amyl alcohol	Soluble	Soluble	Soluble	Soluble
Ether	61.8	60.7	55.1	51.1
Chloroform	54.4	58.7	50.7	43.4
Benzene	66.7	70.6	61.7	57.6
Acetone	8.9	38.7	20.7	11.3
Turpentine oil	77.5	73.6	72.9	63
Beazaldehyde	Soluble	Soluble	Soluble	Soluble
Aniline	Soluble	Soluble	Soluble	Soluble
Amyl acetate	Soluble	2	Soluble	Soluble
Carbon tetrachloride	81.1	77.3	71.9	63

The marked solubility of pale Kauri in alcohol is contrary to the general experience. Brown Kauri is more resistant than pale Kauri.—E. F. A.

Resin; A liquid —. W. Fahrion. Z. angew. Chem., 1909, 22, 582—583.

A LIQUID resin, which has been called "tallöl," is obtained as a by-product in the preparation of cellulose from Swedish pine. It is a dark brown fairly fluid oil, readily soluble in alcohol, ether, and acetone, but incompletely soluble in benzene and oil of turpentine; it boils at 270° C. at 40 mm., sp. gr., 0.997 at 15° C.; acid value, 163. The oil is fairly stable, hardening very slowly on exposure, but its salts with the heavy metals dissolve in benzene and turpentine and harden rapidly. In composition it resembles colophony and gives similar products on dry distillation, but, unlike this substance, it is readily esterified by treatment with alcoholic sulphuric acid; it consists principally of resin acids of the formula, $C_{20}H_{30}O_2$, one of which is a solid. Hitherto the technical applications of tallöl have been limited.—F. SOHN.

Resin-tapping experiments in India. Board of Trade J., April 1, 1909. [T.R.]

ACCORDING to the Progress Report on Forest Administration in the Punjab in 1907, experiments are being made in resin-tapping on three sample plots in Kangra, with the object of ascertaining the yield from trees tapped to death and the time it takes to kill them. These experiments should be extended, as the resin industry has a great future, consequent on the approaching extensive utilisation of American resins for the manufacture of synthetic camphor, and the results obtained from them will be utilised in other divisions besides Kangra.

PATENTS.

Turpentine and rosin; Process for removing — from resinous woods. H. T. Yaryan, Toledo, Ohio. U.S. Pat. 915,400, Mar. 16, 1909.

THE wood is treated with a hydrocarbon solvent to extract the turpentine and rosin, and the bulk of the solvent subsequently removed from the extract by distillation (e.g., by means of a heating coil and separating chamber). The turpentine and remainder of the solvent are next separated from the rosin in a similar manner, whilst the solvent is separated from the turpentine by means of a rectifying column and condenser.—C. A. M.

Rosin; Process of purifying and treating —. H. T. Yaryan, Toledo, Ohio. U.S. Pats. 915,491 and 915,402, Mar. 16, 1909.

THE colophony is dissolved in a hydrocarbon or other suitable solvent, and treated with sulphuric acid, which precipitates the darker impurities. The supernatant liquid is treated so as to separate and recover the solvent and the rosin, whilst the precipitate is treated with water, and the rosin extracted with a suitable solvent from the curd-like mass obtained. The dilute sulphuric acid is subsequently concentrated by heating.—C. A. M.

Naphthalene and formaldehyde; Process for preparing condensation products from —. Badische Anilin und Soda Fabrik. Ger. Pat. 207,743, April 24, 1907.

PRODUCTS very similar to natural resins are obtained by treating 1 mol. of naphthalene with more than one-half mol., and preferably not much less than 1 mol., or even more, of formaldehyde or substances which generate formaldehyde, in presence of acids. The products have much higher melting-points than those obtained by treating naphthalene with one-third mol. of methylal in chloroform solution, in presence of sulphuric acid.

—T. F. B.

(C.)—INDIA-RUBBER.

Sulphur in vulcanised rubber; Determination of total —. M. Pontio. Caoutchouc et Gutta-Percha, 1909, 6, 2751—2752.

BERTRAND (Caoutchouc et Gutta-Percha, July 15, 1907) has stated that dry methods for the determination of sulphur in vulcanised rubber are inaccurate owing to loss of sulphur by volatilisation. The author has therefore tried the method proposed by him in 1904 (Rev. gen. Chim., Jan., 1904) and modified in 1908 (Caoutchouc et Gutta-Percha, July and August, 1908) with sulphur alone. A powdered mixture of 5 grms. of manganese dioxide, 10 grms. of sodium carbonate, and 15 grms. of potassium carbonate was prepared, and a portion of it was mixed with 100 mgrms. of powdered sulphur. Another portion of the oxidising mixture was placed on the bottom of a platinum crucible, the sulphur mixture was then introduced, and the whole covered with the remainder of the oxidising mixture. The crucible with the lid on was then gradually heated to redness in a muffle-furnace, and after $\frac{1}{2}$ hours, withdrawn, quickly cooled, and plunged into hot water. In the solution the sulphur was determined as barium sulphate in the usual manner. The results show that practically no sulphur was lost by volatilisation, 99.87, 99.2, and 99.73 per cent. respectively of the sulphur being converted into sulphate in three trials. The author states that by this method the total sulphur in vulcanised rubber can be determined to within 0.2 per cent.—A. S.

Rubber; Determination of organic and mineral impurities in raw and vulcanised —. M. Pontio. Caoutchouc et Gutta-Percha, 1909, 6, 2752—2753.

ONE of the methods proposed is based on the solubility of vulcanised rubber in cumene. The sample is suspended above a quantity of commercial cumene in a special flask provided with a reflux condenser and a filter, and the cumene is heated to boiling. The cumene vapour when condensed and containing dissolved rubber, passes through a small filter of calcined kaolin, which retains the insoluble impurities, back to the distilling flask. After about 12 hours, the filter and insoluble matter are removed, and washed with benzene, and with boiling 95 per cent. alcohol. The impurities in raw rubber or in rubber vulcanised but not loaded, can be determined by dissolving the caoutchouc in a suitable solvent and filtering the solution under pressure through a disc made of paper sold under the name of "paper for copper-plate engraving."—A. S.

PATENT.

Elastic products similar to indiarubber; Method of manufacturing —. R. W. Wallace and G. Reynaud, London. Eng. Pat. 3572, Feb. 17, 1908.

SEE Fr. Pat. 394,215 of 1907; this J., 1909, 319.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Monascus purpureus, a fungus occurring in oil-dressing [of chamois leather]. A. Piedallu. Compt. rend., 1909, 148, 510—513.

It is well known that the oils used in the dressing of chamois leather undergo chemical changes whilst they are in the skins, and become brown in colour, acid in reaction, and considerably thicker. These changes are attributed to the action of micro-organisms, and particularly to the action of *Monascus purpureus*, a species of *Ascomycetes*, which the author has isolated from the oils used for dressing the skins. This fungus grows on various solid culture media, and its colonies ultimately develop a pink to dark purple colour. When cultivated on artichokes, the substratum below the pink colony acquires a greenish colour, owing to the action of an oxydase. If a drop of oil be placed on the surface of a growing colony, it is gradually invaded by the mycelium and coloured red; fish oils, however, are coloured orange to brown. Experiments made with Japanese fish oil, such as is used in leather dressing, showed the development of a yellow to brown colour, darker at certain points; the reaction of the oil became very distinctly acid and its consistence considerably thicker. Thus all the principal changes which occur in the oil in practical use were reproduced by means of pure cultures of this fungus. Similar results, but without the development of the red colour, were obtained in cultures in liquid media on which drops of various oils were floated. The characteristic changes which this fungus effects in the fish oils used in leather dressing may be due to the oxydasic ferment which it secretes, which is shown by the green coloration of artichoke tissue and a blue reaction with guaiacum tincture. —J. F. B.

Chromated gelatin films. Mayer. See XXI.

Tea; Contribution to knowledge of —. Hartwich and Du Pasquier. See XVIII.

PATENTS.

Leather; Method of treating partially-tanned —. W. H. Teas, Ridgway, Pa. U.S. Pat. 916,557, March 23, 1909.

THE claims are for a process of filling leather consisting in treating the partially tanned product with waste sulphite cellulose lyes, which have been concentrated till they have the sp. gr. 1.40—1.35, the liquor being agitated during the treatment.—A. S.

Hides and skins; Process serviceable with apparatus for the tanning and treatment of —. C. W. Nance, Sydney, N.S.W. Eng. Pat. 12,799, June 15, 1908.

SEE Fr. Pat. 391,720 of 1908; this J., 1909, 101.—T. F. B.

Hides and leathers, hair, furs, and feathers, yarns and threads; Treatment of —. H. R. Vidal, Paris. Eng. Pat. 15,009, July 15, 1908. Under Int. Conv., Aug. 29, 1907.

SEE Fr. Pat. 391,466 of 1907; this J., 1908, 1150.—T. F. B.

XV.—MANURES, &c.

Nitrogen compounds of the fundamental rocks. A. D. Hall and N. H. J. Miller. J. Agric. Sci., 1908, 2, Ann. Rep. Rothamsted Exp. Station, 1908, 8.

THE carbon and nitrogen compounds existing in the unweathered rocks from great depths, when subjected to the action of soil bacteria, are attacked; but they yield nitrate so slowly, that in all probability some of the nitrogen found in soils is that present in the rock from which the soil was formed and is not of recent origin. Ammonia and nitrates were found in all the rocks examined by the authors.—F. SONN.

Soils; Acidity of —. R. Albert. Z. angew. Chem. 1909, 22, 533—537.

THE author's method gives results agreeing with those obtained by the Süchting-Tacke method (this J., 1908, 171), and is much easier and more rapid in execution. Into a Jena conical flask holding about 1 litre, 20—50 grms. of the air-dried soil are put, and 200 c.c. of distilled water are added. Then a known volume (50—100 c.c.) of barium hydroxide solution of known strength is allowed to run in with the necessary precautions, 10 grms. of solid ammonium chloride are added, the flask is connected with a condenser, the ammonia set free by the barium hydroxide is distilled into N 10 sulphuric acid, and the residual acid is titrated with sodium hydroxide, using sodium alizarinsulphonate as indicator (which allows of titration in a hot solution). The amount of barium hydroxide neutralised by the acids in the soil can then be calculated. Acid silicates, as well as humic acids, are determined by this process. An indication of the quantity of humic acids in soil is afforded by shaking up the soil with water and adding a small quantity of lithium phosphate. Soluble "lithium humate" is formed by any free acid present, and the depth of colour of the solution is a guide to the amount of acidity.—J. T. D.

Soils; Nitrification in —. Pouget and Guiraud. Compt. rend., 1909, 148, 725—727.

ON the Algerian littoral during winter, nitrification is hindered by persistent rain. After such hindrance, however, nitrification is re-established only with difficulty; it commences towards the end of May, about a month after the rainy season. During summer, in a compact soil, nitrification takes place but denitrification also occurs; the nitric-nitrogen diminishes. Ploughing has a good effect in facilitating nitrification and preventing denitrification owing to the aëration to which it gives rise. In February, March, and April, in a compact soil such as that used for wheat, no nitrification takes place. During this period, however, the absorption of nitrogen by the wheat is most active; it is necessary therefore that the nitrogen-nutrition of wheat, during this interval, should be secured by the absorption of ammoniacal compounds.—J. C. C.

Azotobacter chroococcum, Beijerinck. S. Krzemieniewski. Anzeiger Akad. Wiss., Krakau, 1907, 746—749; 1908, 929—1051. Chem. Zentr., 1908, 1, 1198—1199; 1909, 1, 1029.

THE greatest fixation of nitrogen is obtained with nutrient solutions infected with fresh soil; oxygen and nitrogen are absorbed and carbon dioxide and hydrogen are evolved. When the nutrient solution is infected with a pure culture of *Azotobacter chroococcum*, less nitrogen is fixed, oxygen is absorbed abundantly, and carbon dioxide, but no hydrogen, is formed. If pasteurised or sterilised soil be added to the nutrient solution sown with the pure culture, the fixation of nitrogen is increased. The nitrogen-fixing power of the *Azotobacter* is increased by either soluble or insoluble salts of humic substances, but not by aqueous soil extracts prepared in an autoclave at 120° C. With pure cultures containing a constant quantity of dextrose, the fixation of nitrogen is proportional to the amount of humic acid salts present, whilst with a constant quantity of humic substances, it is proportional to the amount of sugar. Different results are obtained with humus from different soils, and the natural product cannot be replaced by artificial humus prepared from sugar and acids. The greatest fixation of nitrogen is obtained when 200 c.c. of nutrient solution contain 0.25—0.5 gm. of humic substances and 2.5 grms. of dextrose. Humus cannot be used alone as a source of nitrogen or carbon. As a source of carbon dextrose gives the best results; sucrose is less effective, and mannitol even less so. Soluble humic substances (sodium salts) are more effective than insoluble (calcium salts). The efficacy of natural humus is considerably diminished by boiling it with hydrochloric acid, a treatment which causes the solution of a considerable portion of the nitrogenous compounds of the humus. Humic substances cannot be satisfactorily replaced by other nitrogen com-

pounds (nitre, ammonia, amino-acids, and amides). For a consumption of 1 grm. of dextrose, the *Azotobacter* is capable of fixing up to 17 mgrms. of nitrogen. The most favourable temperature is 28° C.; at 9° C. the *Azotobacter* becomes inactive, whilst at 33° C. its activity is greatly diminished. The activity appears to vary with the origin of the organism, but is not affected by the presence of other bacteria. The ratio of carbon dioxide formed to oxygen consumed is always in the neighbourhood of 1, being somewhat greater than 1 in presence of dextrose, and somewhat less in presence of mannitol. *Azotobacter chroococcum* is distinctly aerobic; in pure cultures, neither acids nor alcohol are formed, and carbon dioxide is the only gaseous substance produced.

—A. S.

Calcium cyanamide; Gaseous compounds produced by the decomposition of — and their influence on plant growth. E. Haselhoff. Landw. Versuchsstat., 1908, 68, 189. Biedermann's Zentr., 1909, 38, 150—155.

WHEN calcium cyanamide was mixed with moist soil and subjected to the action of a current of air, 10 grms. yielded 0.068—0.077 grm. of ammonia in 8 days, and 0.0795 per cent. of acetylene in 3 days. 50 grms. yielded 0.00068 grm. of hydrogen phosphide in 3 days. Traces of hydrogen sulphide were also sometimes formed, but no hydrocyanic acid. Comparative experiments showed that the germination of seeds is affected injuriously by small quantities of ammonia, hydrogen phosphide, or hydrogen sulphide, but not by acetylene; whilst plant growth was retarded by ammonia and hydrogen phosphide, and to a lesser extent by acetylene and hydrogen sulphide.—A. S.

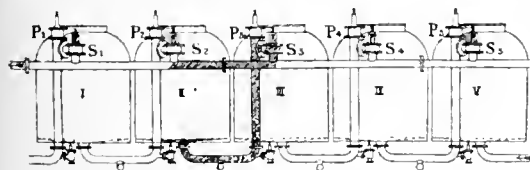
Ammonia; Manufacture of synthetic. —. E. Brönnert. Bull. Soc. Ind. Mulhouse, 1909, 79, 39—47.

THE author gives a description of Serpek's process for preparing aluminium nitride. Aluminium carbide is prepared by heating a mixture of carbon and alumina in the electric furnace. On treatment with water this carbide yields methane and when heated in a stream of nitrogen (generator gas) it is transformed into aluminium nitride. The carbide need not be isolated but is mixed with a further quantity of alumina and treated with nitrogen. The nitride contains 20—24 per cent. of nitrogen and can be used directly as a manure as, under the influence of water and atmospheric oxygen it evolves ammonia, alumina being also formed. The pure nitride contains 34 per cent. of nitrogen.—J. C. C.

Waste from stripping of sisal hemp. Hebert and Heim. See V.

XVI.—SUGAR, STARCH, GUM, &c.

Diffusion process [Sugar] in which the effect of the inactive space in the battery is obviated. E. Psenicka. Z. Zucker-ind. Böhm., 1909, 33, 308—310.



EVEN in the most modern methods of working the diffusion process the result is influenced by the inactive space in the battery and the author overcomes this disadvantage by his process as illustrated in the accompanying figure. The diffusion vessels, I. to V., are provided with the uptake valves, P_1 to P_5 , and the saturated juice valves, S_1 to S_5 . The valves below are worked as usual. The diffusion vessel, II., is filled with fresh chips and introduced into the diffusion process in the usual manner, but as soon as the juice in it has risen to the air vent, the current is reversed by reversing the valves, P_2 and S_2 , and simultaneously opening S_1 , when the juice from the inactive space of the diffuser, below the dotted lines, as

well as the weaker juice, which has only been slightly in contact with the fresh chips, streams into diffuser, III., filling the inactive space in this vessel, ready to come first into contact with fresh chips at the next mashing operation, thus realising an ideal and regular procedure in the contact of juice and fresh chips. Only so much juice is admitted into diffuser, III., that the juice drawn off into the measuring tank may be as high in density as possible, as determined by laboratory tests. When this quantity has been run in, the valve, S_4 , is closed and the dense juice passes to the measuring tank. About 90 per cent. of the harmful effect of the inactive space is obviated by working in this manner.—L. J. DE W.

[Sugar] Juices and syrups; Purification of — by aluminium and calcium silicates. J. Smahel. Z. Zucker-ind. Böhm., 1909, 33, 310—313.

THE process of Gans for purifying juices and syrups by filtration over natural zeolites or the artificially prepared silicate, "calcium permittite," permits of a partial replacement of potassium by calcium and, in consequence of the lower chemical equivalent of calcium, the ash of the juice is lessened and a higher quotient of purity apparently results. The introduction of lime into the juice by filtration over aluminium and calcium silicates however produces a series of undesirable results. The juices darken, are difficult to grain, require prolonged boiling, and give a smaller yield of sugar of inferior quality, and in consequence of the slow boiling, the total work is decreased. The author found in one case that when the juice had a quotient of 95 per cent. at 14° Balling, it contained 0.12 per cent. of potassium oxide. After filtration over silicate, half of the potassium was replaced by calcium and it then contained 0.036 per cent. of lime. On boiling to thick juice at 52° Balling the percentage of lime amounted to 0.13 and juice containing this amount can scarcely be boiled. The replacement of potassium in molasses by calcium or sodium lowers its value to distillers who do not buy it for sugar alone but with a view to utilising the potassium also.—L. J. DE W.

Sucrose; Role of magnesium oxide in the hydrolysis of — at different temperatures. J. Tribot. Compt. rend., 1909, 148, 788—790. (See also this J., 1908, 1125.)

THE author has studied the progress of hydrolysis of sucrose, at temperatures ranging from 25° to 60° C., under the action of crude invertase, of invertase with magnesium oxide, and of invertase purified by twelve successive precipitations. For short periods, the rate of hydrolysis of sucrose by invertase with magnesium oxide begins to become constant at 40° C. whilst with invertase alone, the rate continues to increase up to 60° C. The activity of invertase, purified by successive precipitations, and containing only a trace of mineral matter, though much diminished, is not reduced to zero. At high temperatures, more sucrose is hydrolysed in a given time by the enzyme with magnesium oxide than by the enzyme alone and there is an equivalence between the action of magnesium oxide and the influence of temperature. Hence, magnesium oxide plays the part ascribed to invertase as a whole, and to ferments in general, a part which E. Solvay has described as "thermocatalysis" and which would consist in a lowering of the true temperature of reaction.—L. E.

Starch; The colloidal properties of — in relation to its chemical constitution. E. Fouard. Compt. rend., 1909, 148, 502—504.

PERFECT solutions of starch may be obtained by filtration of the colloid through collodion membranes. If small quantities of potassium hydroxide be added to such true solutions, the specific rotatory power of the dissolved substance is diminished. This diminution depends on the proportion of alkali, and it takes place progressively until a rotatory power of $[\alpha]_D - 141$ is reached, corresponding to that of maltose. The modification produced by the alkali is instantaneous and reversible; the original rotation is restored when the alkalinity is neutralised. If a pseudo-solution of starch be fractionated at different stages of its spontaneous gelatinisation and the fractions

filtered separately through collodion, it is found that the concentrations of dissolved starch decrease as the gelatinisation is more advanced, and that the specific rotatory power of the dissolved substance likewise decreases towards a limit corresponding with the rotatory power of maltose. Both these observations point to the conclusion that the solution of starch, whether by the action of potassium hydroxide or of water, depends on a process of reversible hydrolysis, with maltose as its ultimate term. Starch is therefore simply a condensation product, in a variable and undetermined degree, of maltose. It is a true molecular aggregate of this carbohydrate, aggregation proceeding progressively with elimination of water until the product assumes a colloidal gelatinised state. The changes in the physical state of the colloid are therefore essentially dependent on chemical changes and are consequently in close relation with its constitution.—J. F. B.

Gum tragacanth: Distinction of genuine — from spurious Indian gums. W. L. Scoville. *Drugg. Circ.*, 1909, 53, 116—117.

Two grms. of the gum are shaken with 100 c.c. of water until thoroughly swelled and free from lumps. If in powder, it is first suspended in 3 c.c. of alcohol and poured quickly into the water. Two grms. of borax are then dissolved in the gum solution, and the mixture is allowed to stand over night. Spurious tragacanth then forms a very slimy mucilage, which when drawn out between the finger and thumb, affords long viscous strings. An admixture of 5 per cent. of spurious Indian tragacanth with the genuine gum, under these conditions gives a mucilage which will form strings $\frac{1}{4}$ to $\frac{1}{2}$ inch long when thus manipulated. Genuine tragacanth mucilage shows no such viscosity, and does not acquire a stringy consistence until it has been in contact with borax for several days. Even then, the stringy character is much less marked than is the case with the spurious gum. Indian gum tragacanth mucilage is transparent; acid in reaction; gives no blue colour with iodine solution; does not froth when shaken with an equal volume of 5 per cent. potassium hydroxide solution; and precipitates slowly when mixed with two volumes of alcohol. Mucilage of genuine tragacanth is opaque; neutral in reaction; gives a blue colour with iodine; froths when shaken with 5 per cent. potassium hydroxide solution; and precipitates immediately when mixed with two volumes of alcohol.—J. O. B.

Determining the value of starches. Binz and Marx. See V.

Tapioca and palm starches for paper-making. Virneisel. See XIX.

"Stachyose" in white jasmine. J. Vintilescu. See XX.

XVII.—BREWING, WINES, SPIRITS, &c.

Hordeum vulgare (barley): Selective permeability of the coverings of seeds of —. Brown. See XXIV.

Maize: The maltases of raw —. R. Huerre. *Compt. rend.*, 1909, 148, 505—507.

IN a recent note (this J., 1909, 254), the author showed that the early white and yellow maizes of the Landes contain maltases of different characters, termed respectively "low" and "high" maltases according to the temperatures of their activities. Certain other varieties of maize have now been examined, with the result that they have been found to secrete maltases which may be classed with the two extreme types previously studied, without, however, being actually identical with them. The variety called "Anxonne" secretes a "high" maltase which has no action on maltose at temperatures below 20° C. The other varieties of maize studied, viz., "coarse red," "King Philipp," "Cuezo red" and "white" secrete "low" maltases which hydrolyse maltose readily at 15° C., with differences in the rapidity of their action. These "low" maltases, however, have not the same optimum temperatures of reaction as the "low" maltase of the early white maize of the Landes. The maltase of

"Cuezo red" resembles the "low" maltase of the white maize of the Landes in that it acts upon maltose at 0° C. and is destroyed at 68° C.; but it resembles the "high" maltase of the yellow maize in the fact that the most favourable temperature for its action is about 60° C. The limits of activity of the "King Philipp" maltase are 4° C., minimum, and 60° C., maximum, but its optimum temperature is about 50° C. The author has endeavoured to ascertain whether the different temperature relationships of the various maltases of maize were due to differences in the composition or reaction of the extracts, but these different relationships were always maintained when small quantities of acids, alkalis, or asparagine were added. They are probably, therefore, specific differences, depending on the different origin of the enzymes, unless it be assumed that they depend on the presence of some unknown co-enzyme in greater or smaller proportions.—J. F. B.

Saké yeast: Two Saccharomyces from —. R. Nakazawa. *Zentr. Bakt., u. Parasitenk.*, 1909, II. Abt., 22, 529—540. *Chem. Zentr.*, 1909, 1, 1178.

THE author describes the morphological and biological properties and the conditions of growth of two kinds of *Saccharomyces*, *S. Tokyo* and *S. Yelo*, which he has isolated from saké yeast. In neutral yeast water containing 5 per cent. of sucrose, the two yeasts colour the liquid red and produce a red deposit. They are bottom-fermentation kinds and cause rapid fermentation. Dextrose, sucrose, galactose, and maltose are fermented by them; raffinose is hydrolysed; melibiose and lactose are not attacked.—A. S.

Brewing: The nitrogen question in —. Part II. H. T. Brown. *J. Inst. Brewing*, 1909, 15, 169—284. (See also this J., 1907, 884.)

THE "permanently soluble" nitrogenous constituents of worts and beers may be divided into those which are "assimilable" by yeast and those which are "non-assimilable," and it is only the former class which exerts any influence on the behaviour of the beer. The relation between assimilable and non-assimilable nitrogen may be determined by successive fermentations by yeast in such a manner that reproduction is limited solely by the exhaustion of the assimilable nitrogen. Under fixed conditions of extraction of a given malt, the relation of assimilable to total permanently soluble nitrogen is fairly constant, in which case it is sufficient to study the factors which tend to increase or diminish the latter; under fixed conditions this is in close relation with the initial nitrogen content of the barley. The percentage of the initial barley-nitrogen which is converted and extracted in the form of permanently soluble nitrogen is fairly constant under given conditions. Other things being equal, the increased development of the young plant connotes an increase in both permanently soluble and assimilable nitrogen in the extract from the malt. In the case of an average English malt extracted at 152° F., about 48 per cent. of the permanently soluble nitrogen of the extract is contributed by the germ and 52 per cent. by the endosperm. Of the assimilable nitrogen about 52 per cent. is due to the germ and 48 per cent. to the endosperm. The increased permanently soluble nitrogen of the extracts of "forced" malts is mainly due to the increased mass of the plumule which remains in the malt. Since the weight of the germ amounts to only one-tenth of that of the malt and since it contains about one-half of the assimilable nitrogen, a very great reduction of the latter could be effected, if desired, by de-germing the malt before extraction. Slow drying in the early stages of kilning has practically no effect in increasing the permanently soluble nitrogen of the malt; the final temperature of curing, provided it does not exceed 190° F., also has very little effect. The temperature of mashing has a very powerful influence on the extraction of permanently soluble and assimilable nitrogen. The extraction increases gradually but regularly as the temperature is increased from 60° F. to 100° F. From 100° to 110° F., the extraction of permanently soluble nitrogen increases very rapidly; above 110° F., the increase is slower and reaches a maximum at 120° F., corresponding

with the maximum intensity of the action of the proteolytic ferments. The permanently soluble nitrogen extracted at 120° F. from an English malt amounts to about 40 per cent. of the total nitrogen of the malt, 23 per cent. being pre-existent and 17 per cent. being the product of proteolysis. Above 120° F. the extraction curve falls, and the ordinary mashing temperature of 150° F. marks a critical point at which a degree or two on either side makes a very considerable difference in the permanently soluble nitrogen of the wort. At 180° F. the proteolytic enzymes are inactive and the extraction of permanently soluble nitrogen becomes the same as at 60° F. The curve illustrating the extraction of assimilable nitrogen at different temperatures follows a similar course. When the assimilable nitrogen is classed according to its degree of assimilability, certain well marked changes are noted, depending on the temperature of extraction. When an attempt is made to increase the extract by excessive sparging at high temperatures, a marked increase in the proportion of permanently soluble nitrogen in the extracted matter is noted. Certain mineral salts, e.g. carbonates, restrict the extraction of permanently soluble nitrogen, probably by their influence on the phosphates, and thus on the proteolytic enzymes. Calcium chloride promotes the extraction; the fineness of grinding has no influence. *Hops*.—Boiling with hops in the usual brewing proportions precipitates small quantities of the non-assimilable permanently soluble nitrogen, but the hops contribute an equal amount of assimilable nitrogen to the wort, so that the nett result of the process is to increase the yeast-nutrient to the extent of about 2.5 per cent. of the total nitrogen of the wort. When hops are added to an unboiled wort, their precipitating action on subsequent boiling is confined to the permanently soluble nitrogen. Rather more than one-fourth of the permanently soluble nitrogen is precipitable by an excess of gallotannic acid. Of this precipitated nitrogen about 24 per cent. is readily assimilable, 34 per cent. less readily assimilable and 42 per cent. non-assimilable. *Yeast*.—The relation between the rate of cell-increase and the removal of nitrogen has been carefully studied. For this purpose the number of cells was counted in a unit standard volume of wort ($\frac{1}{47000}$ cub. mm.) and at the same time the nitrogen in the liquid was determined. If a = the nitrogen removed expressed as grms. per 100 c.c., and b = the cell-increase per unit volume, then $a/b = N$ is called the nitrogen coefficient per unit cell. This is practically constant for any given yeast, provided the removal of nitrogen does not exceed 40 per cent. of the total nitrogen of the wort (assimilable nitrogen = about 60 per cent.). Beyond that limit starvation conditions set in and the relation between the two factors is no longer constant. Most commercial top-fermentation yeasts show a nitrogen coefficient of about 0.0020, but in the case of one variety of small-celled yeast it was found as low as 0.0016. *Aeration*.—When a wort contains an excess of the substances requisite for the healthy nutrition of the yeast, the cell-reproduction and removal of nitrogen stand in direct relation to the amount of free oxygen which is available. But even when the last traces of free oxygen are removed there is still a slight reproductive activity, amounting to about 6 cells per unit volume and independent of the quantity of seed yeast, due probably to the presence of some substance which the yeast is able to reduce and utilise in place of free oxygen. In a fully aerated wort the yeast increase and removal of nitrogen have about double the values found for an air-free wort. Up to a degree of about 50 per cent. of full saturation with air, equal increments of free oxygen result in equal increments of cell-increase and nitrogen removal; beyond this point, increased aeration is still effective but not to a proportionate extent. The aerating efficiency of any type of refrigerator may be ascertained by making a blank experiment with boiling water and estimating the dissolved oxygen by Winkler's method: there is no difficulty in obtaining in practice an aeration of 85–100 per cent. saturation. Fully aerated worts, when pitched with yeast in brewing proportions, give up the whole of their free oxygen to the yeast in 2 or 3 hours. The influence of "rousing" in stimulating fermentation is two-fold: it prevents the premature separation of the yeast, promoting

contact between the single cells and fermentable matters, and it favours reproduction of the yeast and the removal of nitrogen by introducing further supplies of air, provided it is conducted in such a manner that the influence of the carbon dioxide is overcome. There are small but appreciable differences in the yeasts of different breweries as regards their power of nitrogen removal from worts when the initial supply of oxygen and other conditions are constant. In ordinary practice the removal of nitrogen from the wort is a function of the free oxygen available and is not influenced by variations in the initial concentration of assimilable nitrogen. Traces of free oxygen in the finished beer exert a marked influence on the subsequent activity of primary and secondary yeasts and their tendency to produce turbidities.—J. F. B.

Wine; Action of iron on —. Trillat. *Compt. rend.*, 1909, 148, 792–795.

THE injurious action of iron on wine has long been recognised: a large proportion of the colouring matter is deposited and the effect of the metal on the odour and flavour of the wine resembles that caused by ageing. The author has found that the proportions of acetaldehyde, ethyl acetate, and acetal are increased when wines are left in contact with metallic iron for several days. The production of aldehyde in wine left in contact with metallic iron or treated with ferric chloride (1 : 5000), is more rapid when the wine is exposed to free air than when the air-supply is limited. The amount of aldehyde produced in wine by contact with metallic iron is alone sufficient to cause precipitation of the colouring matter. The author has also found that the iron is more or less rapidly attacked by the wine according to the degree of purity of the former and the nature of the latter; the action does not, however, always correspond to the degree of acidity of the wine. For a given quantity of iron dissolved in different wines, the appearance of a deposit is accelerated in wines of low alcohol-content and retarded in wines containing much sugar or glycerol. Such deposits, however, may not be due entirely to formation of aldehyde; the oxidising action of the iron on the colouring matter must be taken into consideration. The author concludes that the alteration of wine in contact with iron is due in part to a rapid formation of aldehyde, and the effect of this, in certain cases, explains how a cask of wine may be completely spoiled by the presence of a nail. From the recent researches of de Stoecklin on the oxidising action of iron tannate (see this J., 1909, 111), it may be supposed that the iron is most active in this form.—L. E.

Wines; Coefficient of partition and its application to the determination of the volatile acids of —. P. Malvezin. *Compt. rend.*, 1909, 148, 784–787.

THE author has investigated the partition of some organic acids between ether and water, and between ether and aqueous alcohol at 15° C. He found that under the conditions of his experiments, the acidity acquired by the ether varied with the concentration of the volatile fatty acids (acetic, propionic, butyric) but was independent of the concentration of the fixed acids (tartaric, succinic). On these results, he has based the following method for determining the volatile acids of wines:—Ten c.c. of the wine are thoroughly shaken for 1–2 minutes with 10 c.c. of 65 per cent. (65°) ether in a test-tube (length, 20 cm.; internal diam., 2 cm.). The tube is then closed with a stopper carrying a thermometer, and immersed in water at 15° C. for 10 minutes. The ethereal extract is then decanted and shaken. Five c.c. of the extract are transferred to a flask containing 5 c.c. of 90 per cent. alcohol, the mixture is treated with phenolphthalein (4 drops for a red, 2 drops for a white wine) and titrated with $N/10$ sodium hydroxide. The author has found that under the above-described conditions, 72 per cent. of the volatile acids of a wine are dissolved by 65 per cent. ether. The volatile acidity (expressed as grms. of acetic acid per litre) is found from the formula:

$$(2A - 0.2) \times 0.006 \times 100 \times 100,$$

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in which A = no. of c.c. of $N/10$ alkali required, and 0.2 is the correction coefficient for this concentration of

alkali. The method is very expeditious, does not involve distillation, and the author has shown that it gives results which agree closely with those obtained by the method of Duclaux.—L. E.

Rôle of magnesium oxide in the inversion of sucrose. Tribot. See XVI.

Colloidal properties of starch. Fouard. See XVI.

PATENTS.

Whisky: Distillation of —. R. M. McDougall, Glasgow. Eng. Pat. 6396, Mar. 23, 1908.

THE process consists in the continuous distillation of whisky possessing all the characteristics and flavour of pot still whisky. The apparatus includes a pot still with a head containing distilling and rectifying plates, the vapour being rectified in one operation. The head, which is surmounted by a water-jacketed conical section, is fitted with cut-out coils and pipes whereby one or more of the rectifying plates may be put out of operation to adjust the strength or flavour of the whisky as desired. The spirit vapour is cooled, first by fresh wash, and then by cold water; the fresh wash, which is supplied continuously, is further heated, before entering the distilling apparatus, by the spent wash and the waste steam from the heating coil in the still.—L. E.

Brewers' wort: Production of —. H. Breker, Cologne, Germany. Eng. Pat. 27,956, Feb. 15, 1908. Addition to Eng. Pat. 25,356, Nov. 15, 1907.

SEE Addition of Nov. 7, 1907, to Fr. Pat. 385,574 of 1907; this J., 1908, 703.—T. F. B.

Brewing, distilling, and the like. S. Armstrong, Burton on Trent. U.S. Pat. 915,150, March 16, 1909.

SEE Eng. Pat. 12,012 of 1907; this J., 1908, 702.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(A.)—FOODS.

Raw milk: Coagulation of — by the rennet of the Papaw tree. C. Gerber. Compt. rend., 1909, 148, 497–500.

THE rennet ferment contained in the papayotin prepared from the Papaw tree possesses the same high degree of resistance to the action of high temperatures as the proteolytic ferment of the same plant. This rennet coagulates milk at 0° C. without the necessity of adding calcium chloride, and its action is quite distinct from that of pepsin or Hansen's rennet. The action of papaw rennet generally shows a divergence, depending on the temperature of the reaction, from the law of inverse proportionality between concentration of ferment and time of action. In the case of boiled milk it is easy to obtain slow coagulations, but it was found in the case of raw milk that only rapid coagulations were successful, and these also showed a divergence from the law of Segeleke and Storch in the same sense as the coagulation of boiled milk, the divergence being more pronounced the longer the milk was kept after drawing. It was then found that raw milk when freshly drawn from the cow behaves in an approximately normal manner, and gives slow coagulations almost as readily as boiled milk. The resistance to dilute solutions of the rennet increases, the longer the milk is kept, and at the end of four hours only rapid coagulations can be obtained; the milk then retains this property which it has acquired. The author has proved that the above peculiarity is not due to the fat, the calcium phosphate, nor the salts, but concerns only the colloids, lactalbumin and lactoglobulin. Milk heated to 78° C. behaves in the same manner as boiled milk, and raw milk which has become resistant by keeping, loses this resistance when heated to 75°–78° C.—J. F. B.

Camembert cheese: Proteolytic changes in the ripening of —. A. W. Dox. U.S. Dept. of Agric., Bull. No. 109, 1908.

THE biological factors necessary to the production of Camembert cheese are the lactic acid bacteria, which are normally present in milk, and two moulds, *Penicillium camemberti* Thom and *Oidium lactis*. Other moulds may be present, but they are generally contaminations and often deleterious to the cheese. The actual ripening is caused by the proteolytic enzyme of the mould; this enzyme is secreted by the mould growing on the surface of the cheese and diffuses towards the centre. The digestive action of the enzyme on the paracasein of the cheese produces the true ripening. No appreciable proteolysis occurs until after the cheese is two weeks old, but certain changes take place in the character and solubility of the curd. These changes consist mainly in the liberation of paracasein from combination with calcium, and at the same time the paracasein is converted into a form which is completely soluble in 5 per cent. salt solution; at a later stage it again becomes insoluble. The enzyme appears to be of the nature of erepsin; it attacks casein and peptone readily, but is without action on fibrin and coagulated egg albumin. The following substances have been isolated from Camembert cheese:—caseoglutin, protocaseose, deuterocaseoses A. B. and C, α - and β -peptones, histidine, arginine, lysine, glutamic acid, tyrosine, and leucine, whilst the author failed to find paraneucin, tryptophan, indole, skatole, mercaptan, hydrogen sulphide, and phenols. The ripening of Camembert cheese cannot be due to peptic digestion, as paraneucin, the characteristic product of peptic digestion, is absent, and amino-acids and ammonia are present in considerable amount. Moreover, the greater part of the phosphorus is liberated and appears as acid calcium phosphate; according to Plimmer and Bayliss, pepsin liberates the phosphorus slowly and incompletely, and mostly in the organic form. On the other hand, the ripening resembles ereptic digestion in many respects, as follows:—(1). The acidity of the cheese before the ripening commences is most favourable to the activity of ereptase. (2). The digestion proceeds beyond the peptone stage. (3). A study of the enzyme shows that it is a vegetable ereptase. The absence of tryptophan, which is ordinarily liberated in ereptic digestion, is noteworthy, as is also the presence of caseoglutin, which substance, to the author's knowledge, has not been observed in digestions with pure enzymes.—W. P. S.

Egg albumin: Hydrolysis of — with sodium hydroxide. Z. H. Skrap and F. Hummelberger. Monatsh. Chem., 1909, 30, 125–145.

EGG albumin when hydrolysed with 6 per cent. sodium hydroxide solution is broken up into protalbinic acid, lysalbinic acid and lysalbin-peptone. Protalbinic acid is sparingly soluble in water and dilute acids, lysalbin-peptone is soluble in saturated ammonium sulphate solution. These properties allow protalbinic acid and lysalbin-peptone to be purified, but the lysalbinic acid isolated possibly contains both these substances. On complete hydrolysis the following products are obtained:—

	Original egg albumin.	Protalbinic acid.	Lysalbinic acid.	Lysalbin- peptone.
	per cent.	per cent.	per cent.	per cent.
Histidine.....	1.5	2.3	0.3	0.6
Arginine.....	2.0	0.4	0.2	0.3
Lysine.....	3.0	3.3	5.3	4.0
Tyrosine.....	2.4	3.4	2.6	1.1
Phenylalanine...	5.8	12.0	5.2	2.4
Proline.....	1.5	2.0	1.0	0.3
Amino-acids.....	7.0	14.7	7.0	3.2
Glutamic acid...	3.2	1.8	1.0	1.6

In the case of protalbinic acid, the aromatic products of hydrolysis—tyrosine and phenylalanine—are obtained in larger amounts than from albumin; these amounts

fall further in the case of lysalbinic acid, which has nearly the same composition as albumin, and they fall lowest in the case of peptone. With proline and the amino-acids—leucine, valine, and alanine—similar relations subsist. Protalbinic acid hardly shows any carbohydrate reaction, but lysalbinic acid and particularly the peptone show this more strongly than the original protein. Apparently that part of the protein molecule which is most resistant to sodium hydroxide contains relatively more of the aromatic constituents but lacks the sugar residue. Further this sugar residue forms part of the more resistant portion of the protein molecule and is not a part of the relatively simple peptides which are the first to be eliminated. Protalbinic acid alone yielded hydroxy-protic acid on oxidation with permanganate, indicating that this acid is formed from the more resistant part of the protein molecule. Apparently by the action of sodium hydroxide glutamic acid is more rapidly eliminated from egg albumin than tyrosine, whereas Abderhalden found that tyrosine is the first to be eliminated from edestine and casein on hydrolysis with pancreatic juice.—E. F. A.

Flour and cereals; Alteration of — by sulphur dioxide. M. and G. Careret. Bull. Soc. Chim., 1909, 5, 270—272.

Flour submitted to the action of sulphur dioxide forms a sticky dough from which no gluten is obtained on washing in the usual manner. Flour made from wheat which has been treated with sulphur dioxide, forms a sticky dough very difficult to knead, which will not ferment with yeast and gives very close bread unfit for consumption. The sulphur dioxide destroys the elasticity of the gluten; in the dough it causes the destruction of gluten into its constituents rather than its solution in the weak acid liquid.—E. F. A.

Tea; Contribution to the knowledge of —. C. Hartwich and P. A. Du Pasquier. Apoth.-Zeit., 1909, 24, 109—110, 119—121, 130—131, 136—137. Chem. Zentr., 1909, 1, 1182—1183.

For the microchemical detection of caffeine in the different portions of the tea-leaf, the authors make use of the formation of the double compound of the alkaloid hydrochloride and gold chloride, the leaves being immersed first in water to remove the tannin, and then in a mixture of hydrochloric acid and gold chloride. The results so obtained corresponded with the results of analytical determinations of the alkaloid by Keller's method. In 19 kinds of tea the caffeine content ranged from 1.78 to 4.21, average 3.95 per cent. Young leaves from Pallanza, Italy, contained 3.7; old leaves, 1.35 per cent. of caffeine. With a good commercial tea, the youngest leaves contained 9.2 per cent. of caffeine, and then with increasing size of the leaves, the percentage of caffeine fell to 3.9, 3.6, and 0.8 respectively. The wood of the stem of the plant contained 0.06; the bark, 0.08; the wood of the root, 0; and the root-bark, 0.15 per cent., of caffeine. In blossoms from Pallanza, the calyx contained 2.39, the petals, 0.44, and the whole buds, 2.09 per cent. In two kinds of Cochin-China tea consisting entirely of dried flower buds, 1.17 and 1.25 per cent. of tannin respectively was found. In tea seeds, 0.059 per cent. was found in the husk and 0.097 and 0.107 per cent. in the cotyledons. The tannin of tea reduces Fehling's solution. The chief proportion of the caffeine is liberated during the withering and rolling operations, the quantity being increased only by about 3 per cent. during the fermentation process. During the roasting the amount diminishes by about 14 per cent. The tannin liberated from the caffeine-tannin compound during the withering and rolling operations, yields phlobaphene on fermentation. Analyses of a number of rare kinds of tea are given in the original.—A. S.

Cocoa industry of Bahia. Board of Trade J., April 1, 1909. [T.R.]

THE total output of cocoa from the State of Bahia during the 1907-8 season amounted to about 27,000 metric tons; the average yield of each mature cocoa tree, per season, may be taken to be 2½ kilos. of dried beans; the number of cocoa trees planted per hectare may be

taken to average 625. Hence the total area under cocoa cultivation in the State at the present time amounts to some 16,000 hectares (40,000 acres), and that there exist some 10,000,000 cocoa trees in bearing.

Three varieties of cocoa are grown in Bahia, differing in the size and shape of their pods, and in the texture of the rind. In the matter of the average yield per tree, and of quality of bean, there would seem to be little to choose between the three varieties. The yield per tree, in the case of mature trees, is taken to average 2½ to 3 kilos. of dried beans annually. That this average could be substantially increased by the bestowal of a little intelligent care upon the trees admits of no doubt, since the product of one carefully cultivated plantation averages over 6 kilos. of dried beans per tree per season, and on an estate in the Belmonte district there are trees that have yielded 15 kilos. of dried beans during a season.

Experiments have been carried out in Bahia during the past few years in connection with the drying of cocoa by artificial heat. It has been found that the oven system dries the beans more thoroughly than does exposure to the sun, and that the product fetches higher prices in the Bahia market than does the sun-dried article, by reason of its superior and more regular colour. The system, however, has been adopted to only a very limited extent, owing to the cost. At the present time there are not more than a dozen such stoves at work.

Brazil, as a whole, furnishes at the present time something over one-fifth of the world's supply of cocoa. Of that proportion the State of Bahia contributes over 80 per cent. The output of cocoa in the State of Bahia has increased from 14,000 metric tons in 1901-2 to 25,182 metric tons in 1907-8, and 27,000 metric tons (estimated) in 1908-9.

There is every reason to believe that this rate of increase will be maintained in the future. The area of land in the State suitable for the cultivation of cocoa is practically unlimited, and the conditions existing there are favourable for the growth of the cocoa tree. On the other hand, the planters are heavily handicapped by lack of transport facilities, there being no railway in the cocoa-producing area, whilst the roads are very bad, and the rivers inconvenient.

The exports of cocoa from Bahia in 1907 were as follows:—United States of America, 6,402,463 kilos., Germany, 6,167,180 kilos., France, 4,778,732 kilos., United Kingdom, 2,373,225 kilos., and 1,290,168 kilos. to other countries.

Irvingia butter. Bontoux. See XII.

PATENTS.

Food product, and process of making same. A. Behr, Pasadena, Cal. U.S. Pat. 914,379, Mar. 9, 1909.

THE food product, consisting principally of nitrogen-phosphorus compounds, is obtained by steeping corn (maize) in hot water, rendering the liquid alkaline, and separating the precipitate formed.—W. P. S.

Milk; Apparatus for concentrating —. E. E. Claussen, Hartford, Conn. U.S. Pat. 915,019, Mar. 9, 1909.

THE apparatus consists of a number of receptacles placed side by side and each surrounded by a hot-water jacket. Each succeeding receptacle is of smaller capacity than the one preceding it. The milk to be concentrated is introduced into the first receptacle of the series, and jets of compressed air, entering through pipes at the bottom of the receptacle, are passed through it, a perforated screen being placed across the receptacle in order to break up the air bubbles. The milk then flows through a channel at the top of the receptacle into the next of the series, where it is also subjected to jets of air, and so on.—W. P. S.

Albumen; Process for drying —. P. A. Schmitt and O. Ahrens, Hamburg, Germany. Eng. Pat. 14,256, July 4, 1908.

SEE Ger. Pat. 201,680 of 1907; this J., 1908, 1172.—T.F.B.

(B).—SANITATION; WATER PURIFICATION.

Water; Storage of raw river — antecedent to filtration. A. C. Houston. Report to Metr. Water Board, 1909, 1—47.

THE report deals with the systematic observations, including chemical and bacteriological investigations, which were carried out during the twelve months ending July 31st, 1908, on the effect of storage on raw river water. As regards the advantages of storage, it is pointed out that adequately stored water is probably incapable of causing epidemic disease, and the author is in favour of storage *plus* filtration. It has been shown previously (see this J., 1908, 873) that typhoid bacilli perish rapidly when added to raw river water, and it may be inferred that a still more marked reduction, if not total elimination, of the less hardy and less numerous microbes of water-borne disease takes place. The recorded results of the experimental part of the investigation show that storage reduces the number of bacteria of all sorts and devitalises the microbes of water-borne disease (e.g., the typhoid bacillus and the cholera vibrio); it also reduces the amount of suspended matter, colour, ammoniacal nitrogen, hardness, and oxygen absorbed from permanganate; the quantity of albuminoid nitrogen in the water may be reduced, or its quality altered, by storage. It was found that storage tends generally to lengthen the life of the filters and has a marked "levelling" effect on the quality of water delivered to the filter beds. The use of stored water enables a constant check to be maintained on the safety of London's water antecedent to and irrespective of filtration, and renders any accidental breakdown in the filtering arrangements much less serious than would otherwise be the case. The author concludes, finally, that raw river water should be stored before filtration, preferably for 30 days. This period of storage would, possibly, have to be subject to the qualification that provision must be made for times of flood or drought when river water could not be admitted to the storage reservoirs.

The report also deals with the shape, size, depth, construction, and method of working storage reservoirs; alternative measures (sterilisation being the only one, and this would be impracticable on account of expense); and the disadvantages of storage. All the real or assumed disadvantages of storage disappear if the use of stored water be regarded as an elastic policy which can be departed from on occasions when the local conditions render this feasible and at the same time desirable.—W. P. S.

PATENT.

Water; Process for purifying —. C. W. Schultze, Assignor to H. K. Perry, Buffalo, N.Y. U.S. Pat. 944,887, Mar. 9, 1909.

WATERS containing calcium salts are purified by the addition of definite proportions of aluminium sulphate, kaolin, and starch. The gelatinous precipitate which forms enmeshes the bacteria and suspended matters, as well as dissolved organic substances, in the water, and the whole precipitate is then removed by passing the water through fibrous material.—W. P. S.

(C).—DISINFECTANTS.

Basic cuprous chloride (cuprous oxychloride). M. Deletrez, L'Engrais, March 26, 1909.

THE action of copper salts in the treatment of the cryptogamic diseases of plants has long been known, but it has been more recently proved that if instead of using copper sulphate according to the old methods, cuprous oxychloride, produced preferably by the electrolytic method (this J., 1907, 987), be substituted, then both economy and efficiency are gained, for this green powder remains for a long time in suspension when mixed with water, and adheres with great tenacity to the leaves and fibres of plants. For spraying vines, for the destruction of mildew, the oxychloride is used in aqueous suspension, in which 200 to 250 grms. are contained in 100 litres of water, the weight of metallic copper represented being approximately 125 grms., as compared with 2 kilos. of copper sulphate

in 100 litres of water, and containing 500 grms. of metallic copper, which would have been required for the same purpose.

PATENT.

Terpineol preparations [disinfectants]; Process for obtaining water-soluble —. F. Fritzsche und Co. Ger. Pat. 207,576, Jan. 24, 1906.

A QUANTITY of terpineol greater than that required merely to impart a perfume to the product, is added to ordinary soaps, with the exception of the so-called "Derizin soaps." Contrary to the view generally held, it has been found that sufficient quantities of terpineol for disinfecting purposes can be mixed with soaps, without any addition of alcohol, glycerin, etc., and without the necessity of using a special kind of soap.—A. S.

XIX.—PAPER, PASTEBOARD, &c.

Pulp logs; Loss of wood in trimming —. B. Smärt. Papier Zeit., 1909, 34, 923—924.

LOGS intended for pulping are roughly trimmed in the forest and are subsequently cleaned and freed from residual bark in the mill. This latter operation may be performed either by hand or machine; hand trimming wastes less wood, but costs more in labour. Thick logs suffer less loss, in proportion, than slender logs. The loss of wood in the barking operation may be determined either by measuring or by weight, the latter method being preferable. The results actually obtained must be corrected so as to show the loss of real wood as distinct from the bark proper; they must also be calculated on the dry substance. A fresh spruce log contains 25—30 per cent. of moisture in its heart-wood and 60—70 per cent. in the outer rings. As the result of storage this relation may change, and the outer portions become drier than the centre, or else as the result of rain they may become still wetter than before. The extent of the preliminary removal of the bark, the season of felling, and the length of storage all influence the relative proportions of moisture in the outer and inner layers. In the following table results obtained in the hand trimming of logs of different sizes, which had been felled in the winter, only roughly trimmed in the forest, and stored for a year, are given.

Diameter of logs.	Dry substance.		Total loss of dry substance.	Weight of true bark.	Loss of wood with bark.	
	In the wood.	In the bark.			On original log.	On trimmed log.
cm.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
10	60.4	55.0	20.0	9.3	10.7	11.8
12	63.0	48.5	18.5	9.1	9.4	10.4
14	68.0	60.0	17.0	9.5	8.4	9.3
16	65.4	52.1	16.1	9.0	6.2	6.9
18	70.9	55.0	14.2	8.2	6.0	6.5
20	60.2	45.1	13.0	8.7	5.2	5.7

—J. F. B.

Sulphite wood pulp; The rosin-content of — and its effect in paper-making. E. Ahlfors and H. Helin. Papier-Fabrikant, 1909, 7, 287—289.

ROSIN specks in paper may be due either to the size used, or to the presence of resinous impurities in the sulphite wood pulp. The pale French rosins, when used for making size are particularly liable to form sticky deposits, owing to the fact that, in order to preserve their pale colour, the distillation of the turpentine is not carried so far as in the case of dark varieties of rosin. The possibility of rosin specks is greater the higher the proportion of free rosin in the size. According to Dalén, rosin specks due to this size, give off the characteristic odour of rosin when touched with a hot needle; they are also more readily soluble in

ether or alcohol than rosin specks derived from the wood pulp. The latter are generally larger, more irregular, and darker than size specks, and they generally occur in combination with calcium sulphate or sulphite. In the case of a resinous pulp, the rosin gradually agglomerates in the beating engines, stuff-chests, and paper machine to form lumps which, when carried forward in the paper, are deposited, and according to circumstances, cause tearing or puncture of the paper at the couch-roll, stoppage of the wires, sticking at the press-rolls, finally appearing as specks in the paper. Pulp which contains much rosin presents the peculiarity of requiring far more beating than clean pulp of a similar degree of boiling. Sometimes it is necessary to give the resinous pulp double the usual time of beating, with the result that the wearing qualities of the paper suffer. The treatment during the boiling of the wood, has no particular influence on the rosin-content of the pulp; provided the treatment is sufficient to dissolve the lignin, it is also sufficient to decompose the polyterpenes which exist in combination with the rosin. But if the pulp and the digestion liquor be allowed to cool in presence of each other after boiling, the rosin is re-deposited on the fibres and is not readily removed by washing. In order to obtain a clean pulp, the liquor should be drained off the pulp as hot as possible, and the stuff should then be washed with hot water. It is possible to eliminate the terpenes by steaming the wood, previous to boiling, for several hours at a sufficiently high temperature, and removing the condensed water. If the wood be stored for several months after felling, a considerable portion of the turpentine exudes, whilst the remainder is converted into a less objectionable form. Finally, an advantage may be derived by treating the pulp in the breakers or separators with a hydrocarbon, which dissolves the rosin and carries it away with the wash-waters. Certain pulp-makers trace a connection between an excess of lime in the digestion liquors, or the use of weak digestion liquors, and a resinous product.—J. F. B.

Tapioca and palm starches for paper-making. F. Virneisel. Papier-Fabrikant, 1909, 7, 335—338.

In Germany, potato starch is the variety generally used for paper making, on account of its lower price as compared with the cereal starches which find favour in England. As substitutes, the author has investigated two starches from German East Africa, viz., tapioca starch and the starch from a species of palm, *Tacca pinnatifida* Forst. African tapioca starch has a pale yellow colour; considering the crude methods employed in its refining, it is remarkably free from residues of the cellular tissue of the plant, consequently it should present no difficulty in manufacture. Contrary to Wiesner's observations, the sample of tapioca starch examined, contained only a minority (about 33 per cent.) of twin granules or their components, the majority being of fairly regular spherical form. The dimensions ranged from 5 to 35 μ , the most common size being 18—20 μ , thus resembling maize and wheat starches. The hilum is generally distinct, being stellate in the larger granules; no stratification is visible. Gelatinisation begins at 55° C., and is complete at 64° C. The starch of *Tacca pinnatifida* had a yellowish colour, and was perfectly free from tissue residues. Its microscopic appearance closely resembles that of tapioca starch, with the exception that a larger proportion of the granules are or have been aggregates, and a smaller proportion of spherical granules are present. The limiting dimensions are the same as for tapioca starch, but with a tendency to a higher average. Gelatinisation takes place between 55° and 68° C. These African starches occupy an intermediate position between potato starch and the cereal starches such as wheat and maize. Their pastes, whether made with hot water or with caustic alkali, are likewise intermediate in character between the compact, stiff-setting pastes of potato-starch and the more fluid, slimy pastes of the cereal starches. In alkaline solution the tapioca starch has a darker colour than the *tacca* starch. These starches are considerably cheaper than the cereal starches, and are already employed outside Germany for textile finishes; there is no reason why they should not find a place in the paper industry.—J. F. B.

PATENTS.

Paper. M. B. Diskin, New York. U.S. Pat. 914,394. March 9, 1909.

TOBACCO waste is steamed until all deleterious matter is removed, after which the residue is converted into pulp, and the pulp made into paper.—A. G. L.

Copying paper; Manufacture of —. A. and M. Pidelaserra y Brias, Barcelona, Spain. Eng. Pat. 5963. March 17, 1908.

SEE U.S. Pat. 901,824 of 1908; this J., 1908, 1130.—T. F. B.

Treating partially-tanned leather [with waste sulphite-cellulose lyes]. U.S. Pat. 916,057. See XIV.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Quinine in cinchona bark; Determination of —. W. Duncan. Pharm. J., 1909, 82, 429—430.

THE author finds that if 10 grms. of sodium sulphate be dissolved in 100 c.c. of a solution containing 0.1 gm. of anhydrous quinine sulphate, and the whole kept for 24 hours at a temperature not above 3° C., the quinine sulphate is precipitated practically quantitatively. At higher temperatures the separation of the alkaloid is less complete; at 12° C., under otherwise similar conditions, 0.0051 gm. remains dissolved. Under the same conditions and even at greater concentrations, the sulphates of quinidine, cinchonine, and cinchonidine remain dissolved. In making use of this difference for the determination of quinine in cinchona bark, the sulphuric acid solution of the total alkaloids is exactly neutralised with sodium hydroxide solution and 10 grms. of sodium sulphate added per 100 c.c. of solution. After 24 hours, the quinine sulphate is filtered off, and either washed with water saturated with quinine sulphate, dried, and weighed; or, preferably, washed with a small quantity of 10 per cent. sodium sulphate solution, dissolved in alcohol, and titrated with N/20 alcoholic sodium hydroxide solution, using phenolphthalein as indicator.—A. S.

Aconite root and preparations; Modification of the U.S. Pharmacopœia method for alkaloidal valuation of —. H. Bernegau. Amer. J. Pharm., 1909, 81, 122.

TWELVE grms. of powdered aconite root are shaken occasionally for four hours with 100 c.c. of ether, 21 c.c. of chloroform, and 12 to 15 c.c. of saturated sodium bicarbonate solution. An aliquot part of the ethereal solution (say 60 c.c.=6 grms. of drug) is then filtered off, and shaken in succession with 50, 40, and 30 c.c. of 1 per cent. sulphuric acid solution. Without waiting for complete separation of the emulsion, the aqueous portions with the emulsified layer are run off and mixed in another separator; on shaking these, almost complete separation takes place at once. The clear liquid is drawn off, and the remaining emulsion and froth is washed with another 30 or 40 c.c. of 1 per cent. sulphuric acid solution, the separated liquid being mixed with the other acid liquid. The determination of the alkaloid is then continued as directed in the U.S.P., using cochineal as indicator in the titration.—J. O. B.

Alkaloidal extracts; Deterioration of — by keeping [due to presence of moisture]. H. Ribaut. Bull. Sci. pharm., 1908, 15, 495—503. J. Fricotel, *ibid.*, 687—691.

RIBAUT has observed a marked loss in total alkaloids in a series of extracts from solanaceous plants, kept for 4 years. This loss varied in different batches of the same extract; in the case of extract of belladonna herb, it was from 3 to 45 per cent. of the total alkaloids. Belladonna root extract lost from 1 to 12 per cent.; henbane herb extract, 69 per cent.; henbane seed extract, from 19 to 24 per cent., and stramonium extract, from 8 to 31 per cent.

Fricotel has determined monthly the alkaloidal loss in a series of extracts for a period of 8 months: the extracts experimented with being belladonna herb and root, henbane herb and seed, stramonium, hemlock, aconite, and opium. The results confirm those of Ribaut. It is found, however, that when these extracts are dried, they all retain their alkaloids practically unaltered during a period of 6 months. Dried extracts of alkaloidal drugs should, therefore, replace the soft, moist extracts at present used in pharmacy.—J. O. B.

Aloes from Sicily. G. Conde-Vissichio. Arch. Pharm., 1909, 247, 81–95.

THE author has examined a species of aloes indigenous to Sicily (*Aloë vulgaris* Lamarek). The drug prepared from the sap contains a large proportion of aloin (sicaloin), together with a small amount of emodin. Sicaloin, $C_{15}H_{10}O_7$, is a white crystalline powder, which forms colourless solutions with ethyl or methyl alcohol, acetic acid, or pyridine, and pale yellow solutions with alkalis, or hydrochloric acid. It contains one methoxyl grouping. Its properties differ from those of other aloins previously described.—F. SHDN.

Viburnum nudum; Fruit of —. R. H. Lott. Chem. News, 1909, 99, 169–171.

FROM the dried fruits of the shrub, *Viburnum nudum*, which is common in swampy regions from the New England States to Florida, the author has extracted two sugars, probably dextrose and levulose, and an oil related to olive oil (present in the kernel). The percentage of total sugar in the fruits was 42.85. Albumin, citric and tartaric acids, and a little malic acid were also found. Analysis of the ash showed: silica 2.11 per cent., alumina 3.88, ferric oxide 3.88, calcium oxide 7.66, magnesia 1.87, potassium oxide 12.87, sodium oxide 16.79, sulphur trioxide 27.14, and phosphoric oxide 12.89.—F. SHDN.

"Stachyose" in white jasmine (Jasminum officinale, L.). J. Vintilescu. J. Pharm. Chim., 1909, 29, 336–339.

THE twigs of white jasmine, gathered in December, were extracted with boiling water in the presence of excess of chalk. The filtrate was evaporated under reduced pressure, and the residue extracted with alcohol to remove mannitol. The substance remaining was dissolved in water, alcohol added, and the liquid filtered. The filtrate was treated with lead acetate, filtered, and the excess of lead removed. Barium hydroxide was added, followed by the addition of alcohol, which caused a precipitate. The precipitate was removed, dissolved in water, and the barium removed by means of carbon dioxide. The filtrate was evaporated and the residue crystallised from alcohol. The substance thus obtained melts at 100°C . in a capillary tube. It dissolves in water, and does not reduce Fehling's solution till after boiling with a mineral acid. In aqueous solution it has $[\alpha]_D^{20} = +132.2^{\circ}$ to $+132.98^{\circ}$. It is oxidised to mucic acid by nitric acid. The molecular weight is 630. It agrees in its properties with the stachyose, $C_{24}H_{42}O_{21}$, of Schulze and von Planta (see Tanret, this J., 1903, 888).—F. SHDN.

Calcium citrate and lemon juice; New method of analysis of —. L. and J. Gadais. Bull. Soc. Chim., 1909, 5, 287–289.

TWENTY grams of calcium citrate are boiled with 20 c.c. of distilled water and 25 c.c. of hydrochloric acid, the solution is cooled, made up to 250 c.c. and filtered. 25 c.c. of the filtrate are placed in a porcelain crucible, and treated with $N/1$ potassium hydroxide until a drop of phenolphthalein is just coloured rose; a few drops of $N/1$ hydrochloric acid are then added and 1 c.c. of saturated calcium chloride solution. The liquid is concentrated to 25 c.c. and filtered whilst hot, the crystalline precipitate being washed on to the filter and washed several times with boiling water before being dried at 105°C . The calcium citrate adhering to the crucible and stirrer is dissolved in 4 drops of $N/1$ hydrochloric acid, the main filtrate added, the liquid neutralised with ammonia, and concentrated to 15 c.c. It is again filtered whilst hot, and the precipitate collected, washed, and dried as before.

The process is repeated a third time. The dry precipitates are united in a platinum crucible and calcined: the colourless ash is transferred to a porcelain dish and the crucible washed out with 30 c.c. of $N/1$ hydrochloric acid to dissolve the remaining carbonate and this acid used to dissolve the rest. The liquid is boiled to expel carbon dioxide, and the excess of acid neutralised with $N/1$ potassium hydroxide. In analysing lemon juice, 120 c.c. are made up to 1000 c.c., 25 c.c. are taken, neutralised, 20 c.c. of calcium chloride added and the process carried out as above.—E. F. A.

Turpentine (pinene); An aldehyde from —. C. Harries and H. v. Splawa-Neyman. Ber., 1909, 42, 879–880.

PINENE obtained by distillation from French turpentine oil was dissolved in glacial acetic acid and treated with ozone. The solution was heated on the water-bath and fractionated. The fraction boiling between 100° and 140°C . at 12 mm. reduced Fehling's solution. It yielded a disemicarbazone, $C_{12}H_{22}N_4O_2$, melting at 214° – 215°C . Probably pinonic aldehyde was produced by the action of ozone upon pinene.—F. SHDN.

Camphor exports from Formosa. Board of Trade J., April 15, 1909. [T.R.]

THE exports of camphor from Formosa in 1908 showed a falling-off of about 33 per cent. as compared with 1907. The distribution of the export for the two years was as follows:—

	1907.	1908.
To—	lb.	lb.
Hong-Kong, ultimate destination Europe	1,304,933	561,600
United Kingdom	548,000	460,000
India via Hong-Kong	—	4,000
France	—	278,666
Germany	—	53,333
United States	588,900	870,400
Japan	—	536,734
Transhipped at Kobe—		
To United States	1,046,400	—
" India	33,333	—
Total	4,121,566	2,764,733

THE total export to Europe in 1908 was 1,353,599 lb., as against 2,452,933 lb. in 1907, a decrease of 1,099,334 lb. The serious decrease in the export of camphor is due chiefly to the competition of synthetic camphor and the increased export from China, assisted by the low price of silver in the latter country.

Borneol, camphor, and isoborneol; Action of potassium hydroxide on —. Racemic campholic acid. M. Guerbert. Compt. rend., 1909, 148, 720–723.

THE author has previously shown that when *d*- or *l*-borneol is heated at 250° – 280°C . with potassium hydroxide, most of the substance is converted into the corresponding campholic acid. It is now found that camphor is present in the products of the reaction: this transformation of borneol into camphor implies a loss of hydrogen, whilst camphor can combine with nascent hydrogen to form borneol. There is therefore formed an equilibrium mixture of the two and this explains the simultaneous presence of camphor and borneol in all the author's experiments. The yield of campholic acid in the above reaction becomes almost theoretical when camphor is heated with twice its weight of anhydrous potassium hydroxide in a sealed tube at 280° – 290°C . Isoborneol, heated under the same conditions, furnishes an inactive campholic acid identical with the racemic acid resulting from a mixture of the *d*- and *l*-acids. *r*-Campholic acid crystallises in transparent hexagonal tablets, melting at 109° . 100 parts of alcohol dissolve 19.8 parts of the acid at 80°C . The sodium salt has the formula, $C_{15}H_{17}O_2Na \cdot 8H_2O$; the anhydride, $(C_{15}H_{17}O_2)_2O$, melts at 66°C . and the amide at 90°C .—J. C. C.

d-Limonene nitrosochloride and a new carvoxime.
E. Deussen and A. Hahn. Z. Riech- u. Geschmacksstoffe, 1909, 1, 25–26.

THE nitrosochloride of *d*-limonene was treated with sodium methoxide to convert it into carvoxime. The crystals of *l*-carvoxime (m. pt. 72° C.) which separated were removed, and the remaining oil benzoylated. The product was crystallised from light petroleum, when a benzoylcarvoxime was obtained, which melted at 77° C. after crystallising from dilute alcohol, and which had $[\alpha]_D^{20} = +75.3^\circ$ in benzene. On hydrolysing with alcoholic potassium hydroxide, *d*-carvoxime, $C_{10}H_{14}NOH$, was produced. This crystallises from dilute alcohol in glistening needles melting at 57°–58° C., and has $[\alpha]_D^{20} = +68.3^\circ$ in benzene. The author proposes the name α -carvoxime for the *l*-carvoxime of m. pt. 72° C., and the name β -carvoxime for the new carvoxime described above.

—F. SHDN.

Essential oils; Constituents of —. *Enolisation of camphenilanaldehyde. Production of terpinolene by the inversion of carvenene.* F. W. Semmler. Ber., 1909, 42, 962–966.

By treating camphenilanaldehyde with acetic anhydride and sodium acetate, *enol*-camphenilanaldehyde acetate, $C_{15}H_{18}O_2$, is produced. This substance boils at 113°–116° C. at 10 mm., and has the sp. gr. 1.0125 at 20° C., and $n_D^{20} = 1.4816$. On oxidation with ozone, camphenone is produced. When the *enol*-acetate is reduced with sodium and alcohol, camphenyl alcohol, $C_{10}H_{16}O$, is produced, which boils at 105°–106° C. at 10 mm., and melts at 58°–59° C. It is also produced by reduction of the aldehyde. Camphenilanaldehyde must therefore possess a labile hydrogen atom in close proximity to the aldehyde grouping. The “terpinene” produced from sabinene mono- or dihydrochloride is found to contain small amounts of terpinolene, when tested with bromine in amyl alcohol. Carvenene prepared from carvenone contains no terpinolene. When inverted to *iso*-carvenene by means of alcohol and sulphuric acid (this J., 1909, 258), a small amount of terpinolene is formed at the same time.

—F. SHDN.

Ylang-ylang oil. Chem. and Drug., 1909, 74, 534.

THE production of ylang-ylang oil in the Philippines has increased enormously in recent years, the exports (including packages, which amount perhaps to nineteenth of the whole) in the period 1904–7 being 10,917, 13,395, 27,909, and 27,036 kilos, respectively. The industry is carried on mainly in Manila, but also in the provinces of Mindoro, Albay, and the Camarines. The provincial distillers are at an advantage compared with those in Manila, in that they get their flowers cheaper and of better quality, but as the provincials are not so careful in distilling, their oil is generally inferior. In the distillation of the first grade of oil, the only points requiring special attention are that the distillation be conducted slowly, with clean steam, and that not more than 1 kilo. of oil be collected from 400 kilos. of flowers. Any further oil obtained should be kept separate and sold as second class. The distillation-apparatus should be lined with block tin or nickel throughout. Twenty-three samples of first-grade oil and sixteen samples of the second-grade product gave the following results:—

	First-grade oil (23 samples).	Second-grade oil (16 samples).
Specific gravity (30–34° C.)	0.827 to 0.949	0.896 to 0.940
Optical rotation	$[\alpha]_D^{20} = -26^\circ$ to -49.7°	-27.7° to -87.0°
Refractive index (at 30° C. for D line)	1.4747 to 1.4940	1.4838 to 1.5082
Ester value	95 to 129.7	49 to 94

These results all indicate that an oil with a low refractive index, low rotation, and high ester value, is certain to be good. Distillation experiments conducted *in vacuo* showed that of a first-grade oil 50 per cent. will pass over below 100° under 10 mm. pressure. The common adulterants of Philippine ylang-ylang oil are said to be alcohol,

turpentine oil, and coconut and other fixed oils. Samples of a highly refined turpentine oil are said to be prepared for the use of ylang-ylang distillers, who are stated to sprinkle it on the flowers before distillation. Turpentine oil is best detected by distilling 100 c.c. of the oil under 10 mm. pressure, when not more than 1 c.c. should come over below 65° C. Pinene is readily found in such a low-boiling fraction by the usual methods. Alcohol and coconut oil can be detected by the ordinary tests. (See also this J., 1908, 875.)

Cinnamic acids; The isomeric —. E. Billmann. Ber., 1909, 42, 182–188.

THE author points out that there are three isomeric cinnamic acids: Liebermann's isocinnamic acid, m.pt. 57° C.; Erlenmeyer, sen.'s isocinnamic acid, m.pt. 38°–46° C.; Liebermann's allocinnamic acid, m.pt. 68° C. The author considers that these three acids constitute a case of trimorphism. One isomeride may be readily converted into the other if precautions are taken to exclude all traces of the other acids during the experiments. If a tube containing allocinnamic acid is closed by a cotton-wool plug, heated in a steam-oven to 100° C., and cooled in ice, it solidifies and will then melt at 41° C. (Erlenmeyer's acid). If the acid melting at 41° C. is heated to 44° C., and a trace of the acid of m.pt. 58° C. added, it at once solidifies, and then consists of Liebermann's isocinnamic acid, m.pt. 58° C. This can be converted into allocinnamic acid by heating to 64° C. and adding a crystal of allocinnamic acid. Similar results are obtained when these acids are crystallised from light petroleum.

—F. SHDN.

Allo- and isocinnamic acids. C. Liebermann. Ber., 1909, 42, 1027–1036.

THE author confirms the results of the experiments by Billmann (see preceding abstract) on the isomeric cinnamic acids. He finds that both the isocinnamic acids (m. pts., 42° C. and 58° C.) can be converted into allocinnamic acid by certain mechanical and chemical means, such as rubbing in a mortar. Contrary to Billmann, the author finds that when allocinnamic acid is crystallised from light petroleum, isocinnamic acid, m.pt. 58° C., is only occasionally, instead of always, obtained. The acids are stable by themselves over the following temperature intervals; acid melting at 42° C. from 0 to 120° C.; allocinnamic acid up to 80° C., and the acid melting at 58° C. up to 70° C.—F. SHDN.

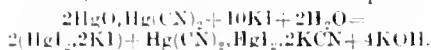
Mutual solubility effect of aqueous solutions of ether, chloroform, phenol, etc. H. Fühner. Ber., 1909, 42, 887–889.

WHEN saturated aqueous solutions of ether and chloroform are mixed, a turbidity is produced, and, on allowing the mixture to stand, drops containing ether and chloroform separate out and the solution becomes clear. This observation is of importance in pharmacology as it may explain why a mixture of ether and chloroform has a more pronounced action than the components. Further, concentrated aqueous solutions of other substances have been examined, phenol and chloroform solutions remain clear when mixed, but phenol and ether solutions give a turbidity. Benzene solutions mix clearly with those of ether, chloroform, and phenol, and solutions of light petroleum, carbon bisulphide, and ethyl chloride behave similarly. Amyl alcohol solution remains clear with chloroform or ether solutions but gives a milky turbidity with phenol solution. Ethyl acetate solution mixes clearly with ether solution, but gives a turbidity with chloroform or phenol solutions.—J. C. C.

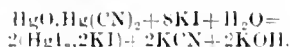
Mercuric oxycyanide. E. Rupp and S. Goy. Arch. Pharm., 1909, 247, 100–107.

WHEN a solution of mercuric cyanide is treated with potassium iodide, the following reaction takes place: $2Hg(CN)_2 + 2KI = Hg(CN)_2.HgI_2.2KCN$. The solution of the triple salt thus formed has an alkaline reaction to litmus and gives up half of its hydrocyanic acid when treated with acids. When excess of potassium iodide is added, mercuric-potassium iodide and potassium

cyanide are produced: $\text{Hg}(\text{CN})_2 + \text{HgI}_2 + 2\text{KCN} + 6\text{KI} = 2(\text{HgI}_2 \cdot 2\text{KI}) + 4\text{KCN}$. When the resulting solution is concentrated, crystals of the triple salt separate. The reaction between mercuric oxycyanide and potassium iodide varies according to the amount of the latter substance present. With an insufficient amount of the iodide, the reaction takes place as follows:— $\text{HgO} \cdot \text{Hg}(\text{CN})_2 + 2\text{KI} + \text{H}_2\text{O} = \text{HgI}_2 + \text{Hg}(\text{CN})_2 + 2\text{KOH}$. With a sufficiency of the iodide, the reaction can be represented:—



When excess of potassium iodide is present, the result is as follows:—



The "glistening crystals" formed when a saturated solution of mercuric oxycyanide is treated with potassium iodide (Holdermann's reaction), consist of mercuric iodide. Towards iodine, mercuric oxycyanide behaves as a mixture of mercuric oxide and cyanide. Similar results are obtained with bromine and chlorine. When mercuric oxycyanide is treated with hydrochloric acid, the double salt of mercuric chloride and cyanide is produced. A similar reaction takes place when hydrobromic acid is used in place of hydrochloric acid. When hydriodic acid is used, mercuric iodide and free hydrocyanic acid are produced.—F. SHDN.

Determining alkali iodides. Rupp and Penning.
See XXIII.

PATENTS.

Pancreas preparation suitable for the treatment of diabetes; Manufacture of a —. A. Zimmermann, London. From Chem. Fabr. auf Aktien, vorm. E. Schering, Berlin. Eng. Pat. 8514, April 16, 1908.

The pancreas of a narcotised animal is laid bare, preferably when digestion is at its height, and the veins of the pancreas ligatured to produce stasis. The pancreas is removed after a time, allowed to digest for 24 hours, the albuminous bodies precipitated by alcohol and the filtrate evaporated in a vacuum. The preparation so obtained is a fine, grey, feebly smelling powder, easily soluble in water and dilute soda solution.—F. SHDN.

Mercury compound (mercuric p-aminophenylarsonate); New — and method of manufacturing the same. May and Baker, Ltd., and A. G. Bates, London. Eng. Pat. 8959, April 24, 1908.

MERCURIC salts and salts of p-aminophenylarsonic acid can be made to interact to form mercuric p-aminophenylarsonate. This compound is insoluble in water. It forms with halogen derivatives of alkali metals or metals of the alkaline-earths, compounds which are soluble in water and do not coagulate albumin.—F. SHDN.

p-Aminophenylarsinic acid; Mercury salt of —. W. Grüttemann, Vohwinkel, Germany. Assignor to Farbenfabriken vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 914,408, Mar. 9, 1909.

THE salt is obtained by the action of mercuric chloride on p-aminophenylarsinic acid; it is a white powder, almost insoluble in water, and insoluble in alcohol or ether. Yellow mercuric hydroxide is precipitated when the salt is treated with sodium hydroxide.—W. P. S.

Iron salts; Manufacture of therapeutically valuable —. C. Sorger, Frankfurt on Main, Germany. Eng. Pat. 23,330, Nov. 2, 1908.

THE alkali salts of phosphoric and tartaric acids, phosphoric and citric acids, arsenic and tartaric acids, or arsenic and citric acids, are treated with soluble iron salts. The formation of the new salts may also be brought about by the addition of a given amount of tartaric or citric acid to iron phosphate or arsenate; or by addition of phosphoric or arsenic acid to iron tartrate or citrate.—F. SHDN.

Ortho-dioxyphenylalkamines; Manufacture of optically active —. Farbwerke vorm. Meister, Lucius, und Brüning. Eng. Pat. 3021, Feb. 8, 1909. Under Int. Conv., July 31, 1908.

SYNTHETIC racemic o-dihydroxyphenylalkamines, such as synthetic suprarenine, for instance, can be resolved into their optically active isomerides by treatment of their tartrates. d-Suprarenine obtained in this way is identical with the natural product. (See this J., 1909, 107.)

—F. SHDN.

Phenoxydialkylaminopropanols and their acyl derivatives; Production of —. Etah, Poulenc Frères and E. Fournéau. Fr. Pat. 395,470, Dec. 28, 1907.

SECONDARY amines are allowed to act upon phenylglycidic ether, or phenoxychloropropanol, when combination between the two takes place with the formation of a phenoxydialkylaminopropanol. The substance may then be treated so as to esterify the alcoholic hydroxyl grouping.—F. SHDN.

Aldehydes; Process of making —. C. Ellis, White Plains, N.Y., and K. P. McElroy, Washington, D.C. U.S. Pat. 915,946, March 23, 1909.

FORMALDEHYDE can be made by exposing a metallic formate to a regulated heat in the presence of a current of gas of regulated composition, which carries away the formaldehyde. The formaldehyde thus formed can be recovered by condensation. The formate can be brought to the point where it is heated in a thin, continuous travelling layer. Other aldehydes can be produced in a similar manner.—F. SHDN.

"Blackboy"; Industrial utilisation of the tree commonly known in Australia as —. R. W. Wallace and G. Reynaud. First Addition, dated Dec. 24, 1907, to Fr. Pat. 394,234, Nov. 20, 1907. (See this J., 1909, 255.)

THE bark and other portions of trees of the *Xanthorrhoea* (Blackboy, Grass-tree, etc.) are ground and treated with water. The woody portions float to the surface and can be removed, whilst the resinous portions settle to the bottom in a compact mass. The resin contains sugar which can be used to form alcohol, which in its turn can be used to extract the gum-resins. Substances such as camphor and benzoin can be obtained from trees of this type by steam-distillation.—F. SHDN.

Camphene and isobornyl esters from pinene hydrochloride; Process for preparing —. G. Wendt. Ger. Pat. 207,888, June 23, 1908.

SOLID pinene hydrochloride (2 parts), glacial acetic acid (4 parts), and glacial phosphoric acid (1 part) are heated under a reflux condenser, at 150° C., for one hour, when a further quantity of phosphoric acid (1 part) is added. After 14 to 24 hours, all the hydrochloric acid will have been separated. The resulting isobornyl acetate always contains camphene in solution; the product can be now saponified and oxidised to camphene or "hydratised." Other organic acids may be employed in place of acetic acid, or the process may be carried out by means of phosphoric acid alone.—T. F. B.

Amides of higher fatty acids; Process for the manufacture of —. O. A. H. H. Kösters, Hemelingen, and L. Ottmann, Bremen, Germany. U.S. Pat. 915,680, March 16, 1909.

SEE Eng. Pat. 6731 of 1907; this J., 1907, 637.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Chromated gelatin films; Electrical method for measuring the changes produced in — on exposure to the light. H. Mayer. Z. physik. Chem., 1909, 66, 33–70.

THE films were produced by pouring on to carefully cleaned glass plates a solution of 4 grms. of soft emulsion-gelatin and 0.5 gm. of potassium bichromate in 96 grms.

of water, and the changes produced on exposure to light were followed by measurements of the electric conductivity. It was found that on exposure to light the conductivity of the gelatin decreased; for the normal time of exposure (1 hour) this decrease amounted to several per cent. of the original conductivity. The percentage alteration of the conductivity was independent of the initial conductivity of the film (before exposure). The conductivity of the chromated gelatin increased rapidly with rising temperature, but the temperature coefficients for the films before and after exposure were different. Comparative measurements of the conductivity must always be made under identical conditions with respect to the humidity of the surrounding atmosphere, as variations in this had a considerable effect on the conductivity. The sensitiveness to light of chromated gelatin, as measured by the percentage alteration of its conductivity decreased with increase of the age of the film, at first rapidly and then more and more gradually. The changes in conductivity produced on exposure to light continued for a certain time on subsequently keeping the film in the dark.

—A. S.

XXII.—EXPLOSIVES, MATCHES, &c.

Guncotton and nitroglycerin; Improvements in production and application of—F. L. Nathan. Royal Institution, Jan. 29, 1909. (See this J. 1908, 193; 1909, 177.)

IN this communication, British Service powder cordite was described, with its preparation, mode of testing, etc. Cordite originally consisted of nitroglycerin, 58 parts; guncotton (insoluble in nitroglycerin), 37 parts; and mineral jelly, a product of the distillation of crude petroleum, 5 parts. To effect the gelatinisation of the guncotton, acetone is employed. A nitroglycerin powder is more powerful than a nitrocellulose powder, and the more nitroglycerin present the more powerful the explosive. Therefore, for equal ballistics, a smaller charge of the former than of the latter is required, and, consequently, the chamber capacity and the size and weight of the breech mechanism are reduced; on the other hand, the higher the proportion of nitroglycerin the higher is the temperature of combustion, and the greater the erosive effects on the surface of the bore of the gun. The presence of nitroglycerin in an explosive allows of the more easy and rapid elimination of the solvent used in manufacture, and of moisture, a small quantity of which is always present in nitroglycerin and guncotton. Nitroglycerin powders are cheaper than nitrocellulose powders, weight for weight, and even more so for equal ballistic effects. The original cordite, the manufacture of which commenced in 1890, contained a high proportion of nitroglycerin (58 per cent.), and the erosion produced, especially in large guns, was considerable. In 1901, a modified cordite known as "cordite M.D.," consisting of nitroglycerin, 30 per cent., guncotton, 65 per cent.; and mineral jelly, 5 per cent., was introduced. The constants of explosion of cordite and cordite M.D., determined at the Royal Gunpowder Factory, are as follows:—

Explosive.	Density of loading.	Heat of explosion at constant volume, water gaseous.	Total gases, water gaseous at 0° C., and 760 mm.	Temperature of explosion.
		Calories per grm.	cc. per grm.	°C.
Cordite	0.2	1156	871	2663
Cordite M.D.	0.2	965	920	2374

This shows a decrease in the heat of explosion of about $16\frac{1}{2}$ per cent. and an increase in the volume of gases of about $5\frac{1}{2}$ per cent., whilst there is a decrease of 289° C. in the temperature of explosion. As would therefore be expected the erosion produced by cordite M.D. is very much less than that produced by the original cordite for the same ballistics, and is certainly not greater, if as great, as that produced by the best forms of nitrocellulose

explosives. Although of minor importance to smokelessness, flamelessness is a desirable quality for propulsive explosives to possess. In this respect cordite M.D. is superior to cordite in the case of rifles and machine guns. A suitable ingredient has not yet been discovered which will render smokeless powders flameless in large guns. A third ingredient in both kinds of cordite, viz., mineral jelly, although present in a comparatively small proportion, is a very important constituent. Cordite, in the advanced experimental stage, consisted of nitroglycerin and guncotton alone, and as their combustion produced no solid residue of any kind, the surface of the bore of the magazine rifle in which the early experiments took place was not fouled in any way. The result was that the cupro-nickel coated bullets, propelled in succession at high velocity through a clean barrel, deposited some of the cupro-nickel in the bore. In order to prevent this a number of substances were incorporated with the nitroglycerin and guncotton, with the object of producing a deposit in the bore, which it was hoped would get rid of the difficulty of metallic fouling. Of all these various substances the one which appeared to answer the purpose most satisfactorily was refined vaseline, and this material became the third ingredient of cordite, as eventually introduced into the British Service. When the manufacture was commenced on a large scale, vaseline was replaced by mineral jelly, the same material, but in a cruder form. The original object with which mineral jelly was introduced was of no importance when cordite was substituted for the black and brown powders used in large guns, but in order to have but one kind of smokeless powder in the service, mineral jelly was added to all cordite whether for use in small arms or artillery. Subsequent experience has demonstrated how very fortunate was the selection of this material for rifle cordite and the extension of its use to all sizes of cordite. Mineral jelly is one of the best ingredients it is possible to have in smokeless powders from the point of view of their chemical stability. This important fact, not recognised originally, was brought out in the following way: In order to facilitate the explosion of cordite in blank ammunition for the rifle, it was cut into very thin flakes and the non-explosive mineral jelly was omitted from its composition. After a comparatively short storage in a hot climate, the stability of the smokeless blank, as it was called, was found to have suffered seriously, whereas the stability of normal cordite containing mineral jelly was not appreciably affected. These facts led to a thorough investigation at Waltham Abbey, of the action of mineral jelly in preserving the stability of cordite, and it was discovered that mineral jelly contained constituents which had the valuable property of combining with the decomposition products (the result of prolonged storage of cordite at high temperatures) to form stable bodies, thus removing these decomposition products, which undoubtedly exert a deteriorating influence on the cordite, from their sphere of action. Smokeless powders are all subject to deterioration, and there is very little doubt that this deterioration is for any given explosive a function of the temperature of storage. The higher the temperature, the more rapid the deterioration. The necessity therefore of some quantitative test which would enable a judgment to be formed as to the extent of deterioration suffered by any given sample of cordite is obviously of great importance, because such a test would afford the means of determining how much longer it would be safe to store any given batch of cartridges or lot of cordite at any given temperature. Any such test must be a heating test, and it must be possible to co-relate the temperature and duration of the test with any given temperature and duration of storage. The rate of deterioration as a function of the temperature was determined by Will for guncotton, and later by Robertson at Waltham Abbey for nitroglycerin. From these and other experiments carried out at Waltham Abbey, a factor of increase in rate of deterioration of cordite with increase of temperature was deduced. This factor having been determined, what is known as the "silvered vessel test" was worked out at the Royal Gunpowder Factory. In this test, cordite is heated in a specially designed vessel at 80° C., a temperature not too far removed from those to be met with when cordite is stored under the

worst service conditions, and the number of hours' heating at this temperature any given sample will stand before it shows signs of active decomposition are ascertained. Then, by means of an equation, containing the factor connecting rate of increase of deterioration with rise in temperature, a calculation can be made converting the hours of heating at 80° C. the sample withstood, to years and fractions of a year it would stand at any given temperature of storage, and therefore a knowledge is obtained of how much longer it would be safe to store this cordite at any given temperature. This test was applied to a considerable number of samples of known age and thermal history. From these data and knowing the number of hours at 80° C. that newly-made cordite of good stability will stand before showing signs of decomposition, the number of hours that the different samples should stand the test were calculated. When the samples were actually tested, the number of hours heating at 80° C. they withstood, were in close agreement with the number of hours it was calculated they should stand. The form of vessel in which the heating is carried out is the well-known vacuum vessel of Dewar. A glass bulb, silvered externally, is enclosed in an outer bulb, silvered internally. The space between the two is highly evacuated for the purpose of limiting the dissipation of any heat evolved by exothermic changes on the one hand, and on the other for the purpose of minimising the effect of accidental slight changes in temperature of environment. In the centre of the inner bulb is situated the bulb of a thermometer, the stem of which passes through a cork in the neck of the vessel. A side tube is attached for the purpose of making observations on the colour of the gases evolved. For heating the vessel, a bath is provided, with cylinders closed at the bottom, and wide enough to admit the vessel to such a depth as the side tube will permit. The bath is surrounded by insulating materials. The vessels are packed in the cylinders with wool yarn, and the tops of the cylinders are closed with felt discs, to exclude draughts. The bath is fitted with a gas regulator or other means for securing that the temperature of the explosive is kept constant. The cordite is coarsely ground, and 50 grms. are used. Readings of the thermometer are taken at intervals, and the time is noted when a rise of 2° C. in the temperature of the explosive above the temperature of 80° C. occurs. At the same time, visual observations are made as to the colour of the column of gas in the side tube, since it is found that previous to the rise in temperature occurring, orange-coloured fumes of nitric peroxide are evolved. When the temperature exceeds 82° C., the test is complete and the flask is withdrawn. The number of hours which have elapsed since the start of the test is the measure of the stability of the cordite.—G. W. McD.

Committee to investigate the Abel heat test for explosives.
Times, April 27, 1909. [T.R.]

THE Home Secretary has appointed a departmental committee to investigate and report on the best means of standardizing with greater accuracy than at present the apparatus and materials employed in the Abel heat test for explosives, and to examine and report on any supplementary test or tests that may be submitted.

The committee is constituted as follows:—Major A. Cooper-Key (Chairman); Colonel Sir Frederic L. Nathan; Captain A. P. H. Desborough; Mr. F. W. Jones; Captain M. B. Lloyd; Mr. C. O. Lundholm; Major J. H. Mansell, R.A. The secretary of the committee is Major H. Coningham, R.A., to whom correspondence may be addressed at the Home Office.

PATENT.

Explosives; Manufacture of — R. Escales and M. Nowak, Munich, Germany. U.S. Pat. 915,165, March 16, 1909.

SEE Eng. Pat. 21,117 of 1907; this J., 1908, 91.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

Nickel coins; Analysis of — W. J. Van Heteren and H. Van der Waerden. Chem. Weekblad, 1909, 6, 157–165. Chem. Zentr., 1909, 1, 1115.

THE usual method for the analysis of nickel-copper alloys consists in dissolving in nitric acid, separating the copper electrolytically, removing nitric acid from the solution by evaporating with sulphuric acid, adding ammonia and ammonium sulphate, and then separating the nickel electrolytically. The authors find that if a mixture of sulphuric acid with a relatively small proportion of nitric acid (for example, a mixture of 15 c.c. of nitric acid of sp. gr. 1.3, 25 c.c. of sulphuric acid of sp. gr. 1.8, and 40 c.c. of water) be used to dissolve the alloy, the troublesome evaporation with sulphuric acid may be dispensed with, the small quantity of nitric acid left in the solution being without any injurious effect on the electro-deposition of the nickel.—A. S.

Antimony; Determination of — E. G. Beckett. Inaug. Dissertation, Zürich, 1909.

THE author's work comprised a study of the methods for the determination of antimony iodometrically and as trisulphide, tetroxide, and pentoxide, and of the separation of antimony from tin. It was found that gravimetrically antimony can be determined most accurately as trisulphide by the method of Henz (Z. anorg. Chem., 1903, 37, 1) or that of Vortman and Metzl (this J., 1905, 943). Antimony trisulphide precipitated from hydrochloric acid solution always contains chlorine. When dried at 110° C., the red sulphide contains about 1 per cent., and the gray sulphide about 0.5 per cent. of chlorine; on heating in a current of carbon dioxide at 300° C., the major portion of the chlorine is evolved in the form of hydrochloric acid, from 0.15 to 0.3 per cent. remaining behind in the residue, a quantity not sufficient to appreciably influence the accuracy of the results. Antimony sulphide can be obtained quite free from chlorine by heating it to its melting point in a current of hydrogen sulphide. Antimony can be determined accurately as tetroxide if the precipitate be ignited at 800°–900° C. in an electric furnace; at 1000° C., the tetroxide is appreciably volatile. Antimony cannot be determined satisfactorily as pentoxide. The iodometric process yields results comparable with those obtained by the trisulphide method only when the atomic weight of antimony is taken as 122; if the atomic weight 120.2 be used, the results obtained iodometrically are always about 1 per cent. lower than those given by the trisulphide method. The author used pure antimony trisulphide as standard substance in his experiments. For the separation of antimony from tin, Vortman and Metzl's method (*loc. cit.*) is not so good as Henz's modification of Clarke's process (this J., 1904, 133).—A. S.

Sulphates and fluorides; Separation of — R. Ehrenfeld and A. Indra. Chem.-Zeit., 1909, 41, 375–376.

THE substance is mixed in a Rose crucible with ten times its bulk of zinc dust, the mixture is covered with a layer of zinc dust and then heated for half an hour over a strong burner in a stream of hydrogen or purified coal gas. After cooling, the mixture is brought into a flask and a few grams of a mixture of precipitated silica and finely ground alumina added to combine with the hydrofluoric acid. Dilute sulphuric acid is then run in and the resulting sulphuretted hydrogen passed into N/10 iodine, the last traces of the gas being driven out by boiling and by a stream of carbon dioxide. Excess of N/10 thiosulphate is then added and the excess titrated back with N/10 iodine.—H. P. P.

Alkali iodides; Acidimetric determination of — E. Rupp and F. Pfennig. Arch. Pharm., 1909, 247, 108–110.

THE fact that a solution of mercuric cyanide becomes alkaline on the addition of potassium iodide can be used

to determine the amount of iodine present in an iodide by the following method. 1—2 grms. of mercuric cyanide are dissolved in 30—50 c.c. of water in a 100 c.c. flask, and 0.5—1.5 gm. of the iodide added, with a milligram or so of potassium chloride to aid the precipitation. This is followed by the addition of 25 c.c. of $N/2$ hydrochloric or sulphuric acid. The volume of the liquid is made up to 100 c.c., the liquid filtered, and the excess of acid in 50 c.c. of the filtrate determined by titration, using methyl orange as indicator. 1 c.c. of $N/2$ acid corresponds to 0.0635 gm. of iodine as iodide. The accuracy of the reaction is not interfered with by the presence of chlorides, but bromides prevent a sharp colour change with the indicator.—F. SHDN.

Barium carbide, etc. [Determination of carbide-carbon, and of cyanide in presence of carbide and cyanamide]. Kühling and Berkold. See VII.

Acidity of soils. Albert. See XV.

ORGANIC—QUALITATIVE.

Distinguishing genuine gum tragacanth. Scoville. See XVI.

ORGANIC—QUANTITATIVE.

Pitch in coal briquettes. Leo. See II.

Organic and mineral impurities in rubber. Pontio. See XIIIIC.

Sulphur in vulcanised rubber. Pontio. See XIIIIC.

Volatile acids in wines. Malvezin. See XVII.

Quinine in cinchona bark. Duncan. See XX.

Aconite root and preparations. Bernegan. See XX.

Calcium citrate and lemon juice. Gadais. See XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Radium rays; Chemical action of — on water. M. Kernbaum. Compt. rend., 1909, 148, 705—706.

The author allowed the rays emitted from radium to pass through thin glass, an air space, and then into a vessel containing water. In this way the action of the α -rays was eliminated. After a month the gas produced was found to consist of almost pure hydrogen, the corresponding amount of oxygen being found in the water in the form of hydrogen peroxide.—J. C. C.

Oxydases of *Russula delica*; Some new properties of the —. J. Wolff. Compt. rend., 1909, 148, 500—502.

The author has examined the oxydasic enzymes of certain vegetable extracts, particularly the glycerol extracts of *Russula delica*. When acting upon tyrosine and many other substances which respond to their oxidising action, these enzymes exhibit their maximum activity when the medium is approximately neutral to phenolphthalein, whereas malt amylase acts most powerfully in a medium which is neutral to methyl orange. When the neutral point to phenolphthalein is passed in one direction or the other, the oxydasic reactions only take place with great difficulty, particularly on the acid side. The oxydases of *Russula delica* possess the property of oxidising a large number of colouring matters, such as sulphonated alizarin derivatives, cochineal, hæmatoxylin, quinoline blue, Poirrier's orange I., and several colouring matters contained in flowers. Poirrier's orange II., magenta and its derivatives, and methyl orange are not oxidised. Some of these substances are oxidised with equal facility by laccase, e.g., hæmatoxylin and quinoline blue, others are more resistant towards laccase, whilst the soluble derivatives of alizarin, cochineal, and the colouring matters of flowers are not oxidised at all by laccase. If cochineal be decolorised by the *Russula* oxydase and the solution be boiled, the colour is regenerated. The regenerated cochineal is precipitated by uranium acetate in the form of a green lake, whereas the decolorised solution is unaffected by the uranium salt. It is assumed that the *Russula* extract contains a reducing substance which

regenerates the oxidised cochineal colour. If the *Russula* extract be heated to 65° C. it loses its property of oxidising tyrosine, but it is still capable of oxidising the colouring matters mentioned above. The difference between the oxydase of *Russula* and laccase may depend on the presence of a special co-enzyme in the *Russula* extract, but if this be so, the co-enzyme does not resist boiling, since a boiled extract does not render laccase capable of acting on the colouring matters which resist it.—J. F. B.

Hordeum vulgare [barley]; Selective permeability of the coverings of seeds of —. A. J. Brown. Proc. Roy. Soc., 1909, B 81, 82—93.

The results of further experiments (see this J., 1908, 134) show that the selective power of the coverings of the barley corn is confined to the testa and probably to that portion of it which is derived from the epidermis of the nucellus during the development of the seed. The power of the seed contents of attracting water from a saturated solution of sodium chloride slightly exceeds the osmotic attraction of the latter. Experiments with volume-normal and weight-normal solutions of sodium and potassium chlorides and nitrates, copper sulphate, sulphuric acid, tartaric acid, and sucrose show that although the various solutes appear to regulate the diffusion of water into the seeds in a very similar manner, minor differences are always observable. Mercuric chloride and cyanide, which are only slightly dissociated in aqueous solution, diffuse readily into the seeds, but after several days no trace of mercuric salt can be detected in those placed in solutions of mercuric nitrate or sulphate, which are highly dissociated. Similar differences are observed with the slightly dissociated cadmium iodide and the somewhat more highly dissociated chloride and sulphate. Acetic, formic, propionic, and butyric acids pass freely, together with water, into the seeds from their aqueous solutions; the entry of glycolic and lactic acids takes place far more gradually. Trichloro-acetic acid rapidly enters the seeds and is the only strong electrolyte capable of so doing. When the corns are immersed in $N/2$ or $N/4$ ammonia solution, water diffuses into them more rapidly than when water alone is used, ammonia passing in at the same time. Water is absorbed by the seeds from solutions of alcohol, aldehyde, acetone, and ethyl acetate approximately as it is absorbed from acetic acid solution or when the seeds are in contact with water alone; in the anhydrous condition, these substances do not diffuse through the seed-coverings, although they do so readily from their aqueous solutions. Glycerol and glycine produce considerable diminution in the proportion of water absorbed and the same is the case, though to a less extent, with urea and ethyleneglycol. The author suggests that the variations in behaviour exhibited by solutions of different substances may be due to differences in the manner of combination of the solutes with the solvent water.—T. H. P.

Trade Report.

Chemical industry of Norway. Chem.-Zeit., March 30, 1909.

THERE are seven carbide factories in Norway, with a total horse-power of 57,000, and capable of producing 80,000 to 90,000 tons of carbide annually. The export of carbide amounted to 22,600 tons in 1907, and 36,666 tons in 1908. The price fell 15 per cent. during the year, and the increase in the number and size of factories, not only in Norway, but in Italy, France, and Switzerland, makes a further fall probable, as the world's consumption is estimated at no more than 180,000 tons. The manufacture of ferro-silicon is completely suspended on account of the over-production which followed the success of this industry in 1907, when 4,000 tons, valued at £50,000, was exported. The manufacture of superphosphate progresses favourably, and one of the two large concerns manufacturing this article has largely increased its sulphuric acid plant. Several companies are now actively engaged in working up low-grade phosphates into precipitate. The cellulose industry did well in the early part of the year, but during the latter half, production was

reduced 30 per cent. all round by arrangement to meet the falling price. Little good was secured by this measure, however, as the Swedish factories failed to fall into line. The condensed milk industry continues to advance, one large company having increased its output nearly 50 per cent. in the year. The export of iron ore shows a slight set back, and one considerable undertaking has suspended operations. The export of high-grade titaniferous ores, containing up to 40 per cent. of titanic acid, has reached considerable dimensions. The single large cement works was destroyed by fire in May, and thereafter the national demand for cement, some 280,000 barrels per annum, was met by Danish supplies. The factory has, however, been rebuilt and enlarged, and expects to render further imports superfluous. The prospects of the industry are not considered very bright, having regard to the general European over-production of cement.

Mineral production of Germany in 1908. Board of Trade J. April 15, 1909.

THE following are the principal items of the mineral production of Germany in 1908, as compared with the preceding year:

	1907.		1908.	
	Quantity.	Value.	Quantity.	Value.
	Metric tons.	1000 marks.	Metric tons.	1000 marks.
<i>Minerals.</i>				
Coal	143,185,691	1,394,271	148,537,417	1,531,740
Lignite	62,546,671	156,347	66,746,057	169,878
Graphite	4,033	201	4,844	248
Asphaltum	126,649	1,087	80,009	774
Petroleum	106,379	7,056	141,900	9,942
Rock salt	1,287,138	5,989	1,327,453	5,982
Kainite	2,624,412	36,117	2,589,804	37,027
Other potash salts	3,124,956	30,527	3,500,635	33,885
Iron ore	27,697,128	119,186	24,224,762	98,129
Zinc ore	698,425	42,293	706,441	34,985
Lead ore	147,272	20,132	156,842	15,037
Copper ore	771,227	26,702	727,384	25,357
Silver ore and gold ore	8,279	1,126	7,654	862
Cobalt ore	4,878	425	6,081	500
Manganese ore	73,105	881	67,692	815
Pyrites	196,351	1,722	219,455	1,988
<i>Salts (various).</i>				
Salt	665,416	16,473	665,413	18,510
Potassium chloride	473,138	53,108	508,622	56,251
Magnesium chloride	32,891	500	20,775	562
Glauber salts	80,347	2,299	72,667	1,906
Potassium sulphate	60,292	9,310	55,755	8,563
Magnesium sulphate	41,105	870	42,976	826
Potassium magnesium sulphate	32,768	2,654	33,149	2,786
Aluminium sulphate	59,472	3,728	54,122	3,348
<i>Products of reduction works.</i>				
Pig iron	12,875,159	824,077	11,805,321	715,314
Zinc	268,195	96,573	216,490	86,006
Lead, pigs, bars, &c.	142,271	54,479	164,079	46,541
Litharge	4,325	1,772	5,339	1,622
Charger ingots	31,946	61,497	30,001	37,688
Sulphuric acid, undistilled	1,268,813	34,890	1,257,218	34,218
Sulphuric acid, distilled	124,585	5,117	128,522	5,214
<i>Products from pig iron.</i>				
Castings, second fusion	2,553,446	480,824	2,306,678	422,426
Wrought iron and steel—				
a. Crude blooms, mill bars, and cement steel	40,443	4,821	26,300	2,978
b. Finished wrought iron products	617,900	101,722	491,318	75,423
Cast iron and cast steel—				
a. Ingots	670,882	65,634	690,186	58,768
b. Slabs, billets, &c.	1,950,495	191,260	1,899,228	166,265
c. Finished cast iron products	8,736,010	1,310,254	8,126,749	1,161,626

New Books.

JAHRBERICHT ÜBER DIE LEISTUNGEN DER CHEMISCHEN TECHNOLOGIE MIT BESONDERER BERÜCKSICHTIGUNGEN DER ELEKTROCHEMIE UND GEWERBESTATISTIK FÜR DAS JAHR 1908. Bearbeitet von Dr. FERDINAND FISCHER, Professor an der Universität in Göttingen. I. Abteilung: Anorganischer Teil. Otto Wigand, Verlagsbuchhandlung m.b.H., Leipzig. 1909. Price, M.15.

Svo volume, containing 619 pages of subject matter with 256 illustrations, and indexes of authors and subject matter, and also a tabulated list of German patents. The subjects treated of are grouped as follows:—I. Wood, peat, coal and coke. II. Petroleum, paraffin. III. Illuminating gas. IV. Acetylene. V. Water gas. VI. Generator gas, etc. VII. Matches and match compositions. EXTRACTION OF METALS AND METALLURGY. VIII. Iron. IX. Manganese, nickel, chromium, tungsten. X. Copper. XI. Gold. XII. Silver and lead. XIII. Zinc, etc. XIV. Alloys. XV. Metallic coatings. CHEMICAL MANUFACTURE. XVI. Sulphur, sulphurous acid, sulphuric acid. XVII. Ammonia. XVIII. Potash industry. XIX. Sodium chloride and soda. XX. Electrolytic alkali and chlorine. XXI. Chlorine, bromine, and iodine. XXII. Nitric acid, nitrate. XXIII. Explosives. XXIV. Phosphates, artificial manures, etc. XXV. Carbides, nitrides, and silicides. XXVI. Metallic compounds, etc. XXVII. Oxygen and hydrogen. XXVIII. Water. XXIX. Glass: clays, cements; lime. XXX. Earthen-ware. XXXI. Portland cement, slag cements, etc. XXXII. Lime, lime-sandstone, and gypsum. XXXIII. Apparatus. XXXIV. New Books. XXXV. Statistics.

LABORATORY GUIDE OF INDUSTRIAL CHEMISTRY. By ALLEN ROGERS, Ph.D., Instructor in Industrial Chemistry, Pratt Institute, Brooklyn, etc. Archibald Constable and Co., Ltd., 10, Orange Street, Leicester Square, London, W.C. 1908. Price 6s. net.

Svo volume, containing 154 pages of subject matter, and an alphabetical index; also 11 blank pages for memoranda. There are 24 illustrations. The subjects treated of are grouped as follows:—I. General processes. II. Inorganic preparations. III. Dyeing of textile fibres. IV. Commercial organic compounds, coal-tar colours, and synthetic oils. V. Pigments and lakes. VI. Driers, varnishes, paints, and stains. VII. Soap, and allied products. VIII. Leather manufacture. IX. Wood fibre, pulp, and paper. X. Useful data.

THE MANURING OF HOPS. By BERNARD DYER, D.Sc. Vinton and Co., Ltd., 9, New Bridge Street, Ludgate Circus, London, E.C. Price 1s.

PAMPHLET, containing 13 pages of subject-matter, and two sheets of photographic illustrations of crops, under the various manurial conditions. Here are brought up to date, the results of the continuous hop manuring experiments carried on by Mr. Shrivell and the author at Golden Green, Hadlow, Tonbridge, showing the average of the results of thirteen seasons, together with detailed results of the crops of 1907 and 1908.

MODERN ORGANIC CHEMISTRY. (Contemporary Science Series.) By CHARLES ALEX. KEANE, D.Sc., Ph.D., Principal and Head of the Chemistry Department, The Sir John Cass Technical Institute, London. The Walter Scott Publishing Co., Ltd., London and Felling-on-Tyne. 1909. Price 6s. net.

Svo volume, containing 488 pages of subject matter, with twenty-nine illustrations, and an alphabetical index. The subject matter is sub-divided and classified according to the following scheme:—I. Historical development of organic chemistry. II. The structure of organic compounds. III. Classification of organic compounds. IV. The aliphatic hydrocarbons. V. The cyclic hydrocarbons. VI. Melting point and boiling point of organic compounds. VII. The sources of the hydrocarbons. VIII. Hydrocarbon derivatives. IX. Ethereal salts. X. Derivatives of the hydrocarbons containing nitrogen.

XI. The laboratory methods of organic chemistry. XII. Stereochemistry. XIII. The sugars. XIV. Isomeric change and dynamic isomerism. XV. Heterocyclic and polycyclic compounds. XVI. Synthesis of physiologically active organic compounds.

THE CHEMISTRY AND LITERATURE OF BERYLLIUM. By CHAS. L. PARSONS, B.S., Professor of Inorganic Chemistry in New Hampshire College. The Chemical Publishing Co., Easton, Pa. 1909. Price \$2.00. Williams and Norgate, 14, Henrietta Street, Covent Garden, London, W.C.

8vo volume, containing 168 pages of subject matter, with a valuable bibliographic list of works on beryllium (pages 72-168), and indexes of authors and subjects. The subject matter is classified as follows:—I. Discovery and history. Preparation from beryl. II. Metallic beryllium. III. Normal compounds of beryllium. IV. Acid salts. V. Double salts. VI. Basic compounds.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

7769. Walker. Driers for rotary kilns. April 1.
8180. Pearce. Cleaning or removing suspended matter from gaseous media. April 5.
8260. Cowper-Coles. Consumption of smoke. April 6.
8299. Dewhurst. Furnaces. [U.S. Appl., April 7, 1908.]* April 6.
8469. Richardson. Evaporating tanks or vessels for acid, liquors, &c. April 8.
8481. Blakeley. Apparatus for washing, cooling, and heating gases or liquids. April 8.
8541. Boulton (Bradley). Drying apparatus. [Comprised in No. 25,299 of 1908.]* April 8.

COMPLETE SPECIFICATIONS ACCEPTED.

- 2479 (1908). Nichols. Separation of the liquid and solid components of wet slimes or ore pulp. April 15.
7613 (1908). Brougham (Preyss). Raising the temperature of substances containing bodies sensitive to change, especially physiologico-chemical substances. April 15.
9384 (1908). Kirkham, Hulett, and Chandler, Ltd., and Hersey. See under II.
14,674 (1908). Featherstone. Filters. April 7.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

7452. Fabry. Recovering ammonia from coal gas. March 29.
7470. Stern. Apparatus for use in producing gas.* March 29.
7780. Duff, and Gas Power and By-Products Co., Ltd. Gas producers.* April 1.
8150 and 8151. Senftner. Electrodes for arc lamps. Ger. Appls., April 14 and Dec. 17, 1908.]* April 5.
8229. Dempster and Sons, Ltd., and others. Manufacture of gas. April 6.

8399 and 8400. Jones. Coke ovens. [Additions to No. 11,660 of 1906.]* April 7.

8476. Dempster and Sons, Ltd., and others. Gas retorts. April 8.

8558. Parker. Destructive distillation of coal. April 8.

COMPLETE SPECIFICATIONS ACCEPTED.

- 4266 (1908). Parker. See under III.
8014 (1908). Lynn. Plant for recovering ammonia from producer gas. April 15.
9384 (1908). Kirkham, Hulett, and Chandler, Ltd., and Hersey. Filters, chiefly for use in purifying gas. April 7.
9891 (1908). Thiernich. Generating coal gas for operating internal combustion engines. April 15.
26,027 (1908). A.-G. f. Kohlendestillation. Recovery of ammonia from gases produced in dry distillation. April 7.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

8026. Eldred. Increasing the efficiency of illuminating oils. April 3.
8558. Parker. See under II.

COMPLETE SPECIFICATIONS ACCEPTED.

- 4266 (1908). Parker. Apparatus for the destructive distillation of coal and other carbonaceous substances. April 7.
26,027 (1908). Act.-Ges. f. Kohlendestillation. See under II.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

7819. Newton (Bayer und Co.). Manufacture of vat dyestuffs. April 1.
7820. Newton (Bayer und Co.). Manufacture of acid wool dyestuffs. April 1.
7821. Newton (Bayer und Co.). Manufacture of azo dyestuffs. April 1.
7905. Act.-Ges. f. Anilinfabr. Manufacture of a secondary disazo dyestuff. [Ger. Appl., April 4, 1908.]* April 2.
7931. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. April 2.
8144. Newton (Bayer und Co.). Manufacture of trisazo dyestuffs. April 5.
8154. Cassella und Co. Manufacture of red, chromable dyestuffs. [Fr. Appl., April 7, 1908.]* April 5.
8416. Newton (Bayer und Co.). Manufacture of disazo dyestuffs. April 7.
8438. Dreyfus, Tompkins, and Clayton Aniline Co. Manufacture of halogenated compounds of indigo and indigoid bodies. April 7.
8677. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs. April 10.

COMPLETE SPECIFICATIONS ACCEPTED.

- 7575 (1908). Newton (Bayer und Co.). Manufacture of condensation products from 1-8-naphthylenediamine. April 7.
27,747 (1908). Inray (Soc. Chem. Ind. in. Basle). Manufacture of brominated indigos. April 7.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

7538. Calico Printers' Association, and Ashton. Production of certain effects in calico printing. March 30.
7617. Friedrich. Production of a substance for use in making artificial threads, &c. (Ger. Appl., March 30, 1908. Addition to No. 4104 of 1909.)* March 30.

7650. Calico Printers' Association, and others. Production of ornamental effects on textile fabrics. March 31.

7731. Ransford (Cassella and Co.). Production of print effects on fabrics. March 31.

7743. Wetter (Knoll and Co.). Treating acetylcellulose to enhance its elasticity and its power of absorbing dye-stuffs. [Addition to No. 24,284 of 1907.]* March 31.

7881. Young. Continuous open bleaching process and machine therefor. April 2.

8079. Green. Cleaning, preparing, and dyeing textile fibres and fabrics, and materials therefor. April 5.

8270. Niblett. *See under XVIII C.*

8331. Huillard. Treatment of fabrics.* April 6.

8600. Mayo. Extraction of grease and similar matter from and treatment of wool-skins, textile and other materials. April 8.

COMPLETE SPECIFICATIONS ACCEPTED.

8726. (1908). Johnson (Badische Anilin und Soda Fabrik). Discharge of colouring matters of the thio-indigo and indigo classes. April 7.

11,834 (1908). Schneider. Treatment of animal fibres, yarn, or fabrics to modify their shrinking properties. April 7.

14,593 (1908). Johnson (Badische Anilin und Soda Fabrik). Production of green, olive, and brown effects in dyeing and printing. April 15.

17,653 (1908). Frazer. Bleaching or boiling kiers for linen or cotton piece goods or yarns. April 15.

21,829 (1908). Gminder. Treatment of fabrics in spread-out form with liquids. April 15.

2522 (1909). Johnson (Badische Anilin und Soda Fabrik). *See under XIV.*

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

7452. Fabry. *See under II.*

7495. Chem. Werke vorm. H. Byk. Manufacture of solid durable perborate preparations. (Ger. Appl., April 14, 1908.)* March 29.

7507. Serpek. Production of aluminium nitride. March 29.

7633. Jaubert. Manufacture of salts derived from alkaline, alkaline earth, or earthy peroxides. (Fr. Appl., April 29, 1908.)* March 30.

7720. Lévy. Production of substances by means of chlorine. March 31.

7849. Clark (Dellwik-Fleischer Wassergas-Ges.). Production of hydrogen. April 1.

8469. Richardson. *See under I.*

8555. Dolphin. Manufacture of copper and other metallic sulphates. April 8.

COMPLETE SPECIFICATIONS ACCEPTED.

6888 (1908). Troeller. Extracting, in the shape of oxides, sulphites, and sulphates, zinc and other metals from ores and products. April 7.

6919 (1908). Arndts. Manufacture of durable solutions of hydrogen peroxide. April 7.

8014 (1908). Lynum. *See under II.*

26,027 (1908). Act.-Ges. f. Kohlendestillation. *See under II.*

2522 (1909). Johnson (Badische Anilin und Soda Fabrik). *See under XIV.*

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

7685. Cliff. Revolving kilns for making enamel and other pottery ware. March 31.

7823. Sievert. Manufacture of glass plates. [Comprise in No. 25,042, Nov. 20, 1908.]* April 1.

8381. Neale and King. Material for use in decorating earthen, china, and similar ware. April 7.

8594. Rowart. Apparatus for the manufacture of glass in continuous sheets. April 8.

COMPLETE SPECIFICATION ACCEPTED.

7230 (1908). Sulman, Picard, and Heath. Application of metallic coatings to articles of glazed china, porcelain or earthenware. April 15.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

7696. Blackburn. Manufacture of bricks, &c. March 31.

8176. Gerbache. Process for preserving wood.* April 1.

8193. Soc. J. et A. Pavin de Lafarge. Manufacture of cement. (Fr. Appl., May 15, 1908.)* April 15.

8675. Mellersh-Jackson (Soc. J. et A. Pavin de Lafarge). Manufacture of cements. April 10.

COMPLETE SPECIFICATIONS ACCEPTED.

10,554 (1908). Nussbaum. Process for preparing wood. April 15.

16,376 (1908). Prince. Kilns for burning or drying bricks, tiles, &c. April 15.

25,833 (1908). Mecke. Making cement, mortar, and concrete, even when under pressure, watertight. April 7.

X.—METALS AND METALLURGY.

APPLICATIONS.

7519. Mackenzie (Stevens). Process for extracting metal from ore.* March 29.

7811. Macallum. Manufacture of steel. (U.S. App. Feb. 4, 1909.)* April 1.

8100. Farmer and Graham. Alloying iron with copper producing iron-bronzes and iron-brasses. April 5.

8163. Bloxam (Treibacher Chem. Werke). Manufacture of pyrophoric alloys.* April 5.

8287. Lockwood and Samuel. Oils and oily liquids for use in treating ores, &c. April 6.

8457. Mallmann. Crucible furnaces. April 7.

8682. Penhale and Mascall. Solvent for precious metals. April 10.

COMPLETE SPECIFICATIONS ACCEPTED.

2479 (1908). Nichols. *See under I.*

6888 (1908). Troeller. *See under VII.*

7227 (1908). Rosenberg. Depositing metals on metal surfaces. April 15.

7429 (1908). Herrenschmidt. Treatment of antimony and other ores. April 15.

13,146 (1908). Dor-Delattre. Extracting dust and fumes produced by zinc furnaces, &c. April 15.

14,926 (1908). Perry (Bismarckhütte). Refining steel in electric furnaces. April 7.

17,350 (1908). Siemens and Halske A.-G. Increasing the ductility of tungsten. April 15.

17,438 (1908). Siemens und Halske A.-G. Manufacture of objects of tungsten or of tungsten and nickel. April 7.
18,596 (1908). Chalas. Recovery of nickel from silicious ores. April 7.

19,585 (1908). Usine de Desargentation. Eliminating lead, arsenic, antimony, etc., from plumbiferous copper matter, ore, or alloy, and simultaneously recovering the copper as metal. April 15.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

7338. Nya Ackumulator Aktiebolaget Jungner, and Estelle. Alkaline accumulator.* April 1.

8194. Grondal Kjellin Co., Ltd., and Hårdén. Electric induction furnaces.* April 5.

8195. Nya Ackumulator Aktiebolaget Jungner, and Estelle. Positive electrodes for electrical elements with alkaline electrolyte.* April 5.

8261. Bradley and Thew. Electrodeposition of metals or alloys on other metals or alloys, fabrics, stone, plaster, or wood. April 6.

8443. Salpetersäure Ind.-Ges. Electric furnaces for treating gases or gas mixtures. [Ger. Appl., May 22, 1908.]* April 7.

COMPLETE SPECIFICATIONS ACCEPTED.

10,378 (1908). Cornelius. Electric furnaces. April 7.

13,502 (1908). Knowles. Electric furnaces. April 15.

5958, 5960, and 5962 (1909). Gibbs. Production of metallic articles by electrodeposition. April 7.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

7852. Swiftsure Synd., Ltd., Mellor, and Baildon. Manufacture or treatment of soap, oils, fats, &c. April 2.

8245. Noltenius. Immediate recovery of residuary oil from bleaching earths by the use of steam.* April 6.

8287. Lockwood and Samuel. *See under X.*

8674. Grant. Manufacture of soap.* April 10.

COMPLETE SPECIFICATIONS ACCEPTED.

15,466 and 19,140 (1908). Common and Hull Oil Manufacturing Co. Increasing the viscosity of castor oil and rendering it miscible with mineral oils. April 15.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATION.

8532. Child and Johnston. Manufacture of printing and lithographic inks. April 8.

(C.)—INDIA-RUBBER.

APPLICATIONS.

8062. Dogny, Henri, and Veil-Picard. Manufacture of products from india-rubber or other plastic material.* April 3.

8271. Campbell. *See under XIV.*

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

7777. Molhant. Process for depilating hides.* April 1.

8271. Campbell. Substitute for leather or rubber. April 6.

8600. Mayo. *See under V.*

COMPLETE SPECIFICATIONS ACCEPTED.

7580 (1908). Pianko and Knaster. Manufacture of leather. April 15.

26,593 (1908). Müller. Production of imitation leather. April 15.

2522 (1909). Johnson (Badische Anilin und Soda Fabrik. Bleaching agent and its use for bleaching leather, glue, feathers, and straw. April 15.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATION.

8447. Boidin. Treatment of amylaceous materials.* April 7.

COMPLETE SPECIFICATIONS ACCEPTED.

7813 (1908). Boulton (Sparre). *See under XVII.*

18,237 (1908). McMullen. Manufacture of sugar. April 15.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATION.

7989. Faulkner, Collett, and Collett. Malt extracts. April 3.

COMPLETE SPECIFICATION ACCEPTED.

7813 (1908). Boulton (Sparre). Production of products in addition to alcohol by fermentation of saccharine solutions preferably maltose. April 15.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATION.

8041. Willmann. Processes of pasteurising milk. [U.S. Appl., May 25, 1908.]* April 3.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

7464. Leigh. Treatment of liquids in filter beds. March 29.

8296. Candy. Purification of water. April 6.

COMPLETE SPECIFICATION ACCEPTED.

26,013 (1908). Maccormac. Apparatus for the bacteriological treatment of sewage and other polluted liquids. April 15.

(C.)—DISINFECTANTS.

APPLICATION.

8270. Niblett. Production of a disinfecting or deodorising compound applicable also for bleaching purposes. April 6.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

7743. Wetter (Knoll und Co.). *See under V.*

8175. Rinman. Treatment of waste liquors from soda pulp mills. [Swed. Appl., April 14, 1908.]* April 5.

COMPLETE SPECIFICATIONS ACCEPTED.

17,810 (1908). Pierucci. Manufacture of papers for filtering and like uses. April 15.

18,600 (1908). Gestetner. Preparation and treatment of stencil paper. April 15.

23,947 (1908). Gunn. Bleaching pulp used in the manufacture of paper. April 7.

XX.—FINE CHEMICALS, ALKALOIDS,
ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

8069. Raschig. Manufacture of phenol esters chlorinated in the side chain, and of oxybenzyl alcohols, oxybenzaldehydes and oxybenzoic acids.* April 3.

8421. List, and Saccharin Fabr. A.-G. vorm. Fahlberg, List, and Co. Manufacture of *o*-sulphamidobenzoic acid.* April 7.

COMPLETE SPECIFICATIONS ACCEPTED.

7613 (1908). Brougham (Preyss). *See under 1.*

9855 (1908). Imray (Meister, Lucius, and Brüning). Manufacture of reduction products of oxyarylarsonic acids. April 15.

21,389 (1908). Lepetit. Para-ethoxyphenylamidomethyl alkaline sulphites and process of making same. April 7.

XXI.—PHOTOGRAPHIC MATERIALS AND
PROCESSES.

APPLICATIONS.

7518. Cunningham. Treating photographic prints. [U.S. Appl., April 9, 1908.]* March 29.

7800. Hans. Producing chromate glue pictures on metal, porcelain, glass, &c.* April 1.

COMPLETE SPECIFICATIONS ACCEPTED.

7087 (1908). Donisthorpe. Photographic sensitive surfaces. April 7.

20,111 (1908). Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses Fils. Screen or plate for direct colour photography. April 15.

XXII.—EXPLOSIVES, MATCHES, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

7921 (1908). Boulton (La Motte). Explosives and process of making the same. April 15.

13,890 (1908). Larsen. Waterproofing blasting cartridges. April 15.

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MAY 15, 1909.

No. 9, Vol. XXVIII.

Birmingham Section.

Meeting held at Birmingham University on Thursday,
March 11th, 1909.

MR. HARRY SILVESTER, B.Sc., F.I.C., IN THE CHAIR.

INFLUENCE OF SMALL QUANTITIES OF ARSENIC AND ANTIMONY ON COPPER.

BY A. H. HIORNS AND S. LAMB, A.R.S.M.

COPPER AND ARSENIC.

Arsenic is well known to have a beneficial effect on the strength and durability of copper for many purposes, but there is great divergence of opinion as to the quantity of arsenic that should be present without prejudicial effects. In Watts' Dictionary of Chemistry, it is stated that with 0.15 per cent. the metal becomes somewhat brittle when cold and very brittle at a red heat, but it is not stated what the other impurities of the copper were, hence the statement is of no value. Hampe (*Chem.-Zeit.*, 1892, 16, No. 42) found that 0.5 per cent. of arsenic produces no bad results, and even when the arsenic is increased to 1 per cent. only a slight degree of red shortness, but no cold shortness, could be noticed. He found that copper with 0.8 per cent. of arsenic could be drawn into the finest wire: that small percentages of arsenic (0.216 per cent.) even increase the tenacity of copper, but diminish its electrical conductivity. Stahl (*Inaugural Dissertation*, Tübingen, 1886) states that a small percentage of arsenic prevents copper from becoming porous. Hiorns (this J., 1906, 616) showed that copper with arsenic up to 0.4 per cent. was very malleable in the cold; that the same result applies to arsenic in the presence of antimony, the proportions of each element being 0.2 per cent.; that arsenic is beneficial in copper in neutralising the bad effects of lead and even bismuth. In fact, that arsenic in the presence of antimony, makes the copper more malleable than it is with antimony alone, although antimony alone, when not above 0.2 per cent. is present, only slightly impairs the malleability of copper; and that arsenic in copper is highly beneficial, because it deoxidises cuprous oxide, which tends to destroy the malleability of copper. Johnson (*Birmingham Metallurgical Society*, 1906) states that copper with 0.5 per cent. arsenic, has, in the cast state a tensile strength of 10 tons per square inch, and 24 per cent. elongation. After forging, whilst hot, the tenacity was raised to 12.75 tons and an elongation of 35 per cent. By being subjected to further mechanical treatment by rolling, the tenacity was 14 tons, and the elongation 48 per cent. After being highly wrought and cold drawn the tenacity of the same cast copper

was raised to 15.9 tons and the elongation 24 to 50 per cent.; the specific gravity was also raised from 8.83 in the cast state, to 8.896 in the worked state. He further states that arsenic has a remarkable effect in reducing the conductivity of copper. A sample of electrolytic copper to which 0.06 per cent. of arsenic was added, had its conductivity reduced as much as 19 per cent.

Percy (*Metallurgy*, p. 288) gives the conductivity of copper containing a trace of arsenic as 57.8 and copper containing 2.8 per cent. of arsenic as 13.14.

The mode of procedure in the preparation of the alloys was, first, to make an alloy of pure copper and arsenic. This alloy was used as a source of arsenic instead of introducing it into the copper in the elementary state.

Preparation of copper with high arsenic content.—The copper was melted in a fireclay crucible using the coke furnace. Metallic arsenic was added to the copper and a very rich copper-arsenic material was thus formed. It was kept molten for several minutes in the furnace, and well stirred with a charred stick of wood, after which it was poured into an iron mould which had previously been blacked over an ordinary gas flame. The material was allowed to cool gradually, and then powdered

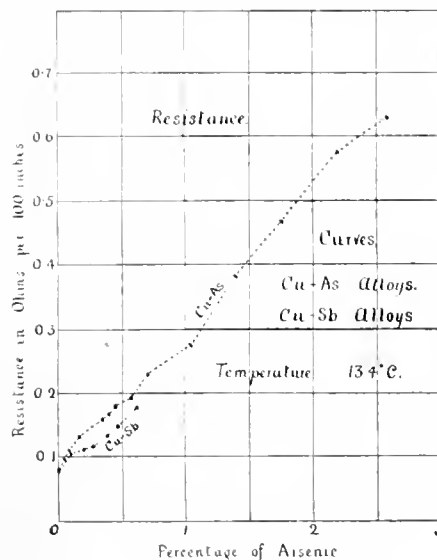
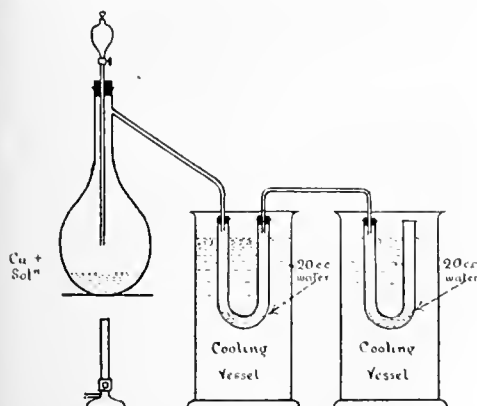


FIG. 2.

in a large iron mortar. Any pieces of iron which it contained were separated by means of a large magnet. The whole was then carefully mixed and sampled for analysis.

Methods of analysis.—0.5 gm. was dissolved in 5 c.c. of strong nitric acid and 5 c.c. of water in a small beaker. When dissolved the solution was evaporated (until crystals commenced to form) with 3 c.c. of strong sulphuric acid. Cold distilled water was added and the crystals dissolved. The volume of the solution was made up to 50 c.c. The copper was extracted by electrolysis, with a current of 1.5 amps. and a voltage across the terminals of 3.3 volts, a rotating cathode being used. Under these conditions, the whole of the copper was removed in ½ hour. The cone was first washed by distilled water, then immersed in alcohol, and finally in ether. It was then dried in an oven at about 50° C. for 5 minutes, weighed, returned to the oven for another 5 minutes, and then re-weighed. The cathode was weighed before and after the experiment, and thus the copper contents found.

Testing deposit.—The deposit, which was of a fine salmon pink, was dissolved in dilute nitric acid and evaporated to near dryness, and sulphuric acid again added to remove the nitric acid. A strong solution of potassium hydroxide



Apparatus for Arsenic determination

FIG. 1.

was added and the solution well boiled for 10 minutes, when it was filtered to remove the copper oxide, hydrogen sulphide passed into the alkaline solution, and any precipitate filtered off. To the solution hydrochloric acid was added until it was just acid, and then hydrogen sulphide was passed for 20 minutes. A very slight precipitate was produced which was collected on counterpoised filters, washed by carbon bisulphide to remove sulphur, and then weighed as arsenious sulphide.

Copper and arsenic may be separated if the current density, speed, etc., are properly adjusted, as was found by varying it in other experiments.

Arsenic in solution after copper was removed by electrolysis.—The solution was evaporated nearly to dryness, and then 10 c.c. of strong nitric acid added and allowed to stand for 15 minutes on the hot plate. The solution was then diluted to 20 c.c. with water, and strong ammonia solution added until just neutral; 10 c.c. were then added in excess, and then 2 grms. of magnesium chloride and 3 grms. of ammonium chloride in 5 c.c. of hot water (just made alkaline by ammonia) added. The solution was then well agitated for six hours at intervals and the arsenic was thus precipitated. The precipitate was collected, washed with 10 per cent. ammonia, and then dried and ignited apart from the filter, and weighed as $Mg_2As_2O_7$. The copper in solution was so small that no coloration could be observed in many cases. When, however, any was observed, however slight, it was determined colorimetrically, using ammonia and a standard copper solution.

Results:—

Copper	67.340	Arsenic	32.691
"	67.320	"	32.703
"	67.340	"	32.650
Average	67.333	Average	32.681

The following alloys were prepared:—

Desired.	Analysis.	Desired.	Analysis.
0.05	0.05	1.00	1.04
0.10	0.098	1.50	1.395
0.20	0.205	2.00	1.740
0.40	0.382	2.50	2.244
0.50	0.471	3.00	2.581
0.60	0.581	3.50	2.893
0.70	0.701		

The copper used for the preceding and subsequent alloys was pure electrolytic, which contained a trace of iron, amounting to 0.02 per cent.

The method employed was to melt the calculated amount of pure copper in a crucible made of compressed carbon and then stir well with a charred stick, in order to remove any oxide which may have formed. The calculated quantity of rich copper-arsenic alloy was then added, wrapped in small pieces of tissue paper, and immediately stirred with a charred stick. The alloy was then poured into an iron mould, previously heated and then blackened by an ordinary gas flame.

First set of alloys.—Made as indicated. Weight of ingots = 2000 grains.

They were cast in an open mould, measuring 4 ins. by $\frac{1}{2}$ in. and $\frac{1}{2}$ in. thick. The castings were allowed to cool in the mould and then rolled down to a sufficient degree with suitable annealings in order to obtain pieces of the requisite thickness to draw into wire.

Up to 0.1 per cent. the alloys showed a slight elevation of the surface. From 0.2 per cent. up to 0.4 per cent. the surface was level, but above 0.5 per cent. a distinct furrow was observed, which appeared to increase as the percentage of arsenic was increased. Below 0.2 per cent. the ingots tended to be a little blowholy, but all others were very sound. Those containing above 0.5 per cent. were perfect and no blowholes were seen. We tried to cast an ingot of pure copper, but always found it filled with blowholes, however carefully it was melted and cast. The metal became lighter in colour as the percentage of arsenic was increased. At 3.5 per cent. the metal was almost the colour of gun-metal. The metal

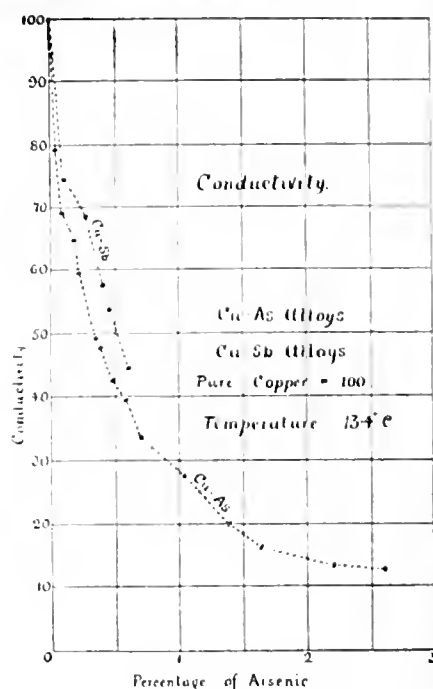


FIG. 3.

appears to file better as the percentage of arsenic is increased. No clogging occurred above 0.5 per cent. arsenic.

Hardness.—The ingots were filed at the upper surface and polished, and then their hardness determined in terms of that of an ingot of pure copper. The scleroscope and the intensifier hammer were used. With increasing arsenic contents the metal became harder, and the following are the results.

Percentage of arsenic (supposed).*	Rebound of hammer.
0	7 degrees
0.05	8 "
0.40	9 "
1.50	10 "
3.00	11 "

* See analyses above.

Pieces were cut off each of the ingots for microscopic investigation.

Preparation of wires for conductivity tests.—The ingots were rolled cold down to 0.135 inch with two annealings at a dull red heat (650° C. about). The strips so prepared were sheared by hand and a strip about $\frac{1}{4}$ inch square was used to prepare the wire. The prepared strips were then filed down to just fit tightly in the first hole of a drawplate, and after annealing in a Bunsen flame until just red, they were allowed to cool, and then the wires were drawn first on a small drawbench and then by hand.

Notes on drawing.—Pure copper draws very well, but the blowholes always cause it to break. Every break was across a blowhole. Length, 30 inches. Passed 50 hole. Annealed after 17 hole in drawing. Left hard. 0.05 per cent. arsenic. Strip drawn to 50 hole. Left hard. Annealed after 5 and 17 holes. Gave a good wire. Draws well. 0.1 per cent. arsenic. Drawn to 50 hole. Annealed after 5 and 17 holes. Left hard. Good wire and draws well. 0.2 per cent. arsenic. Drawn to 50 hole. Annealed only after 17 hole. Left hard. Very good wire and draws well. 0.4 per cent. arsenic. Drawn to 50 hole. Annealed after 17 hole. Good wire. Left hard. 0.5 per cent. arsenic. We experienced difficulty in getting

a wire from this alloy. Three attempts were made and we always found that the wire broke during drawing, but no blowhole could be seen on the fracture. Surface cracks, however, were seen on the ingot after rolling, and probably these were in no small measure accountable for the rupture. Drawn to 50 hole. Left hard. Annealed after 17 hole. Rough wire. 0.6 per cent. arsenic. Drawn to 50 hole. Annealed after 17 hole. Left hard. Wire again tended to be weak owing to cracks on the surface which were small. 0.7 per cent. arsenic. Drawn to 50 hole. Wire broke twice during drawing. Small surface cracks evident. Left hard. Annealed after 17 hole. 1 per cent. arsenic. 50 hole passed. Annealed after 17 hole. Good wire. Left hard. 1.5 per cent. arsenic. Passed 50 hole. Annealed after 17 hole. Good wire. Left hard. 2.0 per cent. arsenic. Passed 50 hole. Annealed after 17 hole. Good wire. Left hard. 2.5 per cent. arsenic. Passed 50 hole. Annealed after 17 hole. Left hard. Good wire.

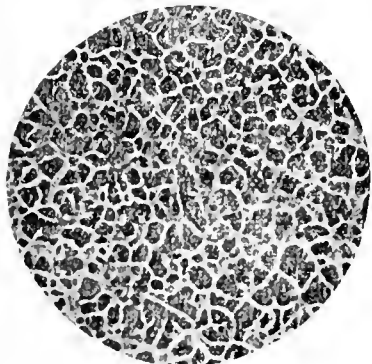


FIG. 4.

From the remains of the strips after the piece for wire drawing had been cut off, filings were taken and cleaned by a magnet. These were reserved for chemical analysis.

Analysis.—Alloys were analysed by distillation with a hydrochloric acid solution of ferric chloride. (See Figure 1.) This was made by digesting 200 grms. of "Venetian red" in one litre of strong hydrochloric acid, just below its boiling point, for 24 hours, and making the solution up to one litre with strong hydrochloric acid. The weighed quantity of copper (1 to 2 grms.) was then added to the flask and 50 c.c. of solution poured down the funnel, and distillation continued until the residue became pasty. Then another 50 c.c. of hydrochloric acid was added, and the solution again boiled until nearly dry. The distillate, which was collected, was poured into an 8-inch porcelain dish and just neutralised with ammonia. Hydrochloric acid was then added to make just acid, and then 4 grms. of sodium bicarbonate added and allowed to dissolve. Starch was used as an indicator, and then the solution was titrated with a solution of iodine, 1 c.c. of which was equivalent to 0.001 grm. of arsenic. In a blank experiment one grm. of pure copper needed 0.8 c.c. of iodine solution. Those alloys above 0.5 per cent. were also estimated by the revolving cathode, as before explained.

Rolling tests of copper-arsenic alloys.—A set of alloys was made with the following percentages of arsenic: 0.05, 0.1, 0.2, 0.4, 0.7, 1.0, 1.5, 2.0, 2.5, 3.0, and 3.5 per cent. The ingots before rolling were 2.36 inches long, 0.139 inch diameter (thick), and 0.945 inch broad. This set was then passed through the rolls one after the other, so that they should have precisely the same treatment. They were rolled cold down to the smallest possible gauge of our rolls. After rolling they were 12.5 inches long (about); 1 inch broad, and 0.02 inch thick.

Up to 0.2 per cent. the ingots frayed slightly on the edges, probably due to enclosed oxide. Between 0.2 and 0.5 per cent. the metal stood the test exceedingly well and the edges were perfect. Above 0.5 per cent. up to 2 per cent. the metal again showed cracks at the edges. Above 2 per cent. up to 3.5 per cent. the

metal rolled exceedingly well, and did not produce any large edge cracks. The colour of the material becomes lighter as the percentage of arsenic increases.

This is of course purely cold work, and we do not consider the higher percentages would have stood a hot rolling test as they stood the cold rolling test. Pure copper stood the rolling test very well.

Electrical resistance and conductivity of alloys.—Wires were made from each of the alloys.

Arsenic found.	Length of wire.	Diameter of wire.	Resistance in ohms.	Conductivity.
per cent.	ins.	ins.		
0.00	100	0.0325	0.0770	100
0.050	100	0.0325	0.0970	79.4
0.098	100	0.0325	0.1108	69.5
0.182	100	0.0325	0.1201	64.1
0.220	100	0.0325	0.1295	59.5
0.366	100	0.0325	0.1572	49.0
0.382	100	0.0325	0.1613	47.7
0.417	100	0.0325	0.1679	45.9
0.471	100	0.0325	0.1807	42.7
0.580	100	0.0325	0.1933	39.8
0.701	100	0.0325	0.2321	33.2
1.040	100	0.0325	0.2761	27.9
1.395	100	0.0325	0.3854	20.0
1.740	100	0.0325	0.4665	16.5
2.214	100	0.0325	0.5744	13.5
2.581	100	0.0325	0.6110	12.6

Figs. 2 and 3 give the curves for electrical resistance and conductivity.

The method of determining resistance was the Post Office box method. A D'Arsonval galvanometer was used to give the point when balance was obtained, and owing to the distance from the mirror being fairly great, the balance could be obtained with great accuracy.

COPPER-ANTIMONY ALLOYS.

Copper-antimony alloy. The copper was melted in a clay pot and antimony added until about $2\frac{1}{2}$ times the weight of the copper had been added. It was readily taken up, and the material became very fluid. Antimony was, to a certain extent, volatilised, as evidenced by a white smoke continually rising from the pot. The material was stirred with a charred stick and poured into an iron mould which was blackened by a gas flame. This alloy was very brittle, and could be powdered in a large iron mortar. Iron was again separated by a magnet. The powdered material was sampled and analysed by the following method:—0.5 grm. of the alloy was dissolved in 20 c.c. of hydrochloric acid and 5 c.c. of nitric acid, and evaporated to a small bulk, but no precipitate was allowed to appear. 10 c.c. of hydrochloric acid were again added to remove all traces of nitric acid. The solution was then poured into a solution of 30 grms. of potassium hydroxide and boiled. The black precipitate of copper oxide was allowed to settle, filtered, dissolved in dilute nitric acid, and the copper separated by the revolving cathode. Hydrogen sulphide was passed into the alkaline solution, and any black cuprous sulphide which was pre-



FIG. 5.

precipitated was collected and added to the former solution. The solution was made acid by hydrochloric acid and kept warm for one hour, when the antimony was precipitated as antimonious and antimonie sulphides. This was collected, washed by carbon bisulphide to remove sulphur, then washed into a weighed porcelain dish and evaporated to dryness, heated to 230° C. in carbon dioxide, and weighed as antimonious sulphide.

Results:—

Copper by electrolysis, corrected for solution by coloration.	Antimony (weighed as sulphide).
32.820	67.082
32.860	67.116
32.850	67.128

Average analysis:—

	Per cent.		Per cent.
Copper	32.843	Antimony	67.107

An attempt was made to separate the antimony from the copper by oxidation with nitric acid. The solution containing the copper was electrolysed as in the case of the copper-arsenic alloy. It was found impossible to remove the copper from the solution, however the current was varied or whatever was the speed of the cathode. The precipitated copper always contained antimony, however small the amount left in solution.

A complete set of alloys was prepared having the following percentages of antimony. They were made by adding the requisite amount of rich alloy in the same way as in the arsenical alloys.

Antimony (aimed at).

per cent.
0.1
0.2
0.3
0.4
0.5
0.6

Antimony (found).

per cent.
0.098
0.203
0.280
0.392
0.461
0.605

Limit of wire drawing.

Antimony not determined—
per cent.

0.7
1.0
1.5
2.0
2.5
3.0
3.5

Ingots were made 0.163 inch thick, 3.0 inches long, and 1.5 inches in diameter. These were rolled down to 0.1065 inch and then sheared in order to produce the strips for wire drawing. The alloys all showed faint cracks along a plane at right angles to the rolls. The cracks increased as the percentage of antimony increased. The limit at which we could draw wire was 0.6 per cent. antimony. Above this, however carefully annealed, the sample broke in the wire drawing.

Every ingot tended to have blowholes, even in the



FIG. 6.

higher percentages, and it shows conclusively that antimony has not the effect that arsenic has in removing or preventing their formation. With increasing antimony contents the alloy becomes much lighter in colour. Antimony and arsenic appear to lighten the colour in about the same degree.

Effect of antimony on the hardness.—According to Scleroscope measurements antimony does not confer hardness to the same degree as arsenic.

Antimony (aimed at).

Rebound.

per cent.
0
1
3

7
8
9

The ingots made for rolling were 2.35 inches long, 0.139 inch broad, and 0.945 inch thick. These were cold rolled down to the same dimensions as the arsenic alloys. All the alloys of antimony cracked during rolling to a much greater degree than the corresponding arsenic alloys.

Electrical resistance.—The alloys were first made into suitable wires, and then the resistance measured in the same way as with the arsenic alloys.



FIG. 7.

Antimony.	Length of wire.	Diameter.	Resistance.	Conduc- tivity.
per cent.	ins.	ins.	ohms.	
0	100	0.0325	0.0770	100
0.098	100	0.0325	0.1015	76
0.203	100	0.0325	0.1100	70
0.280	100	0.0325	0.1125	68.5
0.392	100	0.0325	0.1320	58.4
0.461	100	0.0325	0.1575	48.9
0.605	100	0.0325	0.1818	42.4

MICROSCOPICAL EXAMINATION.

Copper-arsenic alloys.—The sections selected for examination were transverse and obtained from ingots which were cooled quickly and very slowly respectively. They were polished by hand in the usual way on graded emery papers and finally on chamois leather, charged with the finest rouge. The photo-micrographs were taken with an arc lamp, all with the same magnification of 100 diameters so as to make them strictly comparable. The illumination was normal in all cases.

In all the alloys from 0.05 to 3.5 per cent. the general structure was found to be practically of the same general pattern. This consisted of dark polygonal crystals, very soft and difficult to get entirely free from scratches: these were bounded by a lighter coloured and harder material, which was assumed to be a solid solution of arsenic in copper because it was structureless. In the quickly cooled alloys, the whole mass was found to consist of these two constituents alone; the only difference being that with increase of arsenic the boundaries became wider and the polygons correspondingly less in area. The latter do not consist of pure copper, inasmuch as they darken on etching, whereas pure copper does not. It



FIG. 8.

is very probable, however, that the boundaries contain the greater portion of the arsenic, for reasons which will be given when discussing the slowly-cooled alloys. It may be stated that the small blowholes, which are invariably present, always appear in the boundaries and not in the interior of the crystals, from which it may be safely assumed that the boundaries were the last portions to solidify. The above-mentioned alloys, then, consist of soft crystals bounded by a harder and more brittle material, which, while it greatly hardens and strengthens the mass as regards tenacity, diminishes its ductility and eventually makes the whole mass more brittle.

The slowly-cooled alloys were prepared by melting 500 grains of the alloy under charcoal, covering with a lid, and then transferring to a gas muffle and maintaining at a temperature of 700°C . for two hours. The gas was then turned off, and the crucible left to gradually cool. The button was then sawn through at right angles to the cooling surface, and the piece polished and etched as before. Much the same general structure was observed as in the quickly-cooled alloys, but both the constituents were very much larger in area for any one crystal and its boundary. There was much less definition between the crystals and the boundaries, the one passing insensibly into the other. There was also the same proportional diminution in the size of the crystals with increase of arsenic as with the quickly-cooled samples. There was, however, one notable difference. In the boundaries appeared a new structureless constituent, of a light blue colour, which is very probably the chemical compound, Cu_3As . Very small quantities of this constituent were observed in the alloy with 0.21 per cent. of arsenic, and gradually increasing quantities as the percentage of arsenic increased. The solid solution, which forms the boundaries, is super-saturated with arsenic, and, on slow cooling, the excess separates in the form of the above-mentioned compound. In the 5 or 6 per cent. alloys, slowly cooled, the light coloured boundaries have disappeared and are replaced by branching masses of the light blue compound, which, however, is not continuous. Seeing, then, that the boundaries eventually yield this chemical compound, it may be fairly assumed that they contain the greater portion of the arsenic present and only a small portion is retained in the copper crystals.

Fig. 4 contains 0.25 per cent. arsenic quickly cooled.

Fig. 5 „ 0.22 per cent. „ slowly „

Fig. 6 „ 5.00 per cent. „ quickly cooled,

and shows the chemical compound which has separated out from the boundaries.

Copper-antimony alloys.—The sections obtained for microscopic examination were prepared in a similar way to those for the copper-arsenic alloys. In all the alloys from 0.1 to 3.5 per cent. of antimony, the structure was found to be practically the same. Both slowly and quickly-cooled samples were examined. The structure consists of dark polygonal crystals, very soft and difficult to get free from scratches, bounded by a lighter and harder material. As the crystals take a dark colour on a short immersion in hydrochloric acid, they cannot consist of pure copper, and therefore contain a little antimony. Prof. Arnold ("Engineering," Feb. 7, 1896) remarks concerning copper with 0.2 per cent. of antimony,

"The latter metal produces very thick brown cell walls, which seem in area to be altogether out of proportion to the percentage of antimony present. On examination with a high power the antimonide meshes are found to possess a compound structure consisting of alternate dark and light laminae, suggesting that in the first instance an attenuated antimonide involves the copper cells at a high temperature, but at a low temperature the walls split up into plates of pure copper alternating with those of a less basic antimonide."

In our experiments the material of the boundary walls was structureless, with a magnification of 1000 diameters, for alloys with small percentages of antimony. The alloys with higher percentages of antimony contain small crystals of impure copper surrounded by wide boundaries of varying widths, which contain a neutral gray or bluish constituent in the form of irregular patches. As this constituent separates out from the boundaries it is inferred that the boundaries consist of a solid solution of antimony in copper from which the chemical compound, Cu_3Sb , separated on slow cooling. The amount of this structureless compound increases with increase of antimony, until the boundaries are entirely replaced by it.

Fig. 7 contains 0.4 per cent. antimony, quickly cooled
Fig. 8 „ 0.4 „ „ „ slowly cooled.

DISCUSSION.

The CHAIRMAN said this important paper could not have been delivered in a more appropriate place, because more copper was consumed in Birmingham than in any other manufacturing centre. He hoped that through the agency of the Institute of Metals, copper and non-ferrous metals would, by means of papers similar to the one read to the meeting, be placed on the same level as iron and steel had been through the agency of the Iron and Steel Institute.

Professor TURNER said that 20 years ago certain elements were known to have ill-effects on steel, and it was assumed that the same would occur with regard to copper, and that it was necessary to have a perfectly pure copper in order to get a good material. It had long been known, however, that arsenic for certain purposes was not merely not injurious, but that it was absolutely beneficial or necessary. Many years ago he analysed a sample of copper which contained about 0.75 per cent. of arsenic, and the material was, apparently, quite satisfactory. For wrought copper for certain purposes arsenic was regularly added and was satisfactory. Arsenic had two distinct effects on copper. In the first place the tenacity of the copper was distinctly increased, especially at high temperatures, while its working properties were not seriously interfered with; and, on the other hand, there was a very marked reduction in the conductivity. It would be interesting to compare the curves (which had been shown) with reference to the effect of antimony and arsenic on conductivity with the results and theoretical conclusions of Guertler (Z. Anorg. Chem., 1906, 51, 397; 1907, 54, 58). His own impression was that the figures shown would be found to correspond with the general laws that had been adduced. That antimony had less effect than arsenic would be in accordance with those laws. In the determination of arsenic, he was doubtful as to the wisdom of boiling the iron arsenic solution down so as to become syrupy and then distilling again, because the ferric chloride might, if overheated, liberate an appreciable amount of chlorine, and if one were working by the method described, that chlorine might interfere. He was interested in the scleroscope tests, and he thought the results would agree with certain observations he had been making lately not on arsenic, but on copper, under various circumstances and with various elements. When using this fascinating instrument they would in testing various kinds of metals find considerable enlightenment, and many puzzling observations.

Mr. F. PLATTEN said that many years ago it was the custom of all engineers to specify that arsenic should be reduced to less than 0.15 per cent. There was now, however, general agreement that the presence of arsenic in copper was beneficial. All engineers specified it, in certain amounts, up to 0.55 per cent. It was certainly useful to have the matter followed out to its limits as had

been done by the authors of the paper, and the curves put on record. These experiments were all done by erieble, but he would like to ask the authors if they could give any explanation of the following facts. When producing a copper containing a certain percentage of arsenic, it was the custom in the refinery to add the arsenic, because arsenical copper did not come into the market in any considerable quantity. It came mostly in Bessemer bars, and the arsenic was blown out, so that they had to add it. When they added arsenious oxide the effect on the tensile strength of copper was practically negligible, but if metallic arsenic were added to the copper in the refinery furnace, there was an increase in the tensile strength. The addition of the arsenious oxide seemed to have no effect except on the question of conductivity. As to the analysis of arsenical coppers, engineers specified a copper with 0.3 to 0.5 per cent. arsenic, and with this margin at any rate for works purposes, it was sufficiently accurate to titrate the distillate direct. An absolutely accurate result running into the third decimal place could be obtained by precipitating the arsenic from the distillate in the form of sulphide, dissolving it in water, and then titrating as mentioned in a paper he read before the Society some years ago.

Mr. O. F. HUDSON said the two photographs showing the structure of quickly-cooled and slowly-cooled alloys, showed that in the case of arsenic the copper could hold 0.2 per cent. at least in solid solution. He understood that the authors were of the opinion that the dark and light portions represented in the slowly-cooled alloy two constituents; but he thought it was clear that they showed a simple solution of the arsenic and copper: the dark and lighter portions merged gradually one into another, darker portions representing the parts slightly freer from arsenic.

Mr. E. A. LEWIS said his experience of arsenical copper made in the refineries was that it always contained a certain percentage of oxygen, and nearly always as much as in a non-arsenical copper. It seemed that the arsenic did not remove the oxygen. With regard to the structure of antimonial copper, Arnold stated some years ago that the copper-antimonial boundary was a compound structure. It seemed that it depended entirely on the rate of cooling, and the weight operated upon. With regard to the point raised about estimating arsenic, he did not find it necessary to evaporate down to dryness. He took a comparatively long time for the distillation—about two hours—and titrated arsenic direct.

Mr. D. M. LEVY suggested that the authors of the paper should continue their investigations, and show the effect of increasing quantities of oxygen on the alloys that they had prepared. That was a point of practical importance. The general idea, he thought, was that arsenic combined with copper to form a compound which passed into solid solution, and which might separate, on further cooling, to form the boundaries which interfered with the electric conductivity and similar properties. The effect of oxygen might be to form an insoluble copper arsenate, which would collect the arsenic into the form of nodules and not have so damaging an effect on the conductivity and other properties of arsenical copper. Some years ago a paper was published, showing that the effect of arsenic on copper was not so great unless there was a certain quantity of lead present. Oxygen was not mentioned, but it seemed to him, from a large number of tests on metal, that the presence of arsenic and lead was more desirable than the presence of either of them alone. It would be interesting to have some tests done on the hot rolling or drawing of those alloys to see if those boundaries might pass into solution at higher temperatures and show better working properties.

Mr. E. J. BARTY said he had taken several photographs in regard to this question of arsenic in electrolytic copper. He started with a high conductivity copper which always gave the same definite structure. In the electrolytic copper used there was about 0.1 per cent. of oxygen and 0.1 per cent. of other impurities. When he added metallic arsenic to that, in small proportion, he found that the structure was absolutely changed. If he added copper oxide to introduce oxygen, as long as the total impurities were less than 0.5 per cent., the structure approached the electrolytic structure again, but the

crystal boundaries became pitted, which he thought was due to the oxygen from the bismuthates and arsenates which separate at the crystal boundaries on cooling. He knew that in impure coppers with oxygen added the conductivity was much better than when the oxygen was not there, and by melting under charcoal, one got low conductivity again.

Mr. F. JOHNSON pointed out that the authors had not spoken of the effect of arsenic on copper at high temperatures. It was this particular property which seemed to be the great point. Another great advantage of arsenic was that it raised the point at which copper became annealed. It also made it tougher at all temperatures. These facts were of immense importance when copper had to be used for loco, plates and tubes. The use of arsenic considerably modified the effect of bismuth. He was surprised to hear that copper containing 0.5 per cent. of antimony, was hard to draw into wire, and a paper read by Mr. T. JOHNSON in 1906, before the Birmingham Metallurgical Society, contained a table bearing on this point. In this paper he gave a copper with 0.5 per cent. of antimony which had a tensile strength of 15.6 tons per square inch and an elongation of 45 per cent., and had had a good deal of work put on it. That, he thought, must be due to the fact that the copper was a refined copper containing oxygen as well as antimony. He thought the hardness of the copper quoted by the authors was due to the fact that it contained no oxygen.

Mr. A. H. HORNES, in reply, referred first to some peculiarities he had detected in carrying out the experiments. Mr. Stansbie had read a paper on the effects of small quantities of elements on copper with regard to their action with nitric acid. From those experiments he was led to the conclusion that 0.215 per cent. arsenic in copper was a critical point—that above and below that percentage there was a different action and that different amounts of gases were given off. From some experiments which he conducted some time ago on the effect of arsenic on copper, he found when he arrived at a certain percentage, that a blue constituent, totally different from the others, separated out on the boundaries. On increasing the quantity of arsenic this blue compound increased in quantity, until finally he arrived at a percentage when the whole mass consisted of the blue compound. After analysis that was found to be a chemical compound containing 28.34 per cent. of arsenic. From that he was led to state with considerable certainty that the small quantities of this blue substance separating out, even when the percentage of arsenic was small, were the same compound, and he was therefore led to consider that the influence of arsenic on copper was largely due to this compound. He was of opinion that this compound, Cu_3As , in copper was in solid solution under certain circumstances; in other circumstances it separated out. They found when there was as low as 0.22 per cent. of arsenic there was, on very slow cooling, a slight separation of this compound. That did away with the transformation point at 0.215 per cent., because they were led to expect if no separation could be brought about by long cooling below 0.25 per cent., that that would show the reason why there was a difference in the properties below and above that point. It seemed reasonable to suppose that by extremely long-continued cooling and with the smallest percentage of arsenic this compound might separate out. Did this chemical compound therefore have any influence on the properties of the copper? He thought it did. Those properties would differ according as this chemical compound was in the free state or in the state of solid solution. To their surprise they found that in the neighbourhood of 0.5 per cent. arsenic there was a difference in the malleability of the copper. From these observations he was led to consider that it was not safe to introduce more than 0.2 per cent. of arsenic into copper, although the quantity of the chemical compound on slow cooling made little difference. But as one gradually increased the percentage, the arsenic became more and more deleterious. They found between 0.5 and 1 per cent. the malleability seemed to diminish, and when they passed 1 per cent. and got up to 2 per cent. and 3 per cent. they had a metal which rolled almost perfectly. It was harder

than pure copper. There was more of this chemical compound separated out, so it seemed that the separation of the compound, which always took place in the boundaries, had little influence upon the malleability and the conductivity of the copper with these higher percentages of arsenic. But when a certain amount was separated out, the property seemed to go back again. With a small percentage of arsenic—under 0.5 per cent.—the copper ought to be more brittle by slow cooling than by quick cooling. By rapidly causing the metal to consolidate so as to prevent the separation of this compound, the metal ought to be more malleable than when slowly cooled. He would like to ask Mr. Platten whether the same quantity of arsenic was found in the finished copper as in the case of adding metallic arsenic.

Mr. PLATTEN: Exactly.

Mr. HORNES replied that it could not be a matter of the arsenic not being reduced, and remaining as oxide. It was possible that when the oxide was reduced, if the arsenate were not formed, and these reversible actions took place, it might form copper oxide. With a certain quantity of arsenic introduced into copper, the first small proportions acted by reducing the oxygen in the oxide of copper because they found, that with small percentages of arsenic, the added amount of arsenic was in every case lower by analysis. But when they arrived at a certain percentage, the amount of arsenic was practically the same. They assumed that a certain quantity of the arsenic acted in reducing the copper oxide. With regard to the micro-structure of the alloys, with the point raised by Mr. Hudson, he was quite in accord. He had not been able to confirm Arnold's experiments about the double line. Arnold considered there was a line running through the boundary separating it into two divisions, something like the action of bismuth in copper. In investigating the action of oxygen on copper, the difficulty was in the analysis of oxygen. Perhaps the most important question was that in relation to the action at high temperatures. Many alloys had been tried, to find what was the effect on the mechanical properties by an increase of temperature. Aluminium bronze, for example, was a most excellent metal in the cold, but it was absolutely fatal for rivets in copper plates in fire-boxes, because in a short time it would scale badly, and become very weak, and the copper plate itself would be distorted. As arsenic was put into copper for the purpose of resisting rupture at high temperatures, the question was of supreme importance. It seemed that arsenic had, too, that extremely valuable property of enabling copper to resist the corrosive action of the gases, as well as wear and tear; and he believed that copper, with a certain quantity of arsenic, acted better than any other alloy, save, perhaps, manganese bronze. But copper with manganese had the disadvantage that if it was brought into flame it corroded. They might say that copper with arsenic was the most valuable of all the metals for resisting high temperatures, and the question which arose was only as to how much arsenic might be safely introduced.

Mr. LAMB referred to the question of estimating the amount of arsenic in copper. He agreed with Professor Turner that care was necessary in heating down to a syrup. Care was necessary that the flame did not come into contact with the side of the retort, or chlorine was liberated. It was well to use a low flame and an asbestos pad. Mr. Platten said it was a rough works method. He found it could be made accurate to less than 1 per cent. if a weak solution of iodine was used. He found that 0.8 c.c. was used when one grain of pure copper was distilled with the same amount of solution. Taking the alloy, 0.1 per cent. of arsenic, they found it came to 0.098. Distilling to dryness was not necessary. Taking a low bulk was necessary with the high percentage alloys. Up to 1 per cent. it might not be necessary, but after that it was necessary to evaporate to syrup and distil a second time. He found that answered with copper precipitates. They were distilled with 50 c.c. of the solution, and then the arsenic determined. The bulb was put back and distilled with another 50 c.c., but not taken to dryness. An appreciable quantity of arsenic then came over, and by reducing to dryness the last traces of arsenic were removed.

London Section.

Meeting held at Burlington House on Monday, April 5th, 1909.

MR. E. GRANT HOOPER IN THE CHAIR.

THE ACTION OF SULPHURIC AND NITRIC ACIDS IN THE NITRATION OF CELLULOSE.

BY C. NAPIER HAKE AND MARCUS BELL.

A previous investigation, "On the formation of sulphuric esters in the nitration of cellulose and their influence on stability" (Hake and Lewis; this J., 1905, 374), confirmed the formation of sulphuric esters in cellulose nitrates prepared with mixtures of nitric and sulphuric acids (Cross and Bevan, Ber., 1901, 34, 2496). Further investigation was directed to the conditions which govern the formation of mixed esters during nitration, and to the properties of the products.

Our experiments have covered such a wide range, and suggest so many new points of interest, that it has been found impossible to bring the whole of the work to completion in the time at our disposal. We have therefore confined ourselves in this communication to the study of the action of concentrated sulphuric and nitric acids in contact with cellulose at temperatures within reasonable limits. All the experiments were carried out in a laboratory at temperatures between 10° and 20° C. Filter paper was found to be the most convenient form of cellulose with which to work, being both pure and practically uniform in physical condition. It is more easily handled than cellulose in the form of cotton wool or raw cotton, the experimental conditions being more easily controlled. The majority of our experiments were therefore made with cellulose in the form of Swedish filter paper.

The acids used were commercial concentrated sulphuric and nitric, the sulphuric acid containing from 92 to 96 per cent. of H_2SO_4 , the nitric acid from 91 to 95 per cent. of HNO_3 . The nitric acid contained from 2.5 to 3.5 per cent. N_2O_4 . The acid mixtures used for nitration contained from 5 to 8 per cent. of water.

In carrying out the experiments, the following conditions were observed, except in cases where special conditions are mentioned:—(a) The cellulose, previous to nitration, was dried in the water oven, and allowed to cool under a desiccator. (b) A large excess of acid mixture to cellulose (at least 50:1 by weight) was taken, the weight of acid mixture used being such that 12–13 parts of nitric acid were present for each part cellulose. (c) After nitration, the products were drowned in a large excess of cold water, and washed in cold running water until neutral, i.e., until after standing for two hours in a small quantity of distilled water, the water gave no indication of free acid.

The estimations of combined nitric and sulphuric acids were made on the thoroughly cold washed products. The degree of nitration was found by estimation of nitrogen in Lunge's nitrometer, the combined sulphuric acid by fusion with alkali, precipitating and weighing as barium sulphate.*

With a view of determining the chief factors governing the formation of sulphuric esters during nitration, the experimental conditions were varied in respect to:—(1) Temperature of the acid mixture. (2) Proportions of acid mixture to cellulose taken. (3) Proportion of water in nitrating acids. (4) Relative proportions of sulphuric and nitric acids in the nitrating mixture. (5) Physical condition of the cellulose. (6) Time of contact between cellulose and acids.

(1) and (2) We find that variations of temperature well within practical limits (0° C.—25° C.), both in mixing the acids and during the process of nitration and drowning, or variations in the excess of acid mixture to cellulose taken (25 to 200 parts of acid mixture to 1 of cellulose) have little or no influence on the formation of sulphuric esters.

(3) The following results, averaged from a large number of experiments, show that within the limits of 4 to 8 per

* For details of method see this J., 1905, 376.

cent., the water contents of the acid mixtures have practically no effect on the product.

Acid mixture.		In product.	
Water.	Proportion H_2SO_4 HNO_3	Combined sulphuric acid.	Nitrogen.
Per cent.		Per cent.	Per cent.
4	3/1	0.08	13.7
7	3/1	1.00	13.6
8	3/1	1.01	13.5

These results are confirmed by all our experiments, both with cellulose in different physical conditions, and with acids in other proportions than 3/1.

Before discussing the effects of the proportions of the two acids in the mixture, the physical condition of the cellulose, and the time of contact, it will be convenient to consider the action of concentrated sulphuric and nitric acids separately in contact with cellulose. Sulphuric acid rapidly attacks and dissolves cellulose, forming soluble cellulose sulphates. On standing, the solution blackens more or less rapidly, giving evidence of breaking up of the cellulose molecule. The gradual hydrolysis of these esters, dextrose being the ultimate product, has been investigated by A. L. Stern. Concentrated nitric acid, on the other hand, rapidly forms insoluble nitrates, the degree of nitration depending on the concentration of the nitric acid. The maximum degree of nitration attainable by the nitric acid used is reached after a few minutes' contact; the product is found to be highly parchmentised and readily stabilised by boiling with water.

Our experiments show that, when the two acids are mixed, and are in contact with cellulose, each acid endeavours to carry out its characteristic function, the sulphuric acid to dissolve, and the nitric acid to form nitrates, not readily attacked, when once formed, by the sulphuric acid in the mixture. The acids in the mixture exert a mutual checking or retarding influence; in fact, each may be looked upon as a diluent. The sulphuric acid (considered apart from its dehydrating action), delays nitration, and the nitric acid checks the solvent action of the sulphuric acid. The quantity of combined sulphuric acid found in the product depends on the extent to which each of the acids has been able to exert its influence. It must be borne in mind, however, that of the two acids, nitric shows far more reactivity with cellulose, the ester-forming reaction proceeds with much greater velocity, and the resulting nitrates are comparatively inert as regards further action of mixed acids. They are insoluble, both in nitric acid and in acid mixtures containing large proportions of sulphuric acid. On the other hand, the solvent action of sulphuric acid is not only intrinsically slower than the action of nitration by nitric acid, but produces a condition (solution) which is readily susceptible to further chemical changes.

(4) *Relative proportions of sulphuric and nitric acids in the nitrating mixture.*—Table I. gives the results obtained by immersing cellulose in mixtures containing various proportions of sulphuric and nitric acids. The experiments were made with Swedish filter paper. The excess of acid mixture used in each experiment in Sections A, B, and C was such, that not less than 12.5 parts by weight of nitric acid were present to each part of cellulose. The third and fourth columns give the results of determinations of the degree of nitration and percentage of sulphuric acid combined in the products.

TABLE I.

Section.	Acids H_2SO_4 HNO_3	Time of contact with acids.	Product.		Remarks.
			Nitrogen.	Combined sulphuric acid.	
	Nitric acid alone	—	Per cent. 9.6 to 13.5	Per cent. —	
A.	1/3	1 hour	13.70	0.27	Strongly parchmentised. Degree of nitration varies between wide limits according to concentration of nitric acid. Nitration complete in few minutes.
		1 hour	12.64	0.79	Strongly parchmentised.
		5 minutes	10.69	0.01	Parchmentised. Yield, 178 per cent.
	3/1	15 minutes	12.84	0.08	Slightly parchmentised. Not broken up.
		30 minutes	13.20	0.08	2.5 per cent. soluble in 98 per cent. alcohol.
		1 hour	13.55	1.01	Yield, 178 per cent.
B.	5/1	6 hours	13.48	1.96	Unchanged in appearance. 4.3 per cent. soluble in 98 per cent. alcohol.
		3 days	13.53	1.60	Unchanged in appearance. 3.9 per cent. soluble in 98 per cent. alcohol.
		10 days	12.55	1.75	Unchanged in appearance.
		41 days	13.60	1.56	Broke up on washing.
	6/1	6 hours	12.87	2.42	Soft, not broken up. 6.1 per cent. soluble in alcohol.
		3 days	12.41	1.77	Broke up on washing. 5.9 per cent. soluble in alcohol.
		10 days	13.53	1.63	Broke up on washing.
		41 days	13.65	1.85	Broke up on shaking in mixed acids.
	8/1	6 hours	10.72	4.33	Soft, broke up on washing. 12.9 per cent. soluble in alcohol.
		3 days	12.56	2.68	Broke up in nitrating acids. 12.7 per cent. soluble in alcohol.
		10 days	13.31	2.03	Broke up in nitrating acids.
		41 days	13.40	2.10	Broke up to fine powder on washing. Yield, 50 per cent. approximately.
C.	10/1	3 hours	7.41	6.46	Soft, broke up on washing.
		6 hours	10.02	6.58	Soft, broke up on washing. Yield, 162 per cent.
		3 days	11.59	4.48	Broke up in acid mixture. Yield, 130 per cent.
		6 days	11.63	4.23	Much broken up in acids. Yield, 67 per cent. approximately.
	12/1	3 hours	—	—	Breaks up into powder on washing.
		6 hours	—	—	Cellulose broken up.
		3 days	—	—	Cellulose partially dissolved.
		6 days	—	—	Solution nearly complete.
	15/1	3 hours	—	—	Solution complete.
		6 hours	—	—	Solution nearly complete.
		3 days	—	—	Dissolved, solution not quite clear.
		6 days	—	—	Clear solution, no charring.
D.	19/1	1 hour	—	—	Complete solution in 1 hour, no charring.
	38/1	30 minutes	—	—	Complete solution in 30 minutes, charred on standing.
	H_2SO_4	20 minutes	—	—	Complete solution in 20 minutes, slight charring.

All the phenomena attending the reaction of nitration are characterised by their progressive nature; the results show a gradual change in the reaction, from rapid nitration with high yields in Section A, through stages of delayed nitration with increasing solution of the cellulose, until the solvent power of the sulphuric acid predominates, and the material goes into solution. Progressive action is further shown by the physical condition of the products. Cellulose nitrates made with nitric acid alone, or with acid mixtures containing relatively large proportions of nitric acid, are much hardened and parchmentised. This hardening effect takes place immediately on immersion in the acid, and not, as in the process of parchmentising with sulphuric acid, only on washing. It is probable that these products consist of cellulose not only nitrated, but also hydrated. Further investigation may show that when the proportion of sulphuric acid present is small, water enters into the composition of the product. We have also observed that the products of nitration with acid mixtures containing from 16 to 21 per cent. water are similarly hardened and parchmentised.

Lunge ("Researches on nitrocellulose," J. Amer. Chem. Soc., 1901, 23, 527) observed that, when the proportion of sulphuric acid in the mixture exceeds 7/1 the product breaks up into a fine powder on drying. He also found that nitration with 3/1 acids, but at temperatures from 60°–80° C., gave similar products. We would suggest that the effect is due to the same cause in both cases, *viz.*, to increased solvent action by the sulphuric acid, brought about in the one case by its excess in quantity, and in the other case by its increased solvent power at raised temperatures. The greater reactivity of nitric acid is shown by the fact that the retarding influence of excess of sulphuric acid is not apparent to any great extent until the proportion 6/1 is reached; even the mixture 10/1 has primarily a nitrating action. On the other hand, a comparatively small proportion of nitric acid is capable of delaying considerably the solvent power of sulphuric acid.

proportion of sulphuric acid (Section B), an excessive quantity of mixed ester is first formed; this excess is, however, reduced by the action of the nitric acid until in each acid mixture an equilibrium is reached when no further SO_4 groups are replaced by NO_3 . At the same time, the yield diminishes as the proportion of sulphuric acid in the mixture is increased. These actions are progressive, and indicate that while the action of the nitric acid is delayed, sulphuric acid is enabled to act on the cellulose, tending to form soluble sulphuric esters.

The question now arises whether mixed esters are formed by the complete solution of part of the cellulose in sulphuric acid, and subsequent precipitation within the material by the addition or substitution of NO_3 radicals. In order to test this theory, cellulose was allowed to dissolve completely in sulphuric acid, and this solution was then mixed with nitric acid. The addition of nitric acid was made by two methods, *viz.* :—

(a) By adding the sulphuric acid solution gradually to excess of nitric acid; and

(b) By gradually adding concentrated nitric acid to the sulphuric acid solution. By both methods precipitates are obtained; they have similar properties, but these are in no way characteristic of mixed esters. The product consists of an amorphous powder containing from 14–15 per cent. nitrogen and 0.5 per cent. sulphuric acid.*

The conditions favourable to the formation of mixed esters were then sought for at a stage of the reaction before complete solution. It was found that a condition of partial solution or gelatinisation of the cellulose by sulphuric acid is most favourable to the formation of mixed esters. The following experiments (Table II.) show the products obtained by allowing concentrated sulphuric acid to act first on cellulose for various times, and then placing the cellulose, saturated with sulphuric acid and in a state of semi-solution, into a nitrating acid, either nitric acid alone, or a mixture of sulphuric and nitric acids, for various periods.

TABLE II.

Form of cellulose.	Treatment previous to nitration.	Nitrating acid.	Time of nitration.	Product.	
				Nitrogen.	Combined sulphuric acid.
				Per cent.	Per cent.
Swedish filter paper, Density =1	(1) Dipped in sulphuric acid, drained a few seconds.	3/1 Nitric acid	1 hour	12.22	3.4
	(2) Dipped in sulphuric acid, drained a few seconds.		16 hours	13.17	1.9
			$\frac{1}{2}$ hour	12.13	2.2
Thick filter paper, Density =1.52.	(3) Dipped in sulphuric acid 10 seconds, drained half hour.	3/1	$\frac{1}{2}$ hour	7.50	7.0
			$\frac{1}{2}$ hour	9.68	4.8
	(4) Dipped in sulphuric acid 3 seconds, not drained.	3/1	1 hour	11.04	4.4
			3 hours	12.08	4.9
	(5) Dipped in sulphuric acid 30 seconds, drained 2 minutes.	3/1	3 days	13.65	1.8
			$1\frac{1}{2}$ hours	11.37	5.8
	(6) Dipped in sulphuric acid 30 seconds, drained $1\frac{1}{2}$ hours.	Nitric acid	1 hour	10.56	1.3

It will be seen that sulphuric acid is combined in all the products of nitration with mixtures of sulphuric and nitric acids, and that the amount of mixed ester formed, other conditions being equal, is determined by the proportions of the acids in the mixture acting on the cellulose. When the proportion of nitric acid in the mixture is sufficient to ensure rapid nitration, the cellulose is immediately protected from the solvent action of the sulphuric acid, by conversion into nitrate.

The results given in Section A are directly contrary to the theory of the "pioneering" action of sulphuric acid; that is, that the first action consists in the conversion of the cellulose into sulphate, and that nitric acid subsequently replaces sulphuric acid in the ester. Section A shows the formation of sulphuric esters side by side with nitration. It will be observed that by increasing the

The results detailed in Table II. point to the conclusion that partial solution of the cellulose and "fixation" of the product by substitution of nitric acid radicals are the stages through which mixed esters are formed.

(5) *Physical condition of the cellulose.*—Under the same conditions of nitration, cellulose in different physical forms gives nitrated products varying in composition.

In the following series of experiments, five forms of cellulose were nitrated, namely:—(1) Cotton wool; (2) Washed cops; (3) Swedish filter paper; (4) Filter paper issued by the Home Office for the use in making heat test paper; (5) A thick filter paper. Samples of

* This substance will form the subject of a separate note.

each of these forms of cellulose nitrated for one hour in 3/1 acid mixture, gave the following products:—

TABLE III.

Form of cellulose.	Product.	
	Nitrogen.	Combined sulphuric acid.
	Per cent.	Per cent.
1. Cotton wool	13.75	0.70
2. Washed cops	13.75	0.73
3. Swedish filter paper.....	13.35	1.01
4. Heat test paper	13.38	1.53
5. Thick paper	12.52	2.58

From the results given in Table I. we may conclude that these variations are due to the fact that the acid mixture acting on the cellulose is not the same in each case, but the proportion of sulphuric acid acting is least in sample (1), and greatest in sample (5), and this, although the bulk of the acid mixture used was identical in composition in every case. The notable difference in physical condition of the five samples is one of density of the material. The surface of cellulose exposed to the action of the acids is greatest in cotton wool, and less in each succeeding sample. In the case of the three papers (3), (4), and (5), the relative densities were determined, taking Swedish filter paper as a standard, with density = 1. Equal areas of the three papers were taken, their average thicknesses found, and the equal areas weighed. In this way it was found that sample (4) has a density of 1.22, and sample (5) a density of 1.52, when compared with sample (3). This increase in density leads, when the papers are immersed in a nitrating mixture, to concentration of sulphuric acid in the absorbing material. Two explanations suggest themselves:—(a) That sulphuric acid is, in itself, able to penetrate and occupy the spaces between the particles more easily than nitric acid (selective action); or (b) that the mixed acids absorbed at first may be in the proportions in which the acids were made up in the mixture (no selective action): but nitric acid is continually being removed by combination with cellulose from the mixture absorbed; thus the proportion of

considered independently of the bulk. The greater the quantity of acid mixture in contact with unit weight of cellulose, the more rapid is the nitration, and the less the effect from partial solution by sulphuric acid. The conditions are evidently most favourable in the case of cotton wool; a large surface is presented to the action of the acids and the minimum of sulphuric acid is found combined. In the case of the papers, samples (3), (4), and (5), above, the amount of acid absorbed per unit weight of cellulose decreases with the increase in density of the paper, the acid mixture becomes richer in sulphuric acid, and delayed nitration and partial solution lead to increase in the combined sulphuric acid.

That the difference in the products obtained by nitrating these three papers under the same conditions is due only to the physical condition of the samples, was shown by the following experiment. A sample of each of the papers was pulped by shaking up for some time with warm water; the water was drained off on a Büchner filter funnel and the cellulose in the funnel pressed gently, so that in each case a layer of cellulose was obtained of about one-fifth inch thickness. Each sample was then nitrated under the same conditions, and the combined sulphuric acid in the products determined. The results were:—

	Combined sulphuric acid.
	Per cent.
Swedish filter paper	1.42
Heat test filter paper	1.45
Thick filter paper	1.44

(6) *Time of contact between cellulose and acids.*—In considering the results given in Table I. above, it has been shown that the extent to which sulphuric esters are formed depends mainly on the proportions of the acids in the mixture. The action being progressive, the amount of combined sulphuric acid and the degree of nitration vary at different stages of time of contact. In Table I. the proportions of acids in the mixture and the time of contact were varied, the physical condition of the cellulose being the same in all cases. In Table III. the physical condition of the cellulose is the variant, the proportions of acids in the mixture and the time of contact being constant.

In the following experiments (Table IV.) the time of contact and the physical condition of the cellulose are the variants, the proportions of the acids in the mixture being constant (3/1 in all cases).

These results show that as the density of the material increases, there is a general tendency towards slower

TABLE IV.

Time of nitration.	Cotton wool.		Swedish paper, Density, 1.		"Heat test" paper, Density, 1.22.		Thick filter paper, Density, 1.52.	
	Nitrogen.	Combined sulphuric acid.	Nitrogen.	Combined sulphuric acid.	Nitrogen.	Combined sulphuric acid.	Nitrogen.	Combined sulphuric acid.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
5 minutes	11.71	0.5	10.69	0.9	—	—	6.1	2.0
15 minutes	13.18	0.7	12.84	1.0	11.73	1.3	10.18	3.2
30 minutes	13.41	0.7	13.20	1.0	13.17	1.1	11.23	2.5
1 hour	—	—	13.35	1.0	13.38	1.5	12.52	2.6
2 hours	—	—	13.31	1.0	—	—	13.17	1.9
3 hours	—	—	13.69	1.1	13.84	1.4	13.24	1.6
6 hours	—	—	—	1.0	13.74	1.3	13.43	1.6
1 day	—	—	13.67	1.0	13.86	1.5	13.67	1.4
3 days	—	—	13.93	1.2	13.87	1.3	13.60	1.3
6 days	—	—	13.96	1.1	13.84	1.3	13.51	1.2
10 days	—	—	12.82	1.3	13.64	1.5	13.65	1.4
16 days	—	—	13.90	1.2	13.82	1.3	13.76	1.5

sulphuric acid in contact with the cellulose for the time being is increased. The latter view is found to be in accordance with the facts. The bulk of the acid mixture in the nitrating vessel may be considered as non-reactive, serving only as a reservoir or acid supply: the acid mixture actually in contact with the cellulose being

nitration, and increase in the proportion of sulphuric acid combined in the product. In Table I., where the physical condition of the cellulose was the same in all cases, the same result was arrived at by increasing the proportion of sulphuric acid in the mixture, as will be seen in the following table:—

TABLE V.

Cellulose nitrated.	Acids.	Time.	Nitrogen.	Sulphuric acid.
			Per cent.	Per cent.
Thick filter paper....	3/1	1 hour	12.52	2.6
Swedish filter paper }	6/1	6 hours	12.87	2.4
	8/1	3 days	12.56	2.7

The proportions of the acids acting on the cellulose determine the rate of nitration and the consequent formation of sulphuric esters; therefore the proportions of the acids acting on the cellulose in the experiments given in Table IV. cannot be the same in all cases.

An attempt was made to estimate the proportions of sulphuric and nitric acids in contact with cellulose while nitration is proceeding. Samples of Swedish and thick filter papers were cut into circular pieces about 1 inch in diameter. Several of these pieces were immersed in 3/1 acid mixture for given times. The nitrated papers were removed from the acid bath, and pressed gently on blotting paper to remove the acids adhering to the surface. The papers, now containing only the acids actually absorbed and acting on the cellulose, were washed free from acid in distilled water. The ratio, sulphuric acid/nitric acid, in the acids washed out was estimated: the total acid being found by titration with *N*/50 alkali, and the proportion of sulphuric acid by weighing as barium sulphate. The degree of nitration of the products was also determined. The result of this series of experiments is given in Table VI. The figures represent the average of a large number of experiments.

These results show that the denser material is not capable of absorbing the same weight of mixed acids per unit weight of cellulose as the less dense material. It follows that as the nitric acid is removed by combination,

no sulphuric acid was combined with the nitro-cotton, which was contrary to expectation. The other fact was, that with an impure paper like Swedish filter paper, a percentage of nitrogen resulted higher than was foreseen by Lunge, who found 13.80 per cent. and whose guncotton at that percentage was unstable. The authors had 13.96 as the maximum, and one began to think that a theoretical nitrocellulose could be reached, at any rate in a laboratory. He did not know whether these percentages of nitrogen had been found before properly washing and stabilising. He expected that a good deal of combined sulphuric acid was thereby removed, and the mere fact that such removal took place was interesting, inasmuch as it showed that the percentages of nitrogen might be incorrect. Whilst the authors had found a number of interesting data, they were nevertheless mostly obvious facts, obvious in this sense, that when 38 parts of sulphuric acid to one of nitric acid were taken, and they were told that the quantity of nitric acid was in all cases 12, one part of cotton must have been nitrated in something like 456 parts of acid, out of which 444 parts were sulphuric acid. Under such conditions it was not surprising that the sulphuric acid had a preponderant action. If the authors had kept to the same quantity of acid and varied the proportion of nitric acid to sulphuric acid the results might perhaps be a little more comparable; as they were, they gave the obvious result that the more sulphuric acid used, the larger was the quantity of mixed acid, and the more the cellulose was dissolved, until ultimately solution was complete. On the other hand, with a large excess of sulphuric acid, a large quantity of combined sulphuric acid was to be expected, and then, by longer exposure to nitration the nitric acid would displace the sulphuric acid.

Dr. R. ROBERTSON said the previous paper by Messrs. Hake and Lewis had proved useful to those engaged in the manufacture and stabilising of guncotton, and in the same way they might gain much interesting information from this one. From Table I, it appeared that as the

TABLE VI.

Time.	Swedish paper.			Thick paper.		
	Nitrogen.	Grms. acid washed out per grm. cellulose.	Proportion, sulphuric acid to nitric acid, in acid washed out.	Nitrogen.	Grms. acid washed out per grm. cellulose.	Proportion, sulphuric acid to nitric acid, in acid washed out.
	Per cent.			Per cent.		
1 minute	6.3	2.25	5.4	—	—	—
2 minutes	7.9	2.65	4.4	4.8	1.40	8.0
3 "	8.0	2.55	4.4	5.3	1.45	7.5
5 "	10.7	2.65	4.1	6.1	1.49	6.5
10 "	11.8	2.73	4.1	8.3	1.61	6.1
20 "	13.0	3.04	2.9	9.9	2.01	5.4
30 "	13.2	3.01	3.7	11.2	2.13	3.8
60 "	13.3	2.95	3.6	12.5	2.50	3.2
3 hours	13.7	3.00	3.5	13.2	2.68	3.0

the mixture becomes rich in sulphuric acid, and these conditions, favourable to the formation of sulphuric esters, prevail until equilibrium is slowly reached.

SUMMARY.

1.—Sulphuric acid is found to be combined in all products of nitration with acid mixtures containing sulphuric acid.

2.—The formation of mixed esters is due to delayed nitration, partial solution or gelatinisation of the cellulose by sulphuric acid, and subsequent fixation by nitric acid.

3.—The amount of sulphuric ester formed is determined by the proportion of sulphuric and nitric acids acting on the cellulose during nitration.

4.—The proportions of the acids acting on the cellulose during nitration is determined by the density of the material.

Our best thanks are due to Mr. N. K. S. Brodribb for his assistance in carrying out the numerous determinations made in connection with this investigation.

DISCUSSION.

Mr. OSCAR GUTTMANN said they had learned two important facts from the paper, one, that in nitration with nitric acid alone and precipitation with sulphuric acid,

concentration of sulphuric acid in the mixed acids was increased, a greater proportion of sulphuric acid esters in the product was obtained. In section A of Table I, where the proportion of sulphuric acid to nitric acid was still normal, and similar to what one would use in making guncotton, it was found, as time went on that there was no increase in the proportion of sulphuric esters. In Section B, however, a considerable increase was obtained at first, followed by a decreasing proportion until an equilibrium was reached. He gathered that the authors held the view that, instead of the "pioneering" action of sulphuric acid, of which there is no evidence within the range of results shown in Section A, though it might perhaps be said to occur in Section B, the sulphuric acid acted by a process of solution producing a condition of the cellulose favouring the introduction of nitric and sulphuric acid residues. Instead of assuming that the mechanism of the reaction would run in the sense of sulphation followed by an elimination of nearly all the sulphuric acid residues by nitric acid residues, it would seem reasonable to assume that the action of the mixed acids on cellulose would depend on three things: the active masses of the two acids, their relative avidities for cellulose and their relative rates of esterification. The active masses were known, the avidity of the nitric acid for cellulose

was obviously, from the nature of the product, extremely high, but on the subject of the relative rates of esterification there would appear to be some difference of opinion. The authors made the remark that the rate of nitrification is high, while that of solution is low. It might very well be, however, that the rate of sulphation is fairly high, for the authors have shown that when cellulose is dipped for only a few seconds in sulphuric acid and then transferred to a nitrating mixture, a large proportion of sulphuric ester is formed, and also if one took cotton wool, dipped it momentarily into sulphuric acid and washed quickly, the product contained a large quantity of the same body. Thus one might assume the rate of esterification of sulphuric acid to be fairly high. If it were, such a result as that shown in Section B of Table I would seem to be explained. In the first place, the high content of sulphuric acid was due to the large active mass of acid present, and in the second, the gradual tendency towards an equilibrium and lowering of the sulphuric acid content would be due to a disturbance of the equilibrium by the greater avidity of nitric acid; so that this hypothesis seemed to him equally tenable. With regard to the presence of these esters, this paper was certainly important because it would indicate to the manufacturer what to avoid in choosing a nitrating mixture and it might very well account for the superior quality of the guncotton made by the displacement process, in which the nitrating mixture contained over 20 per cent. of nitric acid, while in the Abel process the guncotton was for many hours in contact with an acid containing not much more than 10 per cent. Fortunately there was little difficulty, with a proper method of boiling, in getting rid of these sulphuric acid esters. In an acid solution they readily broke down, and there was no practical difficulty in detecting them. On subjecting guncotton containing these esters to any heating-up test, the presence of a non-volatile catalyser very readily produced a marked evolution of gas, and an extraordinary high evolution in the Will test, mentioned by him on a previous occasion (this Journal, 1901, 21, 820), was due simply to the presence of about 0.7 per cent. of sulphuric acid ester.

Mr. W. RINTOUL said whether the sulphuric ester was formed side by side with the nitric ester or not, was not quite clear: as Dr. Robertson had said, Table I afforded evidence either way. Section A showed that with 3/1 acid, the sulphuric acid ester was a constant, but in Section B there was distinct evidence of a decreasing amount being found with the increase of time. It looked there as if the sulphuric ester was broken down by the nitric acid with the formation of nitric esters. It had been suggested by Haessermann (*Z. Ges. Schiess-u. Sprengstoffwesen*, 1908, 3, 121), that, in the formation of the lower cellulose nitrates, the production of addition compounds between the nitric acid and the cellulose constituted one step in the reaction of nitration. It was possible that a similar and intermediate formation of addition compounds occurred during the production of the higher nitrates from mixed acids. This hypothesis would explain the abnormally high nitrogen contents quoted in some of the tables, as the nitrocelluloses examined had been only very slightly washed. The test of two hours' standing which had been applied was not sufficiently drastic to prove that no more acid could be removed by cold washing. His own experience had been that, if the washing were prolonged this point of first neutrality, sulphuric and nitric acids were removed in equal quantities. Another difficulty had occurred to him in trying to account for the sulphuric acid present in guncotton, namely, that on boiling nitrocellulose until a state of thorough stability was reached there still remained a small proportion of sulphuric acid organically combined. If this residue were present as an ester, as in the cold washed nitrocelluloses containing high proportions of sulphuric acid, it ought to be possible to remove it, but he did not think any method had yet been found whereby guncotton absolutely free from organically combined sulphuric acid could be produced from mixed nitric and sulphuric acids. Although their knowledge of the subject was considerably advanced by the present paper, there still remained many points in relation to the nitration of cellulose which required elucidation.

Mr. W. F. REID said the whole series of experiments was practically made on a material, Swedish filter paper, which was, to begin with, quite indefinite, but which the authors assumed to be pure cellulose. Then there was another material called "thick paper" upon which they had no information at all; therefore for him the only practical interest centered in Table 3, where materials were used which were of practical importance. Another point which affected the whole of this series of experiments was that the method of treating the material produced was totally different from that which had been found necessary in practice. It had been washed cold, and they knew that if they washed such bodies cold, they did not get the same result as if they washed it hot. The product was dependent on a variety of circumstances which were not represented in these Tables in any way at all. He did not wish to criticise a very interesting work too much, but some things which were well known many years ago were given as the result of these experiments. For instance it was thoroughly well known that the state of sub-division of the material was important. Von Lenk had shown that, if not some one earlier. Certainly in the guncotton industry it was found many years ago that they could only use cotton waste, when carded and finely subdivided. The industry therefore had been based on a fact which was one of those supposed to be brought out in this paper. Again, with regard to the action of a mixture containing a large quantity of sulphuric acid, as compared with one containing a smaller proportion, it was very clear that mass action had something to do with the ultimate product. He thought the question was not only one of nitration, but there might be denitration taking place, which ought to have been gone into. When nitro-products were exposed to the action of a large bulk of sulphuric acid for a long time, a certain degree of denitration took place.

Captain M. B. LLOYD said Dr. Robertson seemed to have missed a point in Table I, Section B, viz., the question of yield. He was referring to the way in which the sulphuric acid esters were diminished with time, but was not that due to the increased quantities taken up in the solution rather than to the sulphuric acid esters being turned into nitric acid esters? There was the total yield given at the bottom, but it was rather a pity, from his point of view, that there was not a column of yields corresponding to each time of nitration. The yield for 41 days was only 50 per cent., and therefore a very large percentage of sulphuric acid esters was probably taken into solution. In Table C there was given the 3-days and 6-hours yield; the 6-hours yield of cellulose was 162 and the 3-days 130, showing that the yield continually diminished the whole time, for which allowance must be made in considering the quantity of esters. With regard to Mr. Reid's criticism he thought the authors' intention was rather to investigate the process of nitration than to present figures which would be of use in estimating the finished product, and therefore it was important that the products should not have been boiled and reduced to their finished state, because in that condition, as was well known, the greater part of these organic esters would have been removed.

Mr. G. W. MACDONALD, replying on behalf of the authors, said, with regard to the "pioneer" theory put forward by Messrs. Cross and Bevan (*Berichte*, 1901, 34, 2496), it should be pointed out that they were working with a 3 to 1 ratio of sulphuric to nitric acid. The authors' results, when using this same ratio, show this theory to be incorrect. Lunge stated that, using strong nitric acid to nitrate cellulose, the maximum obtainable was 12.78 per cent. of nitrogen. The percentage of nitrogen (13.5) found by the authors in similar conditions, was not affected by boiling till stable. It should be noted that the analyses were carried out on the cold-washed products. They had not been stabilised. As Captain Lloyd pointed out, the mechanism of the reaction was what the authors were investigating, and that was undoubtedly of great value from the manufacturing point of view. As guncotton was not manufactured in Australia the authors were at rather a disadvantage in not being able to obtain confirmation of their results on the large scale. They thought, however, that the results showed, among other things, that homogeneity of material, fineness

of division, absence of knots or cellulose hardened by chemical treatment, and reduction of sulphuric acid in the mixture to the minimum consistent with economy of production are obvious advantages. The speaker considered that the authors' results were largely confirmed from the manufacturing point of view, seeing that the amount of sulphuric acid fixed, in the normal course of manufacture, was about 1 per cent. On stabilising this amount greatly diminished, and Mr. Chrystall, who had devoted a good deal of attention to this point, had found in 6 different samples of gun-cotton of current manufacture percentage of combined sulphuric acid varying from 0.09 to 0.30. He agreed with Mr. Rintoul that there was no nitro-cotton manufactured on the large scale which was free from combined sulphuric acid—somewhere about 0.2 per cent. The same remark applied to collodion cotton, even though in that case the nitro-cotton was probably prepared with a less ratio of sulphuric acid to nitric acid in the mixed acid.

Mr. A. E. LEIGHTON wrote: "The appearance of this paper is most opportune in view of the revival of interest in the direct dipping process for the manufacture of nitro-cellulose consequent on the invention of the Waltham Abbey displacement process. However inviting a new process of nitration may be on economical considerations, the stability and quality of the product is of the first importance, and there appears to be little doubt that the stability of nitrocellulose, and especially of mixtures of nitroglycerin and nitrocellulose, is gravely affected by the presence of combined sulphuric acid in the nitro-cellulose. The authors' research, permitting as it does of estimating the effect of composition of the nitrating acids, the nature of the cellulose and time of nitration on the formation of cellulose sulphuric esters, is of great value. There can be no doubt, as judged by modern stability tests, that the elimination of the combined sulphuric acid from nitrocellulose, is attended by an improvement in the stability of mixtures of nitroglycerin and nitrocellulose. In the discussion on Hake and Lewis' paper (this J., 1905, 380), Dr. Robertson pointed out how readily nitroglycerin reacted with "stabilised" nitrocellulose and how valuable was the paste test as an indication of the quality of the nitrocellulose ingredient. This reactivity of nitroglycerin with "stabilised" nitro-cellulose assumes the greater importance the longer the mixture of nitroglycerin and nitrocellulose is to be stored. It may be that existing purification processes for the nitrocellulose used in blasting explosives, which are not usually stored for prolonged periods, meet all requirements, and yet be faulty where the nitrocellulose is to be used in a nitroglycerin-nitrocellulose propellant, which may be called on to withstand drastic storage conditions for many years. Further bearing on this question is the fact that the slow decomposition of nitrocellulose gives rise to fatty acids, and such acids will therefore be produced on prolonged storage of a nitroglycerin-nitrocellulose powder. The exact significance of this slow decomposition becomes clear by the experiments on the effect of acetic acid vapour on cellulose sulphuric ester recorded in the research by Hake and Lewis (this J., 1905, 374), and points to the possible production of free sulphuric acid in nitroglycerin-nitrocellulose powders when the latter are stored under conditions favouring decomposition. It must be admitted that even the possibility of free sulphuric being produced in a powder should be avoided, and it seems that the total elimination of combined sulphuric acid from the nitrocellulose is the result to be aimed at. However, it appears to be much easier to obtain cellulose sulphuric esters than to remove them, when once formed, by the ordinary process of stabilisation, and it is therefore of importance that the process of acid treatment should fix the minimum of sulphuric acid on the cellulose. It is here that the authors' work is of great value to anyone brought face to face with the problem of substituting a new process of nitration for an old, thoroughly-tried process such as the Abel, for it is no light matter to throw over a process producing nitrocellulose which has withstood successfully the climatic trial of thirty years. In my opinion, it is not sufficient to say that two nitrocelluloses of exactly similar ultimate composition will have equal stability under similar storage conditions, for the one may

have entered on its stabilisation treatment containing much more combined sulphuric acid than the other, and it is not probable that the elimination of this sulphuric acid can be brought about without straining the ester in some particular direction, and possibly conferring added reactivity with nitroglycerin. Fortunately the work of the authors makes it clear that such a change of method of acid treatment as that from the Abel process to the Waltham Abbey displacement process, will not have the effect of forming a mixed ester containing more sulphuric acid, or one less susceptible to stabilising treatment, for the authors show with acids mixed in the proportion of three of sulphuric acid to one of nitric acid, that temperature of nitration and variations in the excess of nitrating acids to cellulose, have little or no influence on the formation of sulphuric esters. Turning to Table III. it is interesting to note the authors' experience with cellulose materials of varying degree of compactness, when the materials were subjected to acid treatment for a period too short to eliminate the effect of apparent density. The authors found that where there was great resistance to the free circulation of the mixed acids, nitration was delayed by reason that the acid mixture actually attacking the cellulose became richer in its proportion of sulphuric acid, with consequently increased amount of sulphuric esters in the product and a low nitrogen content. Similar experience used to be met with by the direct dipping of cellulose in pans, and where the waste acids were revived time after time. After a certain number of cycles, the acids became dirty from a cellulosic slime, which, settling on the charge of cotton waste, made it difficult for the mixed acids to find free access to the fibre, and the nitrogen content of the product was then found to be low. This trouble was accentuated by the use of cotton waste containing an undue amount of fly. Although such a difficulty is not met with where the waste acids are filtered before revivification, as occurs where the acids are drawn off slowly through the nitrated charge, the authors' results are valuable, as they draw attention to irregularities experienced under the old direct dipping process which raised some prejudice against the system. The results given in Table IV, prove that from two to three hours' immersion in mixed acids, is sufficient to eliminate any effect of the apparent density of the cellulose as affecting the final composition of the ester, and should dispel any doubt as to the suitability on chemical grounds of nitration of cellulose by a properly designed direct dipping process."

Mr. W. R. QUINAN (South Africa) writes as follows:—"In its practical application to nitrocellulose making, I regard this paper as one of the most important published in recent years. The conditions under which varying amounts of sulphuric esters appear in the nitrated product are made clear for the first time.

"It may add a little to the interest of the discussion to consider the analogy between the nitration of cellulose and the nitration of glycerin. In the manufacture of nitroglycerin, it is well known that a portion of the glycerin unites with sulphuric acid to form glycerol sulphate, thus impeding the nitration and preventing the realisation of the theoretical yield. The amount of glycerol sulphate formed increases with the percentage of sulphuric in the mixed acid. Also that time (with suitable conditions—especially low temperature) will cause a partial replacement of the combined sulphuric by nitric acid, forming additional nitroglycerin. This change takes place during cold storage of the waste acid and adds to the total yield from 2 to 8 per cent., depending upon the composition of the original nitrating mixture and proportion of glycerin used.

"There is strong evidence to show this reaction takes place wholly or partly in stages—that is, a lower form of nitroglycerin is first made, which by further action of nitric acid is changed to the highest form or nitroglycerin proper. This may be taken as an indication that the sulphuric forms more than one compound with the glycerin, but in view of its large excess in the waste acid and the readiness with which it unites with glycerin, this is not likely, and the simpler view is that for the time being, we have in this partly formed nitroglycerin a case of compound ester—a molecule in which glycerol is united with both the sulphuric and nitric acid radicle.

"An interesting question arises as to the nature of the authors' 'mixed' ester in the nitration of cellulose. Is there a compound ester present—that is, a molecule in which both sulphuric and nitric acid radicles enter—or are the respective esters complete in themselves, and only mechanically joined? One wishes that the authors had hazarded a speculation as to this. Their long and patient labours would not only give weight to their judgment, but would naturally incline them to one opinion or the other. It seems to me there are strong reasons for thinking that real compound esters are present. In the first place, the difficulty of getting rid of the sulphuric acid in purification suggests some obstacle greater than the mechanical one offered by structure after the nitrocellulose has been pulped. The term 'fixation' used by the authors implies a union which renders the ester holding the sulphuric acid, insoluble in the ordinary washing process. The complex nature of the cellulose molecule, which allows of many degrees of nitration, and the analogy with the action taking place in nitroglycerin waste acid, favour the view that in prolonged nitration, the replacement of the sulphuric radicle takes place at least partly in stages forming compound esters. This view is also confirmed by the extraordinary effect of even a small percentage of nitric acid in the mixed acid in checking the dissolving action of the sulphuric acid on the cellulose. The simplest explanation is that it enters into the composition of the molecules and makes compounds which are insoluble in the acid mixture, and as the process of maximum replacement takes a long time, while the checking action is immediate, it probably works in stages on each molecule."

New York Section.

ERRATUM.—*Sublimed White Lead*. By L. F. Hughes; this J., April 30th, 1909, p. 405, col. 2, line 10, for "sulphate" read "sulphide."

Nottingham Section.

Meeting held at Nottingham, on Wednesday, March 17th, 1909.

MR. O. QUIBELL IN THE CHAIR.

THE VOLUMETRIC DETERMINATION OF PHOSPHORIC ACID, MONO-ALKALI AND DI-ALKALI PHOSPHATES.

BY J. M. WILKIE.
(See this Journal, 1909, 68.)
DISCUSSION.

Mr. WILKIE said that the weakest part of the paper as published was the manner of ensuring neutrality of

the silver solution. That this solution should be neutral or at least of known acidity was vital, and a little consideration showed that that could be ensured very simply indeed. About 0.2 grm. of pure sodium chloride was dissolved in a little recently boiled and cooled water (30 c.c. or so of $N/10$ sodium chloride may be substituted if preferred) to which was added a few drops of phenolphthalein solution and one drop of $N/10$ barium hydroxide. A strong pink tint should result, which persists after adding 25 c.c. of the $N/10$ silver solution. That of course ensured that the silver solution was practically neutral. The titration was now conducted in the Jena round-bottom flasks used in the preliminary boiling to decompose carbonates and to expel carbon dioxide, thus avoiding transference to a special vessel for the titration. The end point with very little practice indeed could be readily observed, and of course any doubt was quickly dispelled by allowing the precipitate to settle for a minute or two, as the pink tint was permanent, and does not fade even after 24 hours. Finally the use of $N/5$ sodium acetate had been discontinued, and instead an equivalent amount of a $3N/2$ solution was used. This strength (20.4 per cent.) was convenient for ordinary laboratory use, and its use avoided unnecessary multiplication of solutions. In due course he hoped to publish some extensions of the method.

Mr. O. QUIBELL said that he had found the method work fairly satisfactory with acid phosphate; one difficulty was particularly noticeable, and that was the determination of the end reaction. Several determinations were made on a superphosphate containing 31.1 per cent. of water-soluble phosphates as determined by the magnesia method; 2 grms. of the original phosphate were made up to 100 c.c., and the phosphate was estimated as outlined in the paper, and the percentage found was 31.18 and 31.13. The titrations in this case were done with barium hydrate, as suggested. He saw no reason why the titration should not be done with sodium hydroxide, so several determinations were attempted in that way; but for some reason the results were extremely erratic, and he would like an explanation as to why sodium hydroxide solution is not so good as the barium hydroxide.

Mr. WILKIE replied that any difficulty as to the end point was removed by giving the precipitate a moment or two to settle. He had used sodium hydroxide in a number of titrations, and when carbonate was allowed for, excellent results were obtained. When using sodium hydroxide, his practice was to standardise in the cold against standard sulphuric acid which had been freed from carbon dioxide by boiling-working at about the same dilution as in the actual test, and of course using phenolphthalein as indicator. Barium hydroxide had the advantage of a sharper end point because of the absence of carbonate. He might again point out that decinormal sulphuric acid was the only standard solution required by the method.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Mixing or agitating liquid compounds; Machinery for — and for other purposes. B. Skinner, Rosherville, B. J. Wilders, Westcliff-on-Sea, and E. Wilders, London. Eng. Pat. 19,347, Sept. 15, 1908. Addition to Eng. Pat. 21,160, Sept. 24, 1906 (this J., 1907, 611).

The vertical rotating cylinder described in the principal patent is made of tapering form, like an inverted truncated

cone, and is completely submerged in the liquid to be mixed or agitated. The external screw-threads may be dispensed with. For mixing water with a lighter material such as flour, the cylinder is rotated in such a direction as to cause a downward current within the cylinder. When using the apparatus to agitate a liquid for cleansing or rinsing fibrous or textile materials, these materials are placed in a perforated wood or metal chamber above the rotating cylinder, or they may be kept away from the rotating cylinder by means of a perforated screen.

—A. T. L.

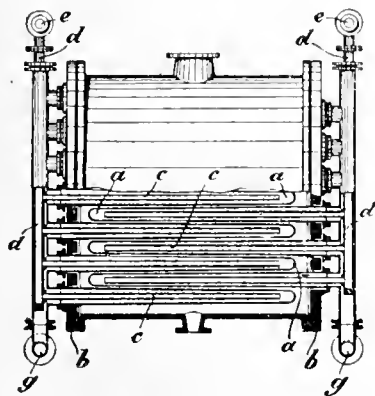
Distilling and concentrating liquid mixtures; Process of simultaneously — H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 27,473, Dec. 17, 1908.

THE mixture of liquids to be separated is introduced into an evaporating vessel at such a rate that it is completely vaporised. The mixed vapours are conducted into the lower part of a rectifying column into the top of which is introduced a regulated quantity of the pure liquid which forms the lowest-boiling component of the mixture. This liquid is introduced in such quantity that the vapour of the pure liquid only escapes from the top of the column. The liquid or liquids of higher boiling point are condensed in the column and escape from a siphon at the lower end. If desirable the vapours may be superheated in a coil before they enter the column.—W. H. C.

Kiln. G. E. Snowden, New Cumberland, W. Va. U.S. Pat. 916,498, March 30, 1909.

THE claim is for the construction of a kiln having a vertical flue formed in the side wall. The upper end of this flue communicates with the interior of the kiln and the lower end with an underground flue leading to the stack. Intermediate between its upper and lower ends, the vertical flue has a side branch flue which communicates with the atmosphere. A valve-box having two flap-valves is arranged in this branch, so that the kiln may be put into communication either with the underground flue or with the air as desired.—W. H. C.

Evaporator; Cast-iron — with Field tubes. G. Sauerbrey Maschinenfabr., A.-G. Ger. Pat. 207,478, Jan. 5, 1908.



IN order to avoid undue pressure on the tube-plates, *b*, of the evaporator, the cast-iron heating tubes, *a*, closed at one end, are connected to steam pipes, *d*, outside the evaporator, these latter being in communication with the steam-mains, *c*, and with pipes, *g*, for running off condensed water. The steam does not enter the heating tubes directly, but through the distributing tubes, *c*.—A. S.

Steaming and drying apparatus; Movable perforated drum in — H. Meyer. Ger. Pat. 207,483, June 26, 1908. Addition to Ger. Pat. 172,451, May 3, 1905 (this J., 1906, 1032).

THE perforated drum in which the steaming or sterilisation of the material is effected is mounted within an outer jacketed drum in which the drying is performed. Means are provided, e.g., bolts and levers, whereby the door closing the inner drum against the outer one, can be opened from outside the apparatus.—A. S.

Retaining wall for loose filtering material. S. v. Kraszewski. Ger. Pat. 207,579, May 5, 1907.

THE walls of the vessel containing the filtering material (e.g., sand), are constructed with series of lips or cups projecting outwards, and the liquid to be filtered is introduced through these lips.—A. S.

Filtering air and other gases or vapours; Apparatus for — R. Winter. Ger. Pat. 207,631, Feb. 21, 1907.

THE air or other gas is passed through a casing divided into alternate filtering-compartments and compartments into which the dust falls when brushed or setaped from the filters; both sets of compartments are disposed obliquely to the path of the air. Outside the casing, on one side, is a receptacle provided with openings communicating with the lower ends of the dust-collecting compartments. The dust falls from the latter into the receptacle and is thus prevented from being again entrained by the current of air.—A. S.

Centrifugal filter. L. Honigmann. Ger. Pat. 207,885, May 9, 1907.

THE filter consists of a hanging centrifugal basket or cage surrounded by a receptacle for the filtered liquid. The cage is closed above and opens below into a funnel-shaped chamber through which the solids are removed. The liquid to be filtered is introduced through the hollow vertical shaft of the apparatus, and falls on to a distributing plate fixed to a spindle which is movable vertically within the hollow shaft.—A. S.

Pyrometers. Norma Compagnie, G.m.b.H., Wurttemberg, and J. Kirner, Stuttgart, Germany. Eng. Pat. 27,245, Dec. 15, 1908.

SEE Fr. Pat. 395,229 of 1908; this J., 1909, 356.—T. F. B.

Filtering apparatus; Rotary — A. J. Arbuckle and A. Osborne. Fr. Pat. 395,446, Oct. 17, 1908.

SEE Eng. Pat. 20,400 of 1908; this J., 1909, 130.—T. F. B.

Filtering apparatus. A. J. Arbuckle and A. Osborne. Fr. Pat. 395,928, Nov. 3, 1908.

SEE Eng. Pat. 21,452 of 1908; this J., 1909, 195.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Natural and briquetted coal; Comparative tests of — including torpedo-boat tests, and some foreign specifications for briquetted coal. W. F. M. Goss. U.S. Geol. Survey, Bull. No. 363.

THIS bulletin contains 56 pages of matter, and a bibliographic list of works on the subject dating from 1906 to 1908 inclusive. The author describes an elaborate series of tests with natural coals and also with briquettes made from them as carried out at the testing plant of the Pennsylvania Railway Co. at Altoona, Pa., besides some preliminary experiments involving the use of briquettes, in the marine service, and carried out on the U.S. Torpedo Boat "Biddle." Illustrations and charts indicate the results obtained. The conclusions arrived at are:—I. The briquettes by the Government apparatus have well withstood exposure to weather and have suffered but little deterioration from handling. II. The use of briquettes instead of natural coal appears to have increased the evaporative efficiency of the boilers tested. III. In most cases, the smoke density has been less with briquetted coal. IV. The use of briquettes facilitates the maintenance of an even fire over the whole grate surface. V. In locomotive service, the use of briquettes results in increasing efficiency, and boiler capacity, with decreased smoke. VI. In torpedo boat service the use of briquettes improves evaporative efficiency of the boilers, but no change is noted as regards smoke.

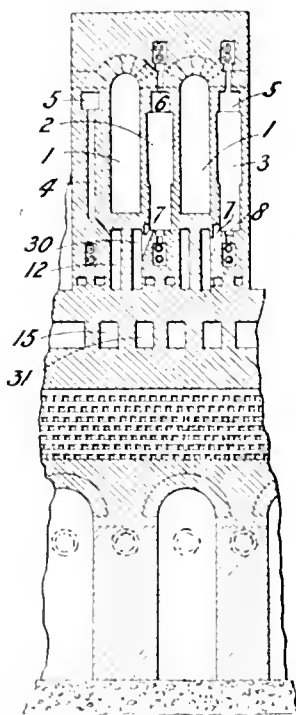
Carbon monoxide, hydrogen, and methane; Simultaneous determination of — by fractional combustion. V. Nesmijelow. Z. anal. Chem., 1909, 48, 232—272.

THE author has studied the fractional combustion of mixtures of carbon monoxide, hydrogen, and methane by means of silver oxide, palladium-asbestos, and copper oxide respectively. No satisfactory results could be obtained with silver oxide (see this J., 1898, 603; 1899, 299); the carbon dioxide formed by the oxidation of the carbon monoxide was partly absorbed by the silver oxide

with formation of silver carbonate; also, some silver oxide was always reduced by the hydrogen as well as by the carbon monoxide. With palladium-asbestos (this J., 1903, 652) it was possible to determine carbon monoxide in a mixture of the three gases, but only if the speed of the gas through the combustion tube did not exceed 1 litre per hour. No preliminary warming of the palladium-asbestos was required. If the speed of the current of gas were unduly increased, the temperature of the contact-material was raised to such an extent that the methane also was partially oxidised. Good results were obtained in the analysis of a mixture of carbon monoxide, hydrogen, and methane by passing the gas over copper oxide heated to 250° C. (see this J., 1898, 1190), at which temperature methane was not affected, whilst hydrogen and carbon monoxide were completely oxidised.—A. S.

PATENTS.

Coke ovens. The Coke Ovens and By-Products Co., Ltd., and S. N. Wellington, London. Eng. Pat. 6223, Mar. 20, 1908.



A SERIES of regenerative, inclined coke ovens, (1), is arranged in battery form with the discharge ends of the ovens opening on to a receiver for the finished coke, the opposite ends being provided with charging doors. The side walls (2) are hollow and divided into a number of vertical main flues (3) and "intervertical" flues (4). All the flues open at the top into a common longitudinal chamber (5), which also forms the combustion chamber for a set of upper gas-nozzles (6). At the base of each of the vertical flues (3) are hot air inlets (7) and lower gas-nozzles (8). The lower gas-nozzles are divided into two series, each series being again subdivided into three sets of four nozzles, and each set supplied by a separate gas-supply pipe. Below the floor of the oven

is situated a passage (12), with which all the "intervertical" flues communicate, and below this passage and communicating with it at each end, is another passage (15). From each end of the lower passage (15) a passage leads to one of two series of regenerative tunnels, a valve governing each of these communicating passages. Passages (30) and (31) afford communication to all the air-supply passages in a manner similar to the communication given by the passages (12) and (15) with reference to the "intervertical" flues. Means are provided for connecting either series of regenerative tunnels with a main uptake flue or with the air, whereby the air supply may be reversed, so that either the upper gas-nozzles can be supplied with air, while the air-supply passages for the lower gas-nozzles serve for taking off the products of combustion, or *vice versa*.—O. R.

Coke-quenching device for horizontal coke ovens. F. J. Collin. Ger. Pat. 207,199, June 11, 1908.

THE coke-quenching box is closed on all sides and is provided with pipes for leading away the ammoniacal

vapours produced on quenching the glowing coke. Means are provided for lifting the quenching-box and transporting it from one part of the coke platform to another.—A. S.

Pyrophoric substances; Manufacture of —. Lucium-Werk, Elektro-Chem. Metall-Ind. Ges.m.b.H. Fr. Pat. 396,198, Nov. 12, 1908.

PYROPHORIC substances consisting of a rare-earth metal and silicon, titanium, or boron are manufactured by adding the silicon or other non-metal to the molten rare-earth metal out of contact with air, or by introducing the non-metal into an electrolytic cell in which the rare-earth metal is being deposited. The substances thus obtained yield sparks, by abrasion or concussion, suitable for igniting combustible gases, liquids, and even solids. The substances may also be used as flash-light powders when mixed with suitable oxidising substances.—A. T. L.

[Suction] Gas producer plant. J. King and H. Workman, Glasgow. Eng. Pat. 6191, Mar. 20, 1908.

A GAS-HOLDER of sufficient capacity to prevent the engine from slowing down when the load is suddenly increased, is interposed between the producer and the engine, and the bell is counter-weighted so as to contain gas at slightly less than atmospheric pressure. The gas-holder thus serves to draw gas through the producer, causing a continuous instead of an intermittent draught. The bell has a definite slightly fluctuating position for each rate of demand, and the rise or fall of the bell controls, by means of levers and cords, a valve on the air inlet to the producer and a valve regulating the supply of steam or the feed of water to a boiler or evaporator; or the rise and fall of the bell may control a valve regulating the proportion of air passing through the steam space of evaporator. The valves may be similar to those described in Eng. Pat. 17,414 of 1907, the area of the ports being adjustable in one direction by hand and in a direction at right-angles to the former by the movements of the bell.—A. T. L.

Gas producers. J. Stewart, Alfreton. Eng. Pat. 6204, Mar. 20, 1908.

THE patent relates to gas producers provided with grates fitted to rotate about a horizontal axis, and especially to producers fitted with grates of the kind described in Eng. Pat. 15,074 of 1906. The grates referred to comprise a drum with radial arms of different lengths which support segmental grates provided with projecting claws, the whole forming a hollow cylindrical grate, mounted eccentrically on a horizontal axis above the water-trough in the base of the producer. The invention consists in providing horizontal or inclined doors, below the level of the water in the trough, projecting inwards from the sides of the trough in order to support the fuel. The doors are hinged along the sides of the trough and can be raised or lowered to adjust the space between the grate and the inner edges of the doors, so as to regulate the discharge of ashes and the descent of the fuel.—A. T. L.

Gas producers. A. Jabs, Zurich. Eng. Pat. 13,753, June 29, 1908.

A GAS producer for caking coals comprises a producer chamber in the lower part, surmounted by a group of narrow vertical chambers through which the fresh fuel descends, meeting the hot gases from the producer chamber and being distilled by them. These distilling chambers are made wider towards the lower end to facilitate the descent of fuel, and they are charged from the feeding hopper through vertical feeding channels of smaller cross-section than the upper ends of the distilling chambers, so that an annular outlet is left for the gas at the top of each distilling chamber.—A. T. L.

Gas producer. G. C. F. Vater, St. Louis, Mo. U.S. Pat. 916,806, March 30, 1909.

A CYLINDRICAL air receptacle is mounted in the centre of a water-pan, which is situated at the bottom of the combustion chamber of the producer. An air pipe extends upwards through the air receptacle, which supports and communicates with a conical grate. The air pipe is

perforated and has its upper end closed by the apex of the cone, which is not perforated, the perforations of the air pipe being in the same horizontal plane as the grate openings.—O. R.

Ozone; Process and apparatus for the admixture of — with gases and carburetting materials for illumination and power. O. Patin. Fr. Pat. 395,804, Jan. 7, 1908.

OZONISED air is upon leaving the ozoniser, mixed with more or less ordinary air in a mixing chamber, the proportion being controlled by valves, and the mixture subsequently carburetted by gas or oil vapour and sent into the supply main. The mixing chamber may be dispensed with and the degree of ozonisation varied by increasing or decreasing the electric current producing the ozone, by means of a rheostat.—R. L.

Illuminating gas; Process for the manufacture of — by distillation of coal and admixture of a cheaper gas with the coal-gas. H. Koppers. Ger. Pat. 207,098, March 6, 1908.

COMBUSTIBLE materials (brown coals, lignites, peat) of more recent formation than ordinary coals, are carbonised in a separate furnace, the gas is subjected to the usual condensing process and also freed from a portion of its carbon dioxide, then led through a gas producer charged with coke in order to convert a further portion of its carbon dioxide into carbon monoxide, and finally mixed with coal-gas produced in the ordinary manner.—A. S.

Electric incandescent lamps; Filament for —. J. Schilling. Berlin. U.S. Pat. 917,159, April 6, 1909.

METALLIC filaments are made by mixing a finely powdered refractory substance, and a finely powdered conductor having a negative temperature coefficient, with a solution of ammonium sulphide as binding agent, so as to form a paste. The paste is formed into filaments, and the ammonium sulphide is expelled by the passage of a current. —A. T. L.

Electric incandescent lamps; Manufacture of [filaments for] — from oxides or other basic compounds of metals. J. M. Canello. Fr. Pat. 395,360, Oct. 24, 1908.

THE patent relates to the manufacture of lamp filaments from the reducible oxides or other basic compounds of refractory metals such as molybdenum, osmium, and tungsten with or without the admixture of non-reducible oxides such as the oxides of thorium and zirconium. The reducible oxide or basic compound is very finely powdered, and the heavier particles are removed by a process of repeated levigation. The extremely fine powder thus obtained is mixed with 5 to 10 per cent. of powdered gelatin, and made into a paste with water. The paste is formed into filaments, and the filaments are dried and heated to a moderate temperature in a reducing atmosphere preferably of hydrogen. The filaments are finished by heating them electrically in a reducing atmosphere and are finally mounted in exhausted lamp-bulbs into which a trace of phosphorus or other reducing substance is introduced.—A. T. L.

Electric incandescent lamps; Process for securing [metallic] filaments to the terminals in —. Bergmann-Elektricitäts-Werke Akt.-Ges. Fr. Pat. 395,482, Oct. 19, 1908.

THE ends of the filament are covered with the material of which the leading-in wires are composed, for example, platinum, silver, nickel, copper, iron, or alloys of these metals. The filament is then held in position and the ends fused on to the ends of the leading-in wires.—A. T. L.

Electric incandescent lamps; Manufacture of filaments for — from difficultly fusible metals. Bergmann-Elektricitäts-Werke Akt.-Ges. Fr. Pat. 395,484, Oct. 19, 1908.

IN the manufacture of lamp filaments from molybdenum, tungsten, chromium, uranium, tantalum, niobium, vanadium, and similar metals, the filament is heated in an atmosphere consisting of hydrogen and nitrogen or of hydrogen and ammonia, in order to render constant the electrical properties of the filaments. The invention consists in the use of illuminating gas instead of hydrogen,

the preferred proportions of nitrogen and illuminating gas being 5 to 1. The filaments are brought gradually to a reddish-white heat, and kept at that heat for 10 seconds only instead of 4 minutes as when hydrogen is used.—A. T. L.

Drying apparatus [for peat, etc.]. W. T. Griffin, Plainfield, and B. W. Tucker, Newark, N.J., Assignors to I. Pedraza, Paris. U.S. Pat. 916,437, March 30, 1909.

SEE Fr. Pat. 381,272 of 1907; this J., 1908, 113.—T. F. B.

Alcohol; Process for transforming — for use as fuel. N. Manger. Fr. Pat. 395,966, Nov. 4, 1908.

SEE Eng. Pat. 23,806 of 1908; this J., 1909, 237.—T. F. B.

Shaft-kiln with generator-gas firing. E. Schmatolla, Berlin. U.S. Pat. 917,667, April 6, 1909.

SEE Addition of April 19, 1907, to Fr. Pat. 352,549 of 1906; this J., 1907, 1049.—T. F. B.

Combustible or carburetting liquids used in explosion motors or for lighting or heating; Composition for improving —. C. Poulain. Fr. Pat. 396,066, Nov. 7, 1908. Under Int. Conv., Nov. 16, 1907.

SEE Eng. Pat. 25,435 of 1907; this J., 1908, 1010.—T. F. B.

Incandescent bodies for electric glow-lamps; Producing metallic —. F. Blau, Assignor to Deutsche Gasglühlicht A.-G. (Auerge.), Berlin. U.S. Pat. 916,659, March 30, 1909.

SEE Eng. Pat. 14,816 of 1906; this J., 1907, 861.—T. F. B.

Carbon, filament, and method of making the same. W. R. Whitney, Glenville, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 916,905, March 30, 1909.

SEE Eng. Pat. 6959A of 1904; this J., 1905, 721.—T. F. B.

Filaments of Chinese ink for electric incandescence lamps. K. Rittersberg and H. Rubert. Fr. Pat. 395,782, Oct. 29, 1908. Under Int. Conv., Oct. 30, 1907.

SEE Eng. Pat. 11,600 of 1908; this J., 1908, 1145.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Acetate of lime [calcium acetate]; Analysis of commercial —. T. S. Gladding. J. Ind. and Eng. Chem., 1909, 1, 250—252.

IN the author's method, 2 grms. of the sample are treated with 30 c.c. of water and 10 c.c. of phosphoric acid of sp. gr. 1.70, and the mixture is distilled in a long-necked flask of 300 c.c. capacity for about 1½ hours, the volume being kept constant during distillation by the continuous introduction of water free from carbon dioxide. The vapours which distil over are condensed and collected in standard alkali solution. This method has been condemned by Fresenius and Grünhut (this J., 1908, 1012), but it is pointed out that in their tests, they employed a current of steam instead of introducing water into the distilling flask and thus introduced a source of error which had previously been recognised by the author and also by Grosvenor (this J., 1904, 530). The author has tested his method with solutions containing calcium acetate and phosphoric acid in varying degrees of concentration, and obtained concordant results in all cases.—A. S.

Petroleum oils; Differentiation between — of different origin. F. Schwarz. Mitt. Kgl. Materialprüfungsamt Gross-Lichterfelde West, 1909, 27, 25—28.

AMERICAN petroleum, even the most carefully refined, is characterised by its high iodine value, 6, as against 0.7—3 for European oils, and its low specific gravity, 0.788—0.802 at 15° C. Oil with a low iodine value and specific gravity above 0.815 may generally be taken as Russian, but occasionally may prove to be Roumanian or German.

Russian oils remain liquid at -20° C., whereas Roumanian (except Bustinian) and German petroleum become more or less viscous. The lighter constituents of Russian petroleum show a higher specific gravity (0.800—0.806) than those of the Roumanian or German oils (0.780—0.794). Differentiation between these last two is practically impossible, but the quantity of German oil produced is so small that nearly all is consumed locally. Oil with a low iodine value and specific gravity of 0.808—0.815 may be Galician, Roumanian, German, or Russian "Meteor" oil. The last may be recognised by the high specific gravity of the more volatile constituents, also by its higher flashing-point (30° — 37° C.). The inferior kinds of Galician oil become very viscous on cooling; the flashing-point of Galician oil is low (26° — 32° C.) as compared with Roumanian oil (31° — 34° C.) and German oil (31° — 39° C.).—A. G. L.

Mineral oil; Examination of — for fatty oil. F. Schwarz and J. Marcusson. Mitt. Kgl. Materialprüfungsamt Gross-Lichterfelde West, 1909, 27, 17—19.

In testing mineral oils for the presence of fatty oils by heating with sodium or potassium hydroxide (Lux's test), the authors contend that if appreciable quantities of fatty matter are present, both gelatinisation and formation of a soapy lather will occur. If the sample gelatinises without forming a lather, traces of fat, or rosin, or naphthenic acids may be present. In these cases the samples should be further examined. To remove mineral acid from naphthenic acids, the ethereal solution should be shaken with a concentrated solution of sodium sulphate, not with water.—A. G. L.

PATENTS.

Retort for the destructive distillation of resinous woods. P. Brown, Troy, Idaho. U.S. Pat. 917,531, April 6, 1909.

This relates to vertical retorts for a retort furnace comprising a number of vertical ovens which are open at both ends and are arranged between two spiral flues, leading from separate combustion chambers to the stack. A removable retort for each oven is provided at its upper end with a detachable cover for charging, and with a detachable gas-outlet pipe leading to a trap-box. The wood is supported on a removable grate, and the lower end of the retort is closed by a vessel secured to it beneath the grate.—A. T. L.

Wood-tar and formaldehyde; Process for making water-soluble compounds of the condensation products of —. W. P. Thompson, Liverpool. From K. A. Lingner, Dresden, Germany. Eng. Pat. 22,122, Oct. 19, 1908.

The condensation products are heated with soap, or the process of incorporation of the tar and the formaldehyde is combined with the process of "saponification." The resulting compounds are soluble in water.—W. H. C.

Ammonia from gas-liquor; Apparatus for recovering —. Berlin-Anhaltische Maschinenbau Akt.-Ges. Ger. Pat. 208,254, Mar. 31, 1908.

In the apparatus claimed, the heat of the smoke gases from the gas-retort furnace is utilised for distilling ammonia from the gas-liquor. Two chambers are built in opposite portions of the wall of the chimney of the furnace. The gas-liquor enters the lower part of one chamber, leaves near the top, flows through a connecting pipe outside the chimney to the lower part of the other chamber, and leaves this also near the top. The vapours expelled from the liquor flow out through pipes at the tops of the chambers to a reflux condenser in order to recover the ammonia.—A. S.

Impregnating material resembling coucouhou [from pitch] for mill-boards or textile materials used for covering roofs; Process for the preparation of an —. O. Schreiber. Ger. Pat. 208,378, Sept. 13, 1905.

The impregnating material is prepared from the pitch left behind in the distillation of coal-tar, petroleum, and animal or mineral products. The pitch is heated and cold

air is forced through it: during this treatment oxidising substances such as manganese dioxide, sulphuric acid, etc., and subsequently formaldehyde, are added to the mass.—A. S.

Still for distilling crude bituminous products. H. W. Asb, Cambridge, Mass., Assignor to Warren Bros. Co., Charleston, W. Va. U.S. Pat. 917,702, April 6, 1909.

The claims are for a still with means for delivering a heating blast within, and for introducing solid foreign matter into the blast-pipe so as to be carried by the blast into the still.—A. T. L.

Montan wax; Process for the purification of —. T. Asher. Ger. Pat. 207,488, Dec. 21, 1907.

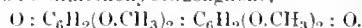
The montan wax is heated twice with nitric acid of sp. gr. 1.2—1.4, then washed, and melted, whereupon, it is stated, the asphaltic or resinous matter separates and can be removed mechanically. The wax may, if necessary, be treated with bleaching liquor before being melted.—A. S.

Apparatus for determining viscosity of liquids. Ger. Pats. 205,235, etc. See XXIII.

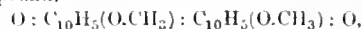
IV.—COLOURING MATTERS AND DYESTUFFS.

Indigoid dyestuffs. IV. Indigoid and indolignoid dyestuffs of the naphthalene series and their products of fission (Hydroxynaphthaldehydes). A. Bezdik and P. Friedländer. Monatsh. Chem., 1909, 30, 271—286. (Compare this J., 1908, 398, 743.)

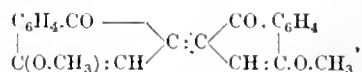
The authors propose a new nomenclature for the complicated indigoid dyestuffs described in this and the previous papers. Starting from the name "lignone" as being generic for the binuclear *p*-quinones, coeruleignone becomes *bis*-3 : 5-dimethoxybenzolignone,



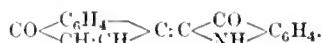
The compound,



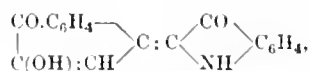
is *bis*-2-methoxynaphthalenelignone, whereas the isomeric substance,



is *bis*-4-methoxy-2-naphthalenelindigo. The dyestuff of the constitution,



previously described, lies between the lignoid and indigoid class and is classed as an "indolignone," being 2-indole-1-naphthalenelindolignone. 2-Indole-3-hydroxy-1-naphthalenelindolignone,

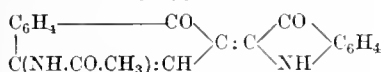
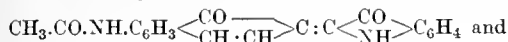


is prepared by mixing warm solutions of equimolecular quantities of 1 : 2-dihydroxynaphthalene and isatin chloride (in benzene). It forms metallic, brown needles, dissolves in hot alcohol or glacial acetic acid with a violet colour, and dyes chrome-, iron-, and alumina-mordanted cotton greenish-blue. It is especially well fixed with a cerium mordant. 5-Hydroxy-2-naphthalene-2-indole-indigo,



prepared by warming 1 : 5-dihydroxynaphthalene and α -isatinanilide with acetic anhydride, forms coppery needles which are sparingly soluble in ordinary solvents but dissolve in concentrated sulphuric acid with a blue colour. By similarly condensing 1 : 5-aminonaphthol and

1:4-acetaminonaphthol with α -isatinilide, 5-acetamino-2-indole-1-naphthaleneindigo and 4-acetamino-2-naphthalene-2-indoleindigo,



respectively are obtained as violet needles. The production of 1-hydroxy-2-naphthaldehyde by boiling 2-naphthalene-2-indoleindigo with caustic soda is described in detail, as are also similar compounds from analogous dyestuffs.—J. C. C.

Reduction of aromatic nitro-compounds by means of sodium disulphide. J. J. Blanksma. Rec. trav. chim. Pays-Bas, 1909, 28, 105—112.

Sodium disulphide may react in two different ways with aromatic nitro-compounds. If the nitro-compounds contain halogen atoms or nitro-groups rendered mobile by the presence of nitro-groups in the ortho or para positions, these mobile groups are replaced by S_2 groups, with formation of disulphides, which may easily be converted into sulphonic acids by oxidation. If the nitro-compound does not contain mobile halogen atoms or nitro-groups, reduction takes place with formation of the corresponding amino-compound and also usually a small quantity of an azoxy-compound. The results obtained by the action of an alcoholic solution of sodium disulphide on a number of nitro-compounds are given. From 5 grms. of nitrobenzene, 4.5 grms. of aniline hydrochloride were obtained. The nitro-anisols (*o*-, *m*-, and *p*-) gave yields of 70—80 per cent. of the corresponding anisidines. *m*-Bromonitrobenzene gave a good yield of *m*-bromoaniline. *m*-Chloronitrobenzene and 3,5-dichloro- and dibromo-nitrobenzene gave yields of 70 per cent. of the corresponding amino-compounds. Reduction products were also obtained from *o*- and *m*-nitrotoluene, 3,5-dinitroanisole, the 2,4-dinitro derivatives of anisole and phenol, 3,5-dinitrotoluene, and 1,3,5-trinitrobenzene. With *o*- and *p*-chloronitrobenzene, substitution products (dinitrodiphenyldisulphides) were formed in addition to reduction products, and this happened also with *o*-dinitrobenzene. In the case of *p*-nitrotoluene there were obtained *p*-toluidine and a condensation product of *p*-aminobenzaldehyde.—A. S.

PATENTS.

Azo colouring matters [dyestuffs] and intermediate products; Production of —. J. Y. Johnson. London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 25,311, Nov. 24, 1908.

By treating *p*-phenylenediaminesulphonic acid with benzoyl chloride or a substitution product thereof, compounds are obtained which probably possess the constitution, $\text{X.HN.C}_6\text{H}_3(\text{SO}_3\text{H}).\text{NH}_2$, where X represents the benzoyl or substituted benzoyl residue. When these benzoyl derivatives are diazotised and combined with α -naphthol-3-sulphonic, -3:6-disulphonic, or -3:6:8-trisulphonic acid, dyestuffs are obtained which give rise to Bordeaux-red to violet-red lakes extremely fast to light. As benzoyl compounds are mentioned benzoyl, *o*-, *m*-, and *p*-nitrobenzoyl, and the chlorobenzoyl chlorides. The condensation is effected in aqueous solution in the presence of sodium carbonate, and the product is precipitated with hydrochloric acid. In the example describing the production of the azo-dyestuff, benzoyl-*p*-phenylenediaminesulphonic acid is diazotised and combined with α -naphthol-3:6-disulphonic acid in alkaline solution.—J. C. C.

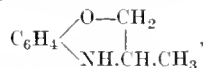
Basic dyestuffs; Production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 395,793, Oct. 29, 1908. Under Int. Conv., Jan. 10, 1908.

BASIC red or violet dyestuffs giving bright shades on taunin-mordanted cotton are obtained by treating salts of dinitrophenyl- or naphthyl-pyridinium or of cyano-pyridinium or substitution products with dihydroindole

or phenmorpholine or their substituted derivatives. Example 1: A mixture of 28.15 kilos. of 2:4-dinitro-pyridinium chloride, $\text{C}_{11}\text{H}_8\text{O}_4\text{N}_3\text{Cl}$, 60 kilos. of alcohol, and 26.6 kilos. of dihydro- α -methylindole,



is boiled under a reflux condenser for 4 hours. Dilute hydrochloric acid is then added and the precipitated dyestuff collected. It forms red brown needles and dyes in shades resembling those produced by Rhodamine 6G but purer and faster to light. Example 2: To a mixture of 8 kilos. of pyridine, 60 litres of alcohol, and 29.8 kilos. of methylphenmorpholine,



is added 50 litres of a solution of cyanogen bromide in ether or benzene (containing 212 grms. of cyanogen bromide per litre). The mixture becomes hot and after 1 to 2 hours dilute hydrochloric acid is added and the dyestuff collected. Brown violet needles are obtained which dye taunin-mordanted cotton in yellower shades than are produced by the preceding dyestuff.—J. C. C.

Azo-dyestuffs dyeing on a mordant. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 395,824, Oct. 30, 1908. Under Int. Conv., Feb. 19, 1908.

THE diazo-compounds of derivatives of *o*-aminophenol or *o*-aminocresol containing halogen or nitro-groups or both, but not containing sulphonic or carboxylic groups are combined with 2:3- or 2:6-dihydroxynaphthalene or with $\beta\beta$ -aminonaphthols or with alkyl or aryl derivatives of these. On chromed wool black shades are produced which are very fast to milling and light. An example is given describing the combination of diazotised 4-nitro-2-aminophenol with 2:6-dihydroxynaphthalene in alkaline solution.—J. C. C.

Azo dyestuffs dyeing cotton direct; Production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 395,960, Nov. 4, 1908. Under Int. Conv., Feb. 11, 1908.

TRISAZO-DYESTUFFS are prepared by combining a diazo-derivative of the benzene or naphthalene series with an amine, diazotising the resulting aminoazo-compound and combining it with a second molecule of the same or a different amine, diazotising the aminodisazo-dyestuff and combining it with a monoacyl-*m*-diamine containing a free position para to the amino-group. The dyestuffs produced dye cotton direct in violet to blue shades, and they can be diazotised and developed with (for example) β -naphthol on the fibre, giving blue shades fast to light and washing and capable of being discharged to a pure white with hydro-sulphite. The combination of diazotised *o*-sulphanilic acid with 1-naphthylamine-6-sulphonic acid, the diazotisation of the product, combination with 1-naphthylamine-7-sulphonic acid, further diazotisation and combination with 4-acetyl-amino-2-aminoanisole, $\text{Cl}_2\text{O.C}_6\text{H}_3(\text{NH}_2).\text{NH.CO.CH}_3$, are described.—J. C. C.

o-Hydroxyazo dyestuffs; Process for preparing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 208,498, March 4, 1908.

SUCH derivatives of *o*-aminophenol or *o*-aminocresols as contain no sulphonic or carboxylic acid groups, are diazotised and combined with 1,3-dihydroxyquinoline. These dyestuffs give very fast red shades on chrome-mordanted wool: they can be dyed from a dye-bath which also contains the mordant, e.g., a bichromate; thus, the wool is introduced into this bath, which is heated for some time, acetic acid is added, and the bath is further heated.—T. F. B.

Mercaptans of the anthraquinone series; Process for preparing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 208,640, Dec. 12, 1907.

THE usual methods for converting thiocyanates into mercaptans cannot be applied to anthraquinone thiocyanates (see Ger. Pat. 206,054; this J., 1909, 239),

since hydrochloric acid has no action, and alkali hydro-sulphides reduce the -CO-groups. It is found, however, that the conversion can be brought about by means of alkalis. 10 kilos. of anthraquinone- α -thiocyanate are made into a paste with 20 litres of alcohol, and boiled under a reflux condenser with 60 litres of a 10 per cent. alcoholic solution of sodium hydroxide, until the product is soluble in water to a clear cherry-red solution: the mixture is then diluted with sufficient hot water to effect solution, filtered, and the mercaptan precipitated by addition of hydrochloric acid containing a little sulphurous acid.—T. F. B.

Thioindigo; *Process for preparing* —. Kalle und Co. Ger. Pat. 208,499, June 30, 1907.

3-KETO-2-ANILIDOBIPHENYL(1)THIONAPHTHENE, prepared by the action of primary aromatic bases on 2-dibromo-oxythionaphthene, is dissolved or suspended in alcohol or acetic acid, and hydrogen sulphide is passed through the solution until the orange-red anilide (which is soluble in benzene) has been entirely converted into thioindigo, which is very sparingly soluble in benzene.—T. F. B.

Anthracene series; *Process for preparing vat dyestuffs of the* —. Ges. f. Chem. Industrie in Basel. Ger. Pat. 208,559, May 3, 1908.

AMINO-DERIVATIVES of β -methylantraquinone are converted into vat dyestuffs by heating with alkali hydroxides in presence of oxidising agents such as lead oxide, cupric oxide, potassium chlorate, etc. Five parts of 1-amino-2-methylantraquinone, 5 parts of lead oxide, and 20 parts of potassium hydroxide are heated at 170–180° C., with stirring, for a long time. The residual dyestuff, after extraction with water and hydrochloric acid, gives a brown vat with alkali and hydrosulphite, in which cotton is dyed fast red-brown shades. Other β -methylantraquinone derivatives furnish dyestuffs giving various shades of brown.—T. F. B.

Sulphurous acid esters from pyridine and its derivatives; *Process for the preparation of* —. H. Bucherer. Ger. Pat. 208,638, Sept. 5, 1907.

SULPHUROUS acid esters are prepared from pyridine or its derivatives by heating them under a reflux condenser with excess of a bisulphite solution. Some of the homologues of pyridine behave in an analogous manner, but others do not react with bisulphite, and hence the method can be utilised for separating different constituents of a mixture of these compounds, those not converted into sulphurous acid esters being removed from the reaction-product by distillation with steam or by extraction with ether. The sulphurous acid esters are insoluble in the usual organic solvents; they are fairly resistant to acids, but are decomposed by alkalis. They are useful for the preparation of dyestuffs and as medicaments.—A. S.

1,8-Naphthylendiamine; *Manufacture of new condensation products obtained from* —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7575, April 6, 1908.

SEE Fr. Pat. 388,955 of 1908; this J., 1908, 975.—T. F. B.

Red dyestuffs. W. König, Dresden, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 913,513 and 913,514, Feb. 23, 1909.

SEE Fr. Pat. 395,793 of 1908; preceding.—T. F. B.

[1:2o]dyestuffs; *Production of new mordant* —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 395,926, Nov. 3, 1908. Under Int. Conv., March 3, 1908.

SEE Ger. Pat. 208,498 of 1908; preceding.—T. F. B.

[1:2o]dyestuff and process of making same; *Red cotton* —. R. Schüle, Frankfurt, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 912,182, Feb. 9, 1909.

SEE Eng. Pat. 2721 of 1908; this J., 1909, 304.—T. F. B.

Polyazo dyestuffs containing two mols. of aminophenyl-naphthimidozohydrozysulphonic acid or aminophenyldihydronaphthimidozohydrozysulphonic acid; *Process for preparing* —. L. Cassella und Co. Fr. Pat. 396,100, Jan. 15, 1908.

SEE Eng. Pat. 2721 of 1908; this J., 1909, 304.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Diazotisable substantive dyestuffs; *Production of dyeings with* —. G. Friedländer. Rev. Gen. Mat. Col., 1909, 13, 97–98.

WITH this class of dyestuffs the dyeings may be produced by diazotising the colouring matter on the fibre and combining with an amine or a phenol, or the dyed material may be passed through a bath containing a diazotised amino-compound or submitted to the action of solidogene. By these means the fastness to washing is improved and the depth of the shade increased. The process, however, is somewhat long; the dyeing is carried out for three-quarters of an hour at the boil, with 3–5 per cent. of dyestuff and 25 per cent. of Glauber's salt. The material is then rinsed and treated in a bath containing 2–4 per cent. of Azophor Red and 1–2 per cent. of sodium acetate and finally rinsed and soaped. The author has found that the process may be shortened by padding in a bath containing 3–5 per cent. of dyestuff and 3–5 per cent. of Glauber's salt, squeezing, and developing directly in a dyeing machine with a solution containing 2–4 per cent. of Azophor Red and 1–2 per cent. of sodium acetate, finally rinsing and soaping. By this method, shades are obtained which are equal in depth to those obtained by dyeing by the ordinary methods.—F. M.

PATENTS.

Scouring, bleaching, dyeing, etc., of manufactured fibrous materials; *Machine for the* —. C. Hall, Eccles. Eng. Pat. 9132, May 1, 1908.

THE material may be subjected in the machine to one, two, or three operations, in a rapid and convenient manner. The main features are a tank with three compartments (the middle one being much deeper than the others), squeezing rollers fixed between the compartments, and ordinary and auxiliary batching rollers in connection with the two side tanks. Communication is provided between the two side tanks and the middle one by means of pipes with valves. Two pieces of material may be treated simultaneously in the side compartments, by running from the auxiliary batching roller through the liquor contained in the tank and on to the ordinary batching roller. Or a piece may be given two separate treatments by running from the batching roller, through the first tank and squeezing rollers, and through the liquor in the other side tank, or subjected to three operations by leading it under the guide roller in the middle tank, as well.—F. M.

Scouring wool by means of electricity; *Process and apparatus for* —. J. M. Baudot. First Addition, dated Jan. 4, 1908, to Fr. Pat. 375,237, May 8, 1906 (this J., 1907, 963).

AN improvement in the arrangement of the electrodes and the endless cloth diaphragm is described. The negative electrode is semicircular in shape and forms a perforated false bottom to the beck. The positive electrode is circular, and is fixed upon a wooden drum, mounted upon a shaft, the bearings of which are fastened to the sides of the beck. The shaft also carries the radial arms upon which the endless cloth diaphragm (carrying transverse wooden laths, with teeth), is supported. By means of differential gearing, the positive electrode and the cloth diaphragm may be rotated at different speeds, and the movement tends to keep the surface of the electrode clean.—F. M.

Cleaning fabrics; Rotary machine for —. C. Tewes, London. From "Tecza" Dampf-Fabrik chem. Reinigung und Kunst-Färberei in Krakau, Austria Hungary. Eng. Pat. 23,026, Oct. 29, 1908.

THE material to be cleaned is placed inside a washing drum, which is of open-work construction and may be revolved by means of suitable gearing. The shaft passes through stuffing-boxes in the sides of the case which surrounds the drum. This casing carries three tanks, lying parallel to the axis, for the storage of benzene, the openings between the tanks and the interior of the case being closed by valves, the spindles of which pass through the outer covers of these receptacles. The opening in the case, through which the material to be cleaned is introduced into the drum having been tightly closed, the valve of the first benzene tank is opened and the benzene allowed to flow over the goods. The outer case is held in position and the drum is slowly revolved for about 10 minutes. The outer case is then turned until the empty receptacle reaches the lowest possible point, when the used benzene drains into it; the valve is then closed and that of another tank is opened and the operations repeated with the fresh solvent. After the final washing and draining, the interior of the case is connected, by means of a pipe, with a cooling arrangement into which the vapours of the residual benzene are conducted and condensed.—F. M.

Lace; Corrodible groundwork for —. R. Bauer, Leipzig, Assignor to R. Schiller, Plauen, Germany. U.S. Pat. 917,402, April 6, 1909.

A DURABLE corrodible groundwork for lace is obtained by impregnating a material consisting of vegetable fibres with a 15 per cent. solution of aluminium sulphate, containing some colouring matter, and then drying at a temperature of 25° C. to 30° C.—S. H. H.

Weighting of silk or half silk in the form of hanks or pieces; Process for the —. F. Müller. Fr. Pat. 395,731, Oct. 28, 1908. Under Int. Conv., Sept. 23, 1908.

WHEN tin salt is employed, the weighting cannot be carried beyond a certain point without risk of damage to the fibre, the damage becoming evident during the dyeing and finishing, on storing, or in wear. The material may however be loaded to a much greater degree and without any risk of tendering, etc., by using aluminium chloride, alone or in combination with tin salt, as the weighting agent. The handle is improved by giving a final treatment with cerium chloride. The process consists of a treatment with a solution of aluminium chloride of 30° B., followed by a passage through a bath of sodium phosphate and rinsing. The operations are repeated until the desired degree of weighting is obtained.—F. M.

Union fabrics; Dyeing of —. L. Cassella und Co., Frankfurt-on-Maine, Germany. Eng. Pat. 270, Jan. 5, 1909. Under Int. Conv., Jan. 6, 1908.

CERTAIN union fabrics, such as astrachan, sealskin cloths, etc., cannot be satisfactorily dyed by the one-bath method with a mixture of substantive and acid dyestuffs in a neutral bath, owing to the injurious effect of the boiling neutral bath upon the wool. The method is rendered practicable however, by the addition of ammonium chloride, sulphate, or acetate to the dyebath; these salts dissociate as the temperature rises, and, without interfering with the dyeing of the cotton, the slight acidity produced in the bath ensures the preservation of the wool. Example. From 3 to 5 per cent. of Oxydiamine Black J E I extra conc., 3—5 per cent. of Naphthylamine Black 4B, 3—6 per cent. of ammonium chloride, and 20—30 per cent. of Glauber's salt are added to the dyebath. The material is first dyed lukewarm and then for half an hour at the boil.—F. M.

Dyeing; Process of —. Farbenfabriken vorm. F. Bayer und Co. Fr. Pat. 395,679, Oct. 26, 1908. Under Int. Conv., Oct. 1, 1908.

THE claim refers to the dyeing of half-wool, and deals with the use of substantive cotton dyestuffs, in an acid bath, for dyeing both the wool and the cotton, the wool

being brought up to shade where necessary by the addition of a suitable wool dyestuff to the bath. A number of dyestuffs which give practically solid shades are mentioned.—F. M.

Dyeing of thread on bobbins; Process for the —. J. O. Obermaier. Fr. Pat. 396,151, Nov. 10, 1908.

IN the dyeing of "cheeses," the height of which is less and the diameter greater than is usual, it has been found that owing to the differences in density between them, the inner layers do not get such a perfect treatment as the outer layers, to which the liquors obtain freer access. The fault is not obviated by filling in the spaces left between the cheeses in the dyeing vessel with a suitable material. Perfectly level dyeings are obtained however when the cheeses are arranged in a frame in which they may be subjected to a lateral mechanical pressure. In the spaces between them are placed suitably shaped wooden blocks, and the sides of the frame are then screwed up until the pressure throughout the body of the cheese is uniform. The dye-liquor therefore must penetrate evenly into the material and it is found that the dyeings obtained are quite uniform.—F. M.

Red dyeings on fibres; Process for producing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 207,574, May 19, 1907.

THE products formed by the oxidation of thioindigo, are reduced by alkaline reducing agents; the fibrous material is immersed in the vat thus obtained, and oxidised by exposure to the atmosphere. The dyeings are said to resemble those produced by thioindigo both as regards fastness and shade.—T. F. B.

Textile substances; Apparatus for treating — and for mixing liquids, &c. R. Diederichs. Addition, dated Oct. 26, 1908, to Fr. Pat. 390,105, May 11, 1908. (See this J., 1908, 1016).

THE space between the two concentric vessels is enlarged and now used to contain the materials under treatment; it is also provided with a perforated bottom. By this arrangement the movement of the aspirating bell in the central compartment is not impeded; it can be made to rise and fall at any desired speed.—S. H. H.

Schreiner of textile fabrics; Means for the —. W. and T. Pickles, Burnley. Eng. Pat. 10,649, May 16, 1908.

A SUPERIOR lustre and more silk-like appearance and handle are obtained by schreiner with bowls which are more or less conical in shape—the surface of the bowl being inclined to the axis. The axes of the bowls lie parallel to each other, the smaller diameter of one bowl being contiguous to the larger diameter of the other. The fabric passing between the bowls is thus subjected to a special kind of friction, which produces the superior effect.—F. M.

Resist effects; Production of — on textile fabrics. J. Y. Johnson, London. From Badische Aniline und Soda Fabrik, Ludwigshafen a. R. Eng. Pat. 12,416, June 9, 1908.

DYESTUFFS of the indigo and thioindigo classes can be resisted by printing the material with china clay in combination with acid salts or oxidising salts of copper, zinc, aluminium, etc., but the fabrics can then only be dyed in the zinc, or vitriol, dipping vat owing to the liability of the resist to be softened and removed in the alkali-hydrosulphite vat or in the mechanical or continuous dyeing machine. The resists may be employed however when dyeing with bromo-substituted indigo or thioindigo, indanthrene, etc., in a hydrosulphite vat on the jigger, or analogous machines. A white resist is prepared by mixing together 120 parts of china clay, 120 parts of water, 200 parts of 50 per cent. gum thickening, 300 parts of lead sulphate paste, 50 parts of lead sulphate powder, 100 parts of lead nitrate, and 50 parts of zinc sulphate, then boiling, and stirring well whilst cooling. A red resist is prepared by mixing 82 parts of the white resist

with 15 parts of a solution of diazotised paranitramiline and 3 parts of sodium acetate. This mixture is printed upon material which has been prepared with β -naphthol. —F. M.

"Black-red style"; Process for the manufacture of the —. O. Imray, London. From Farbw. vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. Eng. Pat. 12,811, June 15, 1908.

THE improved process for producing the black-red style in calico printing consists in printing diphenylamine derivatives alone or in combination with aniline or with *p*-phenylenediamine on fabrics which are prepared with β -naphthol, then developing the black by steaming for a short time, and dyeing directly in a solution of diazotised *p*-nitramiline. The black becomes pure, full and bright and the formation of light borders round the black pattern is entirely avoided. —J. C. C.

Textiles; Method of figuring —. M. Freiberger, Budapest, Hungary. Eng. Pat. 13,896, June 30, 1908.

NITRIC acid and similar compounds have been employed, printed with wooden blocks, for producing discharge effects on indigo-dyed cloth, but could not of course be used with the usual metal printing rollers. The difficulty is overcome by printing the cloth with a mixture which has no action upon the engraving of the roller, and then liberating the active principle by a subsequent treatment. Thus salts of nitric or nitrous acids may be printed, and the free acids may afterwards be liberated by treatment with acids or acid salts. Coloured discharges and combinations may be produced by incorporating suitable dyestuffs in the printing pastes. Thus to produce white, yellow, and red effects upon a blue ground, the fabric is dyed with indigo and prepared with naphthol; the white discharge is obtained by printing with zinc nitrate and formic acid, or sodium nitrate; the yellow discharge is produced by means of lead nitrate, and the red by means of sodium nitrate together with red developing or body colours. The fabric is steamed, given a short passage through sulphuric acid of 40° B., washed, and passed through a chromate solution to develop the yellow. —F. M.

Printing colours; Manufacture of permanent — and the application thereof. O. Imray, London. From Soc. of Chem. Ind. in Basle, Basle, Switzerland. Eng. Pat. 15,352, July 20, 1908.

IN printing with vat dyestuffs, the dyestuff has hitherto been incorporated in a reducing paste and printed, and the reduction and fixation have then been effected by steaming; or, the dyestuff has been reduced and the leuco derivative printed with the necessary thickening. The drawbacks incidental to these methods are overcome by mixing the dyestuff with dextrin, gum, or other thickening and then reducing with alkali hydrosulphite. The printing colour may be prepared in open vessels, as it keeps well, and the mixture may contain much less alkali than in the older methods. Steaming alone is necessary to fix the colour and the steaming may be conducted without the exclusion of air or the use of special apparatus. —F. M.

Printing of fabrics. E. Siefert-Schwab, Neunkirchen, Austria. Eng. Pat. 19,216, Sept. 12, 1908.

A SPECIAL effect is produced when the raised parts of a fabric alone are printed. The process consists in carrying the fabric in a stretched condition over the engraved roller in such a manner that it only just touches the roller. Thus only the raised parts, and particularly the weft threads (which are caused to protrude, where they intersect the warp, by the longitudinal stretching of the fabric) are able to receive the colour. To ensure perfect contact between all the intersections of the weft and warp threads and the roller, a light, elastic pressure is exerted at the back of the fabric at the place where it touches the roller. The pressure applied in an ordinary printing machine is much too great to give the desired effect, and it is stated that a foulard machine without levers and having an engraved lower roller (fitted with a

doctor and colour trough) is well adapted for the purpose. The upper roller is covered with soft indiarubber and its weight is sufficient to produce the necessary pressure. —F. M.

Designs and colour effects on textile fabrics; Production of —. J. Hübner, Cheadle Hulme, England. U.S. Pat. 917,298, April 6, 1909.

ORNAMENTAL effects are produced on textile fabrics by embossing or impressing the fabrics in the wet state after they have been treated with mercerising agents either with or without tension; and colour effects are produced on dyeing the impressed fabrics. —S. H. H.

Designs on fibrous materials; Production of —. Dr. Lövinsohn und Co. Fr. Pat. 395,609, Oct. 23, 1908.

CERTAIN aniline dyestuffs, e.g., Victoria Blue, are melted and the resulting liquid used as the printing material. A printing ink which does not dry quickly may be mixed with the melted colour. —S. H. H.

Vulcanised fibre; Manufacture of —. British Vulcanised Fibre, Ltd., and T. E. Briggs, Manchester. Eng. Pat. 6300, Mar. 21, 1908.

SUITABLE chemicals such as aluminium hydroxide or sulphate, ammonium borate or phosphate, sodium silicate, etc., are incorporated with the fibre during its manufacture, or the prepared sheets are impregnated with the salts, or coated with asbestos paint or other fireproofing composition. Fibre treated in this way is fire-resistant; it will not flame when exposed to heat but merely chars. —F. M.

Fireproof fibre and method of making same. K. P. McElroy, Washington, D.C., and C. Ellis, New York, Assignors to Fireproof Products Co., N.J. U.S. Pat. 914,300, Mar. 2, 1909.

A WAXY, non-volatile covering, insoluble in water, is given to fibrous bodies, e.g., textile materials, wood, paper, etc., by treating them with fused hexachloronaphthalene. On heating, the hexachloronaphthalene gives off vapours which retard the combustion of the material. In some cases the material is treated with a solution of a metallic salt, as in the usual fireproofing processes, sharply dried, and then treated with the hexachloronaphthalene; in this way the salt is protected from the action of water. —S. H. H.

Ramie and other fabrics; Process of rendering — water repellent and permanently colouring same without dyestuffs. A. M. Hart, London. Eng. Pat. 13,020, June 18, 1908.

RAMIE or other textile is rendered water-repellent and dyed at the same time by the following process: 3 lb. of casein are made into a homogeneous mixture with water and added to a mixture of 1 lb. of gum tragacanth with 1 lb. of water; 1 pint of sweet oil and half a pint of caustic soda (17° T.) are stirred in and then 1 lb. of dry colour (first prepared by boiling a dry pigment with water for an hour, allowing to settle, decanting the surplus water and drying the residue) mixed into a smooth paste with water is added and the whole brought with water to a volume of 2 gallons. The mixture is boiled for about an hour, stirring the whole time, and the yarns or fabrics are passed through the mixture, then between rollers into a bath of water containing 15 per cent. of alum, thence into clean water and again between rollers, being finally dried in the air. —J. C. C.

Textile materials; Removal of lye from — [after mercerising]. J. Matter, Laackon, Prussia. Eng. Pat. 7605, April 6, 1908.

SEE Fr. Pat. 392,400 of 1908; this J., 1908, 1201. —T. F. B.

Reserving woollen threads in dyeing union goods with sulphurised dyestuffs; Process for —. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 22,549, Oct. 23, 1908.

SEE Ger. Pat. 203,427 of 1907; this J., 1908, 1202. —T. F. B.

Impregnating material. Ger. Pat. 208,378. See III.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Pyrites; The increasing consumption of —, and its supply. B. Wetzig. See X.

Hydrogen peroxide; Determination of acids in —. H. Endemann. Z. angew. Chem., 1909, 22, 673—674.

DIRECT titration of hydrogen peroxide solutions in the cold with phenolphthalein as indicator gives only half the amount of acid present, and to find the whole quantity it is necessary to heat the hydrogen peroxide with excess of alkali, and then to titrate the excess with standard acid. Fifty c.c. of the sample are gently heated in a platinum basin with 10 to 15 c.c. of $N/5$ sodium hydroxide solution until evolution of oxygen has ceased, after which the liquid is cooled and titrated with $N/5$ hydrochloric acid, with phenolphthalein as indicator. For technical purposes it is sufficient to determine the amount of free acid in hydrogen peroxide solutions by direct titration in the cold, and to multiply the result by two.—C. A. M.

PATENTS.

Phosphoric acid and Glauber's salt; Process of making —. E. H. Strickler, New York. U.S. Pat. 917,502, April 6, 1909.

THE mixture of Glauber's salt and phosphoric acid, formed by digesting native calcium phosphate with sodium bisulphate solution, in combining proportions, is concentrated and the sodium sulphate separated by crystallisation. The sodium sulphate, thus obtained, is recrystallised, after adding lime to remove free acid.—F. SOEX.

Nitric acid; Manufacture of commercially pure —. Salpetersäure Ind.-Ges. First Addition, dated Nov. 2, 1908, to Fr. Pat. 374,237 of April 11, 1906. (See this J., 1906, 758; 1907, 760.)

THE mixture of gases, obtained by the process described in the principal patent, is cooled by refrigeration to a temperature somewhat above or below 0° C., according to the proportion of nitrogen peroxide present, and in this way acid of 60 per cent. strength, or over, is obtained in one operation. The concentration of the acid produced is found to increase in a marked degree, as the temperature of condensation is reduced.—F. SOEX.

[Salts of] *nitric acid; Apparatus for the manufacture of —.* G. Kettler. Fr. Pat. 396,161, Nov. 11, 1908. Under Int. Conv., Nov. 13, 1907.

THE apparatus consists of a furnace, which is heated by the combustion of a mixture of gas and air passing through it, and contains a spiral of refractory metal or porcelain, through which passes a mixture of nitrogen and oxygen. The temperature of the mixture is thus brought to 1300°—1400° C. The front part of the spiral is further heated by being enclosed in a tube, in which a mixture of benzene or other inflammable vapour and oxygen is burned, and the temperature of the gas is thus raised to about 2000° C. A further increase to 2400°—2600° C. is effected by injecting a mixture of acetylene and oxygen into the flame issuing from the spiral, or an electric arc may be disposed in front of the nozzle. The flame, which now contains nitric oxide, enters a sheet iron pipe of comparatively large rectangular section, slightly inclined in the direction of the flame, and enclosed in a vessel filled with a solution of lime or other base, which completely surrounds the pipe. In this pipe peroxidation takes place, and, when desired, the solution can be introduced as a shower through a grating arranged in the upper surface of the pipe, thus suddenly cooling the flame and absorbing the oxide with the formation of nitrate, the solution being pumped back into the vessel until neutralised. A special opening is provided for observing the flame as it leaves the spiral.—F. SOEX.

Sulphuric acid; Simultaneous manufacture, concentration, and purification of —. G. C. de Briailles. First Addition, dated Oct. 19, 1908, to Fr. Pat. 393,665 of Oct. 31, 1907. (See this J., 1909, 139.)

THE addition relates to an improved apparatus for realising the process described in the principle patent. A stoneware vessel encloses a porous pot in which is the anode of platinum wire; granules of retort carbon or coke and antimonial lead are packed outside the porous pot and surround a rod of antimonial lead which acts as the cathode. The vessel is closed, gas-tight, by a stoneware cover, and a mixture of liquid sulphurous acid and sulphuric acid (45° B.) is introduced. Sulphuric acid is produced at the anode and becomes more and more concentrated as electrolysis proceeds, and hydrogen or pure sulphur, according to the voltage, is liberated at the cathode.—F. SOEX.

Sulphuric acid; Construction of lead chambers for the manufacture of —. R. Moritz. Fr. Pat. 395,694, Oct. 26, 1908.

INSTEAD of the closely attached wooden framework generally employed for supporting sulphuric acid chambers, it is proposed to adopt a stout external suspending frame, not in direct contact with the lead chamber. The walls of the chamber are attached, by a series of projecting leaden strips, each extending from top to bottom, to fairly rigid iron tie-rods hanging from the external roof and attached below to the sheet-iron casing round the floor of the chamber. The top of the chamber is preferably arched, and from it project upwards strips of lead which are secured between iron plates, suspended by wires from the framework above; this allows of free expansion. The floor of the chamber is supported by reinforced concrete or sheet iron, perforated so that a leak may be readily located, and the angle between the floor and the wall is also encased in sheet iron which may be perforated, so as to hasten cooling and prevent the corrosion usual at this part. Glover and Gay-Lussac towers may be constructed on the same principle, which is said to allow more uniform expansion and contraction and minimise corrosion of the lead.—F. SOEX.

Copper nitrate; Manufacture of —, chiefly for use in agriculture and viticulture. H. Gouthière et Cie and P. Ducaucel. Fr. Pat. 395,806, Jan. 7, 1908.

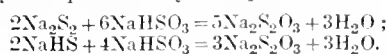
A SOLUTION of copper nitrate for use in agriculture and viticulture is made by mixing solutions of commercial calcium nitrate and copper sulphate. The product is claimed to be most active if prepared just before use, and the calcium sulphate also formed is said to be of service to the soil.—F. SOEX.

Potassium chloride and other salts; Vessel for the refining of —. Maschinenfabr. Bikan, Akt.-Ges. zu Magdeburg. Ger. Pat. 207,887, March 26, 1907.

IN the refining of potassium chloride and other salts by washing them with water or suitable solutions, a double vessel is used, the inner chamber of which is perforated. After the covering or washing liquor has run through into the outer chamber, the inner one is lifted bodily out, carried over a suitable receptacle, and emptied. According to the present patent, the inner chamber is mounted on pivots or hinges on one side, and its contents emptied out by raising the other side.—A. S.

Alkali thiosulphates; Process for the preparation of —. Destrée et Cie. Ger. Pat. 208,633, May '06, 1908.

THIOSULPHATES are prepared by treating a solution of a bisulphide or a hydrosulphide with a bisulphite, the latter being added gradually and the mixture warmed to 60° C. The preparation of sodium thiosulphate in this way may be represented by the equations:



—A. S.

Calcium carbide; Process and apparatus for making — J. S. Seymour, Whitney Point, N.Y. U.S. Pat. 916,495, March 30, 1909.

THE finely powdered raw materials are intimately mixed with air and fuel and injected into a combustion chamber in the form of a blast, which impinges upon a bed of the mixture to be acted on. The region of highest temperature where chemical reaction takes place, is kept clear of excess of material, and the incoming mixture is preheated by the issuing hot gases and finished product.—O. R.

Silicon; Production of — G. O. Seward, East Orange, N.J., and F. von Kugelgen, Holcombs Rock, Va. Assignors to Virginia Laboratory Co., New York. U.S. Pat. 916,793, March 30, 1909.

A porous mixture of silica and carbon or some carbonaceous reducing agent is subjected in an electric furnace to a temperature above that at which silicon carbide remains stable. By keeping the are deeply immersed in the mass, a cooler and non-oxidising atmosphere is maintained around the reducing zone, and in this atmosphere the volatilised element is condensed.—C. A. W.

Peroxide of hydrogen; Method of making durable solutions of — J. Arndts, Paderborn, Germany. Eng. Pat. 6919, March 28, 1908.

SEE Ger. Pat. 196,370 of 1907; this J., 1908, 448.—T. F. B.

Peroxide of hydrogen; Process for electrolytically producing — G. Teichner, Nuremberg, Germany. U.S. Pat. 916,900, March 30, 1909.

SEE Eng. Pat. 24,507 of 1906; this J., 1906, 379.—T. F. B.

Precipitates; Method of producing pulverulent — N. A. Langlet, Gothenburg, and E. L. Rinnman, Upsala, Sweden. Eng. Pat. 17,589, Aug. 21, 1908.

SEE Fr. Pat. 388,527 of 1908; this J. 1908, 898.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Felspar, flint, and china clay; Action of heat on binary mixtures of — A. Heath and J. W. Mellor. Trans. Eng. Ceram. Soc., 1907—1908, 7, 80—100.

Two bodies may begin to react and actually flux together at temperatures below the melting point of either. Thus, felspar, melting at 1150°C ., begins to react with quartz and china clay below 1000°C . The less fusible constituents of a body are attacked by the more fusible materials to form a viscous solution. If the process were allowed to complete itself, the ware would lose its shape. Pottery chemistry is therefore a chemistry of arrested reactions, and deductions from phenomena associated with completed reactions are often misleading. The progress of the reaction, however, can be followed empirically by measuring the contraction, porosity, or specific gravity at different stages of the firing. The porosity figure obtained by the ordinary soaking method is only the apparent porosity, owing to the presence of air bubbles completely surrounded by glassy flux impermeable to liquid. The authors describe how to obtain the porosity *in vacuo*, and explain how to calculate the true porosity. A piece of felspar fired in china biscuit gave the following figures:—0.3 per cent. porosity by ordinary soaking, 6.12 per cent. porosity by soaking *in vacuo*, and 15.15 per cent. true porosity. But it is doubtful if the results obtained justify the trouble of deducing "true porosity." Contraction is primarily an effect of the surface tension of the more fusible constituents of the mixture. If bubbles of gas are developed in the body, the body will "bloat," thus masking the real contraction. A body containing a high proportion of flint, may expand on firing, owing to the changes in volume which flint undergoes when heated. Three sets of experiments were made with the felspar and china clay mixtures. One set was fired in the earthenware glost oven, another in the earthenware biscuit, and the third in the china biscuit oven. Tables are given of the contraction and porosity, but the errors of experiment are great. Roughly speaking,

increased contraction attends the addition of china clay to felspar, and the authors compare this with the effect of quartz on the softening of felspar, and of bone on the softening of china. The apparent porosity curves run fairly consistently with the contraction curves and with one another. Microscopic examination showed development of sillimanite crystals in the china biscuit oven in the mixtures: felspar 45 to kaolin 55, and felspar 75 to kaolin 92.5 per cent. Under ordinary conditions of firing, felspar can dissolve approximately 20 per cent. of china clay to form a clear solution, and 15 per cent. of flint.—H. H. S.

"Spit-out"; The adsorption and dissolution of gases by silicates. B. Moore and J. W. Mellor. Trans. Eng. Ceram. Soc. 1907—1908, 7, 1—20.

"SPITTING," a bubbled appearance of the surface of the glaze, is often attributed to the glaze itself, but the authors opine that at least 80 per cent. of cases of "spitting" are due to moisture or organic matter in the body. Organic matter may find its way into the body in several ways—imperfect oxidation in the biscuit oven of carbonaceous matters in the bone and clays; reducing gases in the glost or biscuit oven; tarry matters condensing on the cooler parts of the ware in the enamel kiln and finding their way into the body; the "resist" on ware in "acid decoration" working into the body; and the decomposition of hydrocarbon gases by red-hot porous earthenware causing carbon to deposit in the pores. Associated with this is the brown patching of green china, which is often accompanied by "spitting." The "greening" is caused by ferrous phosphate, which, if oxidised, would become brown, and any organic matter present would be simultaneously oxidised (see this J., 1906, 265). Earthenware is remarkably tenacious of moisture, which the biscuit may imbibe through the unglazed parts. Old ware is particularly liable to "spit" for this reason. Moisture may also appear to act as a reducing agent by cutting off the supply of oxygen, the steam preventing the combustion of hydrocarbons until the kiln is at a fairly high temperature, when sudden oxidation takes place with consequent "spitting." When "spitting" is a glaze effect, the phenomenon is more complex. It may be due, as in the body, to absorption of carbon or hydrocarbons; hot glazes absorb oxygen, and the combustion of the hydrocarbons may take place below the surface of the glaze. The bubbles may be caused by the chemical reactions in the glaze, if the temperature be not high enough to give a glaze sufficiently mobile to clear itself of bubbles. The presence of sulphates leads to "spitting." Seger found that the greater the acidity of the glaze, the less is its carrying capacity for sulphates, a bisilicate glaze saturated with sulphates containing 4 per cent. of sulphur trioxide in solution, whereas a trisilicate contained only 2 per cent. Hence if the glaze dissolves silica from the body, sulphur trioxide, sulphur dioxide, and oxygen would be ejected from the glaze. Also, when lead volatilises from a glaze saturated with sulphates, the glaze becomes more acidic and sulphur oxides are given off. To this cause, the authors attribute tendency of fritted lead glazes to blister more readily than raw lead glazes; the fritted bisilicate would become more acidic during the reaction and consequently less able to hold sulphates. Sulphates may also cause "spitting" by reduction to sulphites. Finally, a glaze may "spit" on cooling, having taken up an abnormal amount of gas, and the phenomena of devitrification, which may be overcome by alumina, is similarly accompanied by "spitting."—H. H. S.

Glazes; Solubilities of metallic oxides in — III., IV., and V. C. E. Ramsden. Trans. Eng. Ceram. Soc., 1907—1908, 7, 21—36.

IN a previous paper (this J., 1906, 266) the author dealt with the solubilities of nickel and manganese oxides in glazes maturing at about 1050°C . III. *Chromium oxide*.—The solubility is seldom greater than 1 per cent. It varies with the composition of the glaze and can be increased by adding silica to a lead glaze; reducing the boric anhydride whilst maintaining the acidity with silica; adding about 0.5 per cent. of tin oxide to the glaze; lowering the alumina as much as is

consistent with the prevention of devitrification; replacing the zinc oxide by lead oxide (which is contrary to the results obtained with oxides of nickel, manganese, and copper, but similar to iron oxide); or by replacing part of the lead oxide by alkalis. In the absence of R_2O bases, the proportion of lead oxide must not be lower than 0.7 molecular part in an unfritted glaze. If the lead oxide exceeds 0.7, it can be partly replaced by lime or baryta. The solubility seems to be greater at $1050^\circ C.$; at $1100^\circ C.$ the glazes are not so clear. The quicker the cooling the more likely is the glaze to be free from coloured separations. When clear the lead glazes are yellow-green. The colours are made browner by alumina, clay, tin oxide, baryta, and lime, the last named producing an orange shade. The finest greens are obtained in a slightly reducing atmosphere. A bright green, quite distinct from that of lead glazes, results with alkaline glazes, and this is made yellower by alumina. Volatilisation from a transparent chromium glaze is small, but if the glaze be saturated with the oxide, there is condensation on the fireclay box covering the tiles. *IV. Iron oxide.*—The solubility varies from 3 to 14 per cent. It can be increased by adding silica; lowering the alumina (though this will impoverish the colours); replacing lime by lead in a lead glaze (contrary to the results with oxides of nickel, manganese, and chromium, but agreeing with those obtained with copper oxide); or adding baryta or magnesia. In a lead glaze, the silica may be replaced by boric acid up to $0.5 B_2O_3$, and in an alkaline glaze up to $1.5 B_2O_3$. In the absence of R_2O bases the lead must not be lower than 0.7 PbO in an unfritted glaze. The solubility varies directly with the temperature, but the colours are impoverished at 1100° . The quicker the cooling after complete fusion, the clearer the glazes. The colour imparted by iron oxide is the well-known brown. In a lead glaze it is improved by alumina, clay, and boric acid, and greatly augmented by barium. Far more oxide is required to give the same tint in leadless glazes; it is strengthened by silica, alumina, and boric acid. No volatilisation of iron has been observed. *V. Copper oxide.*—The solubility is 3 to 8 per cent. It can be increased by adding silica, replacing silica by boric anhydride; or lowering the alumina or kaolin. In the absence of R_2O , the lead oxide should not be less than 0.7 molecular part. If it exceed this, a small portion may be replaced by zinc oxide or magnesia. Lime and baryta have little influence. The colours are generally spoilt at $1100^\circ C.$, and the turquoise tint of the alkaline glaze is destroyed above $1000^\circ C.$ Separations from the glazes are less, the quicker the cooling. The colour of the lead glazes is green, made browner by adding kaolin or copper oxide and by a higher temperature. The alkaline glazes are blue-green, and turquoise is obtained at a low temperature in the absence of alumina and by raising the silica. Volatilisation of copper is considerable when the glaze is saturated with oxide, and is greater in lead than in alkaline glazes. Decomposition of the surface takes place in a few months in lead glazes unless the proportion of boron exceeds $0.5 B_2O_3$, and to a less extent in alkaline glazes, when again the iridescence diminishes with increase of boric anhydride.

In the subsequent discussion, Solon referred to a magnificent brown which the Japanese obtain by introducing nickel oxide into the body and volatilising this oxide at 1200° — $1400^\circ C.$ —H. H. S.

Copper red; Development of — in a reducing atmosphere.
L. Franchet. Trans. Eng. Ceram. Soc., 1907—1908, 7, 71—79.

"ROUGE-FLAMBE" seems to have been developed originally by the Chinese, its first occurrence being probably accidental. It was introduced to Europe by Ebelmen and Salvétat, who analysed the glaze from a Chinese vase and obtained the following figures:—silica 73.9 per cent., alumina 6.0, iron oxide 2.1, lime 7.3, soda 3.1, potash 3.0, copper oxide 4.6. In 1879, at Sèvres, Lauth examined the effect with a view to manufacturing it on the large scale, but his resources did not enable him to build a special oven for the purpose. Consequently, the cooling was much slower than in the small experimental oven; it was impossible to keep the atmosphere in the necessary reducing condition; and "greening" took place. By

adopting a down-draught oven of two cubic metres capacity with three fire-mouths, and putting the regulating damper at the base of the chimney, the present author is able to manufacture the copper red industrially with a loss of less than four per cent. The body used is a mixture of kaolin and pegmatite vitrefying at cone 10. The glaze must contain alkalis, lead, and a quantity of tin oxide greater than that of copper oxide, the best results being obtained with 10 per cent. of lead oxide, 3 of copper oxide, and 8 of tin oxide. A better red is produced by fritting the copper glaze before use; the fritting need not take place in a reducing atmosphere. The glaze, with a little gum tragacanth added, is best pencilled on (2 mm. thick), as the irregularities produced by the brush give more varied effects than in dipping or spraying. The ware should be fired in closed saggars (unglazed); in open saggars, the reducing gases come much more easily into contact with the vases, but so does the subsequent oxidising atmosphere. The reducing fire lasts 9 hours; at cone 0.12 the oxidising fire is started and goes up to cone 10, lasting 12 hours. The cooling must be done as quickly as possible; the pieces are drawn 48 hours after the fires are extinguished.—H. H. S.

PATENTS.

Reverberatory furnace for burning porcelain, porcelain enamel, faience and pottery, with oil, wood or gas firing.
J. B. Nicolas, A. Yvernaud, and J. B. Coindeau. Fr. Pat. 395,302, Aug. 31, 1908.

A NUMBER of fire-grates are placed around a central chamber containing the goods to be burnt. The flames from the grates pass up to the crown of this chamber through flues, then down through the chamber itself, emerging into a canal placed below the chamber. The hot gases then ascend a second series of flues and pass through a second chamber placed above the first into the chimney.—A. G. L.

Glass articles; Fire glazing or finishing of —. M. Cummins, Manchester. U.S. Pat. 916,959, March 30, 1909.

SEE Eng. Pat. 390 of 1908; this J., 1909, 22.—T. F. B.

Glass; Process and apparatus for drawing —. The Window Glass Machine Co. Fr. Pat. 396,093, Nov. 9, 1908.

SEE Eng. Pat. 23,968 of 1908; this J., 1909, 425.—T. F. B.

Ceramic products; Process for baking porous —.
Grünzweig und Hartmann Ges.m.b.H. Fr. Pat. 395,548, Oct. 21, 1908.

SEE Eng. Pat. 22,613 of 1908; this J., 1909, 310.—T. F. B.

Porcelain of very low fusing grade; Process of making —. E. Berdel. Fr. Pat. 395,795, Oct. 29, 1908.

SEE Eng. Pat. 23,461 of 1908; this J., 1909, 310.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Building stone; Kessler's "fluates" for protecting — against frost. A. Hanisch. Mitt. Tech. Gewerbe Museums in Wien, 1909, 19, 44—46.

THE author subjected various limestones and sandstones that are used for building in Vienna to freezing and thawing 25 times. It was found that the untreated stones crumbled rapidly, but those that had undergone the Kessler "fluating" process possessed a most satisfactory resistance. This process is described as treating the stone with silicofluorides, with the result that resistant double-silicates are formed.—H. H. S.

Trass-lime mortar; Influence of the method of mixing on the strength of —. H. Burchartz. Mitt. kg. Materialprüfungsamt, Gross-Lichterfelde West, 1909, 27, 38—45.

THE author shows that the best results are obtained with trass-lime mortars (with or without the addition of sand)

if the trass is most intimately mixed with the lime. The official method of the German union for the testing of materials of construction does not secure sufficiently intimate mixing.—A. G. L.

PATENTS.

Plastic material and process of making the same. W. E. Carson, Riverton, Va. U.S. Pat. 915,060, March 9, 1909.

THE plastic materials consist of mixtures of lime (3 or 6 parts) with hydrated alumina, e.g., bauxite (1 part) and only sufficient water (6 or 4 parts) to slake the lime and to leave a dry powder after the excess of water has evaporated. The water may be added to a mixture of lime and bauxite, or, preferably, lime may be slaked with water containing bauxite in suspension. The hydrated alumina may be replaced by hydrated ferric or chromic oxide. The resulting materials set and harden on further addition of water. In practice they are mixed with 85 or 88 parts of dry slaked lime, and 3 parts of sand or filling material is added to 1 of the mixture.—A. G. L.

Aluminous materials [for abrasives]; Treatment of —. A. C. Higgins, Worcester, Mass. U.S. Pat. 916,866, March 30, 1909.

ALUMINA or other aluminous material is fused, and the fused product is chilled in the furnace into a pig or mass of practically uniform character, and subsequently crushed.—O. R.

Preserving wood and the like. B. Diamand, Idaweiche, Germany. U.S. Pat. 917,265, April 6, 1909.

A VESSEL is filled with the wood and an impregnating liquid. A part of the liquid is then withdrawn, while the entry of air is prevented so as to produce a vacuum within the vessel. The liquid is then again introduced into the vessel, while any gases given off by the wood are allowed to escape. The liquid is then again partially withdrawn while entry of air is prevented, after which the liquid is again forced in under pressure, and the whole contents of the vessel maintained under pressure for some time.—A. G. L.

Preserving wood; Process for — by permanently fixing large quantities of metallic salts in the wood. J. Gerlache. Fr. Pat. 396,235, Nov. 14, 1908.

THE wood is impregnated with an aqueous solution containing free ammonia and ammonia compounds of copper and zinc (e.g., ammoniacal solutions of copper sulphate and zinc chloride).—A. G. L.

[Silica] bricks; Treating —. G. Dallavedova. Fr. Pat. 395,463, Oct. 19, 1908.

IMMEDIATELY after burning, the bricks are immersed for 3–4 days in sea-water or other saline or acid liquid. After air-drying, the bricks are heated to 100° C., and when thoroughly dry are immersed for several minutes in hot tar or in a hot mixture of oil and tar.—A. G. L.

Waste gases from ring-kilns; Process for utilising — especially for the preliminary heating of bricks. H. Köddewig. Fr. Pat. 396,233, Nov. 14, 1908.

AN annular or ring kiln is provided with a long external tunnel, through which the raw bricks travel on endless bands or rails in one direction, whilst the air which has been used for cooling the burnt bricks, together with hot products of combustion from the burning chambers, traverse the tunnel in the opposite direction.—A. G. L.

Rotary kiln for cement. Soc. Anonyme des Ciments Français. Fr. Pat. 395,978, Nov. 5, 1908.

THE burning zone of a rotary kiln is surrounded by a fixed envelope, which communicates at the top, by means of valved pipes, with the open air and with a second narrow envelope, which completely surrounds the kiln at a point in its upper part where the drying of the cement material takes place. This second envelope communicates with the interior of the kiln by a tuyère revolving with the kiln.

By this arrangement the hot air from the outside of the burning zone is utilised to assist the drying of the materials. Hot gases from the chamber at the base of the chimney may also be used for the same purpose, by providing a valved pipe leading from this chamber to the hot-air conduit described above. If this second device is used, the chimney must be partially closed by a damper.—A. G. L.

Wood; Method of impregnating —. P. C. Reilly. Fr. Pat. 395,462, Oct. 19, 1908.

SEE U.S. Pat. 901,557 of 1908; this J., 1908, 1153.—T.F.B.

Cement, mortar, and concrete; Method of making — even when under pressure, watertight. P. Mecke, Stettin, Germany. Eng. Pat. 25,833, Nov. 30, 1908. Under Int. Conv., Feb. 14, 1908.

SEE Ger. Pat. 200,968 of 1908; this J., 1908, 1021.—T.F.B.

Cement; Manufacture of hydraulic —. C. J. Potter, Willington Quay. U.S. Pat. 917,129, April 6, 1909.

SEE Eng. Pat. 25,969 of 1907; this J., 1908, 1153.—T.F.B.

X.—METALS AND METALLURGY.

Pyrites; The increasing consumption of —, and its supply. B. Wetzig. Z. angew. Chem., 1909, 22, 721–724.

THE export of pyrites from Spain in 1870 was 200,000 tons, whilst in 1907 the export from the port of Huelva alone was 2,600,000 tons. In addition, 400,000 tons were shipped from Portuguese ports, and over 100,000 tons from Seville, the total export from the Huelva district thus exceeding 3 million tons. The consumption of pyrites for the Leblanc process has remained stationary during the last 30 years, and the increased export is required chiefly for use in the manufacture of superphosphate and ammonium sulphate. In 1907 the production of superphosphate reached nearly 5 million tons, an increase of 300,000 tons on the preceding year. No exact estimate can be formed of the quantity of pyrites still available, but Vogt has given the following figures for the Huelva district:—Rio-tinto mine, 130 million tons; Tharsis mine, 30 million tons; and other parts of the district, 10 million tons. The author considers the estimate for the Rio-tinto mine to be too low, but the quantity of pyrites containing over 15 per cent. of copper is probably less than 130 million tons. It is doubtful whether the whole of the Tharsis pyrites is of saleable quality, but the estimate for the other parts of the district is too low. At the present price, the annual export from Huelva is not likely to increase. With reference to the future demand for pyrites, other possible sources of sulphur are considered. The sulphur ore of Sicily is unsuitable for export unless the sulphur content is first increased to 30 or 40 per cent., and the use of this ore otherwise than locally is improbable. The residues left after the extraction of copper from low-grade copper-pyrites, as formerly practised in the Huelva district, do not form, as is often supposed to be the case, an additional source of sulphur, owing to the wasteful methods which were adopted. Attempts to convert native calcium phosphate into a soluble phosphate without the use of sulphuric acid have all been unsuccessful. By melting the insoluble phosphate with silica, a product similar to Thomas slag is obtained, costing about the same as superphosphate but less efficient as a manure. Nitric acid obtained from atmospheric nitrogen is not at present cheap enough for the manufacture of superphosphate. The decomposition of the native phosphate by heating with sulphurous acid under pressure is incomplete, and the recovery of sulphur dioxide by heating the calcium sulphite is impracticable owing to the formation of calcium sulphate and sulphide. The demand for pyrites is thus likely to continue to increase unchecked, and an increase in price may be confidently expected.—A. T. L.

Pig-iron in the electric furnace; Production of — from pyrites residue. F. E. Carcano. *Electrochem. and Met. Ind.*, 1907, 7, 155—156.

WHILE admitting that at the present time the electric furnace cannot in general compete with the blast-furnace for the production of pig-iron, the author draws attention to a case where it has been able to do so. About 100,000 tons of pyrites ash containing 46—57 per cent. of iron with about 2 per cent. of sulphur are yearly abandoned in Italy, because it would be difficult to treat such a powdered material rich in sulphur in the blast-furnace, especially in the absence of suitable iron ore and cheap coke. Water power is however available close to these refuse heaps, and in Lombardy, where the experiments were carried out, the kilowatt-hour costs only 0.09d., whereas small coke and coal dust cost respectively about 10s. and 16s. 8d. per ton, while furnace coke such as is used for the blast-furnace would cost £2 1s. 8d. per ton. Two types of electric furnace were used. In the first, two groups of electrodes were in series, with a carbon hearth and magnesia lining, and the gas and flame were allowed to escape. The second was an arc furnace with a vaulted roof for the recovery of the gases. The latter is the more economical for a permanent plant. The cost of making pig-iron in the first furnace works out at £2 9s. 10d. per ton, and in the second two or three shillings less. In the same locality if a blast-furnace were used, the cost of making pig-iron would be £3 0s. 5d. per ton. Not only therefore was the cost less, but there was no preparation of raw material. The following materials have been obtained:—

	Sulphur.	Phosphorus.	Manganese.	Silicon.
Foundry iron, . . .	0.046	0.063	2.23	3.53
Open hearth iron . . .	0.031	0.070	1.44	5.68
Spiegel	0.015	0.069	11.25	3.30
Silico-spiegel	0.020	0.065	12.66	8.90

In comparing the electric furnace with the blast-furnace, it should be remembered that:—(1). It is possible to use impure ores directly in the electric furnace which cannot be so used in the blast-furnace. (2). Coals of various kinds may be used. (3). It is easy to make castings direct, or to convert rapidly the pig-iron into a special steel in a second electric refinery furnace. (4). Silicon, manganese, or other elements can be easily incorporated with the steel.—A. H. C.

Steels; Study of the gases evolved by the action of cupric salts upon —. E. Goutal. *Compt. rend.*, 1909, 148, 988—991.

WITH a view to completing his previous work in connection with the potassium-cupric-chloride method for the determination of the total carbon in steels, etc. (this J., 1899, 521), the author has investigated the gaseous products evolved during the process of dissolution by which the carbonaceous residue is obtained for combustion. By treating one portion of the steel with the slightly acidified double chloride in a current of pure nitrogen, with suitable washing and absorption arrangements, the carbon dioxide and carbon monoxide in the gaseous products were quantitatively determined; whilst, by a modification of the process, the total carbon in the gases derived from the treatment of another portion of the steel was estimated, results thus being obtained for residual carbon, carbon evolved as dioxide, carbon evolved as monoxide, and carbon evolved as other unidentified gases. It was found that the total carbon in the gaseous products derived from different kinds of steel varied between 0.01 per cent. and 0.05 per cent. (calculated on the steel), about half of which was due to carbon dioxide occluded by the carbonaceous residue, from which it was expelled on desiccation. The author concludes that the loss of carbon experienced in the potassium-cupric-chloride process, as usually conducted, may be entirely obviated by heating the reagent to boiling during the dissolution of the steel, mixing the gaseous products with excess of pure oxygen, passing the mixture slowly over a heated platinum spiral and absorbing

the resulting carbon dioxide; and by omitting to dry the carbonaceous residue before the final combustion.

—W. E. F. P.

Special steels; Analysis of —. J. Pepin-Lehalleur. *Monit. Scient.*, 1909, 23, 263—264.

THE author discusses the methods proposed by Blair (this J., 1908, 902), and describes those which he has found most satisfactory in practice. For the separation of molybdenum from other metals by means of ether, it is best to take a special portion of the metal. The solution of the metal in hydrochloric acid of sp. gr. at least 1.12, should have a volume of 60 c.c. and be shaken twice with 40 c.c. of ether. Under these conditions only about 2 mgrms. of molybdenum remain in the acid solution. The ethereal solution should not be washed with hydrochloric acid. The ether is distilled off from the solution, the residue evaporated with sulphuric acid until white fumes appear, then re-dissolved in water, and the molybdenum precipitated by passing hydrogen sulphide through the hot solution. The precipitated sulphide is heated to bright redness in a current of hydrogen sulphide. Vanadium may be determined accurately by Campagne's method (this J., 1903, 1149). The author first precipitates it as manganese vanadate in ammoniacal solution, and then dissolves the precipitate in concentrated hydrochloric acid. In absence of tungsten, chromium may be determined by converting it into chromate, reducing this with Mohr's salt (ferrous-ammonium sulphate), and then titrating the excess of ferrous salt with permanganate. For determining tungsten, silicon, and chromium when present together, the metal is dissolved in hydrochloric acid, a small quantity of nitric acid added, the solution evaporated to dryness, the residue dissolved by means of hydrochloric acid and potassium chlorate, and the solution evaporated. The residue is now dissolved in boiling dilute hydrochloric acid, and after standing for 1 hour, the solution is decanted through an ashless filter, and the residue washed by decantation twice with dilute hydrochloric acid and once with dilute nitric acid. The solution (A) is set aside. The residue is treated with 50 c.c. of boiling dilute ammonia solution which dissolves the tungstic acid and a small proportion of the silica, and the solution is filtered through the paper used previously, the latter being then washed with ammoniacal water. The filter-paper and insoluble matter are incinerated, weighed, treated with hydrofluoric acid in the usual manner, and again weighed, the difference representing the chief proportion of the silica. The ammoniacal solution is concentrated, treated with 5 c.c. of nitric acid, evaporated to dryness, the residue heated to dull redness for 5 minutes, weighed, treated with hydrofluoric acid, and again weighed. The difference corresponds to the remainder of the silica, and the weight of the final residue represents the tungstic acid. The residue left from the determination of the chief quantity of the silica is fused with bisulphate, the product dissolved in water, added to solution (A), and the chromium determined in the usual manner. Tests for the qualitative detection of molybdenum, and of vanadium in presence of chromium are also given.—A. S.

Ferro-nickel; Cast — spoiled by working at too high a temperature. E. Heyn and O. Bauer. *Mitt. kg. Materialprüfungsamt Gross-Lichterfelde West*, 1909, 27, 1—7.

Two pieces of ferro-nickel, which showed fissures on working, were examined. Their composition was: Nickel, 5.5 per cent.; carbon, 0.09; manganese, 0.59; silicon, 0.22; phosphorus, 0.01; sulphur, 0.03; and copper, 0.12 per cent. Microscopic examination showed a coarse structure, similar to that of cast ingots; on reheating for one hour at 900° C. the structure became fine-grained. On working reheated samples it was found that fissures were produced if the temperature to which the samples were heated was too high. But the maximum temperature permissible depends not only on the time of reheating, but also on the size of the pieces heated. Thus, pieces with a cross-section of 10 by 10 mm. could be heated safely for periods up to

2 hours at 1200—1300° C.; but pieces with a cross-section of 40 by 55 mm. could not be heated much above 1100° C. without showing fissures on subsequent working.

—A. G. L.

Welding and hard-soldering. C. Diegel. Chem.-Zeit., 1909, 33, 427—428.

THE plates to be welded (in making stills, boilers, dryers, etc.) formerly consisted entirely of wrought-iron, but at present mild steel is almost exclusively used. Siemens-Martin steel with a tensile strength of 30—40 kilos. per sq. mm. being the most suitable. The iron should contain less than 0.01 per cent. of phosphorus, if possible, and certainly not more than 0.04. Too much sulphur, copper, or silicon, or too little manganese render the iron hot-short. The manganese should not be less than 0.4 per cent. for 0.01 per cent. of silicon; but iron with 0.75 per cent. of manganese and 0.15 per cent. of silicon can be readily welded. Mild steel becomes brittle at about 300° C. or on cooling after being heated to above 1000° C.; in the last case, heating for a short time to 900° C. restores the original tenacity. The different methods of welding iron are as follows:—1. Electrically, by passing a large ampère and low voltage current between the superimposed pieces. 2. By means of the arc; either by an arc formed between one of the pieces of iron and a carbon rod; or, by an arc formed between two carbon rods and deflected magnetically; or else, by forming an arc between one of the pieces to be joined, and an iron rod, which melts and flows into the space between the two pieces. 3. The thermite process. 4. Autogenous welding by melting the two edges together in a gas flame (hydrogen, acetylene or coal-gas and oxygen). 5. Welding by hammering or rolling, the pieces being heated in a coke-fire or by water-gas, both gas and air being supplied to the burner under pressure in such quantities as to give a reducing flame. Thin sheets, up to 6—8 mm. in thickness, are preferably joined by a hard solder. Brass is generally used, but copper and bronze are also employed. Increasing content of zinc renders the solder more fusible, but diminishes its tenacity; by adding 4—10 per cent. of silver the solder becomes easily fusible and strong. As flux, borax, or "Perlinax" is used.—A. G. L.

Electrochemistry of the solution of gold in potassium cyanide. J. B. Ekeley and A. L. Tatum. Western Chemist and Metallurgist, 1909, 5, 19—23.

MCLAURIN in 1893 (this J., 1893, 359) showed that the presence of oxygen is necessary for the solution of gold in potassium cyanide. Following the lines of Christy's researches (this J., 1901, 259; 1902, 779), the authors constructed a cell composed of electrodes of gold on the one hand and oxygen (platinised platinum in oxygen) or the other in an electrolyte of potassium cyanide. With cyanide solutions of concentrations varying from 0.05 to 0.45 per cent., in all cases much larger quantities of gold were dissolved with the external circuit closed than when this was open, and the results indicate that were it possible to supply oxygen at a sufficiently rapid rate to the platinised platinum and exclude all oxygen from the cyanide solution, then the solubility would be directly proportional to the current according to Faraday's law. Measurements of the potential of gold in cyanide solutions against the oxygen electrode gave results agreeing with the measurements of Christy and others against the normal calomel electrode. Considered electrochemically the solution of gold in potassium cyanide may be represented by the equation: $4Au + 8K' + 8CN' + 2H' + 2OH' + 2O' = 8K + 4Au(CN)_2' + 4OH'$, the gold dissolving on account of the formation of innumerable short-circuited gold-oxygen cells. The four charges carried by the oxygen ions may, however, be supplied in other ways. If furnished by mechanical means, gaseous hydrogen would be evolved as solution of the gold proceeded: $2Au + 4K' + 4CN' + 2H' + 2OH' = 4K + 2Au(CN)_2' + 2OH' + H_2$. The solution of gold in a cyanide solution containing cyanogen bromide is represented by the equation: $2Au + 3K' + 3CN' + Br' + CN' = 2K + 2Au(CN)_2' + K' + Br'$.

—A. S.

Cyanide lixiviation [of gold and silver ores] by agitation.

W. M. Brodie. Eng. and Min. J., 1909, 87, 695—696.

IN the Brown or Pachuca tank, which consists of a tall tank having a conical bottom, with a central air lift (see this J., 1908, 1065), the compressed air which is introduced at the bottom of the tank, causes an active circulation of the pulp by inducing an upward current of the solution containing the slimes, through the central air lift. The circulation is however impeded if fine concentrates or sands collect in the conical bottom, round the air-lift pipe. In order to overcome this, a series of pipes is arranged either round the central air-lift pipe or attached to the inner walls of the tank, extending from just below the working surface of the solution to within 6—18 in. of the lower end of the air-lift. When material has settled in the cone and the air supply is turned on, solution passes down these pipes and washes away everything in the apex of the cone, thus allowing the accumulation to sink and in turn be washed away. The circulating pipes, which are generally three or four in number, have their upper ends fitted with return elbows, so that ore fed into the tanks, or coarse settlements thrown up by the lift, may not fall down the pipes. The great advantage of the circulating pipes is that a much larger proportion of sands can be stirred effectively than in any other of the customary agitation vats, so that complete sliming of the ore is unnecessary.—F. R.

Silver cyaniding; Recovery of metals from solutions in —.

M. R. Lamb. Eng. and Min. J., 1909, 87, 705.

IN order to reduce the large quantity of zinc required to precipitate the precious metals from rich cyanide solutions, the author proposes that about 85 per cent. of the values be removed by electrolytic deposition and the remainder be precipitated in zinc boxes, thus removing the difficulty of electrolytically treating solutions containing very small amounts of silver or gold.—F. R.

Borax in assay fluxes. J. E. Clennell. Eng. and Min. J., 1909, 87, 696.

IN order to ascertain whether the use of borax as an assay flux gave rise to any loss of precious metal, comparative tests were made on a quartzose ore containing iron oxide, using fluxes free from, or containing varying amounts of borax. It was found that the presence of 5—10 grms. of borax in the flux, per assay ton of ore, was advantageous as it increased the fusibility of the charge, but when larger proportions of borax were used, the slag became hard and stony and the lead button was only separated from it with difficulty. There was no evidence that borax carried any appreciable amount of gold into the slag, but when too large a proportion of borax was used, a film of lead almost invariably broke off the button and adhered tenaciously to the slag, giving rise to mechanical loss.—F. R.

Determining vanadic and arsenic acids and vanadic and antimonie acids in presence of each other. Edgar. See XXIII.

Copper production of the world. H. R. Merton and Co., March, 1909. [T.R.]

THE world's production of copper in 1908 amounted to 748,625 tons, compared with 713,865 tons in the previous year, 429,626 tons 10 years ago, and 279,391 tons in 1891. For three years the production by the principal countries has been as follows:—

	1906.	1907.	1908.
	tons.	tons.	tons.
Australasia	36,250	41,250	39,500
Canada	25,466	25,615	29,570
Chile	25,745	26,685	38,513
Germany	20,340	20,490	20,200
Japan	42,540	48,535	43,000
Mexico-Bolco	10,830	10,975	12,400
Mexico, miscellaneous	49,795	45,590	25,170
Peru	8,505	10,575	15,000
Russia	10,490	15,000	20,085
Spain and Portugal	49,320	49,675	52,585
United States	409,650	392,520	425,175
Total	714,100	713,865	748,625

Platinum; Its occurrence and extraction. W. Geibel.
Z. f. Elektrochem., 1909, 15, 212—218.

THIS is a prize essay, containing besides descriptions of the direct methods of extraction of the metal itself, also those of the separation of the various associated metals from the crude platinum. The entire subject is classified as follows:—I. Occurrence and extraction. II. Geographical and geological data, etc. III. Description of the individual deposits. IV. Methods of extraction. V. Statistics as to prices and production. VI. Winning the ore, and separating the platinum metals. VII. Working process. VIII. Uses. It is shown that whilst the deposits worked in 1879 yielded 5 oz. of metal per ton, the present average is much below 1 dwt. There is some platinum in all the streams running east or west from the Urals, and there is much probability that those running northwards may contain it in quantity. More elaborate and scientific methods of operating are employed in the larger workings than those used in the small and scattered workings. This fact explains how that in these larger workings economy of labour can be afforded, and thus deposits of lower grade can be turned over to profit. It is still estimated that at least 10 per cent. of the total platinum found is stolen.

PATENTS.

Sulphide ores or products; Treatment of —. W. Hommel, London, and The Metals Extraction Corporation, Ltd., London. Eng. Pat. 6511, March 24, 1908.

THE ore is roasted in order to remove the bulk of the sulphur; it is not advantageous however to eliminate the whole of that element but only such portion as will pass away in an oxidising calcination. The product is then mixed with a certain amount of carbon or carbonaceous matter, together with residues produced in the later part of the process, and subjected in a blowing furnace to an air-blast. The whole of the zinc, together with some small amounts of lead and silver, is volatilised and condenses in the flues in the form of oxide. The residue contains nearly the whole of the lead, silver, gold and copper, and may be treated in any suitable manner or the recovery of these metals. The zinc oxide product, after suitable agglomeration, is mixed with some form of carbon and distilled for the metal in the usual manner, the residue in this case being again employed in the preliminary distillation, as above.—C. A. W.

Oxides and sulphides; Reduction of metallic — for the purpose of obtaining the corresponding metal. E. Chatillon. Fr. Pat. 395,658, Jan. 3, 1908.

THE process is particularly applicable to the case of antimony, existing either as oxide or sulphide. The mineral sulphide having been melted in a furnace of appropriate design, it is run into a receptacle and subjected to the action of a current of air which may either be blown in or passed over the surface. When the oxidation, which is never complete but results in a mixture of oxide with oxysulphide and unreduced sulphide, has come to a stop, the current of air is cut off, and reduction effected by blowing in industrial gases rich in hydrogen, hydrocarbons, and carbonic oxide, such as coal gas, water-gas, or gases obtained from the distillation of wood. The metallic vapours produced in the reduction are led into a double condensing chamber, of which the interior compartment has walls composed of filtering tissues, the filtered gases passing away through a chimney. The process may be carried out in a furnace with inclined hearth with a cavity in the lower portion to serve as a receptacle for the molten ore. Moreover, in order to prevent volatilisation, it is convenient to cover the mass with some inert fusible material, such as common salt.

—C. A. W.

Muffle furnace; Hardening —. A. Mergler, Cologne, Germany. Eng. Pat. 17,367, Aug. 18, 1908.

A GRATE is provided close to one side of the muffle. The hot gases from this grate first pass over a partition placed close to this side of the muffle, then down beneath the partition and the muffle, next horizontally beneath the muffle, then up past the other side of the muffle, and finally over the top of the muffle to the flue, which is

placed close to the partition. The muffle is supported on a number of transverse ridges, which form passages through which the hot gases pass.—A. G. L.

Furnace; Ore-reducing —. G. F. Rendall, New York, Assignor to American Reduction Co., New Jersey. U.S. Pat. 916,487, March 30, 1909.

THE furnace, used in calcining ores, comprises a revolving chamber which is connected by means of a conduit with an externally heated retort, the latter being used for the production of combustible gas. Means are provided for mixing this gas with air as it passes into the calcining chamber, and also for preventing any further combustion in the receiver where the residual portions are collected.

—C. A. W.

Alloy; [Bearing metal —]. W. G. Black, St. Louis, Mo. U.S. Pat. 912,645, Feb. 16, 1909.

THE alloy, which consists of copper 50—60, iron 40—50, nickel 4—6, lead 6—15, and aluminium 0.25—0.5 per cent., is made by adding the nickel to the previously melted iron and when these have alloyed, adding the copper and aluminium and after well stirring, finally adding the lead. The mixture is again well stirred before pouring. The percentage of lead determines the relative softness of the alloy, and the nickel is said to act as a lubricant when the alloy is used as a bearing metal.

—F. R.

[Gold and silver] Assaying; Process of —. J. C. Hames, Goldfield, Nev. U.S. Pat. 913,129, Feb. 23, 1909.

THE finely divided ore, say half an assay ton, is mixed, preferably dry, with three times its weight of a mixture, substantially consisting of 1 part of gum camphor, 20.736 parts of iodine, and 41.471 parts of potassium iodide, then adding water equal to 14 times the weight of the ore and stirring the whole. The gold is precipitated from the solution by the addition of 0.75 dram of sodium amalgam and is afterwards recovered by the usual methods. In assaying for silver, the same method is employed, except that instead of the amalgam, an amount of sodium cyanide equal in weight to the ore, is added, the silver being afterwards precipitated from the solution with zinc shavings or dust. The zinc precipitate is dissolved in nitric acid and the silver determined in the solution.

—F. R.

Gold; Extraction of — from cyanide solutions with simultaneous regeneration of the alkali cyanide. P. de Wilde. Fr. Pat. 396,170, Nov. 11, 1908. Under Int. Conv., Nov. 20, Nov. 28, and Dec. 16, 1907.

THE cyanide solution containing dissolved gold is slightly acidified by addition of hydrochloric acid or sodium bisulphate. In order to collect the liberated aurous cyanide, which is present in so small a quantity that the liquid appears absolutely clear, a small amount of cuprous chloride, dissolved in a concentrated solution of common salt or in hydrochloric acid, is added and the mixture agitated for a few minutes. The precipitate of cuprous cyanide, which settles rapidly after a short rest, is found to have carried down with it the whole of the aurous cyanide. The liquid having been decanted off, the precipitate may be treated with moderately concentrated hydrochloric acid, when the cuprous cyanide will be dissolved without decomposition, the gold compound being left untouched. The solution of cuprous cyanide may then be employed again. The acidified solutions of cyanide deprived of their gold are subsequently treated with a slight excess of caustic alkali, when the resulting mixture is ready for the treatment of a fresh quantity of ore. Certain varieties of carbon, such as those obtained by calcining nitrogenous animal products with potassium carbonate likewise possess the property of absorbing and fixing large quantities of aurous cyanide.

—C. A. W.

Ores and the like; Calcining, desulphurising, agglomerating, and sintering —. F. D. Weeks, Salida, Assignor to Ohio and Colorado Smelting and Refining Co., Colo. U.S. Pat. 916,903, Mar. 30, 1909.

THE apparatus consists of a stationary annular grate on to which the material is fed by means of a hopper

which moves in a rotary path along the surface. The material having been ignited by means of a burner affixed to the hopper, the combustion is maintained by a current of air which is drawn down through the mass, the strength of the draught being regulated by an exhauster arranged to that end. Finally the roasted product is swept from the grate-surface by means of a scraper attached to the hopper and movable therewith.—C. A. W.

Cast iron; Method and product for soldering — with metals or alloys. G. Fano fu Gustavo and G. Voghera. Fr. Pat. 395,283, Oct. 15, 1908.

The solder consists essentially of a metallic salt easily decomposable by heat, a deoxidising agent, melting at the temperature of fusion of the metal by which the actual joint is made, and a small quantity of an energetic oxidising agent, this last being used when the iron has a high content of carbon (5 to 6 per cent.). The soldering metal should fuse at a temperature below the melting point of the most fusible of the metals it is required to solder. In the composition specified, zinc chloride, 38 parts; sodium borate, 60 parts; potassium permanganate, 2 parts, the action depends upon the breaking down of the first into chlorine, which cleans the surface of the iron, and zinc, by which the actual weld is made. —C. A. W.

Iron and steel articles; Coating of — with a view to preserving them from rust. Langbein-Pfanhauser-Werke A.-G. Fr. Pat. 395,409, Oct. 16, 1908. Under Int. Conv., Dec. 21, 1907.

THE objects of iron or steel, having previously received a coating of lead, are covered with zinc electrolytically. In this way there is produced at the surface of contact of the two metals an alloy of lead and zinc which, since it shows the potential of zinc, offers the same protection against rust as would a coating of that metal alone. A smaller deposit of zinc may be employed if, subsequently, the object be brought to a temperature such that the formation of the alloy is extended through the entire coating.—C. A. W.

Alloy of magnesium and iron or of iron and a magnesium alloy; Production of an — suitable for the deoxidation of cast iron and steel. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 396,009, Nov. 6, 1908.

THE direct addition of magnesium to molten iron or steel is not possible without the risk of an explosion. It is however found that the addition may be made at the moment when the bath is passing from the solid to the liquid condition, that is when it constitutes a thick pasty mass. As such a procedure would not be possible in practice, it is preferable to prepare previously a ferro-magnesium alloy in the above manner and to add this to the bath as in the ordinary addition of ferro-manganese. If it be desired to add nickel, aluminium, or other metals to the molten bath, these may be alloyed with the magnesium which is then used in the preparation of the ferro-alloy as before.—C. A. W.

Aluminium alloys; Method of obtaining —. J. A. Boutes. Fr. Pat. 395,331, Oct. 6, 1908.

UNDER ordinary conditions it is not possible to obtain aluminium containing more than 5 to 6 per cent. of heavy metals without impairing its mechanical properties. The fact that a solution saturated with any substance is able to take up a certain proportion of another substance which may be soluble in the original solvent is applied to the production of ternary and quaternary aluminium alloys. To this end, the several metals, in the liquid condition, are added one by one to the molten solvent. The process may be modified by melting first of all the metal with the highest melting point and proceeding in the reverse order, finally adding the requisite amount of aluminium. In this way alloys such as aluminium-

silver-copper and aluminium-copper-nickel-zinc may be obtained, excelling in malleability and ductility those of the binary type.—C. A. W.

Tantalum; Manufacture of metallic —. Siemens und Halske A.-G. Fr. Pat. 395,730, Oct. 28, 1908. Under Int. Conv., Nov. 16, 1907.

TANTALIC acid or other oxygen compound of tantalum is reduced by carbon at a white heat. It is found that a pure metal can be obtained in this way if all access of air be excluded during the operation. To this end the reduction may be operated in a current of hydrogen and, in order to avoid as far as possible the formation of carbonic acid, such a proportion of carbon is taken as will lead to the production of carbon monoxide alone. In one method of heating, the mixture of oxide and carbon is pressed into sticks, a little tantalum powder being added if necessary to give the requisite conductivity, and the whole brought to the particular temperature by the passage of the electric current. Although the metal may absorb large quantities of hydrogen, this can subsequently be removed by fusion in the electric furnace under reduced pressure.—C. A. W.

Ores; Process for preventing the concretion of — in mechanical roasting furnaces. E. W. Kauffmann. Fr. Pat. 395,848, Oct. 31, 1908.

IN the roasting of sulphide ores, the great rise in temperature produced by the oxidation of the sulphur may lead to the fusion of the smaller particles, which consequently tend to become agglomerated. In a mechanical roasting furnace of the upright type having, for example, five floors, this effect would be most noticeable on the second and third floors where the oxidation is at an early stage and the content of sulphur is high. It is therefore proposed to increase the velocity with which the ore travels over these floors and in this way reduce the disengagement of heat in the same proportion. To this end the teeth fitted to the radial arms in the zones in which concretion may occur are arranged at a greater inclination to the line of flow, and thus present a greater working surface, than on the other floors.—C. A. W.

Tin-plate; Removal of tin from — by means of chlorine. H. von Schütz. Fr. Pat. 395,999, Nov. 6, 1908. Under Int. Conv., Nov. 15, 1907.

THE tin-plate, packed on the floor of the chlorination chamber, is freed from moisture by submitting it to a current of hot air. The chamber having been exhausted, the cooled material is subjected to the action of the gases obtained by allowing liquid chlorine and liquid air to spontaneously evaporate into the vacuum. In this way a further cooling is obtained, so that the temperature, which tends to rise as a consequence of the heat of reaction, never becomes too high. Moreover the pressure produced never becomes much greater than atmospheric pressure, and the gases, which pass into the chamber through several tuyères, act uniformly on the material. The liquid stannic chloride as it drops from the metal is collected in a gutter and run off from time to time, and in order to remove the last traces, a current of water is passed in, after which the plates are again dried by the action of heated gases. After removal to a second chamber where they are gently heated and become covered with a film of oxide, the plates are rolled out and cut up into pieces of the required shape. The washing with water may be omitted, when the last traces of chloride will be removed in the final heating in the second chamber.—C. A. W.

Zinc from zinciferous lead and other low-grade zinc alloys; Process for the recovery of —. D. Coda. Ger. Pat. 207,019, June 21, 1907.

AN alloy of copper or of copper and aluminium with lead is added to the fused alloy containing zinc, in order to concentrate the zinc in a dross which is practically free from silver and can be distilled. Good results are obtained with an alloy containing about 94 per cent. of lead and 5 of copper, obtained by reduction of a mixed ore con-

aining radium. The alloy can be easily melted with inciferous lead, and is said to have the power of withdrawing from the latter about 10 per cent. of its weight of zinc, forming a dross, which yields metallic zinc on distillation. The patentee ascribes the action of the alloy to a physical modification of the copper caused by the presence of small quantities of radium.—A. S.

inc and other metals from ores and products containing them; Method of extracting in the shape of oxides, sulphides, and sulphates — W. Troeller, Frankfort, Germany. Eng. Pat. 6888, March 28, 1908.

EE Fr. Pat. 388,503 of 1908; this J., 1908, 905.—T. F. B.

Roasting furnaces; Mechanical — R. von Zolewski, Engis, Belgium. Eng. Pat. 15,192, July 17, 1908. Addition to Eng. Pat. 21,961 of 1907, dated Oct. 13, 1906.

EE Addition of May 29, 1908, to Fr. Pat. 382,138 of 907; this J., 1908, 1116.—T. F. B.

Subjects of tungsten or of tungsten and nickel; Manufacture of — Siemens und Halske, A.-G., Berlin. Eng. Pat. 17,438, Aug. 19, 1908. Under Int. Conv., Sept. 26, 1907.

EE Fr. Pat. 393,595 of 1908; this J., 1909, 149.—T. F. B.

Nickel from silicious ores; Process of recovering — A. Chalas, Philadelphia, U.S.A. Eng. Pat. 18,596, Sept. 4, 1908. Under Int. Conv., Sept. 6, 1907.

EE U.S. Pat. 887,735 of 1908; this J., 1908, 631.—T. F. B.

Iron and steel; Direct process of manufacturing — T. J. Heskett, Brunswick, and M. Moore, Melbourne, Victoria. U.S. Pat. 917,475, April 6, 1909.

EE Fr. Pat. 368,598 of 1906; this J., 1907, 53.—T. F. B.

Aluminum coating on oxidisable metals of high melting point; Process for producing a — M. Baum. Fr. Pat. 396,033, Oct. 16, 1908. Under Int. Conv., Oct. 17, 1907.

EE Ger. Pat. 201,666 of 1907; this J., 1908, 1160.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Electro-chemistry of the solution of gold in potassium cyanide. Ekeley and Tatum. See X.

Determining mercury electrolytically. Perkin. See XXIII.

Electric furnace. C. W. F. Gorrell, Ottawa, Canada, Assignor to M. Ruthenburg, Lockport, N.Y. U.S. Pat. 916,548, March 30, 1909.

EE claim relates to a particular form of electrode comprising a tubular metallic body fitted at the furnace end with a screw-threaded cap. By means of this cap, small tip of carbon or other refractory substance which carries may be readily detached from the electrode proper. Leads are provided for directing separate currents of refrigerants through the body and tip respectively.

—C. A. W.

Electrodes; Process of making carbide or carbide-containing — H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 917,707, April 6, 1909.

EE carbide of a metal is mixed with a solid hydrocarbon substance which will yield free carbon when heated, the mixture is pressed into the required shape, and the electrode is finally heated in a non-oxidising atmosphere so as to decompose the hydrocarbon substance.—A. T. L.

Electric furnaces. E. Cornelius, Trollhättan, Sweden. Eng. Pat. 10,378, May 13, 1908.

EE Fr. Pat. 390,220 of 1908; this J., 1908, 1026.—T. F. B.

Electric transformer-furnace. O. Frick, Saltsjöbaden, Sweden. U.S. Pat. 917,040, April 6, 1909.

SEE Eng. Pat. 4866 of 1904; this J., 1904, 667.—T. F. B.

Electric incandescent lamps. U.S. Pat. 917,159. See II.

Electric incandescent lamps. Fr. Pats. 395,360, 395,482 and 395,484. See II.

Adding ozone to gases and carburetted materials. Fr. Pat. 395,804. See II.

Scouring wool by means of electricity. Addition to Fr. Pat. 375,237. See V.

Manufacture, purification, and concentration of sulphuric acid. Addition to Fr. Pat. 393,665. See VII.

Producing silicon. U.S. Pat. 916,793. See VII.

(B.)—ELECTRO-METALLURGY.

Electric smelting in British Columbia. Times Eng. Suppl., May 5, 1909, 19. [T.R.]

DURING 1908 the Canada Zinc Company erected at Nelson, British Columbia, an electric smelter for the treatment of mixed ores of lead and zinc by the method of F. T. Snyder. (This J., 1907, 879.) This plant has been installed for smelting 15 tons of ore per day with provision for an increase to 40 tons. It is situated on the water front of Kootenai Lake and represents an investment of £22,000.

The ore as received by rail or water, first enters a sampling department where it is crushed to the size of wheat, and sampled for analysis. From the sampling department, it is bedded down after mixing with the requisite fluxes, etc., in storage bins holding 100 tons each. From the bedding bins the ore is fed automatically by a feeder to a roaster of the McDougald type specially modified for roasting the mixed lead zinc ores. This roaster consists of a number of circular hearths superposed upon each other to reduce radiation, down which the ore is stirred by arms projecting from a central vertical revolving shaft. From the roaster the red-hot finished ore, which by this time has lost most of its sulphur, falls into a revolving cooler which delivers it cold and dry to the storage bins for the electric furnace. The electric furnace, similar in appearance to an ordinary lead or copper water-jacketed furnace with electrodes for carrying electricity, in place of tuyères for taking in a blast, receives the roasted ore at the top and melts it down into slag. The lead produced, sinks through this slag and passes into a crucible at the bottom of the furnace. The zinc is vaporised and led to condensers, where it condenses into a sump and is ladled out into pigs.

The ore of the Slocan district is exceptionally high in silver (shipments in excess of 100 oz. to the ton being common) and this silver is not a direct constituent of the galena but of an associated grey copper ore (freibergite), assaying, when picked out, 4000 to 5000 oz. of silver to the ton.

With heat generated in the charge of ore and not having to penetrate from the outside (through retort or furnace walls, &c.), the retort can be enlarged to a point where machinery can replace hand labour with corresponding decreased labour costs per ton. No heat having to pass through the walls, these can be made thick and mechanically strong. With internal electrical heat it is not necessary to keep the retort horizontal; it can be placed vertically and the ore either fed in from the top or forced in from the side. Certain other advantages follow from the vertical position. Any lead in the charge, instead of falling against and corroding a hot wall, will fall to the bottom and can be collected separately from spelter. But the principal advantage from the electrical firing is that the residues can be so strongly heated as to melt them, whereby not only is it possible to completely expel the zinc as vapour, but the residues can be removed by the low-labour plan of tapping off slag. But the principal advantage of the electric furnace is that the zinc in the charge is no longer oxidised, and may be condensed

and saved. The slag, being freed from the burden of dissolving this zinc, requires less iron and can be compounded to carry away lower lead and silver values. From 800 to 1200 horse-power hours are required per ton of material fed into the furnace, varying with the zinc content of the charge. This amount of electricity can be generated from steam with the coal required (2250 lb.) per ton of ore by the retort method of zinc smelting. The use of electricity, however, involves the cost of electrodes. In practice this has been found to vary from £5 to £20 per ton of furnace charge, varying with the composition of the charge and the physical character of the electrodes.

PATENTS.

Electrolytic parting of gold bullion and gold alloys; Process for the —. Norddeutsche Affinerie, A.-G. Ger. Pat. 207,555, Sept. 22, 1908.

The electrolytic parting is effected in solutions containing excess of hydrochloric acid or chlorides with either an asymmetric alternating current or with both a direct and an alternating current working either in parallel or in series. The process is carried out with current-densities of 500–1000 ampères per sq. m., and the solution of gold chloride forming the electrolyte may be cold, in which case it should contain at least 3 per cent. of free hydrochloric acid; or warm, when the amount of free acid must be less than 1 per cent.—A. S.

Steel; Refining of — in electric furnaces. C. L. Perry, London. From Bismarckhütte, Bismarckhütte, Germany. Eng. Pat. 14,926, July 14, 1908.

SEE Addition of May 23, 1908, to Fr. Pat. 386,786 of 1908; this J., 1908, 1117.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Mutton tallow; Mixed glycerides of palmitic and stearic acids in —. A. Bömer, Z. Untersuch. Nahr. Genussm., 1909, 17, 353–396.

IN a former communication (this J., 1907, 974) the author showed that the most insoluble glyceride in beef and mutton fats was tristearin, of which the former fat contained about 1.5 per cent. and the latter about 3 per cent. In the present paper it is shown that a very large number of fractional crystallisations is required to separate the glycerides of the saturated fatty acids in mutton fat. The mixed glycerides thus separated were dipalmitostearin (4 to 5 per cent.) and palmitodistearin (4 to 5 per cent.). The presence of tripalmitin is doubtful, and in any case this compound cannot form any considerable proportion of the saturated glycerides. The dipalmitostearin after repeated recrystallisation melted at 57.3° C. (57.5° C. corr.), or about 2.3° C. higher than the similar glyceride isolated by Hansen from mutton fat. It had a saponification value of 201.4 (theory, 201.8) and the amount of stearic acid, determined by Hehner and Mitchell's method, in its separated fatty acids agreed with the theoretical amount. The palmitodistearin melted at 63.0° C. (63.3° C. corr.), whilst the glyceride separated by Hansen (this J., 1902, 553) melted at 62.5° C., and that isolated by Kreis and Hafner (this J., 1904, 755) at 63.0° C. Both of these mixed glycerides showed the same m.p.s. whether crystallised from a solution or solidified after melting.

—C. A. M.

Fatty oil in mineral oil. Schwarz and Marcusson. See III.

PATENTS.

Washing compounds or soaps; Manufacture of —. J. B. Irving, Ballinluig, Perthshire. Eng. Pat. 6304, Mar. 24, 1908.

CLAIM is made for the manufacture of a washing compound or soap by mixing a fatty acid (e.g. 1 lb. of "oleine" containing 95 per cent. of free fatty acids), an alkali (e.g. 1 lb. of crystallised sodium carbonate) and water (e.g. 5 lb.), and preferably, heating the mixture by means of a steam coil or the like.—C. A. M.

Soap; Process for making —. E. Schon. Fr. Pat. 395,383, Oct. 16, 1908.

SEE Eng. Pats. 20,916 and 26,540 of 1907; this J., 1908, 1027.—T. F. B.

Apparatus for determining viscosity of liquids. Ger. Pats. 205,235, etc. See XXIII.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

Thioindigo and indigo; Use of — as pigments for oil-paints. E. Täuber. Chem.-Zeit., 1909, 33, 417–418.

THE author describes further experiments with different preparations of indigo and thioindigo, all of which have confirmed his former conclusions (this J., 1908, 1073) that both pigments when used in oil-paints fade in the course of a few weeks. He is unable to confirm the statement of Eibner (this J., 1909, 373) that there is a fundamental difference in this respect between indigo and thioindigo. Pure synthetic indigo, however, proved not only to have more colouring power, but also to be considerably more stable than natural indigo or artificial indigo precipitated with alumina. Moderate heat accelerates the bleaching process. Thus layers of oil-paints containing these pigments, which at the ordinary temperature took several weeks to fade, were bleached in one or two hours when exposed in the dark to a temperature of 40° to 60° C. Conversion of indigo or thioindigo into alkali salts of their sulphonic acids obviates their instability as pigments in the presence of oil. This is attributed to these sulphonated salts being insoluble in oil, and it is suggested that it may be possible to prepare serviceable oil-paints from thioindigo red and allied compounds by converting their sulphonic acids into metallic salts completely insoluble not only in oil but also in water.—C. A. M.

PATENTS.

Amorphous carbon; Apparatus for the preparation of — by decomposition of hydrocarbons. J. Machtoff, K. Bosch, F. Closs, and G. and T. Boehm. Ger. Pat. 207,520, Nov. 9, 1907.

IN the preparation of amorphous carbon by the decomposition of hydrocarbons by means of an electric spark (see Fr. Pat. 364,034; this J., 1906, 894), claim is made for the use of a series of connected decomposition chambers, only the first of which is provided with a sparking device. The chambers are connected by tubes provided with non-return valves. On passing the spark, the pressure produced in the first chamber by the explosion, and the flame, pass on to the second chamber, causing explosion of the hydrocarbon therein; and so on throughout the series.—A. S.

Soot; Process for increasing the yield of — from coal-tar, coal-tar pitch, and similar substances. Rütgerswerke, A.-G. Ger. Pat. 208,600, May 24, 1908.

THE raw materials (coal-tar, coal-tar pitch, etc.) are first extracted with a suitable solvent, the solution is separated from the residual "free carbon," and is then either as a whole, or after expelling the solvent, burnt in the usual manner for the production of soot. The "free carbon" has the same composition and may be used for the same purposes as soot. As suitable solvents, naphthalene and heavy coal-tar oils are specified, and special claim is made for the use of the former.—A. S.

(B.)—RESINS, VARNISHES.

Turpentine; Determination of petroleum in —. J. H. Coste. Analyst, 1909, 34, 148–151.

AS the result of further work, the author still maintains that Armstrong's method, if properly applied, is the most trustworthy one for the determination of petroleum spirit in turpentine (see this J., 1908, 694). Petroleum oil

should be determined by distillation of the original sample in a current of steam, and petroleum spirit by polymerisation of either the distillate from this process, or another portion of the original. In discussion, L. M. Nash stated that petroleum spirit could be detected in turpentine, and its quantity determined fairly accurately, by shaking the sample in a graduated tube and comparing the resulting froth with that produced by similarly shaking mixtures of known composition. The amount of frothing is in direct proportion to the quantity of petroleum spirit present, turpentine itself giving no froth.—W. P. S.

Colophony; A colour reaction of —. J. Sans. Ann. Chim. Analyt., 1909, 14, 140—141.

Ox gently heating a minute quantity of colophony with 1 or 2 c.c. of methyl sulphate, a rose coloration changing to violet and then to deep violet is obtained. On increasing the temperature the colour disappears, leaving only a faint brown tint. This reaction is very characteristic and is given by resins, soaps, etc., containing traces of colophony. It is more simple than Halphen's test (this J., 1909, 151), and the coloration is more distinctive than those obtained in Liebermann's reaction. Neutral ethyl sulphate gives a similar coloration. In the author's opinion the colorations are due to traces of free sulphuric acid, invariably present in methyl and ethyl sulphates, and the test may be employed conversely, to determine the degree of purity of those compounds.—C. A. M.

Shellac; Analysis of —. H. Endemann. Z. angew. Chem., 1909, 22, 676—677.

In analysing shellac by the author's method (this J., 1907, 1207) it is essential to have the residue left after the evaporation with hydrochloric acid thoroughly dry. If it does not yield a clear solution in alcohol after the addition of one drop of acid, the drying has been insufficient, and the evaporation must be repeated with fresh portions of hydrochloric acid. The test for rosin by means of sulphuric acid and sugar should be applied to the alcoholic extract, not to the original shellac, the colouring matter in which has a disturbing influence on the results. Further examination of samples of genuine shellac have confirmed the author's conclusion that the proportion soluble in alcohol is only about 8 per cent. Granular lacs (*Körnerlacke*), however, form an exception, and may yield as much as 16 per cent., due to matter extracted from fragments of twigs and insects present as impurities. When these lacs are used in the preparation of shellac, the impurities remain in the filter-bag, and are sold as "refuse shellac." This contains as much as 70 per cent. of shellac and fat, and in the powdered form can only be recognised by microscopical or chemical examination. The trihydroxypalmitic acid previously found in hydrolysed shellac is oxidised by alkaline permanganate to sebacic acid and δ -hydroxycaproic acid. When heated to about 130°—140° C., it loses a mol. of water and is converted into an amorphous elastic anhydride, insoluble in alcohol. By long continued boiling with sodium hydroxide this anhydride can be again hydrated. The acid separated from the new product, however, now crystallises in needles, which also lose a mol. of water when heated. Shellac which had been adulterated with a considerable quantity of rosin gave these needles directly.—C. A. M.

PATENTS.

Copals; Process for transforming — into a mass resembling natural amber. F. Spiller. Ger. Pat. 207,744, April 30, 1907.

THE copal (1 kilo.) is heated for about 48 hours in a closed vessel at a pressure of 16—20 atmospheres with water (1 litre), to which acid, alkaline, or neutral compounds, especially succinic acid (5 grms.) may be added. After cooling, the resin is dried either by exposure to air and light for a long period, or by warming at 40°—50° C. for 2 hours, then at 100° C. for 12 hours, and finally at 130° C. or a further 24 hours.—A. S.

Varnish and the manufacture of the same. E. C. R. Marks, London. From F. R. Suter, New York. Eng. Pat. 23,429, Nov. 3, 1908.

SEE U.S. Pat. 905,384 of 1908; this J., 1909, 31.—T. F. B.

Copals; Process for dissolving hard and semi-hard — in drying oils. H. Terrisse, C. Coffignier, and Soc. Anon. de Prod. Chim. de St.-Denis. Fr. Pat. 395,705, Oct. 27, 1908. Under Int. Conv., Oct. 29, 1907.

SEE U.S. Pat. 883,842 of 1908; this J., 1908, 457.—T. F. B.

Phenols and formaldehyde; Process for making condensation products of — resembling resins. Knoll und Co. Fr. Pat. 395,657, Jan. 2, 1908.

SEE Eng. Pat. 28,009 of 1907; this J., 1908, 908.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Latex of Ficus elastica; Presence of a rennet in —. V. Cayla. Caout. et Gutta-percha, 1909, 6, 2852.

A SMALL quantity of latex was obtained from incisions in a *F. elastica* grown under glass. Of this, five drops were added to five c.c. of sterile cow's milk, contained in a test-tube. The latex was very faintly acid, but not sufficiently so to neutralise the natural alkalinity of the milk. After 10 minutes' incubation at 45° C., no change could be detected, but in 15 minutes the milk was completely coagulated. The existence of vegetable rennets is already known, one such occurring, for example, in the latex of the fig tree, another *Ficus*. The presence of such an enzyme in rubber latex may have an important bearing upon methods of coagulation, and the author raises the question as to whether its presence in the latex examined is the result of the growth of the plant under abnormal conditions, or whether the rennet also occurs in the latex of trees grown under normal conditions.

—E. W. L.

Guayule rubber. I. and II. T. Whittelsey. J. Ind. and Eng. Chem., 1909, 1, 245—249. (See this J., 1903, 1250, 1358; 1905, 203; 1906, 704; 1908, 633, 1123.)

THE guayule shrub (*Parthenium argentatum*) contains about 9 per cent. of "pure rubber," calculated on the dry substance of the whole plant. The crude rubber contains about 20 per cent. of resin. It softens more quickly on the rolls than most other rubbers, but can be used in place of many of the African rubbers. The amounts of guayule rubber received at New York were 850,000 lb. in September, 929,500 lb. in October, and 1,444,000 lb. in November, 1908.

Distribution of rubber in different parts of the shrub.—Different parts of the plant were extracted with water and with alcohol, and then the rubber extracted with carbon tetrachloride. The following results were obtained:—

	Dry weight.	Rubber.	Weight of rubber.	Rubber, per cent. of total.
	grms.	per cent.	grms.	
Trunk bark	349	21.4	74.7	25.7
Root bark	127	19.5	24.8	8.5
Branches and leaves	1918	9.7	186.0	64.0
Trunk wood	404	0.0	0.0	0.0
Root wood	255	2.0	5.1	1.7
Totals	3053	—	290.6	99.9

Thus the dry substance of the whole plant contains 9.5 per cent. of rubber. The percentage of rubber in the air-dried plant is 7.8. The trunk wood contains no rubber, but yields to alcohol an elastic resin, which when dried in a steam oven, becomes insoluble in alcohol, acetone, and carbon tetrachloride. Unless special care be taken, some of this resin may be returned as rubber in the analysis of the plant. It is possible that the "rubber" extracted from the root-wood is also really a resin analogous to that

yielded by the trunk wood, but insoluble in alcohol. This question is being further studied. In view of the results given above, the relative amounts of wood and of bark were determined. The trunks of the shrub contain 46.4 per cent. of bark and 53.6 per cent. of wood, whilst two plants weighing 235 grms. and 152 grms. contained 54.6 and 57.8 per cent. of bark respectively. It would appear, therefore, that the use of an efficient decorticating device before extracting the rubber would result in considerable economy.—A. S.

PATENTS.

Ebonite and vulcanite: Manufacture of — [from waste materials]. O. C. Immisch, Finchley, Eng. Pats. 28,159 and 28,365, Dec. 24, 1907.

(1). WASTE ebonite or vulcanite, reduced to powder, or in the form of shavings, is filled into a mould, where it is subjected to considerable pressure in order to consolidate it, the mould being cold during this process. The mould is then locked and heated to a certain critical temperature, dependent upon the amount of sulphur present in the waste, but which is in the neighbourhood of 400° F. At this temperature an abnormal expansion of the material takes place, resulting from the fact that sulphur, when heated to about 400° F., undergoes a physical change and assumes a semi-plastic condition. A high degree of compression is thus brought about in the mass, and a dense product obtained when the mould is allowed to cool and opened. (2). Waste ebonite or vulcanite is reduced to such a state of division (turnings or shavings), that the bulk of it per unit weight is considerably greater than that of the same material in a granulated or pulverised condition. It is then placed in a cold mould, of greater capacity than the volume of the article required, subjected to a high pressure, and the mould clamped and heated at about 280° F. for a time depending on the dimensions and weight of the mould. While the mould is cooling, it is subjected to further pressure, and when cool it is locked and heated to a temperature of over 400° F. Finally the mould is allowed to cool, before being opened. In the manufacture of articles of large dimensions, it is desirable to provide means, such as a spring, for taking up any excessive pressure produced by the change of physical condition in the ebonite at 400° F., in order to avoid damage to the mould.—F. W. L.

Caoutchouc: Composition chiefly intended to replace —, and its preparation. F. Tolkien, Fr. Pat. 395,505, Oct. 20, 1908. Under Int. Conv., Oct. 28, 1907.

SEE Eng. Pat. 23,755 of 1907: this J., 1908, 695.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning materials; Notes on some western (U.S.A.) —. J. H. Russell and F. O. Sprague. J. Amer. Leather Chem. Assoc., 1909, 4, 92—95.

THE native tanning materials at present used by Californian tanners consist only of oak and Mexican bark, the former being far the most important and constituting the main source of tannin on the West Coast. Analysis of this oak bark shows it to contain about 5 per cent. more tannin than a good quality Eastern rock oak bark. Although the proportion of tannin to non-tannins is greater in the Californian than in the Eastern oak, the difference is not great enough to account for their very different action in the tannery. This difference is chiefly due to dissimilar bacterial conditions in eastern and western yards. The oak bark liquors in Californian yards do not develop acid as do oak bark liquors in Eastern tanneries. What a Californian tanner terms "souring his liquors," consists mainly of a viscous fermentation causing the liquors to become stringy and jelly-like, but not developing sufficient acid to de-lime or plump the goods. Leather tanned with the extract prepared from this bark is much redder than that tanned with the bark itself and resembles hemlock leather. The so-called "Mexican" bark is very similar in many ways to mimosa bark but it gives a light reddish colour to leather, different from the pink of mimosa. Tanners

claim that it makes the leather plump but light and porous, and that the fibre has very little tensile strength. "Koa" bark has been used for tanning in the Hawaiian Islands and is said to give a leather similar to that tanned with Californian oak-bark but of redder colour.—S. H.

Chestnut wood: Analysis of —. W. K. Alsop. J. Amer. Leather Chem. Assoc., 1909, 4, 95—99.

THIS article is the result of research made on the lines suggested by Kerr (J. Amer. Leather Chem. Assoc., 1909, 77) for the analysis of spent chestnut wood. By extraction of the wood with water in the Teas extractor and subsequent analysis of solutions of different concentrations, it is apparent that the amount of extractive matter obtained from chestnut wood, depends upon the time of extraction and the rate of boiling, or amount of water passing on to the wood. Some substances soluble in the water are yielded almost indefinitely. In this method of extraction, the amount of tannin as shown by the hide powder method, increases to some extent as the extraction is prolonged. The author states that the method proposed by Kerr does not yield a definite amount of tannin but is influenced by the conditions of extraction as with the usual one, the proportional increase not being very different by the two methods. Tables are given showing results obtained several years ago in the extraction of chestnut wood, by the use of the Reed extractor and also by the Procter extractor, and the increase in tannin by prolonged treatment is about the same in both methods. On account of the practical impossibility of duplicating in the laboratory the conditions that prevail in the tannery, the author considers it extremely difficult to devise a general method of analysis of new and spent wood, that will give the yield as to extractive matter or tannin, that should be realised at the works.—S. H.

PATENTS.

Tanning and treating skins, etc.; Tumblers for —. C. S. Bedford, Leeds, and H. Brewer and J. T. Hardy, Nottingham. Eng. Pat. 21,582, Oct. 12, 1908.

THE tumbler is provided, on its internal periphery, with dash-boards parallel, with one exception, to the main axis of the tumbler. The dash-board which forms the exception is inclined downwards towards the trunnion end plate of the tumbler, and, being provided with a return board along its inner edge, forms a trough along which liquid can travel towards the trunnion-end. Here the trough is connected with a box-shaped trough or spout which passes along the end plate of the tumbler towards the centre, where it communicates with a flanged gland pipe passing through the hollow trunnion. Whilst the tanning or other process is in operation, this pipe is kept closed by a cock, which is opened when the process is at an end, the tanning or other liquor being thus removed from the interior of the tumbler.—E. W. L.

Tanning machine. F. H. Tocum, London, Ontario. U.S. Pat. 916,821, March 30, 1909.

THE machine described comprises a vat, in which, near the top, is mounted a shaft, provided with radial arms. Inclined to the arms are plates provided on their inner faces with guideways to take the ends of the bars which support the hides. These bars are allowed a limited motion towards and from the axis of the shaft. Suitable means are provided for rotating the shaft.—E. W. L.

Sulphite-cellulose lyes; Process for purifying — for the purpose of obtaining a preparation suitable for the tannery. A. Kumpfmiller. Ger. Pat. 207,776, Aug. 1, 1906.

THE lye is first freed from the main portion of the sulphurous acid and calcium sulphite it contains by heating or by treatment in a vacuum. It is then treated with ozone, whereby the remainder of the sulphurous acid and calcium sulphite are converted into sulphuric acid and calcium sulphate respectively, the greater portion of the latter separating out. On now adding precipitated barium carbonate, the dissolved sulphuric acid and sulphate are precipitated. The liquor thus purified is suitable for use as a tanning and filling material for hides.—A. S.

Lithographic stones [from hides]; Substitutes for —.
E. T. Day, London. Eng. Pat. 21,239, Oct. 8, 1908.

Raw hides are unhaired and dried as usual. The hides are then immersed in a saturated solution of barium chloride for one day, and allowed to dry naturally. When nearly dry, they are again immersed for six hours in barium chloride solution, and again dried. When nearly dry, the hides are immersed in a weak solution of sulphuric acid (1:3000) for 12–24 hours. The hides are next dried on frames, rubbed with sand-paper, washed with a 10 per cent. solution of gelatin, dried, immersed in formalin, again dried, and polished. The whole process is then preferably repeated. Instead of using barium chloride as above, the hides may be washed with "a saturated solution of barium carbonate," allowed to dry, immersed in a saturated solution of barium hydroxide, and then treated as before.—A. G. L.

Skins; Machine for applying liquid to —. W. B. Turner, Melrose, Assignor to Turner Tanning Machine Co., Peabody, Mass. U.S. Pat. 917,683, April 6, 1909.

SEE Fr. Pat. 375,747 of 1907; this J., 1907, 936.—T. F. B.

XV.—MANURES, &c.

[Soils]. *Bacteriological-chemical investigations.* O. Lemmermann, H. Fischer, H. Kappen, and E. Blanck. Landw. Jahrbh., 1909, 38, 319–364. Chem. Zentr., 1909, 1, 1187–1188.

THE results of subjecting a number of soils of different kinds to different treatments are given. It was found that the nature and course of the reactions taking place in the soil could be studied most accurately in the soils themselves under conditions approaching the natural ones as closely as possible. By the use of a sand culture method (glass sand moistened with a nutrient solution), it was not possible to detect differences in the decomposition of organic nitrogenous compounds with soils of widely different character, nor could the actions of various fertilisers be differentiated. It was observed, however, that the action of denitrifying bacteria was weaker in the case of peaty soils than in that of mineral soils; in both cases the action was considerably increased by addition of lime, but other fertilisers had no noticeable effect. In the case of soils in which, in the natural condition (earth culture), denitrification was very weak, this became much stronger when the soil was added to a sand culture, whilst when the soil was introduced into a nutrient solution (liquid culture), all nitrate was decomposed in a short time. The nitrate-nitrogen was for the most part converted into protein-nitrogen. With these soils, an action of stable manure could be observed only with earth cultures. By means of earth cultures it was found that ammonium sulphate when added to soils manured with Thomas meal and kainite, was utilised to a greater extent by peaty soils than by clayey soils. Of the ammonia-nitrogen utilised, most was converted into nitrate-nitrogen, especially in the peaty soils. The quantity of nitrogen and the relative proportions of the different forms of nitrogen compounds in sandy and clayey soils were not appreciably altered by sterilisation, but in humic soils the quantity of nitrogen capable of being liberated (as ammonia) by magnesia was increased. The nitrogen compounds of sterilised mineral soils were, however, more easily decomposed by bacteria than those of sterilised humic soils. With earth cultures nitrification proceeded more vigorously in clayey than in sandy soils. In soils which were sterilised and then treated with a suspension of the same soil unsterilised, the original nitrifying power was not regained during the time of the experiments. Drying the soils also weakened the nitrifying power, and no denitrification took place in dried soils. Sterilisation also weakened the power of the soil to decompose calcium cyanamide. In natural soils formation of ammonia and nitrification may proceed side by side. In general, the authors conclude that in order to obtain an accurate notion of the reactions in the soil, experiments must be made

with the fresh natural soil and analytical determinations must be made throughout the course of the experiments, not only at the beginning and end.—A. S.

Soil fatigue caused by organic compounds. O. Schreiner and M. X. Sullivan. J. Biol. Chem., 1909, 6, 39–50.

COWPEAS were grown repeatedly on a sandy loam soil until the yield, which was very good at first, became poor, although on the same soil, wheat and potatoes would grow well. The cause was found to be due to the presence in the "sick" soil of a substance toxic to cowpeas. By mixing the soil with a large quantity of water and distilling with steam, a turbid distillate was obtained, a portion of which, when filtered, proved much less satisfactory than distilled water as a medium for the growth of cowpeas. By standing and also by extraction with ether, a quantity of fine, needle-shaped crystals was separated from the distillate. A saturated aqueous solution of these crystals proved to have a very marked retarding action on the growth of cowpeas. The soil which had been subjected to steam distillation gave much better yields of cowpeas than the untreated soil.—A. S.

Phosphate rocks; Determination of iron oxide and alumina in —. T. S. Gladding. J. Ind. and Eng. Chem., 1909, 1, 249–250. (See this J., 1909, 102.)

FIVE grms. of the phosphate rock are boiled for 1 hour with 50 c.c. of hydrochloric acid (1:1), the solution is filtered, treated with a few c.c. of hydrogen peroxide solution, boiled to oxidise the iron and expel oxygen, cooled, and made up to 250 c.c. 25 c.c. of the solution (=0.5 gm. of sample) are heated to boiling, a slight excess of ammonia added, and then sufficient hydrochloric acid to just redissolve the precipitate. The clear solution is treated with 1 gm. of ammonium oxalate, boiled, and the calcium oxalate filtered off. The filtrate is evaporated with 5 c.c. of concentrated sulphuric acid until white fumes are evolved, in order to destroy the excess of oxalic acid, then cooled, treated with 50 c.c. of water and 5 c.c. of concentrated hydrochloric acid, and boiled until it becomes clear. It is then made up to 150 c.c., and the iron and aluminium precipitated as phosphates. The iron oxide is determined in 50 c.c. of the original solution of the phosphate rock by the bichromate or permanganate method.—A. S.

Cyanamide; Its manufacture in France, and its part in agriculture. Ch. Pluvinage. Bull. Soc. d'Encouragement, 1909, 111, 549–562.

PATENTS.

Manure; Method of treating —. F. A. Goeckeler, Worcester, Mass., U.S.A. Eng. Pat. 5999, Mar. 18, 1908. Under Int. Conv., Mar. 18, 1907.

FRESH manure is treated with sulphuric and hydrochloric acids in sufficient quantity to fix the ammonia and salts, and to effect deodorisation, though not in sufficient quantity to decompose the manure. The resulting product may be exposed to the air for a long time without emitting foul odours or loss of valuable constituents. Suitable proportions claimed for this purpose are half a pint of a mixture of the acids in about equal proportions and 3 pailful of water to 128 cubic feet of manure. In cases where insufficient ammonia or ammonium compounds are in the manure, ammonium salts may be added to the mixture of acids.—C. A. M.

Phosphoric acid or substances [manures] containing phosphoric acid soluble in citric acid or water; Preparation of — from natural phosphates. N. A. Langlet. Fr. Pat. 396,195, Nov. 12, 1908. Under Int. Conv., Nov. 14, 1907.

THE invention relates to the preparation of phosphoric acid or a phosphate soluble in citric acid or water, for use as a manure, by treating the raw insoluble phosphate, such as apatite, with an ammonium salt, so as to liberate ammonia and produce phosphoric acid or a soluble phosphate, the ammonium salt being subsequently regenerated. Three cases are possible, according to the ammonium salt used:—(1). The calcium salt formed is soluble. When insoluble diacalcium phosphate is the other product,

the soluble calcium salt is separated from it by solution, and calcium carbonate is precipitated from the liquid by treatment with ammonia (obtained in the process) and carbon dioxide, thus regenerating the ammonium salt; when, by the use of more ammonium salt, phosphoric acid or monocalcium phosphate have been formed, the mixture is dissolved and di- or tricalcium phosphate first precipitated by ammonia, and then calcium carbonate is precipitated from the residual solution as before. (2) The calcium salt formed is sparingly soluble (e.g., the sulphate). Monocalcium phosphate or phosphoric acid is produced by using a sufficient quantity of the ammonium salt, and is then separated by solution from the insoluble calcium salt, which is treated with ammonia and carbon dioxide to recover the original ammonium salt. (3) When the ammonium salt is decomposed by heat (e.g., the sulphate or phosphate), it may be first heated (with or without steam) to drive off all or part of the ammonia, and the residual acid or acid salt may be used for treating the phosphate as above.—F. SOMER.

XVI.—SUGAR, STARCH, GUM, &c.

[Sugar] Cane; Relation between added water per cent. on —, and dilution per cent. of normal juice. H. Pellet. Internat. Sugar J., 1909, 11, 193—195.

THE author criticises the conclusion of Coombes (this J., 1909, 102) that the quantity of water added and calculated per cent. of cane cannot be higher than that expressing dilution of normal juice. As a preliminary it is remarked that the only way to calculate the water added to a given weight of cane is to measure the water entering at the mills, and, taking account of the temperature, obtain the water consumed in the mills for a given weight of crushed cane. This water only mixes incompletely with the juice present in the bagasse; consequently the juice extracted is more dilute than it would have been had the water been uniformly distributed over the bagasse, and the dilution of the extracted mixed juice is always greater than that calculated from quantity of water entering per cent. of cane. It also explains why there has been more difficulty in decreasing the richness of the bagasse when diluting 15 to 18 per cent. than when 24 to 35 per cent. of water is used.—L. J. DE W.

Sugars; Spontaneous oxidation of the —. A. P. Mathews. J. Biolog. Chem., 1909, 6, 3—20.

LEVULOSE, galactose, dextrose, maltose, and lactose oxidise rapidly in the presence of air if their solutions are alkaline, but not if they are neutral or acid. It would appear, therefore, that for oxidation it is necessary that a salt of the sugar be formed. This salt ionises and the sugar residue forming the anion is in a condition in which it readily decomposes, and is then easily oxidised. Of the sugars, levulose oxidises the most rapidly in alkaline solution; the others oxidise at about the same speed and about one-fourth as fast as levulose. With all the sugars examined, though less markedly in the case of levulose, there is an acceleration of the velocity of oxidation and decomposition as the reaction goes on. This is attributed to the fact that by the decomposition of each sugar molecule, several reducing molecules are produced, and hence the concentration of the reacting substances is increased. Oxidation is most rapid in $N/1$ sodium hydroxide in the case of levulose, and in about $N/2$ sodium hydroxide in the case of the other sugars. With stronger alkali, the rate of oxidation is reduced. The above results indicate that under the term of oxydases there have hitherto been confused two classes of substances: one which renders the oxygen active; the other—the more important class—which causes dissociation of the reducing substances, and thus renders them active.—A. S.

PATENTS.

Calcium sucate; Apparatus for making —. J. F. Pool, Philadelphia, Pa., Assignor to The American Sugar Refining Co., Jersey City, N.J. U.S. Pat. 912,887. Feb. 16, 1909.

This invention has for object the weighing and conveying of the lime and the feeding of the same into the cooling

apparatus, in a practically dust-proof case, and without handling. The apparatus includes a feed hopper, the neck of which is provided with a number of independent, co-acting valves, by means of which the quantity of powdered lime introduced into the weighing hopper below, can be controlled. The weighing hopper is mounted on the platform of a weighing scale, and is connected, above, to the feed hopper, and below, to a conveyor casing, by contractile and expansible tubes of closely woven cloth or other material impermeable to the powdered lime. The bottom of the weighing hopper is closed by a pair of overlapping and swinging valves, by means of which the weighed quantity of lime is discharged into the conveyor casing, to be carried from thence to a dust-proof hood at the top of the cooler of the calcium sucate apparatus, which may be of any desired character, e.g., that described in U.S. Pat. 861,893 (this J., 1907, 1023).—L. E.

Sugar masscutes with regular crystals; Process for obtaining crude — whereby economy is effected in the steam used for heating the vacuum apparatus. F. Tiemann. Fr. Pat. 395,753, Oct. 28, 1908. Under Int. Conv., Aug. 5, 1908.

THE masscuite pans are intercalated as elements in the multiple effect system, and are heated by steam at a temperature of 70° — 100° C. from this system (triple or quadruple effect). Owing to the low temperature of this steam, the slow concentration of the masscuite can be so regulated that the crystals already present increase in size and the formation of a further quantity of small crystal is avoided. A considerable economy of steam is also effected. To keep the masscuite in motion, a stirrer is used, or steam, from the same source as that used for heating, is injected directly into the masscuite.—L. E.

Bagasse; Process for drying wet material consisting of pieces, e.g., cane —. F. Tiemann. Fr. Pat. 395,863 Oct. 31, 1908. Under Int. Conv., March 4, 1908.

THE material passes downwards through a shaft and is subjected therein to the action of transverse currents of hot gases. Two opposite walls of the shaft, which diverge towards the base to allow for increase in bulk of the descending material, consist of louvre-boards inclined downwards towards the interior. One of these walls is divided longitudinally into sections to which funnels are adapted externally, so that gases from different sources or at different temperatures, may be introduced at different heights of the shaft; this contrivance also prevents loss of heat. After traversing the material, the gases pass out through the opposite louvre-wall.—L. E.

[Starch] syrup; Process of refining —. C. B. Duryea Cardinal, Canada. U.S. Pat. 916,683, March 30, 1909. SEE Fr. Pat. 380,680 of 1907; this J., 1908, 32.—T. F. F.

Glucose [dextrose]; Manufacture of —. C. B. Duryea Cardinal, Canada. U.S. Pat. 916,684, March 30, 1909. SEE Eng. Pat. 11,800 of 1907; this J., 1908, 238.—T. F. F.

Maltose; Process of making —. C. B. Duryea, Cardinal, Canada. U.S. Pat. 916,685, March 30, 1909. SEE Eng. Pat. 11,799 of 1907; this J., 1908, 238.—T. F. F.

XVII.—BREWING, WINES, SPIRITS, &c.

Yeast; A yeast-poison in —. F. Hayduck. Spiritusind. 1909, 32, 127—128, 139—141, 150—151.

THE presence of a yeast-poison of a protein nature in certain cereals (this J., 1908, 85) led the author to see for a similar poison among the proteins of yeast itself. For convenience in manipulation, the present experiments were carried out on dried yeast, but similar searches with fresh yeast are in progress. It was found that when top-fermentation distillery yeast, rapidly dried at a high temperature (70° C.), was extracted with water acidulated with hydrochloric acid, an extract highly poisonous to bottom-fermentation beer yeast was obtained. On the other hand, the extract from yeast slowly dried in the air was non-poisonous. In neither case was it

extract, prepared with pure water, poisonous; in fact, pure aqueous extracts were rather stimulating. The difference in the behaviour of yeast slowly dried and that tried rapidly is attributed to the destruction of the poisonous protein by the activity of the tryptic enzyme in the former case. The poisonous extract is most readily obtained in a highly active condition by digesting 20 grms. of rapidly dried yeast with 2 litres of 0.1 per cent. hydrochloric acid for 2 hours at 50° C.; sulphuric and acetic acids do not extract the poison. The filtered extracts should be neutralised accurately with sodium hydroxide before testing. Whilst an extract of distillery yeast is poisonous to beer yeast, that of the beer yeast itself is stimulating; distillery yeast is stimulated by extracts both of beer yeast and distillery yeast. As in the case of the cereals, these peculiarities are due to the inhibitive action of calcium salts on the poisonous action of the protein; distillery yeasts are far poorer in calcium salts than bottom-fermentation beer yeasts, and therefore yield more poisonous extracts. If the calcium salts be eliminated as completely as possible, extracts may be prepared which are poisonous to both types, and which immediately lose their poisonous properties on the addition of a little chalk. The removal of calcium salts may be effected before extraction or by subsequent treatment of the extract. The treatment in the former case consists in making a preliminary extraction of the dried yeast with dilute hydrochloric acid or, still better, with pure water, before the extraction of the poison is started. Extracts made under these conditions show an increased toxicity towards beer yeast, but are still non-poisonous to distillery yeast; such a procedure readily yields an extract from beer yeast which is poisonous to beer yeast. A more highly poisonous extract is obtained by drying the yeast in a fresh state, than after keeping it for some time before drying; the latter condition is equivalent to slow drying. The most powerfully poisonous of all the extracts were prepared by eliminating the calcium salts from ordinary extracts by dialysis with chloroform water for 24–48 hours, and subsequent removal of the chloroform. In this way extracts prepared from beer yeast, which were either stimulating or only moderately poisonous before dialysis, were brought into such a condition that 95 per cent. of the cells of beer yeast were killed within 2 hours. By this method also it was possible to convert a distillery yeast extract, previously stimulating to distillery yeast, into one which was distinctly poisonous to distillery yeast. These observations form the foundation of a new explanation of many of the instances of degeneration or sickness of the yeast which occur in practice. They also illustrate the general theory of Delbrück with regard to the vital processes of cells, depending on the fine balance of activities summed up in the term "physiological condition."—J. F. B.

Starch in barley; Saccharification and polarimetric determination of —. F. Schubert. Oest.-Ungar. Zeits. Zuckerind. und Landw., 1909, 17; Z. Spiritusind., 1909, 32, 157.

For many reasons the polarimetric determination of the dextrose produced by the saccharification of starch is preferable to the cupric reduction method, but the processes hitherto described do not yield concordant results because the products are not of constant composition. The author has modified Geschwendner's and Parow and Lemmann's methods (this J., 1906, 870; 1908, 84) and claims that the results are concordant and satisfactory, and that none of the dextrose undergoes secondary decomposition. He uses as the saccharifying agent, an acid brine containing 100 grms. of salt and 0 grms. of hydrogen chloride per litre. Twenty grms. of barley grist are treated with 100 c.c. of this reagent in a 200 c.c. graduated flask, and the mixture is heated for 5 hours in a vigorously boiling water-bath provided with a constant level arrangement and a means for preventing superheating. An oil-bath provided with a thermo-regulator at a temperature of 98°–100° C. offers certain advantages. After cooling, the contents of the flask are diluted to the mark, filtered without clarification, and polarised. Since the true polarisation value of the

dextrose solution is not immediately established after dilution, the reading should be checked after standing for some little time. 1° Ventzke corresponds to 0.2941 grm. of starch and 1 circular degree to 0.8514 grm. of starch, with the 200 mm. tube. It is noted that it is not necessary to heat the liquid for 5 hours continuously; the saccharification may be interrupted and completed the next day if desired.—J. F. B.

Beetroots; Report on Collettes' process for extracting juice from — in the distillery. Lindet. Bull. Soc. d'Encour., 1909, 111, 468–472.

The employment of beetroots as raw material for the manufacture of alcohol, increases yearly. The advantages possessed by the process patented by A. G. and R. Collette (see this J., 1907, 1023), are the small cost of installation, the automatic working, the reduction of manual labour, and the thorough extraction attained. The amount of juice extracted (130 to 150 litres per 100 kilos. of beetroot), and the degree of extraction (0.2 per cent. of sugar being left in the exhausted cossettes), are such as are obtained under the best conditions of the diffusion process. The process is not suitable for sugar manufacture, since, owing to exposure to the air, the juice would be darkened by the oxydases of the beetroot, and the treatment with sulphuric acid which prevents this in the distillery process, should not be permitted in the sugar-house. The process, first installed in the Seclin distillery in 1907, was, in 1908, being worked in 13 factories.—L. E.

Helianthus tubers as a material for the production of spirit. J. Kocks. Z. Spiritusind., 1909, 32, 161.

ANALYSIS of various samples of *Helianthus* tubers shows that they contain 27.38–27.98 per cent. of dry substance, which consists of 11.69–14.06 per cent. of protein, 8.11–13.60 per cent. of sugar (laevulose), 58.33–60.52 per cent. of inulin (and other substances yielding sugar on hydrolysis with acids), and small proportions of fat, ash, and cellulose. The author has measured the yields of alcohol obtained by fermenting with beer yeast the tubers themselves or the expressed juice, either with or without preliminary treatment with dilute sulphuric acid, and distilling the fermented wash. The following numbers represent the yields of alcohol in litres obtained in four cases, from 100 kilos. of the tubers:—

	I.	II.	III.	IV.
Juice fermented, without sulphuric acid	5.16	5.16	5.33	4.07
Juice fermented, with sulphuric acid	8.21	8.10	9.40	6.60
Tubers fermented, without sulphuric acid	5.92	7.90	6.38	—
Tubers fermented, with sulphuric acid	8.83	7.90	7.97	—

—T. H. P.

Colour of turbid worts; Determination of the —. H. Roeder. Z. ges. Brauw., 1909, 32, 169–171.

When the colour of turbid worts is measured by means of iodine solution, better results are obtained by rendering the water, to which the iodine solution is added, turbid by the addition of an alcoholic colophony solution, yeast cells, isinglass, or hordein. When, however, comparison is made with prepared colour standards, this method cannot be employed, and it becomes necessary to clarify the wort. Such clarification cannot be effected by repeated filtration or centrifuging, but the author finds that if 100–120 c.c. of the turbid wort be vigorously shaken several times with 2–3 grms. of precipitated barium sulphate and filtered, until the liquid passing through the filter is bright, this liquid will have the same sp. gr. as, and will retain all the colour of, the original wort. Worts clarified in this way do not become turbid again even after standing for 24 hours.—T. H. P.

Cider; Composition of —. B. T. P. Barker and E. Russell. Analyst, 1909, 34, 125–134.

THE results of analyses of seven samples of cider, each made from a selected variety of apple, are given, and

also of six other samples which were blends collected from various sources and representing the type of cider which finds its way on to the market. The total solids contained in the samples varied from 2.1 to nearly 8 per cent.; the acidity, expressed as malic acid, from 0.22 to 0.59; the tannin, from 0.01 to 0.37; and the alcohol, from 2.7 to 6.69 per cent., by weight. The ash of the first seven samples lay between 0.246 and 0.441 per cent., whilst in the case of the blended ciders it varied between 0.308 and 0.346. The alkalinity of the ash (all the samples) varied from 0.02 to 0.156 per cent., and the phosphoric acid from 0.013 to 0.025 per cent. A comparison of these results with the standards suggested by various authorities (a synopsis of these standards is given in the paper) shows that whilst they may be of use in limiting the amount of adulteration of cider, they still leave a considerable scope for sophistication of pure-juice ciders of average quality. A test is described by means of which the presence of even small quantities of apple juice may be detected in ciders. The liquid under examination is concentrated by evaporation to one-tenth of its bulk and is then shaken with an equal volume of ethyl acetate; when separation has taken place, the ethyl acetate solution is drawn off and poured over the surface of a little lime-water contained in a test-tube. A yellow coloured zone appears at the junction of the two liquids if as little as 0.1 per cent. of apple juice be present. In a genuine cider this reaction is obtained without concentration. In an entirely artificial cider (even if tannin has been added) the characteristic reaction does not occur. In the discussion, F. J. Lloyd drew attention to the fact mentioned by Allen that boric acid is present in all genuine cider (see this J., 1902, 922), and suggested that this might be employed for distinguishing between genuine and artificial ciders. The presence of tannin in apple-juices also afforded a means of detecting artificial cider, which did not as a rule contain tannin.—W. P. S.

Diastases of fungi. Zellner. See XXIV.

Decomposition of sugar during the respiration process. Jensen. See XXIV.

Determining tartaric acid. Carles. See XX.

PATENTS.

Fermentation vessels; Quicksilver [mercury] closure for —. W. Lazarus, Kiel, Germany. U.S. Pat. 912,581, Feb. 16, 1909.

This invention depends on the discovery, that the resistance opposed by a funnel to the flow of a gas, is greater when the gas passes through the funnel from the base to the point, than when it passes in the opposite direction, whereas, with liquids, the reverse is the case. The apparatus consists of a U-tube, *a*, containing mercury, and provided, in its ascending limb, *a'*, with one or more funnels, *b*, the points, *c*, of which are directed downwards. To prevent the retention of mercury on the walls of the tube, a small quantity of water is placed on the mercury column in the ascending limb. To prevent this water from being carried away with the escaping gas, one or more bell-shaped, or other contrivances, *n*, are placed in the ascending limb, a very narrow space between the rim of the bell and the wall of the tube, being left for the passage of the gas.—L. E.

Alcohol; Process and apparatus for purifying crude —. E. G. Hager. Fr. Pat. 395,971, Nov. 5, 1908.

SEE GER. Pat. 200,980 of 1907; this J., 1908, 993.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(A.)—FOODS.

Wheat flour, dough, and fermented dough; Sugar content of fine —, and diastatic power of wheat flour. H. J. von Liebig. Landw. Jahrb., 1909, 38, 251—271. Chem. Zentr., 1909, 1, 1256—1257.

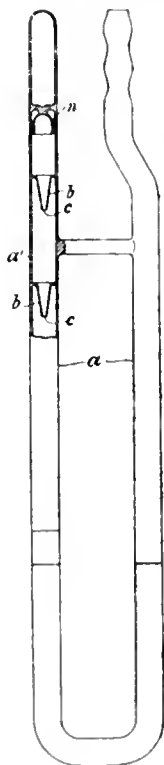
The sugars present in wheat flour are dextrose and sucrose, the respective quantities being 0.1—0.4 and 1—1.5 per cent. calculated on the dry substance. By the action of a diastatic enzyme, maltose is formed on digesting the flour with water and also in the dough. The production of reducing sugar in the dough proceeds vigorously at a favourable temperature: for example, after 14 hours at 30—40° C., 4.6 per cent. of reducing sugar (reckoned as dextrose) were formed. The sucrose content, on the other hand, shows little variation in the dough. The increase of the dextrose (maltose) content of the dough gradually slackens considerably. When dough prepared from the finest quality of flour was fermented at 30° C. with the usual quantities of yeast, water, and salt, the loss of sugar amounted to from 1.42 to 2.05 per cent. in 2 hours, the reducing sugar being acted upon much more strongly than the sucrose. The diastatic power (Lintner) of wheat flour was about one-third of that of an average malt in the case of dark coarse flours, and about one-seventh in the case of the finest "extract flours." The extracts to be used for determining the diastatic power of wheat flours, should be prepared by making the flour into dough, and kneading this with water to separate the starch from the gluten. The values obtained represent only the action on dissolved starch. The starch-liquefying power of the diastase of wheat flour is quite insignificant compared with that of malt diastase. The author suggests that the wheat diastase is a weak so-called translocation-diastase which becomes active in the dough. (See also J. L. Baker and H. F. E. Hulton, this J., 1908, 368.)—A. S.

Benzaldehyde in almond flavouring extract; Determination of —. W. Denis and P. B. Dunbar. J. Ind. and Eng. Chem., 1909, 1, 256—257.

The method is based on the precipitation of benzaldehyde as its phenylhydrazine by means of a reagent composed of 1 c.c. of phenylhydrazine, 1.5 c.c. of glacial acetic acid, and 20 c.c. of water, prepared immediately before use. Two 10 c.c. portions of the almond extract are treated respectively with 10 c.c. and 15 c.c. of the reagent in stoppered flasks, and after shaking, the mixtures are allowed to stand over night. 200 c.c. of water are then added to each flask, the precipitates collected in Gooch crucibles on asbestos, washed with cold water and then with 10 c.c. of 10 per cent. alcohol, and dried *in vacuo* over sulphuric acid or for 3 hours at 70—80° C. in a vacuum oven. It is advisable to make the second determination with 15 c.c. of reagent, because, although most almond extracts contain only about 1 per cent. of oil of bitter almonds, occasionally samples are met with containing as much as 6 per cent. of benzaldehyde. The method gives results corresponding to 97—99 per cent. of the theoretical ones, and the accuracy is not affected by the presence of benzoic acid or nitrobenzene.—A. S.

Casein; Note on the hydrolysis of — with hydrochloric and sulphuric acids. Z. H. Skraup and W. Türk. Monatsh. Chem., 1909, 30, 287—288.

F. KITSCHER has stated that by the hydrolysis of casein with sulphuric acid, much less glutamic acid is produced than when hydrochloric acid is used. The authors have carried out the operation on the one hand by boiling casein for 6 hours with six times its quantity of fuming hydrochloric acid and on the other by boiling for 18 hours with nine times the quantity of 33 per cent. sulphuric acid. In each case the amount of glutamic acid was about the same: 100 grms. of casein gave (1), 22.3 grms. of the crude hydrochloride, and (2), 20.3 grms.—J. C. C.



Mixed glycerides in mutton tallow. Bömer. See XII.

PATENTS.

Butter; Process for making — G. V. Frye, Lexington, Ohio, U.S.A. Eng. Pat. 6444, March 23, 1908.

SEE Fr. Pat. 389,836 of 1908; this J., 1908, 1036.—T. F. B.

Caséin; Manufacture of — C. A. Baechler. Fr. Pat. 396,104, Nov. 9, 1908. Under Int. Conv., March 20, 1908.

SEE Eng. Pat. 6247 of 1908; this J., 1908, 1036.—T. F. B.

(B.)—SANITATION; WATER PURIFICATION.

PATENTS.

Water purifying apparatus. F. C. Pulsford, Leicester. Eng. Pat. 12,711, June 13, 1908.

THE apparatus is essentially a measuring device which delivers definite volumes of the crude water to chemical tanks; the solutions from the latter are then mixed with the main volume of the water, which is also measured by the apparatus and delivered into the mixing tank. The apparatus consists of a tank divided into compartments; the measuring vessel is mounted on a spindle in this tank and is also divided into a number of compartments connected to each other by means of suitable pipes or tubes. The water is delivered into the central or largest compartment of the measuring vessel, the smaller compartments being filled at the same time by the water flowing through the connecting pipes. When the vessel is full, it tips and delivers the contents of its various compartments into corresponding compartments in the outer tank. The water from the smaller compartments, which may be of any predetermined capacity, is conducted to the tanks containing chemicals and thence to the mixing tank, whilst the bulk of the water is delivered directly to the mixing tank. By means of a lever and valve, the supply of water is cut off when the measuring vessel tips, but is turned on again when the vessel automatically assumes its normal or upright position. The measuring vessel may also have the form of a double tipping arrangement, the compartments on one side being filled while the ones on the other side are discharging. The volume of water measured each time the vessel is filled and discharged may be regulated by means of adjustable weights fitted to the sides of the vessel.—W. P. S.

Raising sewage or other liquid by air pressure. J. B. Allott and A. M. Philps, Nottingham. Eng. Pat. 13,655, June 27, 1908.

THE claim is for improvements in the apparatus described in Eng. Pat. 28,789 of 1904, and consists in arranging the air inlet and exhaust valves of a pair of "ejectors" so that only one is emptied at a time, and that if the one that is being filled becomes full before the other is empty, compressed air is admitted to the former to stop the inflow of sewage and to prevent it rising up to the level of the valves.—W. H. C.

(C.)—DISINFECTANTS.

PATENT.

Manufacture of copper nitrate. Fr. Pat. 395,806. See VII.

XIX.—PAPER, PASTEBOARD, &c.

PATENTS.

Paper; Method and means of treating — A. M. Meinke, Winchester, Mass., Assignor to T. N. Tripp, Lynn, Mass. U.S. Pat. 916,469, Mar. 30, 1909.

THE process consists in laying down the fibres on the surface of the partially dried, but uncalendered, web, first on one side and then on the other. The web is subsequently compressed. In the apparatus described, an ironing device,

having a curved surface for engaging the web, is situated adjacent to the drying cylinders, and means are provided for stretching the web and for drawing it over the surface of the ironing device.—W. P. S.

Impregnating material. Ger. Pat. 208,378, See III.

Purifying sulphite-cellulose lyes for use in the tannery. Ger. Pat. 207,776. See XIV.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Laudanosine; Complete synthesis of — A. Pictet and M. Finkelstein. Compt. rend., 1909, 148, 925—927.

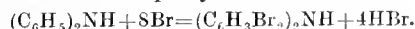
WHEN sodium hypobromite acts upon dimethylhydrocaffeic amide, homoveratrylamine is produced. Starting from eugenol, homoveratryl chloride was obtained. These substances condense under the action of sodium hydroxide to form homoveratryl-homoveratrylamine, $(\text{CH}_3\text{O})_2\text{C}_6\text{H}_3\text{CH}_2\text{CH}_2\text{NHCOCH}_2\text{C}_6\text{H}_3(\text{OCH}_3)_2$. When this substance is treated with phosphorus pentoxide, a molecule of water is removed, with the formation of dihydropapaverine. The dihydropapaverine is treated with methyl chloride and reduced with tin and hydrochloric acid, when racemic methyltetrahydropapaverine is produced. This base has been resolved by Pictet and Athanasesco (this J., 1900, 1036, 1139) into its optical isomerides, of which the dextro-rotatory modification is identical with natural laudanosine.—F. SHDN.

Ketones; Catalytic preparation of — J. B. Senderens. Compt. rend., 1909, 148, 927—929.

ORDINARY ether can be prepared in a good yield by the catalytic action of aluminium oxide (see this J., 1909, 219). Besides this, the only other ether which can be made to give a satisfactory yield by this method is dimethyl ether. Acetone can be made by passing the vapour of acetic acid over precipitated aluminium oxide heated to 300°—380° C. (this J., 1908, 185). Fairly good yields of the corresponding ketones are obtained in a similar manner from propionic and butyric acids, but only a poor yield from isobutyric acid. Ethyl acetate passed over aluminium oxide heated to 380°—420° C. gives a good yield of acetone, together with some ethylene. Thorium oxide, which is a poor catalyst for the production of ethers, gives good results for the preparation of ketones. The thorium oxide must be heated to 380°—420° C. while the acid vapours are passed over. Diethylketone, dipropylketone, and diisopropylketone were prepared in this way. Formic acid gives formaldehyde when passed over heated aluminium oxide. If thorium oxide heated to 250° C. is used, a considerable amount of carbon dioxide is produced, with some formaldehyde, and unchanged acid.—F. SHDN.

Diphenylamine; Determination of — as tetrabromodiphenylamine. W. Dreger. Z. ges. Schiess- und Sprengstoffw., 1909, 4, 123.

DIPHENYLAMINE in alcoholic solution reacts with bromine to form tetrabromodiphenylamine:



THIS bromo-derivative is insoluble in water, sparingly soluble in alcohol, readily soluble in benzene, xylene, chloroform, and ethyl acetate, especially on warming; it melts at 102° C., and crystallises in reddish needles having a silky lustre. For the determination of diphenylamine in the commercial product, the sample is dissolved in alcohol, or if already in ethereal solution, the ether may be driven off by adding alcohol and warming. Excess of bromine is then added, drop by drop, with constant stirring. The solution is next mixed with twice its volume of water and the whole boiled until the alcohol and excess of bromine are driven off and the bulk is reduced to one-half—constant stirring is needful. The precipitate of

tetrabromodiphenylamine is transferred to a funnel, or Gooch crucible, connected to a water pump, and washed with warm water to remove the last traces of alcohol and bromine, and lastly dried at 98°—100° C. until of constant weight. Smaller quantities may be estimated by evaporating to dryness in a previously weighed glass vessel. If it be desired to determine the diphenylamine contained in gelatinised nitro-cotton, the nitro-compound is gradually decomposed by means of soda lye in a capacious flask. The flask is closed by a doubly perforated stopper fitted with a stoppered funnel, and a bent tube attached to a condenser, which communicates with a suitable receiver. The free diphenylamine and any camphor that may be present are carried into the receiver which contains ether. The distillate is well shaken with common salt; the ether completely dissolves the diphenylamine and any camphor, and the determination is then completed as before indicated.—J. W. G.

Tartaric acid; Determination of — in commercial products. P. Carles. J. Pharm. Chim., 1909, 29, 381—382.

SENSITIVE litmus paper is the most satisfactory indicator for the acidimetric titration of tartaric acid. According as the standard alkali employed may be caustic potash or soda, strips of sensitive litmus paper are plunged half-way in solutions (1:120) of either pure neutral potassium tartrate, or of Rochelle salt. The strips show a delicate blue shade in the immersed portion, which is the neutral tint to be worked to. In the solution of bitartrate to be titrated, similar bands are immersed in the same way, and phenolphthalein is also used as a rough indicator to regulate the addition of the standard alkali. When the blue shade appears in the moistened litmus paper, the liquid is boiled, and then tested with a fresh band. When the shade of this and of the control band are identical, the reading is taken.—J. O. B.

Bismuth poisoning and a non-toxic substitute for bismuth for use with Röntgen rays. L. Lewin. Münch. med. Wochenschr., 1909, 56, 643—645. Chem. Zentr., 1909, 1, 1345.

THE author describes the symptoms of bismuth poisoning and argues against the designation of bismuth subnitrate poisoning as a nitrite poisoning, pointing out that similar symptoms to those produced by bismuth subnitrate can also be caused by other compounds of bismuth, for example, bismuth-potassium tartrate, bismuth subgallate (dermatol), and bismuth oxyiodide gallate (airol). The substitution of other bismuth compounds, e.g., the carbonate, for bismuth subnitrate in working with Röntgen rays is thus no safeguard against poisoning. [In preparing radiographs of interior parts or organs of the body, bismuth compounds have been administered in order to outline such parts before exposure to the rays.] It has been found that an efficient, non-toxic substitute for bismuth salts in such work is the magnetic oxide of iron.—A. S.

Iodine pentoxide; Preparation of pure —. M. Guichard. Compt. rend., 1909, 148, 923—925.

ALTHOUGH the solubility of iodic acid in water is very great, in nitric acid of sp. gr. 1.4 it is only 0.67 gm. per 100 grms. of solvent. Hence if nitric acid is added to an aqueous solution of iodic acid, and the liquid concentrated, iodic acid is deposited in the form of fine crystals. Impure iodic acid can be purified by crystallisation from nitric acid. A good yield of iodic acid can be obtained by the following process. A horizontal tube is connected to the neck of a retort, and filled with iodine moistened with fuming nitric acid. A mixture of fuming nitric acid and phosphorus pentoxide is gently heated in the bulb of the retort, when nitrogen pentoxide passes over the iodine, converting it into iodic acid. The contents of the tube are dissolved in water, evaporated, and the residue dried at 220° C. 100 grms. of fuming nitric acid produce 20 grms. of iodic pentoxide, a much greater yield than has been obtained hitherto with the same reagents.—F. SHDN.

PATENTS.

p-Ethoxyphenylamidomethyl alkaline sulphites and process of making same. R. Lepetit, Garressio, Italy. Eng. Pat. 21,389, Oct. 9, 1908.

p-ETHOXYPHENYLAMINOMETHYL sulphites are obtained by heating *p*-phenetidine with formaldehyde and an alkali bisulphite, in presence of excess of 95 per cent. alcohol and only sufficient water to dissolve the product when boiling. Thus, 1000 grms. of *p*-phenetidine are dissolved in 3 litres of 95 per cent. alcohol, 571 c.c. of 40 per cent. formaldehyde are added and then 1420 c.c. of sodium bisulphite solution (38° B.); the mixture is heated to 60° C., one litre of warm water is added, and the whole is boiled for a short time; after 24 hours the product is filtered off, and is obtained quite pure. It is easily soluble in hot water, slightly soluble in alcohol, insoluble in ether or chloroform. Acids precipitate the free acid from aqueous solutions of the salt. The salts possess the antineuralgic and antipyretic properties of *p*-phenetidine, without its toxic effects.—T. F. B.

Tartaric acid; Manufacture of —. G. F. Berry, London. Eng. Pat. 22,029, Oct. 17, 1908.

THE raw material (potassium bitartrate) is ground to powder and added to a 50 to 60 per cent. cold solution of calcium chloride. After stirring well, the mass is neutralised with chalk or milk of lime and again agitated for about four hours. After settling, the clear liquid containing calcium and potassium chlorides is run off, and the residue of calcium tartrate is washed with cold water and converted into tartaric acid and calcium sulphate by means of sulphuric acid. The tartaric acid solution thus obtained is decolorised by animal charcoal, freed from any lead and arsenic it may contain by precipitating these metals as sulphides, and after filtering is purified by crystallisation.—O. R.

Guaiaicol compounds. F. Hoffmann-La Roche and Co., Bale, Switzerland. Eng. Pat. 24,072, Nov. 10, 1908. Under Int. Conv., Oct. 5, 1908.

CLAIM is made for the production of a new compound, hexamethylenetetraminetrignuaicol, which crystallises in brilliant needles becoming soft above 80° C., and melting to a turbid liquid at about 95° C. It is readily soluble in alcohol and chloroform, and yields guaiaicol on distillation in a current of steam. It may be obtained by the interaction of guaiaicol and hexamethylenetetramine in concentrated aqueous solution, or by treating a solution of formaldehyde with an ammoniacal solution of guaiaicol containing the necessary amount of ammonia to form hexamethylenetetramine.—C. A. M.

Formic aldehyde-containing composition, and process of making the same. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 917,706, April 6, 1909.

THE composition consists of formaldehyde, a fixed vegetable oil such as maize oil, and a medicating agent, such as eucalyptol.—A. T. L.

Anhydromethylenecitric acid; Preparation of the esters of —. Farbenfabrik vorm. F. Bayer und Co. Fr. Pat. 395,447, Oct. 17, 1908. Under Int. Conv., Jan. 3, 1908.

CLAIM is made for the production by the usual methods of esters of anhydromethylenecitric acid. The methyl ester melts at 76° C., the ethyl ester at 55° C., and the amyl ester at 52°—53° C.—F. SHDN.

Phenoxydialkylaminopropanols and their acyl derivatives; Preparation of —. Etab. Poulenc Frères and E. Fourneau. 1st and 2nd Additions, dated May 2, 1908, to Fr. Pat. 395,470, Dec. 28, 1907. (See this J., 1909, 442.)

THE process described in the principal patent (*loc. cit.*) for the production of phenoxydialkylaminopropanols, has been extended to the following substances. *p*-Cresol is condensed with dichlorhydrin, and the product treated with dimethylamine. *p*-Methylphenoxydimethylaminopropanol thus produced, is a colourless basic oil, boiling

at 175°—176° C. at 10 mm. Starting with thymol instead of *p*-cresol, 1-methyl-4-propylphenoxymethylaminopropanol is produced, which boils at 177° C. at 11 mm. Guaiacol gives rise to 1-methoxy-2-phenoxydimethylaminopropanol, which crystallises from ether and melts at 60°—61° C. Naphthoxydimethylaminopropanol melts at 81°—82° C., and boils at 217° C. at 17 mm. *p*-Nitrophenoxymethylaminopropanol crystallises from 60 per cent. alcohol in yellow leaflets, melting at 81°—82° C., and forms a picrate melting at 153° C. Phenoxypropanol-aniline is prepared by heating together aniline and phenoxypropane oxide, and crystallises from alcohol in fine needles melting at 57° C. Using phenetidine in place of aniline, phenoxypropanolphenetidine is produced, which crystallises from dilute alcohol in fine white needles melting at 95° C. Methylphenoxypropanolphenetidine crystallises from dilute alcohol and melts at 91° C. —F. SHDN.

Colloidal silver or silver oxide; Process for obtaining preparations containing —. L. Sensburg. Ger. Pat. 208,189, July 30, 1907.

PREPARATIONS containing colloidal silver or silver oxide are obtained by treating aqueous solutions of silver salts with alkaline solutions of such tannin-substances (catechu, catechin, catechu-tannic acid, gambier, kino, etc.) as yield protocatechuic acid and phloroglucinol when fused with potassium hydroxide. The colloidal solutions thus produced are freed from alkali and salts by dialysis, and then evaporated to dryness, preferably in a vacuum. The products are soluble in water and are valuable therapeutically, possessing both the antiseptic properties of colloidal silver and the astringent properties of tannin-substances.—A. S.

Eugenol- and isoeugenol-acetamide; Process for preparing N-substituted aminomethyl compounds of —. A. Einhorn. Ger. Pat. 208,255, Aug. 8, 1907.

NEW compounds, which are of value as local anaesthetics, are produced (1), by the action of formaldehyde and secondary bases on eugenol- or isoeugenol-acetamide, $\text{CH}_3\text{O.C}_6\text{H}_3(\text{C}_2\text{H}_5)\text{O.CH}_2\text{CO.NH}_2$; (2), by the action of secondary aliphatic bases on the methylol derivatives of the above compounds. The aminomethyl group attaches itself to the amino group of the eugenol derivative.—T. F. B.

p-Aminophenol and methyl-p-aminophenol; Process for separating —. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 208,434, Aug. 29, 1907.

"METOL," the sulphate of methyl-*p*-aminophenol, always contains *p*-aminophenol sulphate as an impurity. In order to separate the two bases a solution of their salts is agitated with an aldehyde, such as benzaldehyde, preferably in slightly acid solution, *e.g.*, with acetic acid. If benzaldehyde is used, the benzyldine-*p*-aminophenol is completely precipitated after a short time, and filtered off, and the excess of benzaldehyde is removed by boiling. —T. F. B.

1-Aryl-2,4-dialkyl-5-halogenmethyl-3-pyrazolones; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 208,593, Feb. 5, 1908. Addition to Ger. Pat. 206,637, Oct. 3, 1907.

THE process described in the principal patent for preparing 1-aryl-2,4-dialkyl-3-halogenmethyl-5-pyrazolones (this J., 1909, 325) is applied to preparing the isomeric 1-aryl-2,4-dialkyl-5-halogenmethyl-3-pyrazolones from 1-aryl-2,4-dialkyl-5-methyl-3-pyrazolones.—T. F. B.

Mesityl oxide; Process for preparing —. M. Kohn. Ger. Pat. 208,635, Nov. 16, 1907.

ACETONE is condensed by means of alkalis to diacetyl alcohol, and the latter is heated with a very small quantity of some dehydrating agent (*e.g.*, one per cent. of sulphuric acid by volume).—T. F. B.

1-Alkyl-2-alkoxy-pyrimidine derivatives; Process for preparing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 208,639, April 25, 1908.

2-ALKYLOXYPYRIMIDINES are readily alkylated in the 1-position, *e.g.*, by treatment with a dialkyl sulphate in presence of alkali. The products may be used in the preparation of 1-alkylpurine derivatives.—T. F. B.

Aminoarylsulphonic acids; Manufacture of acid derivatives of —. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Main, Germany. Eng. Pat. 17,139, Aug. 14, 1908. Under Int. Conv., Aug. 19, 1907.

SEE Fr. Pat. 392,857 of 1908; this J., 1909, 107.—T. F. B.

Mercury salts of p-aminophenylsulphonic acid; Process for producing —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 396,192, Nov. 12, 1908. Under Int. Conv., Nov. 19, 1907.

SEE U.S. Pat. 914,408 of 1909; this J., 1909, 442.—T. F. B.

Yeast preparation suitable for hypodermic injection and process of manufacturing the same. A. Ascoli, Milan, Italy. Eng. Pat. 21,820, Oct. 15, 1908.

SEE Ger. Pat. 194,950 of 1906; this J., 1908, 644.—T. F. B.

Theobromine double salts. C. Mezger and A. Weller, Frankfurt, Assignors to Verein. Chininfabr. Zimmer und Co. U.S. Pat. 917,996, April 6, 1909.

SEE Eng. Pat. 6439 of 1908; this J., 1909, 220.—T. F. B.

Radio-active bodies from uranium and thorium; Process for obtaining —. A. P. H. Trivelli, Scheveningen, Holland. U.S. Pat. 917,191, April 6, 1909.

SEE Fr. Pat. 386,751 of 1908; this J., 1908, 769.—T. F. B.

Sulphurous acid esters of pyridine, etc. Ger. Pat. 208,638. See IV.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Photographic sensitive surfaces. E. S. Donisthorpe. London. Eng. Pat. 5641, March 13, 1908.

SENSITIVE emulsions are applied to flexible, opaque supports, such as black paper or pigmented celluloid.—T. F. B.

Photographic sensitive surfaces. F. W. Donisthorpe, Bath. Eng. Pat. 7087, March 31, 1908.

AN emulsion is coated on an opaque, rigid support, such as black glass or ebonite. The negatives can be printed by any of the contact processes not requiring transmitted light.—T. F. B.

Film for cinematograph and like apparatus; Manufacture of —. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils, Lyons, France. Eng. Pat. 16,114, July 29, 1908. Under Int. Conv., June 3, 1908.

A LAYER of gelatin or similar non-inflammable colloid, which is coated with a sensitive emulsion, is supported by a film of collodion, celluloid, etc., during the photographic operations, to ensure the gelatin film, when separated subsequently, being of the same dimensions throughout its length.—T. F. B.

Colour plates or screens for colour photography; Manufacture of —. J. H. Christensen, Holte, Denmark. Eng. Pat. 20,971, Oct. 5, 1908. Under Int. Conv., Jan. 25, 1908.

COLOUR screens are formed of small particles produced by the emulsification of a coloured medium in a liquid. For example, a solution of shellac or other resin in spirit is divided into three parts, which are coloured with the colours of which it is desired to compose the screen. These coloured solutions are each "emulsified" by shaking

them with turpentine: after standing some time, the larger particles settle, and it is possible to draw off portions of each mixture with particles of approximately the same size. These are now spread on a glass or other support, either separately or after mixing together, and the whole is heated gently or subjected to pressure to amalgamate the particles and produce a homogeneous layer. A layer of sensitive emulsion may now be applied to the screen. The resin may be replaced by gelatin, gum, or albumin.

—T. F. B.

Films: Process for the manufacture of continuous — M. Ratignier and H. Pervillac et Cie. Fr. Pat. 395,665, Jan. 4, 1908.

ANY of the solutions employed in the manufacture of artificial silk may be used for making films by this process, which is characterised by the fact that the film is kept in a stretched condition throughout its manufacture, thus avoiding shrinkage and yielding a product having a very smooth surface and a high degree of transparency. From a reservoir, in which the level of the liquid is maintained constant, the solution flows out on to the surface of a slowly revolving drum. The flow and the width of the film are regulated by means of an adjustable slide in the wall of the reservoir, which is set to leave a space of a desired dimension between its lower edge and the surface of the drum. The lower part of the drum is surrounded by a mantle in which the coagulating liquid is circulated. The film after passing through this liquid is detached from the drum and, its edges engaging with two parallel endless bands which serve to keep it in position, is led around a number of perforated drums upon which the operations necessary to ensure complete coagulation, washing, etc., are carried out, after which the film is dried upon a cylinder.

—F. M.

Polychromatic screens [for photography]: Process of producing — A. and L. Lumière, Lyons-Montplaisir, France. U.S. Pat. 916,467, March 30, 1909.

SEE Fr. Pat. 393,296 of 1907: this J., 1909, 109.—T. F. B.

Photographic paper. Y. Schwartz, Hanover, Germany. U.S. Pat. 916,616, March 30, 1909.

SEE Fr. Pat. 373,699 of 1907: this J., 1907, 716.—T. F. B.

Photographic surface: Self-developing — W. F. C. Kelly and J. A. Bentham, London. U.S. Pat. 917,310, April 6, 1909.

SEE Eng. Pat. 8911 of 1905: this J., 1906, 828.—T. F. B.

Screens for polychrome photography: Process for producing — J. H. Christensen. Fr. Pat. 395,521, Oct. 20, 1908.

SEE Eng. Pat. 20,971 of 1908: preceding.—T. F. B.

Pyrophoric substances. Fr. Pat. 396,198. See II.

Separating p-aminophenol and methyl-p-aminophenol. Ger. Pat. 208,434. See XX.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives: Chlorate and perchlorate — Girard and Laroche. Monit. Scient., 1909, 23, 217–252.

RECENT methods of manufacture have enabled a class of chlorate and perchlorate explosives to be produced—notably those of the Street type known in France as cheddites, which are safe to manufacture, store, handle, and use. Ammonium perchlorate being stable and yielding gaseous decomposition products is, in the opinion of the authors, well adapted to be used to a greater extent than hitherto. It does not begin to decompose until a temperature of 135° C. is attained, and then only with extreme slowness and after long heating at that temperature as follows: $\text{NH}_4\text{ClO}_4 = 2\text{H}_2\text{O} + \text{O}_2 + \text{Cl} + \text{N}$. The rate of decomposition increases with rise of temperature, but is regular throughout. The general method of preparing cheddites is as follows:—Castor oil is heated to 70° C.,

by steam in a double-walled vessel. Mononitronaphthalene, which may be used with, or replaced by, another nitro-derivative, is added, and then the melted and homogeneous mass is mixed with the requisite proportion of warm, dry, and powdered sodium or potassium chlorate with a wooden spatula. 25 kilos. of explosive can be made in about 7 minutes. The process is completed by pouring the material on to a wooden table, allowing it to cool to 30°–35°, and then rolling it with a wooden roller. The rolling process is repeated when the mass is cold. The finished explosive assumes the form of small grains. Two individuals of the class, officially designated Type 60 and Type 41, were experimented on. Their composition was as follows:—

	Type 60.	Type 41.
Potassium chlorate.....	80	80
Mononitronaphthalene	12	12
Castor oil	6	8
Picric acid	2	—

Effect of shock.—In this case the following standard explosives were used for purposes of comparison:—No. 1 dynamite (75 per cent. of nitroglycerin), gelatin-dynamite (*Dynamit-gomme*), smokeless powder, French mining powder, French sporting powder. The last two were in either grains or powder, as were also the cheddites. In each case 8 grms. were uniformly distributed over a circular steel anvil of 140 mm. diam. To ascertain whether shock or combustion were propagated, a train 10–20 cm. long was laid from the explosive along the anvil or on sand. Shock was communicated by a 35-kilo. weight which was allowed to fall from various heights either directly on the explosive layer, or on a cylinder of the same diameter as the anvil, weighing 6 kilos., and resting on the layer. From the figures given it appears that when decomposition took place, the standard explosives detonated or burnt with more or less violence with propagation in the majority of cases, while the cheddites detonated feebly without propagation of either shock or combustion. The stability of cheddites is increased by prolonged storage: they are quite insensible to any shock likely to occur during manufacture or handling. They can only be usefully exploded by fulminate. *Resistance to friction.*—100 grms. each of cheddites No. 60 and No. 41 were spread over a steel surface. A bullet coated with German silver was fired from a gun of 8 mm. bore inclined at 10° to the horizontal. 25 grms. burnt with feeble detonation in the track of the bullet. *High temperatures and flame* cause cheddites to burn more or less rapidly. There is no detonation with large or small masses. When burnt under very varied conditions the fire was easily extinguished by a small amount of water. *Resistance to the action of strong sulphuric acid.*—Masses of a few grms. to 50 kilos. weight burnt briskly when acid of 66° B. was used; there was no detonation even when the substance was enclosed in wooden cases. *Resistance to low temperatures.*—On cooling to –20° C., the plasticity was unaltered, and the sensitiveness to shock was not increased. *Resistance to heating.*—Heated for 8 days at a temperature of 90°–100° C., the cheddites remained soft. At 200° the oil decomposed, the nitro-compounds were volatilised, and the mass dried and blackened. At the decomposing temperature of the chlorate, the explosives deflagrated sharply. They safely withstood a prolonged temperature of 120° C., and showed resistance to water vapour and water. Eschweiler has tested cheddites having the following composition:—

	Type 41 N.	Type 60 N.
Sodium chlorate	80	80
Dinitrotoluene	—	2
Nitronaphthalene	12	13
Castor oil	8	8

The results obtained by tests analogous to those already given show them to have the same qualities as Nos. 41 and 60. All four types are said to stand the official

English heat test for a longer period than is officially demanded. A list of chlorate and perchlorate explosives formerly proposed and patented, is appended. It contains details of two ammonium perchlorate explosives which have the following composition:—

	Type C.	Type B.
Ammonium perchlorate.....	50	82
Sodium nitrate.....	30	—
Dinitrotoluene.....	15	13
Castor oil.....	5	5

“B,” though more powerful, should not be used in mine galleries as ammonium perchlorate yields hydrochloric acid gas by explosive decomposition, and to prevent this sodium nitrate should be admixed.—J. W. G.

Determining diphenylamine [e.g., in gelatinised nitro-cotton]. Dreger. See XX.

Explosives in coal mins. Chem. and Drug., April 24, 1909. [T.R.]

UNDER the Coal Mines Regulation Act, 1896, a Secretary of State, on being satisfied that any explosive is or is likely to become dangerous, may by order prohibit the use of it in any mine, either absolutely or conditionally. A new order declares that the order of December 17, 1906, “shall take effect as if the explosives named and defined in the schedule to this order were named and defined in the first schedule to that order.” The explosives mentioned are amasite, dominite, and St. Helen’s powder, and in each case the order sets forth the conditions upon which these may be used. The Home Secretary also gives notice that, by an Order dated recently, he has removed the explosives saxonite and geloxite from the list of permitted explosives for use in mines to which the Explosives in Coal Mines Order of December 17, 1906, applies. The Order takes effect as from Monday, May 3, inclusive.

PATENT.

Explosive compounds and their manufacture. G. Lezinsky. Fr. Pat. 395,635, Oct. 24, 1908. Under Int. Conv., Nov. 1, 1907.

SEE U.S. Pat. 909,915 of 1909; this J., 1909, 384.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

PATENTS.

Viscosity of liquids; Apparatus for the determination of the —. W. Graaff and Co., Ges.m.b.H., and H. Mikorey. Ger. Pats. 205,235, March 17, 1905; 207,177, Feb. 8, 1906; and 207,178, May 1, 1906.

(1). A PROPELLER-SCREW is rotated in the liquid of which the viscosity is to be determined, and the driving-power developed by the screw is measured by fitting the frame carrying the propeller-shaft with a pointer and scale, the pointer coming to rest when the driving-power of the screw is balanced by the resistance of the frame. Special claim is made for combining the screw, frame, pointer, and scale in a connected whole, which can be used with liquids contained in different kinds of receptacles. (2). The turbine which drives the propeller-screw is fixed on the propeller-shaft, but is movable in its casing in an axial direction. (3). Instead of a turbine, an electric motor is used to drive the propeller-screw, the armature of the motor being fixed to the propeller-shaft.—A. S.

INORGANIC—QUANTITATIVE.

Silver: Determination of — iodometrically, using potassium chromate as precipitant. F. A. Gooch and R. S. Bosworth. Amer. J. Sci., 1909, 27, 302—304.

UTILISING the fact that silver may be completely precipitated with a sufficient excess of potassium chromate, even

in the presence of nitric acid, the authors have devised a volumetric method of determining this metal, which consists in dissolving the precipitated chromate in ammonia, reprecipitating by boiling to a small volume, and then titrating iodometrically, either the chromate ion combined with the silver, or that of the excess of potassium chromate remaining after precipitation with a known amount of this reagent.—F. SOBX.

Mercury: Determination of — by electro-analysis with a gold cathode. F. M. Perkin. Faraday Soc., March 30, 1909. [Advance proof.]

DETERMINATION of mercury electrolytically with a gold cathode gives somewhat high results, and it is considered that a gold electrode cannot be satisfactorily employed for analytical purposes. A rotating silver electrode also gives values which are too high. Mercury is best deposited upon a mercury cathode, and this is done very rapidly if a rotating anode be used.—F. SOBX.

Arsenic; Volumetric determination of small amounts of —. L. W. Andrews and H. V. Farr. Amer. J. Sci., 1909, 27, 316—320.

ABOUT 20 c.c. of the solution to be examined are mixed with 50 c.c. of a solution made by dissolving 20 grms. of stannous chloride crystals and 40 grms. of tartaric acid in 1 litre of 40 per cent. hydrochloric acid, and the mixture is maintained for 2—3 hours at 35°—40° C. in a well-stoppered bottle, until the precipitated arsenic has completely subsided. The precipitate is transferred to an asbestos filter with the aid of a little strong hydrochloric acid, free from chlorine, and washed, and then asbestos and precipitate are returned to the bottle with an amount of N/100 or N/10 iodine solution, 10—100 per cent. above that indicated by the equation, $\text{As} + 5\text{I} + 7\text{NaHCO}_3 = \text{Na}_2\text{HAsO}_4 + 5\text{NaI} + 7\text{CO}_2 + 3\text{H}_2\text{O}$; enough of a 5 per cent. solution of sodium bicarbonate or sodium phosphate is added to maintain neutrality throughout the reaction, and, when all the arsenic is dissolved, the excess of iodine is titrated with N/100 or N/1000 arsenite solution. For quantities of arsenic smaller than 0.5 mgrm., N/1000 solutions may be employed, but in this case a correction must be made for the amount of iodine required to produce the end-reaction. The process is said to be accurate, fairly rapid, and widely applicable. It is suggested that mirrors obtained by the Marsh method might be accurately determined by titration with iodine.—F. SOBX.

Vanadic and arsenic acids and also vanadic and antimonie acids; Determination of —, in the presence of one another. G. Edgar. Amer. J. Sci., 1909, 27, 299—301.

VANADIC and arsenic acids may be determined in the presence of each other by a process of differential reduction. One portion of the solution containing the acids is boiled with tartaric or oxalic acid, until the blue colour of vanadium tetroxide indicates complete reduction; the solution is then cooled, nearly neutralised with potassium bicarbonate, and an excess of standard iodine solution is added; this is followed by an excess of bicarbonate, and the solution is allowed to stand half an hour, when the excess of iodine is removed with standard arsenious acid and the solution titrated with iodine. Another portion of the solution, acidified with sulphuric acid, is heated in a closed pressure flask for 1 hour on the steam bath with strong sulphurous acid solution; the excess of sulphur dioxide is removed by boiling in a current of carbon dioxide, and the solution is then cooled, nearly neutralised with potassium bicarbonate, iodine added, and the process finished as before. In the first portion the vanadium is reduced to tetroxide, the arsenic acid being unaffected, but in the second portion both vanadium and arsenic are reduced. Re-oxidation takes place according to the equation, $\text{As}_2\text{O}_3 + \text{V}_2\text{O}_4 + 3\text{I}_2 + 3\text{H}_2\text{O} = \text{As}_2\text{O}_5 + \text{V}_2\text{O}_5 + 6\text{HI}$. Antimonie and vanadic acids are determined by a similar process.—F. SOBX.

Determining acid in hydrogen peroxide. Endemann. See VII.

Gases evolved by the action of cupric salts upon steels. Goutal. See X.

Analysis of special steels. Pepin-Lechalleur. See X.

Borax in assay fluxes. Clennell. See X.

Determining iron oxide and alumina in phosphate rock. Gladding. See XV.

PATENT.

[Gold and silver] assaying. U.S. Pat. 913,129. See X.

ORGANIC—QUALITATIVE.

Differentiating petroleum oils of different origin. Schwarz. See III.

Fatty oil in mineral oil. Schwarz and Marcusson. See III.

Colour reaction of colophony. Sans. See XIII B.

Cider. [Detection of apple-juice in artificial cider.] Barker and Russell. See XVII.

ORGANIC—QUANTITATIVE.

Determining carbon monoxide, hydrogen, and methane. Nesmelow. See II.

Analysis of calcium acetate. Gladding. See III.

Determining petroleum in turpentine. Coste. See XIII B.

Analysis of shellac. Endemann. See XIII B.

Analysis of chestnut wood. Alsop. See XIV.

Determining starch in barley. Schubert. See XVII.

Determining colour of turbid worts. Roeder. See XVII.

Analysis of chocolate. Booth and others. See XVIII A.

Benzaldehyde in almond flavouring extracts. Denis and Dunbar. See XVIII A.

Determining diphenylamine. Dreger. See XX.

Determining tartaric acid. Carles. See XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Gases occluded in the lavas of the last eruptions of Mont Pelée and Vesuvius; Analysis of —. Grossmann. Compt. rend., 1909, 148, 991–992.

THE gases, which were obtained by heating the finely powdered rocks *in vacuo*, were found to have the following percentage composition by volume at 0° C. and 760 mm. pressure:—

	Mont Pelée (1902).		Vesuvius (1906).	
	Andesite from the summit.	Pumice, 9th July.	Lava from Boscotrecase.	Lapilli thrown upon Ottajano.
Volume of gas from 100 grms. of rock . . .	8 c.c.	2.5 c.c.	66 c.c.	65 c.c.
Carbon dioxide . . .	85.00	78.01	24.6	58.1
Oxygen	—	—	1.5	2.41
Nitrogen	5.42	6.61	9.2	17.6
Hydrogen	5.02	2.12	50.6	2.41
Carbon monoxide	7.46	11.11	11.1	17.2
Methane	—	—	2.6	—
Residual gas	—	2.12	1.5	1.4

Neither acetylene, ethylene, propylene, nor benzene was found in the samples, but traces of helium and argon were discovered in the Mont Pelée pumice and the Boscotrecase lava respectively, rare gases being absent in the case of the Ottajano lapilli. The great difference in composition between the gases from the Vesuvian products is remarked upon and regarded as probably supporting the contention of Lacroix that the lapilli which fell upon Ottajano during the 1906 eruption were composed of old volcanic material and did not represent the actual lava flow of that date.

—W. E. F. P.

Fungi; Chemistry of the higher —. Part III. Diastases of fungi. J. Zellner. Monatsh. Chem., 1909, 30, 231–246. (Compare this J., 1908, 94.)

THE author has studied the chemical action of the enzymes contained in 19 species of wood fungi, by observing their action on potato starch. He finds that:—(1) Amylolytic enzymes are generally contained in wood fungi. (2) The enzymes retain their activity in the dried fungi for a considerable time. (3) Their action is partly or completely inhibited by the presence of even a small quantity of inorganic acids or bases, but dilute organic acids give rise to an increased action. (4) The diastatic degradation proceeds most rapidly between 40° and 60° C.; the optimum temperature is about 50° C., and the action is stopped at 70° C. (5) Compared with malt, the diastatic power of the fungi is very small. (6) The products of the enzymatic hydrolysis are primarily substances of the dextrin group, and finally, in addition to dextrin, chiefly dextrose. Maltose could not be detected with certainty. (7) Other carbohydrates (such as inulin, arabinose) are not attacked by the ferments.—J. C. C.

Sugar; Decomposition of — during the respiration process. P. B. Jensen. Ber. Deutsch. Botan. Ges., 1908, 26, 666. Chem.-Zeit., 1909, 33, Rep. 153.

IF during the alcoholic fermentation of dextrose, hydroxylamine hydrochloride be added to the liquid, small quantities of the oxime of dihydroxyacetone are formed. Also, after the fermentation is complete, dihydroxyacetone can be identified as its methylphenylosazone by addition of acetic acid and methylphenylhydrazine. Dihydroxyacetone itself can be fermented, with production of alcohol and carbon dioxide. According to the author, alcoholic fermentation may be divided into two stages, the decomposition of dextrose with formation of dihydroxyacetone, and the splitting-up of the latter into alcohol and carbon dioxide. Hence zymase must consist of two different enzymes, *dextrase* and *dihydroxyacetonease*. If fermentation of sugar be carried out in glycerol solution, the dextrase alone is active, and dihydroxyacetone is the final product. Dihydroxyacetone can be decomposed by means of oxydase, but no alcohol is produced. By addition of oxydase to a fermenting sugar solution, the normal process of respiration of plants can be imitated. Dihydroxyacetone is produced from the dextrose by the action of the dextrase of the yeast, and is then decomposed by the oxydase with formation of carbon dioxide and water.—A. S.

New Books.

CHEMICAL TECHNOLOGY AND ANALYSIS OF OILS, FATS, AND WAXES. By Dr. J. LEWKOWITSCH, M.A. Fourth Edition, entirely rewritten and enlarged. Three volumes. Macmillan and Co., Limited, St. Martin's Street, London. 1909. Price £2 10s.

THREE 8vo volumes, containing:—VOL. I.: 540 pages of subject matter, and an appendix with additional matter of two pages. The volume contains 54 illustrations. VOL. II.: 786 pages of subject matter, and an appendix with additional matter of 21 pages, followed by indexes of botanical names and zoological names for the entire work. There are 20 illustrations. VOL. III. 379 pages of subject matter, and an appendix with tables, &c., of 6 pages, followed by the alphabetical index of the entire work. There are 28 illustrations in Vol. III.

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THIRD REPORT OF THE WELLCOME RESEARCH LABORATORIES AT THE GORDON MEMORIAL COLLEGE, KHARTOUM. ANDREW BALFOUR, M.D., B.Sc., F.R.C.P., Director, Medical Officer of Health, Khartoum, &c. Baillière, Tindal and Cox, 8, Henrietta Street, Covent Garden, London. 1908. Price 21s. net.

LARGE quarto volume, containing 477 pages of subject matter, including 27 pages of index, and illustrated by 28 coloured plates, 51 reproductions of black and white drawings, 263 reproductions of photographs, and 19 maps and plans. The subject matter is classified as follows:—
I. INTRODUCTION. **II. TRYPANOSOMIASIS IN THE ANGLO-EGYPTIAN SUDAN.** By R. G. Archibald. **III. KALA-AZAR IN THE ANGLO-EGYPTIAN SUDAN.** By S. Lyle Cummins. Observations on Kala-azar in Kassala Province. By L. Bousfield. **IV. REPORT OF TRAVELLING PATHOLOGIST AND PROTOZOOLOGIST.** By C. M. Wenyon. Some interesting reptiles collected on the Upper Nile. Poisonous snakes of the Anglo-Egyptian Sudan, etc. By R. T. Leiper. **V. REPORT ON ECONOMIC ENTOMOLOGY.** New mosquitoes from the Sudan. By H. H. King and F. V. Theobald. **VI. THE HEALING ART AS PRACTISED BY THE DERVISHES.** By Hassan Effendi Zeki. **VII. REPORT ON THE PHYSICAL CHARACTERS OF SOME NILOTIC NEGROID TRIBES.** By D. Waterston. **VIII. NOTES ON ETHNOGRAPHICAL SPECIMENS COLLECTED BY DR. A. MAC TIER PIRRIE.** **IX. REPORT ON THE CHEMICAL SECTION.** By William Beam. (i.), Special research on gum arabic. (ii.), Chemical composition of Nile waters, etc. (iii.), Poisonous well waters. (iv.), Limestones and limes. (v.), Gypsum deposits, Red Sea province. (vi.), Detection of well pollution by means of fluorescein. (vii.), Chemical composition of some Sudan grains. (viii.), Analyses of oil seeds, earthnuts, safflower, cotton seeds, castor oil seeds, sesame, sesame-cake. (ix.), Some Sudan fats and oils. Heglig fruit. Shea butter. Zawa oil. Ben oil. (x.), Sudan gums. Hashab gum. Tapping for exuding gums. Origin of gum. Conditions affecting its production, etc. Analyses of soils from gum districts. Talh gum. Gum of *Acacia arabica*. Kuk gum. Gums from *Acacia suma* and *Odina fruticosa*. Sabakh gum. Tartar and Wa gums, etc. **X. NOTES ON THE CHEMISTRY OF SUDAN GUMS.** By E. S. Edie. (i.), Pentoses in gums. (ii.), Changes in viscosity.

(iii.), Sugar in gums. (iv.), Optical activity of gums. (v.), Their molecular change. (vi.), Bacterial origin. (vii.), Gum bacilli. (viii.), Gum and beetles. (ix.), Bacterium found in Hashab gum.

LABORATORY MANUAL OF DYEING AND TEXTILE CHEMISTRY. By J. MERRITT MATTHEWS, Ph.D. John Wiley and Sons, New York, U.S.A. 1909. Price \$3.50. Chapman and Hall, Ltd., London. Price 15s.

Svo volume, containing 349 pages of subject matter, and an alphabetical index. Pages 325 to 349 are devoted to an appendix, chiefly containing tables, technical calculations, etc. The subject matter is classified and grouped as follows:—**I.** Chemical study of the fibres. **II.** Scouring textile fibres. **III.** and **IV.** Bleaching of wool and cotton. **V.** Classification of dyestuffs. **VI.** Application of acid dyestuffs. **VII.** Testing the fastness of colours. **VIII.** Application of basic dyestuffs to wool, silk, and cotton. **IX.** Representative basic dyestuffs. **X.** Application of substantive dyestuffs to cotton, wool, and silk. **XI.** Application of mordant dyestuffs to wool. **XII.** Developed dyestuffs on cotton and silk. **XIII.** Sulphur dyestuffs on cotton. **XIV.** Use of logwood in dyeing. **XV.** The minor natural dyestuffs. **XVI.** Mineral dyestuffs. **XVII.** Vat dyes. **XVIII.** Testing dyestuffs, and their reactions. **XIX.** Miscellaneous dyeing tests. **XX.** Testing the fastness of colours. **XXI.** Analysis of textile fabrics.

TRAITE COMPLET D'ANALYSE CHIMIQUE APPLIQUEE AUX ESSAIS INDUSTRIELS. Par J. POST et B. NEUMANN. Avec la collaboration de nombreux chimistes et Spécialistes. Deuxième édition française entièrement refondue. Traduite d'après la troisième édition allemande et augmentée de nombreuses additions. Par le Dr. L. GAUTIER. Tome premier. Troisième Fascicule. Librairie Scientifique A. Hermann et Fils, rue de la Sorbonne, 6, Paris. 1909. Price 8.50 fres.

Svo volume, containing 860 pages of subject matter, and 45 illustrations. Forming part iii. of the entire work, the whole of this volume is devoted to Chapter IX., which treats of the following metals, their ores, extraction, details as to sampling, analysis, etc. A. Iron. B. Metals other than iron, and comprising: (i.), Copper. (ii.), Lead. (iii.), Silver. (iv.), Gold. (v.), Zinc. (vi.), Cadmium. (vii.), Nickel and cobalt, and alloys of nickel. (viii.), Tin and alloys of tin. (ix.), Bismuth and its alloys, etc. (x.), Antimony and its alloys. (xi.), Arsenic. (xii.), Mercury and amalgams. (xiii.), Aluminium and alloys (xiv.), Platinum. (xv.), Chromium. (xvi.), Tungsten. (xvii.), Uranium. (xviii.), Vanadium. (xix.), Molybdenum.

PATENTS, DESIGNS AND TRADE MARKS. TWENTY-SIXTH REPORT OF THE COMPTROLLER-GENERAL. 98. Price 2½d.

This report deals with the work of the Patent Office during the year 1908. The number of applications for patents and for registration of designs and trade marks during that year, as compared with the two preceding years, is shown by the following table:—

	1906.	1907.	1908.
Patents—			
Applications	30,030	28,915	28,598
Specifications—			
Provisional	21,025	19,568	19,495
Complete	18,243	18,829	17,746
Sealed	14,707	16,272	16,284
Designs—			
Applications	22,001	24,928	24,907
Registered	21,212	24,039	24,389
Trade Marks—			
Applications	11,414	10,796	10,645
Registered	4,731	6,255	5,965

EAST INDIA (TRADE). TABLES RELATING TO THE TRADE OF BRITISH INDIA WITH BRITISH POSSESSIONS AND FOREIGN COUNTRIES, 1903-4 TO 1907-8. [Cd. 4595.] Price 1s. 1d.

ORDER IN COUNCIL MAKING REGULATIONS UNDER SECT. 2 OF THE POISONS AND PHARMACY ACT, 1908, AS TO THE SALE OF CERTAIN POISONOUS SUBSTANCES FOR AGRICULTURAL AND HORTICULTURAL PURPOSES. Statutory Rules and Orders, 1909, No. 345. Price 1d. (See this J., April 15, 1909, p. 382.)

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

8714. Coplans. Centrifugal separator for filtering liquids. April 13.
 8841. Cowper-Coles. Furnaces. April 14.
 8943. Wedge. Furnaces. [U.S. Appl. April 16, 1908.]* April 15.
 8958. Moscicki. Bringing liquids into intimate contact with gases or vapours. [Swiss Appl. June 1, 1908.]* April 15.
 9072. Porter. Dehydrating apparatus.* April 16.
 9230. Jeffcock and Yardley. Separator for treating gaseous or liquid bodies. April 19.
 9493. Johnson. Apparatus for screening, cleaning, and separating materials with different specific gravities. April 21.
 9672. Mercer. Washing or mixing apparatus. April 23.
 9691. Lymn. Process for dehydrating peat. April 23.
 9698. Leaver, and Brittany China Clay Co. *See under VIII.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 7841 (1908). Churchill. Classifiers for materials of different specific gravities. April 21.
 8821 (1908). Diederichs. *See under V.*
 10,442 (1908). Burstall. *See under II.*
 10,854 (1908). Schmatolla. Gas-fired shaft furnaces. April 21.
 14,693 (1908). Black, Lennox, and Lennox. Apparatus for cleaning or washing smoke and for inducing draught. April 21.
 4684 (1909). Seck. Separating and sorting materials. April 28.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

8914. Fabry. Extraction of sulphuretted hydrogen from the gases evolved by coal distillation. April 15.
 8920. Fabry. Horizontal coke ovens.* April 15.
 8940. Hill and Westwood. Apparatus for making a combustible heating and illuminating gas. April 15.
 8968. De St. Laurent, and Pollux Synd., Ltd. Manufacture of incandescent gas mantles. April 15.
 8969. De St. Laurent, and Pollux Synd., Ltd. Production of light. April 15.
 9076. Lewis. Arc lamp electrodes. April 16.
 9339. Cliff and Williamson. Manufacture of gas retorts. April 20.
 9405. Baglin. Coke ovens. April 21.
 9445. Soc. Anon. d'Ongrée Marilhaye, and Eloy. Coke ovens or furnaces.* April 21.
 9798. Menz. Process for compressing coal gas. [Swiss Appl. April 25, 1908.]* April 24.

COMPLETE SPECIFICATIONS ACCEPTED.

- 8524 (1908). Botley and Cutler. Gas generating plants. April 28.
 10,442 (1908). Burstall. Apparatus for extracting tar, dust, etc., from gases. April 21.

- 14,292 (1908). Fielding. Gas producer. April 21.
 14,604 (1908). Bolz. Gas generating furnace. April 21.
 16,614 (1908). Lake (International Gas Development Co.). Process of making gas. April 21.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

8938. Newton (Bayer und Co.). Manufacture of trisazo dyestuffs. April 15.
 8939. Newton (Bayer und Co.). Manufacture of azo dyestuffs. April 15.
 9219. Newton (Bayer und Co.). Manufacture of vat dyes of the anthracene series. April 19.
 9220. Newton (Bayer und Co.). Manufacture of azo dyestuffs and process of developing them on the fibre. April 19.
 9689. Ransford (Cassella und Co.). Derivatives of carbazol and dyestuffs formed therefrom. April 23.

COMPLETE SPECIFICATIONS ACCEPTED.

- 8531 (1908). Imray (Soc. Chem. Ind. in Basle). Manufacture of vat dyestuffs. April 21.
 2918 (1909). Haas. Derivatives of carbazol and dyestuffs formed therefrom. April 21.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

8744. Alsop and Sibson. Circulating dyeing machine.* April 13.
 8829. Fox. Washing inflammable fabrics. April 14.
 9220. Newton (Bayer und Co.). *See under IV.*
 9307. Regordosa and Regordosa. Continuous dyeing of skeins.* April 20.

COMPLETE SPECIFICATIONS ACCEPTED.

- 7972 (1908). Hübner, and Riley and Co. Waterproof and lustrous cloth or other fabric and its production. April 21.
 8620 (1908). Ashton, and Calico Printers' Assoc. Printing textile fabrics. April 21.
 8821 (1908). Diederichs. Apparatus for treating textiles and for mixing chemicals, etc., with liquids. April 28.
 13,790 (1908). Imray (Meister, Lucius, und Brünig). Manufacture of fatty acid compounds with aldehydes and ketones, and their application in colour printing. April 21.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

8992. Bass. *See under XX.*
 9132. Humphrey, and Brimsdown Lead Co. Apparatus for making litharge and other metallic oxides. April 17.
 9145. Cie. Indus. des Alcools de l'Ardèche. Recovery of sulphurous acid from solutions. [Fr. Appl. June 18, 1908.]* April 17.
 9394. Schlossberg. Manufacture of acid- and fire-proof bodies consisting of pure silicic anhydride.* April 20.
 9618. Ashcroft. Concentration and evaporation of caustic alkali solutions.* April 22.

COMPLETE SPECIFICATIONS ACCEPTED.

- 19,656 (1908). Schulthess. Method and apparatus for slaking lime. April 28.
 21,959 (1908). Moscicki. Production of oxides of nitrogen by means of a rotary flame. April 21.
 21,823 (1908). Steynis. Apparatus and process for producing ozone. April 28.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

8974. Thomson. Manufacture of glass from cheap material. April 15.

9698. Leaver, and Brittany China Clay Co. Apparatus for separating particles of different specific gravity, particularly for treating china clay. April 23.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

8754. Lockwood. Manufacture of artificial stone. April 13.

9207. Goddard. Concrete. April 19.

9229. Landgraf. Treatment of cement, ores, etc., in the rotary furnace.* April 19.

9381. Haddan (Meramec Portland Cement and Material Co.). Waterproof Portland cement and process for making same.* April 20.

COMPLETE SPECIFICATION ACCEPTED.

8307 (1908). Eggenhöfner and Sbertoli. Magnesia cements. April 21.

X.—METALS AND METALLURGY.

APPLICATIONS.

8773. Talbot. Utilising iron oxides and certain slags in the manufacture of iron and steel. April 13.

8778. Schoop. Welding objects of aluminium or aluminium alloys. [Addition to No. 24,283 of 1907.]* April 13.

8781. British Thomson-Houston Co. (General Electric Co.). Manufacture of rods or filaments of refractory metal. April 13.

8834. Wales. Alloys of iron, particularly for armour plates.* April 14.

8835. Wales. Treatment of armour plates, etc.* April 14.

8842. Simpson and Oviatt. Direct production of steel from the ore. [Comprised in No. 5802, March 10, 1909.] April 14.

8970. De St. Laurent, and Pollux Synd., Ltd. Alloys. April 15.

9091. Kelsey and others. Treating zinc for use in solder, etc. April 17.

9108. Peyton. Hardening steel or other metals. April 17.

9158. Weeks. Apparatus for calcining, desulphurising, agglomerating, and sintering ores, etc. [U.S. Appl. April 18, 1908.]* April 17.

9163. Simpson and Oviatt. Direct production of iron and steel from the ore. April 17.

9229. Landgraf. *See under IX.*

9286. Kelsey and others. Soldering aluminium and other metals. April 20.

9287. Kelsey and others. Alloy suitable for casting. April 20.

9300. Martin. Separating complex ores or their products. April 20.

9397. Levy. Extracting tin, arsenic, etc., from hard-head, tin smelters' products, etc. April 21.

9508. Greene. Refining metals and alloys.* April 21.

9614 and 9615. Sulman, and Metals Extraction Corporation. Treatment of ores and mineral substances. April 22.

COMPLETE SPECIFICATIONS ACCEPTED.

5244 (1908). Clinch-Jones. Annealing metals. April 21.

12,258 (1908). Hugot. *See under XI.*

12,825 (1908). Down and Morgan. Rotary roasting furnace. April 21.

18,680 (1908). Lessing. Briquetting ore with blast-furnace slag. April 28.

19,163 (1908). Haddan (Eccleston). Ore concentrators. April 28.

24,244 (1908). Schneider et Cie. Treatment of steels. April 28.

24,685 (1908). Potter. Working manganese steel. April 21.

28,081 (1908). Kurz. Manufacture of leaf metal, particularly leaf gold. April 28.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

8734. Backus. Electroplating apparatus. [U.S. Appl. April 13, 1908.]* April 13.

8863. Walton. Manufacture of a composition for electric insulating. April 14.

9796. Bradley and Williams. Electrolytic cells. April 24.

COMPLETE SPECIFICATIONS ACCEPTED.

5214 (1908). Jungner. Galvanic gas batteries. April 21.

5223 (1908). Jungner. Galvanic gas elements. April 21.

12,258 (1908). Hugot. Electric furnaces for the manufacture of steel. April 21.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

8768. Finlay. Manufacture of wax for candles, etc.* April 13.

8982. Welter. Making soaps containing solvents of fat.* April 15.

9441. Nauton frères et de Marsac, and Tesse. Saponaceous neutral paste. [Fr. Appl., March 10, 1909.]* April 21.

9590. Bloxam (Jacobi). Apparatus for cooling soap. April 22.

9802. Brown. Manufacture of soap. April 24.

COMPLETE SPECIFICATION ACCEPTED.

9096 (1908). Pritchard. Apparatus for making soap. April 28.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

8686. Profes. Paints.* April 13.

8967. Luciani and Battesti. Apparatus for the manufacture of artificial ultramarine. [Fr. Appl., April 15, 1908.]* April 15.

COMPLETE SPECIFICATIONS ACCEPTED.

15,921 (1908). Newton (Bayer und Co.). Preservative compositions. April 28.

18,616 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of pigments or lakes. April 21.

(B.)—RESINS, VARNISHES.

APPLICATION.

8882. Hollinger. Production of linoleum imitating wood.* April 14.

(C.)—INDIA-RUBBER.

APPLICATIONS.

9284. Markus. Utilisation of waste rubber. April 20.

9794. Blaisdell. Manufacture of a unified mass of strained rubber. April 24.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

APPLICATIONS.

8960. Johnson (Chem. Fabr. Elektro). Manufacture of compositions for use in dressing leather. April 15.

9383. Buffum and Carter. Waterproof leather board. [Addition to and comprised in No. 28,219, Dec. 28, 1908.]* April 20.

XVI.—SUGAR, STARCH, GUM, Etc.

APPLICATIONS.

9148. Grière. Direct conversion of sugar syrups into crystallised sugar. [Belg. Appl., April 25, 1908.]* April 17.

9370. Paira, and Administration der Minen von Buchsweiler. Production of soluble starch.* April 20.

XVII.—BREWING, WINES, SPIRITS, Etc.

APPLICATIONS.

9157. Anker. Storage and fermentation vessels. April 17.

COMPLETE SPECIFICATION ACCEPTED.

1269 (1909). Melhuish. Treatment of malt liquors. April 21.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

9440. Ikeda and Suzuki. Preparation of a nutritive and flavouring substance.* April 21.

9537. Epstein. Treatment of cocoa and chocolate. April 22.

9682. Johnson (Chem. Fabr. vorm. Goldenberg, Geronmont, und Co.). Manufacture of baking powders. April 23.

9716. Little. Treatment of flour. April 23.

COMPLETE SPECIFICATIONS ACCEPTED.

5155 (1908). Hogarth. Treating and conditioning cereals and their products and other alimentary substances. April 28.

9691 (1908). Beck and Angermüller. Treating grain preparatory to and in milling. April 21.

11,653 (1908). Schwartz and Schwartz. Manufacture of aerated beverages. April 28.

19,455 (1908). Rousseau. Cream preparation. April 21.

(B.)—SANITATION; WATER PURIFICATION.

COMPLETE SPECIFICATIONS ACCEPTED.

15,570 (1908). Storey. Treatment of vapours from refuse destructors, etc. April 21.

27,272 (1908). Marks (Oliver-Roche Co.). Water purifying apparatus. April 21.

XIX.—PAPER, PASTEBOARD, Etc.

APPLICATIONS.

8945. Lederer. Manufacture of sheets or objects from cellulose acetate.* April 15.

9340. Pasmore and Gilroy. Manufacture of adhesive art or coated papers. April 20.

COMPLETE SPECIFICATION ACCEPTED.

28,538 (1908). Ratignier, and Pervillac et Cie. Manufacture of pellicles or films. April 28.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

8992. Bass. Mixing machine for manufacturing citrate of lime. April 16.

9128. Smythe and Smythe. Prophylactic kolloid. April 17.

COMPLETE SPECIFICATIONS ACCEPTED.

13,790 (1908). Imray (Meister, Lucius, und Brüning). *Silinder V.*

22,132 (1908). Justice (Boehringer Sohn). Salts of sulpho acids of guaiacol carbonate. April 21.

XXI.—EXPLOSIVES, MATCHES, Etc.

APPLICATION.

8962. Pay and Goodricke. Manufacture of explosives. April 15.

COMPLETE SPECIFICATION ACCEPTED.

20,214 (1908). Palmer. Explosives. April 28.

XXII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATIONS.

9368. Barron (Moir). Colour screens for detecting potassium. April 20.

9518. Brenot. Apparatus for analysing gaseous mixtures and recording the result. [Fr. Appl., April 22, 1908.]* April 21.

Journal of the Society of Chemical Industry.

No. 10, Vol. XXVIII.

MAY 31, 1909.

No. 10, Vol. XXVIII.

Liverpool Section.

Meeting held at the University on Wednesday, March 10th, 1909.

DR. JAMES T. CONROY IN THE CHAIR.

I. THE COMPOSITION OF SHEA BUTTER.

BY JAS. E. SOUTHCORBE, M.Sc.

On the Continent of Europe recently considerable attention has been directed to the utilisation of shea butter both as a foodstuff and as a raw material for soap and candle making, the high titre of the fatty acids rendering it peculiarly valuable in the latter industry, while it has been found possible to use it with considerable success for soap-making when mixed with from 10 to 30 per cent. of other oils.

While these technical investigations have been diligently pursued, the chemistry of the fat appears to have received but little attention, and so far as the author is aware, no attempt has been made to elucidate its composition since the publication of Stohmann,* who gives for the composition of the fat seven parts of tristearin to three of triolein, but it has been pointed out by Lewkowitsch that these figures are not in accordance with the iodine value of the fat determined by several investigators.

The writer, having recently had several samples of the nuts and fat for examination, has made a study of the composition of the fat.

Two varieties of *Bassia Parkii* are known, the fruit of which yields fats of slightly different properties, viz., shea nuts and kariti nuts. The fats from these different varieties are frequently spoken of indifferently as shea butter, but the constants of the respective fats present marked differences.

Analyses of samples of kariti and shea nuts from different sources give the following figures:—

Source.	Yield of fat.	Melting point.	Saponification value.	Iodine value.
	Per cent.	° C.		
Kariti.. Soudan	35.0	27	177.1	66.0
" .. —	32.7	25	175.3	67.1
Shea .. Bida, Nigeria	53.6	30	183.4	56.2
" .. S. Nigeria	49.8	27-28	173.9	54.8
" .. —	51.3	30	177.5	57.5

In the author's experience the kariti nut always yields considerably less fat of lower melting point and higher iodine value than the shea nut. The sample used for this investigation was native prepared and contained 0.6 per cent. of moisture and 2 per cent. of foreign matter (sand, fibre, &c.).

The following table gives the analytical data for the sample:—

Sp. gr. 98-99° C.	Melting point.	Solidifying point.	Acid value.	Saponification value.	Iodine value.	Hegner value.	Reichert-Meissl value.
0.861	29° C.	20-21° C.	26.17	178.7	57.6	93.8	1.15

Attempts were made, in the first instance, to separate the glycerides by fractional crystallisation and a quantity of tristearin was isolated in a fairly pure condition, but no satisfactory quantitative separation could be effected. Accordingly the purified fat was saponified, the resultant soaps dried and treated with petroleum ether, when 3.8

per cent. of a fragrant resinous unsaponifiable matter was extracted. The sodium soaps were decomposed with lead acetate, and the resulting lead salts treated with ether by the process of Ruggieri and Tortelli. The soluble lead salts yielded liquid acids absorbing 90.6 per cent. of iodine, and on oxidation with alkaline permanganate were converted wholly into dihydroxystearic acid, no sativic acid being detected. The solid acids melted at 52-57° C., absorbed 3.2 per cent. of iodine, and had a molecular weight of 275. 25 grms. were dissolved in the minimum quantity of alcohol at 0° C. and fractionally precipitated with magnesium acetate.

The free acids from the magnesium soaps gave the following figures:—

Fraction.	Weight.	Melting point.	Mol. weight.
	Grms.	° C.	
1	5.4	68-68.5	287
2	6.1	65-67	280
3	7.0	59-60	270

The residue fractionally crystallised from alcohol yielded a further quantity of stearic and lastly a small amount of lauric acid (m. pt., 43-44° C.; mol. wt., 210).

A determination of stearic acid in a separate portion of the solid acids gave the value 90.5, and as no palmitic acid was detected the solid acids must consist of about 4 to 5 per cent. of lauric acid and 90.5 per cent. of stearic acid contaminated with oleic acid.

From the foregoing it would appear that the insoluble acids in shea butter are oleic, stearic, and lauric, with a possible small quantity of linolic, and accordingly from the iodine value of the mixed fatty acids we are able to calculate the approximate percentage composition, viz.:—Oleic acid, 60 per cent.; stearic acid, 30-35 per cent.; lauric acid, 3-4 per cent.

Several samples of the fat examined were distinctly rancid, possessing a disagreeable odour and taste which was not completely removed by washing with alkali. Shea butter as imported into this country would appear to be particularly liable to oxidation in this way, since the crude methods of extracting the fat practised by the natives leaves a considerable quantity of nitrogenous matter in the bulk. It is interesting in this connection to note that there is a perceptible rise in the percentage of volatile fatty acids in butter which has been stored for some time.

Samples of crude and purified butter were allowed to stand for some months in the laboratory in open vessels. The following table shows the rise in Reichert-Meissl value:—

	Crude fat.	Purified fat.
Fresh	1.10	0.75
Two months later	1.56	0.90
Four months later	1.8	0.90

The author begs to thank the committee of the Institute of Commercial Research in the Tropics, and Prof. B. Moore, of the Bio-Chemical Department, Liverpool University, for kindly placing facilities for this research at his disposal.

II. ANALYSIS OF THE OIL FROM THE SEEDS OF *SYMPHONIA GLOBULIFERA*.

BY J. E. SOUTHCORBE, M.Sc.

The seeds are obtainable in considerable quantity in South America. They are ovoid in shape, about 1-2 in. long and $\frac{3}{4}$ -1 in. broad. The interior of the seed is mottled yellowish white when fresh, but darkens on long standing. On extraction with petroleum ether the seeds

* See Muspratt's Chemistry, 4th Edition, Vol. 3, 574.

yield a dark reddish-coloured fat possessing the following characters:—

Sp. gr. 99-100 °C.	Melting point.	Acid value.	Saponi- fication value.	Iodine value.	Hehner value.	Reichert- Messeel value.
0.8849	35 °C.	10.1	194.6	64.2	94.3	1.00

Mixed fatty acids.

Sp. gr. 99-100 °C.	Melting point.	Solidifying point.	Iodine value.	Unsapo- nifiable matter.
0.891	48-50 °C.	46 °C.	64.8	Per cent. 1.1

DISCUSSION.

In reply to some questions, Mr. SOUTHOMBRE said the natives extracted the fat by macerating the nuts with hot water and skimming off the fat from the surface, in which process it naturally became contaminated with leaves, pulp, etc. He had not been able to make any exhaustive examination of the unsaponifiable matter, but it was a whitish resinous mass possessing a fragrant odour resembling vanilla, and yielded a small quantity of volatile oil on distillation. It might possibly be interesting to examine it further, but so far as the utilisation of the fat as a foodstuff was concerned, the presence of the unsaponifiable matter would not be objectionable in the least.

London Section.

Meeting held at Burlington House on Monday, March 1st, 1909.

DR. J. LEWKOWITSCH IN THE CHAIR.

SOME REQUIREMENTS OF A COLOUR STANDARD.

BY JOSEPH W. LOVIBOND.

Colour standards must be available for use under ordinary daylight conditions, and for determining the colour of liquids, solids, or gases they may be either fixed points or scales, but scales have a much wider range of application. The character of the light used in preparation must be defined, both for intensity and composition. The angle of incidence of the light must be defined, and also the distance of the eye from the object of vision, the latter on account of the intensity of the light reflected, the former as causing variations in colour and intensity.

In order to standardise the sensation of colour it must be correlated to a physical colour-constant, for which the following have been suggested, and used with more or less success:—The solar spectrum, the spectrum of the arc light, the colours of diffused daylight, pigments, chemical solutions. The solar spectrum naturally suggests itself as a standard, and at first appears to be promising; practical work, however, discloses so many complications that up to the present no satisfactory results have been arrived at. It does not furnish a workable area uniform in colour over its whole surface; the source of light must be intense, and no intense light has yet been found sufficiently constant, either in intensity or in colour-ray composition; spectrum colours are only fully distinguishable in a specially darkened room, whereas everyday work must be carried on in daylight.

The range of spectrum colours is limited in two directions compared to the range of daylight colours, in that it has no representation of mixtures of red and violet which really form one-sixth of the daylight colour cycle, and, secondly, only one combination is possible for any two overlapping monochromes of a given wave length.

The spectra of incandescent vapours may possibly prove to be constant as standards for definite colours, but work up to the present is not very hopeful.

Pigments may ultimately furnish reliable colour standards, and the mechanical difficulties of uniformity in chemical composition, in grinding, in media, and in the manner of presentation, may be overcome, but there remain other complications. Few pigments are sufficiently pure to represent true monochromes, the reds in most cases being tinged with violet or orange; the yellows with orange or green; and the blues with green or violet, the proportions varying with each density.

In all questions of mixing pigmentary standards, corrections are required for variations in the natural colour depth of different pigments, in order to bring them into equivalence. In water colours, for instance, one of the deepest reds (carmine) registers 19 red units; the deepest yellow (demon yellow) only 9 yellow units; and the deepest blue (cobalt) 12 blue units; these numbers are only approximate, as they vary more or less by every maker, and at times in different samples by the same maker.

Comparisons with pigments are not readily made with transparent liquids or gases, and the colours of pigments are not sufficiently stable for a lengthened period.

Chemical solutions are already used as colour standards for specific purposes, but the colour variations are too limited for wide application. They have, however, proved of service for many specific purposes, and in verifying the equivalence of tintometrical colour scales.

The colours developed by the selective absorption of diffused daylight have, up to the present, proved the most reliable as colour standards, but some precautions are required in order to insure constancy in reading.

The use of direct sunlight in colour comparisons is known to lead to confusion, for apart from variations in intensity, there are quality variations at different seasons, and at different times of the day. The colours developed by direct sunlight are also not in accord with those developed by the same light after diffusion.

No artificial light has yet been found sufficiently reliable as a standard light for colour comparisons, being subject to some of the disabilities of direct sunlight, though some applications of a limited character have been obtained by modifying the light of a standard candle, such as the measurement of fog densities, and that of other lights below the intensities of ordinary daylight.

Diffused daylight as an illuminant is free from most, if not all, the disadvantages of direct lights, and has the distinct advantage, that whilst one part of the impinging beam illuminates the object, another part illuminates the colour standards. The work already done leaves but little doubt that, in reading colour sensations for record, constancy is obtainable by observing certain conditions, all of which appear to be within the limits of definition. The principal points to be defined are the intensity of the light, the angle of incidence, and the degree of diffusion.

Among the conditions of observation are:—Variations in light intensity, limitations of angle of light incidence, and of degree of diffusion, and limitations in distance between the eye and the object and in time of observation.

By variations in light intensity, the variations incident to direct lights as such are not meant, but the variations due to the preponderance of white light as a component of a coloured beam. Theoretically, the smallest proportional variation comes within the range of argument, but the discriminating power of the human vision is limited, with the result that there is a considerable range of proportional variations in light values, which appear to be constant to the eye.

In order to define these limitations, measurements were first made of the six water colour pigments, red, orange, yellow, green, blue, and violet, in a diffused daylight of 26 units intensity as reflected from the standard white surface, then with decreasing intensities of the same light, which was regulated through a conical rectangular hopper tapering from 2 feet to 2 inches square. The small end was brought sufficiently close to the object, as to exclude side lights. The wide outer end was fitted with shutters, for reducing the light intensities by limiting the area of aperture.

TABLE A.—*Influence of light variations on constancy of colour readings.*

Light area.	Light intensity.	Red. "Carmine."	Yellow. "Lemon."	Blue. "Cobalt."	Orange. "Chrome."	Green. "Emerald."	Violet. "Fr. Mauve."
Sq. ins.	Units.	Red. Or. Blk.	Yel. Or.	Blue. Vio. Blk.	Or. Red. Light.	Gr. Yel. Light.	Vio. Red.
	26	16.9 + 1.1 —	7.0 —	10.5 + 0.5 + —	6.0 + 3.2 + —	6.6 + — + 0.05	7.2 + 2.8
12	22	16.9 + 1.1 —	7.0 —	10.5 + 0.5 + —	6.0 + 3.2 + 0.05	6.6 + — + 0.2	7.2 + 2.8
10	20	16.9 + 1.1 + —	7.0 —	10.5 + 0.5 + —	6.0 + 3.2 + 0.05	6.6 + — + 0.2	7.2 + 2.8
8	16	16.9 + 1.1 —	7.0 —	10.5 + 0.5 + —	6.0 + 3.0 + 0.05	6.6 + — + 0.2	7.2 + 2.8
6	14	18.95 + 0.50 + 0.46	6.9 + 0.1	10.7 + 0.2 + 0.1	6.2 + 3.0 + —	6.4 + — + 0.05	7.2 + 3.0
4	11	19.1 + 0.4 + 0.5	6.9 + 0.1	11.5 + — + —	6.0 + 3.4 + —	6.4 + 0.2 + 0.05	7.4 + 3.0
2	10	20.2 + 0.3 + 0.5	6.9 + 0.1	11.5 — — —	6.0 + 3.4 + —	6.4 + 0.2 + 0.05	7.4 + 3.0

The results on Table A show the colour readings to be constant until the light intensity is reduced to 16 units by the 8 inch square aperture. These limitations between 26 and 16 units fairly accord with those between 28 and 18 already observed in laboratory practice. After 16 units intensity the readings vary, but at different rates for the several colours, each colour having an idiosyncrasy of its own.

The proportion of incident light reflected to the eye from a flat surface varies with the angle of incidence. This also applies to colour rays developed by selective absorption, but the rate varies for different colours, as shown by the curves in Diagram B. The nature of the

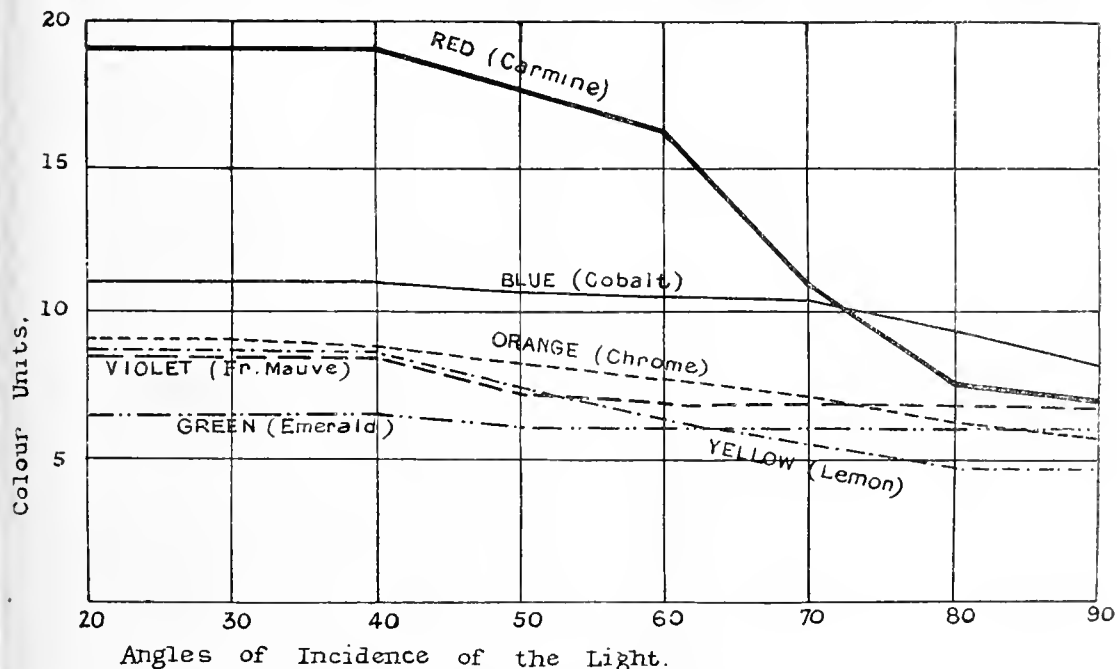
show that the readings were uniform for all the colours between the perpendicular and 40 degrees, after which each had a rate of loss specific to itself down to an angle of 70 degrees when the object passed out of view.

As this is only a preliminary experiment and the first of its kind, it will be unwise to draw definite conclusions, but it may be remarked that the rate of decrease varies for each colour. Green, for instance, after losing 15-hundredths of a degree between the angles of 20 and 40, continues unaltered until it passes out of vision.

By degree of diffusion, is meant sunlight after it has been subject to numberless natural reflections, refractions, dispersions, and absorptions before impinging on a surface

TABLE B.

Colour Measurements of Six Water Colour Paints with Diffused Daylight at different Angles of Incidence.



surface also has an influence in determining the colour proportions of the beam, and, therefore, care was taken that the pigmentary surfaces were of similar smoothness. These facts made it necessary to find the angle limitations which gave uniform readings. Experimental work has already determined that an inclination of 15 degrees of the optical instrument to the objective surface gave constant results, and also that slight variations from this caused no disturbance. In order to define the angle limitations more precisely, the following set of observations were made:—Six water colour pigments were prepared as already described for diffused light, and measured under a diffused light of 26 units, the angle variations being made by altering the inclination of the optical instrument. The results are plotted in curves on Table B. The curves

already screened from the direct rays. It was for a time considered that such a light when taken from the north, or from opposite the sun's meridian, and of a luminous intensity between 18 and 28 units, was constant for colour comparisons. This, whilst generally true, requires qualification, as some substances are sensitive to colour changes within narrower limits than these, especially when in a bright sunlight passing clouds reflect varying proportions of direct rays to the object.

Ten inches is the best average distance between the object and the eye, but the ordinary distance at which the observer holds a book is a factor to be considered.

On continuously viewing a colour, the nature of the sensation excited changes as time goes on: this makes it necessary to establish a time limit for the observation

of colour standards. I find 3 seconds' observation for dark colours and 5 for light colours to be the extreme limits in practice, but I am led to believe that the ideal time varies for the different colours, by finding that continued observation increase the sensibility for all colours, but at widely different rates, being the greatest for red, and the least for yellow.

The standard colours are derived from a white light, in such a condition that it excites no special colour sensation in the vision at any degree of intensity; when in that condition it is composed of the six colour rays, red, orange, yellow, green, blue, and violet in equal proportions, and is termed "Normal white." On any departure from this condition of colour-equivalence, the light becomes abnormal or coloured, the colour being that of the one or two preponderating rays, and the depth of colour being in proportion to their preponderance. To measure a given colour, a beam of normal white light is analysed to correspond to the colour, by means of a set of scales of selective colour absorbents, which are colour-constants by having been co-related to freshly prepared pure chemical solutions; they then comply with the essentials of a scientific scale, in that the divisions are equal, and the unit recoverable.

Besides the curves descriptive of colour measurements under different angles and conditions, the author produced a coloured illustration comparing the solar spectrum with Rood's diffraction spectrum and a circle of graded tints showing the "Tintometer cycle of colour constants."

DISCUSSION.

The CHAIRMAN congratulated Mr. Lovibond upon having found a quantitative expression for colour sensation in his tintometer, an apparatus which had acquired great practical importance. It was now used in the United States as a basis in cotton-seed oil transactions, and was the only apparatus relied upon. It had not yet become the custom in this country to buy cotton-seed oil on the basis of colour, as expressed by units of the tintometer scale, but on the Continent, this oil was already sold by this standard. They were aware that also in other industries the tintometer was largely used.

Mr. JULIAN L. BAKER said Mr. Hulton and himself (this J., 1906, 552) had critically examined the results afforded by the Lovibond tintometer, because in the malting industry it was now customary to buy malt on certain standards, one being the colour of the hot aqueous infusion. They found, as others probably had found, that buyer and seller did not always agree, but they were able to narrow down the differences to the position of the instrument in relation to the source of light, and to lay down fairly well defined conditions under which it would be possible for different observers to obtain approximately the same results. He understood that Mr. Lovibond had further perfected his instrument by devising a standard light; and he was hoping they would have heard something about it.

Mr. GRANT HOOPER asked if the author said that it was necessary to provide an adjustment for focussing in making observations. At the present time the instrument in general use had no such arrangement and the determinations were made at a fixed distance. Had the author made any progress in what might be called a neutral colour? On each occasion when the question had arisen before, it had been pointed out, and he thought generally agreed, that an exact comparison of two different colours which were not of the same brightness could not be made. The practical point to be solved in connection with the use of this instrument therefore seemed to him to be the production of a neutral tint which would permit of the colours being dulled to the same extent so that the comparison could be made under equal intensity of light. This was now done by a combination of glasses, but a single neutral tint glass which, though theoretically it produced no colour, yet did actually diminish the brightness, was desirable. There was undoubtedly a difference in the sensitiveness of the eyes of different persons, and one could not expect that two observers with a different natural appreciation of colour would arrive at precisely the same result. This of course did not imply any defect in the instrument.

Mr. LOVIBOND said that was impossible. He should like Mr. Hooper to describe the position of the laboratory in which the discrepancies he referred to occurred. If one got too far within the laboratory, so that the light became complicated by broken side lights, there was confusion at once, and the vision of individuals would from some unknown cause differ; but given a proper amount of light and the same conditions of observation, he thought his experience was sound. Reliable work could be done with daylight between 16 and 26 units. In his book he said between 18 and 28, as reflected from the standard white surface. The direct daylight used was about 9 units stronger, because about 9 units were lost in the reflection. It was a very poor daylight that was below 16 units, even on a dull winter's day.

Mr. GRANT HOOPER said that Mr. Lovibond's experiments seemed to be a little more fortunate than his own. He had known in the same laboratory and under the same conditions of light, two or three different observers to get slight differences. He wanted to clear the ground as it were, so that those differences though small in amount should be recognised as a margin of error which might be expected and which should be taken into account with the object of avoiding controversy.

With reference to the neutral tint glass, it had to be borne in mind that in comparing the colour of a liquid under the best conditions of light available it was often found that when the colours had been closely matched there was still a difference which bothered one. The two were not equally bright, but by putting in a combination of colours producing a neutral tint an exact comparison became possible. He suggested that something might be done in the way of developing a series of compound glasses giving neutral tint by which the degree of brightness could be brought down to that of the solution with which one had to deal.

Mr. LOVIBOND, in reply, said it was undoubtedly better to focus, but it was sometimes necessary to have it out of focus. For instance, when the surface to be examined was irregular, the colour of the elevations must necessarily vary from the colour of the depressions, in which case it was thrown as little out of focus as possible so as to unite the whole broken colours in one beam. That was a matter of practice; there were two or three ways of doing it: First, he had lenses of different *foci* to drop on the eye piece, but the readiest way was, to close the eyelids a little, and then a match could be made quite easily. The description of neutral tint as a pigment was scarcely a full explanation; neutral tint may rather be described as the difference between two normal white lights of different intensities, and is applicable wherever this difference exists, as well as in pigments of a dull character, it is easily measurable and is represented in the tables by numerals; all such colours were below the colour purity of the standards used. For colours brighter than standards a measurement is effected by the interposition of neutral tint glasses of known absorptive value which reduces the brightness to that of the standards, the unit values of the intercepting glasses are then considered as light units in contradistinction to the black factor of dull colours; for instance, the blue glass standards used are coloured by cobalt which has a spectrum absorptive band in the green, therefore bright greens more frequently require a light factor than other colours; he was not sure that this explanation was truly philosophical, but it was at least practical and definable. With regard to the difference in observers, he found that the people who passed through his laboratory were all normal (except, of course, the colour blind) after training, although some were longer learning than others; he thought that the noticed differences of colour perception between individuals was mainly, if not entirely due to want of colour education, or to physical differences in the conditions of observation. As an instance of the latter, he called to mind the colour matching experiments by means of mixed lights by Sir William Abney in the old days at the Society of Arts which passed the lecture room screen tests; he afterwards had an opportunity of repeating the experiments with the late Professor Hummel at the Yorkshire College. They found no difficulty in matching colours as at the lecture, the difficulty arose on changing

the position of the observer a little to either side, or forward or backward, when the colour no longer matched. If that held good in ordinary daylight observation, it would easily be understood that no two persons would agree exactly; because it was almost impossible that they could view under exactly similar conditions of position and light incidence. It was to overcome this difficulty that the optical instrument was designed. They were dealing with practically a new branch of science; and no quantitative colour work had been done until a colour sensation was correlated with a physical colour constant. Up to that point there was no possibility of precisely defining a colour sensation.

Meeting held at Burlington House on Monday, May 3rd, 1909.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE INDIAN MAGNESITE INDUSTRY.

BY H. H. DAINS, F.I.C.

The first idea of the possibility of starting a magnesite industry in India seems to have originated with Dr. Macleod, who experimented with the Salem magnesite and reported on it to the Government of India in 1826. He suggested the use of it as a substitute for imported cement. It is only within recent years, however, that work on anything like a large scale has been carried on.

The principal deposits lie in the "Chalk Hills," two miles from the town of Salem in the Madras Presidency, 200 miles west of Madras, and an equal distance from the port of Beypore on the West Coast. These ports are connected by the Madras Railway, which passes within a mile of the deposits. The magnesite covers a superficial area of about 2,000 acres and occurs in abundant irregular veins of unknown depth, which exceeds 60 ft. The veins intersect an ultrabasic intrusion of eruptive rock called dunite, after its prototype, native at the Dun Mountain, New Zealand.

This rock, which is ultra-basic on account of the absence of felspar and quartz, has undergone a series of remarkable mineral changes owing to the non-resistance of the unstable olivine to metamorphic influences. The change resulting in the formation of magnesite may be expressed somewhat as follows:—

*Dunite		
	Olivine	Chromite
(containing a little iron)		
	Serpentine	
(A number of varieties, e.g., Massive, Retinalite, and Picrolite)		
	Magnesite.	Chalcedony. Silica, etc.

* Report on the Magnesite Areas near Salem, by C. S. Middlemiss. (Geological Survey of India.)

	Greek magnesite.					American (Mineral Industry, 1902).	Hungarian.	Silesian.
	(J. Chem. Soc., Jan., 1903).	(Ferguson.)						
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Magnesia.....	46.09	45.75	—	—	—	—	—	46—48
Carbon dioxide.....	51.51	49.88	—	—	—	—	—	46—50
Magnesium carbonate.....	(97.60)	(95.63)	93.70	94.00	93.00	93.66	94.80	—
Silica.....	0.38	1.63	2.20	3.10	2.00	2.76	0.80	4.5—5.25
Lime.....	1.68	1.44	—	—	—	—	—	0.6—0.7
Alumina.....	0.15	0.17	0.10	0.80	0.50	—	1.10	—
Iron oxides.....	0.08	1.19	0.07	0.30	0.07	—	3.20	1.5
Calcium carbonate.....	—	—	4.02	1.98	4.49	2.78	0.10	—
Combined water.....	—	—	traces	0.65	0.40	—	—	—
Carbonate of iron.....	—	—	—	—	—	0.40	—	—

Analyses of dunite (sp. gr., 3.176).

	Per cent.
Silica	39.10
Magnesia	48.26
	87.36
Iron, alumina, manganese, chromium, moisture, etc. ..	12.64
	100.00

Dunite from Dun Mountain (Von Hochstetter).

	Per cent.
Silica	42.80
Magnesia	39.73
Ferrous oxide	9.40
(after the chromite had been removed).	

Oriental olivine (sp. gr., 3.351) (Dana).

	Per cent.
Silica	50.13
Magnesia	9.19
Ferrous oxide	—

Serpentine is found widely disseminated throughout the deposits associated with the magnesite, but for the most part in small quantities. The magnesite varies slightly in appearance and composition. The outcrops are of a greyish colour and intensely hard. Under the surface it becomes softer the greater the depth at which it is found, and in some cases where water has had access to the veins it can be almost dug out with a spade, and crumbles readily in the hand.

Generally the magnesite is almost perfectly white. It has a sp. gr. of 3.0 to 3.06, and a hardness of about 5.

The average mineral is of excellent quality, being exceptionally low in lime, silica, iron oxide, and alumina. It contains about 96—97 per cent. of magnesium carbonate, but picked specimens have given as much as 99 per cent.

Indian magnesite.

	Blount.	Dains.	Pattinson (cargo sample).	Ferguson.	
				1.	2.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Silica	0.22	0.29	1.17	0.31	1.70
Iron oxide	—	—	—	0.40	0.65
Alumina	0.30	0.65	0.14	0.10	0.10
Manganese oxide.....	—	0.20	0.06	—	—
Lime	Nil.	0.83	0.78	—	—
Magnesium oxide.....	47.35	46.42	46.28	—	—
Carbon dioxide.....	51.44	50.71	50.10	—	—
Combined water.....	0.27	0.16	1.30	0.60	traces
Sulphuric acid	—	—	0.03	—	—
Phosphoric acid	—	—	0.01	—	—
Magnesium carbonate.....	(98.79)	(97.13)	(96.34)	97.80	97.40
Calcium carbonate.....	—	—	—	0.85	trace
Alkalis	—	—	—	—	Nil
	99.58	99.26	99.87	100.06	99.85

Other sources of supply where magnesite is worked are Euboea in Greece, Styria, California, Canada, South Africa and Macedonia. The Greek magnesite most nearly approaches the Indian variety.

Magnesite in the raw state is used chiefly for the manufacture of carbon dioxide. In the United States of America, magnesite is very largely used for this purpose, the gas being obtained by calcination in retorts. The residue is sold to makers of refractory bricks by whom it is made up into bricks for basic furnaces. In some works the carbon dioxide is evolved by the action of sulphuric acid.

Calcined magnesite is of great commercial value. The

calcined material may be classed according to the temperature at which the calcination takes place, as: (a) lightly calcined, or caustic magnesia; (b) dead burnt, sintered, or shrunk magnesia. The caustic magnesia is obtained by calcining at a temperature of 800° C., and the process is best carried out in a gas-fired kiln. It is largely used for Sorel or oxychloride cements, fire-proof partitions, plaster, artificial stone, steam packing, flooring, grindstones, millstones, emery and polishing wheels, etc. At Salem the caustic magnesia was first obtained by calcination in ordinary lime kilns. These, however, gave an inferior product owing to the contamination with fuel ash. A regenerative gas-fired kiln has now been erected and is working satisfactorily, the material produced being a great improvement, both as regards colour and quality, on the old bottle-kiln material:—

Indian caustic magnesia.

	From old kilns.		Gas-fired kiln.		
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Loss on ignition	4.62	4.82	5.76	1.82	2.31
Silica	1.64	1.72	1.36	1.13	0.54
Insoluble residue	—	—	—	1.13	0.54
Oxide of iron and alumina	1.02	0.94	0.74	0.63	0.44
Lime	1.53	2.43	2.25	1.06	1.03
Magnesia	91.03	90.18	90.28	95.80	96.10
	99.84	100.09	100.39	100.44	100.42

The standard quality stipulated for by continental consumers at the Leipzig meeting, December, 1908, is 85—90 per cent. magnesia with the lime not exceeding 4 per cent., conditions which the Indian magnesia easily fulfils.

Sorel cement is formed by mixing the caustic magnesia with a solution of magnesium chloride of sp. gr. 1.162 to 1.263. This cement is very hard, white, and of great durability, and will carry up to 20 parts of sand for one of magnesia. When used with sawdust as an aggregate it makes a practically noiseless and dustless flooring.

Dead-burnt or shrunk magnesia is obtained by calcining at a temperature of not less than 1700° C. At Salem the calcination is done in a Schneider kiln, but it would be preferable to calcine in a gas-fired kiln to avoid contamination with the ash from the fuel. The product thus obtained is very basic, and has a sp. gr. of 3.5. It is free from carbon dioxide, and has practically no tendency to absorb water.

Indian dead-burnt.

	Schneider kiln.		Gas-fired kiln.
	Per cent.	Per cent.	Per cent.
Silica	4.92	5.59	4.38
Ferric oxide	2.74	2.20	1.02
Alumina	1.92	1.67	1.04
Lime	89.53	89.83	93.12
Magnesia	0.39	0.34	0.34
Loss on ignition	—	—	—
	99.50	99.63	100.00

The principal uses of dead-burnt magnesia are as a refractory lining for open-hearth furnaces and converters in the steel industry, for rotary kiln linings in Portland cement manufacture, for furnace hearths, crucibles, cupels, and refractory bricks. The most refractory dead-burnt magnesia is obtained from magnesite containing little or no lime, silica, oxide of iron, and alumina. The Indian magnesite is exceptionally low in these deleterious compounds.

The presence of much lime in magnesite bricks used for high temperatures causes them to disintegrate, and in basic steel furnaces is said to cause the phosphorus to pass into the hearth instead of the slag, the hearth thereby becoming "rotten." Silica, oxide of iron, and alumina are objectionable because they lower the fusing point.

For dead-burnt magnesia a high temperature of

calcination is required as it is absolutely necessary not only to drive off all the carbon dioxide but to thoroughly shrink the resulting magnesia.

Styrian magnesite is largely used for making refractory bricks, but it contains a high percentage of iron oxide.

Styrian dead-burnt.

	Per cent.	Per cent.
Silica	2.20	3.40
Iron oxide	7.70	7.60
Alumina	1.02	4.05
Lime	4.92	84.29
Magnesia	83.92	99.34
	99.76	99.34

Dead-burnt magnesia has replaced dolomite to a great extent in basic furnaces because it is not hygroscopic and can therefore be kept any length of time without deterioration whereas owing to the high percentage of caustic lime in dolomite this material rapidly deteriorates on exposure. Dolomite is useless after being once used and whereas 550 to 1100 lb. on an average of this calcined material is required for repairs after each open hearth heat, with dead-burnt magnesite only 110 to 220 lb. is required.

Experiments have been carried out in the calcination of the Indian magnesite on a large scale in electric furnaces. In this process the magnesia becomes partly fused, and the resulting product is a crystalline mass of thoroughly shrunk material having a specific gravity of 3.58. The crystals have the same well defined cubic cleavage as periclase—the natural crystalline magnesium oxide. This crystalline material has been used with much success as a wash and a lining in electric furnaces.

Bricks are usually made in this country by grinding the dead-burnt magnesite in an edge-runner mill, mixing with water in sufficient quantity to make a plastic mass, and moulding in an ordinary hand brick press. The bricks after careful drying are burnt in a high temperature kiln. Another process, however, is to grind the crude material and then add water to enable the crude to be moulded into bricks. These are then burnt and the resulting bricks, which are about half the volume of the original bricks, are then ground again, mixed with water, moulded and burnt. The usual practice on the continent is to mix the ground calcined material with tar, mould, place in a hydraulic press, and after drying burn in a gas-fired kiln. The volatile portions of the tar escape, leaving in the interstices a carbonaceous residue which binds the whole together.

Indian magnesite bricks (sp. gr., 3.58) (Westmoreland).

	(1).	(2).
	Per cent.	Per cent.
Silica	2.60	3.15
Ferric oxide	1.91	0.53
Alumina	1.53	0.23
Lime	93.94	94.28
Magnesia	—	—
	99.98	99.80

The exploitation of the Indian magnesite is as yet in its infancy, but with the immense quantities of such excellent mineral available there is only needed the erection of suitable plant on a sufficiently large scale to make this a very large and profitable business.

DISCUSSION.

Mr. E. GRANT HOOPER asked if the author had any experience in connection with the actual use of the flooring of which a specimen was exhibited and which he understood was made with a mixture of magnesium chloride and calcined magnesia. One might anticipate from the known character of magnesium chloride that there would be some corrosive action if the material were in contact with metal, especially iron; and he should like to know if the author had met with any result of that kind.

Mr. OSCAR GUTTMANN asked if the author was quite certain that the Styrian magnesite, of which he gave an analysis, contained 11.59 per cent. of impurity.

Dr. R. SELIGMAN asked if he was correct in understanding that the dead-burnt magnesia showed a tendency to re-absorb water? He should also be glad of any details about the regenerative gas fired kilns which were being used for calcining magnesite.

Mr. CLAYTON BEADLE asked if this flooring was laid *in situ*, like Val de Travers asphalt, or made in blocks like the specimens shown, and then put down.

Mr. DAVIS asked if the floor covering was impervious to water.

Mr. H. H. DAINS in reply, said he did not think the magnesite could be used as a sort of reinforced concrete in connection with steel, but, once the material had set, like the specimen shown, there should be no action on metals, provided the metal and cement were kept dry at the point of junction. The material certainly could be used for flooring without damage, and it was largely used under various patent names in London and on the Continent. The material was laid *in situ*—not made into blocks and laid down. Various colours might be introduced into it. Where sawdust was used, the most convenient method was to mix it dry with the caustic magnesite, make plastic with magnesium chloride solution and then lay it in position. The magnesite cement formed was very good, provided it was not placed entirely under water. So long as it was exposed to atmospheric changes it was all right; but if it were kept continuously under water he thought the magnesite would gradually disintegrate and the cement would lose its properties. For walls and building materials it had proved quite satisfactory. There were buildings in London which had been up for some years without any deterioration. The regenerative gas kiln was an ordinary shaft kiln with regenerators.

Nottingham Section.

Meeting held at Nottingham on Wednesday, April 28th, 1909.

MR. O. QUIBELL IN THE CHAIR.

DETECTION AND ESTIMATION OF CHLORIDE IN PRESENCE OF BROMIDE BY THE USE OF DILUTE NITRIC ACID, AND ESTIMATION OF IODIDE, BROMIDE, AND CHLORIDE IN MIXED SOLUTION.

BY R. M. CAVEN, D.S.C., F.I.C.

It was shown by Kebler (J. Anal. Appl. Chem., 1892, 6, 569) that when concentrated nitric acid is added drop by drop to a mixed solution of bromide and chloride, the bromide is oxidised on heating, without appreciably affecting the chloride. Benedict and Snell (J. Amer. Chem. Soc., 1903, 25, 809) have employed 5*N* nitric acid for the same purpose, showing that as little as 0.3 c.c. *N*/100 sodium chloride solution, *i.e.*, 0.1 mgrm. of chlorine, can be detected after eliminating a large excess of bromide, as well as iodide. These authors have thus shown that this method of detecting chloride is at least 10 times as delicate as the chromyl chloride method; and it is certainly more convenient. In spite of this, however, they rejected the method for reasons which will be stated later. Further, this method is preferable to the use of permanganate or dichromate for the oxidation of bromide, because a colourless solution remains to be tested directly for chloride.

Detection of chloride.—To a small volume of the concentrated solution of the mixed alkali halides 10 or 15 c.c. of dilute nitric acid (1 vol. acid of 1.42 sp. gr. to 3 vols. water) are added, and the liquid is boiled in a porcelain dish. The liberated bromine quickly leaves the liquid, and the last traces appear within the bubbles at the surface, so that it is at once seen when the solution is quite free from bromine, and ready to be tested for chloride. More dilute nitric acid should be added, if necessary, after

boiling for a little time, to prevent the concentration rising much; otherwise chloride will be oxidised and lost.

The method is not so satisfactory for detecting traces of bromide, since the liberated bromine may be vaporised by heating before it is seen. Amounts as small as 2 mgrms., however, colour the nitric acid on heating just to boiling and allowing to stand for a minute. If smaller quantities than this need to be tested for, it is better to add a little potassium iodate, as recommended by the above authors. All the bromine is then liberated at atmospheric temperature, in nitric acid solution; and it is accompanied by one-fifth of its equivalent of iodine, which deepens the colour and makes the reaction more sensitive.

Estimation of chloride.—Benedict and Snell (*ibid.*) did not employ the nitric acid method for the qualitative or quantitative separation of bromide and chloride, because they found that when this acid was used to oxidise iodide as well as bromide, the distinction between the two was not sharp, and also because a small quantity of iodic acid was sometimes formed by the oxidation of the liberated iodine. It will be shown subsequently how iodide, when present, may be detected, estimated and eliminated, so that dilute nitric acid may in all cases be used to separate bromide from chloride.

Strength of nitric acid.—It was found by a number of experiments that the acid of most suitable strength is made by mixing one volume of 1.42 acid with three volumes of water. If the acid is weaker than this, evaporation is necessary before all the bromine is liberated; if stronger, an appreciable amount of chlorine will be lost.

Details of the process.—A measured volume of the solution of the mixed halides, or a weighed quantity dissolved in a measured volume of water, is placed in a clear white glass distilling flask of 200 c.c. capacity, and there are added 25 c.c. of concentrated nitric acid so diluted that the total volume of the liquid in the flask is 100 c.c.

The dilute acid may be added through a tap funnel which pierces a doubly bored cork fitting the neck of the flask. The stem of the funnel nearly touches the bottom of the flask, and through the other hole in the cork passes a thermometer which is suspended in the liquid. The delivery tube of the flask is connected with a wash bottle containing a little water, and this in turn is joined to a water pump, so that air can be drawn through the solution in the flask in order to displace the liberated bromine.

On heating the solution in the flask, while air is gently drawn through it, bromine is set free, the solution rapidly deepening in colour as the temperature approaches 80°. Boiling for one minute suffices to complete the reaction, and then the source of heat is removed, and a brisk current of air drawn through the solution as it cools. At the end of about five minutes, or even in less time, the solution will be perfectly colourless, and is then ready for the estimation of the chloride. It is well, however, to continue the aspiration for another minute after the liquid appears colourless. If all the bromine had not been liberated when the heat was removed, the decolourisation of the solution would be much slower. The rapid fading of the colour is therefore a sign that oxidation is complete.

For the estimation of chloride, excess of standard silver nitrate is added, and the excess titrated with ammonium thiocyanate, according to the method of Volhard, after the silver chloride has been filtered off.

The bromide present is estimated by difference, after titration of the total halide by the ordinary method.

Results.—The following results have been obtained:—

Weight of potassium chloride taken.	Weight of potassium bromide added.	Weight of potassium chloride found.
gm.	gm.	gm.
0.1	1.0	0.1004
0.2	1.0	0.2007
0.5	1.0	0.5004

The potassium bromide employed was Kahlbaum's, but it was not quite free from chloride. By two estimations of this salt by the above process, 10 grams being taken for each estimation, 0.085 and 0.081 per cent. of potassium

chloride was found. This correction has been applied in the above results and in those that follow.

In the following estimations the amount of bromide has been obtained by difference, the total halide being titrated either in neutral or acid solution.

A	Taken.	Found.	
		(i.)	(ii.)
Potassium chloride	0.1601	0.1602	0.1599
Potassium bromide	0.1908	0.1921	0.1922

B	Taken.	Found.		
		(i.)	(ii.)	(iii.)
Potassium chloride	0.1181	0.1188	0.1191	0.1181
Potassium bromide	0.1562	0.1554	0.1551	0.1565

[In example B three separate estimations of potassium chloride were made from the same solution; and the mean of two titrations of the total halide, one done in neutral, the other in acid solution (29.01 and 28.95 c.c. $N/10$ silver nitrate respectively) was used for the three estimations of potassium bromide by difference. In (i.) and (ii.) the solution was aspirated for about five minutes after boiling for one minute; in (iii.) aspiration was continued for seven minutes.]

If the above directions are carefully carried out the loss of chlorine which occurs is less than can be estimated by an ordinary volumetric process, and accurate results can always be obtained. The process is rapid, indeed the removal of the silver chloride by filtering, which is necessary before titration with thiocyanate, is the most lengthy part of the operation. This filtering may of course be avoided by titrating the chloride directly in acid solution, employing the shaking method.

The process is convenient for determining the purity of commercial specimens of potassium bromide, which often contain chloride, or it might be employed for the valuation of Kelp liquors. It is less well adapted for estimating small quantities of bromide in chloride, because, if large quantities of the latter are taken for estimation, some chloride will be lost by oxidation, even if the concentration of the solution is not sufficient for hydrogen chloride to be evolved on boiling. (Solutions stronger than $N/2$ lose hydrochloric acid on boiling.)

For example, 1 gram of potassium chloride was heated with 100 c.c. of dilute nitric acid in the usual way, and the evolved vapours led through silver nitrate solution. An appreciable quantity of silver chloride was precipitated; although when the same quantity of potassium chloride was heated with dilute sulphuric acid no chlorine passed over.

Estimation of iodide, bromide and chloride in mixed solution.

The volumetric estimation of iodide, bromide, and chloride necessitates three operations, two of which are the titration of total halide, and of the remaining chloride, after removal of iodide and bromide. For the third operation the choice lies between two possible modes of procedure, which are: (a) elimination of iodide, followed by titration of the mixed bromide and chloride, so that iodide is determined by difference; (b) direct estimation of iodide, and determination of bromide by difference. Apart from experimental considerations, the latter method is preferable, because the equivalent of bromine being less than that of iodine, the proportional error in titration is not so great. Moreover, when iodide is titrated independently, the amount of the substance taken can be adjusted to the proportion of this constituent present. Both methods, however, have been employed with success.

Titration of total halide.—For the titration of total halide the use of chromate indicator in neutral solution would naturally be adopted, but I prefer to add excess of standard silver nitrate in presence of dilute nitric acid, to filter off the precipitate of mixed silver halides, and titrate the excess of silver by Volhard's thiocyanate method. This gives a

sharper end reaction than the titration in neutral solution, since in the latter case the yellow silver iodide somewhat masks the colour of silver chromate.

Elimination of iodide by nitrous acid.—For the elimination of iodide the well known reaction with nitrous acid may be employed. A weighed quantity, or a small measured volume of a solution of the mixed halides is placed in a 200 c.c. distilling flask, and acidified with 2 or 3 c.c. of dilute sulphuric acid. About 0.5 gm. of the purest obtainable sodium nitrite, dissolved in a little water, is added, the solution is heated, and air aspirated through it for a few minutes till the liberated iodine has disappeared, and the solution is colourless. The solution is then ready for titrating the mixed bromide and chloride; or for oxidising the bromide with dilute nitric acid, as described above, so that the remaining chloride may be titrated. It must be observed, however, that sodium nitrite nearly always contains more or less chloride; the amount of chloride in the specimen used must therefore be estimated and allowed for.

Direct estimation of iodide.—In order to estimate iodide directly in presence of bromide and chloride, a reagent must be employed which oxidises hydriodic acid without affecting hydrobromic or hydrochloric acid. Ferric salts are known to possess this degree of oxidising power; and a volumetric process depending on the distillation of iodide with acidified iron alum solution has already been employed (*vide* Treadwell's "Analytical Chemistry," Vol. II., English Edition, p. 517). There is no need, however, to collect the iodine; for an accurate estimation of iodide can be made by boiling the mixed halide solution with dilute sulphuric acid and excess of iron alum until no more iodine vapour is evolved; and then cooling the solution, and titrating the ferrous iron produced by reduction by means of standard dichromate. Care must be taken, however, not to use a large excess of iron alum, for if the remaining ferric salt is too concentrated its presence masks the end of the reaction with ferrieyanide, owing to the brown colour of ferric ferrieyanide.

Elimination of iodide and bromide without the use of nitrous acid.—If iodide is estimated directly according to the method described above, the use of nitrite may be avoided; and this is an advantage, since no chloride need then be introduced by means of the reagents used. Since iodide and bromide are both to be eliminated without necessarily discriminating between them, in order that the residual chloride may be titrated, it might be thought that they could be got rid of together by heating with dilute nitric acid. This is satisfactory enough for a qualitative separation: for even if a little iodic acid is produced, as Benedict and Snell found (*J. Amer. Chem. Soc.*, 1903, 25, 809), the presence of a large amount of dilute nitric acid will entirely prevent the precipitation of silver iodate.

When, however, iodine, liberated on warming iodide solution with dilute nitric acid, is rapidly removed by aspiration of air, not a trace of iodic acid has been detected; for, after neutralising the nitric acid, and then adding acetic acid and potassium iodide, no iodine is liberated.

It is for another reason that it is undesirable to attempt to remove both iodide and bromide by means of nitric acid. When such an attempt is made, whilst the liberated iodine appears to be rapidly removed by aspiration, the colour developed by the liberation of bromine fades very slowly from the solution, so that 15 minutes or more may elapse after the source of heat is removed, before the solution becomes colourless; or it may even be necessary to heat the liquid again during aspiration. Since such a lengthened treatment is likely to result in loss of chloride, this method of eliminating iodide and bromide together was abandoned.

In order, however, to determine the cause of this anomalous behaviour of the mixed halides with dilute nitric acid, the following experiments were performed:—

(i.) 10 c.c. of $N/10$ potassium bromide solution were heated with 90 c.c. of dilute nitric acid containing 25 c.c. of 1.42 acid; and, after one minute's boiling, the solution became colourless in 24 minutes when air was aspirated through it as it cooled.

(ii.) 0.1 gm. of potassium iodide was treated in the same way, and the solution became colourless after three minutes' aspiration.

(iii.) 10 c.c. of $N/10$ potassium bromide solution, and 0.1 gm. of potassium iodide were similarly treated with dilute nitric acid; and after 15 minutes' aspiration a faint yellow tinge still remained in the liquid. Moreover, the colour faded so slowly that it would be difficult to be certain when it disappeared.

(iv.) Experiment (iii.) was then repeated, and, after aspirating for five minutes, the yellow liquid in the flask was cooled and shaken with carbon disulphide in a separating funnel. The carbon disulphide was coloured reddish brown, this colour being distinct from that caused either by iodine or bromine. On shaking with sodium hydroxide solution, acidifying the aqueous layer with dilute sulphuric acid, and adding sodium nitrite, a little iodine was liberated which coloured starch blue.

It is concluded from these experiments that bromide of iodine, IBr , is formed when dilute nitric acid is heated with a mixture of iodide and bromide, and that this compound is displaced less readily from nitric acid solution than either iodine or bromine alone.

Oxidation of iodide by hydrogen peroxide.—P. Jannasch and Fr. Zimmermann (Ber., 1906, 39, 196–7) have shown that only iodine is liberated from a mixture of iodide, bromide and chloride by hydrogen peroxide in presence of acetic acid; and P. Jannasch has also shown (Ber., 1906, 39, 3655–3659) that by the use of dilute sulphuric acid with hydrogen peroxide the whole of the bromide may eventually be oxidised and removed. Either of these dilute acids may be used in the present case; and for each estimation 10 c.c. of $2N$ acetic acid, or 2 c.c. $2N$ sulphuric acid have been employed. When sulphuric acid is used the action is rather more rapid than with acetic acid; but five minutes suffice for the removal of all the iodine even when acetic acid is used with hydrogen peroxide, and the liquid, after being boiled, is kept hot while air is aspirated through it. A slight objection to the use of dilute sulphuric acid is the fact that it causes a little bromine to be liberated so that the solution does not become quite colourless. This does not invalidate the result, however, since all the bromide is subsequently to be oxidised by dilute nitric acid.

Merck's or Kahlbaum's hydrogen peroxide may be employed; both are quite free from chloride; 0.5 c.c. of the 30 per cent. solution suffices for an estimation.

Summary.—The processes finally recommended for the estimation of iodide, bromide and chloride in a mixed solution are as follows:—

(i.) Titration of total halide in acid solution by Volhard's method.

(ii.) Estimation of iodide by titrating with dichromate the ferrous iron produced on boiling the mixed halide solution with iron alum.

(iii.) Titration of chloride in nitric acid solution after successively eliminating iodide by hydrogen peroxide in presence of acetic acid, and bromide by dilute nitric acid.

(iv.) Estimation of bromide by difference.

Results.—

I. Iodide eliminated by nitrous acid and estimated by difference.

	Taken.	Found.	
		(i.)	(ii.)
(a) Potassium iodide	0.1596	0.1599	0.1599
Potassium bromide	0.1518	0.1510	0.1508
Potassium chloride	0.1019	0.1014	0.1015
(b) Potassium iodide	0.1519	0.1518	0.1543
Potassium bromide	0.1935	0.1934	0.1929
Potassium chloride	0.1009	0.1001	0.1007

The difference between the two estimations of iodide in (b) may be attributed to experimental error. A small volume of the solution must necessarily be taken for the titration of the total halide, and of the volume of decinormal silver nitrate employed a relatively small amount represents iodide owing to the high equivalent of iodine.

II. Iodide estimated directly, bromide by difference.

	Taken.	Found.	
		(i.)	(ii.)
(a) Potassium iodide	0.1013	0.1013	0.1013
Potassium bromide	0.1923	0.1938	0.1922
Potassium chloride	0.1021	0.1028	0.1037

In (i.) iodide was eliminated by hydrogen peroxide in presence of dilute sulphuric acid.

In (ii.) iodide was eliminated by nitrous acid.

(b) Iodide eliminated by hydrogen peroxide and dilute sulphuric acid.

	Taken.	Found.	
		(i.)	(ii.)
Potassium iodide	0.1382	0.1379	0.1384
Potassium bromide	0.1446	0.1455	0.1451
Potassium chloride	0.1041	0.1033	0.1027

(c) Iodide eliminated by hydrogen peroxide and dilute acetic acid.

	Taken.	Found.
Potassium iodide	0.1102	0.1102
Potassium bromide	0.1092	0.1091
Potassium chloride	0.1145	0.1149

Of the numerous processes which have been employed for the estimation of mixed halides that of Benedict and Snell (J. Amer. Chem. Soc., 1903, 25, 1138) cannot be excelled for accuracy. These authors, however, do not say how long their process takes to carry out.

With regard to the final method described in the present paper, it may be stated that when the standard solutions had been prepared, and also 100 c.c. of the solution of the mixed halides, 10 c.c. of which were taken for each estimation, the above results [II. (c)] were obtained in exactly one hour.

DISCUSSION.

Mr. J. M. WILKIE thought that the superior accuracy of the Volhard method over that of Mohr was not solely due to obscuration of the end point by the yellow silver iodide, but to the fact that in neutral solution, silver nitrate or alkali iodide might be so precipitated and so lead to uncertain results. Some experiments he had made though they were not wholly conclusive supported this contention (*cf.* Treadwell, Vol. 2, p. 537). He was highly interested in the fact that bromine and iodine could not be removed in one operation by boiling with nitric acid of the specified strength. Had the author made any special investigation of this point? He thought the difficulty might be got over by the successive addition of further amounts of either bromide or iodide preferably as their hydrogen salt when the main reaction was over. With regard to the decomposition of iodides by means of hydrogen peroxide in acetic acid solution, did the author consider the reaction went to completion?

Mr. T. F. HARVEY said that the author's work would appear to provide a delicate and rapid method for the detection of chloride occurring as an impurity in potassium and other bromides; no convenient method had hitherto been devised, and a test which was both rapid and delicate was greatly needed. With reference to the possible oxidation and loss of chlorine in quantitative work, if present in too large quantity, he would like to know what concentration of chlorine Dr. Caven considered would form a safe working limit.

Dr. CAVEN said, in reply, that he was aware that precipitated silver iodide was believed to adsorb silver

nitrate or alkali iodide from solution; but whether the difficulty of obtaining accurate results in titrating an iodide with silver solution was entirely attributable to this cause he did not know. With regard to the removal of bromide of iodine by the addition of more bromide or iodide, he did not think this method was advisable even if it might be effective. The important consideration is the removal of bromide and iodide as speedily as possible so as not to oxidise chloride, and the addition of more bromide or iodide would necessarily retard this removal. The oxidation of iodide by hydrogen peroxide in acetic acid solution is complete, for Jannasch (*ibid.*) used this method for estimating iodide.

In reply to Mr. Harvey, he preferred to use not more than 0.2 gram. of alkali chloride in presence of bromide and iodide, dissolved in 100 c.c. of dilute nitric acid. Probably 0.5 gram. might be used without loss, but if more than this amount were employed oxidation of chloride would take place.

MR. O. QUIBELL IN THE CHAIR.

TESTS FOR THE ACTION OF CHLORIDES ON CAST-IRON.

BY E. J. R. CARULLA.

The fact that some chlorides attack iron and that ultimately they corrode it all away is well known. Anyone however who deals with chlorides in manufacturing operations will not find in chemical literature those cautions that after a short experience he might be led to expect.

Having occasion to treat ferrous chloride during the manufacture of certain products from ferrous liquors, the author some time ago examined its action on cast iron. The method adopted was the immersion of pieces chipped from certain pig irons with the intention of selecting those that were least acted on. The method of sampling was a rough one, but it proved to be sufficiently accurate for the purpose. The more regularly-shaped pieces were carefully measured to find as nearly as might be the area exposed to the surface of the liquor. The unit of area chosen was the square eighth of an inch ($\frac{1}{8}'' \times \frac{1}{8}''$).

Table I. gives the result of two days' immersion in a mixture of one part of ferrous liquor which still contained a little free hydrochloric acid, and three parts of water. After immersion of the pieces of iron, the whole was heated for half an hour and then put aside for two days, when the pieces of cast iron were taken out, washed, dried and re-weighed with the results indicated.

TABLE I.

Brand of cast iron.	Surface units $\frac{1}{8}'' \times \frac{1}{8}''$	Weight, grms.		Loss.	
		Original.	After immersion.	Total grm.	In millionths of a grm. per unit of area.
1	153	16.351	16.329	0.022	143
2	93.5	11.167	11.134	0.033	353
3	167	19.855	19.818	0.037	222
4	65	5.473	5.450	0.023	354
Hematite.	175	37.073	37.045	0.028	160

The piece of hematite was not from the pig. It was chipped off a plate that had been once through the cupola.

A further test was then carried out on the same pieces of iron, but immersing them in a mixture of one part neutral ferrous chloride and three parts water. The whole was heated for 85 minutes and then put aside for three days. The results are shown in Table II. There would really be some slight difference in the surface units, but the amount could not be practically measured, and in any case no error of importance is introduced by taking the original numbers.

TABLE II.

Brand.	Surface units.	Weight, grms.		Loss.	
		Before immersion.	After immersion.	Total grm.	In millionths of a grm. per unit of area.
1	153	16.329	16.264	0.065	425
2	93.5	11.134	11.085	0.051	545
3	167	19.818	19.747	0.071	425
4	65	5.480	5.416	0.064	523
Hematite	175	37.045	36.965	0.080	457

Judging by the values in the last column, the greater action that took place in the experiments recorded in Table II. seems to have altered the relative resisting capacity of the various irons. The character of this change is made more evident by plotting these numbers from the last column of both tables.

It would appear that in the second set of experiments an action nearly equally affecting the more corrodible irons had taken place, in addition to the original action as shown in Table I., the power of resisting which they still retained in varying degrees. One can suppose that these three samples were equally acted upon during the prolonged period of heating, namely 85 minutes, and that their different resisting power only came into play at the lower temperature.

The effect on the more resistant irons according to Table I., viz., No. 1, and hematite, is most remarkable, for No. 1 becomes bracketted with No. 3 and the hematite quite loses its position.

As the experiments detailed in Table II. were conducted with a less acid liquor than those in Table I. it seems strange that the action should have been so much greater notwithstanding the longer time of exposure. It might be supposed that when once the ferrous chloride was saturated with iron no further action would occur. A reasonable explanation seems to be that oxidation of the iron in the chloride takes place with formation of free acid which attacks any metallic iron present, and such an action may go on for any length of time.

Similar difficulties are met with in connection with ammonium chloride, and it becomes of equal importance, when dealing with hot solutions of this salt, to find irons that will stand its corrosive action. The volatile nature of ammonia has enabled a rapid and easy distillation test to be devised. The iron to be tested is boiled in a flask with a solution of ammonium chloride and the resulting ammonia absorbed in standard acid. Three grms. of iron in drillings, 5 grms. of ammonium chloride and 150 c.c. of water are heated to boiling in the distilling flask, and the evolved ammonia is then collected in 10 c.c. of normal acid with 100 c.c. of water for exactly 15 minutes. As a check a second receiver can be got ready with the same amount of acid, and the ammonia collected from the same mixture for another 15 minutes. It will be found that the difference is very slight between the two tests if the boiling has been kept on with the same vigour throughout. The experiments, detailed in Table III., made with drillings from No. 4 pig iron show how regular the evolution of ammonia is and how entirely it depends on the amount of iron used and the time. In all the experiments the same amount of ammonium chloride was employed, viz., 5 grms.

TABLE III.

Cast iron used, grms.	Time, minutes.	Ammonia produced in grms.	
		Total.	In 15 minutes.
1	26	0.019	0.011
2	16	0.0299	0.028
3	15.5	0.0352	0.034
4	15	0.044	0.044

From the above there seems no reason for choosing one particular weight of iron more than another with which to make the test. When one considers however that the action is a surface one and that drillings vary in size even in the same sample of cast-iron, it is obvious that the larger the quantity weighed for the test the nearer will the result be to the truth. Three grms. is a quantity easy to handle, and seems sufficiently large for the purpose.

Experiments on irons obtained from various sources have given the results detailed in Table IV.

TABLE IV.

Cast irons.	c.c. of normal hydrochloric acid neutralised during		Average ammonia evolved in 15 minutes.
	First 15 minutes.	Second 15 minutes.	
A	3.50	3.50	grms. 0.0595
B	2.68	2.65	0.0452
C	1.13	1.75	0.0245
D	1.10	1.60	0.0229
E	1.60	1.65	0.0276

It is remarkable that the iron A which was drilled from the pig should be the most corroded, since it was put forward as a specimen of acid-resisting iron. Sample B was from an evaporator plate, C, D, and E were all drillings sent by manufacturers of chemical plant as from iron suitable for such purposes. This the tests seem to confirm.

Differences that may be thought considerable may be observed, in the case of samples C and D, between the evolution of ammonia in the first and second periods of 15 minutes. These are probably due to the mixture in the distilling flask not having been brought to a sufficiently high temperature in the preliminary heating before beginning to absorb. As before noted, this is a point of considerable importance, for when carefully attended to, concordant results are generally obtained.

Table III. shows that the tests need not be carried on for exactly 15 minutes, as was done with those recorded in Table IV. A calculation can easily be made to bring the results to any standard period of time that may be adopted.

For more exact results, and especially with irons that show any considerable resistance to the action of ammonium chloride, and where consequently the quantity of acid neutralised is small, a correction may be made for the dissociation of the salt itself when boiling. Five grms. of ammonium chloride dissolved in 150 c.c. of water and kept boiling for one hour in a Jena flask evolved 0.001 gm. of ammonia, which represents a correction of 0.00025 as necessary for 15 minutes, the time adopted for the tests detailed above.

From the data obtained by this test the amount of iron that goes into solution can be easily calculated, and consequently the time during which any particular casting is likely to remain fit for its purpose, when employed in apparatus to deal with ammonium chloride liquors.

It is just to mention that Mr. G. K. Davis refers to an

experiment in which wrought iron was heated in an ammonium chloride solution and the iron itself was weighed to ascertain the effect (*Journal of Iron and Steel Inst.*, 76, 81).

DISCUSSION.

The CHAIRMAN said that local water caused considerable corrosion of boiler plates. In glue-making, again, severe pitting took place in the plates of the vessels used.

Mr. W. G. TIMMANS asked whether the author had confined his experiments to pig-iron, or had he also tested actual castings? He thought that the question went beyond the chemical composition of the irons. The temperature at which the castings were run had, he thought, much to do with their soundness, and consequently with their resisting power to chemical action. He had had cause to complain of castings one inch thick that were quite porous.

Dr. R. M. CAVEN remarked on the action of metallic chlorides which, with the exception of those of the alkalis, were almost all hydrolysed by water, especially at high temperatures. This would occur in the case of ferric chloride, which would seem to explain some of the experiences referred to in the paper.

Mr. J. GOLDING asked whether the tests had been brought into line with practical experience. How far were the samples dried, and could the author say what amount of water cast-iron would take up? He had knowledge of experiments conducted on nodules of iron from the coal-measures which were immersed for some time in water, and then frozen, to break them up, in order to see their structure. Might there not be in cast-iron these microscopical fissures between the crystals?

Mr. H. ROGERS suggested that a comparison of the analytical results with those of the author's tests would be most interesting, and possibly throw light on what seemed anomalous.

Mr. T. F. HARVEY asked whether any parallel tests had been made with the immersion and the distillation tests.

Mr. F. J. R. CARULLA, in reply, said that the action of chlorides was more rapid on wrought than on cast iron, so that probably that would account for the experiences of their chairman. These tests had all been applied only to cast-iron, on both pig-iron and to samples drilled from the actual castings. He would not like to say that a good sound casting would take up water, but of course a porous casting would do so. He had selected sound pieces, which were thoroughly washed and dried before weighing, to ascertain the loss after immersion in the ferrous liquors. Dr. Caven's remarks were most valuable, and evidently ammonia must not be included with the alkalis for the chloride certainly hydrolysed. The original samples had been dispersed so that no parallel tests were made, the distillation test being of comparatively recent origin. The latter was intended to show the action of ammonium chloride, whereas the immersion test was for ferrous chloride, both liquors being treated at different stages of the process. An analytical comparison with the tests described would certainly be interesting, but time had not allowed of this being done. He might say, however, that typical analyses of the various pig-irons named might be found in metallurgical books.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

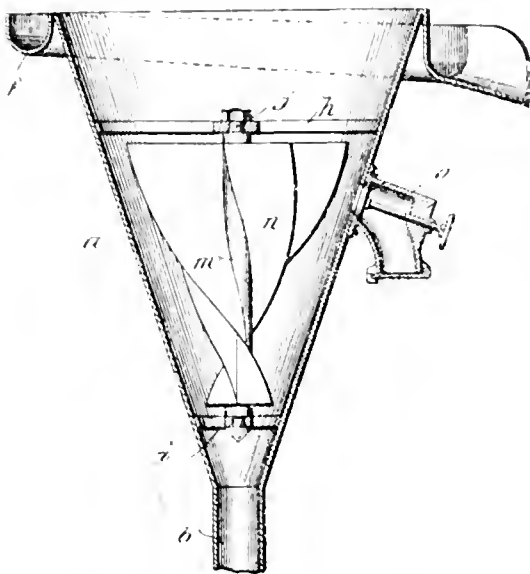
Furnaces or apparatus for supplying heated air for industrial purposes. J. R. Farbridge, Whitley Bay. Eng. Pat. 7403, April 3, 1908.

Air is forced by a fan into a chamber situated in front of the furnace and which can be put into communication,

by means of valves or slides, with the ash-pit of the furnace, with a series of perforated heating tubes which supply secondary air to complete the combustion of the gases, and with a chamber or chambers from which the air passes through the heating tubes proper, placed in the path of the products of combustion. The heated air passes from the heating tubes to one or more chambers situated between the heating tubes and the chamber supplying

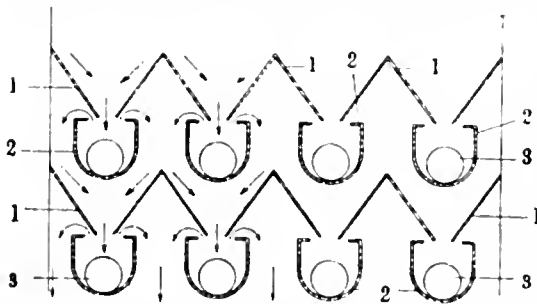
air thereto, being in this way protected from loss of heat by radiation. The air supply chamber is of such a size that an effective pressure can be maintained therein so as to cause an even distribution of air through the tubes.—W. H. C.

Classifiers or separators for materials of different specific gravities. C. Churchill, Boston, Mass., U.S.A. Eng. Pat. 7841, April 8, 1908.



THE materials to be separated are delivered along with a stream of water into the bottom of the cone, *a*, through the pipe, *b*. The cone is provided with propeller blades, *n*, the pitch of which increases from the bottom upwards; these blades are mounted on the hollow shaft, *m*, which is free to rotate about a fixed shaft, *j*, supported by the frames, *i, h*. The cone is also provided with an overflow gutter, *j*, and with several valved outlets, *o*, fixed at different levels. The flow of the water causes the propeller blades to rotate and sets up centrifugal force within the cone. The lighter particles are carried upwards and over the top of the cone into the gutter, *j*, and the heavier particles are drawn off at different levels according to their specific gravities.—W. H. C.

Separating liquid and dirt from gases and steam by means of oblique currents, separators and catch chambers. H. O. Klausner, London. From C. F. Scheer and Co., Feuerbach, Germany. Eng. Pat. 8208, April 13, 1908.

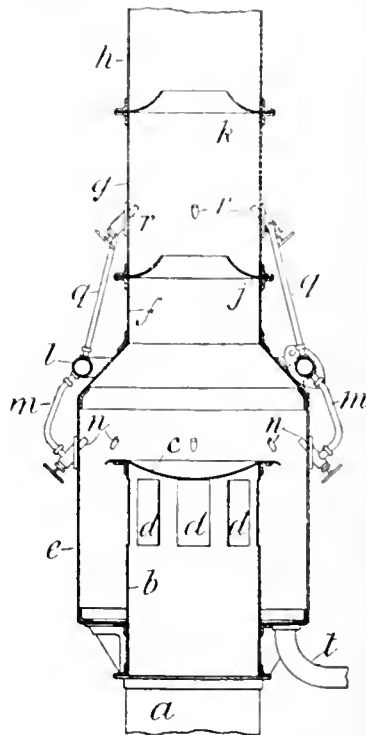


THE steam or gas to be purified enters the apparatus in the direction shown by the arrows and is directed into the curved catchers, 2, by the angle pieces, 1. The semi-circular catchers, 2, have return flanges, as shown, which prevent the deposited matter from escaping back into the stream of gas or steam. The deposited liquids flow away by the openings, 3.—W. H. C.

Superheating steam; Apparatus for — applicable also for heating liquids. J. A. Marchant, Ashton-under-Lyne. Eng. Pat. 7635, April 7, 1908.

THE superheater consists of a number of pairs of concentric tubes ("field-tubes") connected to one or more headers. The interior tubes are carried by removable hollow caps so as to facilitate repairs. The tubes are so grouped that the steam is forced to circulate through several groups of tubes in succession. The superheater is connected by a tube containing mercury with a thermometer fixed at the front of the boiler, in order that the degree of superheating attained may be easily observed.—W. H. C.

Cleaning or washing smoke, and for inducing draught; Apparatus for —. J. Black, and A. H. and H. Lennox, Newcastle-on-Tyne. Eng. Pat. 14,693, July 10, 1908.



THE invention relates to improvements in the apparatus described in Eng. Pat. 27,917 of 1907. The smoke-stack, *a*, has an extension, *b*, closed at the top by the dished plate, *c*, and provided with openings, *d*, through which the smoke passes to the enlarged extension, *e*. The latter is contracted again to form the sectional conduits, *f, g, h*, and is closed below and provided with a drain-pipe, *t*. Curved baffles, *j, k*, open in the centre, are inserted between the sections, *f, g, h*. Water under pressure is delivered from the annular main, *l*, by the pipes, *m, q*, to the upwardly directed spraying jets, *n, r*. The water is discharged through the drain, *t*.—W. H. C.

Crate for carboys, demijohns, and the like.—D. G. Pinkney, London. Eng. Pat. 10,609, May 15, 1908.

IS a crate for carboys, demijohns, etc., having a frame-work box to contain the vessel, and a removable cover having arms adapted to be screwed into place for transit, or to serve as a base with the crate body pivoted on the arms for use,—the combination with the frame-work body, of expansive spring packing strips adapted to engage the sides of the vessel, and cleats secured on to the packing strips for retaining the vessel in position. A further claim specifies the use of pivoting pins, recessed

within the crate arms to accommodate them, and a cover for keeping them from protruding. When it is desired to empty the vessel, the cover is removed and forms a stand on which the crate containing the carboy is supported by trunnions, so that the vessel can be tilted to discharge the contents.—W. H. C.

Gas-fired shaft-furnaces. E. Schmatolla, London. Eng. Pat. 10,854, May 19, 1908.

THE claim is for the arrangement of the furnace described in Eng. Pat. 1168 of 1908 (this J., 1908, 1008), as a shaft-furnace for the continuous burning of materials, and for the provision of a cooling chamber beneath the fire-zone of such a furnace.—W. H. C.

Dry-kiln; Superheated-steam —, and method of drying materials [lumber] with superheated steam. D. E. Lain, Assignor to E. G. Jewett, Bellingham, Wash., U.S. Pats. 918,334 and 918,335, April 13, 1909.

(1). THE claim is for the combination of a drying chamber divided by a diaphragm into unequal parts, with a steam generator connected to the system, a superheater, a steam coil, and means for mechanically circulating the steam through the system. The system is closed at all points except the exhaust. (2). The drying process consists in supplying a quantity of steam to the system and then cutting off the supply and mechanically circulating the steam. The excess of vapour carried off by the steam is condensed and withdrawn from the system, and the steam is continuously reheated and returned through the drying chamber so long as any vapour is given off by the material under treatment.—W. H. C.

Mixing-machine. T. M. Phillips, Assignor to The Youngstown Steel Co., and E. L. Ford, Youngstown, Ohio, U.S. Pat. 919,074, April 20, 1909.

A ROTARY drum mounted on hollow journals is provided with lifting blades and with a longitudinal screen dividing it into two compartments, into which steam is conveyed through one of the hollow journals.—A. S.

Solution and precipitation processes; Apparatus for use in —. W. Hommel, Assignor to Metals Extraction Corporation, Ltd., London. U.S. Pat. 918,749, April 20, 1909.

SEE Eng. Pat. 27,017 of 1907; this J., 1909, 416.—T. F. B.

Rendering material of any kind proof against the action of moisture and chemical agents; Process for —. A. Kronstein, Karlsruhe, Germany. U.S. Pat. 919,031, April 20, 1909.

SEE Eng. Pat. 2679 of 1901; this J., 1901, 460.—T. F. B.

Separating solids from liquids; Apparatus for —. F. E. and A. S. Elmore, London. U.S. Pat. 919,144, April 20, 1909.

SEE Eng. Pat. 26,821 of 1907; this J., 1909, 194.—T. F. B.

Drying machine. J. Black, Newcastle on Tyne. U.S. Pat. 919,529, April 27, 1909.

SEE Eng. Pat. 12,087 of 1907; this J., 1908, 396.—T. F. B.

Concentrating solutions; Process of —. E. Monti, Turin, Italy. U.S. Pat. 919,616, April 27, 1909.

SEE Fr. Pat. 357,770 of 1905; this J., 1906, 113.—T. F. B.

Recovering vapours from volatile liquids; Apparatus for —. H. Diamanti and C. Lambert, Paris. U.S. Pat. 919,832, April 27, 1909.

SEE Fr. Pat. 372,888 of 1906; this J., 1907, 518.—T. F. B.

Acid-proof tank. U.S. Pat. 918,649. See X1B.

II.—FUEL, GAS, AND LIGHT.

Coal industry in the year 1907—1908; Position of the —. W. Bertelsmann. Chem.-Zeit., 1909, 33, 518.

THE production of coal, etc. (in metric tons), in Germany in 1905, 1906, and 1907, is shown in the following table:—

	1907.	1906.	1905.
Coal	143,222,886	136,479,885	121,298,607
Lignite	62,319,802	56,225,189	52,512,062
Coke	21,938,038	20,260,572	16,358,324
Coal briquettes	3,524,017		
Lignite briquettes..	12,890,461	14,500,851	13,009,682

The German imports and exports respectively of the different products in 1907 were:—Coal, 13,729,296 and 20,017,688; lignite, 8,963,103 and 22,065; coke from coal 558,695 and 3,790,642; coke from lignite, 25,526 and 1938; coal briquettes, 136,320 and 837,775; lignite briquettes, 59,084 and 422,360; peat, peat-coke, 15,214 and 25,746 metric tons. Statistics relating to the world's supply of coal are also given (see this J., 1909, 301).—A. S.

Coal-dust [in mines] and its treatment with calcium chloride. H. Hall. Trans. Mining Inst. of Scotland, 1908—1909, 31, 96—118.

THE author recommends the use of calcium chloride for laying dust in coal mines, the salt being used either in the form of a concentrated solution (48°—50° T.), or as fine dry powder in seams where watering cannot be resorted to. It is stated that one application of the salt every three months is sufficient. Comparative tests as to the corrosive action of calcium chloride solution (43° Tw.) and St. Helens town water on iron, showed that the metal lost three times as much in water as in the calcium chloride solution; also that iron exposed alternately to water and air rusted far more quickly than when exposed to calcium chloride solution and air alternately.—A. S.

Fuel from peat. M. Ekenberg. Iron and Steel Institute, May, 1909. [Advance proof.]

RAW peat can be converted into fuel without air-drying by a process of "wet-carbonising," which consists in heating the peat-pulp under pressure to 180°—220° C. and removing the bulk of the water from the product by subjecting the mass to a pressure of about 50 atmospheres. The water cannot be separated from the raw peat by pressure on account of the presence of a slimy "hydro-cellulose" which fills and surrounds the cells. This substance is decomposed when heated with water to 150° C., hence the "wet-carbonised" peat can be dried by pressure. The weight of water remaining in the pressed peat is less with higher temperatures of carbonisation; with a pressure of 20 atmospheres, the pressed peat contains 1½ lb. of water per lb. of peat substance if carbonised at 180° C., or 1 lb. if carbonised at 200° C. Other changes which occur during the heating are an increase in the calorific power and in the percentage of carbon in the peat substance, owing to the separation of part of the hydrogen and oxygen as water. The heating is carried out in a regenerative manner by forcing the peat-pulp continuously through a battery of tubes in a heating chamber; the cold pulp passes through jackets which surround the tubes conveying the hot pulp from the heating chamber to the press. The pressed peat, after air-drying for one week, contains 25 per cent. of moisture, or less moisture than the best ordinary air-dried peat. The pressed peat can be completely dried by heating, the fuel required for "wet-carbonising" and final drying corresponding to about 15 per cent. of the peat substance in each case, or 30 per cent. in all. The dried peat has a calorific power of 11,000 British thermal units per lb., and can be converted into briquettes by the usual processes. The total fuel consumption in making peat briquettes from the raw peat is about 37 per cent. of the peat substance, and with a daily output of 100 tons, the cost of the briquettes is estimated at 6s. 8d. per ton,

without recovery of ammonia from the fuel used. The briquettes burn with a long luminous flame, without soot or smoke, and leave 4 to 5 per cent. of ash. The specific gravity of the briquettes is 1.29 to 1.35, and their heating value is, bulk for bulk, equal to that of coal. The evaporative effect when used for steam raising is high as compared with coal of the same heat value, on account of the smaller quantity of air required for combustion. The "wet-carbonised" peat can be converted into peat-charcoal, and the peat briquettes similarly treated yield a very strong charcoal, or "peat-coke." This "peat-coke" has a crushing load of 300 kilos. per sq. cm., and is suitable for use in blast-furnaces. "Wet-carbonised" peat can also be used in gas-producers, and yields, per ton of dry peat substance, 39,500 cub. ft. of gas having a calorific power of 160 British thermal units per cub. ft., together with 4.2 per cent. of tar, and 4.3 per cent. of ammonium sulphate, 79 per cent. of the nitrogen being recovered. If the gas is used in engines driving electric generators, the cost of current is as low as when generated from water power. Finally, the "wet-carbonised" peat heated in coal-gas retorts or by-product coke-ovens, yields, per ton, 17,000–20,000 cub. ft. of gas of 15 candle-power, having a calorific power of 750–800 British thermal units per cub. ft., and therefore suitable for illumination and heating.

—A. T. L.

Combustion; Influence of surfaces upon — W. A. Bone. J. Gas Lighting, 1909, 106, 300–303.

MIXTURES of combustible gas (hydrogen, carbon monoxide) and oxygen were circulated over different solid substances maintained at a constant temperature below the ignition point of the gaseous mixture. The temperatures employed for mixtures of hydrogen and oxygen were:—platinum, 160–180° C.; porous porcelain and magnesite, 430°; silver, 400°; gold, 250°; nickel, 230°; copper, 204°; nickel oxide, 160°; and iron oxide, 200° C. In all cases the rate of combination was accelerated by the presence of the solid substance. With a given substance, the rate of combination in the case of mixtures of the gases in stoichiometrical proportions was proportional to the pressure, but with excess of either component, the governing factor in most cases was the partial pressure of the hydrogen. With excess of hydrogen, not only was the initial velocity greater, but this was continually accelerated as combustion proceeded. The general result of the experiments was to show that the idea that surface combustion consists of a rapidly alternating series of oxidations and reductions of the surface, is untenable. The combustible gas, in most, if not in all, cases, is in some way, either by direct contact with the surface, or by some influence exerted by the surface on the gas not actually occluded, rendered active, and is then burned with extraordinary swiftness. In some cases, probably with copper, it is not the combustible gas, but the oxygen which is thus influenced. The rate at which the combustible gas which has been rendered active, is burned is very much greater than the rate at which the gas is rendered active, so that the latter is the controlling factor. Whilst under ordinary conditions methane burns at a rate twenty or thirty times quicker than hydrogen does, yet in contact with a solid substance, so great is the action of the surface on the hydrogen, that the latter is burned before the hydrocarbon is appreciably affected. The author's study of the effect of surfaces upon combustion leads him to conclude that in order to attain the highest efficiency in heating by gas, it is essential to introduce as much surface combustion as possible, that is, to proceed so that combustion takes place as far as possible in contact with the hot surface.

—A. S.

Iron carbonyl in coal-gas. J. N. E. Tonne, jun. J. Gas Lighting, 1909, 106, 87.

INCANDESCENCE mantles used with coal-gas produced in a new Dutch gas-works, were found to rapidly lose illuminating power and become covered with a yellowish-brown deposit. The author found this to be due to the presence in the gas of volatile iron carbonyl (see Mond,

this J., 1892, 750). The presence of the iron carbonyl was detected in the gas taken from the outlet of the tar extractor, and a small quantity of iron oxide was found in the water in the washer. The gas contained 7 per cent. of carbon monoxide, and it appears probable that the iron carbonyl was produced by the action of the carbon monoxide on the iron of the mains at a low temperature. Gas taken from the hydraulic main was free from iron, and hence the iron carbonyl was not produced at high temperatures. Iron carbonyl is not acted upon by dilute hydrochloric acid. When the gas was examined some weeks after the first occasion, less iron carbonyl was present, probably owing to the surface of the mains having become covered with tar and naphthalene, which would protect the iron from the action of the gas. (See also this J., 1900, 31, 521.)—A. S.

Incandescent mantles; Ramie — C. R. Böhm. Chem.-Zeitung, 1909, 33, 447.

RAMIE mantles, which were first introduced in 1897, have now almost entirely displaced cotton mantles in Germany, and it is estimated that ramie is now used for three-fourths of the world's production of incandescent mantles. Ramie mantles give a greater intensity of light than cotton mantles owing to the roughness of the thread compared with cotton, and whereas a cotton mantle loses its shape and gives only half the original light after a life of 100 hours, the light of a ramie mantle decreases only by 10 per cent. in the same time, and the average life is 600 hours. The ramie thread is stronger than cotton, so that a finer thread can be used. The collodionised mantles are quite strong enough to permit of export.—A. T. L.

PATENTS.

Lignite and peat; Process for utilising the briquetting (binding) properties of — A. Zindler. Fr. Pat. 395,385, Oct. 16, 1908.

LIGNITE and peat can be briquetted by means of the bituminous matter they contain. The claim is for the utilisation of this property to form briquettes with other bodies such as, for example:—Coal and coke dust, coal dross, iron filings and turnings, fluxes, blends, blast-furnace dust, pyrites, etc.—W. H. C.

Coal tar; Process of treating — in order to allow it to be used as a combustible. R. Garzón. Fr. Pat. 395,799, Oct. 29, 1908. Under Int. Conv., June 8, 1908.

THE tar is heated to render it more fluid and is then injected by an atomiser into the furnace by compressed air. Atomised water is injected into the furnace along with the tar to ensure regular and complete combustion.

—W. H. C.

Oven for the calcination of coal or other materials. L. Wirtz. Fr. Pat. 395,497, Oct. 20, 1908.

THE apparatus consists of a number of narrow vertical coking chambers separated by hollow walls through which the heating gases circulate. The ovens terminate above in a common charging and gas-collecting chamber and below in a common discharge chamber.—W. H. C.

Gas-producer. J. Fielding, Gloucester. Eng. Pat. 14,292, July 6, 1908.

THE producer, which is suitable for use with bituminous fuel, is worked with an upward draught, and the bulk of the gas is taken off by an outlet at a level where the fuel is incandescent, so that the gas contains only a small proportion of condensable matter. The bulk of the condensable gases are taken off at the top of the producer and burnt under a boiler to generate the steam required to prevent the formation of clinker in the producer.

—A. T. L.

Water- and coal-gas; Apparatus for manufacturing — H. W. Benner, Chambersburg, Pa. U.S. Pat. 918,727, April 20, 1909.

THE apparatus comprises a water-gas producer, a superheater, and a chamber containing a number of coal-gas

retorts surrounded by chequer-brickwork. Each part of the apparatus is connected to the other two parts by valved connections. During the air-blow in the producer, the products of combustion are passed through the chamber containing the retorts and then through the superheater, and during the steam-blow, the water-gas is passed direct to the superheater.—A. T. L.

Gas-producer for heating gas retorts or for other purposes. P. V. Parsy. First Addition, dated Nov. 5, 1908, to Fr. Pat. 393,810, Nov. 6, 1907 (this J., 1909, 131).

THE patent relates to means for preheating the air supply or the retort served by the producer. For this purpose a regenerator is arranged at either side of the producer in the lower part of the retort oven. The hot combustion products from the oven pass in a downward zigzag path between hollow horizontal partitions in the regenerators, and the air passes in an upward zigzag path through these partitions. The heated air is delivered from each regenerator through a horizontal burner pipe into the oven, where it meets the producer gas issuing from the horizontal branches of a central channel arranged along the top of the producer chamber.—A. T. L.

Gas-producers. C. Lefebvre. Fr. Pat. 395,510, Dec. 30, 1907.

THE gas-producer, which is adapted for use with wood and other vegetable fuels as well as with coal, comprises two chambers of refractory material formed within a single casing. The first chamber serves for the production of gas and the second, which is provided with a vaporiser, is packed with coke and serves as a dry scrubber. The fuel in the producer chamber rests on a horizontal or slightly inclined hearth, and a vertical grate is arranged at the front of the hearth. The gas leaves the producer chamber opposite to the grate, and passing downwards at the back of the hearth is led under the hearth of the scrubber chamber and enters the latter chamber at each side of the hearth. Dust is deposited by the gas in the space beneath the hearths of the two chambers, and the ashes and clinker on the hearth of the producer can be pushed over the back of the hearth into this space, which is cleared through doors at its ends. The upper part of the producer chamber is provided with a door, and air or steam can be admitted either at this door or through the grate, the producer working with a draught, or with a horizontal draught according to the nature of the fuel. With coal a horizontal draught is used, but with lignite or wood, a down-draught is employed and no steam is admitted. The lower part of the producer chamber is of smaller cross-section than the upper part, so that when the fuel is not too moist, the coke in the lower part of the chamber is kept incandescent by the rapid current of hot gas, without admitting air to the lower part of the producer. When very moist fuel, such as wood waste or olive marc is used, the steam and tar set free in the upper part of the producer chamber are drawn by an ejector through a surface condenser in which the steam is condensed, and the tarry gases are then mixed with hot air from the vaporiser and led back into the producer chamber. The hot water from the condenser is used in the washers. Other improvements relate to the construction of the grate and of the vaporiser. The grate consists of a series of horizontal plates, arranged one above the other so that the lower ones project further into the fire than the upper ones. A shallow trough is formed along the front edge of each plate, and the overflow water from the vaporiser is led to the uppermost of these grooves, and passes from each plate to the next below. With this arrangement the temperature of the fire can be controlled so that clinkers do not adhere to the grate. The vaporiser comprises a number of ranges of Field tubes, arranged in a contracted zone of the scrubber chamber. The tubes are fixed in a detachable plate which can be lifted out when the cover of the vaporiser has been removed. Each Field tube is provided with an inner tube which delivers air and water to the lower end of the Field tube. This inner tube is open at the top and is also pierced near the top for the entry of air horizontally. Above each range

of these tubes is a horizontal water-supply pipe closed at the end and pierced with a small hole at its highest point above each Field tube. The water escaping through these holes flows over the outer surface of the water-pipe and drops into the Field tubes from projections with rounded ends arranged above these tubes. In this way the water is fed regularly in conjunction with air to the bottom of each of the Field tubes.—A. T. L.

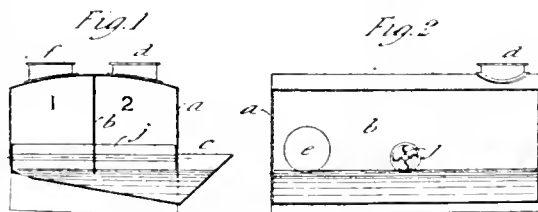
Gas producer. M. Castay. Fr. Pat. 395,790, Oct. 29, 1908.

To permit of the use of small or dusty coal, the upper part of the producer chamber is made in the form of an inverted truncated cone, the lower part being of the usual cylindrical form. The air passing upwards through the fuel maintains the necessary temperature in the cylindrical part of the producer, but the velocity of the upward current decreases progressively in the upper part of the producer until it is insufficient to carry away dust along with the gas. The fuel is supplied through a central hopper the position of which can be adjusted vertically. The depth of the column of fuel in the producer is determined by the position of the hopper, which is adjusted so that the surface of the fuel is kept at a red heat.—A. T. L.

Gas producer. A. C. P. Blanchard. Fr. Pat. 395,807, Jan. 7, 1908.

THE patent relates to producers of the kind in which the gas formed in a producer chamber passes through a hot column of non-bituminous fuel in a second chamber and there undergoes a partial reduction. The two chambers are formed in a single casing and are connected at their lower ends by a channel for the gases, arranged so as not to be obstructed by fuel. For this purpose the producer chamber, which is rectangular, is provided with a horizontal gas outlet near the base, opposite to a vertical or inclined grate at the front of the producer. This gas-outlet passage turns downwards and passes under the hearth of the reduction chamber, where it bifurcates and passing up by the sides of the hearth, leads horizontally into the lower part of the reduction chamber. The lining of the producer chamber at the side opposite to the grate projects so as to direct the descending fuel towards the grate and away from the gas inlet. A boiler or vaporiser is arranged in the top of the reduction chamber and is provided with an air inlet. The mixture of air and steam from the boiler, or hot air alone if desired, is led by a pipe to the producer chamber, to which it is admitted, with cold air if desired, by one or more of three valved inlets. One inlet is above the fuel column, the second leads to the grate, and the third opens into the gas conduit between the producer chamber and the reduction chamber. The apparatus may be operated with a forced blast of air, or by suction, and is suitable for all kinds of fuels.—A. T. L.

Ammonia from producer gas; Plant for recovering —. A. H. Lynn, Bromley, Kent. Eng. Pat. 8014, April 10, 1908.



THE washer, *a*, is constructed as shown in the cross-section (Fig. 1) and longitudinal section (Fig. 2) with a midfeather, *b*, and lute, *c*. The gas enters at *f*, into the chamber, 1, and is washed by spray produced by the dasher, *j*. It then passes through the opening, *e*, near the level of the liquid which fills the washer, into the second chamber, 2, again meeting the spray, and finally escapes through *d*. The gas from the producer passes first through a heat interchanger where it is cooled and heats the air, then through a washer where it is further cooled and heats the cooling water. It next passes through a second

similar washer where the ammonia is absorbed and then through a third washer which acts as a final cooler. The water from the first washer or water-heater is circulated by a pump through a similar washer through which air is aspirated. The air absorbs heat and vapour from the warm water which is cooled and returned, along with a quantity of fresh water to make up for that carried off by the air, to the first washer.—W. H. C.

Filters chiefly designed for use in the purification of gas. Kirkham, Hulett, and Chandler, Ltd., and S. Hersey, London. Eng. Pat. 9384, April 30, 1908.

THE patent relates to filters of the kind described in Eng. Pat. 7538 of 1906 (this J., 1907, 462). The grids are supported on notched bearers carried by vertical supports or trestles. In large filters, where more than two trestles are required, the intermediate trestles are provided with a double set of bearers to carry the abutting ends of adjacent sets of grid-bars; or single sets of bearers may be used, having wide notches to carry the overlapping ends of adjacent sets of grid-bars. The grid-bars of the highest and lowest tiers are made deeper than the others and notched on the underside where they rest on the notched bearers, this arrangement serving to brace the structure.—A. T. L.

Tar, dust, &c.: Apparatus for the extraction of — from gases. F. W. Burstall, Birmingham. Eng. Pat. 10,442, May 14, 1908.

THE apparatus is of the centrifugal type, and the "rotor" consists of a number of radial wires mounted upon a central hub. The flow of gas may be axially through the rotor, or from the centre to the circumference. Water is supplied near the axis of the rotor. The rotor fills the rotor chamber except for a collecting chamber at the periphery, and the gas, in passing through the apparatus, is subjected to a combined sifting and beating action by the wires of the rotor.—A. T. L.

Gas; Washer or cooler for freeing — from tar or dust and for cooling the gas. F. W. Burstall, Birmingham. Eng. Pat. 10,901, May 20, 1908.

THE apparatus comprises a horizontal cylindrical drum, rather more than half filled with water, and a series of parallel plates mounted on a revolving shaft arranged along the axis of the drum. Alternate plates are pierced near the axis and near the circumference, and the space between the circumference of the plates and the drum is sealed by a film of water under the centrifugal action of the revolving plates, so that the gas, in passing through the drum, is forced to take a circuitous path and is brought into contact with a large area of surface which is continually washed with water.—A. T. L.

Alcohol; Solidified — and process of making the same. V. Perelzveich and G. Rosenbusch, Zurich, Switzerland. U.S. Pat. 919,759, April 27, 1909.

SEE Eng. Pat. 26,915 of 1907; this J., 1908, 826.—T. F. B.

Coke oven. J. Armstrong, London. U.S. Pat. 917,744, April 13, 1909.

SEE Eng. Pat. 18,196 of 1907; this J., 1908, 889.—T. F. B.

Coal gas; Process and apparatus for generating — for operating internal combustion engines. B. Thiemich, Dresden-Naussnitz, Germany. Eng. Pat. 9891, May 6, 1908.

SEE U.S. Pat. 912,509 of 1909; this J., 1909, 302.—T. F. B.

Gas generating furnaces. C. Bolz, Budapest, Hungary. Eng. Pat. 14,604, July 9, 1908.

SEE Fr. Pat. 393,081 of 1908; this J., 1909, 82.—T. F. B.

Gas; Processes of manufacturing —. W. E. Lake, London. From The International Gas Development Co., New York. Eng. Pat. 16,611, Aug. 6, 1908.

SEE U.S. Pat. 896,795 of 1908; this J., 1908, 931.—T. F. B.

Gas from hydrocarbons; Process for the production of — and apparatus thereof. W. H. Frost and I. J. Nix, Los Angeles, Cal., U.S.A. Eng. Pat. 16,623, Aug. 6, 1908.

SEE U.S. Pats. 900,010 and 900,065 of 1908; this J., 1908, 1052.—T. F. B.

Gas-producing plant. H. N. Bickerton and P. W. Robson, Ashton-under-Lyne. U.S. Pat. 919,683, April 27, 1909.

SEE Eng. Pat. 13,703 of 1906; this J., 1907, 752.—T. F. B.

Calorimeter-lamp. U.S. Pat. 918,059. See XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Hydroacridin; Occurrence of — in coal-tar. H. Decker and G. Dunant. Ber., 1909, 42, 1178—1179.

SAMPLES of acridine from tars of various origin were used in the preparation of N-methylacridine. On treating a sample with an excess of dimethyl sulphate and adding sodium carbonate solution to the quaternary salt, there was an immediate formation of a gray crystalline precipitate which was insoluble in dilute hydrochloric acid. On distillation in a current of steam, this yielded a body melting at 96° C., and identified as N-methyldihydroacridine, first prepared by Pictet and Patry (Ber., 35, 2535). This was confirmed by its conversion into quaternary N-methylacridinium picrate, m. pt. 190° C. (Ber., 39, 2722). The authors regard this behaviour of the crude acridine as a proof of the occurrence in coal-tar of dihydroacridine first obtained artificially by Gräbe and Caro by the reduction of acridine.—C. A. M.

Paraffin content of petroleum as a criterion for judging the relative geological age of the same. M. Rakusin. Ber., 1909, 42, 1211—1215.

PETROLEUMS may be divided into three classes according to their behaviour to polarised light: (1), transparent; (2), semi-transparent; and (3), opaque. The first class comprises those oils which are transparent to polarised light in a 200 mm. tube (see this J., 1907, 678); and the third, oils which allow polarised light to pass (200 mm. tube) only when dissolved in benzene, benzine, etc., at a concentration of less than 1 per cent. In other words, in the case of oils of the third class, the coefficient of polarimetric opacity, or carbonisation constant (K) as the author prefers to term it, is less than 1, whilst it is 100 for oils of the first class. Oils with a carbonisation constant between 1 and 100 belong to the second class. The author has observed that oils with a relatively high carbonisation constant are also relatively rich in paraffin, and since the carbonisation constant decreases with increase in the geological age of the oil, he arrives at the conclusion that of the corresponding crude petroleum from a given district, those of more recent geological formation are richer in paraffin than the geologically older, opaque oils from a lower level. Evidence in favour of this view is cited.—A. S.

Petroleum from Saghalien. M. Rakusin. Petroleum, 1909, 4, 519—511, 806—810.

PETROLEUM has been found in the northern narrowest portion of the Island of Saghalien; in the eastern portion near where the river Ucha flows into the Okhotsk Sea; and in the southern portion about 200 miles south of the Gulf of Tschai, and 265 miles from Port Alexandrowsky, the chief town of the island. The northern deposit comprises the so-called "great asphaltum lake," together with other similar but smaller deposits. On the surface of the "lake" are holes or pits, in which, floating on the water therein, petroleum is found in layers 3½ ins. thick. Test-borings in this district showed that below the layer of asphaltum (9—21 ins. deep) were strata of greenish-gray clay alternating with greenish or brownish-red bituminous sand; from the borings, up to 16—32 kilos.

of crude petroleum were obtained daily. The southern deposit, consisting of what are known as the "kerosene lakes," is of a somewhat similar character, the petroleum lying below a layer of asphaltum. Of these areas covered with asphaltum, there are said to be five large ones and considerable number of smaller ones; their general location is north to south, the total length being about 100 kilometres and width about 100 m. It is stated that the climatic conditions offer no hindrance to the working of the petroleum deposits. A specimen of Saghalien crude oil examined by Bazewitsch was considered by him to be an oxidation product of a lighter oil occurring at greater depth. The fractions obtained on distillation were of higher specific gravity than those from American oil, and appeared to most nearly resemble those from Baku oil. The illuminating oils distilling over up to 100° C. (yield, at least 30 per cent.) would be quite safe even in hot climates. The author has examined the optical properties of six specimens of crude oil from Saghalien, and from the results calculated the carbonisation constants and coefficients of optical opacity (see preceding abstract).

No.	Source.	Sp. gr. at 15° C.	Carbonisation constant (K) in benzene solution.
.....	Nutowo	0.9011	per cent. 1½—1⅓
.....	Nabil	0.9364	1⅓
.....	Nogliki	0.9406	1⅓
.....	Nabil	0.9599	1⅓
.....	Nogliki	0.9502	1⅓
.....	Nabil	0.9854	1⅓

NOTE.—Nos. 1, 2, 4, and 6 were obtained from the so-called "lakes"; Nos. 3 and 5 from borings.

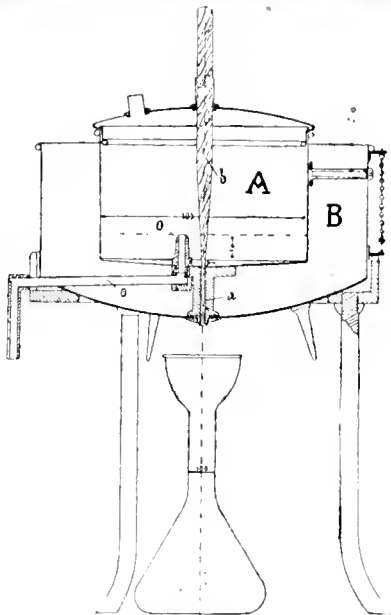
The Nutowo oil on distillation gave the following results:—

Fractions.	Yield, per cent.	Sp. gr. at 15° C.	Colour.
at 220°—250° C.	11.87	0.8532	light yellow
125°—175° C.	14.64	0.8607	straw yellow
175°—225° C.	24.30	0.8918	orange
225°—265° C.	12.70	0.9188	orange-red
265°—300° C.	10.77	0.9300	blood-red
300°—320° C.	9.11	0.9282	deep blood-red
Residue	16.02	0.9860	black

Paraffin wax was not found in any of the distillates. (See also this J., 1900, 1159; 1904, 55).—A. S.

viscosity of petroleum illuminating oil and an apparatus for its determination. J. Ubbelohde. *Petroleum*, 1909, 4, 861—864.

Ubbelohde's viscosimeter whilst useful for lubricating oils is not suitable for the relatively mobile illuminating oils. The author describes an apparatus for determining the viscosity of these latter, and also the viscosity of cylinder oils, etc., at high temperatures. This apparatus (see fig.) comprises a cylindrical brass vessel, A, 105 mm. in diameter, to the bottom of which is connected the outlet tube, a, 30 mm. long and 1.25 mm. inside diam. The inlet tube can be closed by the ivory rod, b. The overflow tube, c, is fixed to the outlet tube, a, the distance between the upper end of c and the lower end of a being 10 mm. The time in seconds required for 100 c.c. of petroleum oil at 20° C. to flow out through a, divided by the time required for 100 c.c. of water, gives the relative degree of viscosity. Full details of the method of calibrating the apparatus with water and for carrying out the determination are given. For determining the viscosity of cylinder oils, etc., at high temperatures, the vessel, B, is made taller and is used as an oil-bath; it is also provided with a stirrer. With this apparatus petroleum benzine had the viscosity 6.692 at 20° C., and eight specimens of petroleum illuminating oils



100 ccm. at 20° C.

gave values ranging from 1.109 to 1.801 at the same temperature. Eight specimens of cylinder oils examined at 200° C. gave values ranging from 0.98 to 4.01.—A. S.

Mineral oil industry of Batoum. Chem. Trade J., May 8, 1909. [T.R.]

ALTHOUGH an improvement in the exports of mineral oils from Batoum during the year 1908 took place, the trade was depressed. The industry is also far from being in a satisfactory condition. Prices of oil at Baku were fairly high during the year, but the wells are apparently giving signs of exhaustion. The production was about 10 per cent. short of the production of 1907, which in itself was deficient. Unless new territory is discovered it is the general opinion that the wells at Baku will only be able to continue to produce sufficient oil for home consumption. 2,026,104 cases and 2,549,450 cans of petroleum were shipped from Batoum in 1908, which together represent an actual kerosene export of 5,941,492 poods, or 21,389,364 gallons. The total quantity of kerosene exported in bulk was 17,507,204 poods, or 63,025,940 gallons, and the grand total of kerosene exports amounted to 23,448,696 poods or 84,415,304 gallons. The exports of other petroleum products, in which are included mazout, spindle oil, lubricating and engine oils, amounted to 19,801,369 poods, or 71,291,236 gallons. The total of the petroleum products that were shipped from Batoum to foreign countries during the past year was 43,250,065 poods (155,706,540 gallons), against 37,073,586 poods (133,464,912 gallons) in the year 1907, and 30,999,197 poods (111,597,409 gallons) in 1906.

The quantity of mineral oil products consumed at Batoum and by the copper mines at Dzansoul for fuel and domestic purposes in 1908 was 1,660,505 poods (5,977,800 gallons), and the stock of oil in tanks at Batoum on December 31, 1908, was 5,450,951 poods (21,443,420 gallons). The total quantity of petroleum products brought to Batoum by rail and through the pipeline from Baku in 1908 was 44,625,829 poods (159,646,806 gallons), which, with the stock remaining in storage accommodation on December 31, 1907, represented a grand total of 50,861,521 poods, or 182,095,290 gallons.

PATENTS.

Destructive distillation of coal and other carbonaceous substances: Apparatus for —. T. Parker, Coalbrookdale. Eng. Pat. 4266, Feb. 25, 1908.

Each unit of the battery of retorts consists of a number of vertical tapering tubes supported in a furnace and all

fitting into a common upper chamber which serves to collect the gas given off and for charging the tubes. The lower ends of the tubes are closed by a hinged door which is common to all the tubes of one unit. —W. H. C.

Ammonia; Process and apparatus for recovering — from gases produced in dry distillation. Act.-Ges. f. Kohlendestillation, Gelsenkirchen-Balunke, Germany. Eng. Pat. 26,027, Dec. 2, 1908. Under Int. Conv., July 10, 1908.

By means of a steam ejector the gases from the coke-ovens or retorts are drawn upwards through a spiral condenser, where tar free from water is condensed, then through two water-cooled condensers, where tar and ammoniacal liquor are condensed, and then through a tar extractor. The tar and liquor from the water-cooled condensers flow into a separator reservoir, from which the liquor overflows into another liquor reservoir, and from thence is pumped into a heater. The gases from the tar extractor pass through the steam ejector and are then forced with the steam, through an ammonia still, into which is also pumped the ammoniacal liquor, and the necessary quantity of milk of lime. The steam expels the ammonia which is carried forward by the gas into a saturator, provided with a tower packed with acid resisting material, down which a shower of sulphuric acid flows into the saturator. The ammonium sulphate is withdrawn from the saturator in the usual way and the gas passes on through the heater previously mentioned, where it parts with its heat to the liquor which is then pumped to the ammonia still. —W. H. C.

Tar; Process of separating products from —. P. C. Reilly. Fr. Pat. 395,738, Oct. 28, 1908.

THE claim is for the process of separating the so-called "free carbon" from crude tar by the method of filtration without any previous dilution. The tar is heated and forced or aspirated through a filter formed by stretching cotton or other suitable fabric over a metallic gauze support. Claim is also made for the products obtained, namely filtered tar free from solid particles especially for use in preserving timber and for the carbon residue freed from the tar oils. —W. H. C.

Bitumen; Process and apparatus for extracting — from bitumen-bearing ore. G. M. Willis, Chicago, Ill. U.S. Pats. 918,628 and 918,629, April 20, 1909.

THE ore is finely ground and taken by a water conveyor to a heating pan, where some of the sand and foreign matter is deposited. The sediment is removed from this pan by a conveyor consisting of a number of spades on an endless belt, and the bitumen is transferred to a second heating pan by a skimmer conveyor travelling at a higher speed. The floating mass in this pan is agitated either mechanically or by blowing air through it, and the sediment and bitumen are transferred as before to a third pan. This pan is inclined, and is heated to dry the thin stream of bitumen which flows through it. The dry bitumen is received in a settling tank where it is further heated to allow impurities to separate, the clear bitumene being finally drawn off. —A. T. L.

Hydrocarbons; Treatment of —. E. A. L. Rouxville, Paris. U.S. Pat. 919,248, April 20, 1909.

SEE Fr. Pat. 356,716 of 1905; this J., 1906, 83. —T. F. B.

Lubricating and anticorrosive oils; Manufacture of —. F. W. Klever, Cologne, Germany. U.S. Pat. 919,884, April 27, 1909.

SEE Eng. Pat. 27,254 of 1905; this J., 1907, 86. —T. F. B.

Treating coal tar. Fr. Pat. 395,799. See II.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indican. Part II. A. G. Perkin and F. Thomas. Chem. Soc. Proc., 1909, 25, 125—126.

WHEN indican is hydrolysed by sulphuric acid (4 c.c. in 1000 c.c. of water) at 60°, simultaneously oxidising with

air, the yield of colouring matter is but 85 per cent., due in part to the formation of brown secondary products. The latter reaction does not so readily occur when the equivalent quantity of hydrochloric acid is employed, and the yield of colouring matter (about 93.5 per cent.) is thus higher. In addition to indigotin, indirubin is also formed in some quantity under these conditions. Stronger solutions of sulphuric and hydrochloric acids at the boiling point in absence of air give respectively with indican identical brown products insoluble in alkali, from which in addition to the Indoxyl Brown previously described (this J., 1907, 1193—4, and 464), an analogous substance more sparingly soluble in alcohol (Found, N=9.65) was isolated. The action of acid in the cold for a long period (compare Schunck and Roemer, Ber., 1879, 12, 2311) has a similar effect, and Indoxyl Brown is thus formed. The brown product obtained from the less extracts of the *Indigofera* by means of acid differs from Indoxyl Brown in that it is soluble in alkali, and appears to arise from a condensation of indoxyl with other compounds derived from the plant. In view of recent discussion on the melting point of dextrososazone (Tutill, this J., 1907, 1289), the pure sugar derived from indican was converted into its acetyl derivative, and this was identical with acetyldextrose.

Indican. Part III. F. Thomas, W. P. Bloxam, and A. G. Perkin. Chem. Soc. Proc., 1909, 25, 126.

THE authors have carried out experiments on the hydrolysis of pure indican by means of indimulsin, its specific enzyme (Beyerinck, Proc. K. Akad. Wetensch. Amsterdam 1899, 1, 120; Hazewinkel, *ibid.*, 1900, 2, 512, and van Romburgh, *ibid.*, 1899, 2, 344), and on the air oxidation of the solutions of indoxyl thus produced under a variety of conditions. The results indicate that, owing to the unstable nature of indoxyl, changes occur both during the fermentation and oxidation processes which prevent the reactions from proceeding in a quantitative manner. The best yields of colouring matter were given when a small amount of acid was present during the fermentation (compare Beyerinck, *loc. cit.*), and the fermented liquor was then oxidised in the presence of a trace of ammonia.

Indoxyllic acid. A. G. Perkin. Chem. Soc. Proc., 1909, 25, 126—127.

THE examination of a sample originally consisting of commercial indoxyllic acid, which had remained unopened for some years showed that no indoxyl or indoxyllic acid was now present. The product contained:

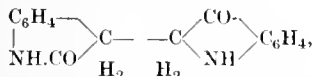
	Per cent.
Matter soluble in alkali	32.44
Indirubin	42.37
Indigotin	17.30
Moisture	2.15
Ash	1.05
Insoluble in nitrobenzene by difference	4.19

THE oxidation appears to have arisen from the gradual admission of air, and whereas the formation of indigotin is easily accounted for, it is considered that the predominance of indirubin has arisen from the formation, in the first place, of isatin from ψ -indoxyllic acid, and its subsequent condensation with indoxyl. That portion of the matter soluble in alkali contained isatin and an acid resembling phenylglycine- α -carboxylic acid, but the major bulk consisted of an amorphous, brown product, free which was isolated a brown substance very closely resembling and possibly identical with the chief constituent of the Indigo Brown (this J., 1907, 464—465) which is present in natural indigo. The examination of two other products derived in the same manner from indoxyllic acid gave results of a similar character, and it thus appears likely that in these circumstances the changes involved are of a normal character.

Indirubin; Reduction of —. A. G. Perkin. Chem. Soc. Proc., 1909, 25, 127.

IT has been shown by Fasal (Mitt K. Tech. Gewerbe-M. Wien., 1895, 307; this J., 1896, 348) that when indirubin

is reduced by zinc dust and alkali under conditions of indigo-vat practice, the Indirubin White at first formed soon undergoes further reduction, indoxyl being thus produced, and this in the dyeing operation is converted into indigotin. A study of the reaction with a large quantity of indirubin derived from an extract of *I. sumatrana* by means of isatin has shown that under these conditions oxindole is also produced, and this, obtained in colourless needles, m. pt. 120°, was identified by means of its nitroso-compound, m. pt., 204—206°, and by oxidation with ferric chloride to isatin. The formation of indoxyl and oxindole is readily understood by reference to the following scheme :



and the behaviour of indirubin in this respect does not suggest that its presence in natural indigo can be economically advantageous. In addition to oxindole, a small quantity of a yellow basic substance resembling the di-indole of Schützenberger (Jabresb., 1877, 511), $\text{C}_{12}\text{H}_{14}\text{N}_2$, was also formed in this reaction. A quantitative study of the reduction of indirubin by this method is in progress.

PATENTS.

Vat dyestuffs; Manufacture of — O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 8531, April 16, 1908.

DYESTUFFS of the thioindigo group are obtained by condensing α - or β -naphthisatin or their substitution products with 3-oxy-1-thionaphthene or a homologue or substitution product thereof. These dyestuffs may also be halogenated, furnishing similar products. The condensation is effected by heating the materials together, generally in nitrobenzene solution for $1\frac{1}{2}$ —2 hours at 220°—230° C. After cooling, the mass is filtered and the solid matter washed with alcohol and dried. The condensation product of bromo- β -naphthisatin and 3-oxy-1-thionaphthene dyes cotton in an alkaline vat in grey-violet tints fast to washing, light, and chlorine. The brominated product dyes in violet-grey shades which are more violet than those obtained with the unbrominated dyestuff. The condensation product of bromo- α -naphthisatin and 3-oxy-1-thionaphthene gives fast violet shades. The product obtained by condensing the chloride of bromo- β -naphthisatin and 3-oxy-1-thionaphthene or oxythionaphthencarboxylic acid in xylene solution dyes cotton in fast violet-grey tints. α -Naphthisatin and 3-oxy-1-thionaphthene furnish a dyestuff producing violet shades and the brominated derivative dyes cotton in bright brown-violet tints. The dyestuff produced by brominating the product of condensation of β -naphthisatin and oxythionaphthene gives bright violet shades.—J. C. C.

Brominated indigos; Manufacture of — O. Imray, London. From Soc. of Chem. Ind. in Basle, Basle, Switzerland. Eng. Pat. 27,747, Dec. 21, 1908.

THE tri- and tetrabromo-indigo derivatives, prepared by treating indigo in concentrated sulphuric acid at moderate temperatures with bromine, yield dyeings which are not so fast to light and chlorine as those from the bromo-indigos prepared by brominating indigo in an indifferent solvent. The products obtained by the former method are found to be mixtures, one constituent (a sulphonic acid derivative) being soluble in dilute alkali, whereas the remainder is dissolved by organic solvents such as nitrobenzene. The nitrobenzene solution, upon cooling or concentrating, deposits crystals which appear to be identical with tetrabromo-indigo, in that the dyeings agree in respect of tint and fastness to washing, light and chlorine. The crystals which separate only on a further concentration of the mother liquor yield dyeings which are much greener in tone and are not so fast to washing.—F. M.

Carbazol; Derivatives of — and dyestuffs formed therefrom. L. Haas, Paris. Eng. Pat. 2918, Feb. 6, 1909. Under Int. Conv., May 15, 1908.

By allowing nitrosophenol or its homologues or derivatives to act on carbazole in the presence of concentrated sulphuric acid, compounds are obtained which yield blue sulphide dyestuffs when treated with alkaline polysulphides. Example: 1 kilo. of carbazol is dissolved in 10 kilos. of sulphuric acid (66° B.) and a solution of 800 grms. of nitrosophenol in 8 kilos. of sulphuric acid (66° B.) is stirred in at a temperature not exceeding 30° C. The blue liquid is poured on to ice and the precipitate is filtered off, washed, and pressed. The paste is now mixed with a very small amount of water, heated with 1—1.5 kilos. of sodium sulphide until decolorisation is complete, and then 1—1.5 kilos. of sulphur are mixed in and the mass melted, the temperature not being allowed to exceed 250° C. The product is isolated and purified in the usual way. It dyes cotton dark blue from an alkali sulphide bath and the shades produced are fast to light and chlorine.—J. C. C.

Sulphide dyestuffs; Process for preparing yellow, yellow-brown, and orange-dyeing — Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 208,805, Feb. 29, 1908. Addition to Ger. Pat. 201,834, April 23, 1907.

BENZIDINE or one of its derivatives is added to the mixture of alkyl-*m*-diamines and aromatic nitro-amino- or dinitro-compounds, or of *m*-diamines or triamines and alkyl-nitro-amines or polynitro-compounds which are melted with sulphur to produce sulphide dyestuffs according to Fr. Pat. 388,539 of 1908 (this J., 1908, 895). The dyestuffs produced are yellower in colour than those previously described.—T. F. B.

[Azo] Dyestuffs which can be developed; Process for preparing — Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 208,968, March 29, 1908.

MONONITROBENZOYLDIAMINES, obtained by the action of mononitrobenzoyl chloride on monoformyldiamines and subsequently eliminating the formyl group by means of dilute mineral acids, are diazotised and combined with 2,5,7-aminonaphtholsulphonic acid or its derivatives substituted in the amino-group. On reduction of the nitro-group of these dyestuffs, products are obtained which can be further diazotised on the fibre, and developed with phenols or amines. The shades produced vary from red to violet.—T. F. B.

Compounds containing sulphur [Diketodihydrothionaphthenes]; Manufacture of — J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 17,498, Aug. 20, 1908. Addition to Eng. Pat. 28,240, Dec. 11, 1906.

SEE Addition of Sept. 3, 1908, to Fr. Pat. 374,287 of 1907; this J., 1909, 238.—T. F. B.

Indigos; Highly brominated halogen — and process of making same. A. Schmidt, H. Rössner, and H. Balhorn, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 918,920, April 20, 1909.

SEE Eng. Pat. 25,514 of 1907; this J., 1909, 17.—T. F. B.

Sulphur [sulphide] dyestuff; Blue — and process of making same. L. Haas, Paris, Assignor to Cassella Color Co., New York. U.S. Pat. 919,572, April 27, 1909.

SEE Eng. Pat. 2918 of 1909; preceding.—T. F. B.

Pigments [from naphthanthraquinone]. Eng. Pat. 18,616. SEE XIII.A.

Lake from sulphonated azo dyestuffs. U.S. Pat. 918,244. SEE XIII.A.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Silk; Studies on the formation of — E. Abderhalden and H. R. Dean. *Z. physiol. Chem.*, 1909, 59, 170—173.

THE authors have raised the general question as to whether the mono-amino-acids, which constitute the ultimate unit groups of the protein substances present in, or furnished to, animal organisms, are capable of being changed in nature or amount, or synthesised from simpler fractions of protein hydrolysis, as the result of the processes of vital metabolism. This question is now open to investigation owing to the accumulation of data yielded by the methods of total hydrolysis, and quantitative determination of the various amino-acids produced. The authors have selected the silk-worm as a convenient subject for study from this point of view, the composition of silk as regards its constituent mono-amino acids having been fairly completely ascertained; moreover, the worm takes no nourishment after it has begun to spin. The silk fibre is particularly characterised by the fact that it contains considerable proportions of tyrosine, glycocoll and alanine groups. The authors have first investigated whether these mono-amino-acids were also present in corresponding preponderance in the worm itself before spinning, or whether they were elaborated from other groups in the act of spinning, by a special process of metabolism. Silk-worms, ready to spin, were dried and hydrolysed, in the manner previously adopted in the case of the silk fibre (this J., 1909, 240). The results showed that the worms contained large supplies of the above amino-acids most abundant in the silk fibre; glycocoll and alanine were particularly prominent in the silk-worm protein. It does not necessarily follow that the worm contains ready-formed silk-protein in the liquid state, but merely that the silk-worm protein contains the necessary ultimate units for conversion into silk by re-arrangement under the metabolic processes carried out by the silk-glands. Further light will be thrown on the general question stated above, by a study of the nature and quantity of the mono-amino-acids present in the proteins of the mulberry leaves consumed by the worms during their active life.—J. F. B.

Silk-worm moth; The mono-amino-acids of the body of the — E. Abderhalden and W. Weichardt. *Z. physiol. Chem.*, 1909, 59, 174—176.

CONTINUING the study of the general question stated in the preceding abstract, the authors draw attention to the fact that, after the act of spinning has been completed, the worm, now a moth, undergoes very considerable morphological changes in its tissues and assumes totally different functions, without the introduction of any further nourishment. If no conversion of the ultimate mono-amino-acids into other bodies of the same order, nor any synthesis from simpler nitrogenous compounds, corresponding with this profound organic change, take place, then the mono-amino-acids obtained by the hydrolysis of the moths should be the algebraic sum of the mono-amino-acids of the worms minus those of the silkworm. This was found to be approximately the case. Compared with the worms, the yields of tyrosine, glycocoll and alanine obtained from the moths were very sensibly lower and the yields of valine and especially leucine were correspondingly higher, as were also those of the other mono-amino-acids. The authors propose to study the results similarly obtained at various stages of the development of the pupa, in order to ascertain whether the change in composition takes place suddenly or progressively.

—J. F. B.

Silk; Composition and chemical structure of various species of — H. The mono-amino-acids of Canton silk. E. Abderhalden and L. Behrend. *Z. physiol. Chem.*, 1909, 59, 236—238. (See also this J., 1909, 240.)

THE amino-acid products of the ultimate hydrolysis of the fibroin of Canton silk have been studied in the same

manner as those from New-Chwang silk. Canton silk is white and closely resembles Italian silk, but has a finer filament. On de-gumming, 480 grms. of raw silk yielded 100 grms. of silk gum. The fibroin contained 5.1 per cent. of hygroscopic moisture (dried at 100° C.) and 0.32 per cent. of ash. On hydrolysis with hydrochloric or sulphuric acid, only traces of a humic residue remained. The tyrosine was determined, as before (*loc. cit.*), after hydrolysis with 25 per cent. sulphuric acid; the other amino-acids were determined after hydrolysis with fuming hydrochloric acid. The quantities of the various mono-amino-acids obtained were as follows: Glycocoll, 37.5; alanine, 23.5; serine, 1.5; leucine, 1.5; aspartic acid, 0.75; phenylalanine, 1.6; tyrosine, 9.8; proline, 1.0; glutamic acid, nil, all calculated as per cent. of the dry ash-free fibroin substance. These numbers show a striking concordance with those obtained by Fischer and Skita for the fibroin of Italian silk.—J. F. B.

Indigo in dyed cotton; Determination of — E. Knecht. *J. Soc. Dyers and Col.*, 1909, 25, 135—137.

THE method described is based upon the well-known facts that cellulose is completely dissolved by sulphuric acid of 80 per cent. strength at a temperature of 35°—40° C., and that acid of this strength also dissolves indigotin, forming a sulphate which, when treated with water, dissociates, with separation of the whole of the indigotin as such. The method was tested by dissolving 5 grms. of cotton yarn and 0.2 gm. of pure indigotin (99.5 per cent.) in 25 c.c. of 80 per cent. sulphuric acid. The whole was slowly stirred, and maintained at a temperature of 40° C.; solution was complete in about 10 minutes. The solution was precipitated by diluting with 120 c.c. of water, and the precipitate collected in a Gooch crucible containing sand and asbestos as the filtering medium. The crucible and its contents were dried at 110°—120° C., and the indigotin then sulphonated by warming in the water-oven with a little concentrated sulphuric acid. The sulphonate was dissolved in water and titrated either with titanous chloride, or permanganate solution. Two estimations, using titanous chloride, gave (1), 0.1981 gm., (2), 0.1979 gm. of indigotin instead of 0.1990 gm. In testing a sample of dyed cloth, about 4 grms. of the material should be taken, cut up into fine pieces, and treated as described. The usual topping colours employed with Indigo (Methyl Violet, Safranine), and Sulphide Blues do not interfere with the results, but Manganese Bronze must be removed by treating with bisulphite before proceeding with the estimation of the Indigo.—F. M.

Acid Green extra; Remarkable atmospheric action on yarn dyed with — A. Herz and C. E. Barracough. *J. Soc. Dyers and Col.*, 1909, 25, 139.

WOOL yarn which had been dyed bright green with Acid Green extra (By.) and Acid Yellow G. (Berlin) and left over-night without washing off, became quite yellow wherever the atmosphere had had free access to it. Washing in boiling water restored the original colour, but the washed hanks became again yellow, after exposure to the atmosphere for about two hours. The atmosphere was acid to litmus, and it was found that gaseous sulphurous acid was capable of bringing about the change of colour the original shade being restored by washing with hot water or on heating. Acid Green extra is bleached by a cold solution of sulphurous acid; on boiling, the colour returns, but is destroyed again on cooling.—F. M.

Picric acid; Colouring and dyeing properties of — L. Vignon. *Compt. rend.*, 1909, 148, 844—846.

1. THE depth of colour of picric acid solutions in various solvents (water, alcohol, ether, benzene) varies in the same sense as the electric conductivity of the solutions.
2. Aqueous solutions dye wool and become impoverished when their conductivity reaches a certain value; this may be achieved either by increase of the quantity of picric acid dissolved, or by addition of hydrochloric acid.
3. In alcoholic solution containing 1 part of hydrochloric acid in 10,000, though the conductivity is considerable there is very little fixation of the dyestuff on the fibre. The fixation of the colour on wool seems, under the conditions employed, to be due to a chemical reaction o

the fibre on the highly ionised dyestuff. It is not due to the formation of salts; for picric acid in benzene solution does not dye wool, though it combines energetically with organic bases.—J. T. D.

Ramie incandescent mantles. Böhm. See II.

PATENTS.

Shrinking properties of wool or animal fibres, and woollen yarn and fabrics; Treatment for modifying the —. J. Schneider, Galashiels. Eng. Pat. 11,834, June 1, 1908. Addition to Eng. Pat. 6152, Mar. 14, 1907 (this J., 1908, 331).

Loose wool or animal fibres, woollen yarn, etc., treated with caustic alkali of less than 32° Tw. acquire the same properties as regards felting, as when treated with chlorine. Fabrics shrink a little under the treatment, but the loss in weight is not so great as in the case of treatment with chlorine. The immunity from shrinkage under a subsequent mild alkaline treatment (milling) is proportional to the strength of the caustic alkali (up to the limit of 32° T.) used in the first instance.—F. M.

Kiers for linen or cotton piece goods or yarns; Bleaching or boiling —. S. J. Frazer, Culleybackey, Ireland. Eng. Pat. 17,653, Aug. 22, 1908.

The kier is provided with a flexible bottom or support for bearing the material to be treated. This bottom comprises, in combination, a central ring resting on a vertical standard, a series of radiating chains secured at their outer ends to the wall of the kier and at their inner ends to the central ring, and finally a series of concentric chains which are suitably fastened to the radiating chains.—P. F. C.

Treating fabrics in spread out form with liquids; Process and apparatus for —. E. Gminder, Reutlingen, Germany. Eng. Pat. 21,829, Oct. 15, 1908.

The fabric to be treated is led through an opening in the side-wall of a cylindrical receiver which is arranged during the filling process with its axis horizontal. In order to arrange the material in regular zig-zag folds, the receiver is made to rock about an axis eccentric to its own. When full, the receiver is placed with its axis vertical, the opening in the wall is closed, and the liquor necessary for the treatment is circulated vertically through the apparatus by means of a pump.—P. F. C.

Dyeing apparatus. T. Allsop and W. W. Sibson, Assignors to The Philadelphia Dyeing Machinery Co., Philadelphia, Pa. U.S. Pat. 918,485, April 13, 1909.

A ROTATABLE perforated cylinder is arranged inside a vat which is provided with means for circulating the dye-liquor. These circulating devices are such that the liquor inside the vat can be made to flow alternately in opposite directions.—P. F. C.

Dyeing machine. C. J. McNamara, Assignor to G. Gross, Philadelphia, Pa. U.S. Pat. 918,767, Apr. 20, 1909.

The upper part of a dye-vat is provided with a movable frame, which carries a number of "dye-sticks" having earings at their ends by means of which they are rotated from a crank shaft.—P. F. C.

Dianthraquinonylamines; Process for fixing the —, obtained according to Ger. Pat. 174,699, or vegetable fibres. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 208,845, Feb. 9, 1908.

The dianthraquinonylamines obtained according to Ger. Pat. 174,699 (see this J., 1907, 314) are reduced to the succo-compounds by means of alkaline reducing agents e.g., hydrosulphites in alkaline solution, and the vegetable fibres or fabrics are immersed in this solution and the colour is subsequently developed by oxidation: very fast, clear, orange shades are produced by this means.—T. F. B.

Green, olive and brown effects in dyeing and printing; Production of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 14,593, July 9, 1908.

By oxidising *m*-aminophenols on the fibre with alkali chlorate and ferrocyanide, shades fast to light and washing are obtained. Example:—A bath is prepared containing 25 grms. of *m*-aminophenol, 50–60 c.c. of 30 per cent. hydrochloric acid, 60 grms. of potassium ferrocyanide, and 25 grms. of sodium chlorate in a litre. The goods are padded with the filtered solution, dried, then steamed for about ten minutes in a Mather-Platt apparatus and next treated with a lukewarm solution of sodium bichromate. To obtain a green shade, the goods are washed in acidulated water and dried. To obtain a brown shade it is necessary to pass the goods through a solution of sodium silicate and then wash and soap. If desired, a reserve can be printed on to the prepared goods immediately after drying. For a white reserve a mixture of 400 grms. of gum solution, 100 grms. of Rongalite C and 400 grms. of potassium sulphite solution (45° B.) mixed with 100 grms. of gum solution, can be employed. For coloured reserves on cotton, the ordinary albumin dyestuffs to which alkali sulphite and acetate have been added, or basic dyestuffs with zinc white, can be used. Upon silk or half-silk, it is sufficient to print basic dyestuffs together with potassium sulphite and sodium acetate.—P. F. C.

Printing of textile fabrics. F. Ashton, Hyde, and The Calico Printers' Association, Limited, Manchester. Eng. Pat. 8620, Apr. 18, 1908.

THE application of resists of resins, fats, or other substances having high melting points, by printing machines has hitherto been made difficult by the solidification of the molten resist upon the engraved rollers. To remedy this difficulty, the engraved rollers and the doctors with which they are provided, are maintained at a temperature sufficiently high to prevent solidification of the resist.—P. F. C.

Fatty acid compounds with aldehydes and ketones and the application thereof in colour printing; Manufacture of new organic —. O. Imray, London. From Farbwärke vorm. Meister, Lucius, und Brüning, Höchst a/Main, Germany. Eng. Pat. 13,790, June 29, 1908.

By treating unsaturated organic fatty acids of high molecular weight with aldehydes and ketones, new compounds are formed which are soluble in alkalis and are very stable in the cold. When heated however, they react like free fatty acids and they are therefore very useful in printing with certain alizarin dyestuffs, such as Alizarin Red and Alizarin Orange, which could hitherto only be printed on goods which had previously been prepared with Turkey-red oil or the like. By adding the above described new compounds to the printing colour, colour lakes are not formed until the goods are steamed, and the previous oiling of the material becomes unnecessary. Example 1: One kilo. of castor oil is gradually mixed with 250 grms. of formaldehyde (40 per cent.) at 20° C. and stirred for some time. Then 200 grms. of concentrated sulphuric acid are added as a condensing agent at 15°–20° C. and the mixture is allowed to stand overnight. The reaction product is stirred in a 10 per cent. solution of Glauber salt and is then heated to 90° C. The oil is next removed and well washed to free it from traces of acid. The product is finally allowed to settle and the separated water is removed. Example 2: To prepare a printing colour, 50 grms. of the product made according to Example 1 are mixed with 400 grms. of acid starch thickening, 200 grms. of tragacanth (60:1000) 75 grms. of Alizarin Red 5 F. (20 per cent.), 25 grms. of Alizarin Red 1 B (20 per cent.), 55 grms. of water, 90 grms. of aluminium thiocyanate (12° B.), 30 grms. of aluminium acetate (12° B.), 20 grms. of tin oxalate (16° B.), 15 grms. of tartaric acid solution (1:6) and 40 grms. of calcium acetate (16° B.).—P. F. C.

Discharge of colouring matters of the Thioindigo and Indigo classes, and pastes to be employed therein. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen a Rhine, Germany. Eng. Pat. 8726, April 21, 1908.

STANNOUS chloride, in an acid medium, has been proposed as a discharging agent for indigo, but is not very suitable as the fibre is attacked and tendered in the process. Thioindigo and indigo dycings may be discharged however by means of glucose (or other carbohydrate), or stannous oxide, in the presence of alkali. A suitable paste for discharging deep shades of indigo is prepared by mixing 650 parts of gum thickening with a solution of 50 parts of 50 per cent. stannous oxide paste in 100 parts of water and 200 parts of 35 per cent. caustic soda lye. The printed material is dried at a moderate temperature, steamed for 5 minutes at 100–105 C. in air-free steam, passed through boiling water containing 10 c.c. of a 35 per cent. caustic soda solution per litre, and finally washed.—F. M.

Goffing effects on yarns, tissues, or the like: Process of obtaining — C. T. Tredup, Godesberg, Germany. U.S. Pat. 918,397, April 13, 1909.

The goods are first impregnated with a bath containing a substance which can be coagulated, then condensed with rollers which are not hot enough to cause coagulation and are finally exposed to dry heat and to steam under pressure, in order to convert the impregnating substance into an insoluble coating.—P. F. C.

Waterproof and lustrous cloth or other fabric and the method and means for producing it. R. Hübner, Radcliffe, and J. H. Riley and Co., Limited, Bury. Eng. Pat. 7972, April 10, 1908.

The fabric is coated with stearic acid or a mixture containing it and is subsequently passed through a Schreiner calender. In order to apply the stearic acid, the fabric is passed between two squeezing rollers, the upper roller having an india-rubber surface whilst the lower one is made of brass and has a finely grooved surface. This lower roller revolves with its lower part immersed in molten stearic acid. A doctor may be used to remove the excess of stearic acid from the lower roller before it touches the fabric.—P. F. C.

Textile material: Apparatus for treating — as well as for mixing chemical materials and the like with liquids. R. Diederichs, Cologne, Germany. Eng. Pat. 8821, April 22, 1908.

SEE Fr. Pat. 330,105 of 1908; this J., 1908, 1017.—T. F. B.

Indigo vat employed in dyeing: Preparation of the — H. Chaumat, Paris. Reissue No. 12,946, dated April 27, 1909, of U.S. Pat. 885,978, April 28, 1908.

SEE Fr. Pat. 379,041 of 1906; this J., 1907, 1196.—T. F. B.

Bleaching agent. Eng. Pat. 2522. See XIV.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

"Chamber regulator" [in sulphuric acid manufacture]. H. Petersen. Chem.-Zeit., 1909, 33, 409–411.

THE advantages claimed for the use of a "chamber regulator" (see this J., 1907, 870; 1908, 981) in the manufacture of sulphuric acid may be summarised as follows:—(1). More efficient fixation of the acid gases leaving the chambers is secured. For nitrous vitriol of the strength used (53°–57° B.) will absorb sulphur dioxide with the production of sulphuric acid and will also absorb oxides of nitrogen, if necessary, though, on the other hand, it will give up these oxides, if there be a temporary deficit and thus keep up the percentage in the Gay-Lussac acid. (2). Sulphuric acid is produced in the regulator itself, as above indicated. (3). Economy is effected in the consumption of nitric acid by the more regular working of the system. (4). The total production

of acid is increased, owing to the possibility of more rapid working, and this without the use of a "double ring" of Gay-Lussac and Glover towers. (5). A stronger acid may be produced in the chambers; for, any deficiency in water vapour in the last chamber, which renders complete fixation of the sulphur dioxide impossible, is made up for by the absorption of this gas in the regulator. Figures are given, relating to an English factory, which show a reduction from 7.4 grms. to 1.7 grms. of sulphur trioxide per cb. m. in the final exit gases and a decrease in the consumption of nitric acid from 1.7 per cent. to 0.7 per cent. after the introduction of a regulator, the yield of acid on the sulphur burnt also showing improvement. The size of the tower constituting the regulator varies from 0.2 per cent. of the total chamber space for systems of 6000–8000 cb. m. to 0.4–0.5 per cent. with systems below 4000 cb. m. A case is recorded of a tower of 75 cb. m. capacity which produced 2900–3000 kilos. of acid (50° B.) in 24 hours, or one-eighth of the total production of the system.—F. SOPH.

Sulphuric acid: Purification of —, from arsenic, by freezing. M. Morane. Compt. rend., 1909, 148, 842–843.

When sulphuric acid is partially frozen, any arsenic present is concentrated in the liquid portion. A sample of Glover tower acid was concentrated to 1.72 sp. gr., and exposed for a day to a temperature varying between 2 and –8 C., when half of it froze. The solid and liquid portions were separated and analysed. For every 100 parts of monohydrate, they contained respectively:—

	Solid portion.	Liquid portion.
Non-volatile residue	0.281	0.829
Ferric oxide and alumina	0.029	0.119
Arsenic	0.033	0.368

—J. T. D.

Sulphuric acid: Concentration of — in cast iron vessels. H. Friedrich. Chem.-Zeit., 1909, 33, 478–479.

A thin stream of Glover or chamber acid, from 50° to 60° B. in strength, is directed on to the surface of a large quantity of concentrated acid of 66° B., which is kept boiling inside a suitable cast iron vessel. The concentrated acid is drawn off from the bottom by means of a siphon, suitable provision being made for condensing the distillate. The cast iron vessel should last at least one year; the space required for the apparatus is 15–20 cubic metres; and a daily output of about 5000 kilos. of 93 per cent. sulphuric acid is obtained at a capital expenditure of £200–£250.—O. R.

Nitric oxide from the air: Formation of — by means of a current of electricity of low voltage. G. W. Morden. Trans. Amer. Electrochem. Soc., 1908, 14, 113–141.

THE author's work is a continuation of that of Haber and Koenig (this J., 1908, 27, 1070), who attempted, by means of a cooled arc, to obtain results due chiefly to electrical action. The apparatus used was different from that of Haber and Koenig: direct current was employed, and short arcs. The cathode was of iridium covered with calcium oxide; the fall of potential at the cathode was relatively very small, and vapour of the electrode material was not present in the arc. The current strength varied between 0.1 and 0.25 ampère with a voltage at the arc ranging from 100–280 volts. It was found that the highest concentrations of nitric oxide were obtained at pressures between 300 and 500 mm. Small gas velocities were favourable to high concentrations, and great velocities to high yields per kilowatt-hour. For every gas velocity there was a maximum concentration of nitric oxide possible; increase of current strength beyond that necessary to attain this concentration resulted only in a decrease in the yield per kilowatt-hour. By using as anode a hollow, water-cooled, silver capillary tube, and by sucking the gases out through its centre, with a hot cathode lying quite near the anode, it was possible to obtain

either high concentrations of nitric oxide or high yields per kilowatt-hour by using appropriate pressure and gas velocity. Hitherto the highest concentrations of nitric oxide obtained from air were 9.5–10 per cent. by Haber and Koenig at 100 mm. pressure. The author obtained a concentration of 9.7 per cent. at 300–400 mm. pressure and with low voltage. The yields obtained in the best commercial processes are given as 550 kilos. of nitric acid per kilowatt-year, or 63 grms. per kilowatt-hour. In the author's experiments a yield of 92 grms. of nitric acid per kilowatt-hour was attained.—A. S.

Finlay electrolytic alkali-chlorine cell; The current and energy efficiencies of the —. F. G. Donnan, J. T. Barker, and B. P. Hill. *Faraday Soc.*, April 27, 1909. [Advance proof.]

In the Finlay electrolytic cell, a middle brine chamber separates, by means of diaphragms, the anode and cathode chambers, whilst a continuous flow of electrolyte is supplied, under a "head," to the middle chamber and passes through the cell diaphragms. The various compartments are built up in the form of a filter-press, so that both sides of the electrodes are electrolytically active, and the resistance is reduced to a minimum by diminishing the thickness of the electrolyte in each compartment. The anodes are of graphite and the cathodes of wrought iron. A series of experiments have been carried out by the authors on a laboratory form of the cell, the current and rate of flow of the electrolyte being maintained constant. Very little disintegration of the carbon anodes was observed, and the particles of carbon were swept out with the anode effluent, thus avoiding the choking of the diaphragms. The cathodic current efficiency (with 2 mm. diaphragms) does not appear to improve with increase of current density, but is a function mainly of the alkali concentration, about 7 per cent. of caustic soda being obtained with an efficiency of 91 per cent. With thicker diaphragms two 2 mm. diaphragms placed together, considerably higher cathodic current efficiencies were obtained for the same strength of caustic soda, and it appears that for higher strengths the efficiency increases with the current density, whilst for lower strengths the reverse is the case. With diaphragms loaded slightly with ferric hydroxide, the average current efficiencies are about the same as those obtained with two 2 mm. diaphragms at the same current density, with the great advantage that the cell voltage is sensibly lower. The composition of the anode gas shows that it contains about 99 per cent. of chlorine, when the cell is making 6 to 7 per cent. caustic soda solution. Experiments have also been made showing that for moderate concentrations of caustic soda (6 to 8 per cent.), the Finlay cell, with double diaphragm and percolating electrolyte, gives enormously higher current efficiencies than single diaphragm cells with non-percolating electrolyte.—B. N.

Nitrogen; Determination of — in saltpetre by means of stannous chloride and iron filings. A. Kleiber. *Chem.-Zeit.*, 1909, 33, 479–480.

The reduction takes place in accordance with the equation, $\text{KNO}_3 + \text{SnCl}_2 + 10\text{HCl} + 3\text{Fe} = \text{NH}_4\text{Cl} + \text{SnCl}_4 + 3\text{FeCl}_2 + \text{KCl} + 3\text{H}_2\text{O}$. For the determination, $\frac{1}{2}$ gram. of saltpetre dissolved in 7.5 c.c. of water is introduced into a distilling flask of about 1 litre capacity, about 5 grms. of solid commercial stannous chloride, 15 c.c. of concentrated hydrochloric acid, and about 4–5 grms. of iron filings are added to the solution, and the mixture is heated on the water-bath for 10–15 minutes. 40 c.c. of saturated caustic soda solution mixed with about 100 c.c. of water and a piece of paraffin wax the size of a pea are added, and the mixture is rapidly distilled over a strong flame, so that the whole distillation is complete in under half an hour. The ammonia is preferably distilled into $\text{N}/2$ sulphuric acid and the excess of the latter titrated with $\text{N}/4$ baryta water. To make the necessary correction for the ammonia retained by the apparatus in the above instance, 0.2 c.c. must be subtracted from the volume of $\text{N}/4$ baryta water used.—O. R.

Calcium-alkali sulphates. J. D'Ans and O. Schreiner. *Z. anorg. Chem.*, 1909, 62, 129–167.

CONCENTRATION-TEMPERATURE diagrams are given of all the double sulphates known to be formed by the alkali metals with calcium between 0° and 100° C., showing their fields of existence and temperatures of formation, as far as could be determined. The salts included in the investigation are the syngenites, $\text{K}_2[(\text{NH}_4)_2\text{Rb}_2]\text{Ca}(\text{SO}_4)_2 \cdot \text{H}_2\text{O}$, the dicalcium sulphates, $(\text{NH}_4)_2[\text{Rb}_2\text{Cs}_2]\text{Ca}_2(\text{SO}_4)_4$, the pentacalcium sulphates, $\text{K}_2[(\text{NH}_4)_2]\text{Ca}_5(\text{SO}_4)_6$, and glauberite, $\text{Na}_2\text{Ca}(\text{SO}_4)_2$. The existence of a labile double salt of the formula, $\text{Na}_4\text{Ca}(\text{SO}_4)_3 \cdot 2\text{H}_2\text{O}$, has also been established, but no double salts with thallium or lithium have been obtained. The influence of various electrolytes and of sucrose on the solubility of potassium syngenite at 25° C. has been studied. Potassium salts are found to lower the sulphate concentration of the solution which is in equilibrium with syngenite and gypsum at that temperature, and the concentration of the potassium salt for which $\text{Ca}=\text{SO}_4$, and beyond which, therefore, the salt is able to form syngenite by double decomposition with gypsum, is found to be 12 mols. of potassium acetate, 18 of potassium chloride, 17.2 of potassium bromide or iodide, and 26 of potassium nitrate per 1000 mols. of water. Acids, on the other hand, increase the concentration both of sulphate and calcium, and, as a rule, their influence is in the order of their affinities; the sodium salts act like the corresponding acids, but less powerfully. The effect of electrolytes is quite analogous to that observed in studying the solubility of gypsum. Sucrose has but little influence on the concentration either of sulphate or of calcium in the equilibrium solution.—F. SONX.

Cuprous and cupric chlorides in hydrochloric acid solution; Equilibrium between —. G. Poma. *Atti R. Accad. dei Lincei*, Roma, 1909 [5], 18, I, 133–138. *Chem. Zentr.*, 1909, 1, 1386.

THE author determined the solubility of cuprous chloride in solutions containing known quantities of hydrochloric acid and cupric chloride, and also in solutions of hydrochloric acid of equal concentration free from cupric chloride. In all cases a larger quantity of cuprous chloride was dissolved by solutions containing cupric chloride. In solutions containing hydrochloric acid in concentrations of 1-N and 2-N, the ratio between this extra quantity of dissolved cuprous chloride and the amount of cupric chloride present increased with increasing concentration of the latter, but in solutions of 4-N acidity, the ratio was almost constant at 0.4. In solutions of cupric chloride in methyl alcohol, free from hydrochloric acid, the ratio was also 0.4. It is concluded that one or more complex cuprous-cupric salts are formed.—A. S.

Lead sulphate; Solubility of — in concentrated solutions of sodium and potassium acetate. J. J. Fox. *Chem. Soc. Proc.*, 1909, 25, 128.

THE increased solubility of lead sulphate in concentrated solutions of sodium and potassium acetates is due to the formation of lead acetate in solution, conclusive evidence being obtained from the examination of the system potassium acetate—lead sulphate. In this case no sulphate was dissolved, although as much as 19 per cent. of lead acetate was found in one of the solutions. As regards the system sodium acetate—lead sulphate, the proportion of sulphate in solution was equivalent to the lead dissolved. The solid phase in the potassium acetate system was altered, lead potassium sulphate, $\text{PbK}_2(\text{SO}_4)_3$, being formed, but no corresponding double salt was obtained from the sodium acetate system. The absence of double salt in the latter case probably arises from the fact that the amount of sodium sulphate formed from the lead sulphate by sodium acetate is insufficient, considered alone, to saturate the solution at 25°. The solubility curve for sodium sulphate in sodium acetate solution is entirely different in character from that of potassium sulphate in potassium acetate, the solubility in the latter case decreasing rapidly with increasing concentration of the potassium acetate. Although the solubility of lead sulphate is shown to be due to the formation of lead acetate in solution, the solubility

curves do not coincide with those derived from the system lead acetate—alkali acetate, since the presence of sulphates in the solid phases tends to reduce the solubility of the lead.

Silver and lead compounds: Impossibility of predicting thermochemically the relative stability of corresponding —. A. Colson. *Compt. rend.*, 1909, 148, 837—839.

THE heats of formation of lead carbonate and nitrate are greater than those of the corresponding silver salts. But whilst at higher temperatures lead carbonate is more stable than silver carbonate, lead nitrate begins to decompose at 283° C., silver nitrate only above 350° C. If lead nitrate be dissolved in melted silver nitrate (in which it is largely soluble with absorption of heat, and thus with diminution of its heat of formation) it gains in stability, for its temperature of initial dissociation is raised to 350° C.—J. T. D.

Bismuth trichloride: Hydrolytic dissociation of —. R. Dubrisay. *Compt. rend.*, 1909, 148, 830—832.

WHEN clear solutions of bismuth chloride in hydrochloric acid are treated with water so as just to effect precipitation of the bismuth oxychloride, equilibrium is reached after three days at the ordinary temperature, after twelve hours at 80° C. Determinations of the composition of the clear liquid remaining after equilibrium is reached, show that the system is bivalent, and hence there is but one oxychloride; and also that the dissociation of the chloride and formation of oxychloride diminish as the temperature rises.—J. T. D.

Coke: Action of —, on ferric chloride and auric chloride in solution. A. Tingle. *J. Amer. Chem. Soc.*, 1909, 31, 461—463.

THE author has repeated with coke, in a slightly modified form, some of the experiments of de Coninck (this J., 1900, 744). Solutions of auric chloride, neutral ferric chloride, and "basic ferric chloride" (the neutral solution to which sodium carbonate had been added till a permanent precipitate just began to form) containing 0.3 to 0.5 gm. of metal per 100 c.c., were allowed to percolate through 20 cm. depth of coke, which passed a 20-mesh but was retained by a 40-mesh sieve, at the rate of 5 c.c. per minute (except Expt. 7, in which the rate was 1 c.c. per minute). In one set of experiments, washed coke was used, i.e., coke which had been extracted with hydrochloric acid and washed free from acid. The results were as follows:—

Washed coke.

	Per cent. of metal lost or gained.	Per cent. of iron reduced to ferrous state.
1. Ferric chloride	— 2.40	1.56
2. Do.	— 0.72	0.50
3. Basic do.	— 7.23	2.50
4. Auric chloride	— 42.75	—

Unwashed coke.

5. Ferric chloride	+ 1.44	22.50
6. Basic do.	— 16.53	not determined
7. Do.	— 7.05	not determined
8. Auric chloride	— 73.82	—

In the author's opinion the results are due largely if not entirely to the sulphur compounds in the coke.

—J. T. D.

Determining perchlorate. Rothmund. See XXIII.

PATENTS.

Zinc compounds and ammonia [from galvanisers' skimmings]: Method of and apparatus for recovering —. E. G. and M. M. Pearlman, Philadelphia, Pa. U.S. Pats. 919,375 and 919,376, April 27, 1909.

SAL-AMMONIAC (ammonium chloride) flux or skimmings, a by-product of the galvanising process, is roasted in a furnace provided with a stack closed at the top. The

fumes evolved, containing zinc chloride and ammonia, are led off from the stack, through a side conduit, to an injector-device, where they are mixed with steam, and are then forced through tanks containing respectively milk of lime and a solution of sulphuric acid, in order to recover the zinc as hydroxide and the ammonia as ammonium sulphate.—A. S.

Carbides: [Electric] Process for producing —. R. Catani, Rome, Italy. U.S. Pat. 918,419, April 13, 1909.

THE carbon, used in the production of the carbide (e.g., calcium carbide), is coated with a refractory compound, such as slaked lime, and heated with slaked lime in an electric furnace, the electrodes of which are also coated with the same compound.—B. N.

Oxygen and hydrogen: Electrolysis of water for the production of —. K. J. Varielle. First Addition, dated Oct. 28, 1908, to Fr. Pat. 355,652, June 27, 1905 (this J., 1905, 1240).

THE troughs, described in the main patent, for the separation of the electrodes are replaced by vertical series of elements each of triangular section, and either solid or hollow. Each electrode consists of a sheet, with U-shaped pieces bound on each side with rivets. The gases are collected in bells, either stamped out of sheet metal or consisting of sheets cut out and folded, and united at the angles by autogenous soldering.—B. N.

Lime: Method and apparatus for slaking —. W. Schulthess, Paris. Eng. Pat. 19,656, Sept. 18, 1908.

SEE Fr. Pat. 390,357 of 1908; this J., 1908, 1018.—T. F. B.

Alkali chloride solutions: Apparatus for the electrolytic decomposition of — by means of mercury cathodes. J. J. Rink, Copenhagen. U.S. Pat. 918,370, April 13, 1909.

SEE Fr. Pat. 365,838 of 1906; this J., 1906, 1053.—T. F. B.

Ozone: Apparatus and process for the production of —. J. Steynis, New York. Eng. Pat. 24,823, Nov. 18, 1908 Under Int. Conv., Nov. 18, 1907.

SEE Fr. Pat. 394,121 of 1908; this J., 1909, 249.—T. F. B.

Liquid air: Art or process of producing —. J. F. Place, Glenridge, N.Y., Assignor to American Air Liquefying Co., New York. U.S. Pat. 918,468, April 13, 1909.

SEE Fr. Pat. 391,326 of 1908; this J., 1908, 1152.—T. F. B.

Nitrogen and oxygen: Apparatus for separating — from mixtures containing them. R. P. Pictet, Berlin. U.S. Pat. 918,589, April 20, 1909.

SEE Addition of June 27, 1903, to Fr. Pat. 322,600 of 1902, this J., 1904, 371.—T. F. B.

Ammonia from producer gas. Eng. Pat. 8014. See I. Producing slaked lime. Ger. Pat. 208,181. See IX.

Producing nitrogen oxides. Fr. Pat. 395,424. See XI.

VIII.—GLASS, POTTERY, AND ENAMELS

"Liquefaction" of clay by alkalis. Böttcher. See 12.

PATENTS.

Glass sheets: Method of and apparatus for making —. H. K. Hitchcock, Tarentum, Pa., Assignor to C. V. Brown, Pittsburg, Pa. U.S. Pat. 918,323, April 13, 1909.

A RECEPTACLE containing molten glass is connected to a conduit with an external basin. The walls of the conduit are constructed so that the heat dissipated from it is proportional to the quantity of glass flowing through it, so as to bring the glass in the basin to a workable temperature. Means for drawing glass sheets from the basin (a bait, rolls, etc.) are provided, as well as means for controlling the flow of glass through the channel and opening through which the basin may be drained.—A. G.

Metallic coatings; Application of — to articles of glazed china, porcelain, or earthenware. H. L. Sulman, H. F. K. Picard, and F. P. Heath, London. Eng. Pat. 7230, April 1, 1908.

A LAYER of "liquid metal" is first applied to the glazed article, and fixed by firing as usual. The article is then washed successively in hydrochloric acid, water, potassium hydroxide solution, and water, and immersed in a plating bath, from which gold, silver, or other metal is deposited electrolytically on the existing metallic film. The "liquid metals" used are "liquid gold" consisting of 80 per cent. of an oily medium, 12 of gold, 6 of sulphur, 1 of bismuth, and 1 of lime, chromium, and iron; and "liquid silver" and "liquid platinum," in which the gold in the above composition is replaced by platinum.

—A. G. L.

Electric furnace for fusing silica. Fr. Pat. 396,017. See XI4.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[Bricks.] *Remarkable lime inclusion in —.* H. Seger and E. Cramer. Tonind-Zeit., 1909, 33, 491.

THE effects of lime inclusions on clays, after burning, depend upon the chemical composition and size of the inclusions, and also upon the temperature reached during firing. The authors have examined some bricks which had not been ruptured although they contained inclusions measuring as much as 12 mm. in diameter. The clay was yellowish-brown and contained a considerable quantity of limestone fragments. The bricks were burnt at Seger cone 010, were unaffected by immersion in water and only began to disintegrate after about 3 months. The analysis of the limestone fragments was:—Loss on ignition, 4.29; insoluble, 8.48; soluble silica, 1.10; alumina and ferric oxide, 1.12; lime, 74.78; magnesia, 1.37; potassium oxide, 0.38; and sulphuric anhydride, 8.51 per cent.

The sulphuric acid corresponds to a content of 14.40 per cent. of dehydrated gypsum. This is an important point since a high content of gypsum seems to retard the slaking of the lime.—W. C. H.

Clay; "Liquefaction" of — by alkalis. M. Böttcher. Sprechsaal, 1909, 42, 117—119, 133—135, 153—155, 168—170, 186—187, 199—201, 217—219, 233—235, 252—253.

EXPERIMENTS were made on the "liquefying" action of alkalis on clay, i.e., on the power of alkalis to render mixtures of clay and water more liquid. The clay used was a fire-clay similar to Bischof's standard clay III.; on analysis, it yielded: loss on ignition, 12.5 per cent.; silica (including sand, 8.4 per cent.) 50.4; alumina and a trace of iron oxide, 34.2; lime 1.5; magnesia 0.15; the remainder, about 1.25, being alkali. About 0.1 per cent. of an organic substance soluble in ether, and 0.012 of calcium sulphate were also present. The liquefying action of alkalis was examined in two ways: In the first place, 25 grms. of the clay were allowed to stand for 15 minutes with 32 c.c. of water containing the alkali in solution; the whole was then well mixed and its viscosity determined by noting the time required for a definite volume of the mixture to issue from a wide glass tube drawn out to an opening 2 mm. in diameter, and always filled to the same height; the mixture was then allowed to stand for 3 hours, and its viscosity again determined in the same way. Secondly, 2 c.c. of the mixture were diluted with about 20 c.c. of water in a test-tube, the whole was well shaken, allowed to stand, and examined after the lapse of several weeks to see how far the clay had settled. It was found that for each alkali tested there exists a maximum proportion of alkali to clay which gives the greatest fluidity; beyond this maximum further increase in the amount of alkali present produces decrease in the fluidity, although even then the viscosity of a mixture of clay and water alone is not reached. This maximum proportion of alkali to clay is independent of the quantity of water present, although this of course affects the absolute viscosity of the

mixture. Alkali hydroxides act 5—6 times as strongly as the corresponding carbonates; in both series the sodium compound is the most powerful, followed closely by the lithium compound, then at some distance by the potassium compound, and finally by the cesium compound. Determinations of the viscosity after 3 hours' standing showed a marked difference in the action of carbonates and hydroxides. Whereas with the former the second viscosity was always higher than the first, probably owing to a small amount of evaporation, in the case of hydroxides the second viscosity was higher than the first only up to the maximum proportion which gave the greatest fluidity at first; beyond this point the second viscosity was less than the first, so that in this series the most favourable proportion of alkali was somewhat greater than in the first series. Solutions of ammonia behaved in this respect like the carbonates of the fixed alkalis. Ammonia had also the weakest action of the alkalis examined, and an increase in its concentration after the greatest fluidity was reached, produced no change in the viscosity determined at once, and only a small one in the second viscosity. Ammonium carbonate and the bicarbonates of potassium and sodium had no action; calcium and barium hydroxides tended to stiffen clays; thus, a clay similar to the first, but containing twice as much calcium sulphate, required more alkali to render it as fluid as the first. The results obtained by the suspension of the clay mixtures in water showed that the least viscous mixtures were also those in which the clay remained suspended longest. It was also found that the clay which had settled from these suspensions was finer and occupied a smaller volume than the clay which had settled out rapidly. When more than the most favourable proportion of alkali hydroxide was present, the mixture required violent shaking to bring the clay into suspension, and this violent shaking decreased the quantity of alkali in the liquid, as shown both chemically and by an increase in the electric resistance of the liquid. The author, in agreement with Foerster (Chem. Ind., 28, No. 24), believes that the above facts are explained by the theory that clays are negatively charged colloids in contact with water, and that these colloids are dispersed and broken up by the hydroxyl ions present in an alkali hydroxide solution, and also to a lesser extent, in an alkali carbonate solution. The decrease in the second viscosity is due to the slow absorption of alkali hydroxide by the clay, thus bringing the concentration of alkali in the water nearer to the most favorable proportion. Apparently the clay does not absorb alkali carbonates or ammonia in the same way. The author's results agree well, on the whole, with those of Simonis (this J., 1905, 547) but the latter puts lithium before sodium in his series of activity.—A. G. L.

Breeze concrete; Dangers of —. D. B. Butler. J. Soc. Architects, April 22, 1909; Engineering, 1909, 87, 604.

CONCRETES made with Portland cement and samples of breeze (crushed coke, clinkers, ashes, and similar materials) from various sources were tested as to their expansion after setting. The results obtained varied widely according to the nature of the breeze used, but the chief cause of this divergence was found to be the presence of bituminous coal, there being little variation in the expansion of different breeze concretes when the breeze used was free from bituminous coal. In many cases test-pieces which expanded considerably when placed under water as soon as they were set, expanded much less when left in the air; also, many of the test-bars which had set and dried in the air, expanded considerably almost immediately when subsequently immersed in water. It was observed during the investigation that breeze concretes have a tendency to corrode iron and steel with which they come in contact.

—A. S.

Adsorption by clays. Rohland. See XXIV.

PATENTS.

Kilns for the burning or drying of bricks, tiles, or other similar goods. T. Prince, Bushey, Herts. Eng. Pat. 16,376, Aug. 4, 1908.

THE kiln is provided with fire-holes beneath its floor, and with openings in the floor for up-draught purposes;

in driving off moisture from the bricks, and having vertical flues recessed in the wall of the kiln, leading to a main flue and thence to the atmosphere, for down-draught purposes.—A. G. L.

Slaked lime; Process for the continuous production of finely-powdered —. C. Schroeder. Ger. Pat. 208,181, July 23, 1908.

THE burnt lime as it leaves the kiln, is subjected to a preliminary slaking whilst in the transporting vessels, and is then fed into the slaking-shaft, which is constructed of brickwork and is of such dimensions, that the slaking process is complete by the time the lime arrives at the discharge openings at the bottom.—A. S.

Clay-ware; Process for preventing efflorescence on —. Henschke und Niemer. Ger. Pat. 208,478, Jan. 14, 1908.

A solution of barium chloride is poured over the clay while it is in the transport wagons, then gas-tight covers are fixed on the wagons, and steam is introduced.—A. S.

Cement-burning apparatus. H. L. Doherty, Assignor to Combustion Utilities Co., New York. U.S. Pat. 918,020, April 13, 1909.

HOT gas from a producer, and hot air from a fire-heated stove, are delivered to the lower end of an inclined rotary cement-kiln, in such a way that the air surrounds the gas. By means of a central jet of air under high pressure, the flame produced is carried into the kiln, and its direction determined.—A. G. L.

Cement clinker; Process of burning —. C. Ellis, White Plains, N.Y. U.S. Pat. 918,025, April 13, 1909.

THE cement mixture in a rotary kiln is spread out over the part of the kiln which is turning upwards to a point within one of the upper quadrants of the kiln. Against the material is projected a flame broad in one direction and thin in another, the broad side of the flame being turned towards the spread-out material, the upper edge of which is made to fall down through the flame.—A. G. L.

Cement; Waterproof —. M. M. Smith, Assignor to The Fredonia Portland Cement Co., Fredonia, Kans. U.S. Pat. 918,384, April 13, 1909.

WHITE waterproof cement is obtained by mixing lime and clay free from iron with a flux, burning the mixture to the verge of fusion, and grinding the resulting clinker together with clay free from iron.—A. G. L.

Cements; Magnesia —. R. Eggenhöfner and E. Sbertoli, Genoa, Italy. Eng. Pat. 8307, April 14, 1908.

SEE FR. Pat. 392,328 of 1908; this J., 1908, 1206.—T. F. B.

Products from tar. Fr. Pat. 395,738. See III.

X.—METALS AND METALLURGY.

Iron-carbon alloys; Decarburisation of —. W. H. Hatfield. Iron and Steel Inst., May, 1909. [Advance proof.]

CEMENT steel containing 1.64 per cent. of combined carbon was almost completely decarburised by annealing in hematite iron ore in the usual way, and after annealing for the same time in carbon was practically unchanged, the carbon still remaining in the combined state. It was also shown that in the case of white iron annealed in iron ore under conditions such as obtain in practice, decarburisation took place during the early stages to a considerable depth without the formation of any temper carbon, the central portions consisting of unchanged white iron. After the maximum temperature was reached, temper carbon was formed throughout the interior.

The final casting contained 0.65 per cent. of combined carbon and 1.1 per cent. of temper carbon, although it had been maintained for three days at the annealing temperature and gradually cooled. The author considers that: (1), it is not necessary that the carbon be precipitated as temper carbon before its removal; and (2), should temper carbon be produced, only that temper carbon which has recombined with the iron by diffusion can be removed. He does not accept the theory of Wiist (see this J., 1908, 450) that it is essential that temper carbon be precipitated before elimination takes place.—O. F. H.

Bessemer steels; A heat treatment study of —. A. McWilliam and E. J. Barnes. Iron and Steel Inst., May, 1909. [Advance proof.]

ENGLISH acid Bessemer steels in the form of forged or rolled 1-inch bars, and containing from 0.10 to 0.86 per cent. of carbon, and 0.56 to 1.03 per cent. of manganese, were subjected to a systematic heat treatment and were then subjected to tensile tests and to Arnold's alternating stress test, and also examined microscopically. The experiments, though done in duplicate, were so arranged that, by taking the tensile test-piece from one end, both the alternating stress test and the microscopic examination were carried out on the same bar. The test-bars were all "normalised" by being placed in a gas muffle at 750° C., raising to 950° C. and after keeping there for twenty minutes, standing them up on end to cool in air. Annealing was carried out by heating for 35 hours at 950° C. and cooling slowly in the furnace. The heat treatment consisted in first quenching, the steels being heated quickly in a Brayshaw salt bath, controlled by two pyrometers, to either 850° C., 900° C., or 950° C. for fifteen minutes and quenched in water at 15° to 20° C. Attention is called to the prevention of scaling by the molten salts, and the more efficient quenching produced. They were next tempered by heating in a lead bath to the requisite temperature, keeping there for 15 minutes and then cooling in air. Tables are given so arranged that each table either represents one heat treatment with the results of the tests of all the steels so treated, or else contains the results of the various treatments for only one steel. The results show that as the carbon content increases there is a gradual fall in the elongation and reduction of area, and an increase in the maximum stress for all treatments. Only the 0.10 per cent. of carbon steel for all treatments, and the 0.27 per cent. of carbon steel when quenched from 850° C. and tempered at 500° C. pass the standard for Arnold's alternating stress test of 300 which is a very severe one. In micro-examination all the sections showed manganese sulphide pools elongated in the direction of rolling or forging. In the normalised and annealed series the usual sequence of structure from a low to a high carbon content was seen. In the quenched and tempered series no difference could be found between those tempered at 500° C. and those at 700° C. They all show the transition product of emulsified or sorbitic pearlite. The authors find that the saturation point of a Bessemer steel containing 1 per cent. of manganese is about 0.80 per cent. of carbon, and illustrate the paper with a few micro-photographs.—A. H. C.

Mild steel; Ageing of — and the influence of nitrogen. C. E. Stromeyer. Iron and Steel Inst., May, 1909. [Advance proof.]

THIS paper is a continuation of two previous ones on the cause of the brittleness of mild steel plates which had failed in practice. (See Trans. Iron and Steel Inst., 1907, No. 1, 200, and No. 3, 86.) Additional comparative tests on the 26 different steels previously examined were made. Small test pieces about 0.4 in. square in section were planed on opposite edges, and chisel edges pressed 0.05 in. into the machined surfaces. The samples were boiled to give them the full ageing effect which had been started by the pressure of the chisel edges and they were then bent in a testing machine. Other sets were torn in a tensile testing machine with and without previous boiling. The net results of the experiments detailed in this and the previous papers, is that the usual tensile

and bending tests do not detect those treacherous steels which, after behaving well under the steelworks tests, fail in the workshops, and also that some of the qualities of mild steel do change with time, and these changes can be accelerated by heating to the temperature of boiling water. A highly important fact revealed by the chemical analyses was the detrimental effect of the presence of nitrogen. The worst steels in the series were those containing the largest percentage of nitrogen and phosphorus, and as the former had the greater influence, instead of adding the percentages together, to get the united effect, the percentages were divided by their respective molecular weights, viz. 0.14 for nitrogen and 0.31 for phosphorus, but as even then, steels rich in nitrogen did not seem to be properly placed, these results were squared. As arsenic belongs to the same group of elements, its percentages were treated in the same way. It was then found that all steels having the sum of the modified percentages of nitrogen, phosphorus, and arsenic above 0.80 were decidedly bad and treacherous. Another striking result of these investigations was that nitrogen also raises the tensile strength of steel far more markedly than carbon. The author gives the following formula for calculating the tensile strength of a steel from its chemical analysis:—

$T = 17.20 + 25 C + 10 Si + 2.5 (Mn + 1.72 S) + 39 P + 300 N$. On account of manganese sulphide being formed in the presence of an excess of manganese, as can be detected microscopically, 1.72 times the amount of sulphur present is subtracted from the manganese (this being in proportion to their atomic weights, 55/32). A table is given showing the ultimate tenacities as found by practical tests, together with values obtained by this formula, the mean differences being only 0.7 ton per sq. in. It is important to note that nitrogen appears to have a nine-fold greater effect than carbon or phosphorus in raising the tenacity, but at the same time it is responsible for the early ageing and subsequent failure of steel that, when new, could successfully pass the usual steelyard tests.—F. R.

Steels; High-tension — P. Longmuir. Iron and Steel Inst., May, 1909. [Advance proof.]

WITH a view to determining the most serviceable class of steel for high tension and endurance purposes, the author has investigated and compared the properties of various types of steel, both in the normal condition and after appropriate treatment as regards quenching, tempering, etc. The average requirements for high-tension steels being an elastic limit of 40 tons per square inch, a maximum stress of 50 tons per square inch, and an elongation of 20 per cent. on 2 inches, the author finds that steels of the chromium-vanadium type give the best all-round results. Nickel steels containing up to 5 per cent. of nickel, were found unsuitable for purposes requiring high tensile strength in association with high elongation. Nickel-chromium steels containing up to 6 per cent. of nickel and 1 per cent. of chromium, showed a considerable advance on simple nickel steels, the characteristic features being a high elastic limit and maximum stress with a fair elongation. Of the vanadium steels, those of the chromium-vanadium type, containing up to 1 per cent. of chromium and 0.2 per cent. of vanadium, were found to be the most satisfactory for the purposes under consideration, the values obtained in these cases exceeding the average requirements for high-tension steels.—W. E. F. P.

[Iron and steel] Tests for hardness, T. Turner. Iron and Steel Inst., May, 1909. [Advance proof.] (See also this J., 1909, 93.)

FOUR of the commonly used methods of measuring the hardness of metals or alloys were selected by the author for comparison:—1. Turner's sclerometer, in which a standard scratch is produced on a smooth surface by means of a suitably weighted diamond point. 2. Shore's scleroscope, in which a pointed steel cylinder, weighing about 2 grms. falls from a definite height (about 26 in.) on to the metal to be tested, the height of the rebound of the cylinder being taken as the measure of hardness. 3. Brinell's test, in which a hardened steel

ball is pressed into the surface of the metal or alloy, and the spherical area of the indentation produced by a known pressure is measured. 4. Keep's test, in which a steel drill is rotated a certain number of times under a definite pressure, the amount of penetration being automatically registered in the shape of a curve, varying from a horizontal line for a dead soft material to a vertical line for one of equal hardness to the drill. These different methods show a remarkable agreement when testing pure cast metals, but when metals or alloys have been hardened by mechanical treatment, or in the case of ordinary or special steels, hardened and tempered, the results when tested by different methods differ widely, no method being equally suitable for all descriptions of hardness, such as tensile, cutting, abrasion, and elastic hardness. Tables of comparative tests, and numerous references are given.—F. R.

Iron; The electrolytic theory of the corrosion of —, and its applications. W. H. Walker. Iron and Steel Inst., May, 1909. [Advance proof.]

EXPERIMENTAL evidence in support of the electrolytic theory of the corrosion of iron has already been advanced by the author (this J., 1907, 1051). Friend, having concluded from his own researches that the electrolytic theory is untenable, the author shows that the carbonic acid theory of corrosion is really included in the more modern electrolytic conception, and explains the results obtained by Friend upon the latter basis. The practical applications of the electrolytic theory are considered in relation to the corrosion of iron embedded in concrete, of boiler-shells and tubes, of galvanised iron, of tin-plate, and of iron covered with a protective coating of the black oxide; and plates are given in illustration of the phenomena observed during the progress of the investigation.—W. E. F. P.

Steel; Protection of — against corrosion. M. Toch. Trans. Amer. Electrochem. Soc., 1908, 14, 207—213.

ACCORDING to the author, after the lapse of six months, there is no difference in the extent of corrosion of steel which has been coated with a good protective paint and steel which has been first rendered passive by means of a chromate and then coated with a similar paint. The corrosion is greatest where two pieces of steel come in contact, and it is recommended that such places be covered with an alkaline or an electrically insulating paint.—A. S.

Nickel in steels; Comparative study of the electrolytic method, Brunck's method, and Grossmann's method of determining —. Prettner. Chem.-Zeit., 1909, 33, 396, 411—412.

FOR the determination of nickel in steels, such as nickel-steel and nickel-chrome-steel, the methods of Brunck (this J., 1908, 284) and Grossmann (this J., 1907, 718) are both to be preferred to the electrolytic method (which, though accurate, is tedious) if proper precautions be taken. Brunck's method leads to good technical results, if an hour be allowed for the reaction, but 24 hours are required for the maximum accuracy. In applying Grossmann's method to the analysis of steel, 1 gm. of the drillings is dissolved in 20 c.c. of hydrochloric acid (sp. gr. 1.12), the solution is oxidised with 6—7 c.c. of nitric acid (sp. gr. 1.20), evaporated to 15 c.c., and allowed to cool. Then 40 c.c. of a 50 per cent. solution of Rochelle salt are added, with stirring, followed by 8—12 c.c. of strong ammonia to dissolve the precipitated tartaric acid and render the solution alkaline. 10 c.c. of an 80 per cent. solution of potassium hydroxide are next added, which should cause the solution to assume a light green colour, then about 0.3 gm. of hydrazine sulphate, to prevent interference from the small quantity of manganese present, and 1—1.5 gm. of dicyandiamine sulphate. After 24 or 48 hours, the precipitated nickel compound is collected in a Gooch crucible, washed (not more than 5 times) with weak ammonia, and dried for 30—45 minutes at 120°—140° C.; it contains 22.5 per cent. of nickel. The volumetric method of determining nickel with potassium cyanide appears, however, to be superior to either of the above, especially as regards speed, and it may be applied

directly to the analysis of steels, without preliminary separation of the nickel. The methods of Brunck and Grossmann are regarded as indispensable, therefore, only in the analysis of substances containing much cobalt.

—F. SODN.

Copper-aluminium alloys: Electrical properties (thermo-electricity and resistance) of —. H. Pêcheux. *Compt. rend.*, 1909, 148, 1041–1042. (See this J., 1909, 369.)

Thermo-electric properties.—The following values for the thermo-electric powers (in microvolts) of couples consisting of copper-aluminium alloys and copper were obtained.

	$\frac{dE}{dt}$
Cupro-aluminium-copper—	
3 per cent. of aluminium	2.31 + 0.003007
5 " " "	2.53 + 0.003207
6 " " "	1.78 + 0.000407
7.5 " " "	1.59 + 0.000907
10 " " "	1.21 + 0.001047
94 " " "	2.21 + 0.006807

Resistance.—The resistance increases with the aluminium-content until the proportion of this metal becomes 7.5 per cent., and then decreases; the resistance of the alloy containing 94 per cent. of aluminium is nearly the same as that of aluminium itself. With increase of the aluminium-content up to 10 per cent., the principal temperature co-efficient decreases; in the case of the alloy containing 94 per cent. of aluminium, this coefficient approximates to that of aluminium itself. Addition of small quantities of aluminium to copper, increases the resistance of the copper very appreciably, whereas the resistance of aluminium is hardly affected by addition of small quantities of copper.—L. E.

Silicon-calcium alloys. S. Tamaru. *Z. anorg. Chem.*, 1909, 62, 81–88.

THE alloys of silicon and calcium have been investigated by the method of thermal analysis. Molten silicon is miscible with molten calcium in all proportions, but solid silicon is insoluble in molten calcium at 900° C. From the molten alloys containing 100–35 per cent. of silicon, pure silicon separates, and this, on cooling to 990° C., combines with the melt, containing about 35 per cent. of silicon, to form the compound, CaSi_2 (58.3 per cent. of silicon); no evidence of the existence of other compounds has been obtained. The alloys with 91–60 per cent. of silicon are unaffected by water, but those with 52–38 per cent. react more or less readily, hydrogen being evolved. None of the alloys are acted upon by alkali solutions, but dilute acids attack them, with the evolution of hydrogen and silicon hydride, the action being most vigorous when a large proportion of calcium is present.—F. SODN.

Fluxes for soldering: Chemistry of —. V. Samter. *Z. angew. Chemie*, 1909, 22, 729–731.

SHEETS of electrolytic copper foil, having a surface of 100 sq. cm. on each side, were submitted to the action of solutions of hydrochloric acid, zinc chloride, and ammonium chloride respectively, and the loss of weight determined. In a 12 per cent. hydrochloric acid solution the loss was 0.25 mgrm. per sq. cm. in 24 hours, in a 25 per cent. solution of zinc chloride the corresponding loss was 0.033 mgrm., and in a 17 per cent. solution of ammonium chloride, 0.225 mgrm. In each case the rate of solution was 10 times as great when air was blown through the liquid, and it was also greater if the copper was coated with a thin layer of acid. The low solubility in hydrochloric acid is due to the formation of a protective coating of insoluble cuprous chloride. Commercial zinc chloride is always a neutral or basic salt, but strong solutions have an acid reaction owing to hydrolytic dissociation. The concentration of the free acid, however, cannot be greater than that of a 0.0036 per cent. solution of the acid, and the action on copper is accordingly very slight. The much greater action of ammonium chloride is due, not to the presence of a larger proportion of free acid in the solu-

tion, but to the fact that the concentration of the copper ions in the solution is diminished by the formation of complex ions containing copper and ammonia, and that a soluble double salt is formed from the cuprous chloride.

—A. T. L.

Zirconium: Analytical examination of metallic —. E. Wedekind and S. J. Lewis. *Z. angew. Chem.*, 1909, 22, 725–729.

FOUR samples of metallic zirconium gave the following results on analysis:—

	A.	B.	C.	D.
Metallic zirconium	83.85	73.70	63.01	24.79
Combined zirconium ..	11.70	17.49	25.41	53.68
Total zirconium	95.55	91.19	88.42	78.47
Oxygen	4.14	6.17	8.97	18.95
Nitrogen	—	2.02	1.55	—
Carbon	—	0.074	—	—
Magnesium	—	0.28	—	—

Samples A and B were commercial specimens prepared by reduction with magnesium; samples C and D were prepared by the authors by the action of potassium on the double fluoride of potassium and zirconium. All the samples had been fused. Metallic zirconium was converted into tetrachloride, by heating the powdered metal in a current of dry chlorine, free from oxygen, oxides of chlorine, nitrogen, and carbon dioxide, preferably prepared from potassium permanganate and hydrochloric acid (see this J., 1909, 424). Zirconium nitride was decomposed by the chlorine, and a correction was made for this after the determination of the nitrogen. In carrying out the analysis about 0.5 gm. of the metal was placed in a boat in a combustion tube, dried by heating in a current of hydrogen, and weighed for the determination of moisture. The air in the other parts of the apparatus was then displaced by chlorine, and a flask on the outlet of the apparatus was filled with chlorine in case of a backflow occurring during the experiment, owing to the rapid absorption of chlorine by the metal. All air having been displaced, chlorine was passed through the combustion tube, and the boat was heated gradually, finally to a dull red heat. Zirconium tetrachloride was deposited on the cooler parts of the combustion tube, any traces carried over with chlorine being trapped by bubbling the gas through 10 per cent. hydrochloric acid in a U-tube cooled in ice. The combustion tube must be quite cold before the current of chlorine is started, as, even at 40° or 60° C., amorphous zirconium may cause the explosion of a mixture of hydrogen and chlorine. After cooling, the boat, containing zirconium oxide, was weighed, and the zirconium tetrachloride was washed out of the combustion tube with cold water, the zirconium was precipitated as hydroxide with strong ammonia in the presence of ammonium chloride, and was weighed as zirconium dioxide. For the other determinations, amorphous zirconium was best dried by heating to 200°–220° C. in a high vacuum. The nitrogen was determined as ammonia, by gently heating the zirconium with strong sulphuric acid for 2 or 3 days, neutralising the acid, and distilling the ammonia into standard acid. Strong heating with the acid led to a very violent reaction, but it was found feasible to hasten the solution of the zirconium by the addition of a persulphate or other oxidising agent, provided the temperature were not allowed to rise too high. Carbon and hydrogen were determined by burning the metal in oxygen under reduced pressure. This was effected by pumping out the air from the combustion tube and also a bulb of 200 c.c. capacity connected to it, heating the boat until combustion commenced, and then admitting oxygen very gradually through a stop-cock.—A. T. L.

Action of coke on ferric and auric chloride solutions. Tingle. See VII.

Separating antimony from thioantimonate solution. Schulte. See XXIII.

PATENTS.

Annealing metals; Method of — F. J. Clinch-Jones, Leamington Spa, Warwick. Eng. Pat. 5244, Mar. 9, 1908.

THE articles to be annealed are heated in a muffle in a current of hot combustible but unignited gas (e.g., gas from a producer), which, after playing over the articles, is fired in a combustion-chamber placed below the muffle. The latter is provided at one end with a vertical channel terminating a little above the ground. Sand is delivered to the top of this channel from a hopper placed outside the muffle. The articles in the muffle are pushed over on to the sand, and descend with the latter through the vertical channel cooling gradually in doing so.—A. G. L.

Roasting furnace; Rotary — J. R. Down and F. J. Morgan, Swansea. Eng. Pat. 12,825, June 16, 1908.

THE hearth of a rotary roasting furnace is divided into two or more concentric chambers by means of one or several fixed "circular baffles" supported from the roof. The charge is introduced into the innermost chamber from a hopper, and is there roasted gently before being subjected to contact with the flames in the outer chamber.—A. G. L.

Roasting furnace. J. E. Greenawalt, Denver, Colo. U.S. Pat. 919,000, April 20, 1909.

THE ore in its passage through the furnace is supported on a porous filter or mass disposed between the hearth and the line of travel of the lowest point of the rables. Below the porous mass is a chamber to which air or other gases are supplied, these gases passing through the porous material to the charge of ore. A conduit is provided through which the porous material may be replaced or removed.—A. S.

Furnace for roasting ores. H. Daniel and H. Römer. Ger. Pat. 208,354, Nov. 1, 1907.

THE furnace consists of a shaft in which, above the fire-place, a series of superposed rotating conical drums is mounted, the axes of the drums being parallel. The larger end of each drum is connected by a conduit with the smaller end of the next lower drum. The ore (pyrites, zinc ores, etc.), is fed into the smaller end of the uppermost drum, and gradually descends, being discharged from the larger end of the lowermost one. The rate at which the ore travels through the furnace depends upon the speed at which the drums are rotated.—A. S.

Furnaces; Regenerative reversing (open-hearth) — U.S. Pats. 919,184—919,189, April 20, 1909. (2), (3), (4), and (6), L. L. Knox, Ben Avon, Pa., (1), and (5), L. L. Knox, Ben Avon, Pa., and M. Murray, Wilkesburg, Pa., Assignors to Keystone Furnace Construction Co., Pittsburg, Pa.

THE claims relate to means for cooling the walls and partitions of regenerative reversing furnaces by the circulation of water through cooling boxes arranged at certain points therein. The gas and air ports may be separated by a removable arch, this arch comprising hollow metallic side and transverse members through which water can be circulated, the whole being supported on brickwork. Or again, a number of water-cooled boxes or castings may be built permanently into the walls on the tapping or charging sides so as to extend in parallel lines along the whole length of the furnace. Finally the cooling boxes may be arranged so as to fit into narrow vertical openings in the walls or roof of the furnace, from which they can be removed when necessary. These boxes, extending entirely through the walls, present their narrow vertical inner ends to the furnace chamber at right angles to the direction of the outflowing gases. Means are provided for shutting off the water supply from one or more compartments as required.—C. A. W.

Furnace-flue dust; Method of utilising — T. M. Phillips, Assignor to the Youngstown Steel Co. and E. L. Ford, Youngstown, Ohio. U.S. Pat. 919,073, April 20, 1909.

CLAY is treated with water and steam so as to form a cream or liquid paste (see U.S. Pat. 919,074, page 511),

then blast-furnace flue dust is added, and the mass is introduced into a furnace in a fluid or "sloppy" condition.—A. S.

Tungsten; Process for increasing the ductility of — Siemens und Halske A.-G., Berlin. Eng. Pat. 17,350, Aug. 18, 1908. Under Int. Conv., Sept. 14, 1907.

SEE Fr. Pat. 393,595 of 1908; this J., 1909, 149. Less than 8 per cent. of nickel is added to the tungsten.—T. F. B.

Plumbiferous copper matte, ore, or alloy; Process for eliminating lead and other impurities, such as arsenic and antimony, from a—, and simultaneously recovering the copper as metal. Usine de Désargentation Soc. Anon., Hoboken-lez-Anvers, Belgium. Eng. Pat. 19,585, Sept. 17, 1908. Under Int. Conv., May 6, 1908.

THE impure copper matte is mixed with sufficient silica to combine with the lead present, and then partly oxidised and sintered by treatment with air or oxygen in a converter. The oxidised matte is then smelted as usual in a reverberatory furnace, metallic copper being obtained by the interaction of the copper oxide and sulphide, the lead going into the slag as silicate. If arsenic or antimony are present, a purer copper is obtained by smelting a mixture containing an excess of copper oxide over sulphide. The lead-copper-arsenic alloy obtained in lead blast-furnaces may be treated by the above process, after mixing it with copper matte or sulphide ores.—A. G. L.

Manganese steel; Working — to produce finished shapes. W. S. Potter, Mahwah, New Jersey, U.S.A. Eng. Pat. 24,685, Nov. 17, 1908.

THE ingot to be worked is heated slowly to above 430° C.; if it is tough and free from strains, it may be heated more rapidly. It is next heated rapidly to the "upper critical point," at about 1010°—1050° C., at which the metal becomes weak and tender, and is then raised carefully to the temperature at which it is to be worked. This temperature is usually about 1250° C., but for thin ingots which do not require much working, it may be 1100°—1150° C. Working is not commenced until the temperature of the skin of the ingot has fallen to that of the interior, and the pressure applied at first should be gentle. The heating may have to be repeated at intervals during the working if the ingot cools too much. It is claimed that the resulting articles have an extremely fine and uniform crystalline structure and an unbroken outer surface.—A. G. L.

Iron and steel; Metallurgy of — W. S. Simpson and H. Oviatt, London, England. U.S. Pats. 918,381 and 918,382, April 13, 1909.

IRON or steel is obtained by mixing a finely-ground iron ore with a carbohydrate containing water and another carbonaceous material, e.g., graphite, and heating the mixture. Manganese dioxide and fluxes may be added.—A. G. L.

Smelter-gases; Process of purifying — P. Danckwardt, Denver, Colo. U.S. Pat. 918,424, April 13, 1909.

A PORTION of the smelter-gases is mixed with steam and passed over red-hot carbon, whereby the sulphur dioxide of the gases is reduced to hydrogen sulphide and the carbon dioxide to carbon monoxide. The reduced gases are then mixed with a further quantity of crude smelter gases, and treated with an aqueous solution of a metallic salt which does not react with the gases, elemental sulphur being deposited owing to the interaction of sulphur dioxide and hydrogen sulphide. The gases are then brought into contact with an iron salt, which removes any excess of hydrogen sulphide and nitrogenous compounds.—A. G. L.

Zinc ores; Process of smelting — A. G. Betts, Troy, N.Y. U.S. Pat. 918,648, April 20, 1909.

THE ore is first mixed with a reducing agent, such as silicon, which is not oxidisable in air below a temperature of 800° C. The mixture is heated to a temperature

lower than this, and exposed to the furnace gases in order to bring about the oxidation of the ore, and it is then heated in a second furnace, away from the furnace gases, to a higher temperature so as to bring about the reduction of the ore by the silicon.—B. N.

Silver; Process of extracting — from its ores. J. C. Pryor, North Bay, Ontario. U.S. Pat. 918,908, April 20, 1909.

An ore containing silver together with arsenides of base metals is smelted to form a speiss, the crushed speiss is calcined, and the product is treated with suitable reagents to reduce the metallic oxides to metals, which are then extracted by a suitable solvent. The residue is subjected to a similar process.—A. S.

Metal from ore; Process of extracting —. C. G. Collins, Woodmere, N.Y. Assignor to C. A. Stevens, New York. U.S. Pat. 919,129, April 20, 1909.

The finely pulverised ore is mixed with carbonaceous material and with carbonates of the alkalis or alkaline-earths, and the whole mixture, in a state of fine division, subjected to heat in a closed retort, the resulting metal being discharged into water. If limestone be employed, a certain amount of water is added before heating, for the purpose of slaking the quicklime produced.—C. A. W.

Copper; Process of extracting — from ores. C. G. Collins, Woodmere, N.Y. Assignor to C. A. Stevens, New York. U.S. Pat. 919,130, April 20, 1909.

The finely powdered copper ore is mixed with carbonaceous material and with alkali or alkaline-earth carbonates, all in a state of fine division. The whole is heated in a closed retort and the resulting copper discharged into water. If necessary, certain proportions of hypochlorites of the alkalis or alkaline-earths may be added to the mixture before heating.—C. A. W.

Beryllium; Process for obtaining metallic — by reduction of beryllium oxide with aluminium. G. Just and M. Mayer. Ger. Pat. 208,402, June 13, 1907.

Is the reduction of beryllium oxide with aluminium by the usual thermite process, the resulting metal is spongy, owing to the relatively low heat of reaction and the high melting point of beryllium (above 1400° C.). According to the present patent, heat is applied to the reaction-mixture as usual to start the reaction, and is then increased until the melting point of beryllium is attained.—A. S.

Slimes or ore pulp; Separation of the liquid and solid components of wet —. H. G. Nichols, Ymir, British Columbia. Eng. Pat. 2479, Feb. 4, 1908.

SEE Fr. Pat. 389,706 of 1908; this J., 1908, 1158.—T. F. B.

Antimony and other ores; Process of and apparatus for treating —. H. L. Herrenschildt, Paris. Eng. Pat. 7429, April 3, 1908. Under Int. Conv., April 5, 1907.

SEE Fr. Pat. 386,107 of 1907; this J., 1908, 756.—T. F. B.

Zinc furnaces and the like; Exhaustion or extraction of dust and fumes produced by —. E. Dor-Delattre, Budel, Holland. Eng. Pat. 13,146, June 20, 1908. Under Int. Conv., July 16, 1907.

SEE Fr. Pat. 391,513 of 1908; this J., 1908, 1158.—T. F. B.

Briquetting ore with blast-furnace slag; Process of —. W. Lessing, Troisdorf, Germany. Eng. Pat. 18,680, Sept. 5, 1908.

SEE Fr. Pat. 392,289 of 1908; this J., 1908, 1209.—T. F. B.

Steel; Refining —. O. Thalner, Assignor to Bismarckhütte, Bismarckhütte, Germany. U.S. Pat. 919,493, April 27, 1909.

SEE Fr. Pat. 386,785 of 1908; this J., 1908, 814.—T. F. B.

Utilising briquetting properties of lignite and peat. Fr. Pat. 395,385. See II.

Zinc compounds and ammonia [from galvanisers' skimmings]. U. S. Pats. 919,375 and 919,376. See VII.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(I.)—ELECTRO-CHEMISTRY.

Nitric oxide from air. Morden. See VII.

Finlay electrolytic alkali-chlorine cell. Donnan and others. See VII.

Electro-analysis. Filippo. See XXIII.

Mercury cathode for determination of metals. Porter and Frary. See XXIII.

Zinc determination with mercury cathode. Kollock and Smith. See XXIII.

PATENTS.

Furnaces; Electric —. C. E. Knowles, Glossop, Derby. Eng. Pat. 13,502, June 25, 1908.

A crucible is supported on a rotating stand or pillar, passing through the bottom of the furnace chamber, and is heated by at least two electric arcs produced between two adjacent or opposite pairs of carbons, the latter being connected in parallel or series circuits. Removable side blocks or walls may be used for lining the furnace chamber.—B. N.

Induction furnace; New form of electric —. Soc. des Procédés Gin pour la Métallurgie Electrique. First Addition, dated Oct. 19, 1908, to Fr. Pat. 363,937, March 7, 1906 (this J., 1906, 892).

Two vessels, containing the material to be treated, are connected together by inclined tubes, so as to form a circulatory system, and around one tube is placed a primary and secondary winding, the latter being connected to two electrodes, which are brought to the surface of the material in one of the vessels. There is thus a superficial heating effect in this vessel, in addition to the heating effect produced by the material itself forming a secondary circuit. A pair of electrodes, connected in series or in parallel, may be placed in each vessel.—B. N.

Furnace; Electric — with self-circulation. G. H. Gin. Fr. Pat. 395,460, Oct. 19, 1908. Under Int. Conv., May 21, 1908.

Two crucibles are connected by tubes, each connecting the lower part of one crucible with the upper portion of the other. Each crucible is provided with an electrode, so that there is a complete circuit from one terminal to the other through the material in the crucibles and tubes. There is thus a superficial heating in each of the crucibles, and a heating effect in each of the inclined tubes, whereby there is produced a circulation of the material from one crucible to the other. A tri-phase current may be used, by employing three crucibles, placed at the corners of a triangle, and connected in series by inclined tubes, the crucibles being each provided with an electrode.—B. N.

Furnace; Electric — for the fusion of refractory materials especially silica, and process of moulding. L. Clerc and A. Minet. Fr. Pat. 396,017, Nov. 6, 1908.

The arcs for melting the material are of great length and intensity, and are produced between carbon electrodes enclosed in carbon tubes, the internal diameter of the latter being slightly greater than the external diameter of the electrodes. The tubes, at their extremities, are connected to the carbon lining of the furnace chamber. A piston, of refractory material, may be depressed through the cover of the chamber, and thus force out the molten material through a side tube into a chamber, from which it may be emptied by mechanical or gaseous pressure or the chamber may be emptied by aspiration, as by producing a vacuum in the moulds. A refractory lining may be produced in the latter, "by making them slightly larger than the material to be moulded, and casting a refractory paste between the inner surface, and a mould

of a female form which is afterwards withdrawn." The mould may also be constructed of carbon, carborundum, or other refractory material, with a trellis-like support of chrome iron, etc., this being plunged into the melted material, or the latter may be moulded by stamping when the mass has attained a viscous state.—B. N.

Storage-battery plates; Process of making —. W. Morrison, Assignor to Exmoor Storage Battery Co., Chicago, Ill. U.S. Pat. 917,787, April 13, 1909.

The active material is prepared in the form of a paste, by mixing a suitable quantity of "soft lead" and an oxide of lead with a liquid, the latter being prepared from water, acetone, ammonium sulphate, and acetic acid.—B. N.

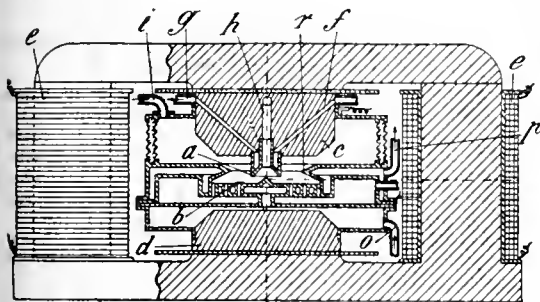
Cell; Electrolytic —. J. H. Reid, Newark, N.J. U.S. Pat. 917,795, April 13, 1909.

The vessel forming the cell, together with the electrodes connected to it, is mounted so that it may be rotated, and a central, hollow, perforated electrode is rotated in the opposite direction. The electrolyte is circulated through the hollow electrode to the outer electrodes, and overflows through outlet ports into a fixed tank, from which it may be again delivered to the central electrode.—B. N.

Electrolytic process. A. G. Betts, Troy, N.Y. U.S. Pat. 918,650, April 20, 1909.

A SOLUTION, containing an oxidisable substance from which a reducible compound may be produced, is electrolysed in solution, employing a suitable anode and a metallic cathode which oxidises superficially forming a coating of an insoluble hydroxide, the latter being a non-conductor of electricity and non-reducible by the electrolysis of the solution.—B. N.

Nitrogen oxides; Process and apparatus for the production of — by means of a rotating electric arc. I. Moscicki, Fr. Pat. 395,424, Oct. 17, 1908. Under Int. Conv., Oct. 17, 1907.



By means of the poles, *c* and *d*, of an electro-magnet excited by the windings, *e*, a rotating arc is produced between the electrode, *a*, and the perforated electrode, *b*, these being cooled by water entering at *f* and *o* respectively, and leaving at *g* and *p*. The gases to be treated enter under pressure at *i*, the current of gas being deflected by the edge, *r*, towards the centre of the arc. In order to avoid short-circuits of the current between the two electrodes, a cooled current of inert gas enters through the channel, *b*, spreading into the form of a cone, so that the arc forms a mantle above it, thus increasing the resistance of the central part of the space situated between the two electrodes.—B. N.

Insulating coatings on heat-resistant materials [electric cables, etc.]; Process for producing —. K. Winkler, Ger. Pat. 208,753, Nov. 19, 1907.

THE material is coated with a mixture prepared from animal fats, especially fish oils and liquid waxes, together with distillation products of rosin, and driers, and is then suddenly heated to a high temperature. For example, 50 parts of cod-liver oil, 45 parts of pinoline, and 5 parts of manganese resin are heated to 275° C., then cooled, and the alternate heating and cooling repeated until the

mass is of the consistence of honey. The product is then applied at 150° C. to the previously warmed material to be coated, and the coated material immediately subjected to a temperature of 450° C. and maintained thereat until the coating material has set. It is stated that the insulating coating thus obtained is transparent and elastic, withstands temperatures of 600° C. and upwards, and is not affected by acids, alkalis, hydrocarbons, or atmospheric influences. The product may be used in the manufacture of electric cables, as a heat non-conducting material, for making tight joints in gas- and water-mains, etc.

—A. S.

Galvanic gas batteries. E. W. Jungner, Kneippbaden, Sweden. Eng. Pat. 5214, March 7, 1908.

SEE U.S. Pat. 884,664 of 1908; this J., 1908, 510.—T. F. B.

Galvanic gas elements. E. W. Jungner, Kneippbaden, Sweden. Eng. Pat. 5223, March 7, 1908.

SEE U.S. Pat. 885,054 of 1908; this J., 1908, 757.—T. F. B.

Electric cells or batteries; Primary —. A. Heil, Frankfort on Maine, Germany. Eng. Pat. 24,008, Nov. 9, 1908.

SEE Fr. Pat. 392,429 of 1908 and Addition thereto; this J., 1909, 28 and 147.—T. F. B.

Secondary battery. E. C. and M. Ekströmer, Assignors to J. C. Kent, Boston. U.S. Pat. 918,831, April 20, 1909.

SEE Eng. Pat. 28,619 of 1907; this J., 1908, 1159.—T. F. B.

Galvanic cell; Carbon-consuming —. E. W. Jungner, Kneippbaden, Sweden. U.S. Pat. 919,022, April 20, 1909.

SEE Eng. Pat. 15,727 of 1906; this J., 1907, 260.—T. F. B.

Galvanic cell. H. P. R. L. Pörsche, Hamburg, Germany. U.S. Pat. 919,457, April 27, 1909.

SEE Eng. Pat. 21,348 of 1906; this J., 1907, 534.—T. F. B.

Electrodes; Method of making —. E. W. Jungner, Kneippbaden, Assignor to Nya Aekumulator Aktiebolaget Jungner, Stockholm. U.S. Pat. 917,875, April 13, 1909.

SEE Fr. Pat. 374,598 of 1907; this J., 1907, 877.—T. F. B.

Oxides of nitrogen; Process and apparatus for producing — by means of a rotary flame. I. Moscicki, Freiburg, Switzerland. Eng. Pat. 21,959, Oct. 16, 1908. Under Int. Conv., Oct. 17, 1907.

SEE Fr. Pat. 395,424 of 1908; preceding.—T. F. B.

Electrical furnace. H. Nathusius, Friedenshütte, Germany. U.S. Pat. 920,078, April 27, 1909.

SEE Fr. Pat. 388,668 of 1908; this J., 1908, 948.—T. F. B.

Producing carbides. U.S. Pat. 918,419. See VII.

Electrolysis of water. Addition to Fr. Pat. 355,652. See VII.

[Electrically sterilising] milk. U.S. Pat. 918,531. See XVIII.A.

Electrolytic products of brine for treating fibre [paper pulp]. U.S. Pats. 912,339 and 912,340. See XIX.

(B.)—ELECTRO-METALLURGY.

Lead-refining; Present-day practice of electrolytic —. A. G. Betts. Metallurgie, 1909, 6, 233–235.

ELECTROLYTIC lead-refining is carried out at Trail, B.C., near Chicago, U.S.A., and at Newcastle-on-Tyne. The first two works have a daily capacity of about 72 metric tons each; the output of the last is less. Electrolysis is carried out in a solution containing 8 grms. of lead and 15–16 grms. "SiF₆" per 100 c.c.; after it has been in use for some time, the solution also contains 0.2–0.3 per cent. of free hydrofluoric acid. In addition, 400–500 grms. of gelatin are used for every ton of lead

deposited. Electrolysis is carried out at 30–35 C. (without external heating), with an E.M.F. of 0.32 volt, and a current of 3500–5500 amperes; the current efficiency is 0.85–0.90. Each bath contains 22–28 anodes (lead plates, 920 × 610 × 25 mm.) and 23–29 cathodes. The cathodes remain in the bath 4–5 days, the anodes twice as long; hence a double set of cathodes is necessary. The electrolyte is circulated from vat to vat, avoiding exposure to the air as far as possible. The 33 per cent. hydrofluosilicic acid used in preparing the electrolyte is made by the works themselves at a cost of about 1½d. per kilo. A large part (one-quarter to one-third) of the anodes is converted into anode sludge, which is periodically brushed off the anodes, collected, freed from electrolyte first by filter-pressing and then by systematic washing, dried and partly oxidised in hot flue-gases, and then treated in a reverberatory furnace, a very easily fusible antimonial lead oxide being obtained, besides metallic lead containing the precious metals and any bismuth, and an argentiferous copper slag. The great bulk of the arsenic present is volatilised. The vats used for the electrolysis consist at present of wood coated on the inside with asphaltum; in future, cement vats will be used. The cost of the electrolytic process is about 17s. 6d. per metric ton of lead, exclusive of laboratory and overhead charges. Its chief advantage is its small loss in lead (about 0.25 per cent.) and larger recovery of the other metals present. It can also be worked economically on a small scale.—A. G. L.

PATENTS.

Metals; Depositing — upon metallic surfaces. A. Rosenberg, London. Eng. Pat. 7227, April 1, 1908.

THE metal is deposited by the frictional application, in the presence of moisture, of a mixture of pulverulent materials, the essential active ingredients of which consist of the metal to be deposited, either in the elementary form or a combined state, an electropositive metal, partly or wholly in the elementary form, such as zinc dust or magnesium powder, and a substance capable of yielding an aqueous electrolyte with the moisture. In order to prevent chemical action taking place in the mixture until required for use, soapstone ("taleum") and chalk are mixed with the dry substances to prevent the absorption of atmospheric moisture. The electropositive metal is protected against oxidation or other premature chemical action, by immersing it in a solution of paraffin, resin, naphthalene, etc., dissolved in a suitable volatile solvent, so as to give it a thin protective coating, which is readily removed by the friction employed in the depositing operation.—B. N.

Electrolytic metallic coating; Process for providing objects of non-conducting material with an —. E. A. Gerbing. Fr. Pat. 396,154, Nov. 10, 1908.

THE object is first coated with a mixture of alkali silicate solution, and a conducting material, such as graphite, carbon, or metal, in a finely-divided form, and the metal is afterwards deposited electrolytically upon the coating.—B. N.

Metals [electrolytically]; Recovering —. W. O. Snelling. Pittsburg, Pa. U.S. Pat. 917,176, April 6, 1909.

METALS, such as tin, are recovered from their electrically-conductive compounds, such as oxide ores, by making the compounds the cathode in a suitable electrolytic bath, the reduced metal being afterwards connected as the anode in the bath, in order to dissolve and re-deposit the metal.—B. N.

Metals [electrolytically]; Producing —. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 918,269, April 13, 1909.

THE process consists in electrolysing a molten bath containing a metallic oxide, and a salt, the anion of which will combine with the metal of the anode, the latter consisting of calcium carbide.—B. N.

Metal; [Electrolytic] Process of reducing —. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 918,950, April 20, 1909.

A SUBSTANCE, containing the metal in combination with one or more non-metallic elements (e.g. oxygen and a halogen), is subjected to electrolysis with the use of electrodes containing a "metal acetylide," the latter being decomposed by an ingredient of the substance employed, and thereby liberating the metal.—B. N.

Slime; Treating anode — from the electrolytic refining of lead. A. G. Betts, Troy, N.Y. U.S. Pat. 918,647, April 20, 1909.

THE slime, which is obtained from the electrolytic refining of lead containing antimony and copper, is treated with lead peroxide, a solution containing the "thorium ion," and a considerable amount of an acid forming a readily soluble salt of lead. The acid employed is the same as that contained in the electrolyte for refining the lead, from which the slime is obtained. Antimony is deposited electrolytically from the solution which is obtained, using an insoluble anode and a suitable cathode.—B. N.

Acid-proof tank for the electrolytic refining of metals. A. G. Betts, Troy, N.Y. U.S. Pat. 918,649, April 20, 1909.

THE tank is composed of porous inorganic material, such as concrete or cement, with solidified sulphur in the pores of the inner surface layer, and with an interior lining of sulphur.—B. N.

Furnace; Electric [metallurgical] —. J. H. Reid, Newark, N.J. U.S. Pat. 917,796, April 13, 1909.

THE furnace includes an outer casing, with an inner chamber, open at the top, provided with a number of horizontally extending and converging electrodes of different polarity, which, together with resistance elements, form a table covering the inner chamber. The electrodes have perforations through which the melted metal may pass, the ore being spread on and cleaned off the electrodes by means of a "sweep."—B. N.

Furnace; Electric smelting —. H. C. Harrison, Exton, Pa. U.S. Pat. 919,165, April 20, 1909.

THE furnace is of the arc type, rectangular in shape, and adapted to the use of polyphase currents. It is first charged with material relatively high in metal, until a molten bath is formed, the latter making electrical connection with the metal bottom of the furnace, which is connected to the ground. The furnace is then charged with a material of lower conductivity than the first charge. Three electrode packets, each of an oblong rectangular shape and placed in a row, are vertically disposed in the furnace, each electrode being connected to one of the branches of the star connection of a polyphase generator, the latter being also connected with the ground. Resisting charge material is placed between the electrodes, in order to prevent any substantial leakage of current from one electrode to another.—B. N.

Electric furnaces for the manufacture of steel. A. Hugot, Firminy, France. Eng. Pat. 12,258, June 5, 1908.

SEE Fr. Pat. 387,747 of 1908; this J., 1908, 864.—T. F. B.

Metallic coatings on glazed china, &c. Eng. Pat. 7230. See VIII.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Linolenic acid in linseed oil; Investigation of —. E. Erdmann and F. Belford. Ber., 1909, 42, 1324–1333.

A PARTIAL separation of oleic acid from the more unsaturated fatty acids of linseed oil was effected by Farnsteiner's method of treating their barium salts with a mixture of benzene and alcohol (this J., 1899, 500; 1903, 371). The fatty acids from the soluble salts were converted

by boiling with sulphuric acid and ethyl alcohol into ethyl esters. These appeared as a colourless liquid which distilled at 133° C. under a pressure of 75 mm., and had a sp. gr. of 0.8854 at 20°/4° C. When reduced by a modification of the method of Sabatier and Senderens (Ann. Chim. Phys., 1905, 4, 319) by being passed in the form of vapour together with hydrogen over finely-divided freshly-reduced nickel, they yielded the corresponding ester of stearic acid. Reduction of linolenic acid or of the mixed unsaturated fatty acids by the same method also yielded stearic acid. From the mean hydrogen value (1.4561) found in this way, these more unsaturated esters apparently consisted of a mixture of the esters of linolic and linolenic acids containing 22.3 per cent. of the latter. This corresponded fairly well with the yield of 15.3 per cent. of linolenic hexabromide obtained from the mixed fatty acids of the oil. The authors term the acid which yields the hexabromide, α -linolenic acid. The ethyl ester of hexabromostearic acid melted at 151.5°—152.5° C., and the methyl ester at 157°—158° C. Reduction of the hexabromide with zinc and alcoholic hydrochloric acid yielded a colourless oil distilling at 157°—158° C. under a pressure of 75 mm. The ethyl ester, debrominated in the same way, had a sp. gr. of 0.8919 at 20°/4° C.; a refractive index of n_D^{20} = 1.46753; and a molecular weight of 278.9 (theory requiring 304). As was shown by Hehner and Mitchell (this J., 1899, 77) linolenic acid, reduced from the hexabromide, only yields a small amount of hexabromide when again brominated. Elementary analysis and its hydrogen value, however, show that it has the formula, $C_{18}H_{30}O_2$, although absorbing less bromine than the original linolenic acid. The authors' explanation of this is that the linolenic acid obtained by reduction of the hexabromide is a mixture of two isomeric acids. One of these is identical with the α -linolenic acid of the original linseed oil fatty acids, whilst the other, β -linolenic acid, only absorbs by addition 4 atoms of bromine to form a fluid tetrabromide with the composition, $C_{18}H_{30}Br_4O_2$.—C. A. M.

Linolenic acid; Constitution of —. E. Erdmann, F. Bedford and F. Raspe. Ber., 1909, 42, 1334—1346.

THE linolenic acid obtained by the reduction of the hexabromide from the mixed fatty acids of linseed oil (see preceding abstract) when treated with ozone, yields a mixture of two ozonides, $C_{18}H_{30}O_{11}$ (or ozonide-peroxides, $C_{18}H_{30}O_{12}$), whilst the ethyl esters form ozonides with the composition, $C_{20}H_{34}O_{11}$ (or $C_{20}H_{34}O_{12}$). All of these compounds are colourless oily liquids. The ozonide-peroxides of the ethyl esters may be distinguished from each other by the speed at which they are decomposed by water. That readily decomposed at the ordinary temperature corresponds to α -linolenic acid, whilst that which is only slowly decomposed corresponds to β -linolenic acid. Both yield the same products of decomposition, viz., propionic aldehyde, malonic acid, and the mono-ethyl ester of azelaic acid, together with the aldehydes of malonic and zelaic acids. The two linolenic acids may be regarded as tereoisomeric, like oleic and elaidic acids, and the chemical constitution of linolenic acid may be expressed by the formula—



—C. A. M.

Horse-chestnut oil. M. Stillesen. Chem.-Zeit., 1909, 33, 497—498.

HE dried and finely-divided seeds of the horse chestnut, *esculus hippocastanum*, yielded on extraction with ether om 1.5 to 3 per cent. of a yellowish-brown, somewhat acid fatty oil, but contained little, if any, ethereal oil. he extracted oil began to solidify at —20° C., and at —37° C. was of wax-like consistency. It gave the following analytical values:—Sp. gr. at 15° C., 0.9260; refractive index, n_D^{20} = 1.4747; saponification value, 194.5; iodine value, 95.4; Reichert-Meissl value, 1.51; Hehner value, 2.9; acetyl value, 13.5; iodine value of "liquid" fatty acids, 95.8; and unsaponifiable matter, 0.53 per cent. From the examination of the fatty acids by the usual methods, the oil was found to consist chiefly of olein, with

small quantities of linolin, palmitin, and stearin, and to be on the border line of the semi-drying and non-drying oils. It did not contain sulphur, but on evaporation of the solvent after the extraction there was a characteristic odour recalling that of mustard oil. This appeared to be due to some principle to which the oil probably owes its repute as an external remedy in cases of rheumatism.

—C. A. M.

Oil of colocynth seeds. C. Grimaldi and L. Prussia. Boll. Chim. Farm., 1909, 48, 93—95. Chem. Zentr., 1909, 1, 1489.

A SPECIMEN of colocynth seeds from Algiers, when extracted with carbon tetrachloride, yielded a yellowish-red oil showing a faint green fluorescence, and having a somewhat bitter taste and a slight odour characteristic of oils from *Cucurbitaceae*. The oil was soluble in boiling absolute alcohol, and in ether, petroleum ether, chloroform, benzene, carbon bisulphide, and amyl alcohol, but only slightly soluble in boiling 95 per cent. alcohol. It had the sp. gr. 0.9289 at 15° C. and 0.8733 at 100° C., referred to water at 15° C.; solidifying point, 14° C.; Zeiss butyrorefractometer reading, 78.2 at 15°, 72.3 at 25°, and 63.5 at 40° C.; "thermal value" in Tortelli's apparatus, 86.4; acid value, 2.7; Hehner value, 90.72; saponification value, 191.7; iodine value (Hübl), 120.37; Reichert-Meissl value, 0.32. The fatty acids had the sp. gr. 0.8537 at 100°/15° C.; m. pt., 29.2°—30° C.; solidifying pt., 26.2°—27.2° C.; butyrorefractometer reading, 56.7 at 30°, 51.5 at 40°, and 48.3 at 45° C.; acid value (neutralisation value), 192.6; saponification value, 198.2; iodine value (Hübl), 121; "absolute iodine value" (Tortelli and Ruggeri), 150; liquid fatty acids, 56.2 per cent., and solid fatty acids, 43.8; mean molecular weight of insoluble acids (Hehner), 272. In the Livache test, 100 parts of the oil absorbed 5.22 per cent. of oxygen in 3 days and 5.76 per cent. in 7 days.—A. S.

Oil [Zachun oil] of Balanites aegyptiaca (Arab.: heglig).

Third Report of the Wellcome Research Laboratories, Gordon Memorial College, Khartoum, 1908, 412. (See this J., 1909, 495.)

THE heglig fruit resembles a dried date and weighs about 7.5 grms. The kernel, which amounts to 9.5 per cent. of the whole fruit, contains 43.57 per cent. of oil. The latter (see Lewkowitsch, Chem. Techn. and Anal. of Oils, Fats, and Waxes, 4th edition, Vol. 2, p. 185, under "zachun oil") has the following characters:—Sp. gr. at 100°/100° C., 0.88919; saponification value, 186.5; iodine value, 99.2; m. pt., about 8° C. It gives no reaction in the Beechi, Baudouin, and Halphen tests; in the claidin test, it forms a buttery mass which separates from a liquid portion.

—A. S.

Fats and oils; Theory of the hydrolysis of —. J. Kellner. Chem.-Zeit., 1909, 33, 453.

IN two of the author's experiments palm-kernel oil was partially saponified with an aqueous solution of alkali, until the fat separated from the mass had an acid value of 96.3 and 193.3 respectively. The amounts of glycerol in these partially saponified fats were 8.26 and 3.41 per cent., whilst the theoretical quantities for quadrimolecular hydrolysis were 8.34 and 3.31 per cent. respectively. When, however, the saponification was carried out in an autoclave, the proportion of glycerol in the partially hydrolysed fat was greater than would be possible on the assumption of a quadrimolecular hydrolysis. Thus in three typical experiments the respective amounts of glycerol found were 12.16, 5.28, and 2.11 per cent., as against 10.22, 3.17, and 1.37 per cent. theoretically required for a quadrimolecular hydrolysis. The author therefore concludes that mono- and diglycerides are present in fats partially hydrolysed in an autoclave either by means of zinc oxide or of water alone, but not in those hydrolysed with an aqueous solution of alkali under atmospheric pressure. (See also this J., 1898, 1107; 1899, 1031; 1904, 905; 1906, 856; 1907, 24, 263, 623; 1908, 693.)—C. A. M.

3-Hydroxy-5-methylfurfural as cause of some colour reactions of hexoses. Van Ekenstein and Blanksma. See XVI.

PATENTS.

Castor oil; Method of rendering — miscible with mineral oils. L. E. Common, Sutton-on-Hull, and The Hull Oil Manufacturing Co., Hull. Eng. Pat. 15,496, July 21, 1908, and 19,140, Sept. 11, 1908.

THE lubricating value of castor oil is increased by mixing it with about 1 per cent. of a reducing agent such as formaldehyde and heating to about 500° F. for some time. By this treatment it is rendered soluble in mineral oils, but before being dissolved in the hydrocarbon oil, its viscosity may be increased by blowing air through it at a temperature of about 250° F.—J. A.

Fatty acids; Process of separating liquid from solid —. E. Twitchell, Wyoming, Ohio, U.S.A. U.S. Pat. 918,612, Apr. 20, 1909.

A RELATIVELY small amount of a sulphonated fatty acid is dissolved in the liquid fatty acids, which may then be separated from the admixed solid fatty acids by washing with water, the liquid oily layer being subsequently decanted from the washing water. Or the mixed fatty acids may be formed into an emulsion, and the liquid fatty acids washed out of the finely-divided mixture.—C. A. M.

Soap; Apparatus for making —. A. H. Pritchard, Toronto. Eng. Pat. 9096, April 27, 1908.

SEE U.S. Pat. 910,083 of 1909; this J., 1909, 209.—T. F. B.

Soaps containing peroxides; Process for the manufacture of —. R. F. Wolfenstein, Berlin, Assignor to P. Beiersdorf and Co., Hamburg. U.S. Pat. 917,828, April 13, 1909.

SEE Eng. Pat. 16,823 of 1908; this J., 1908, 1028.—T. F. B.

Soap or mixtures containing soap; Manufacture of —. M. R. A. Samuel and A. A. Lockwood, Assignors to The Karsam Soap Co., Ltd., London. U.S. Pat. 918,703, April 20, 1909.

SEE Eng. Pat. 24,822 of 1906; this J., 1907, 1244.—T. F. B.

Insulating coatings. Ger. Pat. 208,753. See XI.1.

Gum-like substance from "Java olive oil" [Sterculia oil]. Fr. Pat. 395,733. See XIII.C.

Preservation of fats, oils, &c. Fr. Pat. 395,810. See XVIII.A.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

PATENTS.

Pigments or lakes [from naphthanthraquinone]; Manufacture of —. J. V. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 18,616, Sept. 4, 1908.

WHEN naphthanthraquinone is mixed with substrata (such as alumina, china clay, and *blanc fixe*), pigments are obtained which have a good yellow shade and are fast to water, lime, light, alcohol, and oil. They also have good covering power. The naphthanthraquinone is obtained in a fine state of division by pouring its solution in concentrated sulphuric acid on ice and water, filtering, and washing with hot dilute caustic soda solution. The product obtained by grinding together a paste containing 5 parts of naphthanthraquinone and 50 parts of a 44 per cent. aluminium hydroxide paste, filtering, drying, and grinding is very suitable for lithographic and three-colour process printing inks. The pigment obtained from 100 parts of barium sulphate and a paste containing 10 parts of naphthanthraquinone is suitable for use in the form of a paint, and a further example is given in

which 10 parts of aluminium sulphate, 20 parts of barium sulphate, and a paste containing 5 parts of naphthanthraquinone are mixed and treated with 5 parts of sodium carbonate. The product is filtered and pressed.—J. C. C.

Lake from sulphonated azo dyestuffs. E. Würthner, Assignor to G. Siegle and Co., Stuttgart, Germany. U.S. Pat. 918,244, April 13, 1909.

A METALLIC compound which forms a lake base is mixed with one of the components of a sulphonated azo dyestuff, and the mixture is combined with the remaining component.—T. F. B.

(B).—RESINS, VARNISHES.

Acid value of resins; Determination of —. J. Marcusson and G. Winterfeld, Chem. Rev. Fett- u. Harz-Ind., 1909, 16, 104–107.

A MIXTURE in equal parts of absolute alcohol and benzene readily dissolves the free acids in resins, giving in a short time results in agreement with those obtained by repeated extraction of a resin with boiling alcohol. From 3 to 4 grms. of the finely-powdered sample are heated for a short time beneath a reflux condenser with 200 c.c. of the solvent, and the liquid then cooled and titrated with *N*/10 sodium hydroxide solution, without previous filtration from insoluble matter. Complete solution occurs in the case of kauri and Manila copals, and mastic, sandarac, and elemi resins. When a resin contains ammonium soaps a determination of the ammonia by distillation is necessary to obtain the amount of free acid fixed by the ammonia. In the presence of calcium resinsates the method is modified as follows. From 5 to 10 grms. of the substance are heated for a short time under a reflux condenser with about 50 c.c. of a mixture of 90 parts of benzene and 10 parts of absolute alcohol. Any undissolved matter is then filtered off and washed, and the filtrate diluted with 30 c.c. of neutral 50 per cent. alcohol, and titrated with *N*/10 alkali solution, with phenolphthalein as indicator, until the lower layer becomes pink. When soaps of aluminium, iron, manganese, or other heavy metals are present, from 10 to 20 grms. of the sample are treated with 50 c.c. of benzene, the solution filtered, and the filtrate mixed with 30 c.c. of water containing some methyl orange, and titrated with *N*/2 hydrochloric acid until the aqueous layer, after heating and thorough shaking, remains pink. This gives the amount of acid required to decompose the metallic soaps. The two layers are now separated, and the benzene solution washed once with water, mixed with neutral alcohol, and titrated with *N*/10 sodium hydroxide solution, with phenolphthalein as indicator. An amount of alkali equivalent to the hydrochloric acid used is deducted from the result to obtain the amount neutralised by the free acids of the resin.—C. A. M.

Japan lac; The chief constituent of —. Urushiol and its dimethyl ether. R. Majima, Ber., 1909, 42, 1418–1423.

THE juice of the lac tree (*Rhus vernicifera*) was treated with alcohol and filtered, the alcohol removed, and the residue (about 80 per cent.) of crude "urushinic acid" (this J., 1907, 1245) purified by repeated treatment with petroleum spirit. The filtrate from the insoluble matter (which amounted to about one-eighth) was evaporated first at the ordinary pressure and then under reduced pressure, and left a residue which could be partially distilled (to the extent of about 41 per cent.) *in vacuo* without being decomposed. The main portion of the distillate was a light brown viscous fluid, which had a sp. gr. of 0.9687 at 21.5°/4° C. and was readily soluble in most organic solvents. It was free from nitrogen and gave the same reactions as the crude undistilled substance (*loc. cit.*). It formed dimethyl and diacetyl derivatives, and gave the reactions of divalent phenols, especially the pyrocatechol reaction. Hence the author concluded that it contained two phenolic hydroxyl groups, and that the name of "urushiol" was more suitable than "urushinic acid." The crude substance had almost the same elementary composition (carbon, 79.65; hydrogen, 9.75 per cent.) as the distillate

and the non-volatile portion is therefore probably a polymerised substance of high molecular weight. (See also this J., 1906, 61; 1908, 456; 1909, 318.)—C. A. M.

PATENTS.

Turpentine and resinous matter; Apparatus and process for extracting — from wood. G. B. Frankforter, Minneapolis, Minn., U.S.A. U.S. Pats. 918,989 and 918,990, Apr. 20, 1909.

THE wood is extracted by means of a suitable solvent, which is subsequently treated, at a temperature above its b. pt., with a "reclaiming fluid," with the result that the solvent is evaporated and removed from the wood and the "reclaiming fluid." The special apparatus claimed for this process comprises a boiler connected with a number of extraction chambers by means of pipes which pass from the upper part of the boiler to the top of the chambers, and return pipes coming from the bottom of the chambers to the lower part of the boiler. The different chambers are connected with one another, and are provided with conduits for the introduction of the "reclaiming fluid," whilst there are valves in the different conduits so that each chamber may be used successively with the boiler.—C. A. M.

Polishing compositions or inks, more especially intended for polishing the heels and soles of boots and shoes; Manufacture of —. J. Y. Johnson, London. From Chem. Fabr. Elektro, Biebrich on Rhine, Germany. Eng. Pat. 9663, May 4, 1908.

EE Fr. Pat. 390,437 of 1908; this J., 1908, 1075.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Rubber trees; Manuring of —. G. A. Cowie. India Rubber J., 1909, 37, 463—467.

THE application of excess of nitrogen to the soil has often the effect of stimulating the growth of the foliage to too great an extent, causing the tree to bend over in the wind. It is therefore advisable to restrict the amount of nitrogen and to supplement it with phosphates, and especially with potash, which exerts a particularly beneficial influence on the wood of the tree. Experiments made at Deli-oeda, Sumatra, with *Hevea* trees 2 years 10 months old, give the following results after 2 years' manurial treatment:—

Manure per tree.	None.	2 lb. of pea-nut cake meal, 12 oz. of double superphosphate, 8 oz. of potassium muriate (chloride).	2 lb. of pea-nut cake meal, 12 oz. of double superphosphate.
		9	14
Average circumference of stems in inches			12

The following mixtures are recommended:—
A. For land rich in nitrogen, and where there is a good leaf growth:

	Containing:		
	Potash.	Phosphoric acid.	Nitrogen.
parts of potassium chloride	14	—	—
" " superphosphate .	—	4.50	—
" " bonemeal	—	5.60	0.2
" " oil cake.....	—	—	1.3
" " ammonium sulphate	—	—	1.6
" contain	14	10.1	3.1

400 to 800 lb. per acre.

B. For land poor in nitrogen:

	Containing:		
	Potash.	Phosphoric acid.	Nitrogen.
20 parts of potassium chloride	10	—	—
30 " " superphosphate .	—	5.4	—
10 " " bonemeal	—	2.8	0.1
24 " " ammonium sulphate	—	—	4.9
16 " " oil cake.....	—	—	1.0
100 " contain	10	8.2	6.0

400 to 700 lb. per acre.

—E. W. L.

Latex of Funtumia elastica; Coagulation of —. C. Christy. India-Rubber J., 1909, 37, 400—401, 445—446.

THE coagulation processes dealt with may be divided into two more or less distinct classes, viz.: (1), the slow method, in which coagulation is brought about in the cold; (2), the rapid method in which heat is employed. In the first class are included, (1), spontaneous coagulation, which occurs when the undiluted latex is allowed to stand exposed to the air for several weeks, and which may be hastened by dilution with 15 volumes of cold water (5 to 6 days); (2), coagulation by means of formaldehyde; and (3), coagulation by means of alcoholic creosote. To the rapid methods, class (2), belong (1), the simple boiling process, in which it is better to employ diluted latex; (2), the mercuric chloride process; (3), coagulation by means of tannic acid and heat; (4), by means of alum and heat; and (5), by means of plant juices and heat. Acetic acid, although useless as a coagulant for *Funtumia* latex, is of great value as an aid to the coagulation of fresh latex. In the case of the mercuric chloride process, the addition of acetic acid to the latex, in the proportion of 1 c.c. to the pint, is essential, otherwise no coagulation can be induced until the latex is 10 days old. The following is recommended as a good working formula: Hot water (80° F.), 20 pints; mercuric chloride stock solution, 1 oz.; fresh latex, 5 pints; the stock solution being made up of mercuric chloride, 1 lb.; water, 34 pints; acetic acid, 172 oz. Tannic acid is employed in the following proportions:—Hot water (80° F.), 20 pints; tannic acid stock solution, 1 oz.; fresh latex, 5 pints. Stock solution:—Tannic acid, 1 lb.; water, 16 oz.; acetic acid, 5 oz. Coagulation by means of plant juices is not very practicable on the large scale. Coagulation by means of formaldehyde offers several advantages over other processes, and is effected by the simple addition of about 15 c.c. of a 40 per cent. solution (commercial "formol" or "formalin") to the pint of latex. Coagulation is complete in 15 to 24 hours. The time may be shortened by the use of larger proportions of formalin, but the coagulum then obtained is not so suitable for handling. Alcoholic creosote is useful rather as a laboratory coagulant than on a commercial scale. It is found that whereas the creosote may be replaced successfully by crude phenol (carbolic acid), the purer crystalline form of the latter is quite useless for the purpose. There appears to be little doubt that the best rubber from every standpoint is produced by the cold, slow processes in which the clot is formed by the gradual development of a reticulated structure, consisting of strands and threads of (presumably) protein, in which the globules of caoutchouc become enmeshed. In the hot processes the clot is formed by the coalescing of flakes of rubber and subsequent shrinkage of the mass. Rubber prepared with formalin is of great strength and toughness, but somewhat deficient in elasticity (see this J., 1907, 1264); it is light in colour, dries quickly, is not so liable to mould as other rubbers, and resists oxidation. Rubbers prepared with mercuric chloride and tannic acid are very similar to one another in properties. They dry slowly, and appear to deteriorate fairly rapidly. Rubber prepared with plant juice (*Bauhinia*) is fairly

strong, but apt to be dead and inelastic. Boiled rubber prepared in thin biscuits is of good quality. Risk of discoloration in the rubber may be avoided by prompt coagulation of the latex. It has been found, in certain instances, that the addition of caustic alkali to the latex, when boiling, results in the production of a pure white rubber. The approximate cost of chemicals for the processes referred to are as follows:—Hot tannic and acetic acid process, 10s.; hot mercuric chloride and acetic acid process, 15s.; and formol process, £3 to £3 10s. per ton of rubber.—E. W. L.

Chloral hydrate method [in rubber analysis]. F. Frank and E. Marekwald. *Gummi Zeit.*, 1909, 23, 979.

THE authors find that the chloral hydrate method (see Weber, this J., 1903, 576) is not satisfactory either for the estimation of the rubber resins, or for the separation of these from free sulphur, or for the separation of rubber resins from paraffinoid hydrocarbons, other resins, etc.—E. W. L.

Vulcanised rubber: Spontaneous changes (deterioration) of —. K. Bing. *Z. Chem. Ind. Kolloide*, 1909, 4, 232–235. (Compare Spence, this J., 1909, 374.)

IN a number of old, hardened samples of various rubber articles, including billiard-strip, bicycle tyres, various types of reclaimed rubber, etc., the author found that the presence of sulphuric acid in the free state could be invariably shown. The deteriorated samples all possessed a characteristic smell similar to that of turpentine or varnish. The greatest amount of acid was present in those samples containing relatively little mineral matter, where that mineral matter included traces of copper or lead compounds. The influence of such compounds upon the spontaneous decomposition of various samples of vulcanised rubber was therefore investigated, the three samples selected being: (1), pneumatic inner-tubes (3 per cent. of ash, containing a considerable proportion of lead); (2), red "floating" waste; and (3), a high-grade Para-rubber mixing. In all cases the finely-ground sample was heated in an autoclave for a considerable time, with dilute caustic soda, and was then treated in various ways before being exposed to the action of the atmosphere in diffused daylight. Samples of grey inner tube, which had been heated with caustic soda in a copper autoclave, showed signs of deterioration in a few days, the change being slower the more imperfectly the sample had been freed from alkali. When an iron autoclave was used, however, the samples lasted for at least one month before deterioration became apparent. When the sample treated in the iron autoclave was moistened with a solution of copper chloride, deterioration proceeded at about the same rate as in the case of the sample treated in the copper autoclave. Red floating waste treated in an iron autoclave was found to be more durable, probably owing to the absence of lead, visible change only setting in after about 9 months. When copper chloride was added to the waste, deterioration became evident in about a week. These results were confirmed in the case of the high-grade Para-sulphur mixing. Sulphuric acid was produced in all cases. Further, it was shown that an increase in the amount of acid accompanied the advance of deterioration. Similar formation of sulphuric acid occurs at the surface of ebontite articles, and is partly responsible for the fact that old rods and tubes, etc., of ebontite, are often found to have lost their good insulating properties.—E. W. L.

Rubber resin: a new commercial product. Klassert. *Pharm. Zentralbl.*, 1909, 50, 282.

UNDER the above name a pale coloured resin, obtained from raw rubber, with a conchoidal fracture, has been introduced into commerce. It is soluble, on warming, in most organic solvents, but the greater part is deposited on cooling. It is, however, almost wholly soluble in cold chloroform and in carbon tetrachloride, forming solutions which dry in thin layers, leaving a dull, resistant varnish. The resin can be easily powdered, and has, in the powdered state, the odour of raw rubber. It promises to be a useful electrical insulating material. It becomes strongly electrical with friction. Its chemical

characters differ widely from those of most resins: iodine value, 28; acid value, 0; saponification value, 10. These figures are not materially altered after the resin has been heated for some time to over 100° C.—J. O. B.

PATENT.

Gum-like substance: Process for manufacturing a — from "Java olive oil" [Sterculia oil]. K. Wedemeyer. *Fr. Pat.* 395,733, Jan. 5, 1909.

THE oil from Java olives, when heated to a temperature of about 240° C., forms a tough, gum-like mass (see this J., 1906, 893). To prepare this substance on a large scale, the oil is heated fairly rapidly to a temperature of about 200° C., and then slowly to from 240 to 250° C. When the temperature becomes higher spontaneously, the mass is cooled by passing cold water through pipes contained in the vessel in which the oil is heated, water also being sprayed on the surface of the mass in order to prevent delagellation. The heat of the reaction suffices to evaporate the water from the mass, leaving the latter in the form of a rubber-like substance.—W. P. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Oakwood extracts: Sugar-like substances in —. J. Jedlicka. *Collegium*, 1909, 113–120, 121–126.

THE author's investigations were carried out on Mitrovitz oakwood extract containing 14–15 per cent. of non-tannins. *Non-hydrolysed non-tannins.*—After precipitation of the tannin and colouring matters with basic lead acetate and subsequent removal of the excess of lead with sodium carbonate, the solution was treated with Fehling's solution and the cuprous oxide, after washing, converted into cupric oxide and weighed; the amount of dextrose was calculated from Ruhsam's tables. It was found that the non-tannins left after precipitation of the tannin by hide powder contained generally slightly less sugar than those obtained by precipitation with lead, showing that hide partially retains monosaccharides. Forty analyses made in the course of 8 years showed an average of 3.2 per cent. of sugars in the non-hydrolysed non-tannins. *Hydrolysed non-tannins.*—Sulphuric acid was employed for hydrolysis and was afterwards precipitated by means of lead carbonate. It was found that increasing the time of boiling did not materially increase the amount of sugar. The average amount of reducing sugar (expressed as dextrose) found was 7.0 per cent. in extracts containing 60.0 per cent. of water, the results varying from 7.4 to 6.1 per cent. As a rule when there was less sugar in the non-hydrolysed solution, more was found after hydrolysis. Probably the polysaccharides are partly hydrolysed during the extraction. *Hydrolysed extract.*—After hydrolysing a 4–5 per cent. extract solution with sulphuric acid, higher figures for sugar were obtained than by hydrolysis of the extract after detanninisation—the average being 9.2 per cent. of reducing sugar. This is due to the precipitation of sugar-yielding gums by basic lead acetate.

By fermentation with yeast and measurement of the evolved carbon dioxide, it was found that the non-hydrolysed non-tannins contained 3.5–5.3 per cent. of monosaccharides. Of the hexoses, galactose was found in quantities ranging from 0.6–1.0 per cent. of the extract. In the hydrolysed extract xylose and arabinose were found. By boiling with hydrochloric acid, pentoses were found to the extent of 4–5 per cent.—S. H.

Tanning analysis: The Zeiss immersion-refractometer and —. J. Sager. *Collegium*, 1909, 146–149, 153–158.

THE author has made experiments with the Zeiss immersion refractometer method of tannin analysis described by Zwick (*Deutsche Gerber Zeit.*, 1908, 158), and give numerous tables comparing results obtained by the method with those obtained by the shake method. Greater variations are found in the scale equivalent than those shown by Zwick, and examination of 6 oak barks gave values ranging from 0.173–0.229, corresponding

to a difference of 3 per cent. of tannin. The author points out that conditions of extraction and the amount of moisture in the sample for analysis, influence the results: an oakwood ground moist gave an equivalent of 0.196—when dried and then ground and analysed, 0.176. If the time of extraction be prolonged and the heating increased, higher results are obtained. An oakbark extracted in 4 hours gave an equivalent of 0.192. When the extraction was extended over 12 hours, the same sample gave 0.2. Very small differences in the equivalents become serious quantities when calculated to percentage. The author does not consider the refractometer method of sufficient accuracy for tannin analysis, and certainly for the detection of adulteration or admixtures, it would be necessary to have less variation in the equivalents.—S. H.

Tannin; Constitution of —. M. Nierenstein. Ber., 1909, 42, 1122—1126.

ACETYLLEUCOTANNIN, obtained by the reduction of acetyltannin, when hydrolysed yields gallic aldehyde and gallic acid. When oxidised with potassium persulphate, a dark red powder, purpurotannin, is produced, which yields naphthalene on distillation with zinc dust. When acetylleucotannin is oxidised with acid permanganate, trihydroxyglutaric acid is produced. Commercial tannin is probably a mixture of digallic acid and leucotannin.—F. SHON.

Protein substances; Action of alkalis on —. A. Kossel and F. Weiss. Z. physiol. Chem., 1909, 59, 492—498.

If chupein be left in contact with sodium hydroxide or barium hydroxide solutions at the ordinary temperature, its optical rotation in aqueous solution gradually diminishes, and this change takes place more rapidly at 38° C. Thus the optical rotation of a solution of 2 grms. of chupein sulphate in 40 c.c. of N/2 sodium hydroxide fell from -2.75° to -0.51° in a 100 mm. tube, after standing for 50 hours at 38° C. Solutions of higher proteins show a similar phenomenon. Thus the optical rotation of a solution of gelatin fell from -5.84° to -0.57° in 14 days. From that point the optical rotation showed only slight alteration. The authors attribute this change in the optical rotation to a racemisation of certain parts of the protein mol., and in support of their view point to the formation of optically inactive arginin and ornithin when the products of the reactions of chupein with alkalis are further hydrolysed. In like manner an apparently optically inactive mixture of peptones, obtained by the action of sodium hydroxide solution upon gelatin, yields optically inactive arginin on hydrolysis with boiling dilute acids.—C. A. M.

ERRATUM—This J. page 184, col. 2, line 23 from bottom (title), for "Tocum" read Yocum.

PATENTS.

Bleaching agent and its use in bleaching leather, glue, feathers, and straw. Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 2522, Feb. 2, 1909.

THE new bleaching agent consists of a mixture of anhydrous sodium hydrosulphite and zinc dust, and its use in the bleaching of leather, glue, feathers, and straw is claimed.—S. H.

Imitation leather; Production of —. H. R. Müller, Limbach, Saxony. Eng. Pat. 26,593, Dec. 8, 1908.

AN unstretched knitted or woven fabric is shrunk by steeping in a bath of soda lye, then rinsed, dried, dyed in appropriate tint, rendered pliable by means of soap or oil, and finally rendered soft or "polished" in the usual manner by the use of emery or similar rollers. When two such pieces of fabric are united with their "wrong" or obverse sides together, by means of a suitable cement, the product has the appearance and feel of leather, on both sides.—S. H.

Leather; Manufacture of —. S. Pianko and M. Knaster, Warsaw, Russia. Eng. Pat. 7580, April 6, 1908. Addition to Eng. Pat. 28,743, Dec. 31, 1907.

SEE Addition of March 9, 1908, to Fr. Pat. 385,900 of 1908; this J., 1908, 911.—T. F. B.

XV.—MANURES, &c.

Determining nitrogen in salt-petre. Kleiber. See VII.

Manuring rubber trees. Cowie. See XIIIc.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar; The adsorption of —. P. Rona and L. Michaelis. Biochem. Zeits., 1909, 16, 489—498.

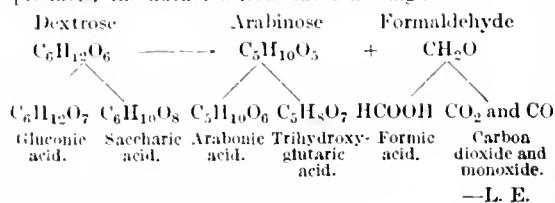
THE typical electronegative and positive adsorption media, e.g., china clay and ferric hydroxide, which adsorb albumin, have no effect on dextrose, acetone, or acetic acid. On the other hand, charcoal is well known to have a powerful adsorbent action on these substances. It has been suggested that the loss of sugar from solutions in presence of charcoal may be due to its destruction or oxidation, as has been proved to be the case with certain other substances, such as phenylthiourea. The authors show that this is not so. The action of charcoal in removing sugar from solution is immediate and final, not progressive. Moreover, the adsorption of sugar by charcoal may be entirely inhibited by the presence of a sufficient quantity of another substance, such as acetone or acetic acid, which is adsorbed more powerfully than the sugar. The practical value of this observation lies in the fact that a dilute solution of sugar, to which 10 per cent. of acetic acid or acetone has been added, may be decolorised by shaking with 5 per cent. of charcoal without any loss of sugar. This applies both to dextrose and to sucrose, and the charcoal has no inverting action on the latter sugar. The presence of albumin, on the other hand, does not influence the adsorption of sugar or acetone by charcoal. The adsorption of sugar by charcoal is a "mechanical" and not an electrical adsorption. The curve showing the concentration of sugar in the charcoal as a function of its concentration in solution has the usual form. According to Freundlich, a substance is susceptible to mechanical adsorption if it lowers the surface tension of the solvent. This, however, does not apply to sugar, since the slight alteration in the surface tension of water, which it produces, is in the other direction. Other causes are also capable of inducing mechanical adsorption: e.g., a substance is susceptible to adsorption if it increases the compressibility of the solvent; also if its solubility is increased by increased pressure. The three causes are not necessarily interdependent nor exhibited simultaneously in the same sense, and the adsorption of sugar by charcoal is probably due to one or both of the two latter causes.

—J. F. B.

Sugars; Decomposition of the —. III. Electrolysis of dextrose. W. Löb. Biochem. Zeits., 1909, 16, 132—144.

THE author has continued his investigations of the question as to whether the synthesis and decomposition of sugar are chemically as well as biologically reversible processes, i.e., does sugar, formed by a polymerisation process from formaldehyde, undergo decomposition by a depolymerisation process involving a rupture of the aldol linkages. His previous experiments, dealing with the action of zinc carbonate (see this J., 1908, 868), zinc dust, and iron Biochem. Zeits., 1908, 12, 466) on formaldehyde and sugar proved only that formaldehyde and sugar yield the same volatile substances—acetol and methylketol. The present paper deals with the decomposition of dextrose by electrolysis. The mode of procedure was as follows:—Dextrose (10—30 grms.), was dissolved in 25 c.c. of water, 25 c.c. of 10 per cent. sulphuric acid being added to the cold solution. The liquid was placed in a porous pot (of about 100 c.c. capacity), the latter being provided with a perforated rubber stopper. A leaden worm, passing through two holes of the stopper, served as anode; a current of cold water through the worm, prevented the temperature of the solution surrounding the anode from exceeding 16° C. throughout the experiment. A bent glass tube, passing through a third hole in the stopper, served to conduct the gases evolved during electrolysis to a nitrometer. The porous

pot was placed in a glass beaker filled, to the same level as the solution in the pot, with 5 per cent. sulphuric acid, and containing a platinum cathode. The potential difference amounted to 4–5 volts. Generally, the electrolysis was continued for such a period that the amount of oxygen set in action corresponded to 1 atom per molecule of sugar. It was found that the amount of gas liberated at the anode was extremely small; in one experiment of 6 hours' duration, only 29.2 c.c. of gas (of which 20.4 c.c. consisted of carbon dioxide, and 2.4 c.c. of carbon monoxide) were liberated at the anode. In addition to unaltered dextrose, the electrolysed solutions were found to contain formaldehyde, formic acid, *d*-arabinose, *d*-arabonic or trihydroxyglutaric acid, and gluconic or saccharic acid. The experiments showed that with continued oxidation, the dibasic saccharic and trihydroxyglutaric acids were formed and finally exceeded the corresponding monobasic acids in amount. Of the possible schemes representing the formation of the products, the author selects the following:—



β-Hydroxy- γ -methylfurfural as the cause of some colour reactions of hexoses. W. A. Van Ekenstein and J. J. Blanksma. Chem. Weekblad, 1909, 6, 217–226. Chem. Zentr., 1909, 1, 1509.

The red coloration produced on treating an ethereal extract of artificial honey with resorcinol and hydrochloric acid (see Fische, this J., 1908, 1127, 1171) is due to the presence of *β*-hydroxy- γ -methylfurfural.

$\text{O.C}(\text{CH}_3).\text{CH}(\text{C}(\text{OH})_2).\text{CHO}$. One gram. of this compound was obtained from 3 grms. of artificial honey by triturating with ether, filtering, evaporating, treating the residue with water, again filtering, and shaking the solution with ethyl acetate which extracted the furfural derivative. Whilst levulose (from sucrose) on heating with oxalic acid under pressure is converted to the extent of 20 per

being made to determine the extent to which the quantity and quality of the gum are affected by the time of tapping and length of the season of exudation. The results obtained up to the present showed that gum of the earliest exudations after tapping, was usually less soluble, this being especially the case with gum from old trees; on storage such gum became quite soluble. Towards the end of the collecting season the gum became harder and more glassy, but of the samples tested in 1908, the hard gum did not yield a solution of high viscosity as is usually the case with hard Kordofan gum. There was a fairly regular decrease in "viscosity-strength" of the gum as the season advanced. The gum from the older trees was usually slightly stronger than that from younger trees. Sudan (and also Senegal) gums exhibit in their solutions two kinds of viscosity. Certain samples appear to dissolve completely to form weak solutions (5–10 per cent.), but in higher concentrations yield, especially on standing, a glairy mucus-like liquid, from which a greater or less amount of a true solution, of lower viscosity separates. This behaviour appears to be more especially characteristic of the harder tears of gums of early collections. These facts indicate the necessity of determining the solubility and viscosity of gums in solution of not less than 20 per cent. strength; moreover the results as to viscosity obtained with 20–30 per cent. solutions are more in accord with the behaviour of the gum in actual use. The abnormal gums become completely soluble even at the higher concentration when kept for some time. Short accounts of talh (*Acacia seyal*), sunt (*A. arabica*), kuk (*A. veruca*), Schwitt, kakamut or siccini (*A. sama*, Kurz), leyun (*Odina fruticosa* Hochst.), subakh (*Combretum* sp.), tartar (*Sterculia cineria*), and da or kandi (*S. tomentosa*) gums are also given.—A. S.

Sudan gums: Notes on the chemistry of the —, E. S. Edie. Third Report of the Wellcome Research Laboratories, Gordon Memorial College, Khartoum 1908, 441–450. (See preceding abstract.)

The author determined the proportions of pentoses and hexoses formed from different samples of gums on hydrolysis with 5 per cent. sulphuric acid, and the optical rotations of 10 per cent. solutions of the gums before and after hydrolysis. The chief results are summarised in the following table:—

Gum.	Pentoses.	Hexoses.	Optical rotation:	
			before hydrolysis.	after hydrolysis.
	per cent.	per cent.		
Kordofan	33.52–35.48	56.88–53.04	– 2.77° to – 3.14°	+ 5.30° to + 5.56°
Senegal	33.66–34.59	51.72–53.17	– 2.70° to – 2.93°	+ 5.42° to + 5.48°
Talh	42.61–45.50	44.31–44.74	+ 5.05° to + 5.26°	+ 7.89° to + 8.35°
Subakh	54.36	25.54	– 4.16°	+ 5.48°
Kakamut	34.74		– 1.16°	+ 6.22°
Kuk	55.70	35.63	– 0.20°	+ 7.07°
Sunt	57.80	29.21	+ 7.73°	+ 8.25°

cent. into *β*-hydroxy- γ -methylfurfural, dextrose under similar conditions yields only 1 per cent., and galactose, 1.5 per cent. The colour reactions of *β*-hydroxy- γ -methylfurfural are, in general, the same as those of furfural, but with aniline acetate solution, it gives first a yellow and then an orange colour, whereas furfural yields a red coloration. The reactions of Seliwanoff for ketohexoses, Baudouin for sesamé oil, and Molisch-Udransky for hexoses, all depend upon the presence of *β*-hydroxy- γ -methylfurfural.—A. S.

Sudan gums. Third Report of the Wellcome Research Laboratories, Gordon Memorial College, Khartoum, 1908, 414–440. (See this J., 1909, 495.)

The chief gum exported from the Sudan is that obtained in the Kordofan Province from the *Acacia verek* ("hashab"), said to be identical with the *Acacia senegal* from which Senegal gum is derived. Experiments are

Some determinations of osmotic pressure of solution of the gums (6 grms. in 100 c.c.) in Moore and Roaf apparatus (Bio-chem. J., 2, 34) were also made. Different specimens of Kordofan gum gave values ranging from 102 to 170 mm. of mercury, whilst for Talh gum the values obtained with three samples were 55, 48, and 41 mm. respectively.—A. S.

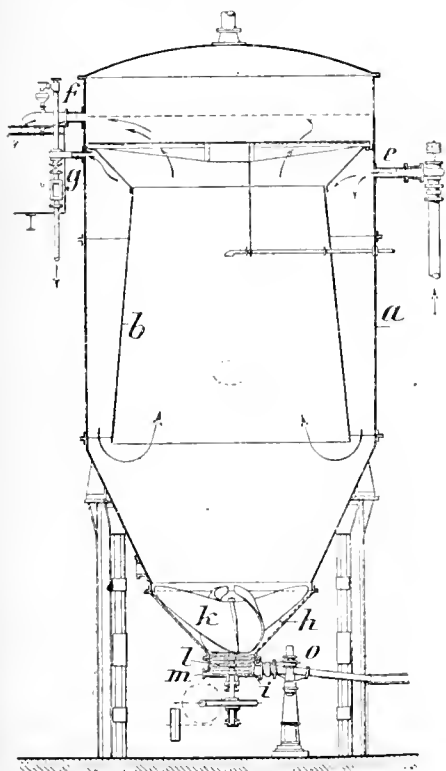
Margarine [and butter]; Parchment paper rendered pliable by means of glucose for packing —, Vo Boltensern. See XVIII.A.

Fixation of carbon dioxide by alcohols, sugars, and hydroxy acids. Siegfried and Howwjanz. See XX.

Determining carbon in aliphatic hydroxy-compound Berl and Innes. See XXIII.

PATENTS.

Sugar juices; Continuously working, depositing vessel for solutions and in particular for — provided with contrivances for compressing and washing the precipitates or deposits. F. Tiemann. Fr. Pat. 395,752, Oct. 28, 1908. Under Int. Conv., Sept. 24, 1908.



The apparatus includes a vessel, *a*, the upper part of which contains a chamber, *b*, of such shape that the annular space between the chamber and vessel is wider above than below. The upper rim of the chamber is fixed to the wall of the vessel by a water-tight joint. The solution passes from the pipe, *e*, through the apparatus in the direction indicated, and is drawn off through the outlet, *f*; this outlet is so placed that the floating impurities, which collect in the upper part of the annular space, are compressed and discharged through the outlet, *g*, by liquid pressure. The lower part of the vessel, *a*, contains a compression chamber, *h*, and a mixing chamber, *i*. The sedimentary impurities are compressed by a compressor, *k*, provided with blades which may be shaped like ploughshares. The compressed deposit passes to the mixing chamber, in which it is subjected to the action of a stirring device, *l*, and washed by water introduced at the inlet, *m*, the solution thus displaced passing upwards. The discharge of the washed deposit is effected by the water-pressure, and may be controlled by a suitably regulated piston or pump, *o*, connected with the exit pipe.—L. E.

Sugar; Manufacture of — G. W. McMullen, Chicago, U.S.A. Eng. Pat. 18,237, Aug. 31, 1908.

SEE U.S. Pat. 913,758 of 1909; this J., 1909, 376.—T. F. B.

Starch; Process of treating — F. Supf, Assignor to The Arabol Manufacturing Co., New York. U.S. Pat. 918,925, April 20, 1908.

SEE Fr. Pat. 394,167 of 1908; this J., 1909, 213.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Enzymes; Electrical migration of —. III. Malt diastase. L. Michaelis. Biochem. Zeits., 1909, 16, 231—234. (See also this J., 1909, 253.)

MALT diastase was subjected to dialysis in 2 per cent. solution for several days and the solution was then used in constructing the cell:

Silver in sodium chloride	Water	Diastase	Water	Copper in cupric chloride
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After 24 hours the diastase was found to have migrated largely towards the cathode, but a small quantity was always found to have migrated towards the anode. In acid solution, 0.5 per cent. of acetic acid being present in each of the three interior compartments, the migration of the diastase took place only towards the cathode, never towards the anode. With 0.2 per cent. of sodium carbonate in the three interior compartments, the enzyme migrated exclusively towards the anode. In the undialysed condition, commercial malt-diastase migrates only towards the cathode owing to the influence of electrolytes. Diastase is therefore amphoteric, as was also shown by the adsorption experiments (this J., 1908, 791). It differs from trypsin, which is also amphoteric, in the fact that it is more strongly positive, whereas trypsin is preponderantly negative.

IV. *Pepsin.*—In the arrangement:

Silver in sodium chloride	Hydrochloric acid	Pepsin and hydrochloric acid	Hydrochloric acid	Copper in cupric chloride
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there is a migration of hydrogen ions with the current, and a replacement by sodium ions from the first compartment, so that the degree of acidity decreases. Since the behaviour of pepsin depends on the degree of acidity, it is necessary to keep this constant by using hydrochloric acid instead of sodium chloride in the first compartment. Then, without hydrochloric acid, pepsin is anodic; with acidities of *N*/400 and *N*/200, it is amphoteric, whilst with *N*/50 acid it is cathodic. Pepsin only exerts proteolytic action in presence of a distinct proportion of acid, i.e., when it is cathodic; in neutral media it is anodic, and then, the author suggests, it is probably the same ferment as rennet.—J. F. E.

Enzyme actions; Inhibition of — by mercuric chloride and their restoration. S. Hata. Biochem. Zeits., 1909, 16, 156—187.

THE author has investigated the influence of varying quantities of mercuric chloride on the action of pepsin, trypsin, rennet, ptyalin, the proteolytic enzyme of horse's liver, and catalase, and has also made experiments on the regeneration of the activity of the enzymes (1), by precipitation of the mercury with potassium sulphide; (2), by treatment with potassium cyanide whereby the mercury, though left in solution, is converted into non-dissociable mercuric cyanide. It was found that mercuric chloride inhibits the action of the enzymes; a considerable quantity of mercuric chloride is required to deprive pepsin, trypsin, and rennet of their activity, whereas only very small quantities are required to prevent the action of ptyalin, the proteolytic liver enzyme, and catalase. In no case did the author observe an undoubted acceleration of enzyme action as a result of addition of mercuric chloride. With regard to restoring the activity of the enzymes, experimental difficulties were encountered in the case of pepsin, whilst with the other enzymes it was found that their activity can be restored by one or other of the above-mentioned methods (the activity of ptyalin can be restored by either method). The experiments also showed that the enzymes are less readily precipitated by mercuric chloride than the proteins accompanying them. Hence, by means of mercuric chloride, it is possible to effect a partial removal of proteins from an enzyme preparation of high protein-content. The mercuric chloride left in solution is removed by a precipitant such as potassium sulphide, the activity of the enzyme being thereby restored.—L. E.

Cold-malt [Kaltmalz]. E. Jalowetz. *Woch. für Brau.*, 1909, 26, 215–216.

THE author describes a method for obtaining a chit-malt, which can be mashed without any admixture of long-grown malt; such malt he terms cold-malt (Kaltmalz). If a steeped barley is heaped to a depth of 50 cm. (20 inches) on a cold floor at a temperature of about 2° R. (36°–37° F.) and is treated in the usual way, it chits after 5–6 days and is finished after 13–15 days, its modification and yield of extract being excellent. If such malt is observed at the period of chitting, it will be found to have a good aërospire growth, while the modification of the endosperm has spread to a considerable distance. In consequence of the low temperature of the air, germination has proceeded only in the direction of the plumule, the growth of the radicle being restricted. If the germination is interrupted at this stage, the so-called 'cold-malt' is obtained. The analytical results for two such malts show (1), saccharification to take place in 20–25 minutes; (2), modification to be somewhat below the normal, the difference between the extracts with coarse and fine grinding being 4.2 and 4.5 per cent. in the two cases. The same two malts had (1), 27 and (2), 23 per cent. of half-grown, and (1), 62 and (2), 50 per cent. of three-quarter-grown corns.—T. H. P.

Spirit duties in the United Kingdom. Board of Trade J., May 13, 1909. [T.R.]

FOLLOWING is a list of duties on certain spirits, etc., payable on or after April 30th, as fixed by General Order No. 15 of 1909:—

		Rates of duty.		
		£ s. d.		
Unenumerated spirits—				
Not sweetened:				
Imported in casks or bottles	Proof gall.	0	15	2
Perfumed spirits:				
Imported in casks	Liquid gall.	1	4	1
Imported in bottles	„	1	5	1
Chloral hydrate	„	0	1	9
Chloroform	„	0	4	4
Collodion	gall.	1	14	11
Ether, acetic	„	0	2	7
„ butyric	gall.	1	1	10
„ sulphuric	„	1	16	6
Ethyl bromide	„	0	1	5
„ chloride	gall.	1	1	10
„ iodide	„	0	19	0
British spirits	Proof gall.	0	11	9

Citric acid fermentation. R. O. Herzog and A. Poletzki. *Z. physiol. Chem.*, 1909, 59, 125–128.

THE results of investigations on the action of cultures of *Citromyces* isolated by the authors are described. The production of citric acid stands in no relation to the amount of mycelium or spores developed by the growth of the fungus, but it appears to be influenced by the form of the culture flask. There is a certain amount of relationship between the proportion of nitrogen in the medium and the yield of citric acid; the concentration of phosphoric acid in the medium also has an influence, but the total composition of the medium appears to affect the influence exerted by the single factors. The concentration of the sub-stratum from which the citric acid is being formed has a considerable effect on the yield of citric acid. Without neutralisation of the acid produced, the maximum conversion in the case of dextrose is obtained at concentrations of 5–10 per cent., amounting to a yield of about 25 per cent. of the sugar taken. The constitution of the substance fermented has a great influence on the yield. The following yields were obtained from 5 per cent. solutions, the experiments lasting over a period of 5 to 9 weeks:—Maltose, about 50 per cent.; sucrose, 30; lactose, only traces; arabinose, 5; xylose, 11; dextrose, 24; levulose, 13; galactose, 8; mannose, 12–19; mannitol, 3; erythritol, nothing; glycerol, 24–29; the yields all being calculated as percentages of the amounts of substratum taken. Ethyl alcohol gave a good growth of fungus, but no citric acid; several other alcohols

behaved similarly. Several ammonium salts of organic acids were tested, without result, but ammonium malate gave a considerable yield of an acid, the nature of which has not been determined. The mechanism of the production of citric acid, particularly from a substance like glycerol, in this manner, is still obscure. It is certain however, that the citric acid is formed from a still unknown intermediate product, as the result of a whole series of changes brought about in the original substance by the activity of the fungus.—J. E. B.

PATENTS.

Malt liquors; Treatment of —. [Priming with lactose.] W. J. Melhuish, Glasgow. Eng. Pat. 1269, Jan. 18, 1909. Addition to Eng. Pat. 13,528 of 1908 (this J., 1909, 255).

THE solution of lactose used as a priming agent in the process described in the main patent may be added at any stage of the brewing operation, and a further quantity of the solution may be introduced, if required, after the brewing is completed.—W. P. S.

Products [glycerol, etc.] in addition to alcohol; Process for the production of — by fermentation of saccharine solutions, preferably maltose. A. J. Boulton, London. From F. Sparre, Wilmington, Del., U.S.A. Eng. Pat. 7813, April 8, 1908.

A SOLUTION containing a sugar, preferably maltose, is inoculated with yeast and allowed to ferment; when fermentation has reached a maximum, a quantity of the liquid is withdrawn and a portion of it used to inoculate a fresh saccharine solution. This solution is allowed to ferment and a portion of it is added to a third saccharine solution, and so on. The main bulk of each solution is allowed to ferment completely, and the residual solutions are then tested for the amount of by-products, particularly glycerol. It is found that this successive inoculation at maximum growth leads to the production of a micro-organism which will, in saccharine solutions, produce a decreased yield of alcohol but an increased yield of by-products, such as glycerol. The reserved portion of the solution withdrawn from the saccharine solution containing the most glycerol is then employed for the production of glycerol from such saccharine solutions. After complete fermentation, the alcohol is removed by distillation, and the glycerol separated from the residue by distillation under reduced pressure.—W. P. S.

Liquid suitable for the production of alcohol; Process for producing a — from straw. W. F. Giles, New York. Assignor to F. C. Norris, Detroit, Mich. U.S. Pat. 918,997, April 20, 1909.

A LIQUID suitable for the production of alcohol is obtained by methodically extracting separate quantities of straw; the first quantity of straw is heated with water under pressure, and the solution obtained is employed for extracting a second quantity of straw, fresh water being added to the first quantity, and the boiling repeated and so on. Each quantity of straw is thus boiled twice under pressure, first with the solution obtained from a previous extraction and then with water. The united solutions obtained are acidified, allowed to remain at rest until the extracted substances have been converted into fermentable material, and then neutralised.—W. P. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(A).—FOODS.

Milk; Enzymes of —. F. Bordas and F. Touplain. *Compt. rend.*, 1909, 148, 1057–1059.

THE authors have shown that it is not necessary to assume the existence of catalases and peroxidases in milk in order to explain the occurrence of the reactions based on the decomposition of hydrogen peroxide. It is the casein, or rather the calcium caseinate, which decompose hydrogen peroxide, and if this action does not occur it

boiled milk, it is because the soluble casein of Duclaux's precipitated on the casein in suspension, forming a coating on the latter, and thus preventing the decomposition of hydrogen peroxide.—L. E.

Milk; Detection of added water in altered —. A. Kling and P. Roy. *Compt. rend.*, 1909, 148, 1050—1052.

THE total nitrogen-content of milk is not altered during storage provided that the sample has been kept in a closed vessel. On this fact, the authors base the following method for detecting added water in milk which has been kept for some time:—The whole sample is weighed (its volume being found by dividing its weight by 1.033), acidified with acetic acid, and evaporated under diminished pressure on the water-bath. The dry residue is treated according to the method of Kjeldahl, the solution of ammonium sulphate obtained, being made up to a known volume; an aliquot portion is used for the determination of ammonia. The nitrogen-content of the sample, multiplied by 6.39, gives the protein-content. The protein-content of 1 litre of the suspected sample is then compared, if possible, with that of an exactly comparable sample of milk, or otherwise, with the average protein-content—33 grms. per litre—of *dépôt* milk ("lait de dépôt"). Two samples of milk, originally containing 2.60 and 27.83 grms. of protein matter per litre, were found to contain 32.58 and 28.60 grms. respectively, after 2 years' storage.—L. E.

Margarine [and butter]; Parchment paper rendered pliable by means of glucose for packing —. O. von Boltensern. *Z. Spiritusind.*, 1909, 32, 174—175.

MARGARINE and butter keep well in parchment paper which has been rendered pliable by dipping into liquid glucose (starch syrup), in spite of the fact that the latter serves as a good medium for the growth of mould-fungi under certain conditions. No trace of the characteristic mould smell is observable after the margarine has been stored for some days in such paper.—T. H. P.

PATENTS.

Milk; Method of treating [electrically sterilising] —. J. L. Goucher. Assignor to Goucher Electric Purifying Co., New York. U.S. Pat. 918,531, April 20, 1909.

THE milk is passed through a closed vessel, the velocity of the current being partially retarded at certain points; at each of these points the milk is subjected to the action of an alternating electric current of not less than 1000 volts. The milk is then cooled rapidly.—W. P. S.

Cheese; Process for the manufacture of —. J. Ragnet. *Fr. Pat.* 395,417, Oct. 17, 1908.

CRIMMED milk is treated with rennet and heated to a temperature of about 40° C., and the curd is separated, drained, pressed, and finely sub-divided. It is next placed in closed vessels and allowed to ferment, the mass being stirred occasionally to prevent the formation of lumps. Each kilo. of the fermented mass is then mixed with 600 c.c. of water containing 20 grms. of sodium chloride; the temperature is maintained at 40° to 50° C. until all lumps have disappeared and is then raised to 80° C., in order to melt the mass. While still hot the product is transferred to moulds, cooled, taken out of the moulds, dusted with starch or flour, and coloured.—W. P. S.

Pasteurising process. A. Goetz and P. A. Jones. *Fr. Pat.* 395,489, Oct. 20, 1908.

THE liquid to be pasteurised is caused to flow through a number of channels or conduits contained in a chamber and surrounded by hot water. These channels are actually narrow spaces between partition walls fitted in the chamber, and interlaced wires are placed in each channel, the object being to thoroughly divert and mix the different currents in the liquid as the latter passes through the apparatus.—W. P. S.

Butter, margarine, tallow, fats, oils, and other substances which are oxidised when in contact with air; Preservation of — by separating some of their constituents. M. Montéran. *Fr. Pat.* 395,810, Jan. 7, 1908.

THE butter, or other fat or oil, is melted in a suitable tank and drawn off into a separator in which an atmosphere of carbon dioxide is maintained. The water is thus separated from the fat, and the latter is then conducted to a tank, whilst the water, etc., flows away through a separate pipe. The fat is next passed into a closed chamber which is surrounded by a hot water-jacket and is there subjected to a low pressure in order to remove the carbon dioxide, an exhaust pump being provided for this purpose. The fat is finally run off into suitable receptacles. The whole operation is continuous and the fat is kept entirely out of contact with the atmosphere. If desired, the fat may be conducted directly from the separator to the vacuum chamber.—W. P. S.

Cream preparation and its process of manufacture. L. M. Rousseau, Erumont, France. *Eng. Pat.* 19,455, Sept. 16, 1908. Under Int. Conv., Sept. 20, 1907.

SEE *Fr. Pat.* 392,253 of 1907; this J., 1908, 1218.—T. F. B.

(E.)—SANITATION; WATER PURIFICATION.

PATENTS.

Vapours derived from refuse destructors or like apparatus; Method of and apparatus for treating —. W. E. Storey, Ramsgate. *Eng. Pat.* 15,570, July 22, 1908.

THE vapours are passed through tubes which are heated by an auxiliary furnace, and are then mixed with air which has been heated by passing through a passage at the back of the auxiliary furnace. The treatment causes the complete combustion of noxious gases present in the vapours leaving the refuse furnace. The mixture of hot gases may be employed for heating water in boilers before finally passing to a chimney shaft.—W. P. S.

Sewage and other polluted liquids; Apparatus for the bacteriological treatment of —. E. C. McCormac, London. *Eng. Pat.* 26,013, Dec. 2, 1908.

THE sewage, introduced into the lower portion of a tank, rises through a perforated false-floor in the tank and comes into contact with filtering material above the false-floor. When the liquid reaches a certain level, it is discharged by a siphon into a tube leading to a revolving distributor which sprays the liquid over the surface of filtering material contained in a second closed tank. After passing downwards through this filter, the liquid is drained off at the bottom of the tank and conducted away to any desired outfall. An overflow pipe is provided in the first filter and also a second outlet in the second filter; these come into operation when the flow of sewage is abnormal. A vent-pipe, fitted with a fan, reaches from the space below the second filter to above the cover of the tank.—W. P. S.

Water purifying apparatus. E. C. R. Marks, London. From the Oliver-Roché Co., New York. *Eng. Pat.* 27,272, Dec. 15, 1908.

THE apparatus consists of a tank containing a second tank which acts as a floating filter. The water to be filtered is introduced through a pipe into the larger tank and rises upwards through the perforated floor of the inner tank and the filtering material contained in this tank, and is then conducted by means of a flexible pipe into a small collecting tank. A float in the latter tank actuates a valve on the main supply pipe, so that as the filter bed becomes clogged, water is admitted through a by-pass into air chambers which form part of the inner tank; this sinks a little and the pressure thus caused restores the normal flow of water through the filter into the collecting tank. When the filtering tank at last rests on the bottom of the main tank, a float in the air chambers closes a valve on the main supply pipe. Means are also provided for cleansing the filter and for emptying the air chambers of water in order to re-start working of the apparatus when this becomes necessary.—W. P. S.

Water and other liquids: Means for filtering and aerating — G. W. J. Allen, Bristol. Eng. Pat. 6760 of 1909; date of application, Mar. 30, 1908.

The water is introduced into a closed chamber, the aerating gas being admitted under pressure either by the same inlet as the water or by a separate inlet. A number of filtering "candles" are suspended from a diaphragm extending across the chamber, their open ends being above the diaphragm. The aerated water is forced through the porous "candles," passing from the exterior to the interior of the same, and escapes into the part of the chamber above the diaphragm, whence the filtered and aerated water is drawn off. The chamber is provided with a sludge outlet and a safety valve.—W. P. S.

Swamp and like liquids: Method of charging — with air or gas and apparatus therefor. C. C. E. Beddoes, Wallingford, Del., U.S.A. Eng. Pat. 8722, April 21, 1908.

SEE U.S. Pat. 895,229 of 1908; this J., 1908, 945.—T. F. B.

(C.)—DISINFECTANTS.

PATENT.

Preservative compositions [insecticides]. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 15,921, July 27, 1908.

SEE U.S. Pat. 906,608 of 1908; this J., 1909, 98.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Determining carbon in aliphatic hydroxy-compounds [cellulose in cuprammonium solution, &c.]. Berl and Innes. See XXIII.

Salt-marsh rush as a papermaking material: American — J. S. Remington, D. Bowack, and B. Dixon. World's Paper Trade Review, 1909, 51, 6—8.

THE authors have investigated, on behalf of the U.S. Government, a sample of what was erroneously described as "Salt-marsh grass" (*Spartina juncea*), but which, according to a subsequent correction, was really "Salt-marsh rush" (*Juncus Roemerianus*). This is a smooth cylindrical rush, varying in diameter from $\frac{1}{8}$ to $\frac{3}{16}$ inch and having an average length of about 3 ft. It grows in large quantities along the Atlantic coast between Norfolk and Savannah, and about 1 million tons could be collected at a cost of 3 dollars per ton. Analysis of the rush showed:—Moisture, 11.9 per cent.; ash, 3.17; loss on α -hydrolysis, 20.77; loss on β -hydrolysis, 41.88; loss on mercerisation, 19.52; gain on nitration, 21.34; cellulose, 36.16 per cent., all values except the moisture being calculated on the dry material. The authors have converted this material into paper on a semi-industrial scale. The most satisfactory conditions for the preparation of the fibre were found by experiment to consist in digestion for 10 hours with 12 per cent. of sodium hydroxide under a pressure of 4 atmospheres, 37 per cent. of washed unbleached fibre being thus obtained. Owing to the highly lignified nature of the raw material, some difficulty was experienced in bleaching the product to a good colour, but this was finally overcome by the use of 10—11 per cent. of bleaching powder, acting for a considerable time. The pulp contains a proportion of an oily substance which appears to improve the quality of the paper, but which also causes a rather unusual amount of frothing. The average length of the unbeaten fibres is 2 mm., two types of fibre, a broad and a narrow, being present. The broad fibres resemble those of coniferous wood pulp, whilst the slender fibres approach those of jute or esparto in appearance and solidity. Unfortunately, the pulp contained groups of pitted cells, which were unresolved by the treatment, and remained as specks in the paper. For this reason only, the papers prepared were unsuitable for fine writing or printing

purposes, but excellent coarse papers, suitable for wrapping, common printing or writing, were prepared from the rushes, either alone or mixed with other fibres, the mechanical properties, particularly the resistance to folding and creasing, being remarkably good.—J. F. B.

Freshwater cord-grass for paper making. J. S. Remington, D. Bowack, and B. Dixon. World's Paper Trade Review, 1909, 51, 1-5.

FOLLOWING their investigations on salt-marsh grass, the authors have now experimented with freshwater cord-grass (*Spartina cynosuroides*), which is found in great quantities in Quincy, Illinois, U.S.A., and can be collected very cheaply. The dried matter resembles straw, and is of a pale yellow colour and lustrous exterior. The stalks are about 3 ft. long. At the root end the stalk is hard, compact, cylindrical, and about $\frac{1}{4}$ th of an inch thick. Treated with the usual chemical reagents, the cord-grass is superior to the salt-marsh grass (indigenous to the United States) as regards its percentage yield of cellulose, the comparative proportions yielded being in the proportion of about 53 to 36 respectively for the two fibres. Examined under the microscope, the new fibre somewhat resembles esparto, but its dimensions are greater. It is easily beaten, and in this process resembles, in many respects, hemp. The following analyses exhibit both the composition and the resemblance to the salt-marsh rush:—

	Salt-marsh rush	Freshwater cord-grass
	per cent.	per cent.
Moisture	11.90	14.98
Ash	3.17	7.04
Loss on α -hydrolysis	20.77	19.54
" " β "	41.88	43.68
" " mercerisation	19.52	18.31
Gain on nitration	21.34	25.04
Cellulose	36.16	53.47

It is more resistant to the action of boiling dilute alkali than the salt-marsh rush, which indicates that the available pulp may be expected to prove very durable in use. With regard to boiling with caustic soda, the best results were obtained with a lye of 10 per cent. strength, under 3 atm. pressure, at 130° C., for eight hours. Although the spent lyes thus obtained only showed a small excess of alkali, the boil yielded a purer and better material than when more alkali and stronger pressure were employed. For bleaching, it is advisable, following the alkali boil, and immediately after removing the pressure to wash, and then add the bleach (bleaching powder and dilute sulphuric acid) at once. The fibre is thus quickly brought to a high degree of whiteness. If not thus followed up quickly, a somewhat yellowish shade may easily remain, only removable by a second bleach. The beating requires but low power, and is soon finished. After an hour's gentle beating in the hollander the material developed its best "felting" properties, and exhibited all the properties of an ordinary normal paper-material which had undergone long beating. The average length of fibre in this condition was found to be 1.92 mm., while its width was not more than 0.01 mm.

The cord-grass fibre alone, furnishes a very good printing and writing-machine paper. By mixing with rag and cellulose, cream-aid note and letter paper, drawing paper, etc., of excellent quality were obtained. The authors predict a great future for this new paper material.

PATENTS.

Papers for filtering and like uses: Manufacture of — L. Pierucci, Pisa, Italy. Eng. Pat. 17,810, Aug. 25, 1908.

FINELY powdered gas-retort carbon is added to the usual pulp and stirred thoroughly therewith before putting the mixture on the web. The paper is said to be suitable for filtering acids, and as an abrasive substance in grinding and polishing surfaces.—G. W. McD.

Pulp used in the manufacture of paper; Method and apparatus for bleaching the —. G. Gunn, Heywood, Lancs. Eng. Pat. 23,947, Nov. 9, 1908.

THE apparatus consists of a vertical cylindrical vessel provided with a false conical bottom. The pulp is filled into this vessel from the top and any excess of water is extracted by means of a drum pump connected with the space between the bottom and false bottom of the vessel. The theoretical quantity of bleaching material is added and the contents of the vessel are circulated through a heater situated adjacent to the main vessel and then returned to the latter, a pump being provided for the purpose. At the same time the drum pump withdraws a portion of the liquid and returns it to the top of the vessel. When the bleaching action is at an end, the bleaching solution is drawn off and the pulp is washed with water; a mixing device is fitted in the vessel and a trough placed round the upper edge carries off excess of water when the pulp is washed with water introduced at the bottom of the vessel. The operations may be repeated as desired until the pulp is thoroughly bleached. Several of the vessels may be used in connection with one another, and each may be closed with a cover where it is desired to remove the bleaching solution by means of compressed air. Rags and long-fibred pulp may be bleached in the apparatus; after the first charge of bleaching agent has been added, the material is transferred to a vessel provided with a helical stirrer where it is subjected first to acid and then to alkaline treatment, washed, and again bleached.—W. P. S.

Brine; Apparatus and process for handling the electrolytic products of — in the treatment of fibre [paper pulp]. W. V. Wentworth and A. B. Larchar, Penobscot, Me., Assignors to Penobscot Chemical Fibre Co., Maine. U.S. Pats. 912,339 and 912,340, Feb. 16, 1909.

BRINE is electrolysed in a suitable cell, the chlorine being led off and converted into bleaching liquor by absorption in milk of lime. The caustic soda liquor is passed through an evaporator, where the liquid is concentrated by means of steam passed through pipes in the middle portion of the apparatus. Below the zone of concentration is a pocket, in which the crystals of salt and concentrated caustic liquor collect. The pocket discharges its contents into a vacuum chamber, and from this the mixture is driven by means of compressed air on to a sand filter. The caustic soda and bleaching liquors are employed in the preparation of paper pulp from wood fibre.—B. N.

Sheets from cores of "palm trees"; Process of making prepared —. V. and L. von Alpenburg, West Hoboken, N.J. U.S. Pat. 917,516, April 6, 1909.

SHEETS, prepared from the core of the *Aradia papyrifera*, are subjected to the action of a solution containing tannin and preservative salts, and then to the action of a solution containing glycerin and methyl alcohol, the excess of the solution being removed in each case by the application of pressure. The sheets are afterwards sized and dried.—W. P. S.

Stereotype paper; Preparation and treatment of —. D. Gestetner, Fr. Pat. 395,788, Oct. 29, 1908. Under Int. Conv., Sept. 4, 1908.

THE paper is coated with a wax composition which dries and hardens on exposure to the atmosphere. This composition is prepared by mixing Javanese paraffin wax, 1 part; carnauba wax, 1 part; and linseed or other drying oil, or fatty acids of the same, 3 parts, all by weight. The composition is kept in a molten state in a closed vessel from which the air is exhausted; a little terebene may be added, the vapours of which will fill the interior of the vessel above the molten wax, or an inert gas may be introduced into the vessel instead of exhausting the air from the latter.—W. P. S.

Stencil paper; Preparation and treatment of —. D. Gestetner, Tottenham. Eng. Pat. 18,600, Sept. 4, 1908.

SEE Fr. Pat. 395,788 of 1908; preceding.—T. F. B.

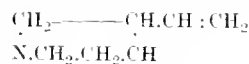
Paper having relief-like effect; Manufacture on the paper-machine of —. K. Franz, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Main, Germany. U.S. Pat. 918,525, April 20, 1909.

SEE Eng. Pat. 10,529 of 1908; this J., 1908, 1130.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Cinchona alkaloids. X. The fission of ketones derived from cinchona bases. P. Rabe. Annalen, 1909, 365, 353—365.

FROM experiments on the interaction between amyl nitrite and quinone (this J., 1909, 381), the author considers that the constitution of quinine is represented by the following formula:—



Quinone was treated with amyl nitrite in sodium ethoxide solution at a low temperature. After standing, crystals of sodium quininate separated. These were removed, and the liquid was found to contain α -oximino- β -vinylechinclidine, m. pt. 146°—147° C. (see this J., 1908, 178). Hydrocinchoninone (this J., 1909, 381) when treated with amyl nitrite in the same way yielded on the one hand α -oximino- β -ethylchinclidine, $\text{C}_{15}\text{H}_{16}\text{N}_2\text{O}$, m. pt. 133°—134° C., and on the other hand, cinchoninic acid, m. pt. 253° C. When ethylchinclidine was digested with hydrochloric acid, the hydrochloride of cincholoiponic acid ethyl ester, m. pt. 158° C., was produced.—F. SHDX.

Cinchona alkaloids. XI. Identity of methyleinchonine and methyleinchonidine. P. Rabe. Annalen, 1909, 365, 366—376.

THE author shows that methyleinchonine and methyleinchonidine are really one and the same substance, viz., methyleinchotoxine. Since the cinchona bases are 1,2-hydramines (α -hydramines), they readily pass into iminoketones. Cinchonine methiodide was heated with acetic acid and sodium acetate. The "methyleinchonine" thus produced melted at 74°—75° C., and had $[\alpha]_D^{25} = +35.28^\circ$ at 20° C. in chloroform. Cinchonidine methiodide treated in the same way yielded a methyl derivative melting at 74°—75° C., and with $[\alpha]_D^{25} = 37.97^\circ$ at 20° C. in chloroform. Both methyl derivatives yielded the same methiodide, m. pt. 197° C. "Methyleinchonine" and "methyleinchonidine" both yield methyleinchotoxinephenylhydrazones, m. pt. 150° C. Other derivatives were prepared and found to be identical.—F. SHDX.

1,2-Hydramines. I. 2-Piperido-1-phenylethanol-(1). P. Rabe and W. Schneider. Annalen, 1909, 365, 377—382.

BY reduction with sodium and alcohol, piperidoacetophenone passes into 2-piperido-1-phenylethanol-(1), $\text{C}_{13}\text{H}_{19}\text{ON}$. This substance melts at 67°—68° C., and boils at 188° C. at 20 mm. It is colourless, easily soluble in alcohol and ether, and soluble with difficulty in water and light petroleum. The normal sulphate undergoes no change when heated to 130°—140° C. The base suffers no change when heated with dilute acetic acid. The methiodide, m. pt. 136°—137° C., is not changed when heated with sodium acetate and acetic acid. When the methiodide is heated with potassium hydroxide solution, acetophenone and N-methylpiperidine are produced, thus supporting the view of the "hydramine fission" of the cinchona bases (see preceding abstract).—F. SHDX.

Narceine. M. Freund and P. Oppenheim. Ber., 1909, 42, 1084—1101.

THE authors' experiments confirm the formula for narceine put forward by Freund and Frankforter (Annalen, 277, 20), and demonstrate the presence of the grouping,

CO_2CH_3 , in the molecule. The methiodide of narcindonine, $\text{C}_{24}\text{H}_{28}\text{NO}_2\text{I}$, forms white crystalline leaflets, m. pt. 217°C . (this J., 1907, 165). Narcindone, $\text{C}_{24}\text{H}_{28}\text{O}_7$, was prepared by the action of sodium ethoxide on the above-mentioned methiodide. It crystallises from glacial acetic acid in large, nearly colourless, hexagonal tablets, melting at $136^\circ\text{--}137^\circ\text{C}$. Narcindone forms a red sodium salt. A further analogy between phenylhydandione and narcindonine is seen in the behaviour of the latter towards bromine. Bromonarcindonine hydrobromide, $\text{C}_{24}\text{H}_{26}\text{NO}_7\text{Br}_2$, was made by the action of an acetic acid solution of bromine on sodium narcindonine dissolved in the same solvent. The substance thus formed crystallises with $1\frac{1}{2}$ molecules of acetic acid in small, nearly white tablets, decomposing at 150°C . When bromonarcindonine is treated with dilute sodium hydroxide solution, it is decomposed into hemipinic acid, and the methyl bromide of hydrocotarnine, $\text{C}_{13}\text{H}_{17}\text{NO}_3\text{Br}$, which crystallises in white needles decomposing at 221°C . A similar result is produced by the action of ammonia, only hemipinimide, m. pt. 226°C , is produced in place of the acid. When the methyl bromide, m. pt. 221°C , is treated with potassium iodide, hydrocotarnine methiodide, m. pt. 206°C , is produced. The methyl bromide, m. pt. 221°C , was boiled with a strong solution of sodium hydroxide, when a colourless basic oil was produced. This, when methylated, yielded N-methyl-*des*-hydrocotarnine methiodide, m. pt. 193°C . Narcine was dissolved in sodium ethoxide solution and amyl nitrite added at 0°C . In this way isonitrosonearcine, $\text{C}_{24}\text{H}_{26}\text{N}_2\text{O}_6$, was formed, which crystallises in white prisms, melting at 196°C , and dissolves in alkalis with a yellow colour. It forms an alcoholate, m. pt. 178°C , and a hydrate, m. pt. 173°C . The hydrochloride melts at 223°C . When isonitrosonearcine is treated with methyl iodide, it forms the methiodide of isonitrosonearcine dimethyl ester, $\text{C}_{26}\text{H}_{31}\text{N}_2\text{O}_9\text{I}$, m. pt. 247°C . When heated with a strong alkali, this methiodide decomposes into hemipinic acid, trimethylamine, and 1-vinyl-2-cyano-3-methoxy-4,5-methylenedioxybenzene, m. pt. 156°C . Isonitrosonearcine hydrate or alcoholate gives the same products when heated to 150°C . When heated to 115°C these substances yield hemipinic acid, and 1-dimethylaminoethyl-2-cyano-3-methoxy-4,5-methylenedioxybenzene, which forms a hydrochloride, m. pt. 204°C .—F. SHDN.

Alkaloids; Affinity values of certain — V. H. Veley. Chem. Soc. Proc., 1909, 25, 115—116.

DETERMINATIONS have been made of the affinity value of some of the more important alkaloids by the methyl-orange and borax precipitation methods, the latter only being put forward as giving approximate results in cases in which the electric conductivity and ester catalysis methods cannot be applied. It was shown that the affinity values of only a few alkaloids are less than $1\cdot 10^{-7}$, those of the greater number are between the limits of $1\cdot 10^{-7}$ and $3\cdot 10^{-5}$ (value of ammonia), and lastly, only a few have a value higher than the last figure, and hence may be classed with the tetra-alkylammonium hydroxides. It appears that when alkaloids consist of two conjoint residues which, if considered each by itself, would give affinity values of a widely different order, such as piperidine or benzylamine, on the one hand, and quinoline or pyrrolidine, on the other, the stronger residue is modified by the presence of the weaker. It seems to be immaterial whether each residue contains a nitrogen atom, and whether such an atom is common to both. The affinity values determined by the methods applied, and collected together for the sake of comparison, illustrate the difficulty of obtaining salts, B_2HCl , in the case of certain dinitrogen alkaloids.

Urotropine and hordenine; Reaction of — A. Labat. J. Pharm. Chim., 1909, 29, 433—435.

DENIGÈS has previously shown that formaldehyde solution, in presence of strong sulphuric acid, forms condensation-products having distinctive colours, when boiled with certain substances possessing phenolic characters. Urotropine, under similar conditions, reacts like formaldehyde. If 1 c.c. of 1 per cent. solution of urotropine be boiled with an equal volume of hordenine

sulphate solution of the same strength and 2 c.c. of strong sulphuric acid, a fine emerald-green colour is rapidly developed. A distinct reaction is evident with 0·0001 grm. of hordenine sulphate. Inversely, employing hordenine sulphate solution as the reagent, an evident reaction results with a 1:1000 solution of urotropine.—J. O. B.

Essential oils; Constituents of — Oenanthaldehyde acetate and *enol-n-octanal acetate*. F. W. Semmler. Ber., 1909, 42, 1161—1163.

Two aldehydes of the fatty series were boiled with acetic anhydride and sodium acetate. Oenanthaldehyde, or *n*-heptanal (b. pt. $42\text{--}43^\circ\text{C}$ at 10 mm., sp. gr. 0·8250 at 20°C , and n_D^{20} 1·41655) gave *enol-n*-heptanal acetate, $\text{CH}_3(\text{CH}_2)_4\text{CH}(\text{CH}_3)\text{O}\cdot\text{CO}\cdot\text{CH}_3$, which boils at $76^\circ\text{--}79^\circ\text{C}$ at 10 mm., has the sp. gr. 0·888 at 20°C , and n_D^{20} 1·43258. Octanal boils at $60\text{--}61^\circ\text{C}$ at 9 mm., has the sp. gr. 0·8211 at 20°C , and n_D^{20} 1·41955. The *enol*-acetate boils at $90\text{--}91^\circ\text{C}$ at 10 mm., has the sp. gr. 0·88 at 20°C , and n_D^{20} 1·43256. The semicarbazone of oenanthaldehyde melts at $106^\circ\text{--}107^\circ\text{C}$. *n*-Octanal oxime melts at 60°C , and boils at $111\text{--}112^\circ\text{C}$ at 9 mm.; the semicarbazone melts at 101°C .—F. SHDN.

Terpenes and essential oils, 98th Communication. Conversion of pulegone into isopulegone. O. Wallach. Annalen, 1909, 365, 240—254.

PERLEGONE in the presence of an alkali is readily converted into isopulegone by the action of hydroxylamine. —F. SHDN.

Terpenes and essential oils, 99th Communication. The preparation of unsaturated cyclic acids and hydrocarbons with semicyclic linkages. O. Wallach. Annalen, 1909, 365, 255—277.

Essential oils. H. Haensel. Chem. Zentr., 1909, 1, 1476—1477.

Oil of marsh mallow leaves.—The dried leaves of *Althaea officinalis* yielded 0·022 per cent. of a brown oil of pleasant odour, which had the sp. gr. 0·9209 at 20°C ; acid value, 88·7; ester value, 33·9. After saponification the oil yielded palmitic acid and a volatile acid with an odour resembling that of valeric acid. A specimen of *cubeb* oil, freed from terpenes, had the sp. gr. 0·9428 at 15°C , and n_D^{20} = 1·005. *Spanish broom oil* obtained in a yield of 0·031 per cent. from *Spartium scoparium*, L., was dark brown in colour, and liquid at the ordinary temperature, but partially solidified on cooling to 0°C . It had the sp. gr. 0·8673 at 15°C ; acid value, 58·6; ester value, 29·4. It contained furfural, palmitic acid, and 3·5 per cent. of a paraffin hydrocarbon which crystallised from alcohol in needles melting at $48\text{--}49^\circ\text{C}$. *Oil of hazel leaves (Corylus avellana)* was obtained in a yield of 0·0425 per cent. It was light brown in colour, solidified at about 30°C , and contained 18 per cent. of palmitic acid, and a paraffin hydrocarbon melting at $49\text{--}50^\circ\text{C}$. It had the acid value, 60·4; ester value, 24·6; ester value after acetylation, 158; in the superfused condition its sp. gr. was 0·8844 at 25°C . The unsaponifiable portion of the oil distilled over between 170 and 295°C . *Monk's pepper oil* was obtained in a yield of 0·36 per cent. from the leaves of *Vitex agnus castus*, as a mobile, reddish-brown oil with an odour of camphor. It had the sp. gr. 0·8993 at 20°C ; acid value, 5; ester value, 20·8; ester value after acetylation, 56·5. It contained palmitic acid, pinene, cineol, a sesquiterpene (b. pt. at 20 mm., $136^\circ\text{--}138^\circ\text{C}$; sp. gr. 0·9209 at 16°C ; n_D^{20} = 1·498), and probably also an unstable sesquiterpene-alcohol.—A. S.

Resorcinoform; Method of preparing — D. Monteil. L'Union pharm., 1909, 50, 159.

110 GRMS. of resorcinol are dissolved in about 100 grms. of commercial formaldehyde solution; sufficient hydrochloric acid is added to the cold solution to cause precipitation. Considerable heat is generated, and the mixture becomes a pink paste, which must be kept well stirred. It is then drained on a filter and dried at 25°C . The amorphous currant-red powder thus obtained is termed resorcinoform; it is an active antiseptic for medicinal use.—J. O. B.

Carbon dioxide; Fixation of — by alcohols, sugars, and hydroxy-acids. M. Siegfried and S. Howwjanz. Z. physiol. Chem., 1909, 59, 376—404.

In the course of the authors' experiments on the fixation of carbon dioxide by amino-compounds (this J., 1905, 451), it was found that in the presence of alcohol a larger proportion of the gas was absorbed. Further experiments have shown that this is due to the alcohol combining with the carbon dioxide, and that other alcohols and also sugars and hydroxy-acids give this *hydroxyl carboxylic reaction*. When carbon dioxide is conducted into milk of lime at 0° C. in the presence of hydroxyl bodies of the fatty series, the filtrate, on standing or heating, deposits calcium carbonate in amounts constant within certain limits for each hydroxyl group. The reaction, which will take place in very dilute (0.1 per cent.) solutions, cannot be due to the formation of colloidal calcium carbonate, since the alkaline filtrate becomes acid on the separation of the calcium carbonate on standing. This agrees with the theory of the formation of salts of hydroxy-carboxylic acids, which are subsequently decomposed with the liberation of carbon dioxide; and other experiments support this conclusion. Under parallel conditions methyl alcohol combines with about three times as much carbon dioxide as ethyl, propyl, or normal or iso-butyl alcohols, whilst tertiary butyl alcohol is practically inert. Polyvalent alcohols can fix one or more mols. of carbon dioxide, the highest value being obtained with mannitol. The difference in absorptive capacity between monovalent and divalent alcohols is very pronounced, but the power of absorption only shows a slight increase in proceeding up to hexavalent alcohols. With regard to sugars, pentoses fix less than $\frac{1}{2}$ mol. of carbon dioxide, whilst dextrose and levulose combine with exactly $\frac{1}{2}$ mol., and galactose with somewhat more. Bioses form compounds containing approximately 1.1 mol. of carbon dioxide. Fermentation lactic acid and paralactic acid fix carbon dioxide in the proportion of about 1 mol. to 4 of the acid; but hydroxyisobutyric acid (like tertiary butyl alcohol) shows practically no reaction.—C. A. M.

Hydrolytic dissociation of bismuth trichloride. Dnbrisay. See VII.

Determining carbon in aliphatic hydroxy-compounds. Berl and Innes. See XXIII.

Chemical action of light. Ciamician and Silber. See XXIV.

PATENTS.

Physiologico-chemical substances; Process for raising the temperature of substances containing bodies sensitive to change, especially applicable to —. F. J. Brougham, London. From W. von Preyss, Baden, Austria. Eng. Pat. 7613, April 6, 1908.

THE patent relates to a process for the production of therapeutic serums, enzymes, etc., enabling them to be produced partly more rapidly and partly with a modified action compared with other methods. The process consists in causing suitable high-frequency electric currents to act on organs containing sensitive substances, said currents being of such voltage and intensity as to cause heat to be generated to a sufficient extent and the desired final products to be thereby formed or a certain influence exerted on their formation.—G. W. McD.

Theophyllin compound. R. Grüter, Assignor to Chem. Werke vorm. Dr. H. Byk, Charlottenburg, Germany. U.S. Pat. 919,161, Apr. 20, 1909.

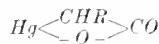
CLAIM is made for the manufacture of double compounds of theophylline and aliphatic diamines, produced by the interaction of the respective substances in molecular proportions. Thus the theophylline may be dissolved in the liquid diamine and the solution dried over a hygroscopic substance, or the theophylline may be dissolved in an aqueous solution of the diamine and the liquid evaporated *in vacuo* over a drying substance. The new compounds, which have diuretic properties,

form white crystals which are readily soluble in water, but less soluble in alcohol and ether. They are decomposed by acids with the liberation of theophylline, whilst heat decomposes them into their components.—C. A. M.

Scandium or scandium compounds; Preparation of — from minerals. R. J. Meyer. Ger. Pat. 208,355, June 2, 1908. Addition to Ger. Pat. 202,523, March 15, 1908.

THE hydrofluoric acid used, according to Ger. Pat. 202,503 (this J., 1909, 108), for separating scandium from other metals, especially iron and manganese, is, according to the present patent, replaced by hydrofluosilicic acid or a soluble silicofluoride.—A. S.

Salts of the mercury derivatives of fatty acids of the formula,
 $\text{Hg}(\text{OH})\text{CHR}.\text{CO}_2\text{Me}$, and the corresponding anhydrides.



(R=hydrogen or alkyl); Process for preparing —. W. Schoeller and W. Schrauth. Ger. Pat. 208,634, July 11, 1907.

MERCURIC oxide is treated with one to two mols. of a malonic ester or a monoalkylmalonic ester in presence of water, and the resulting monomercurimalonic ester is saponified by means of an alkali; the resulting alkali salts of mercurimalonic acid are readily converted into anhydrides of the above formula by treatment with dilute acids, carbon dioxide being eliminated, and these are converted by alkalis into the alkali salts of the corresponding acids; e.g., when a malonic ester is used, the alkali salts of hydroxymercuriaacetic acid are obtained.—T. F. B.

Isobornyl esters from pinene hydrochloride; Process for preparing — by heating with an organic acid in presence of a silver salt. G. Wendt. Ger. Pat. 208,636, Nov. 16, 1907.

PINENE hydrochloride is almost quantitatively converted into an isobornyl ester by heating with an organic acid in presence of silver fluoride, with or without addition of silver sulphite. It is advisable to remove the hydrofluoric acid liberated by passing a current of carbon dioxide through the mixture. The silver is recovered quantitatively as chloride. The silver fluoride obtained from 1 part of silver nitrate is added to a solution of 1 part of pinene hydrochloride in 2 or 3 parts of glacial acetic acid; 0.1 part of silver sulphite is added, and the solution is heated to 50°—60° C. for 8 to 16 hours, a current of carbon dioxide being passed during the process.—T. F. B.

Santalol esters of bibasic acids; Process for preparing neutral, mixed —. J. D. Riedel A.-G. Ger. Pat. 208,637, Jan. 28, 1908.

MIXED santalol esters of bibasic acids are produced by treating monosantalyl esters of these acids with dialkyl sulphates or alkyl esters of sulphonic acids in alkaline solution. Santalylsuccinic acid methyl ester, santalyl-phthalic acid methyl ester, and santalyleamphoric acid methyl ester are described in the specification.—T. F. B.

Cotarnine cholate; Process for preparing —. F. Hoffmann-La Roche und Co. Ger. Pat. 208,923, July 16, 1908. Addition to Ger. Pat. 206,696, Sept. 29, 1907 (this J., 1909, 383).

COTARNINE cholate is prepared by the action of a salt of cotarnine on a salt of cholic acid in presence of alcohol.—T. F. B.

Oxyarylsarinic acids; Process for the manufacture of reduction products of the —. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning. Hoechst on Maine, Germany. Eng. Pat. 9855, May 6, 1908.

SEE Ger. Pat. 206,057 and 206,456 of 1907; this J., 1909, 328.—T. F. B.

Guaiacol carbonate; *Salts of the sulpho acids of — and process of producing same.* P. M. Justice, London. From C. H. Boehringer Sohn, Nieder-Ingelheim on Rhine, Germany. Eng. Pat. 22,132, Oct. 19, 1908.

SEE Fr. Pat. 391,601 of 1908; this J., 1908, 1176.—T. F. B.

Calcium salt of dibromoboric acid. E. Fischer, Berlin. Assignor to Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. U.S. Pat. 917,758, April 13, 1909.

SEE Addition of June 21, 1906, to Fr. Pat. 362,370 of 1906; this J., 1906, 1173.—T. F. B.

Dibromoboric acid; *Magnesium salt of —.* E. Fischer, Berlin. Assignor to Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. U.S. Pat. 919,335, April 27, 1909.

SEE Addition of June 21, 1906, to Fr. Pat. 362,370 of 1906; this J., 1906, 1173.—T. F. B.

Potassium bitartrate; *Process of purifying —.* M. F. Martinez, Jerez de la Frontera, Spain. U.S. Pat. 919,049, April 20, 1909.

SEE Fr. Pat. 379,902 of 1907; this J., 1907, 1295.—T. F. B.

Isobornyl esters; *Process of producing —.* C. Philipp, Assignor to Chem. Fabr. von Heyden A.-G., Dresden, Germany. U.S. Pat. 919,762, April 27, 1909.

SEE Eng. Pat. 10,999 of 1906; this J., 1906, 714.—T. F. B.

Oxidising organic compounds; *Process for —.* A. A. Shukoff. Fr. Pat. 395,662, Jan. 4, 1908.

SEE Ger. Pat. 206,695; this J., 1909, 383.—W. H. C.

Products [glycerol, etc.] in addition to alcohol, by fermentation. Eng. Pat. 7813. See XVII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Screen or plate for direct colour photography and process for manufacture of the same. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils, Lyon-Monplaisir, France. Eng. Pat. 20,111, Sept. 24, 1908. Under Int. Conv., Oct. 21, 1907.

SEE Fr. Pat. 393,296 of 1907; this J., 1909, 109.—T. F. B.

Platines or films; *Method of manufacture of — and apparatus therefor.* M. Ratignier, Lyons, and H. Pervillat et Cie., Villeurbanne, France. Eng. Pat. 28,538, Dec. 31, 1908. Under Int. Conv., Jan. 4, 1908.

SEE Fr. Pat. 395,665 of 1908; this J., 1909, 492.—T. F. B.

Photographs on silver chloride paper; *Printing and developing —.* H. J. Mallabar, Liverpool, Assignor to Synoloids, Ltd., London. U.S. Pat. 918,347, April 13, 1909.

SEE Fr. Pat. 355,790 of 1905; this J., 1905, 1255.—T. F. B.

Flash-light composition. C. Bethge, Berlin. U.S. Pat. 918,818, April 20, 1909.

SEE Eng. Pat. 11,692 of 1908; this J., 1909, 328.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Matches in China. Chem. Ind., 1909, 32, 205.

THE manufacture of matches in China is increasing, and hence the imports show a falling-off, although the demand continues to increase. The imports of materials for match manufacture (powdered glass, phosphorus, paraffin wax, potassium chlorate, and match-wood), on the other hand, have increased. These materials are obtained chiefly from Japan, although some of them are not manufactured there and have to be imported, for instance phosphorus from Great Britain and potassium chlorate

from Germany. Most of the finished matches imported by China also come from Japan. Whilst German and Swedish matches cannot be supplied at less than £6 5s. to £6 13s. 4d. per case, the best Japanese matches are sold at £5 4s. 2d. per case, and the Chinese matches are still cheaper. In the Canton district three match factories were in operation in 1907, and in consequence of the decree of 1907 excluding Japanese goods, it has been proposed to establish a company with a capital of £20,000 for the manufacture of matches in China. Wood suitable for matches has been discovered near Hankow and in the neighbouring province of Kuangsi.—A. S.

Determining nitrogen in saltpetre. Kleiber. See VII.

Determining perchlorate. Rothmund. See XXIII.

PATENTS.

Blasting cartridges; *Means for waterproofing —.* A. Larsen, London. Eng. Pat. 13,890, June 30, 1908.

IN order to waterproof cartridges for use in wet boreholes, a bonnet of india-rubber or other suitable material is used, which is adapted to fit tightly over the end of the cartridge. The open end of the bonnet is contracted so that it may firmly grip the outer cartridge surface. The rear end of the bonnet is provided with a short length of tubing which serves as a means for holding the electric wires or fuse of the detonator. Owing to the elasticity of the rubber, the extra grip exerted by the front end of the bonnet will increase, if the electric wires or the fuse should be unduly pulled during stemming.—G. W. McD.

Explosives and process of making the same. A. J. Boulton, London. From A. La Motte, Wilmington, Del., U.S.A. Eng. Pat. 7921, April 9, 1908.

SEE U.S. Pat. 911,091 of 1909; this J., 1909, 329.—T. F. B.

Explosives. W. H. Palmer, Porsgrund, Norway. Eng. Pat. 20,214 of 1908. Date of Application, Jan. 29, 1909.

SEE Fr. Pat. 394,833 of 1908; this J., 1909, 381.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Viscosity of petroleum illuminating oils and an apparatus for its determination. Ubbelohde. See III.

PATENTS.

Calorimeter-lamp. H. Junkers, Aix-la-Chapelle, Germany. U.S. Pat. 918,659, April 13, 1909.

IN a liquid fuel calorimeter-lamp the liquid to be burned is contained in a reservoir suspended from one arm of a balance, so that the quantity of fuel burned can be determined from the loss in weight. The reservoir is provided with a bent tube carrying a burner which freely enters the calorimeter proper, a filling tube, a pressure gauge and means for increasing the pressure within the reservoir so that the liquid fuel is forced into the burner.—W. H. C.

Measuring different kinds of liquids; *Apparatus for —.* N. Gerbers Co., Ges.m.b.H. Ger. Pat. 207,958, Feb. 21, 1908.

Two forms of the apparatus are described. In that shown in Fig. 1, the liquids to be measured are contained in A and B; on pressing the ball, E, the liquid in A is forced into the measuring pipette, g, and that in B into the pipette, h. The latter when in its lowest position closes the outlet of g, and at the same time its own side outlet opening, i. By raising the pipette, h, both the liquids

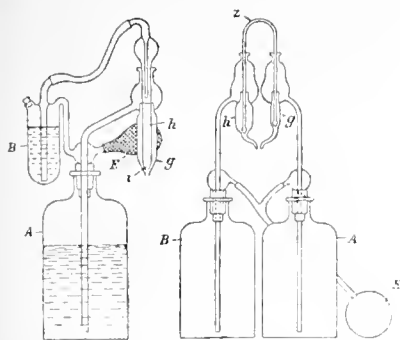


FIG. 1.

FIG. 2.

re delivered together. In the modified apparatus shown in Fig. 2, the openings of the two pipettes are controlled simultaneously by means of *z*.—A. S.

INORGANIC—QUALITATIVE.

Fischer's salt; *Precipitation of — usually considered to be potassium cobaltinitrite.* L. L. De Koninck. Bull. Soc. Chim. Belg., 1909, 23, 200—202.

For the detection of potassium the author uses the following solution:—50 grms. of cobalt nitrate are dissolved in 1 litre of water acidified with 25 c.c. of nitric acid (sp. gr. 1.2) and poured into a solution of 300 grms. of sodium nitrite in 1 litre of water. After 24—48 hours the solution is decanted or filtered from a small quantity of the potassium salt which is deposited. The solution is a bright orange colour and when added to a neutral solution of a potassium salt, a yellow precipitate is immediately produced unless the solution is extremely dilute. The limit of the reaction is about 1:10,000. In order to precipitate cobalt, the use of a solution containing 5 grms. of sodium nitrite and 22 grms. of potassium nitrate in 100 c.c. of water is recommended.—J. C. C.

INORGANIC—QUANTITATIVE.

Antimony; *Separation of —, from solutions of thioantimonates.* W. Schulte. Metallurgie, 1909, 6, 214—220.

From a strongly alkaline solution of sodium thioantimonate, aluminium in the form of shot or powder (but not in heat) precipitates metallic antimony. With shot, the weight of antimony precipitated is never more than one-third of that of the aluminium used; with powder, the action is more rapid, and nearly (but not quite) the whole of the antimony can be precipitated. A more prolonged action of the aluminium results, however, in some of the antimony being redissolved. Magnesium powder acts much more strongly than aluminium, producing considerable rise of temperature and rapid evolution of hydrogen sulphide; and the precipitation of the antimony is so complete that it can be used as an analytical method of determining antimony in a solution of thioantimonate containing no other metals of the group. In all these reductions, traces of the antimony are converted into stibine—no evidence of the formation of stibine in alkaline solutions had previously been given. In the electrolytic determination of antimony the author finds, with Fischer, a gradual loss of weight of the platinum cathode—about 0.5 mgrm. for each determination. He contests Fischer's statements, however, that this loss does not occur if the electrolysis be carried out at the ordinary temperature, and that the anode also suffers loss. By using appropriate electrolytes and current densities, it is possible either to refine Britannia metal electrolytically, or to separate its antimony and deposit it as pure antimony on the cathode. —J. T. D.

Antimony and tin; *Separation of —.* G. Panajotow. Ber., 1909, 42, 1296—1299.

A METHOD is based upon the difference in solubility of the sulphides of antimony and tin in dilute hydrochloric acid

Thus antimony is quantitatively precipitated by hydrogen sulphide at the ordinary temperature from its solution in 15 per cent. hydrochloric acid, whilst tin is not precipitated under those conditions. In the case of mixtures, the precipitate of antimony sulphide obtained at the ordinary temperature invariably contains traces of tin, but if the precipitation be made at 50°—60° C. the precipitate will be free from tin. The solution of the mixed salts in 15 per cent. hydrochloric acid is heated to 50°—60° C. in the water-bath, and a current of hydrogen sulphide passed through it for 30 minutes, after which it is cooled to 30° C. and the current of gas continued for 10 minutes. The precipitate is then rapidly filtered off in a Gooch's crucible previously dried at 110° C., and washed with 15 per cent. hydrochloric acid saturated with hydrogen sulphide. It is next washed successively with water saturated with hydrogen sulphide, with alcohol, with a mixture of alcohol and carbon bisulphide, with carbon bisulphide alone, with alcohol, and with ether, and is finally dried at 110° C., and weighed. The filtrate containing the tin is partially neutralised with ammonia, diluted with water, and heated, and the tin precipitated with hydrogen sulphide. The results are independent of the proportion of the two metals in solution, and, as is shown by test analyses, are very accurate.—C. A. M.

Tungsten; *Determination of —.* M. Tschilkin. Ber., 1909, 41, 1302—1304.

KNOBBE proposed originally the use of benzidine for the determination of tungsten (this J., 1908, 812). The author has found equally good results are obtained with *a*-naphthylamine in place of benzidine. Thus in the analysis of commercial sodium tungstate, the tungstic acid may be precipitated by either *a*-naphthylamine or benzidine. To 100 c.c. of a reagent, containing in a litre 25 grms. of the base, and one and a half times the theoretical quantity of hydrochloric acid, 25 c.c. of a 2 per cent. solution of sodium tungstate are added. After standing for 3 hours in the cold, the precipitate is filtered off and washed with the diluted reagent (1:5). It is then ignited in a platinum crucible, and weighed as tungsten trioxide.—J. N. G.

Electro-analysis; *Rapid —.* H. Filippo. Chem. Weekblad, 1909, 6, 226—229. Chem. Zentr., 1909, 1, 1502.

From 30 to 60 grms. of mercury are introduced into a flask, in the round bottom of which is sealed a platinum wire, 0.5 mm. thick and 2 cm. long, the end of the wire being flush with the inner surface of the flask. A platinum wire formed into a spiral at the end is used as anode. After making connection with the source of current, the solution to be electrolysed is introduced into the flask, and an inert electrolyte (sulphuric acid, nitric acid, sodium sulphate) added in such quantity that with a voltage of 6—10 volts, the current strength is 2—4 amperes, the anode being about 1 cm. above the mercury cathode. In most cases the mercury is set in motion automatically. When the electrolysis is complete, the solution is removed with a pipette, without stopping the current, the cathode washed twice with water and once with alcohol, and then after removing most of the alcohol with a pipette, the amalgam with the remainder of the alcohol is transferred to a weighing bottle, and washed once or twice with alcohol; then the alcohol is removed with a pipette and by means of filter-paper, and the amalgam dried at 50° C., and weighed.—A. S.

Mercury cathode; *Use of a — in the determination of metals.* A. H. Porter and F. C. Frary. Trans. Amer. Electrochem. Soc., 1908, 14, 51—58.

PRICE (this J., 1907, 345) found that low results are obtained when zinc is deposited upon a mercury cathode. He also stated that when pure mercury is washed with alcohol and ether, it loses weight and a black scum is formed. The authors show that this black scum must have been due to impurities in the alcohol or ether, probably in the latter, for with pure mercury and pure alcohol and ether, no scum is formed, and the mercury does not lose weight appreciably. They confirm Price's

statement as to low results in the determination of zinc, the cause being loss of both zinc and mercury on washing the amalgam with alcohol and ether. Copper amalgam, under similar conditions, does not lose in weight, and copper can be determined accurately with a mercury cathode.—A. S.

Zinc: Determination of — with the aid of the mercury cathode and rotating anode. L. G. Kollock and E. F. Smith. *Trans. Amer. Electrochem. Soc.*, 1908, **14**, 59—64.

The authors in opposition to Price (this J., 1907, 345) and others (see preceding abstract), maintain that zinc can be determined quite accurately by their method (this J., 1905, 1127) with a mercury cathode and rotating anode, provided the requisite precautions be taken. The method of working is described in minute detail.—A. S.

Nitric acid in liquids containing much organic matter; Use of nitron for the determination of —. H. Franzen and E. Lohmann. *J. prakt. Chem.*, 1909, **79**, 330—338.

The authors find nitric acid can be accurately determined by Busch's method by means of nitron (this J., 1905, 291), in solutions containing large quantities of organic matter, provided 2—2.5 c.c. of concentrated sulphuric acid be added for each 200 c.c. of solution. This addition of sulphuric acid prevents any co-precipitation of nitron oxalate and also the formation of a colloidal solution of nitron nitrate. When both nitric and nitrous acids are present, the latter may be oxidised to nitric acid by means of hydrogen peroxide, or it may be decomposed by means of hydrazine sulphate (*loc. cit.*)—A. S.

Perchlorate: Reduction and determination of —. V. Rothmund. *Z. anorg. Chem.*, 1909, **62**, 108—113.

ALTHOUGH reduction of the perchlorate ion cannot be brought about by the more common reducing agents, it is easily effected by the action of reduced salts of titanium, vanadium, and molybdenum, and reduction with titanous sulphate, $Ti_2(SO_4)_3$, in acid solution, furnishes a simple and accurate method of determining perchlorates. The solution, which may be prepared by the electrolytic reduction of titanous sulphate in sulphuric acid, should contain about 0.5 gram.-mol. of titanium and 2 gram.-mols. of sulphuric acid per litre, and, for every 0.1386 gram. of potassium perchlorate, 30 c.c. of this solution are used, together with 4 c.c. of strong sulphuric acid; the mixture is boiled for an hour in a stream of carbon dioxide, using a reflux condenser, and, after cooling, the excess of titanous salt is oxidised with permanganate, and the chlorine determined by Volhard's method. Since chlorates are reduced by titanous salts (this J., 1908, 434), it is easy to determine a perchlorate in the presence of a chlorate, as the latter is reduced also by ferrous sulphate and other common reducing agents.—F. Sopex.

Determining nitrogen in salt-petre. Kleiber. *See* VII.

Determining nickel in steels. Prettner. *See* X.

Analysis of metallic zirconium. Wedekind and Lewis. *See* X.

ORGANIC—QUALITATIVE.

β -Hydroxy- ϵ -methylfurfural as cause of some colour reactions of hexoses. Van Ekenstein and Blanksma. *See* XVI.

Detecting added water in altered milk. Kling. *See* XVIII.A.

Reaction of urotropine and hordenine. Labat. *See* XX.

ORGANIC—QUANTITATIVE.

Carbon in aliphatic hydroxy-compounds [cellulose in cuprammonium solution, &c.]; Determination of — in the wet way. E. Berl and A. G. Innes. *Ber.*, 1907, **42**, 1305—1309.

MOST hydroxy-compounds of the aliphatic series undergo complete combustion when treated with chromic acid in presence of concentrated sulphuric or phosphoric acid, and several methods for the quantitative measurement or weighing of the carbon dioxide produced have been proposed. The authors have standardised a gasometric method of procedure for the purpose of determining cellulose in cuprammonium solutions and have found the same to be of general application within certain limits. They prefer to use a very concentrated solution of pure phosphorus pentoxide as the dehydrating acid since sulphuric acid tends to give rise to secondary products. In certain cases, where combustion is difficult or incomplete, the addition of two drops of mercuric iodide is advantageous. The combustion flask has a short wide neck, fitted with a ground-in stopper carrying a tube which is connected to the top of a Bunte's burette. Into the side of the neck of the flask is fused a tap-funnel for the introduction of the acids. A quantity of substance, calculated to produce less gas than would be contained in the whole apparatus under atmospheric pressure, is weighed out into the flask, the connector is made, and the apparatus—flask and gas-burette—is completely evacuated. 5—6 c.c. of a saturated solution of chromic acid are introduced and then, after any action set up has subsided, 5—6 c.c. of concentrated phosphoric acid solution. The combustion is complete by heating for 10 minutes, and the gas is then expelled from the flask by admitting hot water through the funnel until it reaches the cork at the top of the burette. After cooling, the total volume of gas is measured by connecting the bottom of the burette with a pressure bottle containing saturated brine. The carbon dioxide is then absorbed by means of a concentrated solution of sodium hydroxide; this reagent is next removed and the volume again measured over brine. The difference between the two readings shows the volume of carbon dioxide produced which is corrected for the aqueous tension of brine ($\frac{1}{4}$ of that of pure water). The method affords results quite as concordant with the theoretical numbers as the method of dry combustion; it is not applicable to substances of the aromatic series, but it affords a ready means for the analysis of many technical products including carbohydrates and the salts of organic acids, citrates, tartrates, etc. When applied to solution of cellulose in cuprammonium solution, the liquid is weighed into the flask from a pipette, the ammonia expelled by heating gently, phosphoric acid is added and the gases due to by-products are driven off by heating *in vacuo*; the combustion is then effected as described.—J. F. B.

Indigo in dyed cotton. Knecht. *See* V.

Determining acid value of resins. Marcusson and Wintfeldt. *See* XIII.B.

Chloral hydrate method [in rubber analysis]. Frank and Marekwald. *See* XIII.C.

Tanning analysis with the Zeiss immersion-refractometer. Sager. *See* XIV.

XXIV.—SCIENTIFIC & TECHNICAL NOTES

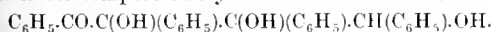
Clays; Adsorption by —. P. Rohland. *Biochem. Zeits.*, 1909, **16**, 220—224.

ACCORDING to Michaelis and Rona (*Biochem. Zeits.*, 1907, **15**, 196), kaolins are good adsorbents for albumoses, and these workers consider that the adsorption of albumose by kaolin differs from the process of mechanical adsorption. According to the author, however, of all varieties of clays kaolins are least suitable for such experiments. He recommends dark-coloured, highly plastic clays which yield large quantities of colloidal hydroxides on contact

with water (see also this J., 1908, 900). Analyses of three such clays are quoted; these were found to contain considerable proportions of organic matter (probably also of a colloidal nature). These clays adsorb colloids, and some complex crystalloids such as dyestuffs (*loc. cit.*, 1908, 34). They adsorb the HCO_3^- and CO_3^{2-} ions completely from solutions of acid and normal carbonates respectively, and partially adsorb the PO_4^{3-} ion from primary phosphates; the adsorption of these ions is perhaps only a phenomenon accompanying the interchange of the alkalis of the salts with the calcium contained in the clay. The colloidal substances formed by contact of the clay with water present cellular structures of large surface area and therefore of high surface energy. The adsorption of colloidal solutions by coagulated substances depends on the property of substances in these two conditions, of uniting to form apparent compounds. It may be conjectured that the meshes of the coagulated cellular structure filled with water are too small to permit diffusion of the larger colloid molecules, but large enough to permit the passage of the smaller crystalloid molecules. Substances, such as dyestuffs, of complex molecular structure, are characterised by the property of becoming concentrated at the cellular surfaces. In all cases, the adsorption proceeds in such a manner that the hydroxides formed from the clay in contact with water, are first dissolved in the colloidal state, and are then coagulated by the presence, or by addition of electrolytes, thereby taking up, and retaining in their cellular structures, the substances to be adsorbed. These adsorptions by clays may also be regarded as special cases of the general rule that every substance that separates in the solid state (in these cases, in the coagulated state) from the surrounding solution, retains on its surface and in the layers immediately beneath, a larger or smaller portion of the other substance.—L. E.

Chemical action of light. XIV. G. Ciamician and P. Silber. *Ber.*, 1909, 42, 1386—1391.

UNDER the influence of light (2½ years' exposure) benzaldehyde yields benzoic acid, hydrobenzoin, and two polymericides of the formula, $(\text{C}_7\text{H}_6\text{O})_2$ (m. pt. 245° — 246° C.), and $(\text{C}_7\text{H}_6\text{O})_4$ (m. pt. 160° — 170° C.), respectively. The latter compound may have the constitution,



Exposure of a solution of dibenzylideneacetone in alcohol to light during a summer gave rise to a white compound of the formula, $\text{C}_{34}\text{H}_{30}\text{O}_2$, which melts at 125° — 135° C. Saffrol in the presence of a trace of iodine remained unchanged by light after a year's exposure, but isosaffrol yielded di-isosaffrol. Under similar conditions methyl-eugenol remained unchanged, whilst isomethyl-eugenol yielded a compound of the composition of di-isomethyl-eugenol as white needles, m. pt. 96° C., which is not identical with the compound described by Francesconi and Puxeddu as melting at 106° C. Mixtures of benzaldehyde and saffrol and isosaffrol respectively furnished in each case additive products of the formula, $\text{C}_7\text{H}_6\text{O}\cdot\text{C}_{10}\text{H}_{10}\text{O}_2$; that from saffrol melts at 150° — 180° C., whilst the one from isosaffrol melts at 170° — 180° C.—J. C. C.

Trade Report.

Chemical industry of France according to the data upon which the proposals for the new French customs tariff were based. *Chem. Ind.*, 1909, 32, 139—142. (See this J., 1909, 165.)

THE industry of heavy chemicals in France is, in general, in a satisfactory condition, and no essential alterations in the tariff are proposed. For bromine and bromides, crude and refined iodine, iodides and iodoform, white and red phosphorus, crystallised gallic, oxalic, phosphoric, and tannic acids, pure oxides of cobalt and lead, barium dioxide, calcined magnesia, potash from molasses, Vasec soda, caustic soda, sodium bicarbonate, sodium salts not otherwise mentioned, ammonia compounds, salts of

cobalt and silver, lead compounds, acetates, amyl alcohol, ammonium and potassium alums, calcined or ground alum-stone, arsenates, borax, chlorates, chlorides, chromates, chloroform, glycerin, kermes mineral, iron lactate, crude calcium acetate, sodium and potassium silicates, sulphates, quinine salts, sulphites and bisulphites, sodium thio-sulphate, potassium cyanide, chemical products from coal-tar, and chemical products not otherwise mentioned, it is proposed that the taxes levied according to the general tariff shall be 50 per cent. more than those of the present minimum tariff. In recent years it has become a general practice to separate the liquid fatty acids from linned oil and maize oil, and send these into France duty-free as "oleic acid," in order to escape the taxes on linned oil (6 fr. per 100 kilos.) and maize oil (12 fr. per 100 kilos.). From this cause the imports of "oleic acid" into France increased from 485,000 kilos. in 1892 to 4,287,000 kilos. in 1906, thus lessening the value of the oleic acid obtained in France as a by-product in the manufacture of stearine. It is therefore proposed to levy a tax of 1.5 fr. in the general tariff and 1 fr. in the minimum tariff on all liquid fatty acids, under the name "oleic acid." Also a tax of 15 fr. per 100 kilos. (general) and 10 fr. (minimum) on stearine is proposed.—A. S.

Patents Act procedure. *Times*, May 4, 1909.

THE Comptroller-General has issued orders amending the procedure under Section 27 of the Patents and Designs Act, 1907, and Patents Rules 78 to 81; these relate particularly to applications for revocation under Section 27, the object being to prevent frivolous and vexatious applications, which may be made merely to extract information as to competing concerns.

German chemical industry in 1908. *Times Eng. Suppl.*, May 5, 1909.

DURING April a number of the German chemical firms published their annual reports. In some cases the dividends declared are less than in previous years, and most of them complain that the past financial year has been an unsatisfactory one. The commercial crisis in America seriously affected the export of colours and chemical products to the United States, and in Japan and China the market has been disappointing. Recent political events in Turkey and in the Balkan States have also had a depressing effect upon the export trade. Reference is made in some of the reports to the stringent conditions of the new British patents law, and the hope is expressed that the German Government will act before the United States forms a similar law, and that it will arrange a reciprocal agreement. In the present year a slight improvement can be observed, and it is expected that normal conditions will soon be re-established.

New Books.

LABORATORIUMSBUCH FÜR DIE INDUSTRIE DER VERFLÜSSIGTEN UND KOMPRIMIERTEN GASE. VON DR. KARL URBAN. Wilhelm Knapp's Verlag, Halle a. S. 1909. Price M.80.

THIS forms Bd. VII. of the series of *Laboratoriumsbüchern für chemische und verwandte Industrie*. It is an 8vo volume containing 40 pages of subject matter with 24 illustrations, and the liquefied and compressed gases forming the subjects of attention throughout the book, are the following:—I. Liquefied ammonia. II. Liquefied chlorine. III. Liquefied carbon dioxide. IV. Liquefied sulphur dioxide. V. Compressed oxygen. VI. Compressed hydrogen. Of these, the chemical properties; physical constants; methods of preparation; apparatus used, etc., are given.

CHEMICAL INDUSTRY ON THE CONTINENT. A Report to the Electors to the Gartside Scholarships. By HAROLD BARON, B.Sc. The University Press, Manchester. 1909. Price 1s. net. Messrs. Sherratt and Hughes, 33, Soho Square, London, W.

8vo volume, containing 68 pages of subject matter, and an alphabetical index. The matter is divided amongst

ten chapters, in which the leading subjects respectively figure as follows:—I. Industrial development in Belgium. II. The Belgian textile industries. III. The chemical industries of Belgium. IV. Textile industries in Northern France. V. Chemical industries in Northern France. VI. Industrial development in Germany. VII. German chemical industries. VIII. A typical German colour works. IX. Dyeing in Western Germany. X. Patent protection.

INDUSTRIES DU PLOMB ET DU MERCURE. Par A. BOUCHONNET. *Tome premier*.—*Métallurgie. Tome second*.—Composés. Octave Doin et fils, 8, Place de l'Odéon, Paris. 1900. Price for Vols. I. and II., 10 frs.

VOL. I.—METALLURGY. Small 8vo volume, containing 287 pages of subject matter, and the alphabetical index. There are 37 illustrations. The work, divided into parts I. and II., treats of the metallurgy of lead in Part I., and of that of mercury in Part II. VOL. II.—COMPOUNDS. Contains 339 pages of subject matter, with 20 illustrations, and is also divided into two parts, Part I. being devoted to the compounds of lead, and Part II. to those of mercury. At the end of the volume (pp. 341 to 356), are (a), a bibliographic index; (b), the alphabetical index of subjects; and (c), a systematic table of contents.

75 JAHRE CHEMISCHER FORSCHUNG AN DER UNIVERSITÄT ZÜRICH. Festschrift zur Eröffnung des neuen Chemischen Instituts verfasst von den Studierenden der Chemie. Ernst Blätter, Bellerivestrasse, 66, Zürich, V. 1900. Price 4 frs., post free.

8vo volume, containing 100 pages of subject matter, and 15 illustrations. The matter consists of a historical description of the development of the chemical department of the University of Zürich, from its commencement in 1832 to the present date, with biographical sketches of the lives and careers of the chemical professors from Löwig, the first professor (1833), to Werner and Pfeiffer, the present professors. The report given of Werner's researches appears especially valuable. The biographies, with photo-engravings, of the following professors of chemistry are given, with descriptive reports of their research work, and dates of the same, with references:—C. J. Löwig (1833–1853); Edw. Schweizer (1852–1860); G. Städler (1853–1870); J. Wislicenus (1867–1872); Victor Merz (1869–1893); W. Weith (1871–1881); H. Abeljanz (1884 to date); Karl Schall (1883–1903); Alfred Werner (1893 to date); P. Pfeiffer (1908 to date).

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 10,027. Motion. *See under XVII.*
 10,095. British Thomson-Houston Co. (General Electric Co.). Production of high vacua. April 28.
 10,557. Yates. Steam-heating pipe coils and radiators for heating, drying, evaporating, &c. May 4.
 10,562. De Murrieta and Tully. Separating liquids from gases or vapours by centrifugal action. May 4.
 10,591. Aktiebolaget Swedish Nitric Synd. *See under VII.*
 10,771. Morgan Crucible Co., and Speirs. Crucibles. May 6.
 10,808. Fielding. *See under XVI.*
 11,030. Holle. Furnaces. May 10.

- 11,068. Pointon. Evaporation and drying of liquid compounds, &c. May 10.
 11,291. Ebbels, McOnie, and Jones. Filters. May 12.
 11,422. Eijduan. Evaporating apparatus.* May 14

COMPLETE SPECIFICATIONS ACCEPTED.

- 9283 (1908). Esping. Apparatus for raising liquid. May 5.
 11,088 (1908). Macfarlane. Evaporators for the concentration of liquids. May 19.
 12,078 (1908). Gray. High pressure digesters. May 12.
 16,405 (1908). Brooke, and Dempster and Sons. *See under II.*
 17,054 (1908). Peat. *See under X.*
 21,623 (1908). Brearley. Indicator for determining the temperature of heated objects. May 12.
 23,289 (1908). Fales and Baldwin. Apparatus for separating oil or other foreign substances from liquids. May 19.
 25,300 (1908). Boulton (Bradley). Centrifugal machine for separating solids from liquids. May 5.
 25,644 (1908). Tiemann. Apparatus for purifying solutions by settling. May 5.
 28,549 (1908). Schmatolla. *See under VII.*

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 10,219. Sonnenschein and Prager. Liquid for illuminating purposes. April 29.
 10,364. Hutchins. Gas plants. May 1.
 10,376. Hall. Incandescent mantles. May 1.
 10,482 and 10,484. Schniewind. Coke or like ovens.* May 3.
 10,486. Schniewind. Coking ovens, furnaces, &c.* May 3.
 10,745. Weickert. Mantles or incandescence bodies for gas lighting. [Addition to No. 2572 of 1908.*] May 6.
 10,765. Otto-Hilgenstock Coke-Oven Co. (Otto und Co.). Removing tar from the hot gases from coke ovens, gas retorts, &c., prior to recovering ammonia. [Addition to No. 12,809 of 1908.*] May 6.
 10,903. Mücke. Incandescent mantles. May 8.
 10,939. Perkins. Utilising anthracite slack or small for fuel. May 8.
 11,159. Richards. Carbonisation and distillation of fuel. May 11.
 11,218. Fielding. Gas producers.* May 12.
 11,254. Trachsler and Ernst. Manufacture of producer-gas. May 12.
 11,265. Gobbe. Gas producers. [Belg. Appl., May 16, 1908.]* May 12.
 11,315. Fisk. Incandescent gas mantles.* May 13.
 11,442. Gewerkschaft der Steinkohlenzeche Mont-Cenis. *See under VII.*
 11,527. Crossley and Rigby. Gas producers. May 15.

COMPLETE SPECIFICATIONS ACCEPTED.

- 6575 (1908). Von Bauer. Coke ovens. May 5.
 9150 (1908). Evans. *See under XXIII.*
 9377 (1908). Bantsart. Coke ovens. May 5.
 10,422 (1908). Rineker and Wolter. Obtaining gas from tar in gas-producer plant. May 12.
 14,942 (1908). Westinghouse Metal Filament Lamp Co. (Westinghouse Metallfaden Glühlampenfabr.). Production of tungsten filaments for electric incandescence lamps. May 12.
 16,405 (1908). Brooke, and Dempster and Sons. Vertical retorts. May 19.
 19,928 (1908). Barth. Manufacture of fuel for internal-combustion engines. May 5.
 20,014 (1908). Lake (Internat. Gas Development Co.). Manufacture of gas. May 12.
 21,489 (1908). Gennotte. Gas retorts. May 5.
 25,854 (1908). Siemens und Halske A.-G. Manufacture of electric incandescence filaments from tungsten or other difficultly fusible metal. May 12.
 1332 (1909). Kuzel. Metal filaments for electric lamps. May 19.

- 2853 (1909). Siemens und Halske A.-G. Manufacture of electric incandescence filaments from tungsten. May 12.
 3951 (1909). British Thomson-Houston Co. (General Electric Co.). Manufacture of incandescent electric lamp filaments. May 12.
 6845 (1909). Von Bauer. Coke ovens. May 5.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

- 10,969. Wallace and Reynaud. Destructive distillation of vegetable substances and resins. May 8.
 11,359. Karno and Naka. Method of freeing petroleum oil from smoke-producing elements.* May 13.

COMPLETE SPECIFICATIONS ACCEPTED.

- 10,892 (1908). Seidenschneur. Method and apparatus for distilling crude petroleum. May 19.
 17,054 (1908). Peat. *See under X.*

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

9888. Johnson (Badische Anilin und Soda Fabrik). Manufacture and employment of anthracene colouring matters. April 26.
 9908. Newton (Bayer und Co.). Manufacture of a new dyestuff. April 26.
 10,187. Cassella und Co. Manufacture of red chromable dyestuffs. [Addition to No. 8154 of 1909. Fr. Appl. May 26, 1908.]* April 29.
 10,461 and 10,462. Newton (Bayer und Co.). Manufacture of azo dyestuffs. May 3.
 10,463. Newton (Bayer und Co.). Manufacture of anthracene compounds. May 3.
 10,666. Ges. f. Chem. Ind. in Basel. Manufacture of green vat dyestuffs. [Ger. Appl. May 11, 1908.]* May 5.
 10,936. Inray (Soc. Chem. Ind. in Basle). Manufacture of substantive azo dyestuffs.* May 8.
 11,253. Newton (Bayer und Co.). Manufacture of azo dyestuffs and process of developing them on the fibre. May 12.
 11,355. Newton (Bayer und Co.). Manufacture of azo dyestuffs and process of developing them on the fibre. May 13.
 11,356. Newton (Bayer und Co.). Manufacture of azo dyestuffs. May 13.
 11,364. Act.-Ges. f. Anilinfabr. Manufacture of blue substantive dyestuffs. [Ger. Appl. May 26, 1908.]* May 13.

COMPLETE SPECIFICATIONS ACCEPTED.

- 10,387 (1908). Newton (Bayer und Co.). Manufacture of derivatives of the anthracene group. May 12.
 12,877 (1908). Fowler and O'Meara. *See under III.B.*
 15,463 (1908). Soc. pour l'Ind. Chim. à Bâle. Manufacture of *p*-amidophenyl-2-azimido-5-naphtholsulphonic acid and dyestuffs therefrom. May 5.
 17,352 (1908). Ransford (Cassella und Co.). Manufacture of sulphide colours. May 19.
 18,107 (1908). Newton (Bayer und Co.). Manufacture of anthracene derivatives. May 12.
 20,802 (1908). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs. May 19.
 3602 (1909). Meister, Lucius, und Brünig. Manufacture of dyestuffs. May 5.

V.—PREPARING, BLEACHING, DYEING, RINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

9840. Sumner. Manufacture of elastic non-inflammable coir fibre. April 26.

9868. Turner. Hawking machines* employed in indigo dye-vats. April 26.*

9920. Dreaper. Manufacture of artificial silk. April 27.
 10,189. Johnson (Badische Anilin und Soda Fabrik). Production of brown shades on fibrous material with or without discharge effects. [Addition to No. 17,241 of 1905.] April 29.

- 10,190. Johnson (Badische Anilin und Soda Fabrik). Printing or dyeing on fibrous material. [Addition to No. 17,241 of 1905.] April 29.

- 10,200. Védie. Ensuring uniformity of colour in fabrics. April 29.

- 10,460. Pinkus. Increasing the durability of animal tissues.* May 3.

- 10,604. Opfermann, Friedemann, and A.-G. f. Maschinenpapier. Treating prepared wood-cellulose to produce artificial threads and nitrocellulose. [Ger. Appl. April 15, 1909.]* May 4.

- 10,609. Lake (Empire Duplex Gin Co.). Treatment of cotton, &c. May 4.

- 10,795. May and Grosvenor. *See under XIX.*

- 11,024. Hoffman and Decoster. Rapid impregnation of vegetable fibres in the cold.* May 10.

- 11,253. Newton (Bayer und Co.). *See under IV.*

- 11,354. Newton (Bayer und Co.). Production of new threads. May 13.

- 11,355. Newton (Bayer und Co.). *See under IV.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 4586 (1908). Brintons, Ltd., and Osborn. Apparatus for dyeing, washing, or bleaching yarns and slubbing. May 12.

- 7201 (1908). Caberti, and Manifattura E. Stamperia Lombarda. Printing on textile fabrics. May 12.

- 9651 (1908). Newton (Bayer und Co.). Fixation of dyestuffs on fibre. May 12.

- 10,289 (1908). Boulton (Jefferson). Bleaching and treating cloth, warp, or other textile materials with liquids. May 19.

- 10,316 (1908). Hoinkes. Treatment of textile fabrics. May 19.

- 12,913 (1908). Worner. Centrifugal drum apparatus for dyeing, &c. May 19.

- 13,760 (1908). Khig. Process and apparatus for drying textile and other materials. May 19.

- 21,840 (1908). Verein. Kunstseidefabr. Making multi-coloured surfaces. May 5.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

APPLICATIONS.

- 10,170. Jahn and Grünhut. Dyeing, impregnation, or proofing of wood. April 29.

- 10,716. Gordon. Printing in natural colours on paper, cardboard, wood, ivory, or porcelain. May 6.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

9918. Walker. *See under X.*

- 10,164. Price. Manufacture of nitrous and nitric acids, nitrate, nitrite, or sulphonitrate or nitrite of lime, soda, or potash. April 29.

- 10,171. Nathan, Thomson, and Thomson. Manufacture of nitric acid. April 29.

- 10,465. Johnson (Badische Anilin und Soda Fabrik). Absorption of oxides of nitrogen. May 3.

- 10,517. Internat. Salt Co., and Tee. Manufacture of salt. May 4.

- 10,591. Aktiebolaget Swedish Nitric Synd. Process and apparatus for concentrating acids. [Swed. Appl. May 6, 1909.]* May 4.

- 10,592. Aktiebolaget Swedish Nitric Synd. Concentration of nitric acid. [Swed. Appl. May 6, 1908.]* May 4.

- 10,774. Grimm. Sulphur burners.* May 6.

- 10,867. Johnson (Badische Anilin und Soda Fabrik). Production of commercially pure nitrates. May 7.

- 11,073. Dewey. *See under X.*
 11,123. Friedrich et Cie. Preparation of sodium sulphite and ammonium chloride. [Ger. Appl., June 20, 1908.]* May 11.
 11,128. Moritz. Apparatus for making sulphuric acid. [Fr. Appl., Oct. 26, 1908.]* May 11.
 11,274. Johnson (Badische Anilin und Soda Fabrik). Manufacture of nitrates. May 12.
 11,275. Johnson (Badische Anilin und Soda Fabrik). Manufacture of calcium nitrite. May 12.
 11,332. Hannan. Manufacture of oxygen and hydrogen or other gases. May 13.
 11,442. Gewerkschaft der Steinkohlenzeche Mont-Cenis. Manufacture of ammonium sulphate from distillation gases. [Ger. Appl., May 15, 1908.]* May 14.
 11,525 and 11,526. Pope. *See under XIII.A.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 26,981 (1907). Ramsay. Recovery of oxides of nitrogen from air or other gases. May 5.
 13,207 (1908). Mond Nickel Co., Hirtz, and Cowap. Manufacture of cobalt compounds and their application. May 12.
 19,148 (1908). Pipereaut and Vila. Preparation of metal sulphides and alkali hydrosulphites from ores and other metallic compounds. May 12.
 23,917 (1908). Millet and Mussi. Alimentary ferruginous salt. May 12.
 28,549 (1908). Schmatolla. Kilns for burning limestone, dolomite, &c. May 12.
 596 (1909). Williams. Extraction of sulphur from spent oxide or like material. May 12.
 1150 (1909). Gruner. Sodium peroxide composition for washing and bleaching purposes. May 12.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

9853. Sievert. Glass-making apparatus.* April 26.
 9926. Redfern and Sharratt. Printing on pottery. April 27.
 11,414. West and Lewis. Kilns or ovens for firing bricks, tiles, china, &c. May 14.

COMPLETE SPECIFICATIONS ACCEPTED.

- 13,179 (1908). Salamon, and Exploration Co. Preparation of china clay. May 12.
 25,042 (1908). Sievert. Manufacture of glass plates. May 5.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

- 10,170. Jahn and Grünhut. *See under VI.*
 11,184. Pavin de Lafarge. Manufacture of cement. [Fr. Appl., June 13, 1908.]* May 11.
 11,414. West and Lewis. *See under VIII.*

X.—METALS AND METALLURGY.

APPLICATIONS.

9918. Walker. Reverberatory furnaces for producing blister copper and sulphuric acid. April 27.
 9955. Brand. Extraction of zinc. April 27.
 9958. Wildbore (Haggenmiller). Smelting pyritic and other sulphide ores.* April 27.
 10,029. Muirhead. Open hearth steel-making furnaces for producing higher grade steels and other alloys. April 28.
 10,224. Molengraaff, Caron, and Keen. Separation of gold from ores, sands, gravels, &c. April 30.
 10,352. Göpfert. Recovery of copper from waste liquors produced in pickling metals. May 1.
 10,381. Simon. Separation of metals or minerals from gangue. May 1.
 10,515. Jackson. Blast furnaces. May 4.

10,615. Matthews and Pim. Treatment of iron and steel. May 5.

10,657. Ruthenburg. Preparation of zinc and other volatile metals from their ores. May 5.

10,658. Ruthenburg. Preparation of zinc oxide for smelting, &c. May 5.

10,790. Simpson and Oviatt. Direct production of iron and steel from oxides of iron. May 6.

10,947 and 10,948. Moeller (Rosalt). Extraction of metals from their ores by a wet process. May 8.

10,952. Simpson and Oviatt. Direct production of iron and steel from oxides of iron. May 8.

10,995. Cowper-Coles. Extraction of iron from its ores. May 10.

11,044. Cox. Concentrating apparatus for separating metals, ores, &c., in wet recovery processes. May 10.

11,073. Dewey. Treatment of arsenide ores and compounds.* May 10.

11,263. Pezzolato. Treatment of pyrites ashes.* May 12.

11,376. Ebbw Vale Steel, Iron and Coal Co., and others. Treatment of spathic and other ores for use in blast furnaces. May 13.

COMPLETE SPECIFICATIONS ACCEPTED.

- 12,042 (1908). Duke. Metallic alloys. May 12.
 14,093 (1908). Baraduc-Muller. Metallurgical process for obtaining alloys and steels containing silicon. May 12.
 15,176 (1908). Loiseau. Manufacture of zinc. May 19.
 17,054 (1908). Peat. Apparatus for subjecting ores, shale, coal &c., to the action of heat, especially for treating iron ore or ironstone shale. May 5.
 17,610 (1908). Siemens und Halske A.-G. Increasing the ductility of tungsten. May 5.
 19,148 (1908). Pipereaut and Vila. *See under VII.*
 23,068 (1908). Higgins. Recovery of tin from tin scrap. May 5.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

- 10,655. Cowper-Coles. Electrodeposition of iron. May 5.
 10,791. Schauli. Electrolyte for galvanic batteries applicable also as an emulsion for photographic negative and as an electrolytic resistance for electric currents. May 6.
 10,834. Fahn. Depolarisers of galvanic batteries. May 7.
 10,911. Niblett. Electrolytic apparatus. May 8.
 11,060. Johnson (Chem. Fabr. Griesheim-Elektron). Production and maintenance of long electric arcs. May 10.
 11,166. Diesser. *See under XIII.B.*
 11,317. Rooper and Belcher. Electric furnaces. May 11.
 11,480. Hiorth and Söderberg. Electric induction furnaces. [Appl. in Norway, May 16, 1908.]* May 11.

COMPLETE SPECIFICATIONS ACCEPTED.

- 16,885 (1908). Lake (Standard Varnish Works). Soluble electric insulating compounds. May 12.
 28,276 (1908). Voelker. Electric furnaces. May 12.
 6267 (1909). Steinert and Stein. Apparatus for electric magnetic separation. May 5.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

APPLICATIONS.

- 10,075. Newton (Bayer und Co.). Medicinal soap. April 28.
 10,616. Dörner. *See under XIV.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 9758* (1908). Barbé, Garelli, and De Paoli. Saponification of fatty materials by means of ammonia. May 11.
 11,597 (1908). Fischer. Production of lecithin, fat oil, and cholesterolin. May 19.

- 23,698 (1908). Boulton (Fischer). Apparatus for use in manufacturing soap. May 12.
 24,836 (1908). Barbé, Garelli, and De Paoli. Separation of solid from liquid fatty acids. May 12.
 24,837 (1908). Barbé, Garelli, and De Paoli. Transformation of liquid into solid fatty acids. May 12.
 24,838 (1908). Barbé, Garelli, and De Paoli. Obtaining soda and potash soaps from ammonia soaps. May 12.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

- 10,073. Newton (Bayer und Co.). Preservative preparations. April 28.
 11,525. Pope. Manufacture of white lead. May 15.
 11,526. Pope. Manufacture of lead oxide and preparing it for conversion into red lead or other lead compounds. May 15.

COMPLETE SPECIFICATION ACCEPTED.

- 16,520 (1908). Hughes. Manufacture of sublimed white lead. May 12.

(B.)—RESINS, VARNISHES.

APPLICATIONS.

- 10,969. Wallace and Reynaud. *See under III.*
 11,166. Diesser. Substances to be used as varnishes and for impregnation and insulation. [Comprised in No. 16,737, Aug. 8, 1908.]* May 11.

COMPLETE SPECIFICATION ACCEPTED.

- 12,877 (1908). Fowler and O'Meara. Extraction of lac-dye and shellac. May 5.

(C.)—INDIA-RUBBER.

APPLICATIONS.

- 10,267. Howard (Evans and Lister). Rubber substitute. April 30.
 10,537. Wheatley. Manufacture of indiarubber substitutes. May 4.
 10,956. Wallace and Reynaud. Synthetic production of indiarubber. May 8.
 10,972. Wallace and Reynaud. Treatment of isoprene. May 8.

COMPLETE SPECIFICATIONS ACCEPTED.

- 11,949 (1908). D'Alòe. Indiarubber compound. May 19.
 14,859 (1908). Rutgerswerke A.-G. Manufacture of filling compositions for addition to rubber and other gums. May 19.
 20,896 (1908). Flamant and Worms. Separating rubber from resin in latex and resinous products. May 5.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

- 10,616. Dörner. Extraction of glue and fats from bones and skins. May 5.
 10,661. Spigno. Solutions for treating leather, skins, and hides. May 5.
 10,667. Spigno. Treatment of tanned hides and skins. May 5.

COMPLETE SPECIFICATIONS ACCEPTED.

- 9652 (1908). Mills (Harrington Co.). Size composition. May 12.
 10,201 (1908). Reddan. Material of the nature of leather and method of manufacturing same from hides. May 19.
 2504 (1909). Mackay. Leather product and process of making same. May 12.

XV.—MANURES, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

- 11,644 (1908). Harrison. Manufacture of fertilisers. May 5.
 21,590 (1908). Carlson. Production of fertilisers. May 12.
 25,958 (1908). Soc. Gen. des Engrais Organiques. Conversion of refuse and sewage into manure. May 19.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATION.

- 10,808. Fielding. Means for drying starch and similar substances. May 7.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

- 10,027. Motion. Apparatus for drying brewers' draff and other material. April 28.
 10,458. Braasch. Production of yeast. [Ger. Appl., May 5, 1908.]* May 3.
 10,671. Dand, and Sharpe and Co. Treatment of beers. May 5.
 11,277. Allen. Treatment of beer and other fermented liquors.* May 12.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

9883. Girard. Cereal foods and the manufacture thereof.* April 26.
 10,033. Bathgate. Bread-making flour. April 28.
 10,277. Henri, Helbronner, and von Reeklinghausen. Treatment of foods and other products which undergo fermentation. April 30.
 10,445. Mislin. Utilisation of the waste product of milled or ground cereals.* May 3.

COMPLETE SPECIFICATIONS ACCEPTED.

- 5133 (1908). Frye. Production of a solid from milk. May 12.
 23,183 (1908). Boulton (Electric Meat Curing Co.). Curing process. May 19.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

- 10,261. Spencer. Materials for purifying air. April 30.
 11,421. Eijdsman. Treatment of sea water.* May 14.
 11,471. Didelon and Braut. Apparatus for rendering soluble and nitrifying sewage and other waste. [Fr. Appl., June 29, 1908.]* May 14.

COMPLETE SPECIFICATION ACCEPTED.

- 25,958 (1908). Soc. Gen. des Engrais Organiques. *See under XV.*

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

9813. Horsfield and Horsfield. Manufacture of wall-paper. April 26.
 9968. Beck. Apparatus for making half-stuff from peat, turf, or other fibrous material.* April 27.
 10,604. Opfermann and others. *See under V.*
 10,795. May and Grosvenor. Apparatus for coating and drying paper, cloth, &c.* May 6.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

- 10,074. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. April 28.

11,108. Wellcome and Pyman. Manufacture of therapeutic compounds. [Addition to No. 314 of 1909.] May 11.

11,109. Wellcome and Barger. Manufacture of therapeutic compounds. [Addition to No. 1560 of 1909.] May 11.

11,110. Wellcome and Barger. Synthesis of physiologically active bases. [Addition to No. 1561 of 1909.] May 11.

COMPLETE SPECIFICATIONS ACCEPTED.

11,597 (1908). Fischer. *See under XII.*

17,132 (1908). Newton (Bayer and Co.). Manufacture of therapeutic compounds. May 12.

22,167 (1908). Gehe and Co., A.-G., and Fey. Dry preparation of cod-liver oil and malt extract. May 19.

24,836 and 24,837 (1908). Barbé and others. *See under XII.*

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

9900. Wilson. Photographic emulsions of silver phosphate. April 26.

9925. O'Brien (Thornton). Photographic films. April 27.

10,059. Weigert-Sterne. Colour photography. April 2.

10,284. Wilson. Photographic emulsions. April 30.

10,611. Berthon. Three-colour photographic processes. May 4.

10,791. Schauli. *See under XI.*

COMPLETE SPECIFICATIONS ACCEPTED.

8919 (1908). Merkel. Colour photography. May 5.

9044 and 9693 (1908). Whitfield. Manufacture of colour screens for colour photography. May 5.

XXII. EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

9992. Schmitz. Manufacture of igniting compositions. April 27.

11,179. Bowen. Explosives. May 11.

XXIII. GENERAL ANALYTICAL CHEMISTRY.

COMPLETE SPECIFICATIONS ACCEPTED.

9150 (1908). Evans. Apparatus for measuring and indicating the explosive and calorific values of gaseous mixtures. May 5.

9726 (1908). Weiss. Estimation of uric acid in urine. May 12.

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JUNE 15, 1909.

No. 11, Vol. XXVIII.

PROCEEDINGS

OF THE

TWENTY-EIGHTH ANNUAL MEETING.

LONDON.

WEDNESDAY, MAY 26TH, 1909.

The twenty-eighth Annual General Meeting of the Society was held in the Jehanghier Hall, Imperial Institute, South Kensington, on Wednesday, May 26th, the President, Prof. R. Meldola, F.R.S., in the chair.

The Minutes of the last meeting were read and confirmed.

On the motion of Sir Robert Pullar, seconded by Dr. Hugo Müller, F.R.S., Messrs. C. D. McCourt and E. Linder were appointed scrutators of the ballot.

The PRESIDENT then declared the ballot closed.

The SECRETARY (Mr. C. G. Cresswell) then read the Report of the Council, as follows:—

REPORT OF COUNCIL.

The number of members on the register is 4,323 as compared with 4,520 at the last Annual Meeting. During the ten months 258 members have been elected as compared with 270 last year, and the losses have been 455 as against 269. This loss is due to the provisions of By-law 12, which allow less latitude than the old By-law to members who do not pay their subscriptions within the specified time. There were 40 deaths as compared with 47 last year.

The names of the members removed by death are: Dr. Jas. Baynes, Alex. Bottle, Harold G. S. Brown, O. F. T. Carlsson, J. Trevor Cart, A. V. Cunningham, J. K. Field, S. P. Franchot, Sir J. Christopher Gamble, J. C. Garnauss, Holbrook Gaskell, Dr. George Gore, W. J. W. Gunther, W. M. Habirshaw, W. H. Hacking, R. H. Harland, Dr. H. A. Hunieke, Jas. S. Hutton, R. V. Jackson, Paul Jantzen, S. H. Johnson, John A. Just, R. Lucas, C. F. McCombie, S. Mellor, Charles Mook, Harry Nicholson, Standen Paine, G. H. Parker, Dr. E. Plath, T. Horne Redwood, W. P. Rix, J. W. Spencer, S. J. Steel, Sir Thomas Stevenson, J. F. Swanson, Howard Ward, Sir Thomas Wardle, H. D. Warren, and A. Zumbeck.

Eight candidates having been nominated to fill four vacancies among the ordinary Members of Council, a ballot is required on this occasion. In accordance with the provisions of By-law 26, the names of the Hon. Treasurer, Hon. Foreign Secretary, and Auditors are set forth on the Ballot paper.

Under By-law 38, the Council may make Regulations, subject to approval by an Annual General Meeting, and, accordingly, Regulations dealing with the subscriptions and entrance fees of Members, the procedure of the Annual General Meeting, the expenditure of the Society's funds by Committees, and the elections of Local Sections will be submitted to this meeting for approval. These Regulations merely continue the procedure set forth in the By-laws of the Society of 1881.

Standing Orders for regulating the proceedings of the Council, and Rules for the Guidance of the Publication Committee, Officers, and others in the production of the Journal are also in course of preparation.

A General Purposes Committee has been formed for consultative and advisory purposes, especially in regard to finance and investments.

By-law 58 gives the option of investing the Society's funds either in the names of Trustees or in the name of the Society. The latter alternative has been chosen, and the securities have now been transferred from the names of Dr. George Beilby and Mr. David Howard, the surviving Trustees, to the name of the Society. The hearty thanks of the members are due to the Trustees

for their long and arduous services, and to Mr. S. Godfrey Hall, as an executor of the late Hon. Treasurer and Trustee, Mr. Samuel Hall, for the assistance he has rendered.

The Hon. Treasurer will lay his financial report before the meeting.

Among the items of extraordinary expenditure during the past year appears the Decennial Index, the total cost of which has been about £3,000. Three thousand copies have been printed, and the sale price for each copy, exclusive of postage, has been fixed at ten shillings, so that if every copy were sold, the charge upon the funds of the Society would be £1,500. So far, only some 1,200 copies have been sold, though it is hoped that, as more members realise its value, some further sales will be made. Serious consideration will be necessary before another Decennial Index is undertaken.

Dr. Charles E. Fawsitt has resigned his post as Hon. Secretary of the Scottish Section on his acceptance of the post of Professor of Chemistry at the University of Sydney, N.S.W., in succession to Prof. A. Liversidge, F.R.S. The meeting will surely wish to be associated with the vote of thanks accorded by the Council to Dr. Fawsitt for his services, and to congratulate him on his appointment.

Mr. Thomas Tyrer has retired, by seniority, from his position as representative of the Society on the Board of the National Physical Laboratory, and Mr. Walter F. Reid has been elected in his place.

Messrs. Wm. Burton, J. T. Dunn, Noel Heaton, Douglas Herman, Walter F. Reid, and W. P. Rix have been appointed to serve on a joint committee promoted by the English Ceramic Society to consider questions connected with refractory materials of all kinds.

Messrs. J. E. Stead and G. T. Holloway have been appointed to represent the Society at a Congress at Copenhagen promoted by the International Association for Testing Materials.

The Council trusts that the Members of this Society will do all in their power to render the International Congress of Applied Chemistry a success, by attending the meetings and taking part in the proceedings.

Mr. R. FORBES CARPENTER moved the adoption of the Report. Some very distinguished men had been removed by death, including Mr. Holbrook Gaskell, Dr. George Gore, Sir Thomas Stevenson, and Sir Thomas Wardle. The Decennial Index was a most valuable addition to the Journal, and it was to be hoped that those who valued the Index would make its benefits still further known: in fact, no member who wished to make good use of the Journal could dispense with it. After referring to the retirement of Mr. Tyrer from his position as representative on the Board of the National Physical Laboratory, he said they might congratulate themselves on the choice of a successor, for Mr. Reid was one of the earliest to draw the attention of the Society to this very important matter, and it was a letter from him to Lord Rayleigh which induced the Royal Society to appoint two representatives from that Society on the Board.

Prof. A. LIVERSIDGE, in seconding the motion, said they were deeply indebted to the Council for the work they had done.

The motion was put, and carried unanimously.

Report of Honorary Treasurer.

The HON. TREASURER (Mr. Thomas Tyrer) drew attention to the slight deficit, as shown by the Balance Sheet, of £183 1s. 1d., which was the total deficit after every possible liability had been settled, and after defraying the cost of the Decennial Index, which was very heavy. In the year 1908 they paid under that heading £1,064 2s. 8d., and the year before £680; the sales in the two years amounted to £180 and £170 respectively, which was not very satisfactory. Speaking as a manufacturer, he would not be without it if it cost five times the money; in fact, it was an absolute necessity

THE SOCIETY OF CHEMICAL INDUSTRY.

INCOME AND EXPENDITURE ACCOUNT FOR YEAR 1908.

EXPENDITURE.			INCOME.		
To Journal	Editorial and Sundry	£ s. d.	By Entrance Fees	£ s. d.	£ s. d.
	expenses		Life Composition Fees	56 11 3	
	Editor's Salary	571 8 0	Annual Subscriptions	5165 15	
	Do, Expenses	44 18 9	Journal		
	Do, Assistants	52 0 0	Advertisements	285 14 11	
	Abstractors	571 9 6	Sales	630 12 9	
	Sub-Editor's Salary	150 0 0	Collective Index Subscriptions		916 7 1
	Indexing Journal	86 9 0	Decennial Index—Sales		13 15 1
	Foreign Journals	11 14 6	Dividends and Interest on Investments		180 0 0
	Sundry do.	14 12 4			
	French and U.S.A. Patents and Specifications	60 5 7			
	Insurance of Stock	1 9 6			
		1573 7 2			
	Publishing expenses	2432 18 0			
					4006 5 2
„ Decennial Index					
	Compilation expenses	424 10 0			
	Publishing do.	630 12 8			
					1064 2 8
„ Sectional expenses					
	Birmingham and Midland	25 0 0			
	Canadian	37 12 0			
	Liverpool	24 16 1			
	London	116 8 1			
	Manchester	57 8 1			
	Newcastle-on-Tyne	25 18 7			
	New England, U.S.A.	55 0 0			
	New York, U.S.A.	200 0 0			
	Nottingham	15 16 6			
	Scottish	19 9 5			
	Yorkshire	34 6 0			
					611 15 6
„ Annual Meeting expenses					150 0 0
„ Working expenses—					
	Secretary's Salary and Honorarium	350 0 0			
	Assistant in Office	200 0 0			
	Honorarium (Treasurer's Assistant)	52 10 0			
	Clerical Assistance (late Hon. Treasurer)	13 0 0			
	Do, (Hon. Treasurer)	12 0 0			
	Do, (Secretary)	20 13 6			
	Rent, Lighting and Cleaning	201 17 2			
	Stationery and Binding	85 2 6			
	Postage, Bank Charges, Telephone, and Sundry expenses	160 4 0			
					1095 7 2
„ Law Costs and other expenses in connection with Charter					372 12 8
					17300 3 2

£ s. d.	£ s. d.
257 5 0	
56 11 3	
	313 16
	5165 15
285 14 11	
630 12 9	
	916 7 1
	13 15 1
	180 0 0
4176 9 2	Metropolitan 3% Consolidated
1000 0 0	New Zealand 3% (1915)
485 4 8	New South Wales 3% (1935)
1231 0 10	Consols 2½%
600 0 0	Gas Light and Coke Co. 3% Consolidated
1084 13 4	North British Rly. 3% Consol. Glen
1606 0 0	Midland Rly. 2½% Perpetual Preference
1509 0 0	Great Eastern Rly. 4% Irredeemable
673 0 0	South Eastern Rly. 4½% Preferred
1000 0 0	Metropolitan Water Board 3% Debenture
200 0 0	Nottingham Joint Station 3% Debenture
1250 0 0	Great Western Rly. 5% Guaranteed
800 0 0	Great Northern Rly. 3% Debenture
150 0 0	Nottingham and Grantham Canal 4% Consol. Glen
	Interest on Deposits
	527 1
	7117 2
„ Excess of Expenditure over Income for year 1908	183 1
	17300 3

to any manufacturer or technical man. In addition, the expenditure involved by the Charter had amounted to £372 12s. 8d. during 1908, and in the previous year £332. Had it not been for those two extraordinary items of expenditure, which would not occur again, there would have been a considerable surplus on the year's working. The average surplus of late years had been something like £350 or £360, and he had no doubt that could be maintained by judicious management. He also called attention to the value of their investments, which this year appeared as £15,590, as against £16,554 last year, owing to the depreciation in securities. The present auditors thought that, although the dividends were practically the same, the actual value at which the Stocks could be realised at the date at which the Accounts were made up should appear in the Balance Sheet, an opinion which he thought the members would endorse. He had only to add that these deficiencies were really only apparent.

Mr. A. C. CHAPMAN moved the adoption of the Report of the Honorary Treasurer. Apart from the fact that the expenditure exceeded the income during the past year, but only to a small amount, and bearing in mind the extraordinary expenditure incurred, they must all agree that the Statement was exceedingly satisfactory, and for that they were indebted in no small degree to the services of the Honorary Treasurer. They all thoroughly appreciated the great services he had rendered, and was

rendering to the Society. He, therefore, in moving the adoption of the Report also moved that their heart thanks be given to the Honorary Treasurer for the service he had so admirably and so ungrudgingly rendered.

Dr. HUGO ERDMANN seconded the motion, which was carried unanimously.

Mr. TYLER said he highly appreciated the good feeling of his fellow members. He believed in the Society and therefore he worked for it, but they wanted it to increase and although it never was in a better position for exercising the great benefits which it did for this and other countries still every member ought to be a missionary, and endeavor to obtain more members.

President's Address.

EDUCATION AND RESEARCH IN APPLIED CHEMISTRY.

By RAFAEL MELDOLA, F.R.S.

It is the privilege of the occupant of the Presidential Chair of the Society of Chemical Industry to address the members on a subject of his own choice, and, in the case of Presidents who are or have been actively engaged in some branch of chemical industry, it is only natural to expect that there should be from this chair an author

THE SOCIETY OF CHEMICAL INDUSTRY.

127.

BALANCE SHEET 31ST DECEMBER, 1908.

Cr.

	£	s.	d.		£	s.	d.		£	s.	d.
Sundry Creditors	607	8	7	By Sundry Debtors (Publishers, &c.)..					445	3	11
Subscriptions received in advance.....	331	5	0	" Dividend on Investments outstanding					358	13	6
Accumulated Fund—				" Cash at Bank					250	0	1
31st December, 1908	15,615	8	11	" Investments (taken at present value)—							
				£ s. d.							
				4476 9 2 Metropolitan 3% Con-							
				solidated	4163	2	1				
				1000 0 0 New Zealand 3%							
				(1945)	870	0	0				
				485 4 8 New South Wales 3%							
				(1935)	422	3	1				
				1231 0 10 Consols 2½ %	1031	15	4				
				600 0 0 Gas Light and Coke							
				3% Debenture ...	507	0	0				
				1084 13 4 North British 3%							
				Consold. Lien	900	5	6				
				1696 0 0 Midland Rly. 2½ %							
				Perpetual Prefer-							
				ence	1187	4	0				
				1509 0 0 Great Eastern Rly.							
				4% Irredeemable .	1629	14	5				
				673 0 0 South Eastern Rly.							
				4½ % Preference ..	747	0	7				
				1000 0 0 Metropolitan Water							
				Board 3% Deben-							
				ture	922	10	0				
				200 0 0 Nottingham Joint							
				Station 3%	166	0	0				
				1250 0 0 Great Western Rly.							
				5% Guaranteed ..	1762	10	0				
				800 0 0 Great Northern Rly.							
				3% Debenture ...	696	0	0				
				450 0 0 Nottingham and							
				Grantham Canal							
				4% Consolidated ..	495	0	0				
									15,500	5	0
	£16,554	2	6						£16,554	2	6

We have examined the foregoing Income and Expenditure Account for the year 1908, and Balance Sheet, dated 31st December, 1908, and have verified the Investments and the balance at the Bankers. In our opinion the accounts correctly show the position of the Society at 31st December, 1908.

9, Old Jewry Chambers, London,
5th May, 1909.

NORTON, FEASEY & SLADE,
Chartered Accountants.

live pronouncement concerning that branch of the industry of which he is the representative. But it has so been the custom in this Society for the Presidency to be held both by men identified with the industrial side of chemistry and by those representative of its purely scientific and academic side. If, on the present occasion, I venture to express the opinion that this custom is a wise one, it is for no personal reasons, but because its recognition by our Society proclaims publicly that principle which it has been one of the main objects of my life to uphold—the interdependence of Science and Industry. In which capacity I have been called upon to discharge the honourable duties of this office it is not for me to decide. I can lay claim to have had some direct experience in manufacturing chemistry, but for nearly a quarter of a century my duties as a Professor have made me responsible for the training of students who have entered the technical College at Finsbury presumably with the object of becoming industrial chemists, and I shall therefore be only following the example of my predecessors in selecting as the subject for an address that topic with which my later occupation has made me most familiar, viz., the educational side of industrial chemistry. It may be useful, by way of prelude, to indicate some of the reasons why it appears to me necessary for this Society to make its voice heard just now in the educational world. We have already made some incursions into this main. The subject has occasionally been dealt with by Sectional Chairmen, and in 1899 the President of the Society, Dr. G. Beilby, gave a most valuable address on "The Relations of the Society to Chemical Engineering and to Industrial Research"—an address of especial significance as coming from a technologist who has interested himself in the educational side of the subject. A decade

has elapsed since the delivery of that address and now the question of the training of industrial chemists has again been raised. The question is by no means a new one—it has been slumbering for some years—but it is only recently that it has taken the more definite form of whether our Universities should develop schools of applied chemistry. The subject has aroused great interest all over the country and discussions have been held under the auspices of our Sections at Birmingham, Manchester, and Liverpool. I may add also that the question has had to be faced in connection with the proposed University at Bristol. The topic is in fact "in the air," and as appears to be admitted on all sides, there is no better organisation for giving scope to free interchange of opinions than our own Society.

How far the question has affected the older Universities will appear from the circumstance that six years ago I was invited to address the University Extension meeting at Oxford on the relations between scientific research and chemical industry.* It is evident to me that we cannot afford to shut our eyes to these signs of the times. If any criticism is to be applied to the earlier attempts to deal with this problem, it is that they have hitherto taken the form of isolated expressions of views by manufacturers or teachers; there has been no organised conference and no practical result has followed. Once more in the history of technical education in our subject, the manufacturers and the teachers have been brought face to face, and the recent Sectional discussions, if not leading to the development of any coherent scheme, cannot have failed to clear the air by enabling the two parties chiefly

* See "Nature," Aug. 27th, 1903.

concerned to realise more precisely the nature of the problem and the points of agreement or disagreement between them.

The question from the University standpoint appears to have been mooted at Birmingham in 1907 by Sir Oliver Lodge, and Professor Kipping's address last year to the Chemical Section of the British Association at Dublin is evidently largely responsible for the renewed discussions in the provinces. I may remind you also that last February Dr. Beilby again dealt with the subject from the point of view of the Technical Schools in his address to the Association of Technical Institutions.* Our former President, Mr. William H. Nichols, has likewise placed upon record some valuable observations and suggestions respecting the college-trained chemist, which, although necessarily concerned with the state of affairs in America, may be profitably read by our members on this side of the Atlantic.†

The Society of Chemical Industry in relation to Technical Education.

Among the many special reasons which may be adduced in support of the contention that the training of industrial chemists is one of the most pressing questions now before the country both from the point of view of industry and of education, I would in the first place invite a comparison between the chemical manufacturers and the representatives of other branches of applied science, more especially the engineering industries. It must, I think, be conceded that, with respect to this latter department of technical education, there has been much more coherence and solidarity—a very much keener personal interest on the part of the leaders of the profession than has been shown by the chemical manufacturers. Of course we all know of notable exceptions in our own industry, and it may not be invidious to mention in this connection the activity of Dr. Beilby in Glasgow and of Mr. Levinstein in Manchester. The suggestive paper by Mr. Oscar Guttman on "The Works Chemist as Engineer," read before our London Section in 1907, may also be regarded as a contribution to the educational side of our work.

But these cases are exceptional, and on the whole it cannot be said that our manufacturers have helped to organise the modern educational policy in this country to anything approaching the same degree as have the engineers. The practical effect of this neglect is that the term technical education in Great Britain has become almost synonymous with training in engineering, either civil, mechanical, or electrical, and on the committees and governing bodies of all the newer institutions the engineering influence is, as a consequence, the predominating influence. From the point of view of the engineering prosperity of our country this is no doubt a matter for congratulation, and I cannot help thinking that chemical industry would have been materially helped if our manufacturers as a class had taken an equally active share with respect to the educational requirements for their own occupation. At any rate, this Society is, *par excellence*, the tribunal to which the present state of affairs respecting the training of chemical technologists can be most appropriately submitted. I may remind you in this connection that we are the only chemical organisation in the country which has been given a direct voice in framing the educational policy of the Imperial College of Science and Technology by our having the right to nominate a representative on the governing body of that institution.

Another reason for directing attention to the relations between this Society and the teaching profession at the present juncture is that the lack of active interest in the educational side of applied chemistry on the part of the manufacturers has acted detrimentally to their own cause. Perhaps I may venture on this occasion to claim to be in some measure a representative of both parties, and from actual experience I know full well that the

teachers, if left severely alone by the manufacturers, are apt to become too purely bookish, while the manufacturer, if they cut themselves adrift from the academic side chemistry, are just as likely to conduct their own industry from a too narrowly practical point of view. Therefore such *rapprochement* as has been brought about, however incompletely, during the past year through the Section discussions seems to me to be of distinct value to both teachers and technologists, and is a branch of the Society work which should receive every encouragement. It appears remarkable, in fact, when the history of modern scientific and technical education in this country is impartially considered, that the voice of chemical industry should not have made itself more distinctly heard. It must be remembered that the modern revival in what is called technical education, which took practical shape more than a quarter of a century ago, had for its motive the scientific education of those who were about to engage in manufacturing or constructive industry. It was considered to be the crying want of the age, not on account of what was going on among foreign nations in this direction, but also because it was rightly thought that the old scientific training of the Universities was too academic and unpractical for turning out technologists of any use. The Technical Colleges, Schools, and Polytechnics which developed out of the movement were intended to supply this deficiency in our education, machinery, and in those directions in which these new institutions can claim to have fulfilled their mission with any degree of success it is mainly, if not entirely, due to the recognition of that principle which is recognised in America and on the Continent much more fully than here—I refer to the principle of co-operation between the teachers and the representatives of industry. Whether the newer institutions here have produced any distinct influence upon British chemical industry is a point which I have dealt with to some extent in my address to the Chemical Society two years ago. It is a question which primarily affects the chemical manufacturers, and it is but natural that we who are devoting our lives to this work should look to them for some definite pronouncement. Speaking as a representative of the teachers, I may say that this matter is one of supreme importance to us. We are doing our best, according to our high and according to the means at our disposal, to play in the hands of those with whom rests the future of chemical industry in this country. The experiment has been carried on in various centres for about a quarter of a century, but has any serious result followed from our efforts? Do our chemical industries show any marked development as the outcome of this modern departure in the way of technical education? If the experiment has been a failure, is it the fault of the system, of the teachers, or of the manufacturers? These are questions which are most appropriately raised before this Society and although I dare not flatter myself that any considerations that I can lay before you are likely to lead to an immediate and definite answer, I can at any rate claim with a footing in both camps, to attempt to clear the ground for a better understanding between the parties concerned.

More especially is this necessary now, because, as has been already pointed out, all the recent discussions have centred round the Universities, and the institution which I represent, the Technical Schools and Colleges, have been passed over. Whether this is to be taken as an intimation that we are discharging our functions perfectly as to be outside the zone of discussion, or whether we are doing our work so badly that we are to be eliminated as a negligible quantity, or whether, again, it is thought that the Universities can do something for chemical industry which the technical education movement has hitherto proved incompetent to deal with, are questions on which the voices of chemical manufacturers should surely be heard. Whether there is concordance or discordance at this stage is immaterial, for if the signs of the times are properly read, there can be no doubt that a crisis is approaching both for teachers and technologist and the sooner a definite understanding is evolved out of the conflict of views the better will it be for the welfare of the nation. It is only necessary to remind you that

* See "Nature," March 4th, 1909.

† "Journal of Industrial and Engineering Chemistry," Vol. I, No. 2, p. 102. The article formed the subject of a communication to the Baltimore meeting of the American Chemical Society in December of last year.

Among other influences, the new Patent Act, under which large factories are to be established by foreign manufacturers in this country, cannot but have a profound influence upon our existing factories, and indirectly upon the teaching institutions.

The Statement of the Case by Teachers and Manufacturers.

The isolated expression of individual opinions or the interchange of views between the manufacturers and teachers has hitherto resulted chiefly in emphasising points of disagreement. In view of the crying demand for a constructive policy with respect to the training of chemical technologists this result is to be deplored. I have unfortunately been unable to take part in any of the recent discussions, but from all the information which I have gathered during a very long period, and as the result of many years' consideration of the points at issue, I am fully persuaded that one of the main reasons why the two parties have not in the past been brought to more intimate association and why the discussions on our subject have been less prolific of practical results, whether educational or industrial, than in other departments of applied science, is because there has been a lack of discrimination on both sides. The contending parties have not made sufficient endeavour to enter into each other's point of view. In one sense the discussions have been too general to be of practical value and in another sense too narrow to affect the broad question of educational policy. As a result there has been much talk which is very wide of the mark, and only occasionally have we received contributions which could be said to reach the core of the subject. The problem is confessedly one of the most difficult that has been presented to educationists since technical education was begun; hence the greater need for discrimination and a clearer mutual understanding. I am fully persuaded that in many cases where the education of the technical or industrial chemist has been under discussion, the disputants have, quite unconsciously, been talking about totally different people, and am equally persuaded that if more precise notions had been formed at the outset, and that if the discussion of the question had set out from that common ground, which is really at the basis of the whole matter, many of the points of difference between the parties would disappear. Many of the most divergent and apparently conflicting views are not really incompatible: the want of agreement is apparent and not real—had the teachers and technologists defined more precisely what kind of "chemical chemist" they were talking about, had the teachers more fully realised what an enormous range of heterogeneous manufacture is covered by the term "chemical industry," and had the manufacturers more fully realised the unity of the fundamental sciences which underlie their operations, there would have been a much nearer concordance, and the cause which we all have at heart, the promotion of British chemical industry, would have made greater advance.

I venture to think that I know what both parties mean, although I take up this position with extreme diffidence, and only by virtue of the office which you have conferred upon me. If the air can be cleared so that we can get a better view of each other's requirements, no good to the cause may be effected. In the first place, then, with respect to that want of discrimination which allusion has been made, it may be useful to try to formulate some definite notions from which both parties can set out. The term "Chemical Industry," as understood by us, comprises the branches of manufacture coming under more than 20 distinct headings, the degree of heterogeneity unknown in any other branch of industry. The general principles of chemistry, physics, mechanics, and so forth are, no doubt, the same in every department, and up to this point the work of the teacher is fairly plain sailing. But when we go into details, the mode of applying these principles differs, and divergences take place in various directions and to a greater or lesser degree according to the nature of the industry. When, therefore, the training of an industrial chemist is under discussion the first question to be settled is what part of his training are we talking about? Is it the preparatory general scientific education, or is it this *plus* something

more that he will require by way of preparation for his career? Now whatever views may be held with respect to the connection between technical education and industrial chemistry in this country, it is generally conceded that there must be a sound preparatory scientific education. At any rate we have got as far as that after a quarter of a century of strenuous work—a small mouse perhaps as the result of much painful labour, but at any rate it is an advance upon the state of affairs that existed in the days of my studentship, when it was considered that a chemical manufacturer could get all the training he required by going straight into the factory from school or college, where, by the way, there was no science teaching at all, or, what was worse, a dreary, uninspiring, pedagogic teaching from books which passed for scientific training. If, therefore, we are now all agreed that there must be a scientific basis to build upon, the questions for discussion are, first, what is to be the nature of this preliminary training? and, secondly, where is that training to be given?

Having reached this stage the next point that arises is this:—Passing over all questions of general preliminary education, with which we are not now concerned, are we agreed that the student who is taking up chemistry for an industrial career needs anything more than a knowledge of the general principles of the science and of such allied sciences as are necessary for him to become a fairly proficient master of those principles? Is something more to be added to the mastery of principles, and if so, what is that "something more" to be? Here there is conflict of opinion due, I believe, to want of discrimination on both sides. Some teachers maintain that the chemical training of the student, if thorough, and if made to comprise original research as a part of this advanced training, is all-sufficient, and that these are the kind of men that our factories are in need of. On this last point I quite agree with the teachers: our factories do need such men, and the development of the research faculty should be made a fundamental part of the advanced training of every chemist who is to hold any position of responsibility in a factory. But there is something more which many of the teachers have left out of consideration. Supposing we turn out such efficiently equipped men—thorough chemists and full of originality; supposing, further, that they made valuable discoveries of new products or of new processes, would they be competent to realise these discoveries industrially? I, for one, doubt it: at any rate, I should regard it as extremely risky to invest capital in any discovery worked under such auspices. It is here that there has been want of discrimination. There is such a thing as factory experience. The purely academic teachers have, so to say, washed their hands of all responsibility in connection with this part of the student's training; they pass it over as requiring no consideration from the educational side. The assumption is made that no educational preparation for this, to us, most important part of the career of the industrial chemist is needed beyond the general training in scientific principles. It is true that the infinitely diversified details in construction of plant and methods of working in the 20 odd departments of chemical industry, quite apart from the pure chemistry of the processes—in other words, the pure *technique* of each particular industry, cannot be taught in any educational institution, excepting perhaps in certain special cases which may be considered subsequently. But the admission that extreme specialisation cannot be realised in practical educational policy by no means carries with it the consequence that no preparation for the factory experience is to be looked for from the modern technical education movement.

Here, I think, there has been some misapprehension as to the functions of technical education in our subject. If the manufacturers imagined that the new departure would enable their works to be staffed by expert technologists and if they were disappointed because no such prodigies were forthcoming, it is because they underestimated the complexity of the *technique* of their own industry. In fact, the more closely we look into the discussions the more evident does it appear that the conflict of opinion is mainly due to the two parties having

quite different classes of "technical chemists" in mind. Those teachers who are clamouring for the staffing of our factories by scientifically trained chemists have, if I may say so, damaged their case by leaving out of consideration the expert technologist—the man whose knowledge of *technique* enables him to translate a new discovery into terms of pounds, shillings, and pence—in the present state of competition one might go so far as to say into the fraction of a penny! This is the point on which we must arrive at an understanding if any practical policy is to be evolved out of our conferences. The education of this "chemical technologist" must surely be of precisely the same order of importance for chemical industry as the education of the "pure" chemist. The academic teachers are right as far as they go—as I have already said, we do want highly competent scientific chemists in the works, but they are as inseparable from the "technologist" or the "chemical engineer" or the "practical manufacturer" or whatever we like to call him as were the Siamese twins. A severance of the union means death to both. And if, therefore, the other half of the twin—the scientific chemist—is really essential for the life of the whole, as many teachers believe, then those manufacturers who talk as though this component might be left out of consideration are doing equal damage to their own cause. On carefully considering the various expressions of opinion it will, I think, be found that the teachers have had more or less in mind the research chemist and the manufacturer the chemical engineer in the broad sense of the term. Perhaps it may not be possible—at least in this country—to draw a hard and fast line between the two classes; or, it may be asked whether it is not possible to combine the faculties of both in the same individual. This is conceivable, but it is an ideal applicable to but few and one which would be extremely difficult if not impossible to realise from the educational point of view. We must look the situation fairly in the face. The research chemist ought to be producible from the Universities and Technical Colleges. If we do not turn him out from the latter, so much the worse for that class of institution which I represent, and on this point I shall have something further to say in extension of the views which were stated in my address to the Chemical Society two years ago. With respect to the chemical technologist the question is whether he can be produced under any of our existing educational curricula, or whether the factory is the only proper training ground. This is a point which requires further consideration and is indeed the very subject on which above all others the manufacturers and the teachers should come to an understanding, if for no other reason because of the enormous practical difficulties which surround it from the educational side, owing to that extreme heterogeneity which is not and cannot be realised by any teacher of pure science who has not had practical experience as a manufacturer. The discussions by the Birmingham and Liverpool Sections last autumn are particularly valuable from this point of view as they practically centre round this aspect of the technical education question.

The Requirements of Chemical Industry.

It is impossible to hold any profitable discussion as to the nature of the training or the place of training unless we discriminate between the two classes of students referred to. I believe that in the Midland Counties, the distinction is emphasized by speaking of the man who is carrying on research work in connection with an industry as the "technical chemist" and the man who is conducting the factory operations as the "chemical technologist." But this is simply a question of terminology, and as long as we know what kind of student we are talking about there need be no confusion. The research chemist may be disposed of at this stage by defining him as a man who has received the highest possible training as a scientific chemist and whose originality and resourcefulness have been developed by prolonged systematic research. It is therefore quite immaterial whether he receives his training in a University or in a Technical College, provided that the staff and equipment are efficient, although, of course, by virtue of their functions, the Universities

in this country have the advantage over the Technical Colleges taken as a whole.

But when we come to the consideration of the chemical technologist, there must be much more discrimination between the requirements of the different branches of chemical industry by both teachers and manufacturers before the conflicting views can be brought into harmony. For this reason I think that the recent attempts to introduce some order into the chaos by Prof. Donnan and Mr. Heathcote, in the papers which led to the discussion in the Liverpool and Birmingham Sections last year, are welcome contributions to the subject, although, as you are aware, the University aspect of the question has been mainly dealt with. It appears from these discussions, and from the replies to the queries circulated by the Birmingham Section, that many of the contributors had in mind either the research chemist pure and simple or the technologist pure and simple, and others seem to imply that both faculties can be combined in the same individual. As I have just said, this combination is practically unrealisable from the teachers' point of view, and if insisted upon in the factory, can only result in crippling the efficiency of both the chemist and the technologist.

The requirements of a chemical factory are capable of being broadly classified under certain distinct headings.

(1) Research for the discovery of new products or new processes for producing known substances, or for the improvement of processes already being carried on.

(2) Supervision of the factory operations with respect both to plant and products, and requiring as an accessory the valuation of the raw materials and finished product as well as in many processes the testing of the intermediate products.

(3) A knowledge of the state of the markets with respect to the supply and cost of raw materials and the demand for the finished products, and the most advantageous means of introducing the latter to the consumers.

It is not pretended that this classification is exhaustive, but I think it covers the ground sufficiently for the present purpose of further discrimination.

Development depends upon a combination of all three. If No. 1 is ignored then Nos. 2 and 3 may serve to keep certain staple industries going for a longer or shorter period at the risk of extermination by No. 1. Many of the older industries in this country have for a long time been maintained under Nos. 2 and 3. It may be prudent to raise the question incidentally whether this state of affairs is likely to continue indefinitely. The answer to this is bound up with an intimate knowledge of the actual state of particular industries which I do not pretend to possess, but in so far as it is connected with the research question, something more will be said later.

No. 1 is primarily the function of the research chemist, backed up by Nos. 2 and 3. Whether this kind of work shall be done in the factory itself or elsewhere is a subordinate point, which may be discussed subsequently, but I wish to associate myself with those teachers who insist that this work is an essential requirement of every branch of chemical industry.

No. 2 is a heterogeneous requirement and is met by various people between whose functions, even if they overlap, it is necessary to discriminate. There are directors or managers in charge of the whole factory, there are foremen in charge of particular operations, there are mechanical or engineers responsible for plant and machinery, and there are labourers whose duties it is to carry out the various operations. The valuation of materials is the work of the analyst, and may or may not be done in the factory. The "works chemist," as understood in this country, must be considered as coming in one way or another under this category. Requirement No. 1 is not frequently complied with in the exclusive sense; if recognised generally overlaps No. 2.

No. 3 is the work of the office—the commercial intelligence department, or, I should prefer to say, the intelligent commercial department, and may be carried out by people having none of the qualifications of Nos. 1 and 2. I dare not attempt to deal with this requirement from the educational point of view, for I am fully aware of my own ignorance.

I feel that it is almost necessary to apologise for bringing these very elementary considerations before this Society, but I claim forbearance because I am taking advantage of the opportunity for addressing also the teachers, at the nature of the educational problem with which we have to deal must be fully realised. Also I would call attention to an omission which has no doubt been supplied by many present, and that is the status of the proprietor or director of a chemical factory. This also is an educational question, because it is evident that the success of any factory is largely dependent upon the policy directed from above, and that policy should be based on a full knowledge of the requirements Nos. 1, 2, and 3. Of course I do not necessarily mean an expert knowledge but a general knowledge, and the deeper it goes and the more completely the proprietor or director is in touch with the various requirements specified, the better will it be for the success of the concern. It is certain that the manufacturers of my own and preceding generations had no such facilities for obtaining a scientific training in this country as are now available for the future generation. No less certain is it that chemical science, and with it chemical industry, is developing rapidly, and the manufacturer of the future will have to be far more thoroughly imbued with the scientific spirit than his predecessors. The problem of the education of the industrial chemist must, in fact, be made to embrace the education of the proprietor, for, upon his training, *i.e.*, his "attitude of mind," will depend the future of his industry.

And now if we come back to the technical education movement which had for its object the improvement of our manufacturing industries, it will be found that our subject the current has been flowing mainly in the direction of the second of the foregoing requirements. There are a few notable exceptions to be found in certain institutions here and there which it would be invidious to name, and which, for the present, may be left out of consideration. The discussions about education in applied chemistry have, from the manufacturer's side, tacitly, if not explicitly, taken it for granted that the teacher is to supply chemical technologists. If the manufacturers have left out the research chemist they are to blame; if the teachers have harped so strongly upon the research chemist as to pour contempt upon the much despised hybrid chemist and engineer, they are equally to blame. Whether our chemical industries are progressing or stagnating or declining, you know much better than I; but whatever may be the actual state of affairs, to suppose that by research alone without technological co-operation we shall be saved is simply preposterous. As already stated, the education of the "works chemist," is no less pressing from the industrial point of view, than is the training of the research chemist. Indeed it is more pressing, because, given a student with the necessary faculties, we can develop those faculties in our educational institutions. Whether manufacturers will make profitable use of him when we have turned him out depends upon themselves, but with respect to the particular product which we of the Technical Schools are supposed to furnish, there is such conflict of opinion and divergence of requirements that I feel it necessary to repeat once again that we are here confronted with one of the most difficult problems in the whole range of technical education.

The "works chemist" as defined, and excluding the pure mechanic or engineer, must be qualified, according to the post which he is called upon to fill, to come under category No. 2, with (possibly) an incursion into the domain of No. 1. He would presumably be placed in a subordinate position at first and, let us hope, have a prospect of promotion. The analytical side of his training offers no particular difficulty and need not be further considered. The extent to which the factory workman shall be brought within the range of technical education is an open question. This, although a digression from the main theme, is a point on which the manufacturers would do well to let us have a definite expression of opinion. As far as my experience goes, and I believe that the majority share this view, such rudimentary smattering of chemical science as he could get by attending evening classes would be of no real use, and if his education is

to be considered by the Technical Schools at all it is certainly not from the chemical side. This matter may not appear of pressing importance to the manufacturers, but to the teachers it is really one of considerable importance because it involves a question of principle which for many years I have been endeavouring to make clear. The "platform cry," if I may say so, of the modern technical education movement was the education of the workman or artisan. At first we heard very little about any other class of person. This was due to that cause which I have already specified—the prepotency of the engineering influence. Not the least disparagement is intended by this assertion, because, from the engineering point of view (using the term in the broad sense of constructive mechanical industry), those who promoted the new education were of opinion that the skill of the workman would be improved by educating him in the scientific principles underlying his occupation. That seems a sound principle; how far it has been successful in practice is a question for experts, but so far as we are concerned I have pointed out again and again that the workman in a chemical factory is not the analogue of the skilled artisan of the engineering workshops, and that the handicraft view of the technical education is worthless from the point of view of the chemical manufacturer. Moreover, the chemical workman himself, as far as I know him, is a very intelligent type, and he knows that the success of his occupation, provided he discharges his duties faithfully, rests entirely in the hands of the higher powers. If the manufacturers agree on this point, it would be of immense value to the cause of technical education in this country if they would unhesitatingly proclaim their views.

The difficulty of meeting the requirements comprised under the second heading is due to a combination of circumstances which call for consideration by both teachers and manufacturers. By the "works chemist" (excluding the analyst, the mechanic, and the workman), I mean a chemist with more or less knowledge of the general principles of engineering as applied to chemical factory plant. He cannot be too much of a chemist, and the more he is of an engineer the more competent will he be to discharge his duties. Now the first difficulty that confronts the educational authorities is, where is this combination of qualifications to be acquired? That resolves itself again into a question of ways and means. But before attempting to deal with this part of the subject let us endeavour to come to some understanding concerning the engineering requirements. It must be realised by the teachers—and this cannot be too strongly insisted upon—that no fixed standard of engineering qualifications for chemical industry as a whole can possibly be set up. It is a sliding scale. There are some industries in which a small number of chemical reactions and a few products are concerned and in which the whole success turns upon the perfection of the plant. There are other industries in which large numbers of very diverse chemical reactions are carried out, each requiring its own special plant. In one class the engineering requirements predominate and in the other the chemical requirements. Between these extremes there is every possible gradation. When, therefore, chemical industry calls for "technically" educated chemists, one manufacturer may have in mind a man who is primarily an engineer and another manufacturer a man who is primarily a chemist. If technical education can do anything for chemical industry—as we believe it can—it must be realised that this is the state of affairs which the educational establishments have to meet, and it must also be borne in mind that there are factories of every degree of organisation, from the large works where the division of function between chemist and engineer is sharply defined, down to the smaller and much more numerous works where there is no division of function. In view of this state of affairs—in view of the circumstance that every manufacturer who expresses an opinion is reading into the requirements of the "works chemist" the requirements of his own industry, and in view also of the fact that the engineering side of the education has hitherto been more or less neglected in this country, it is not to be wondered at if our educational machinery has so far been found incapable of dealing

with all the conditions presented to it. That is why it is so desirable for the manufacturers and educationists to co-operate in developing a constructive policy for the guidance of the teachers and for the equipment of our factories with the most efficiently trained men. It is satisfactory to note, by the way, in this connection, that several of our leading members took part in framing the scheme for the Technological Examination of the Institute of Chemistry.

The Nature and Scope of the Preliminary Training.

The kind of education most suitable for the student who is preparing for a career in industrial chemistry may be considered at first from the point of view of the Technical School or College, because that is the class of institution which, theoretically at any rate, was established with the avowed object of doing this work. If any of them have since their foundation undergone a change of function so as to become cramming establishments, that is a deplorable degeneration from which the manufacturers ought to have helped to save them. In order that the situation may be fairly grasped by both teachers and manufacturers, I will invite attention to the historical development of the technical education movement, and, for the sake of brevity, it will be sufficient to speak at this stage of Technical Schools in the abstract without reference to rank and without attempting to discriminate between Colleges and Polytechnics. So far as my memory extends, the movement was by no means welcomed at first by the various industries concerned. In some cases it was openly opposed, the hostility coming chiefly from those industries where the apprenticeship system prevailed, and where the possibility of receiving training outside the existing establishments threatened to do away with the emoluments derived from premiums. Added to this there was the genuine belief that the college-trained youth was a helpless being in workshop or factory, a survival from the period of the purely academic teaching of science in the Universities. It happened also that the movement was set going at a time when electricity as a branch of applied science was advancing with rapid strides, and the demand for "technical" electricians filled the classes in this subject. But although the engineering industries were the first whose "vested interests" were attacked, we must do them the justice to admit that the former opposition from this quarter, if not wholly extinct, has at any rate almost entirely subsided, and it is the engineers (including electrical engineers) who have been the first to set their house in order or, in other words, to take an enlightened view of the function of the Technical Schools with respect to their industry. The chemical manufacturers at first took little or no interest in the movement; I believe the majority held the same view as the engineers—that the college-trained student was not only a useless, but even a dangerous person to let loose in a chemical factory. I am not sure whether this belief is even now extinct. When therefore the new departure in educational methods began to obtrude itself upon the notice of the chemical manufacturers, who were largely stimulated by the general and technical press and by certain teachers at home, as well as by the example set by other countries abroad, the first point that the technical schools had to meet was the demand for what were called *practical* as distinguished from theoretical men. It used to be the custom in my younger days to speak of theory and practice as two opposing forces or antitheses—it was thought that success alone rested with the practical man and that the merely theoretical man meant disaster. The development of both chemical science and of chemical industry since that period has done much to break down this antagonism, but, if theory and practice are not yet completely welded in the mind of our manufacturers, we have arrived at this common understanding, that the training of the "works chemist" must begin with a thorough grounding in the general principles of chemistry and allied sciences.

The Technical Institutions in carrying out this part of their work have as the raw material of their branch of manufacture the lad who is supposed to have completed his ordinary school education. I am not now considering

evening classes because this phase of technical education, as I have frequently pointed out, cannot seriously influence the development of chemical industry excepting under certain very special conditions which may be referred to later; the student who is entering for a complete systematic course extending over at least three years is the future chemical technologist with whom we have to deal. In spite of an entrance examination which is imposed by the higher Technical Colleges, our raw material is by no means of uniform quality. Both individual differences and the ordinary school training have to be reckoned with. The latter factor opens up another aspect of the education question which is beyond the scope of this address, although the scientific attainments of the students who enter our colleges with the object of becoming industrial chemists must evidently be a matter of concern to the teachers. It may be of use therefore if I state at once that the general experience of our staffs has led to the conclusion that on the whole we much prefer that the students entering our College Chemical Departments should have had no previous school training in science. Such training is generally too shallow to be of use; it has only the effect of stiffening the mental attitude to the point of conceit and of making these students less teachable than those who have not been through the school science classes. I am afraid this is tantamount to a declaration that science teaching in the schools is defective. From our point of view it certainly is, and in calling attention to this opinion, so generally held by the teaching staffs of the Technical Schools and Colleges, it may be well to point out that it is not the principle but the method which we are attacking. There is no reason why school science should not be taught in such a way as to make it of real preparatory value. This question of juvenile science teaching is of course a very well worn topic, but I am glad of the present opportunity of acknowledging that any improvement which may have been effected in this direction of late years is largely due to the persistent campaign carried on by my colleague Prof. H. E. Armstrong who, more than any other educational authority, has helped to inculcate the sound doctrine that science teaching consists on the training of *faculty* and not in cramming the memory with disjointed scraps of information.

But in spite of the efforts of the reformers of school education the science teaching, judging from the results offered to the Technical Schools, show that there is still ample scope for improvement, and the present opportunity is a favourable one for bringing this state of affairs under the notice of the manufacturers. If we wish to see our factories staffed by "home made" chemists it is obvious that the higher the plane on which the Technical College can begin its work the more efficient will be the finished product. The teachers in these colleges are unquestionably in a better position than any other class of teacher to realise the defects of school science teaching; it is they who are confronted with the products of this teaching year after year, and it is they who are called upon to fill in the gap between the school period and the entry into industry with a training during which the student must be imbued with the scientific spirit as a living force. It is the *reality* of science when taught with a view to its applications in industry that has enabled this class of teacher to do good service to the cause of elementary science teaching. It is not going too far to say that the amelioration in science teaching in every grade—from the elementary school to the University—during the last quarter century is mainly attributable to the reaction of "applied" science teaching upon "pure" science teaching. The stimulus to reform has come from those who, by virtue of their knowledge of the practical requirements of the technologist, have had brought home to them in full force the shortcomings of the old mnemonical and didactic method which had been so long prevalent in this country. If, for our industry, the requirements of chemical technology call for still further reform in the elementary teaching of science during the schoolboy period, the manufacturers would do good service to the cause of education if they would make their voices heard also in this direction.

The practical outcome of the existing state of affairs

s that at the Technical College we have to begin from the beginning. In dealing with the nature of the training therefore we have to consider the subjects which are necessary and the time over which the training should extend. On this last point there is some divergence of opinion. When I first entered the Finsbury Technical College in 1885, two years were considered sufficient. It was soon found that this was inadequate, and the course was extended to three years. I certainly think that this period should be taken as a minimum. With respect to subjects it is perhaps only necessary to refer to the published programmes where the courses laid down by the various Technical Schools are set forth in detail. But in connection with certain questions of principle underlying the curricula of the Technical Schools it seems desirable to make use of this opportunity for again bringing the teachers and manufacturers into the arena of discussion.

In the first place it is absolutely necessary to come to a understanding as to what can and what cannot be done during this three years' training; in other words, the function of the Technical College in relation to our industry requires defining with a degree of precision that is indispensable if the teachers and manufacturers are to be mutually helpful. The case may be stated in these terms:—A youth fresh from school with, let us say, no preparatory scientific training, has in the course of three years to receive that thorough grounding in the principles of chemistry and those allied sciences which are necessary to qualify him for becoming a "works chemist" as defined. If we consider critically what this means in the light of the known requirements of chemical industry must be conceded that this is what would be called a large order." The question is how far can the teachers execute it? Of course there are Technical Schools of various grades, but from our point of view it is *only* those which have organised curricula for day students which need be considered here. Now the subjects which, in addition to chemistry, are generally considered indispensable for the future chemical technologist are mathematics, physics (including electricity), and mechanics, including drawing-office practice. It is essential to emphasise the point that at this stage we are concerned only with the fundamental principles of these sciences; a practical application to particular industries cannot in our subject be attempted. We hold, and I think solely, that any attempt at specialisation before the soundwork of scientific principles has been laid is absolutely wrong both from the educational and the industrial point of view. Now it takes at least two years with the average student to lay what may be called an elementary foundation in these subjects, and so there is left but one year for more advanced instruction. How far then does the course enable us to turn out a youth who can be described as more than a potential chemical technologist? Chemical manufacturers have a perfect right to challenge the application of the prefix "technical" as descriptive of institutions. The course which I have outlined cannot meet the conditions specified be honestly regarded as more than a preliminary training. It does not and it must not pretend to add to the scientific training that something more" which is necessary for the technologist. There is no time for specialisation and there are not very few Technical Schools in this country (exclusive of Universities) where specialisation is possible. The case is in reality even worse than this; the handicraft theory of technical education was for so long predominant that there were at first only a very few Technical Schools working up to the level of systematic and organised curricula, although, I am glad to say, of late years there has been some advance in this direction. But if any general and substantial development in the qualifications of our "works chemists" is to be brought about, the manufacturers and the parents of our students will have to realise that we must have sufficient time for our work. The half-trained youth is not a fair criterion of the possibilities of technical education. It is unjust to the schools and colleges; it is a most shortsighted policy, and it is seriously damaging the cause of chemical industry when such men are taken into the factories. I speak strongly on this point it is because I feel strongly.

This "scamping" of the education of our future technologists is one among the many difficulties which hamper the work of the Technical Schools and which provokes the hostility of educationists, who naturally read into this reluctance to give sufficient training the national attitude towards scientific education in general, and towards industrial development in particular.

It might be inferred from this declaration of policy that I have altogether given away the case for the technical education of the "works chemist"—that there is nothing more being done in our Technical Schools and Colleges than such ordinary general scientific training as might have been given anywhere else; that such institutions are not "technical" in the manufacturer's sense at all, and that there was no need for bringing this new educational machinery into existence. It is needless to say that from the teacher's point of view such an inference would be quite erroneous. In the first place it may be pointed out that before the technical education movement was initiated there were only a very few institutions in this country where an adequate training could be given. Indeed there was no attempt in any institution, excepting perhaps the Royal School of Mines, to organise the curriculum with special reference to the application of science to industry. The Universities at that time looked askance at "applied" science. We had to pick up our education as best we could; a course of chemistry here, a course of lectures on physics there, and a course on mechanics by purely lecture-room method somewhere else. Strangely enough mathematics was not taught as an integral part of the system, but had to be acquired as an "extra," and the same was true for modern languages. It was to co-ordinate the science teaching and to give opportunity for training in all the necessary subjects in the same institution that the modern Technical Schools were called into existence. Where these institutions are discharging their functions adequately we claim therefore that a kind of training has been made possible that was impossible before the initiation of the movement. Had such opportunities for the would-be chemical technologist existed in my younger days we should have heard less about the antagonism between "theory" and "practice," and I think it more than probable that I should have been addressing you from this chair as a manufacturer rather than as a teacher.

Not only has the technical education movement given us a new class of science school, but as I have already said, the reaction upon the teaching of science both pure and applied has been most beneficial. How far particular Technical Schools are really capable of doing for chemical industry that which they are supposed to be doing for other industries is a matter for further consideration, but on behalf of those which are doing their work efficiently it may be fairly claimed that their finished products are far better equipped for becoming technologists than was formerly possible. To this extent the movement can and should be regarded as a valuable addition to our national educational resources. Whether the manufacturers will admit that the training is in any way "technical" is partly a matter of definition and partly dependent upon the kind of teaching. I have admitted that our courses are preliminary and I agree with the manufacturers that a chemical technologist is a chemist plus a great deal more, and the next points that arise are therefore (1) whether the technical education can be developed into technological training, and, if so, where? (2) Whether the teaching in the Technical Schools can in any way be made to approach the diversified requirements of the different branches of chemical industry so as to make the preparation for technology more effective. In other words, can the teachers go further under the present system in delivering over to the manufacturers men of a higher degree of preparedness than was ever before attempted? These two questions require separate handling, and the latter, with which I propose to deal next, involves the consideration of the curriculum in somewhat greater detail.

The Nature of the Science Teaching in Technical Schools.

In dealing with this subject I am fully aware that I am entering into a controversial atmosphere and I can

do no more than give expression to personal opinion based on experience of both sides of the question. The practical difficulties which are encountered in carrying out any scheme of instruction which could be regarded as ideal from the manufacturer's point of view—and that, be it remembered, is nominally our function—i.e. both internal and external. From the outside we have manufacturers and parents interposing difficulties or laying down conditions which, if complied with, would strike at the very root of the principle of modern technical education. I think the "blessed word" *technical* is responsible for some of these external difficulties. A parent enters his son at one of our colleges because it is "technical," and in his mind that term conveys an impression that the teaching is practical as distinguished from theoretical. The traditional parent who told the Professor of Chemistry that he did not want his son "to learn about atoms and molecules and benzene rings and all that rubbish," but that "he wanted him to be taught how to make soap," is not, or at any rate was not, a mythical person, because this educational feat was actually expected from me soon after taking up my duties at Finsbury. Fortunately I was enabled to meet the parent on his own ground by sheltering myself behind the excuse that our college had not yet developed a soap-making wing, and that we were therefore not in a position to admit his son. It is to be hoped that this type of manufacturer is extinct; but I relate the experience again because it is thoroughly illustrative of the spirit in which the technical education movement was at first received by many manufacturers, and it is that spirit which had to be allayed—I may add with much expenditure of energy on the part of the teachers—before the true function of technical education with respect to chemical industry could be rightly appreciated.

Coming in the first place to the teaching of chemistry, let it be at once understood that so long as we are concerned with fundamental principles there is only one chemistry whatever future the student may have in view. And let it be further understood that the sound teaching of the general principles of our science involves just as much theory as practice. Mr. Heathcote and Prof. Donnan's remarks on this subject in their papers leading to the discussions at Birmingham and Liverpool are very much to the point. This situation must be grasped, and the sooner the better. Any manufacturer who imagines that practical chemistry is the peculiar possession of the Technical College and that theoretical chemistry is only of use for degree-winning purposes is labouring under a serious misapprehension. The scientific groundwork which by agreement is to be laid during the preliminary training is essentially a theoretical groundwork—it is the abstract summary of our existing knowledge of facts with attempted explanations of the grouped facts by general hypotheses which in turn prompt the discovery of new facts. That is the method by which our science, in common with all other sciences, has been built up. The most practical of our manufacturers must admit that the doctrines which are inculcated in the laboratory or lecture room are the outcome of scientific theorising. To teach or to let the student learn for himself the facts only is to put back the hands of the clock. Such training, however "technical" it might be considered, is of no real value as an educational discipline; it would be of less use in fitting the student for a career in industrial chemistry than would be a prolonged drilling in the dead languages. To divorce theory from facts is to kill the training of the imaginative faculty; the result of devalued teaching of this kind is the production of pedagogues of the narrowest type for teachers and of mere labourers instead of chemical technologists. Just as imagination, fed by facts and stimulated by theory, has developed and is developing pure science, so will it develop applied science, dependent as is the latter upon scientific discovery for its advancement. I have felt it necessary to put forward this plea for what many are pleased to designate "mere theory," not only because of the possible existence of manufacturers of the type exemplified by the parent referred to above, but also because I am persuaded that even now there are many manufacturers in this country who do not realise how largely their

industry is the product of scientific theorising. Had their operations and processes been made to depend upon facts only irrespective of any connecting theoretic principle it may safely be asserted that chemical industry would still remain in that state of empiricism which the whole tendency of modern development is to eliminate. In a remarkable address delivered by Prof. Lyon (afterwards Lord Playfair) 58 years ago under the title, "The Study of Abstract Science essential to the Progress of Industry," being the introductory lecture to the course of chemistry at the Royal School of Mines for the Session 1851–1852, occurs a passage which bears so closely upon this subject that I will quote it in full:—

"Intellect is on the stretch to get forward, and the nation which holds not by it will soon be left behind. For a long time, practice, standing still in the pride of empiricism, and in the ungrateful forgetfulness of what science has done in its development, reared upon it the old and vulgar adage 'an ounce of practice is worth a ton of theory.' This wretched inscription acted like a Gorgon's head, and turned to stone the aspirations of science. Believe it not! for a grain of theory, if that be an expression for science, will when planted like the mustard-seed of Scripture, grow and wax into the greatest of trees."

If therefore the teaching of chemistry in the Technical Schools is to be of the ordinary kind there still remain the question, as yet only partially met, whether there was any necessity from the manufacturer's point of view for creating this new class of institution. The answer has to some extent been given in calling attention to the co-ordinated courses of instruction made possible in these schools. I should now like to add that the demand for a training in chemistry with a view to its subsequent application to industry has enabled us to improve on chemical teaching so that our finished products are distinctly better chemists as chemists than were ever turned out in the same time under the old system of making gas and "test-tubing" for acids and bases. This improvement we claim unhesitatingly as one of the results of the modern technical education movement.

The "technicalising" of Chemical Teaching.

If then as manufacturers we now acknowledge that the teaching of theory is as indispensable as the training in experimental facts, I am prepared to make a concession to chemical technology which for various reasons will probably be rejected by the teachers, or at any rate, by a majority of them. It is really the answer to the question previously raised—whether the teaching in the Technical Schools can be made to approximate more towards the requirements of chemical industry than was formerly possible. Speaking at present with respect only to chemistry I believe it can. Were I unable to justify this belief, I am bound to confess that these newer institutions could claim to be discharging no function differing in any way from those discharged by educational establishments of all ranks in which chemistry is taught for purely academic purposes. The students we are dealing with have presumably taken up the subject with a view to its industrial applications. There is a goal—necessarily ill-defined at first—towards which their studies are directed. I am not considering students who are in training for becoming teachers nor those who have in view a career as analyst. It is open to question, whether the Technical College is the proper place for these two classes of students. It may be taken into consideration also that the average student has no definite view with respect to any particular branch of chemical industry; his object is to become qualified for any opening that may occur. Only rarely, at any rate in London, do we get the sons of manufacturers who are going into their fathers' works. The conditions are undoubtedly different in those districts in which there are Technical Schools in the great centres of chemical industry. But this want of definite outlook is no real disadvantage in fact, from the educational point of view it is a distinct advantage because it compels the chemical teaching to take that general form which at this preliminary stage of training is alone permissible. It is agreed that specialisation should follow and be based upon the general training. It is this specialised training which strictly speaking is the

real "technical" education from the manufacturer's point of view.

But if we cannot get to the "technical" stage as thus defined under the conditions which we have to cope with in the existing Technical Schools, the chemical teaching can be given a bias in that direction without in any way detracting from its value as an educational discipline and without the least damage to its theoretical treatment. Consider the main purpose for which the chemistry is taught. Chemical manufacture in general terms consists in converting certain raw materials into useful products with maximum yield and minimum expenditure in the cost of production. If the teachers will bear this definition in mind it will I think be admitted, at least in principle, that it is possible to give a "technical" bias to the teaching both in the lecture-room and laboratory. When the general elementary course has been passed through and a fair grasp of fundamental principles has been acquired, the systematic treatment of elements and compounds, say in the second and third year courses, can surely be developed in much greater detail in cases where technical products are concerned. There is just as much pure scientific doctrine to be deduced from the study of useful products as from the study of useless products. The utilitarian view which the old-time academic teacher considered as derogatory should loom largely in the teaching of the Technical Schools. It is not contended that special detailed courses on particular industries should be attempted at any stage of the preparatory training. There is no time to teach technology in the strict sense, but there is time to prepare for technology, and the better the student is prepared the shorter will be his period of probation when he passes on to the higher stages of technological training in college or factory. If this spirit does not pervade the teaching I see no reason for our existence as Technical Schools.

All chemical manufacturing operations may be regarded as special illustrations of general principles, and by the skilful teacher may be made use of as such in dealing with advanced students. It will help the teaching considerably if it is brought home that a manufacturing operation is essentially a scientific operation—at least quite as scientific on a scale of hundredweights and tons as on a scale of a few grams. Moreover, the chemical reaction concerned in a manufacturing operation is associated with an element that was absolutely ignored in the old teaching of chemistry: I refer to the *economic* side of the reaction. Consider the training in our own days of studentship. We mixed our reagents indiscriminately and we made our preparations with a lavish expenditure of materials that would spell ruin if magnified to a manufacturing scale. What matter if we failed?; the sink was at hand, and the storekeeper round the corner with fresh supplies. From the point of view of the future technologist such teaching cannot but result in complete infitness for factory work. It is the duty of the Technical Schools to introduce this economic element into the teaching of chemistry, and that is why I am pleading for the "technicalising" of the curriculum. If this side of chemical teaching has hitherto been neglected it can only be because it has no examination value.

My views on this subject will be regarded as very heterodox from the purely academic standpoint. I have but little hope that they will be generally accepted at present, but if they coincide either partially or wholly with the views of chemical manufacturers it is from this Society that the educational world must receive authority for their adoption. As it is of great importance that there should be no confusion of ideas on this subject it may be advisable to reassert that by giving a technical bias to the teaching it is not proposed that technical chemistry in the sense of chemical technology, which is a specialised subject, should be made a part of that preliminary training which up to this stage I have alone had under consideration. It is necessary to arrive at a clear understanding on this point, because it will be remembered that in 1896-97 a special committee of the London County Council Technical Education Board was appointed under the chairmanship of Dr. W. J. Russell to consider the question of the teaching of chemistry, and some manufacturers laid it down in their evidence that

technological chemistry could not be taught in the Technical Schools at all.* That opinion had, I believe, much to do with the stereotyping of the academic traditions of chemical teaching, because the majority of teachers failed to realise that the manufacturers who expressed these views had really in mind the *technique* of particular industries. On this point I shall endeavour to show later that there has been want of discrimination and that the views expressed by the representatives of these industries have been unwarrantably spread over the whole field of chemical industry. But with respect to the present plea it is clear that these views do not tell against that technical bias which can be given to the teaching at a certain stage, which stage must obviously depend upon the status of the school or college.

Any opposition that may be offered to these suggestions will no doubt be based upon the practical difficulties connected with the carrying out of such technicalised teaching. That there are practical difficulties I do not deny; with respect to the teaching institutions the difficulties are both internal and external and it may be useful to point to some of them. In the first place there is the teaching staff. The ideal teacher for the Technical School is the man who can add to his teaching qualifications factory experience in some branch of chemical industry; unfortunately for the schools such men are rare. The man who has factory experience only is generally a very bad teacher, and, on the other hand, the teacher who has had no technological experience is too bookish. Then there is the difficulty of not being able to describe or illustrate the actual manufacturing processes. The average teacher has no time for keeping himself acquainted with the latest development of chemical industry, and if he attempts to deal with the technological side of such subjects as have a technological side he generally retails text-book information. I am sure the manufacturers will support me when I state that the majority of existing text-books, however admirable as scientific treatises, are generally erroneous, misleading, and antiquated in their treatment of manufacturing processes. The later developments both in the purely chemical theory and in the actual *technique* of manufacturing operations are the common possession of experts in the various branches of our industry years before they find their way into the text-books and through these into the Technical Schools. It is, I am afraid, unavoidable under our present system that the teaching staff should consist as a rule of men who have approached the subject from the academic rather than from the technological side, and who do not therefore possess any expert knowledge of chemical industry either in its general or special aspects. The tone of the teaching naturally reflects the training of the teacher, and that is why technicalised teaching is not likely to find much favour under existing conditions. Another difficulty of an external character arises from the circumstance that the manufacturers are not as a rule willing to allow students or teachers to see over their works, and thus the most important of all practical demonstrations—the actual manufacturing processes in operation—are not generally available for educational purposes. In the London district a few industries are liberal in this respect, notably gas and tar works, and breweries. I do not know how far the provincial schools have facilities given for visits to works, but speaking generally and on patriotic grounds I should like to take this opportunity of pointing out to the chemical manufacturers that they can further the cause of technical education considerably by allowing such students to visit their works. Of course, as Mr. Bailey has recently pointed out in his address to the Association of Technical Institutions, there are certain industries in which this is inadmissible, but my plea is not intended for such cases.

With respect to laboratory teaching in the Technical Schools there is also scope for "technicalisation." An

* The Report of this Committee was published in the London Technical Education Gazette for January, 1897, Vol. III., pp. 7-27. Another special Sub-Committee, under the chairmanship of Mr. H. J. Powell, was appointed subsequently to report upon the general question of the relation of Science to Industry. Their Report was published in a separate form by the London County Council Technical Education Board in 1902.

elementary drilling in experimental methods for the development of manipulative skill and the co-ordination of the reasoning faculty with the results of observation must of course be gone through. In so far as this stage of the work is general it calls for no special modification to suit the requirements of any particular class of student. It may be pointed out however that the elementary laboratory work of the modern chemical student has been raised to a very much higher scientific level than that which was considered sufficient in our younger days. The "practical" chemical training of the former generation is no doubt still fresh in the memory of many of us; the preparation of a few gases, the qualitative analysis all beautifully tabularised so as to prevent our learning any chemistry from our work, the quantitative analysis of a few stock salts, and, if we were advanced enough, a little organic and gas analysis. It was essentially a drilling in chemical analysis, and I am afraid that very imperfectly trained chemists were turned out under this régime, especially from the technological point of view. I do not undervalue analysis as a part of chemical training; on the contrary for the technical student I think it most important, and a certain amount of time may be allotted to it in the curriculum with advantage. But that differs from making analysis the whole practical training. Also it may be pointed out that even analysis is not a purely mechanical series of operations, but that there are scientific principles underlying these operations and it is for the teacher to see that the analytical work is not allowed to degenerate into mere chemical handicraft. With advanced students there is no reason why technical products should not be given for identification and analysis; it adds much to their interest in the work. But it is unnecessary here to dwell at too great a length upon the general practical training, although I should like to add that if the level has been raised and if our teaching has become more philosophical we are mainly indebted to a former occupant of this chair, Prof. Emerson Reynolds, who is unquestionably the pioneer reformer in the laboratory teaching of chemistry. I am glad of this opportunity of acknowledging the indebtedness of teachers to Prof. Reynolds because, amidst the later clamour, his share in the development of chemical teaching has been overlooked. The admirable series of little manuals on Experimental Chemistry which commenced with his Dublin introductory lectures in 1874 marked a new era in the methods of laboratory teaching; and, although developments in detail have since taken place, the fundamental principles which he laid down have undergone no modification; they are still the basis of all the most approved schemes of laboratory work.

In other directions also the laboratory teaching may be "technicalised," and to an increasing extent as the student becomes more advanced. A very excellent feature of modern laboratory work is the preparation of various inorganic and organic compounds from raw materials supplied to the student. This kind of work, if combined with the theoretical treatment in the lecture room, is of special value as introductory to the real technology, and it admits of the introduction of that very element which has hitherto been so much neglected; I refer again to the *economic* element. The technical bias can be made manifest. An ordinary student realises as the result of his own work that certain materials acted upon in certain ways with certain reagents can be converted into certain definite products. If properly led he follows the underlying chemical principles and if he has acquired a thorough grasp of those principles the educational value of this work is obvious. But valuable as is this work for the ordinary student it is woefully incomplete from the point of view of the technical student. It is not sufficient for the latter to know that from certain materials certain products can be obtained; he must realise that the value of his future work will turn entirely upon the question of yield and purity—in other words upon the cost of production. Why should not the "preparations" in the laboratories of the Technical Schools generally be made quantitatively? Many of the modern laboratory manuals dealing with preparations give the yields obtainable and, speaking from experience, I know that it gives zest to the work if the student is supplied with a known weight of raw material

and given to understand that the value of his results will be estimated by the yield and purity of his product. It is even possible to go further in "technicalisation" without in the least degree detracting from the educational value of the work. A series of preparations might be arranged in which not only the weight of the raw materials and of the final product were taken into consideration, but also the quantities of the various reagents used, and from these data, making sufficient allowance for the usual—not the laboratory—"working expenses," the actual cost of the product ascertained.

I know full well the objections that will be urged against this kind of work. The manufacturers will say that it is unreal, that it bears no manner of relationship to the actual factory results where the question of scale comes in, and that the cost of laboratory reagents or the value assigned to "working expenses" is too vague to lead to results of any commercial numerical value. The purely academic teacher on the other hand will say that such results, apart from their commercial inaccuracy, are of no scientific value as a discipline and teach no more than can be learnt from the ordinary preparation without any reference to cost. The "purest" of chemical teachers might even go further and say that the subject was being degraded by being put upon a commercial basis. It is needless to say that I do not admit the force of any of these objections or I should not be urging my case now. The results obtained, even if not comparable with factory results, may be made the basis of useful discussion in order to bring out the reasons for the discrepancy between the small and large scale operations. Quantitative preparations worked out from this point of view serve as most forcible object lessons by checking the reckless use of reagents and also by bringing home to the student on the *reductio ad absurdum* principle the worthlessness of his results if measured by the current commercial standard. In other words I believe it possible by introducing the economic element into the laboratory work of advanced students to make this work of more disciplinary value for the future "works chemist" than has hitherto been the custom.

Having, as it were, entrenched myself in this pit of heterodoxy I am prepared to meet the objections of the academic teacher by reminding him that in the most highly scientific of all "preparation" work, viz., the synthesis of new compounds, the whole truth is very seldom proclaimed. I hope that I shall not be accused of giving away the "mysteries" of my scientific colleagues, but it is very well known that the course of chemical synthesis very seldom runs so smoothly as to give a theoretically quantitative yield. In other words the synthetical compound may be the primary product or it may not, and in nearly all cases there are formed with the particular substance which we are aiming at secondary products which are just as much a part of the general chemical process as is the synthesised compound which we want. Now if these subsidiary compounds are crystalline or amenable to treatment by the ordinary methods of research we hear more about them, but if they happen to be tarry or resinous or indefinite we very seldom hear anything more about them. And so the synthetical achievement, as described by the discoverer, however brilliant as a piece of scientific work, is very often but a half-told story as measured by the absolute scientific standard. The tarry, resinous, and indefinite by-products are just as normal to the process as the definite compound which we isolate. If the latter should be a technical product the whole success of the manufacture may turn upon our being able to control the conditions of the chemical reactions so as to avoid or to minimise the formation of the subsidiary products and the degree of our success is a measure of our scientific achievement. If we look critically into some of the later developments of industrial organic chemistry from this point of view it will be seen that they are really marvels of achievement as pieces of purely scientific work. Now the success of a chemical reaction which results in a saleable product is only capable of being measured by a financial standard. The standard of scientific success and of commercial success can be expressed in the same terms—cost per unit of weight; there is nothing derogatory in extending

this principle to all preparation work given for laboratory practice whether concerned with technical products or not. The spirit of working at the highest economical efficiency must be cultivated in the Technical Schools, and the enormous importance of directing the resources of chemical science towards this end is best realised when the student is made to translate his results into commercial terms.

There is yet another possible extension of the principle of "technicalisation" in which I believe my heterodoxy is even more strongly pronounced. The mere statement of these views was at one time sufficient to insure being anathematised by both teachers and manufacturers, but as I shall probably never have a better opportunity of declaring the faith which is in me I claim forbearance while I state once again the case for large scale working in the Technical Schools. I am encouraged to do so by the fact that some of the contributors to the Birmingham discussion appear to have arrived at a similar conclusion and Prof. Donnan at Liverpool gave explicit utterance to the same view. To guard against any misunderstanding on this point I must however make it perfectly clear that my contention is for the introduction of the large scale practical exercise into the advanced stage of the preparatory training, while the plea put forward at Birmingham and Liverpool is for its introduction into the post-graduate or technological stage of the training. I do not know whether there is any real antagonism of opinion between us. It would of course be understood that my claim is only for comparatively simple large-scale preparation work as introductory to the more elaborate and advanced "technological" work proposed for the post-graduate course. At whatever stage however this kind of work begins the actuating principle is the same and has long been accepted by those teachers who have recognised the educational value of such work for those who are in training for chemical industry. The first difficulty which the college-trained student has to face when he enters a factory is his want of familiarity with large scale operations. His experience has been acquired with laboratory utensils and apparatus; he thinks in terms of grams and he finds himself in presence of plant dealing with hundredweights and tons. His beakers, flasks, retorts, and dishes have become magnified into tanks, vats, stills, jacketed pans, etc., and his gas burners have been replaced by furnaces, gas-producers, steam coils, and so forth. The laboratory failure which leads to the loss of perhaps a few shillings' worth of chemicals he now realises to be absolutely inadmissible in the factory when tens or hundreds of pounds' worth of materials are at stake. Can nothing be done in the colleges to make the student better prepared for this experience which he is bound to go through if he becomes a "works chemist"? It will of course be said that this kind of experience can only be gained in the factory and that no employer is likely to put a student fresh from college in a position where his inexperience is likely to lead to disaster. But if we as teachers admit the force of this argument, which is reasonable enough so far as it goes, I maintain that there is still scope for making a further advance in laboratory teaching towards the requirements of the manufacturer and so for providing the industry with a more efficient type of worker than was possible under the old system. My contention is, in brief, that with advanced students in the Technical Colleges the preparation work should be increased in scale so as to introduce an element of training in chemical handiwork. Lest I should be confronted with that awful bugbear of certain academic teachers, the working furnace run in connection with the metallurgical departments of one or two of the newer Universities, let me state at once that I am not now advocating the introduction of working models of special plant used in particular industries. The plea is for the handling of apparatus illustrating such general operations as are carried on in all factories—heating and cooling, evaporating, distilling, mechanical mixing, grinding, solution, filtration, etc.—on something more than the ordinary laboratory scale. The equipment for this kind of work is not very costly as compared with the cost of the elaborate machinery now used in engineering education. The contention that this kind

of experience unfits the student for factory work by familiarising him with fictitious representations of the real things has no real weight. The same argument was advanced in former times against the college workshop training of engineering students—that they were unfitted for their subsequent career by using tools and handling models which had no practical existence in the industry. I suppose every teacher of engineering in the country would repudiate this argument now. From our point of view I believe that a little experience of this sort, if properly directed, is of real educational value, and every Technical College worthy of the name should have a "chemical workshop" of the kind indicated. The teacher who allows the student to imagine that a few hours a week spent in preparing a few pounds or gallons of some chemical product will convert him at the end of his college course into a finished technologist is simply incompetent.

It must be clearly understood that this plea does not mean that the colleges should be expected to teach chemical technology in the strict sense—that is a quite distinct question; neither does it mean that *all* the preparation work should be done on this increased scale. It amounts in fact to nothing more than interpolating as a part of the laboratory training of the advanced student a certain number of hours' experience of a kind which cannot but render him better fitted for factory conditions. It is the extension to chemical teaching of the same principle which is now generally recognised in the mechanical laboratory training of the engineering student who is provided with working models from which he makes observations and takes measurements, and so learns fundamental principles irrespective of the particular piece of apparatus or model which he uses, and which may or not be like anything that he will meet with in his subsequent career as an engineer. More than twenty years ago I introduced this principle into our chemical curriculum at Finsbury, and although it has not been developed there to the extent that I should like, its soundness is borne witness to by the fact that a few of the newer Technical Colleges have equipped such "technical" chemical laboratories. I may particularly mention in this connection the Glasgow and West of Scotland Technical College.

Training in Collateral Subjects.

It is generally agreed that the preliminary scientific training of the works chemist shall comprise mathematics, physics, and mechanics, and I assume that the Technical Schools which are properly organised are provided with the necessary staff and equipment. It only remains for me to indicate a few of the practical difficulties which are experienced in carrying out this part of the work, because a better understanding of these difficulties by the teachers and the manufacturers may help to clear some of them away, or at any rate to lessen them.

In the first place it must be pointed out that there is no Technical School in this country which caters exclusively for the chemical industries. In general terms they are all schools of mixed subjects in which the engineering classes are generally predominant. In principle the teaching of these collateral subjects is the same as with the teaching of chemistry, that is to say, there is only a teaching of the general principles of the sciences concerned and no attempt at specialisation or true technological training. It is recognised in these other subjects, as in chemistry, that specialisation follows the general training. Now the teachers of these collateral subjects are, or should be, men of distinction in their respective subjects; that is to say, men who, superadded to their general attainments, have special knowledge in some branch of applied physics or of engineering, because these are the only teachers who are really in place in a true Technical School. That being the state of affairs, it is but natural that any bias which may perhaps unconsciously be given to the teaching of these other subjects is generally, I may say invariably, in other directions than towards applied chemistry. Of course it will be said that in principle there should be no bias; that the fundamental principles of physics and mechanics and such grasp of mathematical methods as is necessary for the proper understanding of these

subjects are the same for all departments of applied science. Theoretically that may be so and practically it is so up to a certain stage of rudimentary treatment, but sooner or later there is bound to come into the curriculum a development unfavourable to the chemical student and for a reason which does not appear to me to have been sufficiently taken into consideration. That reason is to be found in the circumstance that our subject, chemical industry, is already a highly specialised subject—much more so than the various branches of engineering, in which, however sharply separated they may subsequently become, the general preliminary training can be run on the same lines practically up to the end of the student's college career. In other words, the same chemical, physical, and mechanical training is sufficient for the future engineer at this stage of his education in whatever branch of the industry he may ultimately find himself. But the training in physics and mechanics which suffices to launch the young engineer upon his career cannot, in the nature of things, take the future works chemist so far into his career, because the engineering of chemical plant is quite a special branch of engineering, and practically all the engineering teaching in the Technical Schools is directed towards the civil, mechanical, or electrical branches of the industry. Even in pure physics, in which there is, so to say, a larger area of elementary groundwork capable of being occupied simultaneously by chemists and engineers, the divergence sooner or later tells in favour of the latter, because the physics of modern chemistry has also become more or less specialised.

These difficulties are well known to all who have had to deal practically with the education of technical chemists. They are partially met in various ways, such as by the interpolation of special lectures supplementing the general courses and developing the applications of physics to chemistry in those cases where physical principles have become of paramount importance. In the Universities of Birmingham and Leeds it has been found necessary to organise special courses of engineering for those students attending the departments of applied science other than engineering. It is not a difficult matter to arrange for the work of the chemical student in the drawing office to be of a special character, and my colleague, Professor E. C. Coker, has found that a course of drawing, which commences by exercises in tracing and pencil drawing from copies of the simplest pieces of machinery used in chemical works, can be readily expanded into a course of elementary design in which students are taught to make finished drawings from rough sketches. Chemical manufacturers will, I hope, support us in upholding the principle that the works chemist, even if he is never called upon himself to prepare plans for new buildings or plant, should at any rate have received sufficient practical instruction to enable him to understand a mechanical drawing intelligently and to co-operate with the works engineering staff with greater efficiency than if he had never had any training as a draughtsman. If this be admitted, there is no better period for such instruction than during the career at the Technical College; it is the one chance which the future chemical technologist gets during his student life of acquiring an art of great value in his profession, and an art which the older generation of chemists never had an opportunity of acquiring, for mechanical drawing was at that time considered an exclusively engineering subject.

My object in calling attention to this aspect of the technical education question is not only to make known more definitely to the manufacturers what we are actually doing, but also to enable them to realise the conditions under which the chemical student in the modern technical school receives his instruction in collateral subjects. Of course the ideal school from our standpoint should have its courses in these subjects laid down with a view to the special requirements of chemical industry, but under existing conditions this is obviously impracticable. The methods which I have indicated for dealing with this part of the training are confessedly of the nature of a compromise.

From Technical Chemistry to Chemical Technology.

I have thought it desirable to declare the educational policy of the Technical Institutions as understood by me,

not only because they have been left out of the recent discussions, but also because it would appear from many of the contributions to these discussions, that the actual work being carried on in some of these institutions in the required direction is not sufficiently known. Many of the proposals for the training of industrial chemists are quite familiar to us and many of them have been more or less realised in practice. It is of course possible that this work was known to the various contributors, but that they did not attach sufficient weight to the Technical Institutions as a power in the education of industrial chemists to refer to their work specifically. Perhaps there is some justification for this attitude—at any rate, nothing but good can result from the recent discussions if, in their light, we are led to re-examine our position in the schemes of modern technical education. I have frankly admitted that our finished product is a young man who cannot be regarded as a technologist in the strict sense required by this Society. It is only claimed that he has been prepared for a technological career. Can the Technical Schools or Colleges carry his training to a higher level? Can we turn out students more fully developed as technologists? I will not at present attempt to answer these questions from the point of view of the Technical Institutions in particular, because their consideration belongs to the general subject of ways and means, but in principle, and apart from any particular class of school, I have no hesitation in asserting that it is both possible and desirable to extend the college training far beyond this preparatory stage.

In making the foregoing assertion I am fully aware of the conflict of opinion on this subject. It must be realised that there are two distinct schools. The representatives of one school in principle say: Train a chemist as a chemist and then turn him into the factory for his "practical" (technological) education; this part of his training cannot be dealt with by any educational institution—it can only be acquired in the works. The adherents of the other school maintain that a training in chemistry and allied subjects—in other words, that the purely scientific education, however advanced, and admitting even the moderate amount of technicalisation here advocated, still results only in the production of a young man who has to begin his technological career very low down—practically from the beginning. Now these divergent opinions affect only the nature of the advanced training and not the question of period. Both parties agree that the preliminary training is inadequate for the student who is to become a works chemist in the best sense; the question really before us is: How and where can the educational period be prolonged with the greatest advantage? If it is maintained that the scientific education is all-sufficient and that the factory can supply the remainder, then the supplementary period would be devoted to advanced scientific work; we should be able to supply the works with more highly-trained chemists. On the other view it is held that the purely scientific training makes no provision for factory work—that as the student is nearing the commencement of his technological career his college work requires more specialisation in that direction, or, in other words, that the technicalisation of the curriculum should be carried to a higher level. This is the crux of the whole situation. Those among the teachers who are familiar with the requirements of chemical industry know that what is really wanted is a combination of the principles advocated by both schools of opinion—that the advanced training should be in the direction both of science and of technology. The practical realisation of this ideal is at the root of all the discussions which have been going on since the question of the training of industrial chemists was raised; it is undoubtedly the greatest difficulty with which the Technical Institutions have been confronted since the technical education movement was inaugurated. Partial solutions of the problem have been suggested from time to time, but these, in one form or another, are but modifications of that "sandwich" system which, however applicable to engineering industry, does not seem to be realisable in the chemical industries. Our manufacturers could not allow their works to be staffed by chemists who had to spend part of their time in the factory and part in

college. The problem would be simplified if we took the line of least resistance and divided our students for advanced work into two groups, which for brevity I will provisionally call "scientists" and "technologists." But is this desirable? Is this the course best calculated to supply our factories with the most efficient chemists?

Perhaps the best method of preparing the way for a better understanding on this point will be to follow out the extreme consequences of the two alternatives. According to one school, we should have a class of untechnicalised scientists; according to the other, we should have a class of unscientific technologists. We require either of these: we want scientific technologists. If the scientific chemist is accepted as all-sufficient, then by one stroke of the pen the whole work of the *bona fide* Technical College is struck out from the programme of modern chemical education. There was no necessity for the creation of a new class of educational establishment in order to train scientific chemists. If this is the class of chemist required, our factories could be supplied with any number of graduates from the Universities or other institutions preparing for degrees. But the technical education movement was really a revolt against academic training as preparatory for technology; it has long been admitted, if not explicitly stated, that such a curriculum is imposed for the ordinary science degree is not particularly well adapted for those who have an industrial career in view. Those who hold extreme views have declared that such a course of study is quite unfitting for such purposes. Indeed, some of the newer Universities have recognised the inadequacy of the ordinary science degree by allowing certain branches of applied chemistry to take rank in the curriculum for degree-winning purposes. This seems to me quite sound in principle, but the application is necessarily restricted by the particular branches of applied chemistry for which the University is equipped. As far as it goes this new departure, however, is such a distinct advance in the right direction from the point of view, that I have no hesitation in commending to the notice of the representatives of the particular industries concerned.

But this is a digression into a part of the subject with which I am not now dealing, viz., the functions of a University as a Technical School. The point that the manufacturers are called upon to consider is what kind of advanced training shall follow the preparatory training. If you are satisfied with a youth who has spent his three years at a Technical School, well and good—it is your business, not the teachers'. But most of us teachers—indeed certainly those who have had any experience in chemical manufacture—think that you ought not to be satisfied with this qualification. The chemical technologist is a chemist *plus* a great deal more—so very much more that, even with the most approved methods of instruction, we can do no more than place our finished student on the threshold of his industrial career. If you are satisfied with this moderate degree of training it may be justly urged that the modern technical education movement has not taken us as a manufacturing nation very far beyond that state of affairs which that movement is intended to remedy. Consider by way of comparison the qualifications expected from those who are being trained for other branches of applied science, and it will be seen that you have pitched your requirements at too low a level; you have handicapped yourselves by taking youths whose education, from your point of view, is what biologists would call a state of arrested development. In your interest and in the interest of chemical industry it appears to me that there is a gap between the preparatory training and the factory work which it is the duty of the educational institutions to bridge over. The recognition of this principle is at the basis of all the recent discussions, irrespective of the class of school where advanced training is to be given, and irrespective of the precise nature of that training.

Let me state at once—of course only as an expression of personal opinion—that for many years I have been of the opinion that the factory is not the proper place for beginning technological training. This I know is opposed to the views of those teachers who advocate the all-sufficiency of a pure scientific education. Many teachers who hold

this view have stated explicitly that if a student is thoroughly trained in scientific method and habit of thought the technological part of his training becomes a comparatively simple matter. I think these teachers make light work of a serious educational problem; they underestimate the requirements of chemical technology. Chemical manufacture is an art as well as a science, and an art of such complexity and carrying with it such heavy responsibilities if approached with imperfect preparation, that the student who has been trained in science only is to all intents and purposes a mere novice. I am aware that a few cases can be quoted in which a student trained in pure science only has gone into a factory and has at once made his mark as a technologist. Instances of this kind are sometimes referred to as proving the all-sufficiency of the pure science training. According to my experience, such cases are quite exceptional, and when critically examined resolve themselves into the occasional discovery of a technological genius or into the presence in the factory of a staff already competent to work out the ideas provided by the scientifically-trained chemist. The sporadic appearance of this rare combination of the scientific and technological faculties cannot be used in justification of the omission of all technological training in the Technical Institutions. I have for so long been preaching this doctrine of the necessity for higher training before entering the factory that it gives me peculiar pleasure to be able to quote a passage from that address to the American Chemical Society by our former President, Dr. William H. Nichols, to which I have already alluded. Speaking of chemical engineering in America, Dr. Nichols says:—

"Thirty-five or forty years ago work coming under this head was in this country performed almost exclusively by practical men brought up in the works, whose deductions were the result of experience unenlightened by theory. It was, of necessity, somewhat crude, but good enough for practical purposes while every chemical manufacturer was in the same boat. The advent of the college-trained man changed all this, and the uneducated engineer has been gradually relegated to the background, and for obvious reasons. The advantage the college-trained man had was in his knowledge of the theory of chemistry. His disadvantage was his utter lack of engineering knowledge to enable him to apply it practically. The theory was of more value than the rough engineering without it, for engineering ability of high order has long been attainable, and thus, theory could have a respectable application. . . . In the chemical works, however, where the highest application of the theory is aimed at, chemistry should be the guide and engineering the servant. If the chemist can also be the engineer, so much the better, and so much more likely will he be to bring his theory to fruition."

I only give this extract, but I commend the whole address to the serious consideration of both teachers and manufacturers. The position assigned to college training in America is virtually that chemical industry has thereby been lifted out of its empirical stage and placed upon a scientific foundation. When, therefore, I declare against the factory as a suitable training ground for the initiation of the student at the outset of his technological career I have in mind certain considerations which, with all diligence and I hope without offence, I may venture to submit on this occasion.

The Necessity for, and Nature of, the Higher Training.

In the first place, from what I know of the actual state of affairs in some of the chemical factories in this country, it would be very unfortunate from an educational point of view if a college-trained student entered into such works under the impression that he was going to be converted into a finished technologist. If his training had familiarised him with what was going on elsewhere in the particular branch of industry into which he had entered he might even be justified in declaring that his technological outlook was a very gloomy one—that even his college education had enabled him to realise that he was amidst antiquated plant and imperfect or possibly obsolete processes. Under such conditions the continuation of his education as an industrial chemist instead of being a development might be regarded as a retrogression. Instead of passing directly

from the college preparatory course into the works he might reach a higher level by continuing his advanced training in the Technical College. That is the state of affairs regarded from our platform as technical educators. Now I dare not venture to suppose that the conditions which I have outlined prevail to any great extent in our chemical factories—at least I hope not. But it will not be denied, even by the most patriotic of our manufacturers, that there are works which could not by any stretch of patriotism be regarded as ideal training grounds in chemical technology. And even in those factories where better, or possibly even the best, conditions prevail, it is still doubtful whether it is desirable for the student who has only undergone a preliminary training to begin specialising too early. I invite attention to this aspect of the case from the educational point of view.

The manufacturers must credit us with the desire of providing them with the very best material that we can turn out under the conditions specified in this address. We ask them further to believe that the motive power of our work is the same as theirs—the advancement of British chemical industry. Some of us are trying to effect this object from the educational side, others from the side of research. To very few is it given to be placed in such fortunate circumstances as to be able to promote advancement by both modes of attack. There might be many more if our educational institutions were properly organised, but this is connected with the general subject of the wastage of research faculty in this country which I dealt with two years ago. Now the majority of teachers who know the requirements of chemical industry will agree that the preparatory curriculum, however thoroughly it may be carried out, still leaves the student with a very limited mental horizon. He is but a youth of say 18 or 19, at the most impressionable period of his life. If he forthwith enters a factory his outlook is, by the very nature of his occupation, narrowed down by the requirements of his own industry. In a comparatively short time he settles down into a groove; he is apt to become a purely routine worker, no doubt of immediate use to his employer, but lacking that mental elasticity and expansiveness upon which the future development of his industry depends. We maintain that this is not the best kind of chemical technologist to develop in the factories with a view to the future prosperity of our chemical industries. We know too well the deadening effect of getting into a rut; a few years of specialisation starting from a too narrow general training produces just that type of man who not only fails to recognise progress in his own domain, but who, as he gets older, is generally hostile to anything approaching innovation. That is the kind of man who has crippled many of our industries in the past and that is why we are advocating the extension of the period of college training as an educational discipline. We want to plant in the factories young men with breadth of view and plasticity of mind—men who by virtue of their scientific training are able to follow the course of research and to appreciate all discoveries bearing in the remotest degree upon their industry. Our contention is that chemical industry requires the services of men who are not only apt pupils capable of rapidly mastering the *technique* of the operations going on in the factory, but also capable of teaching the factory where necessary. We want to add to your resources men, not only competent to carry on your present manufactures, but also imbued with the spirit of development. If I may use a simile, it is the dynamical and not the statical chemist who is wanted in our factories. We hold the view that the best way of achieving this result is to broaden the basis of technical education by insisting upon an extension of the training beyond the preparatory stage. You may perhaps secure the services of works chemists more cheaply by taking them at this stage of imperfect development, but our view is that in the long run this will prove to be false economy. If the manufacturers and the teachers will arrive at a *concordat* on this point we think that there will have been achieved one of the greatest advances in technical education ever made in this country, for unquestionably the stress of competition which we as a manufacturing nation are now feeling, and which is bound to become

more acute with the progress of discovery, has fallen with special severity upon many of our chemical industries.

The ideal which we are striving to attain is, I imagine, made sufficiently plain by the above statement of policy. How far we can or shall be in the future enabled to realise this ideal depends very largely upon the support which we receive from the representatives of chemical industry. The responsibility which rests with our manufacturers with respect to the future of chemical industry in this country is assuredly a very grave one. That future according to our view, is ultimately dependent upon the development of education and the promotion of research both in pure and in applied chemistry. I have no desire to pose as an authority on that most intricate of economic questions—the causes of industrial progress or decline; but with respect to chemical industry, I believe I am voicing the opinion of the teachers in general when I say that fiscal policy or patent legislation or any other external influences which may or may not be our common cause are but secondary considerations. We believe, for whatever that belief may be worth, that the prime factor of prosperity and of progress—discovery and invention, and as the attitude of mind which develops that factor is education in the broad sense, we place the consideration of educational policy in the front rank.

On this view it is but a short step to the further conclusion that the training of our industrial chemists at present carried out falls short of the ideal which has been set up as our standard. It is for this reason that I attach so much importance to the recent discussion. The teachers and the manufacturers, or at any rate, considerable number of them, now appear to realise that some further development of technical education in this direction is urgently needed. The discussion resolve themselves in essence into the question of *what* and means for achieving the desired end. All the proposals that have been made in connection with the higher or supplementary training, from the time of Mr. Beilby's address of 1899, down to the latest contribution in our Journal, have taken it for granted that this training is to be of a technological character. Many speakers and writers label it unhesitatingly "chemical engineering" and some add the business or economic treatment of industrial chemistry. I do not propose handling the latter part of the subject now for want of time, but apart from questions of detail with respect to technological curricula, it is clear that the voice of chemical industry is against the all-sufficiency of a purely scientific training. With this opinion I concur, but in giving my adhesion to the views of manufacturers on this point, it must not be supposed that I consider the educational problem thereby solved. If it were admitted that the preparatory scientific education followed by a technological curriculum was all that could be desired, I should have to express dissent, because on this view no scope is given for further training in science. This seems to me a serious omission. The student is not "finished" after a three years' course—not even if he has taken his B.Sc. If, say as a University student, he were going on to a higher degree he would be expected to show evidence of originality by presenting an original investigation. That is of course a sound principle and is now generally recognised. In some Universities original work in some branch of applied science is allowed to rank, and that also is a sound principle.

Now my contention is, and has been for more than a quarter of a century, that the development of the research faculty is a matter of precisely the same order of importance in the education of the industrial chemist as it is in the education of the academic chemist who is in training for let us say, a professorship. Therefore during the supplementary period following the preparatory training there must be given opportunity for research work. No institution of whatever rank professing to train chemists for our factories is doing its duty to chemical industry unless every advanced student is given that opportunity; it is his only chance during the whole period of his educational career. I see no way of getting it in anywhere else. The average student is not fit for research until his general preparatory training has been passed through. I do not believe in forcing original

ork prematurely upon the unprepared student, but I most strongly insist that every student who is prepared could be given his chance. It is immaterial under ordinary circumstances whether the piece of work undertaken is in pure chemistry or in applied chemistry; is the principle of research as an educational discipline the highest value that is being advocated. There are cases where a student is professedly training in some special industry; his research would, in these circumstances, naturally be made to bear upon his future work—it would be an investigation in some department of applied chemistry. But points of this kind are subordinate to the general principle. The kind of research I naturally depend very much upon the particular piece of work going on in the institution and the special "atmosphere" created by the teaching staff.

As the necessity for research as a part of advanced technological training may be challenged by some manufacturers (I do not think the teachers will oppose my intention), it may be desirable to explain somewhat fully what our position really is. As a typical expression of opinion on the part of a manufacturer, I will quote a passage from Dr. Beilby's recent address to the Association of Technical Institutions. After insisting upon the necessity for creating an environment of research in the colleges with which he was dealing, he goes on to say:—

"I do not put forward the plea that research is a necessary and desirable element in the training of all students, for I am still unconvinced on this point. Indeed I am under the impression that many of the less successful students and graduates in science whom I have met have been seriously injured through having been encouraged the idea that the cultivation of original research is the duty of every student of science. The real pioneering work will never be done by mediocre men. . . ."

This statement would at first sight appear to be directly opposed to the views which I have just put forward. In reality, however, there is no divergence of opinion between us. Having had the opportunity of discussing this point with Dr. Beilby, I learn that, on his part, he was referring to premature research work placed upon students during their preliminary training. I agree with me that research, or, at any rate, opportunities for research, should be given during the advanced training. That is all my contention.

It would, I imagine, be quite superfluous for me to state once again the arguments in favour of research in educational discipline; such a plea from me would be nothing more than reiteration of views expressed over and over again during the whole period of my career as a teacher. But the precise bearing of the research training upon the question now under consideration—education of industrial chemists—is a subject upon which there is more to be said. It is claimed that if we are to do anything more for our future works chemist than to give him a preliminary general training, he should be made to show what stuff he is made of by giving him as a part of his advanced training some piece of work which he can do for all the knowledge, originality, and resourcefulness which he may possess. That is to all intents and purposes the research, whether it leads to any result of sufficient importance to publish or not. In the case of research for educational purposes it is the discipline and not the result which we have in view. There has been much confusion on this point. Some teachers who have seen research work have argued as though the production of some publishable original memoir were the sole criterion of success and that if no such work is produced it indicates a failure of the method. They have confused that kind of work which we may reasonably expect from the students and teachers with the educational research which we expect of the students, which may or may not lead to publishable results. Even a negative result following an attempt to work out some particular problem has educational value. Therefore I repeat, every student should be given his chance. It is the opportunity—the only opportunity which the teacher is likely to get of selecting for chemical industry, a particular faculty which from our point of view is of the utmost importance. We all know that this faculty

of originality is rare. That is one of the very strongest arguments that can be used for giving the teachers the opportunity of finding out who among their students is thus endowed and who is not. It is only when all are given the chance that we can find out who is above the standard of mediocrity and who may therefore be developed into a "pioneer." The necessity for giving such opportunity will appear more clearly when I point out that the research faculty is not necessarily associated with aptitude in acquiring knowledge or in passing examinations. We all know instances of brilliant careers in the preparatory stage followed by mediocrity or failure when the test of originality is applied. So also could we name brilliant investigators whose work in the preparatory stage showed no evidence of superiority. The supplementary advanced or technological training should do for industrial chemistry what the post-graduate training does for academic chemistry: it should enable us to sort out the different orders of faculty. A few would be found capable of development as research chemists; a larger number as chemical technologists.

I can hardly expect that this plea for the general recognition of research as an educational discipline will lead to any immediate result. We move very slowly in this country and not always surely. It will be said that it is impracticable—that it is an ideal incapable of being realised in the Technical Institutions. That may be so; as the majority of these institutions are at present constituted, and in the present condition of technical education in our subject, when it is only with the greatest difficulty that we have succeeded in getting recognition even for a three years' course of preparatory training, it may be an ideal difficult to realise practically. But we must formulate our ideals, if only for the future. There are unfortunately so many unrealised ideals with respect to the higher training of chemical technologists that one or two more added to the heap will hardly increase its elevation to a perceptible extent. I am old enough to remember the time when even the highest academic distinction could be won as the result of pure book knowledge with no particle of evidence that the candidate was capable of extending the boundaries of his own subject into the region of the unknown. If this state of affairs has been remedied to a great extent in the academic world, how much more necessary is it in that most practical field of industrial chemistry!

If the manufacturers will recognise this phase of technical education another great advance will have been made. Both the teaching and industrial interests will gain by such recognition. In the first place let me remind you of the lament which I uttered two years ago respecting the failure of the modern Technical Institutions taken as a whole to have given anything approaching an adequate account of themselves as centres of research in view of the teaching staffs which they possess. It may be necessary to point out that I was at the time obviously concerning myself only with the question of research in pure science and not in applied science. Prof. W. M. Gardner in his address to the Yorkshire Section last November* has made this point quite clear, but I am glad of the present opportunity of referring to it again, because I have been misunderstood by a distinguished former President of the Association of Technical Institutions, who defended these institutions on the ground that they were carrying out a lot of industrial research which never saw the light of publication.† Whether that be the case or not in chemical industry is a matter which concerns this Society in particular and I propose dealing with it subsequently. With respect also to the output of research in pure chemistry, I am extremely glad to be able to state by the way that there are marked signs of improvement in this direction since my address to the Chemical Society. Now, one of the reasons why chemical research, either pure or applied, has not been placed in the Technical Institutions in that position which we think it ought to occupy, is because the chemical manufacturers have not made their voices heard. Possibly they do not believe in its efficiency

* This Journal, Vol. XXVIII., p. 13. (Jan. 15th, 1909.)
† "Education," March 6th, 1908, Vol. 8, p. 185.

as an educational discipline—perhaps they have not considered the matter sufficiently to give expression to their views. At any rate that is the quarter towards which we look for help, and if those manufacturers who accept this plea will declare their faith, it should have more effect in raising the whole level of chemical industrial training in the Technical Institutions than any amount either of pleading or of denunciation on the part of the teachers. Speaking freely on behalf of the latter we feel that for many years our voices have been crying in the wilderness. I rejoice to find that Dr. Beilby, in his recent address, has given no ambiguous pronouncement in favour of developing the institutions in this direction. I will go further and say that if they do not give their staffs as well as their advanced technological students opportunities for such work they are failing in their mission as educational establishments. This perennial output of students who have not got beyond the preparatory stage is, I am afraid, having a depressing effect upon the teaching staffs, who cannot but feel that some higher educational platform must be reached if their work is to produce any serious effect upon chemical industry. We may even be excused if we sometimes show signs of impatience when, after twenty years or so of "technical education," we find ourselves still hammering away at preparatory work and no provision for "technological" training in the sense understood here.*

And now if it be asked what the admission of this principle really involves from a practical point of view it simply amounts to this—that every student who has completed his preliminary training should at the discretion of his teachers be given an opportunity of taking part in research work. I do not urge that all students are by nature endowed with the necessary faculties. But I do most unhesitatingly declare as the result of very long experience that these faculties are of much more general occurrence than is usually supposed. If this belief is correct it follows that the omission of research from our educational curricula means a loss to our industry of a class of chemical technologists of which we are in particular in need—the man who has been trained in scientific habit of thought by the most effective of all known methods. There may be good technologists without the faculty of originality: there are excellent routine men running our factories most effectively, and our educational institutions should have no difficulty in keeping up the supply. But the routine man is only effective as long as the conditions remain unchanged. Let the processes with which he is familiar become changed by fresh discovery or displaced by newer and better processes, then the routine man becomes helpless. Had he entered the works with a good drilling in that mental attitude which is covered by the term "scientific method" he would be more able to cope with changing conditions; if his faculties have never been developed in that direction his chances of survival under changing conditions are reduced to a very low figure. Now we want chemical industry to employ chemists who will not collapse under the stress of competition, and it is not mere knowledge that will most effectively equip such men—it is *faculty* as well as knowledge that is required, and the exercise of originality under skilled guidance during the plastic period of studentship is the only method of developing that faculty. Those who are given an opportunity for undertaking this work could soon classify their students according to degrees of originality. I do not believe that out of an advanced class any considerable proportion would be sent down as having no research faculty at all.

In advocating the introduction of research into the advanced curriculum it must be most clearly understood that we are not contemplating the "research chemist" as defined in this address. He comes under another category. We are now considering only the higher education of the works chemist and the importance of research in relation to his advanced training. The actual state of affairs in the educational institutions

which would have to be faced if this most important principle were conceded need not be of a very alarming character. If it is admitted that some advanced training supplementary to the preparatory course is essential, and if it is further admitted that science is to form part of that advanced training, then the advanced laboratory work from, say, the fourth year onwards, could be made to include experimental investigation either in pure or applied chemistry. If by such means there happened to be discovered a student who had special gifts as an investigator that is the man to develop into a "research chemist." But whatever the ultimate career of the student may be—whether he is enabled to devote himself to research for industrial purposes or not—the experience gained would be of such a character that his services to chemical industry would be of a very much higher order than if he had never had such experience. If, as so frequently happens, after entering the factory, he never has a chance of conducting any research in connection with his industry, his scientific grasp of his subject would have been widened so that he would be in a better position for appreciating what advances were being made by others and so of acting the part of a scientific intelligence officer taking note of such discoveries as bore upon his work or threatened to weaken the position of his factory. It is only the man who has been through the research mill himself who can fully realise the bearing of research whether in its "pure" or in its industrial aspects. It is such works chemists that we want to receive the support of the manufacturers in producing in our educational institutions. That the institutions themselves would benefit enormously by such development into schools of research is sufficiently obvious, but the consideration of this point is part of the general question of existing educational resources.

It may perhaps give a more definite shape to the plea for an extension of the educational period beyond the preparatory course if I put the case into concrete form. If the chemical training is, by concession, continued into the advanced curriculum, what kind of chemistry is to be included in the course? Speaking from experience I should say that the development ought to be in those subjects which the preparatory course has excluded for want of time or for other reasons. Such subjects are, among many others, gas analysis, especially of the "technical" kind, valuation of fuels, the theory and use of physical instruments employed in chemistry such as the pyrometer, calorimeter, photometer, polarimeter, spectroscope, refractometer, viscometer, colorimeter, etc. It is unnecessary to enlarge upon this point, every teacher knows all about it. I only mention it here because I want it to be realised what a wide field for further training there is in the laboratory after the preliminary groundwork has been laid. Some of this kind of work can be done during the third year, but it is not possible to get very far in the course of one session when other subjects are also claiming attention both in the laboratory and lecture room.

Chemical Technology as an Educational Subject.

Turning now from the scientific side of the advance work we have to consider the question of technological training. This may be regarded as one of the most important of all the subjects which we have to deal with either as teachers or as manufacturers. Its importance is unquestionable, if only on account of its neglect in the past: it is in fact the fundamental question which tacitly or avowedly is at the basis of all the discussions which have taken place both recently and in former times. But, in spite of its importance, this subject does not require detailed consideration here, because at this stage it is only the question of principle which concerns us. If the principle be admitted the details can be filled in without much difficulty. To me one of the most encouraging aspects of the recent discussion in the provinces is that there appears to be a very general opinion in favour of such training. The proposals have it is true, come chiefly from the University side, but this is immaterial. We have come to the parting of the way the purely academic teachers, who have declared in favour of the all-sufficiency of pure science as a preparatory

* See a paper by the writer read before the Royal Photographic Society on Feb. 2nd, 1892, in the "Photographic Journal" for that year, p. 152.

chemical industry, must realise that the manufacturers as a whole are against them. They must take note of the fact that the majority of teachers, whether in Universities or Technical Institutions, who have taken part in these discussions have conceded or have unhesitatingly declared that some technological training competing the preparatory courses with the factory work is a necessity of the time. I cannot too strongly emphasise the importance of these opinions because, be it remembered, the gap has never yet been adequately filled up in this country. It is the weakest point in the whole of that educational machinery which we have been trying to put in for the purpose of training "technical" chemists. Attempts to move in this direction have been more or less paralysed by the teachers declaring for pure science and by the manufacturers proclaiming that it is impossible to teach chemical technology in the technical institutions. At last light seems to be breaking into this very obscure domain, and a little further discussion may help to disperse more of the obscurity. It is beginning to be perceived that when a technical education of the works chemist is really considered it is the technological training which is really wanted. It is remarkable that we have been so long living at this point. I have indicated the main causes, and I need only add that an enormous waste of energy has been the result of concentrating attention too narrowly on the scientific side of the training—a point which can be dealt with in any properly staffed and equipped technical institution and which really requires no special discussion if the necessity for this training is admitted, as it now is. I will venture to remind you that it is just a decade since this very question of the technological training of chemists was discussed in Germany, when I endeavoured—I must admit unsuccessfully—to stimulate action in this country by calling attention to what was going on over there.*

And now we are, I think, in a position to face that we have to deal with a certain class of teachers—chemical technology in educational institutions. What does it really mean? The broad answer to this question has been given over and over again and I can only paraphrase former statements. It means *generalised* chemical engineering. It does not mean the *technique* of any particular industry, but a knowledge of the chemical, physical, and mechanical principles underlying the construction and working of the machinery and plant of general use under various modifications in all branches of chemical industry. It is a composite subject, part of which is pure engineering—such, for example, as power production and distribution—and part of which is specialised engineering, such as the nature, source, and properties of materials used in the construction of chemical plant. It is in its practical aspect a development and expansion of that "technicalised" chemical training, comprising the *economic element*, the initiatory stage which I have advocated introducing into the preparatory course. It is the extension and elaboration of the technical laboratory work to a higher level. It is not chemical engineering in the narrow sense, because that is generally understood to mean the construction and working of the factory machinery. It is the addition to the purely chemical training of that general scientific knowledge of the principles of construction and working of plant which enables the works chemist to co-operate intelligently with the works engineer or, if he should find himself in a factory with no special engineering staff, to design and run the plant for himself. It is a specialised branch of engineering knowledge added to a scientific grasp of the principles of chemistry. Some educationists would include a training in the principles of such business operations as the keeping of factory accounts, working expenses, etc. I see no objection to this if time can be found. The general object is to prepare the student for the special technology of the industry in which he finds himself. This is the educational development which has once more been brought under the notice of the manufacturers; this is the chemical

technological training which was under discussion in Germany ten years ago and which has been recently developed in America. If this really is an educational requirement of the age—as we teachers believe it is—let the manufacturers say so; it would give an impetus to the work of both the Universities and the Technical Institutions. If the principle is not admitted, let the voice of chemical industry be heard on this side also. We want to know exactly where we are. Only, be it remembered, that no expression of opinion which centres round the particular industry with which the manufacturer himself is identified is of any practical use in framing educational policy. We have to cater for chemical industry in the abstract and not in the concrete. If it be urged that each branch of chemical industry requires special treatment and each its own special school, then we shall have arrived at an *impasse* and the discussion will have been taken altogether out of the domain of practical educational politics.

If the technical education of the works chemist is to be extended in the direction indicated it may be useful to point out the nature of the difficulties which will have to be faced. I am not now concerned with the question of institution—whether University or Technical College; that is a question of ways and means. It must be understood that by difficulties I do not necessarily mean objections, but obstacles which can and ought to be overcome if we are seriously prepared to advocate the new departure. In the first place there is the question of time and curriculum. If the preparatory training takes three years it is not too much to ask for an additional two years for the advanced course. A total course of training of five years is not a very heavy demand in view of the nature of the requirements of chemical industry. It takes seven years to produce a qualified doctor and five years a qualified lawyer or chartered accountant. The answers to the Birmingham queries and the views expressed in the discussions there and at Liverpool make it clear that the minimum period of five years is generally recognised as essential; if it could be extended to six or seven so much the better.

With respect to the curriculum it is only necessary now to lay down the general principle that the course should consist of higher scientific work, including research as advocated, and chemical technology as defined. An immense amount of difficulty has been placed in the way of this development owing to the discordant views concerning the nature of the technological training. But this discordance really only affects questions of detail and not of general principle. Indeed the time is scarcely ripe for formulating any detailed scheme of chemical technology for general acceptance; there may be many schemes, all equally good, and each suitable for a particular district or a particular institution. But the materials are at hand and have been available for a decade or more. Again I invite attention to Dr. Beilby's address of 1899 and the discussion thereon; the scheme prepared for the Technological Examination of the Institute of Chemistry will give a very good notion of what is required. The papers leading to the discussions at Liverpool and Birmingham and also the discussions in these Sections bring out the general nature of the subject. If there is any doubt as to what constitutes chemical engineering look at the late Mr. George Davis's "Handbook," the first edition of which appeared in 1901; look also at Dr. Grossmann's "Elements," published in 1906, and at Dr. Nagel's "Mechanical Appliances of the Chemical and Metallurgical Industries," published last year in New York. Consult further the classical works on special industries, such as those of Lunge and many others. Among foreign publications Wolfrum's "Chemisches Praktikum" with its atlas will give a very good indication of the requirements. The list could be extended indefinitely. It is as unreasonable to declare that chemical technology cannot be handled as an educational subject as it is to suppose that a student can be profitably launched straight into the factory with no other preparation than a training in pure science.

The objections so frequently urged against the introduction of chemical technology into educational establishments are resolvable into the two difficulties, equipment

* See "Nature," Feb. 16th, 1899. Also Dr. Beilby's Address to this Society in 1899, already referred to.

and staff. But, as has just been said, difficulties are not necessarily insurmountable obstacles. With respect to equipment I have already pointed out that there has been great want of discrimination in discussing this question both by teachers and manufacturers. The practical realisation of a course of instruction in chemical technology, as in other subjects, means laboratory work and organised courses of well-illustrated lectures. If visits to works could be made part of the instruction so much the better, but this, as already stated, is not generally practicable. The "laboratory work" in technology is of a different order to that given in connection with the scientific side of the curriculum. It is on a larger scale and involves the use of various pieces of machinery or working plant. In fact for "laboratory" we must read "chemical workshop." Now the outcry that is raised, when instruction in the use of large-scale plant is advocated, is partly on account of initial expense and partly on account of the impossibility of any educational institution keeping itself equipped with the latest forms of plant used in the various industries. With regard to expense, I may point out once again—even if I incur the charge of unnecessary repetition—that the general elementary operations carried out in chemical factories can be illustrated in the college "chemical workshop" at no greater, even at a less, cost than the mechanical principles underlying engineering practice can be and are, in fact, illustrated in the college mechanical laboratory by working models or actual machinery. If the expenditure is justifiable from an educational point of view for the training of engineering students surely it is equally justifiable for "technical" chemical students. It might as well be urged by objectors to the system that college training is of no use for engineers because the students cannot build a locomotive or construct a bridge in the workshops. No teacher of engineering in any of our educational institutions would admit the validity of this objection.

There has, as I have said, been a want of discrimination concerning the equipment for chemical technological work, which has hampered the development of the subject in this country to a most regrettable extent. Because the running of a full-sized furnace by a University department of metallurgy is considered too costly as compared with the educational results achieved—a contention for which there may be some justification—it is argued that no factory operations can be illustrated in a college workshop. Because it is not practicable to work a sulphuric acid plant or to run model alkali works in an educational establishment, it has been declared that chemical technology is beyond the scope of education. The objections have been of far too sweeping a character. Both teachers and manufacturers agree that it is undesirable to attempt instruction in the *technique* of a particular industry, but it does not follow that in some industries we cannot get much nearer to the actual factory operations than in other industries. In certain specialised departments of technology, such as dyeing, preparing and bleaching textiles, and in the leather industries, in photography and photo-technics, in electro-metallurgy, &c.—all of which we claim as branches of chemical industry—the practical operations can be and are carried out in educational institutions, and the scientific principles illustrated by the actual processes which the student conducts with his own hands. If such teaching is not allowed to degenerate into pure handicraft—and no competent teacher would allow this—the technological preparation for the particular industries concerned is of the greatest value. To mention a specific case by way of illustration:—Two of the Guilds of the City of London, the Clothworkers' and the Skinners', have founded departments of applied science in the University of Leeds, one for tinctorial chemistry and dyeing, and the other for the leather industries. Both these departments are equipped for "technological" training in the respective subjects, and would, in fact, be regarded by the Professors of these departments as incomplete without such equipment. With respect to the technological laboratory work, Prof. Procter, in answer to some questions which I submitted to him last year, states:—

"While different manufacturers will differ in the extent to which manufacturing processes can actually be reproduced on the small scale, it is generally possible to teach

a good deal of practical importance, and even to give much special technical knowledge which cannot be acquired in the works, where every operation must be conducted with a view to profit, and no deviations from what is supposed to be the best conditions are possible. I do not consider that leather manufacture is by any means one of the easiest to carry out on the very small scale necessary in a University, and the difficulties are increased by the fact that it is largely a mechanical as well as a chemical industry. We succeed, however, on the small scale, in turning out every description of leather, of a quality which we have no difficulty in selling at a price which averages about that of the actual materials employed and which is equal to that obtained by many similar leathers commercially produced. We have also abundant evidence that our really promising students very rapidly adapt themselves to working conditions on the large scale, and, after a reasonable amount of experience, form a very valuable type of practical man."

The same principle is recognised in the Municipal Technical School at Manchester, in the Glasgow and West of Scotland Technical College, in the Bradford Technical College, and in all the Universities which have developed departments of applied science. *The principle of technical laboratory or workshop training is a sound one; its criticism has not weakened the case which has been made out in its favour by pointing with scorn to certain extravagant developments; neither is it fair to read into the principle certain conclusions for which the principle is in no way responsible, and then to make use of these illegitimate deductions for denouncing the principle.* Over and over again we are told that the conditions existing in a chemical factory cannot be imitated in the College. We ever pretended that they could be? I certainly have never put forward such a claim, neither can I find it in the writings of any teacher of authority who has dealt with the education of technical chemists. So also we are told that the costly working models of plant in a few years become obsolete and are fit only for scrapping. But we ever advocated the maintenance of a chemical technological laboratory in a state of complete equipment with all the latest forms of plant? There is no such claim; any of the schemes of chemical technology that have been put forward either recently or in former times.

But granting the possibility of meeting the requirements of the chemical manufacturer by some adequate scheme of technological training in continuance of the preparatory course, there is still the question of the staffing of the educational institutions to be considered. This is confessedly a difficulty under existing conditions. If technological laboratory work is to be included in the curriculum there must be "instructors" in charge of such laboratories, and here the purely pedagogic type of teacher would be worse than useless. The only instructor of value for such work is the man who has had factory experience and is familiar with the practical working of chemical plant. His function in the chemical department would be analogous to that of the "workshop instructor" of the mechanical department. Another difficulty, which is a very real one, is the engineering course. It is, of course, familiar knowledge to manufacturers that the engineering requirements of chemical industry are of a quite special character. In other words, chemical engineering is a specialised branch of engineering, as has already been pointed out when considering the training in collateral subjects. The advanced engineering training of the future works chemist to be of real use should therefore be in the hands of a professor who has himself specialised in this direction. Such men are rare in this country; the few expert practitioners who could be named are probably better off as private consultants than they would be if they transferred their services to an educational institution.

Although the staffing of a University or Technical Institution for training in chemical technology as defined is thus hampered by the initial difficulty of finding competent teachers, it must not be forgotten that the subject has never yet been properly developed in this country from the educational point of view. If systematic instruction in chemical engineering and chemical technological laboratory work were generally recognised as essential for the

ing of the works chemist, I have not the least doubt that table teachers would be forthcoming. Here, again, the of chemical industry should surely make itself heard. do not mean to imply that this Society should become active educational body, but if the manufacturers agree principle with the plea for chemical technological training which I have advocated, they would do good service the cause by bringing their influence to bear upon the educational institutions in their own districts. I may not out that in those isolated cases where, as at Glasgow and Manchester, some progress in the development of a chemical technological curriculum has been made, it is only due to the influence of those manufacturers who have taken an active interest in educational work.

Research in relation to Chemical Industry.

So much has been said by myself and others of late in connection with the above subject that it may be thought that the theme is exhausted. In view of its intimate relations with the question of the education of technical chemists it may however be of use if I attempt to clear away some of the misunderstandings which have hitherto prevented both teachers and manufacturers from dealing with this question in a manner profitable to either party. We have not now to consider research in an educational discipline—that point has already been discussed. We have to deal with the subject of research in connection with the advancement of our industry, in which it must be clearly recognised at the outset that it has a twofold bearing. It is essential that current processes should be constantly under investigation in order to keep them in a state of perfection or to improve them where possible, and it is no less essential that pioneering research should be carried on with the object of discovering new facts and processes. Who is to do this work and for what it is to be done are questions for future consideration. The weak point in the contention of some of the teachers who have discussed this question from the technical side is that they have laid so much stress upon pioneering work that they have given the impression that they are of opinion that all our existing processes are effete and that the factories might close their gates and scrap their plant until the pioneer discoverer comes to their rescue. That, it is needless to say, is not the state of affairs. It must be realised that the results of pioneering research will fall upon barren ground unless the discoverer is supported by the highest technological competence. The development of that technological competency is within the province of education in precisely the same way as does the training of the research faculty. Pioneering research is wanted, but the results of his work must be added to our existing resources. The manufacturers on the other hand have not given sufficient weight to pioneering research; they only realise that this kind of work is telling against them when they find that their facts and processes are being supplanted. Looking at the actual state of affairs quite impartially from both points of view, it is quite clear to me that the weakness of this country in chemical industry is not so much due to our being unable to compete with other countries in the products which we do make, as to the lack of new products which we do not make. While such research work as we have been carrying on in our factories has been too narrowly concentrated upon the current processes, our competitors have been introducing new facts and processes which have developed into new lines of industry.

A general survey of the progress of chemical industry made during the last half century makes it evident that the expansion and development which have been a marked feature of that progress have been mainly due not so much to the tinkering of old processes, as to the industrial realisation of new scientific discoveries. Products which formerly were in demand have been replaced by newer products which are cheaper or which possess superior qualities for their particular purposes. Compounds which were discovered in the laboratory as the result of purely scientific investigation, having been found to be of industrial value, have been converted

from laboratory curiosities into marketable commodities. While current processes have been kept going at the highest efficiency which science and technology could command so long as they supplied products which were in demand, the factory doors have been always open for the admission of new processes. Moreover, the creation of new branches of manufacture has reacted advantageously upon the older branches by bringing about improvements in the latter and by creating an increased demand for the older products. I need only remind you how the development of the organic chemical industries has given an enormous impetus to the manufacture of "heavy chemicals" and inorganic products generally. It is of course unnecessary to mention specific cases before this Society, but in so far as this very practical outcome of the interdependence of science and industry is bound up with the question of the education of those who are to carry on our chemical industries in the future, it is of the greatest importance that the views of the teachers and manufacturers should be confronted.

Speaking as a teacher with some experience of manufacture, I may safely assert that as chemical industry has developed in the past so will it develop in the future, and we owe to that factory which closes its gates to the progress of scientific discovery. It is for this reason that we have for so long been preaching the doctrine of salvation by research. It is for the same reason that we attach so much importance to the educational value of research as a part of the advanced training of the works chemist. The whole question of the status of research in educational establishments in general and in technical institutions in particular would have been promoted if the chemical manufacturers had declared themselves in favour of this policy at the outset. If they will do so now it will help the cause both directly and indirectly. If the committees and governing bodies are made to realise that chemical industry requires technical chemists in the sense which I have endeavoured to define, it will help to counteract that deadening craze for turning out large numbers of book-trained youths which is sapping the vitality of the teaching staffs and producing no appreciable effect upon our industry. That which I have elsewhere defined as the "statistical fetish" together with what others have described as the "examination bogey" are unquestionably responsible for that estrangement between the manufacturers and the teaching institutions which is so frequently alluded to. One of the reasons why the teaching institutions have not been brought into more intimate association with the chemical manufacturers is because the staffs are given such scanty opportunities for developing themselves by the prosecution of research in connection with chemical industry either in general or in particular. The practical result is that the members of these staffs have not secured the confidence of the manufacturers. If there were a larger number of true experts and a smaller number of pure pedagogues in the technical institutions, these would be enabled to discharge with much greater efficiency that function for the performance of which they were nominally created. Since no teacher can become an expert in any particular domain of chemistry unless he is actively engaged in research, and since, under existing conditions, specialisation is rendered difficult if not altogether impossible, the manufacturer in difficulties or the would-be investor in a new undertaking turns for assistance to the private practitioner and rarely or never to the staff of the technical institution, which more often than not is technical only in name. I am thus brought once again face to face with the question of research in the technical institutions, and on this point I have been making further inquiries with the result that the conclusions arrived at two years ago with respect to pure chemistry are, I now find, equally applicable to applied chemistry. The assertion that there is a large amount of technical chemical research going on in these institutions the results of which, although not published, contribute to the advancement of chemical industry is, I regret to say, not borne out by facts. I have come to the conclusion that the institutions in question taken as a whole are not carrying on industrial chemical research. Three or four out of some 130 existing institutions might

be named in which some of the minor trade problems in the tinctorial and leather industries are made the subject of research by the staff and advanced students. In these cases, and to this extent, the industry is no doubt benefited, but the institutions which I have in mind are exceptional in being situated in the centres of the respective industries.* Nothing would give me greater pleasure than to find that this conclusion is erroneous, but as the evidence stands it cannot be maintained that, outside the province of the particular industries named, the chemical manufacturers of this country entrust any serious industrial research to the technical institutions. To prevent misunderstanding, let me add that the want of co-operation between the manufacturers and teachers is not altogether attributable to the lack of expert knowledge on the part of the latter. In some cases—I fear not many—these institutions have secured the services of experts in certain subjects, but, as a rule, the routine duties of general teaching and administration weigh so heavily as to give no opportunities for research of any kind. Indeed in some institutions research is discouraged or actually prohibited. It is of the greatest importance in the present state of the technical education question that the representatives of chemical industry should know the actual state of affairs, for no improvement is likely to be effected unless pressure is brought to bear from without. If the chemical departments of the various teaching institutions are to do for chemical industry that which their engineering departments are doing for mechanical industry there must be active co-operation between teachers and manufacturers.

Our available Educational Resources; Technical Institutions and Universities.

The general scheme of training which has been broadly outlined in this address embodies the views of all teachers who have had occasion to consider the momentous question of the education of the works chemist. I do not pretend that there would be complete harmony of view with respect to details of subjects or of time, but on the general lines laid down there would be no difficulty in elaborating workable curricula adapted to the requirements of teaching institutions in various centres. In dealing with the subject I have up to this point intentionally avoided drawing distinctions between the different types of educational establishments. The Universities have been alluded to incidentally, but it is mainly those newer institutions which have been called into existence by the demand for technical education which have so far been under consideration. And now, in concluding, it is necessary to particularise more definitely because, if there is to be any further *rapprochement* between the teachers and the manufacturers, it is essential that the actual state of affairs should be clearly indicated both with respect to our educational resources and to the attempts which are being made to meet the requirements of chemical industry. There are, as you are no doubt aware, a large number of Technical Schools of various grades in existence. I made a list two or three years ago and found that the technical education movement had been responsible for the creation of about 130 such institutions in different parts of the country. In nearly all these schools chemistry in some form or another is a recognised subject. Now it will appear of the nature of an anti-climax to the preceding portions of this address when I state that there is practically no Technical School in this country which provides a complete and co-ordinated course of training such as I have advocated. In a few of the institutions a three years' preparatory course for day students is carried on, but the advanced work, research or technological, is not provided for. In a few institutions in centres of particular industries, specialised teaching in

the technology of these industries is carried on, but these cases are quite exceptional, and it is doubtful whether such institutions the specialisation is not forced prematurely—whether, in fact, the students are allowed to enter upon their technological work with inadequate scientific preparation. The situation may be summed up by stating that for chemical industry technical education movement has been arrested just at that stage where the true technical training should begin.

In presenting for your consideration the actual state of affairs it must be clearly understood that I do not attribute the whole blame, nor indeed the greater part of it, to technical institutions themselves. They have not been encouraged to undergo development in the direct way required either by internal or external influences. They are in the first place the imperfections of elementary and secondary scientific education, and the difficulty of making those responsible for sending students into our chemical departments realise that full time must be allowed for training. In the next place the manufacturers must fairly recognise that it is only the voice of that industry which is immediately concerned that can, as it were, speak with any authority. If they had more freely co-operated with the committees and governing bodies of these institutions and with their teaching staffs they would assuredly have been greater progress in the development of higher schools of chemical technology. If they had insisted upon the necessity for a full and complete course of training as an indispensable condition of competency, and had refused to employ men who could not produce evidence of such training they would have helped the cause of technical education in this country enormously. As things are, the greater part of the chemical instruction in the technical institutions is carried on in evening classes. I believe I am voicing the opinion of manufacturers generally when I state that this kind of training is practically valueless for the training of industrial chemists. The persistent condemnation of evening work as a means of educating the works chemist, for which attitude I have long been responsible, has led to some considerable amount of misunderstanding, and as I have frequently been called upon to justify my position, I will make use of the present opportunity for explaining more fully what it is that both manufacturers and teachers agree in condemning.

It is sufficiently evident from the recent discussions in the provinces, and from the observations which I have put together for your consideration now, that a working period of three years is necessary to get a student to the end even of a preparatory training. Now suppose the student works for six hours a day during five days in the week, he spends during the working session 30 hours per week in learning chemistry and the collateral subjects. If the evening department is open for three hours a night the total amount of time which he can spend is 15 hours per week, if he works every evening. Even at this liberal allowance of evening instruction, it would therefore take him six years to arrive at the same standard as the day student. But in practice the evening department is seldom open for more than two hours, and not many institutions in this department open every evening in the week; neither is the evening session so long, as a rule, as the day session. Moreover, the evening student comes to his work at the end of his day's labour, and in the worst possible condition for taking advantage of the instruction offered. It would, I think, be nearer the truth to state that it would take the evening student 12 years at least to complete his preparatory training. I imagine, therefore, that any serious effect upon chemical industry is likely to result from this system of education is simply ridiculous.

To prevent any possible misapprehension—whether the foregoing conclusion be accepted or not—let me further point out that the campaign against evening instruction directed solely against that system of which the underlying assumption is that a course of evening instruction can make the equivalent of a course of day instruction—an assumption fundamentally wrong in principle. I have nothing to say against the students who enter for these courses; on the contrary, their zeal and energy in sup-

* Technical Institutions for training and research in particular industries are so few as to be practically non-existent in this country. For the leather industry we have the Herold's Institute at Birmensley which, through the munificence of the Leather-sellers' Company, is about to be developed into a kind of technical high school for that industry. It is to institutions of this type that we naturally look for "industrial research" in their respective subjects.

menting a day's work by attendance at evening classes is worthy of all commendation. As a class they are often superior to the day students, because they come with the object of making the best of their opportunities, whereas the day student often enters the college simply because his father sends him there and not because he has any real liking for the subject. But it is no use disguising the facts, and it must be realised that by evening work alone the average youth starting in life with the object of becoming a chemical technologist can never hope to attain any position of importance.

On the other side of the question of the function of evening instruction for technical chemists there is something to be said. It has already been stated that under certain conditions this kind of work may become useful. Let me specify what these conditions are because here also there has been some want of discrimination. Where a technical institution has on its staff or where it secures the temporary services of some expert in a particular branch of applied chemistry, then special courses by such an expert can be made of real value as supplementary to the routine course of instruction going on during the day. More particularly is this kind of work useful in connection with local industries. It is perhaps hardly necessary to point out that the student attending such a special course should, as a *sine qua non*, be made to produce evidence that he has reached a sufficiently high level in his general scientific training to enable him to follow the course intelligently. There is also another direction in which evening instruction can be and is being carried on with some advantage to chemical industry, and for which credit must be given to the technical institutions. I refer to the scientific training of men already engaged in particular industries. In such cases it must be remembered that the man, generally a foreman or manager, is already skilled in the *technique* of his industry, but has probably entered the works as a lad and has worked his way up without having had any general scientific training. Now with such men—who are always most zealous workers—a year or two spent at evening classes is of real value, because it helps to give some scientific basis to their factory experience. This has always appeared to me a branch of the work of the technical institutions deserving of the fullest sympathy and support from the manufacturers. But although valuable under existing conditions it must be clearly understood that I regard this kind of instruction as a temporary makeshift. Reduced to its lowest terms it is really an admission that the technical education movement has not yet reached chemical industry, because there ought in fact to be no demand for this kind of instruction. The scientific foundation should have been laid *before the youth entered the works*. When such classes lie out it may be taken as an indication that the technical education movement has influenced the chemical factories.

And so, after giving full credit to the technical institutions for that which they are doing as well as indicating that which they are not doing, we find ourselves face to face with a very remarkable state of affairs. Out of some 130 institutions with the prefix "technical" or its equivalent ("polytechnic") only a very small fraction can claim to be doing anything of the nature of technological work so far as chemical industry is concerned. When, as frequently happens, a parent consults me about the higher education of his son in chemical technology, I am bound to tell him that there is no institution in this country which I could conscientiously recommend him to be sent to for a post-graduate course in that subject. It is really astonishing that after 30 years of technical education applied chemistry should be lagging behind all other branches of technology. It is not that we have been niggardly in our expenditure over technical education here; on the contrary, we have been most lavish, but our aim has been for quantity rather than quality. We have been frittering our resources in multiplying the institutions for the low-level grade of work to such an extent that we have been unable to develop the higher schools. Although London is not favourably situated as a centre with respect to our chemical industries, it is to be hoped that the Imperial College of Science and Technology will give a

lead in founding a high school of chemical technology worthy of this country.* Reference has already been made to the conversion of the Technical Schools into academic establishments for preparing students for University degrees. From our point of view that is a perversion of function. So far as concerns the general question of scientific education and the spread of scientific culture I have nothing to say against this work; only let it be clearly understood that it is a distinct departure from the original motive which prompted the technical education movement. That movement, as I have previously indicated, was initiated because the academic training given in our Universities had proved inadequate as a preparation for a career in applied science. The multiplication of institutions for carrying on academic work, for which provision already existed, instead of developing that technical education which was so badly provided for, seems, to put it mildly, a very wasteful procedure. It is to be hoped that the general scientific status of the nation is being raised by these increased facilities for passing examinations. I am bound to confess that I can see no distinct indication of such a result at present—we must look to the future to decide this point. But so far as our industry is concerned I am sure the chemical manufacturers will support me in the contention that this type of work may be practically ignored. If it is claimed that a course pursued for the purpose of obtaining, say, a B.Sc. degree, however and whenever gone through, is at least a good preparation for a technological career, it is to me very doubtful whether this position could be justified under our present examination system. And even if the adequacy of such training be admitted there still remains the question, where is the technological training to be given? This brings me to the consideration of the Universities as schools of applied science.

Not the least remarkable feature in the history of education in this country is the fact that while large numbers of institutions originally intended for instruction in applied science are carrying on purely scholastic courses, the Universities, originally academic institutions, are now developing schools of applied science. This state of affairs might be taken as an indication that the technical education movement had been a failure. In some subjects such a conclusion could not be justified; the Technical Institutions, or at any rate some of them, can hold their own against the Universities. But in chemical technology, where development has been arrested, there would, I fear, be much justification for this conclusion. It may be taken that the underlying principle which prompted the recent discussions on the subject of the University training of industrial chemists was the desire to supply that higher technological training which the Technical Institutions had failed to develop. The question has taken the definite form whether the Universities should create departments of applied chemistry. In dealing with this question the manufacturers should have much to say. I cannot of course pretend to be the mouthpiece of chemical industry, but such views as have occurred to me in thinking over the matter for many years may be found of use, if not constructively, at any rate as a small step towards the practical solution of the problem.

In the first place in fairness to the Technical Institutions there must be discrimination between Universities. If a University has failed to create an active centre of chemical research its claim to usurp the functions of the Technical School is not a particularly strong one. On the other hand if a University has a reputation as a school of chemistry and the Technical Institution has no school either of research or technology, the case for the University is overwhelming. It must be remembered that the

* Since the above was written there has appeared a paper by Dr. Robert Pohl which was read before the Association of Teachers in Technical Institutions in Huddersfield ("Nature," April 15th, 1909, p. 205), which brings out some of the points dealt with in this address and which is well worthy of consideration. It appears from the author's statements that in this country we are spending in technical education about twice as much per head of population as Prussia, with educational results which "will not bear any comparison." Dr. Pohl gives great weight to the work of evening classes, but I gather from the context that he has under consideration such students as have been referred to above and to the technical education for mechanical and allied industries and special trades.

scientific staff of the Universities would be fully qualified to organise a preparatory curriculum. If the ordinary graduate courses were not suitable for the requirements of the chemical technologist they could, without much difficulty, be adapted. All that a University need do to form a school of chemical technology is to make provision for that kind of advanced work which has already been advocated in this address. Whether special chairs of applied chemistry should be founded seems to me to be after all a minor point. The answer to this question would depend very much upon the constitution of the existing staff and the nature of the local industries. The pure chemical instruction would of course, be under the control of the existing professoriate; if any member of the staff had any technological experience he might be made responsible for the general organisation of the department of applied chemistry and he might be given any suitable rank on the teaching body. The building and equipment of the technological laboratory would necessitate the expenditure of much money, but no more than the requirements of this much neglected side of the education of the industrial chemist seem to demand. There is no occasion to be extravagant nor to go beyond those generalised appliances in the way of plant or machinery to which I have previously alluded. There is no reason why the technological laboratory should not supply some of the materials required by the chemical department for general purposes or for special research. Speaking from experience, I have always found that students take particular interest in making products which are actually going to be used. The technological laboratory instructor must, as I have previously said, be a man of as wide a factory experience as possible. Such men should not be difficult to find; I could name many foremen in chemical works with whom I have come into contact who would have made excellent practical instructors in a technological laboratory. The professor, lecturer, or instructor in chemical engineering would, as already stated, be the chief difficulty at first: in fact, I am inclined to believe that any University founding a department of applied chemistry would have to look abroad for a thoroughly competent representative of this subject. But this point has already been dealt with to a sufficient extent, and it is only necessary to add that if the recent discussions should lead to any serious action being taken by our Universities it is to be hoped that the representatives of the local industries will be given a voice in framing the educational policy.

And now if I am asked more specifically whether the Universities should undertake this kind of work I have only to say that our need for it is great; so far as chemical industry in the abstract is concerned it does not matter who does it so long as it is efficiently done; it is a question of ways and means; who can do it best in the interests of our industry? The question cannot be answered in general terms because it is essentially a local question. The degree and direction of specialisation, if specialisation is admitted, would be to some extent influenced by local requirements, but the question of specialisation is really a distinct one, and requires separate consideration. In principle this question has already been answered, since several of the newer Universities have developed special departments for such subjects as fuel and metallurgy, fermentation, tinctorial chemistry, the leather industries, &c. No question need have been raised on this aspect of the technical education question since it is already an accomplished fact. If the question takes the form whether further developments in the way of special departments of applied chemistry are needed, I should say not, unless the subject is a wide one, such as fuel and metallurgy, which applies to many industries, or like electro-chemical industry, in which we are educationally weak. But the whole question of the desirability of a University undertaking special technological instruction in our subjects is at basis a personal one—it depends primarily upon the man and not upon the buildings or the equipment or even the locality. If we, as a Society, were asked, for example, to nominate professors for the heads of departments of a college of chemical technology, I think we could furnish a body of experts who would create a school of European fame. But these are the kind

of men whose services are in this country but very seldom added to our educational resources. We lose this great national developmental force, because no sufficient inducement is offered to the expert technologist to become an educator. Unless a University can command the services of such experts it would, I think, be wise to abandon all attempts to develop the teaching of applied chemistry in the special sense. It is most emphatically a case of catching your teacher first and letting him build up his school around him. When therefore I advocate the increase in our facilities, or rather the creation of means, for giving systematic instruction in chemical technology, I have always had in mind the generalised and not the specialised course. The latter is necessarily of restricted use as it appeals entirely to those whose careers in a particular industry are already marked out. This is only the case with a small minority of our technical chemical students; the majority want a general and not a special preparation, and at present they are so badly provided for in this country that they have to go abroad or to plunge at once into factory work with inadequate training.

It is evident that there is a serious gap in the education of the technical chemist which requires bridging over. If the Universities will supply this deficiency it will be a distinct gain to chemical industry in the future. I do not wish to imply that there is scope for an indefinite number of schools of chemical technology nor that every one of the newer Universities should develop such a school. Those in centres of chemical industry would obviously be the most appropriate for such work. If the University should already possess a department of special technology so much the better; general and special technology would be found mutually helpful. In advocating this much needed development of technical chemical education it must be understood also that I am now associating it with the Universities, because the recent ventilation of the subject has come from that side, and further because the technical institutions as a whole have made such an insignificant movement in the direction required. Reviewing the position quite impartially it must be obvious that it is to these institutions that we should have naturally looked for the necessary development. As matters stand, and in accordance with the general policy of "muddling through" which characterises our procedure, there has been a complete *bouleversement*! From the rational course of laying the ground work of pure science in the University, and building up the technological superstructure in the Technical Institution, we have departed to the irrational course of attempting the scientific foundation in the Technical School, and of appealing to the University to supply the technology. I may once more emphasize the fact that institutions founded originally for academic work have developed departments of special chemical technology, and institutions founded for the purpose of advancing industry are running classes in order to qualify for academic degrees. Truly an astonishing chapter in the history of education in this country when it comes to be written!

The practical outcome of these considerations must be to plead that a last chance may be given to the Technical Institutions, for we have evidently arrived at a crisis in their history in connection with the training of industrial chemists. If the higher work is to be taken over by the Universities it seems to me that the *raison d'être* of the Technical School will, for chemical industry, become a thing of the past. Most deplorable and most wasteful will it be if we find in the same town the University and the Technical Institution becoming rivals instead of colleagues. Of course the rational solution of the difficulty is that the Technical Institution should become a school of the University, as is the case at Manchester. But this solution carries with it the implication that the Technical Institution will raise the level of its technological teaching to the University standard. So far as I am concerned—I think I may say so far as chemical industry is concerned—that is precisely what we want. If these institutions will develop schools of chemical technology which University graduates could enter for their technological training, we shall have done something towards meeting the criticism of a recent French writer who, in reviewing the subject of

technical chemical education in the Universities of this country, sums up with the following statement:—

"En résumé, rien dans les écoles ne peut intéresser notre enseignement supérieur, toutes ont un but nettement professionnel; l'Angleterre ne nous fournit vraiment aucune méthode à préconiser; tant que l'industrie et la Science ne seront pas chez elle étroitement unies, les écoles techniques produiront bien d'excellents praticiens, mais l'Université ne fournira jamais les chercheurs, capable d'appliquer pratiquement les découvertes du laboratoire."*

The excuse that must be offered for the inordinate length of this address is the importance of the subject at the present time, when, under the new Patent Act, we are likely to see important developments in British chemical industry. So far the discussions on the advantages which we are supposed to derive from the establishment in this country of factories owned by foreigners seems, curiously enough, to have been concentrated exclusively upon the labour aspect of the question. Speaking on behalf of the teaching profession I can assure the manufacturers that we have at heart the very laudable desire of giving the British chemist as well as the British workman at least a chance. It is sufficiently evident from the general considerations which have now been submitted that the home-made chemist is at present very heavily handicapped at the outset of his career; the time is certainly ripe for considering the question of the training of the industrial chemist very seriously. There are many other points which I should like to have discussed—such as the attempts which have recently been made to bring the manufacturer into more intimate association with the teaching centres—but these must for the present remain in abeyance. The main issues before the educational and industrial worlds is the function of the University and of the Technical Institution respectively in the scheme of technical education. I lay claim to have done no more than attempt to smooth out this very tangled problem so that it may be handled in the future with a clearer conception of its true nature and a keener appreciation of the points awaiting definite decision. I venture to think that in framing any educational policy of real *i.e.*, practical, value for our subject, the Society of Chemical Industry can play a very important part. All the teachers of note, both in the Universities and in the Technical Schools are members; so also are all the leading chemical manufacturers of this and of some other countries. We are, in fact, both imperial and international. We have the means of bringing together a body of expert knowledge and experience, both educational and technological, such as is possessed by no other organisation. Surely it is our duty to promote chemical industry by taking an active part in the education of the technical chemist of the future. I am not advocating the conversion of the Society into a teaching body, neither am I calling upon our members to become stipendiary lecturers. There are other and more practical ways in which we can help the cause. It must be for my successors in this chair to bring these suggestions to a practical issue if they are thought worthy of it. An Advisory or Consultative Education Committee or Board, formed by our Council, and from the ranks of our members, comprising both teachers and manufacturers, ought to be of such power that no departure in the technical training of chemists in any educational establishment, whatever rank, could afford to neglect its counsels. In this, among other ways, the voice of chemical industry would make itself heard most effectively. The mere bringing together of such a Committee or Board would be of incalculable value to both the teachers and manufacturers composing it. If, carried away by the enthusiasm of the idea, I allow myself to foresee developments of national importance arising from such co-operation between the Society and the educational centres, I must add the extenuating circumstance that this is my last chance of propagandism from the Presidential platform. The work of such a Committee could, through our various sections, be extended all over the country, and the educational establishments thus brought into more direct

association with their nearest local Sections. Moreover, being as we are an American as well as a British and Colonial Society, we have the incalculable advantage of being able to secure the co-operation of those who have educational experience in other countries and under different industrial conditions. I do not think this suggestion is too Utopian to be realised practically; it would perhaps be premature to formulate it more definitely at this stage, but I confidently leave it for the future consideration of our Council and Officers.

In vacating the chair, which by your courtesy I have had the honour of occupying since the last Annual Meeting, I feel it something more than a mere formal duty to acknowledge the loyal support and active co-operation which I have on all occasions received from the Officers and Council. One pleasant memory which will be always associated with my tenure of office is that we have for the third time in our history been fortunate enough to secure as President an American colleague. By the election of Dr. Ira Remsen not only do we add one more link to that chain which binds us by sympathy of thought, language, and occupation to chemists across the Atlantic, but we have also the satisfaction of feeling that the chair is filled by a man whose works, both scientific and educational, are not only familiar to chemists and educationists in all English-speaking countries, but wherever chemical science and chemical industry are being developed.

Dr. W. H. NICHOLS said that, in the unavoidable absence of President Ira Remsen, the pleasant duty had fallen upon him of moving a vote of thanks to the President for his address. It would be quite impossible to refer at length to what the President said, but it had been his good fortune to read the complete address, and they could have no adequate idea of the argument from the portions which they had heard. Before attacking any proposition which had been put forward they should read every word of the paper, and he was quite sure they would find it worth their time and attention. The subject was one of very great moment, and it seemed extraordinary that anyone could doubt its importance. It was certainly important that the technological chemist should be educated for his work, considering that the future life of the world might be shortened enormously if the chemist did not come to the assistance of those who were so rapidly taking from the bosom of the earth her wealth of metals and materials. Why had there been a failure—if there had been—in arriving at a consensus of opinion as to the education of the chemical technologist? Possibly as great a reason as any had been the selfishness of the chemical manufacturers, who, hugging to their breasts what they believed to be secrets of great personal value, had been unwilling to give them to the world. He had always found that the teacher was ready to do his work, but how could a teacher in a technical school keep up to date on a subject which was hidden from him in the recesses and the privacies of a chemical plant? This was not true of education in any other form. In engineering, whether mechanical or civil, the engineer had simply to walk out into the streets of London, or any other great city, and see splendid evidences of the newest work, which might be his for the assimilation; but it was not so with the work of a manufacturing chemist. Speaking as one of that class he might say that, if they did not open themselves more, so that the very newest and latest things could be universally known, very possibly the education of the future chemist might be delayed too long. After all, research, whether simple research in the abstract, or in the field of chemical technology, was absolutely essential. If they looked back to the time fifty years ago, when those magnificent words were uttered by Dr. Playfair, how much light had their utterer at that time? How much more light had they to-day? Almost infinitely more, but what did anyone in that room know of the science of chemistry? One hundred years from now their descendants would still be in their infancy in this respect. How were they going to progress unless they gave the time, the energy, and the necessary work for opening up the field of research? That was where the gain was to be made. The application of research afterwards was a matter of detail. It might be done better

* "L'Enseignement technique de la Chimie dans les Universités," by M. Paul Baud, in the "Revue Scientifique," Feb. 1908.

by one, and worse by another, but knowledge to be gained by research was the one great necessity, and they could not do without co-operation. He hoped this address would be the beginning of an appeal which would result in much closer co-operation between the manufacturer and the teacher. He had great pleasure in moving a vote of thanks to the President for his able address.

Prof. W. A. TILDEN said he was very glad to have the privilege of seconding this resolution. It was not the first time the chemical world had been indebted to Professor Meldola for a clear exposition of this most complicated and difficult question. It was evident from his address that the question of technical education in chemistry bristled with difficulties of every kind; but however much room there might be for differences of opinion on many points of detail, they would all feel very grateful to him for his clear and careful statement of the case. Time did not allow of discussing even one of the subjects he had referred to, but he had been very glad to hear Dr. Nichols' remarks. He felt when he heard an eminent chemical manufacturer speaking to his colleagues and business associates and friends in such language, that there was some little hope for chemical industry. One point became very clear not only from the address, but from what Dr. Nichols had said. He had been convinced for many years that a large part of this question was entirely one for manufacturers themselves. It mattered not how a College was equipped with apparatus or machinery, or what kind of teachers were invited to take part in the instruction, it was quite impossible to give a complete technical course so as to turn out a man at the end of a certain number of years qualified at once to take charge of a branch of chemical industry. That arose not only from the fact that some teachers really did not know anything about the industrial aspects of the subjects they had to teach, but from the practical difficulty which was constantly being forced upon him as a teacher by having to discuss with his students what they were to do. At the end of three or four years, when a man had completed his ordinary academic course, and was a fairly good mathematician, physicist, and chemist, with a certain amount of skill, he had then to ask himself what line was he to take; should he devote a year or two to further laboratory study, to the problems connected with say heavy chemicals, such as sulphuric acid or soda? He might have wasted the whole of his time if he had not the opportunity of finding his way into that department of the industry; and when the opportunity came he might find he was called upon to assist in manufacturing colours or alkaloids, or something of a totally different kind. The solution of this difficulty lay with the manufacturers. Until they were prepared to take the academically prepared student, a man who had been instructed in the methods of research, and had a fair amount of intelligence, and put him into a place in their works, and instructed him in his business, he did not see how they were to get any further. There was a disposition nowadays to require of the young man taken into industrial chemistry rather too great diversity of accomplishments. It was not necessary only that he should be a skilled and experienced chemist, that he should know something about electricity, that he should have sufficient mathematics at command to enable him to tackle any problem in physical chemistry, and also that he should know something of engineering, but he had to study the nature of markets, and how to deal with matters of business. It seemed to him that there could not be rolled into one person a research chemist, a works manager, and a business manager; it was physically and humanly impossible that any such person could ever be found, and the man who was to assist as a scientific chemist in a works must be allowed to devote himself to that department of the business. If he were wanted in the office that was one thing, but the laboratory was another. It was not fair, and neither human strength, nor human life, were sufficient or long enough to enable a man to undertake all these various functions.

The motion was put by Dr. Nichols, and carried unanimously.

The President, in responding, thanked Dr. Nichols and Professor Tilden for the kind way in which they had

proposed and seconded this motion, and he would take the opportunity of announcing the result of the ballot.

Report of Scrutators.

The Scrutators beg to report that they have examined 272 ballot lists, of which 10 were spoilt, and declare that the following are elected Ordinary Members of Council:—Mr. D. Lloyd Howard, Prof. W. R. Lang, Mr. B. E. R. Newlands, and Dr. Julius Raschen.

Prof. Ira Remsen has been elected President, and Dr. Geo. Beilby, Mr. E. Grant Hooper, Prof. R. Meldola, and Dr. R. Messel have been elected Vice-Presidents.

The appointments by the Council of Mr. Thomas Tyrer and Dr. Ludwig Mond as Hon. Treasurer and Hon. Foreign Secretary are approved; and Messrs. Norton, Feasey, and Slade are elected Auditors.

(Signed) ERNEST LINDER, C. D. McCOURT.

The new Council is therefore composed as follows:—

LIST OF COUNCIL, 1909-1910.

President: President Ira Remsen.

Vice-Presidents:

Dr. G. Beilby, F.R.S.	Dr. R. Messel.
Eustace Carey.	Sir Boverton Redwood.
Dr. J. T. Dunn.	Walter F. Reid.
E. Grant Hooper.	Geo. C. Stone.
A. R. Ling.	Dr. T. B. Wagner.
Prof. R. Meldola, F.R.S.	R. C. Woodcock.

Ordinary Members of Council:

Prof. P. Phillips Bedson.	D. Lloyd Howard.
Prof. W. Hodgson Ellis.	Dr. Charles A. Keane
Oscar Guttmann.	Prof. W. R. Lang.
H. Hemingway.	B. E. R. Newlands.
Prof. G. G. Henderson.	Dr. Julius Raschen.
Prof. W. R. E. Hodgkinson.	Harold Van der Linde.

Sectional Chairmen and Secretaries:

Dr. T. Slater Price.	BIRMINGHAM.	F. R. O'Shaughnessy
Dr. Milton L. Hersey.	CANADIAN.	Alfred Burton.
Max Muspratt.	LIVERPOOL.	W. Roscoe Hardwick.
Dr. J. Lewkowitsch.	LONDON.	Julian L. Baker.
R. H. Clayton.	MANCHESTER.	Julius Hübner.
C. J. Potter.	NEWCASTLE.	Dr. F. C. Garrett.
Dr. W. H. Walker.	NEW ENGLAND.	Alan A. Claffin.
Maximilian Toch.	NEW YORK.	Dr. H. Schwellzer.
S. J. Pentecost.	NOTTINGHAM.	S. R. Trotman.
D. J. Playfair.	SCOTTISH.	Dr. G. B. Neave.
Prof. J. A. Schofield.	SYDNEY, N.S.W.	T. U. Walton.
Prof. W. M. Gardner.	YORKSHIRE.	Thomas Fairley.

Honorary Treasurer: Thomas Tyrer.

Honorary Foreign Secretary: Dr. Ludwig Mond, F.R.S.

General Secretary: Charles G. Cresswell.

Dr. H. SCHWEITZER moved the adoption of the following Draft Regulations made under the provisions of By-law 38:—

MEMBERS.

1. At whatever period of the year a new Member may be elected he shall be required, unless the Council shall determine otherwise, to pay his subscription for that year; having done which he shall be entitled to receive all the numbers of the Society's Journal for that year. (c.f. By-law 7.)

2. If a Member who has been duly elected, and has paid an Entrance Fee and one or more subscriptions, resigns under By-law 14, and later seeks re-election, the Council may re-admit him without further Entrance Fee.

ANNUAL GENERAL MEETING.

3. When a ballot is required under By-law 26, then at such stage in the proceedings of the Annual General Meeting as shall be most convenient, the Members present shall hand their Ballot Lists to the General Secretary, or, in his absence, to such other person as the President may appoint. Members unable to attend the Meeting may send their Ballot Lists before the Meeting to the

General Secretary in sealed envelopes. Each such sealed envelope must be marked "BALLOT LIST," and must, moreover, have written upon it the name of the Member sending it. The names written upon such sealed envelope having been compared with the Society's Register by the General Secretary, such sealed envelopes shall be opened at the Meeting by Scrutators appointed by the Meeting. The Scrutators shall see that the conditions of the Ballot are strictly fulfilled. Any Member shall be at liberty to strike out any name or names of Ordinary Members of Council printed on his voting paper.

COMMITTEES.

4. No Special Committee, nor any Committee of a Local Section shall have any control over the funds of the Society, except to the extent to which funds for its use may be voted by the Council. An account of the manner in which any funds so voted for the use of any Committee have been expended shall be furnished to the Council on or before the 15th of November in each year.

LOCAL SECTIONS.

5. All elections to the Committee of a Local Section and all elections of Officers of the Section, with the exception of those to fill up unforeseen vacancies, shall take place so that they can be reported to the Council in time to be considered at the Meeting held under By-law 24 not less than two months prior to the Annual General Meeting; but the Members of Committee and Officers thus elected shall not take office and those whom they are to succeed shall not retire from office until the close of the Annual General Meeting aforesaid.

Mr. T. FAIRLEY seconded the motion, which was carried unanimously.

Place of Annual Meeting in 1910.

Mr. D. J. PLAYFAIR (Chairman of the Scottish Section) said he had much pleasure on behalf of the Scottish Section in inviting the Society to hold the next Annual Meeting in Scotland, with its headquarters in Glasgow. On two previous occasions, namely, in 1898 and 1901, Glasgow had been honoured by the Society meeting there, so that the town was not unknown to most of the members. Those two visits synchronised with an International Exhibition which was being held there, but next year they could not hold out the prospect of a similar attraction; still it might be hoped that Glasgow and its neighbourhood was sufficiently interesting to make them worthy of a visit. They had very considerable and diversified industries, including some chemical works, within their borders, and some fairly picturesque scenery within easy reach, and in the nine years which would have elapsed since the Society last visited Glasgow there had been a continual industrial advance in many directions. Amongst educational institutions there had been a great development, especially in the Technical College, which would be of special interest to the members in view of the address they had heard that morning. If the invitation were accepted he was quite confident that the members of the Scottish Section would give the Society a most hearty welcome, and do all they could to make the Meeting a success.

Prof. G. G. HENDERSON, in seconding the motion, said that everybody north of the Tweed would receive them with great cordiality.

The motion having been carried unanimously,

The PRESIDENT said he would ask their colleagues from the other side of the Tweed to convey the best thanks of the Society for this invitation, which was cordially accepted.

Mr. MAXIMILIAN TOCH (Chairman of the New York Section) then proposed a vote of thanks to the University of London and the Organising Committee of the International Congress of Applied Chemistry, for granting the use of that Hall for the Annual Meeting.

Dr. T. E. THORPE, in seconding the motion, said he did so with all the more pleasure that he understood that the University had not in any way depleted the funds of the Society in return for its hospitality, and whilst he congratulated the Society on this fact, he congratulated

the University much more on the manner in which it had seized the opportunity of showing what it ought to show as a University.

The motion was carried unanimously.

The PRESIDENT, in concluding the Meeting read a letter from Prof. Ira Remsen, the newly elected President.

Mr. THOMAS TYLER suggested that a message should be sent to President Remsen telling him he had been unanimously elected, and congratulating him on behalf of the Meeting.

This was agreed to, and the proceedings terminated.

LUNCHEON.

At the conclusion of the proceedings the members were entertained at luncheon by the London Section in the Great Hall of the University of London, the chair being taken by Dr. Lewkowitsch. Many foreign members and visitors were present.

After the usual loyal toasts had been given,

The CHAIRMAN proposed the health of the guests. He said the London Section of the Society felt proud to welcome their distinguished and illustrious guests, among whom were the most representative men of science from the four corners of the world. After referring in detail to the names of a great number of the distinguished visitors present from Japan, China, Canada, the United States, France, Germany, Italy, Austria, and the Colonies, and then to Principal Miers and Rector Dr. Bovey, he pointed out that many of those he had named were members of the Society. Amongst them were Sir Henry Roscoe, and a large succession of past Presidents. He referred also to their President, Professor Meldola, as the true type of what a member of the Society should be, a technical man who combined the highest flights of science with technical success. He, like Faraday, might have added fortune to fame if he had kept to industry, but, like Faraday, he threw in his lot with science. They were proud to see before them the representatives of every Section of the Society. They hoped before long to have other Sections in the southern hemisphere, including one in New Zealand, where the cold storage industries were so much coming to the front. Some day they also hoped to have Sections in South Africa and in India, and to increase the number in Canada, and also in the United States. The bond which kept them together was the Journal, as all their members wanted to get value for their money, and were very much alive to the needs of the day. They might not have discarded classical knowledge, but at any rate they had altered the old Latin adage, *multum non multa*, into *multum et multa*. In connection with the Journal, much voluntary work was done by experts, and it was looked after in a manner in which no other Journal in the world was. If imitation was the sincerest form of flattery they might flatter themselves they had that admiration, for their German friends had published a Journal not very different from their own, and he congratulated them on their success, and was proud to think that in following English methods they were doing equally well. Their American friends were also publishing a Journal of applied chemistry and chemical engineering, and were going to make a friendly effort to do better. In conclusion he offered a hearty welcome to the ladies present. He complied with the toast the names of Professor Albin Haller, Geh.-Reg. Rath Dr. von Böttinger, Prof. Comm. Arnaldo Piutti, and Dr. F. W. Clarke.

The toast having been received with great enthusiasm,

Professor HALLER said: "Je suis heureux de l'occasion qui m'est offerte pour vous dire en quelle haute estime nous tenons votre Société, tout ce que nous lui devons et toute la sympathie qu'elle nous inspire."

"Ecluse, il y aura bientôt trente ans, sous l'impulsion de l'illustre doyen de la chimie Britannique, notre confrère Sir Henry Roscoe, votre Société, si elle n'est pas la plus ancienne en date, a incontestablement pris la première place parmi toutes celles qui de par le monde, s'occupent des applications de la chimie à l'industrie."

"Et cette place elle l'occupe non pas uniquement par le nombre, près de 4,500, et par la qualité de ses

membres, mais encore et surtout par les signales services qu'elle a rendu, et rend tous les jours, à tous ceux qui s'intéressent aux questions de chimie industrielle.

"Votre organisation en douze sections réparties, non seulement sur tous les points du vaste empire, mais encore aux États Unis, à New York et à Boston, en fait une Société internationale, et répond bien au but que vous poursuivez, celui de susciter l'attention, la curiosité de tous vos adhérents et de provoquer ainsi les initiatives les plus fécondes et les plus hardies.

"En parcourant la liste de vos anciens Présidents et de vos Conférenciers on est frappé de voir le soin que vous avez toujours mis à maintenir une balance égale entre les théoriciens et les techniciens, pourvu qu'ils se fussent distingués par une œuvre marquante. Quant à votre Journal, il n'est à ma connaissance aucune publication, aucun organe au monde qui, sous une forme aussi claire, aussi concise et aussi méthodique, contienne sous les multiples rubriques autant de documents précieux et pour le chimiste, et pour le technicien, et pour le commerçant. Vous songez à tout ce qui peut être utile pour votre industrie, sans vous préoccuper dans votre libéralisme ardent et élevé, de savoir si, en divulguant le résultat de vos expériences et de vos observations, vous fournissez des armes à vos rivaux."

GEH. REG. RATH VON BÖTTINGER, MITGLIED DES HERRENHAUSES, in a very eloquent speech, delivered in German, referred to the coming Congress and to the many visitors who had arrived from all parts of the world. He laid stress on the fact that such international gatherings not only brought together representatives of chemistry, but also distinctly made for the peace of the world, in that they promoted the common brotherhood of man, and furthered the highest aims of humanity by clearing away such misunderstandings as would arise sometimes between nation and nation. He felt convinced that this would mark the most important feature of the Congress. Concluding in English, he recommended them to take to heart the famous lines from Longfellow's "Psalm of Life":—" . . . And, departing, leave behind us footprints on the sands of time ;

"Footprints, as perhaps another, sailing o'er life's ocean main,

"A forlorn and shipwrecked brother, seeing, shall take heart again."

"Prof. PIUTTI said: "Permettetemi, Signore e Signori, di brindare alla salute ed alla prosperità della Società dell' Industria Chimica Inglese, sotto i cui auspici ci troviamo qui riuniti e che ci accoglie con tanta ospitalità e cortesia. A che servirebbero mai le aride ricerche del laboratorio ed i trovati dei più insigni scienziati se non vi fosse chi li applica per il maggior benessere di tutti? Se un eletta d'uomini, uniti fra di loro da un ideale comune non sviluppasse intorno a sé e non portasse nei paese anche i più lontani i benefici delle conquiste scientifiche, ogni più elevato e fecondo pensiero umano resterebbe sterile.

"A questa Società dunque che realizza l'ultimo sogno di Fausto morente a nella viva e palpitante realtà di mille fabbriche afferma i suoi forti propositi, seguendo un gradino più alto nel progresso umano, io vi invito a bere, col più caldo sentimento ed ammirazione, col desiderio più intenso che nel luminoso cammino proceda con attività ognora crescente sino a raggiungere i suoi alti destini."

Professor F. W. CLARKE said that gathering might almost be defined as a sort of chemical experiment, consisting of a bright light, a loud noise, and a smell. They certainly had had most illuminating speeches, there had been a reasonable amount of loud noise, and in a gathering of chemists there would generally be found more good sense than in any other gathering whatever. There were forty or fifty members present from America who much enjoyed the present entertainment, and were anticipating other pleasant things to come. They wanted to retaliate, and were very anxious that three years hence the English members should visit America and see how well they had learnt the lesson which had been set here. America was a new country, with the enthusiasm of youth, but they had good teachers. Priestley spent the last ten years of his life in America,

and was buried there, so that they owed their first inspiration in chemical work to England; but they hoped that those on this side of the Atlantic would come over and see how far they had made progress, which at any rate they had tried to do. He would not attempt to say what they were doing in America for fear he might put himself under the imputation which his countrymen sometimes laboured under, of bragging, the reason being that they simply told the truth about their country and nothing else. At any rate he hoped that in three years' time they would have a large delegation from all the countries of Europe to America as missionaries to help them to do better than they had done before, and he could assure them that every European who came over would have as hearty a welcome there as those from America had had on this side of the water.

In the afternoon the London Section and Ladies' Committee gave an "At Home" in the Great Hall of the University of London, which was very well attended. During the day the "Red Band," under the direction of Mr. Alfred Batty, gave an excellent selection of music. A very successful photograph of the party at luncheon was taken by Messrs. Fradelle and Young, 283, Regent Street, W., from whom copies might be obtained, price 4s. 6d. each unmounted and 5s. 6d. mounted.

ENTERTAINMENT AT LONDON UNIVERSITY, MAY 29TH, 1909.

On Saturday evening, May 29th, the members of the Congress were entertained at the Imperial Institute Buildings by the London Section of the Society of Chemical Industry. Invitations were issued to 3500, and there was a very large attendance, the guests being received by the officers of the Section and their wives. The Great Hall, Marble Hall, East and West Galleries, and gardens of the University of London were all used. The principal part of the entertainment was the concert in the Great Hall, where the artists included Miss Myra Hess, Miss W. Smith, Miss M. Wadia, Miss Carmen Hill, Herr and Madame Tobler, Mr. Marcus Thompson, Mr. Harold Wilde, Mr. Charles Coborn, and Mr. John Bardsley. Some thought-reading experiments were carried out by Professor Anders. Mr. Cyril Towsey was the accompanist. In the Upper Galleries psychological character studies were given. There was dancing in the East Gallery, and the gardens, which were illuminated, were much used for promenades. The entertainment lasted from half-past eight o'clock until midnight.

INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

The seventh International Congress of Applied Chemistry, and the first to be held in London, was formally opened on Thursday, May 27th, at the Albert Hall, by the Prince of Wales, who was accompanied by the Princess of Wales. Their Royal Highnesses were escorted on to the platform by Sir Henry Roscoe, Hon. President, and Sir William Ramsay, Acting President, of the Congress. The Prince at once took the chair and opened the proceedings. On his left were the Princess of Wales, Dr. Harvey W. Wiley, chief representative of the United States, M. Armand Gautier, representing France, and Professor E. Paternò, representing Italy. On his right were Sir Henry Roscoe, Sir William Ramsay, Professor Dr. O. N. Witt, representing Germany, and Professor Arrhenius, representing Sweden. Among those present on the platform were the American, French, Italian, and Russian Ambassadors, the Chinese, Danish, Japanese, Netherlands, Portuguese, and Swedish Ministers, the Duke of Northumberland, Lords Rayleigh, Strathcona and Wolverhampton, Mr. Runciman, M.P., the Master of Elibank, M.P., Sir Hugh Bell, Bart., Sir Wm. Crookes, Sir Jas. Crichton-Browne, Sir John Brunner, Sir Richard Garton, Sir Walter Palmer, Sir Jas. Dewar, Sir Boverton Redwood, Sir H. Trumion Wood, Dr. G. T. Beilby, Prof. R. Meldola, Prof. W. A. Tilden, Dr. T. E. Thorpe, Dr. L. Mond, Prof. P. F. Frankland, Dr. J. Lewkowitch, Sir Andrew Noble, Prof. W. H. Perkin, Mr. John Gretton, M.P., Prof. Adrian Brown, Dr. J. A. Voelcker, Mr. N. H. Martin, Mr. T. Tyrer, and a throng of official delegates.

In opening the proceedings the PRINCE OF WALES said:—

Your Excellencies, my Lords, Ladies, and Gentlemen.—It gives me much pleasure as Vice-Patron to preside over the first meeting of this important International Congress of Applied Science, and the Princess of Wales is very glad to accompany me on this occasion. Delegates and members, including many ladies, have come not only from every country in Europe, but all parts of the world—literally from China to Peru. Six Congresses have already been held in the various capitals of Europe. This is the first time that you have assembled in London, and in the name of the King, who is patron of this Congress, I offer you his Majesty's most hearty welcome. His Majesty is very glad to think that the foreign representatives will be able to visit Windsor Castle during their stay in this country. The main object which you all have in view is to discuss in your numerous sections the many topics of interest and importance that are continually arising owing to the marvellous discoveries which the science of chemistry, both pure and applied, is making from day to day. Those interested in some special branch meet in the different sections their *confrères* from other lands to their mutual benefit. In the larger gatherings, which I am glad to see have been arranged by the committee, members will have further opportunity of social meeting. These conferences, whether of a scientific or of a more intimate character, between men living in distant lands, all working for the same object, although under different conditions, cannot but be favourable to the progress of science and of the industries to which many of you have devoted your lives, as well as to the general peace of the world. I fully appreciate the important part which chemistry plays in almost every branch of our modern industry. We all recognise that without a scientific foundation no permanent superstructure can be raised. Does not experience warn us that the rule of thumb is dead and that the rule of science has taken its place, that to-day we cannot be satisfied with the crude methods which were sufficient for our forefathers, and that those great industries which do not keep abreast of the advance of science must surely and rapidly decline? On behalf of the Princess of Wales and for myself, I offer our cordial greetings to the members of the Congress, and I earnestly trust that great results may accrue from your deliberations. I now have much pleasure in declaring the seventh International Congress of Applied Chemistry open.

SIR HENRY ROSCOE, the Honorary President, who was then called upon by his Royal Highness, said he rose in the first place to express on the part of British chemists a hearty English welcome to their *confrères* who had assembled from all parts of the world. He rose also to ask the members and delegates to express their thanks to the Prince and Princess of Wales. A formal vote of thanks was unnecessary, for the thanks came from all their hearts for the grand send-off which their Royal Highnesses had given the Congress and for the kind and felicitous terms in which the Prince had opened the proceedings.

SIR WILLIAM RAMSAY, the Acting President, said, following the lead of the Prince of Wales and of Sir Henry Roscoe, it fell to him to bid the delegates welcome to the Congress. The last meeting was held in Rome, where the King of Italy occupied the position which the Prince of Wales had kindly filled that day. There the Hon. President was the world-renowned Cannizzaro, the publication of whose views, almost exactly 50 years ago, effected a revolution in chemical thought, and made clear what was formerly obscure and involved. It was delightful to think that Professor Cannizzaro, though unable to take part personally in this Congress, was strong and well, and in full possession of all his faculties. Professor Paternò was then Acting President, and Sir William Ramsay took the opportunity of bidding him welcome to England. He also welcomed the small band of young Italians to whom the surplus of the funds collected for the sixth Congress had given an opportunity of visiting England. Professor Witt, the Acting President of the fifth Congress, which was held at Berlin, was also a guest. They thanked him for coming, and for the great help

he had given the Organising Committee by his advice. They were glad also to welcome M. Lindet, the President of the first French Congress. It was impossible to draw a hard-and-fast line between scientific and technical chemistry. Chemistry was above all a practical science, although in recent years it had tended to become more and more a branch of applied mathematics. The principles remained the same, and indeed the methods were only slightly varied, whether the apparatus used were beakers, test-tubes, funnels and flasks, or tanks, filter-presses, and autoclaves. The chief difference between the pure science and its application consisted in a satisfactory answer to the question—all-important to the technical chemist, but wholly irrelevant to the man of science—"Will it pay?" On the answer to that question the commercial success of a process depended; but in its essence, chemistry, whether scientific or industrial, was one. This, he thought, had hardly been realised in a practical manner on this side of the Channel, or, indeed, on the other side of the Atlantic. But our Continental friends had long seen and acted on the conviction that the industrial prosperity of a country could best be advanced by a close friendship and constant association between the technical and the practical workers, between the University and the factory, between the pure and the applied science. Congresses like the present could teach them much: if they learnt this lesson from them they would have gained a valuable national asset. It had often been said that science was cosmopolitan, and knew no country. The existence of such a Congress as that was in itself a proof of the truth of the saying. There were present representatives of every civilised State in the world, met together to discuss how best to develop the special branches of chemistry to which they devoted their lives: how to further their progress and to mark the level to which they had already attained. There was a city on the other side of the Atlantic whose motto was one of the noblest imaginable—"Philadelphia Maneto!"—"Let brotherly love continue!" Sir William Ramsay then addressed a few words of cordial welcome to the foreign delegates successively in French, German, and Italian.

Dr. H. W. WILEY, Department of Agriculture, Washington, acknowledged the welcome on behalf of the United States of America. He said there was no more apt illustration of the utility of chemistry than to say that were its principles unknown and unapplied the teeming millions of the globe would at this moment be unclad and starving. The great strides now making to apply the principles of prophylaxis in medical science were largely due to the services of chemistry. In fact sanitation was principally a chemical problem; pure food, pure air, pure water ensured pure activity of mind and body, and cured disease by evading it and prolonging by many years the most valuable part of human life—viz., its period of *maximum* endeavour. Chemistry had also undertaken to improve the morality of man. It detected frauds and adulterations in articles bought and sold. It exposed the manufacturer and dealer who made and sold articles deleterious to man or under a false name or representation to public scorn and to the penalties of the law.

Professor ARMAND GAUTIER returned thanks on behalf of the French delegates, and said that if in the past political causes had divided Great Britain and France, mutual appreciation of good qualities and frequent complementary aptitudes and a tradition of a common culture had gradually drawn them together more effectively than could have been done by formal treaties. In the development of industrial science England and France remained not the only, but the great, leading nations—always rivals, but never enemies. Incidentally Professor Gautier recalled the names and discoveries of a long series of eminent chemists of both nations, beginning with Priestley, Cavendish, Dalton, and Humphrey Davy, and showed that Englishmen and Frenchmen had again and again worked in the same fields.

Professor Dr. O. N. WITT, speaking in German, said that in the name of the Imperial German Government and the Prussian Royal Government, and also on behalf

of the German Chemical Society, whose president he had the honour to be, he expressed the warmest good wishes for the success of the Congress. He hoped it might not only equal its predecessors in the extent and importance of its labours, but might also mark a further advance in the path of international discussion and understanding trodden by their science. The field of applied chemistry covered by the Congress extended in two directions: it included the analysis by scientific methods and the control of commercial raw materials and finished products, and also the advance of the chemical industries concerned with them. There was no country which was not in some degree interested in the subjects of their Congress. These Congresses promoted friendly understanding and noble rivalry, and therefore they enjoyed the patronage of those who guide the destinies of nations. As a past President he begged their Royal Highnesses to accept the thanks of all taking part in the Congress and to convey them to his Majesty the King.

Professor E. PATERNO was next called upon. Speaking in Italian, he said that as President of the sixth Congress at which, held in the eternal city of Rome, London had been chosen as the seat of the present Congress, it was his duty to pronounce an inaugural greeting to that imposing gathering of illustrious scientists and practical and expert manufacturers. In the name of the Government of his Majesty the King of Italy, of the Royal Academy of the *Lincci*, and of the Italian Chemical Society, he offered the warmest wishes for the success of the Congress, and returned hearty thanks to the Organising Committee in London for their hospitable and genial reception. They were all bound to respond enthusiastically to an invitation from the country which gave to chemistry Boyle, Black, Cavendish, Priestley, Wollaston, Dalton, Davy, Faraday, and Graham. Even in the busy, noisy, bewildering rush of London life men of science yet knew how to find the tranquillity and quiet necessary for the investigation and discussion of the most abstruse problems of philosophy and science. He concluded by saying that Italians cherished another sentiment not less warm in the memory of the hospitality and succour found in this classical land of liberty by the fathers of their political regeneration.

Professor ARRHENIUS, Stockholm University, responded for the delegates of other foreign countries, and, describing England as the classical land of applied chemistry, said that it was in this country, and especially in London, that successful efforts had been made to improve hygiene by the application of chemical methods, and as a result London had the lowest death rate among large cities of the world.

The proceedings closed with the playing of the National Anthem on the organ.

JOINT BANQUET OF THE INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY AND THE SOCIETY OF CHEMICAL INDUSTRY.

On Friday evening, May 28th, 1909, the joint banquet of the International Congress of Applied Chemistry, and of the Society of Chemical Industry, took place at the Crystal Palace. Sir William Ramsay, K.C.B., F.R.S., occupied the chair, supported by Prof. R. Meldola, F.R.S., President of the Society of Chemical Industry. There were present between 1400 and 1500 members of the Congress, a very large proportion of whom were members of the Society of Chemical Industry.

The PRESIDENT gave the toasts of "The King," and "Foreign Rulers."

The PRESIDENT then proposed the toast of "Our Friends from Abroad." They had amongst them on that occasion representatives from no less than twenty countries, and it was obviously impossible to give each country the chance of responding for itself, especially as there was an exhibition of fireworks to follow the dinner. He should, therefore, single out a few countries, not because of their eminence, but in alphabetical order, and would call upon delegates from those countries to respond. He first called upon Dr. Nichols.

Dr. W. H. NICHOLS (New York) said he was very pleased to reply on behalf of America. As he spent his summers in Canada, resided in New York, and was a representative of the Mexican Government, he thought he was entitled to speak for North America. It was impossible to express their sense of the wonderful hospitality with which they had been greeted. They had had the honour of having the Congress opened by the Prince of Wales, and, if he might say it respectfully, after that he felt that they could call him one of themselves. But what could he say about those two magnificent men who had acted, and were still acting, as Presidents of the Congress, of the ladies who had shown them the most magnificent hospitality, and of all that had been done to make the Congress a success? The chemist owed much to the world, but the world owed much to the chemist, and it would owe more before it owed less. The President had asked for a few well chosen remarks. His mathematical education would enable him to comply with the first part of that request, but he regretted that the rest of his education rendered it impracticable for him to comply with the second. However, on behalf of the 4500 chemists whom he and his friends represented, he begged to return their most hearty thanks, and to assure them that in that great problem of the future just about to commence, the building up rather than the pulling down of the Universe, the chemists of America would do their share.

The PRESIDENT said he regretted the absence of the official representative of the Austro-Hungarian Empire, Prof. Strohmer, but he had great pleasure in calling upon his old friend Dr. Brauner to reply for Austria.

Prof. BOHUSLAV BRAUNER said he accepted the honour conferred on him in the name of all the nations forming the Austrian Imperial Monarchy represented at the Congress. He desired to thank their English colleagues for their hospitality and the kindness they had shown. He was not a stranger in this country, having studied 30 years ago under their honoured President, Sir Henry Roscoe, and he was thus able to appreciate the great progress made in England since that time both in pure and applied chemistry. Thirty years ago Sir Henry Roscoe had to preach a crusade against the domination of the "rule of thumb," and he rejoiced to find that the highest in the land now declared that the "rule of thumb" was dead, and the Congress of Applied Chemistry was the one to give it its *coup de grâce*.

Prof. ARMAND GAUTIER responded on behalf of France. Speaking in French, he pointed out that over 300 French chemists had come over to take part in the Congress and if the ladies were added, their number reached over 350. This was the best possible manner of demonstrating the *entente cordiale* which existed between the English and French chemists, an understanding which was more than a century old, dating back, as it did, to the time when Priestley came to Paris, when Lavoisier called William Black his master, and when Napoleon allowed Humphry Davy to travel in France with Faraday as his assistant at a time when every other Englishman was forbidden French soil.

Dr. VON BÖTTINGER, having responded in his own language for Germany, added in English a few words referring to the visit of the Prince and Princess of Wales to the Congress. Many of them had revived old friendships, and made new ones. He concluded by expressing the hope that one of the results of the Congress would be to advance, not only the work of science, but the work of furthering amiability and friendship amongst all nations.

Prof. Com. PIUTTI briefly responded for Italy.

Prof. HOOGWERFF (Holland), being called upon to respond for the Other Countries, said it was a great honour to respond for the guests of so many other nations, but the circumstances were not favourable to a lengthy speech. The science of chemistry owed very much to England. It was here that Faraday by his discoveries laid the foundation for the theory of ions, and it was

that and the discovery by the President of the rare gases of the atmosphere, and to the disintegration of what only a short time ago was considered to be indivisible, which had done so much for science. Equally important, if possible, was the share of England with regard to applied chemistry. Not far from there the industry connected with sulphuric acid had its birth, and English hands tended its growth. London was the first city lighted by coal gas, and a Scotchman named Young laid the foundation of the shale industry. He might also refer to the coal tar industry, and many others which had taken their birth in Great Britain. Having referred to the grand reception afforded the delegates by the Lord Mayor and the Corporation of London, and the reception at the Foreign Office, he concluded by proposing the health of Sir Henry and Lady Roscoe and Sir William and Lady Ramsay.

The PRESIDENT said there were still about 19 toasts on the list, which the Toastmaster would recite in order, and he would ask them to give a cheer for each, and three cheers for the British Empire at the conclusion.

The list was then read, beginning with Argentina, and ending with Turkey.

A display of fireworks in the grounds of the Palace brought the proceedings to a close.

On Saturday morning, May 29th, the King received a deputation from the International Congress of Applied Chemistry, who were accompanied by Sir Henry Roscoe (Hon. President), Sir William Ramsay (Acting President), and Mr. William Macnab (Hon. General Secretary).

The following delegates had the honour of being presented to the King by Sir Henry Roscoe:—Dr. William H. Nichols (America), K. K. Regierungsrat Frederick Strohmer (Austria), Dr. Francis Sachs (Belgium), Mr. Ou Kouanze (China), Prof. Léon Lindet (France), Geh. Regierungsrat Prof. Dr. Otto N. Witt (Germany), Prof. Emanuel Paternò (Italy), Prof. Kuhara (Japan), Dr. S. Hoogewerff (Netherlands), N. Tavildaroff (Russia), Prof. Pierua y Alvarez (Spain), Prof. Arrhenius (Sweden), and Monsieur F. Reverdin (Switzerland).

CLOSING MEETING OF THE CONGRESS, WEDNESDAY. JUNE 2ND, 1909.

The PRESIDENT, Sir William Ramsay, announced that the Congress had been attended by 3000 members and 650 ladies.

The reports of the presidents of sections were then read. Out of a total of 105 papers presented to the section of Analytical Chemistry 60 were read and discussed. The section of Inorganic Chemistry and Allied Industries heard and discussed 47 papers. In the Metallurgical section, 52 papers were discussed, and 32 in the Explosives section. The papers presented to the section of Organic Chemistry and Allied Industries numbered 111, of which 60 were read. The number of communications read and taken as read before the section of Colouring Matters and their Application was 52. At the meetings of the section of Physiological Chemistry and Pharmacology 66 papers were presented and 46 were read. The Industry and Chemistry of Sugar section heard 68 papers read, the Starch section 29, the Fermentation section 58, and the Agricultural Chemistry section 43. At the meetings of the Hygiene section 36 papers were presented and 28 were read and discussed. The Electrochemical section heard 87 papers. The Pharmaceutical section received 44 papers, and of these 40 were read. Of 85 papers received by the Bromatology section 42 were read; and the ninth section, that of Photography, considered 27 papers.

Various resolutions received from the sections were adopted, but several from Section XI., dealing with the patent laws, were dropped, as no one was present to explain and support them.

On the proposition of M. LINDET, it was resolved to continue the International Commission on Analyses, with a grant of 2000fr.

Invitation from the United States.

MR. WHITELAW REID said that, at the request of the American delegates, he was there to present on their behalf and on behalf of the United States people, an official invitation that the next meeting of the Congress should be held in the United States. The Ambassador then read a letter from the Secretary of State of the United States intimating that the President had approved a joint resolution of the Senate and the House of Representatives authorising the President to invite the International Congress of Applied Chemistry to hold its eighth meeting in the United States of America in 1912. Perhaps the people of the United States might not be able to surpass the splendid hospitality with which the Congress had been received in London, but they would do their best to rival it. The delegates, if they accepted his invitation, would go next to a country which looked especially on the work of science as, above all, tending to promote happiness and diffuse peace among the nations of the earth.

Dr. H. W. WILEY, of the Department of Agriculture, Washington, supported the invitation, and said that according to the last census over 10,000,000 of the citizens of the United States had been born in foreign lands. Thus, an eighth of the whole population of the United States were foreigners who had been received into citizenship. The delegates of every nationality could count upon being welcomed in their own tongue.

Prof. R. MELDOLA, representing the Society of Chemical Industry, who also supported the invitation, said it was the first time in the history of the Congress that the delegates had received a direct message from the ruler of a great nation asking them to meet in his country.

The invitation was accepted with acclamation.

The PRESIDENT then proposed that Professor E. W. Morley should be the Honorary President of the eighth Congress, and that Dr. W. H. Nichols should be the Acting President.

Dr. WITT seconded the proposal, and said the success of the Congress hitherto had been largely due to a circum-spect choice of presidents.

Prof. BASKERVILLE supported the resolution, and it was carried unanimously.

Dr. WILEY proposed that the official American delegates to the seventh Congress should be constituted the Organising Committee of the eighth Congress, with power to add to their number.

Prof. F. W. CLARKE (Washington) seconded the resolution, which was carried.

The PRESIDENT proposed that a permanent officer (Délégué des Présidents) should be appointed by the International Commission of the Congresses of Applied Chemistry. Sir William Ramsay said it was usual for such congresses as theirs to have a permanent official to carry on the record from meeting to meeting and to preserve the continuity of the work of the successive assemblies. It was intended that the permanent official, if one was appointed, should, after publishing the official proceedings of one Congress, take up his residence in the country in which the next Congress was to be held and there give the Organising Committee such aid as it might require. The International Commission, consisting of the former Presidents of the Congress, would make the appointment in consultation with the Organising Committee.

The resolution was carried, as was also a suggestion of Dr. NICHOLS that the expenses of the appointment should be borne by the next Congress.

Sir HENRY ROSCOE moved:—"That all communications to the Congress be submitted to an English Publication Committee on the understanding that they be judged with perfect fairness and impartiality." He said that hitherto papers had frequently been printed in the Proceedings which had already been before the scientific world, and now it was proposed to edit all papers before printing them. It was desired that the volume of Proceedings, which had already become unwieldy, should contain only papers of originality and importance. The English Publication Committee would consist of experts in all branches of science—members of the Chemical Society, of the Society of Chemical Industry, of the Society of Public Analysts, of the Institute of Brewing,

of the Iron and Steel Institute, and other similar societies. If disagreement occurred between an author and the committee the matter would be referred to the Publication Committee of the author's own country, and its decision as between the English committee and the author would be final.

Prof. CARL DUISBERG recorded the resolution, which was adopted.

The following delegates then expressed their thanks for the entertainment which had been extended to the members of the Congress whilst in London:—M. Lindet, a past president, who specially referred to the hospitality of the English ladies and to the work of the organising committee; Dr. F. P. Lavalle (Argentina), Dr. Strohmer (Austria), M. F. Sachs (Belgium), Mr. Ou Kouanze (China), Dr. Louis E. Mourgues (Chile), Prof. Armand Gautier (France), Prof. von Bubka (Germany), Senatore E. Paternò (Italy), Prof. Mitsuho Kohara (Japan), Dr. Hoogewerff (the Netherlands), Dr. H. Mastbaum (Portugal), Prof. M. T. Lecco (Serbia), Prof. E. Piñerúa y Alvarez (Spain), Prof. P. Klason (Sweden), Prof. E. Bosshard (Switzerland), and Dr. D. T. Day (United States of America).

The PRESIDENT added an expression of thanks to the University of London and the Imperial College of Science and Technology for the use of their buildings, and then declared the seventh Congress closed.

Birmingham Section.

Meeting held at Birmingham University on Thursday, March 18th, 1909.

MR. HARRY SILVESTER, B.Sc., F.I.C., IN THE CHAIR.

THE CHEMIST'S RELATION TO THE COPPER AND BRASS INDUSTRIES.

PART II.

BY ERNEST A. LEWIS.

In a previous paper I have dealt with the chemist's relation to the copper and brass industries as far as the management of the works is concerned (this J., 1908, 479–482). I now bring forward some suggestions for the analysis of various metals, ores, and residuals used in the trades.

The determination of moisture in ores and residues causes considerable trouble and loss, owing to different chemists using different methods. Moisture, from a smelter's point of view, represents, in addition to water, organic matter.

Different materials need different methods of determining moisture. Material containing finely powdered metallic copper, such as precipitate, will rapidly oxidise and gain weight if heated over a direct flame, but a sulphide ore will either lose weight owing to sulphur burning away, or gain weight owing to oxidation, depending on the heat used. Thus a suitable method must be used for each class of product.

Ores are best dried at 100° C. The quantity taken (50 to 100 grms., according to the fineness of the ores) is spread out in a thin layer; in the case of a sulphide ore too prolonged heating, even in a steam oven, will cause oxidation. To dry a sulphide ore in a pan over a flame is objectionable although it is often done.

Copper precipitate.—Two lots of 200 grms. each are dried for 4 hours in a steam oven, and reweighed after a further 1 hour's drying to ensure the weight being constant. The use of a higher temperature leads to inaccurate results; this material usually contains straw, fibres, and similar organic matter, and to attempt to remove this will lead to oxidation of the copper.

Rich copper scale.—Many sellers insist upon this material being dried in a steam oven, so that only moisture is driven off, whilst the smelters dry it over a flame to drive off oily matter. The determination of moisture is made by heating two lots of 200 grms. each of the scale in porcelain dishes over a small rose flame until the water is driven off, then the heat is increased until

the oil comes off; the scale must be stirred continuously, and immediately vapours cease coming off the heating must be stopped.

Shop sweeps and similar residues.—Two lots of 500 or 1000 grms. each are dried in an iron pan over a flame until all vapours are driven off and all organic matter decomposed. The samples for analysis must be taken from the dried material.

Methods of copper assay.—Two methods of assaying copper can be relied upon to give accurate results; they are the electrolytic method and the iodide assay. To determine copper it must be separated from the gangue and matter mixed with it.

A copper ore can usually be crushed to go through a 90 sieve. Two grms. are treated in a porcelain dish with 15 c.c. of *Aqua regia*, until decomposed; the cover is washed and the solution evaporated to dryness, the residue dissolved in 15 c.c. of fuming hydrochloric acid and again evaporated to dryness. The residue is now extracted with 10 c.c. of hydrochloric acid and about 50 c.c. of hot water, and the solution is filtered into a beaker, at the bottom of which is a piece of thin zinc stick about 2 inches long. The residue is well washed with hot water. The solution is heated for about $\frac{1}{2}$ hour on the hot plate to precipitate the copper, which is then filtered off, washed, and is dissolved in nitric acid, using 4 c.c. for each grm. supposed to be present; if a very rich ore is used, the solution must be diluted and an aliquot part used for the determination assay. The zinc is cleaned with nitric acid as described below. In the case of a very poor ore, double the above quantities are used.

The sample of residue, as received by the chemist for assay, usually has a sample of metallics in the packet. Some chemists crush the fines to go through a 90 sieve, weigh out 1 or 2 grms. of the proportion of fines and metallics, decompose with nitric acid, filter off the silica and electrolyse. This method is doubtless satisfactory for some products, such as copper scale, but for others it is unsuitable. The method I adopt for all these residuals, such as ashes, sweeps, concentrates, precipitates, etc., is to assay the metallics separately, using about 0.4 grm., and estimate the copper by the iodide method. The fine material, which should have been crushed to go through a 30 sieve before it reaches the laboratory, is crushed to go through a 60 sieve; there is no need to use a finer sieve: if there are any metallics which will not go through a 60 sieve they must be cut up as fine as possible—there is no need to separate them and assay separately. The fines are thoroughly mixed and 10 grms. evaporated to dryness in a 500 c.c. Jena flask with 20 c.c. of nitric acid and 50 c.c. of hydrochloric acid. When cool the residue is moistened with 30 c.c. of hydrochloric acid, boiled until all nitrous fumes are driven off, diluted with about 100 c.c. of hot water, and boiled for 10 minutes; if any of the material sticks to the flask it must be loosened with a glass rod. The solution is then filtered into a 500 c.c. Jena lipped beaker, at the bottom of which are 2 pieces of thin zinc stick, weighing about 20 grms. After washing, the beaker is put on the hot plate for 15 minutes until the copper is all deposited. The spongy copper is filtered off, well washed with hot water, and washed into the beaker, whilst the pieces of zinc are transferred to a test tube. 10 to 20 c.c. of nitric acid (according to the amount of copper) are poured on the zinc, and as soon as the effervescence commences the acid is poured into the beaker and the zinc washed with about 10 c.c. of cold water, and a further 10 to 20 c.c. of nitric acid is poured into the beaker. The cleaning of the zinc must be carried out quickly and the zinc must be instantly washed with water. Every trace of copper is removed from the zinc. The copper is dissolved by boiling on the hot plate for at least 10 minutes. The solution is cooled and diluted to 500 c.c., and, according to its richness in copper, 25, 50, or 100 c.c. are taken for the iodide assay, and 50 or 100 c.c. for the electrolytic assay. The percentage of metallics and fines being known, a simple calculation will give the percentage of copper in the residue.

To estimate the copper in a pure copper scale, 10 grms. of the powdered material are dissolved in 40 c.c. of nitric

acid and 40 c.c. of water, boiled to expel acid fumes, diluted, and filtered into a 500 c.c. measuring flask; 50 c.c. are electrolysed after adding 10 c.c. of sulphuric acid and diluting to about 250 c.c.

Assay of brass borings.—The accurate estimation of copper in samples of brass borings is not easy. Brass borings are often bought in large quantities without analysis. I have recently come across cases of adulteration with sand; in one case nearly 20 per cent. being present, which could not be seen by casual inspection. Borings often contain from 1 per cent. to 3 per cent. of oil. If the sample contains any large pieces they must be cut up to get the whole sample of an average size. Then 10 grms. are heated in a large porcelain crucible, over a small rose flame, to drive off oil; immediately the evolution of fumes ceases the crucible is allowed to cool and weighed. The borings are transferred to a 500 c.c. lipped beaker, with 40 c.c. of nitric acid and 40 c.c. of water, and when the metal is dissolved the excess of acid is boiled off. Any sand or tin can easily be seen on diluting. Brass borings do not as a rule contain tin except in very small quantity. If tin and sand are present, they are best weighed together after ignition, the tin is reduced in hydrogen, dissolved in hydrochloric acid, precipitated with pure zinc, digested in nitric acid, and weighed as oxide. The sand is determined by difference. The filtrate from the tin and sand is received into a 500 c.c. measuring flask; 250 c.c. are evaporated with 20 c.c. of sulphuric acid to separate the lead, and iron precipitated by means of ammonia, as usual, and weighed as ferric oxide. The copper is determined in 50 c.c. of the original solution by electrolysis or in 25 c.c. by the iodide assay. For technical purposes the zinc is taken by difference. Manganese bronze borings, after separating the tin and sand (if present), are analysed as described or manganese bronze below. When it is desired to find the percentage of free iron in borings, 20 grms. are washed with ether to extract oil, and the free iron picked out with a magnet and weighed.

Cum-metal borings.—10 grms. are heated to remove oil, and digested with 60 c.c. of nitric acid and 60 c.c. of water, the solution is filtered, and any tin and sand is ignited and weighed. The precipitate is macerated in a small mortar, a portion weighed into a boat and reduced in hydrogen; the tin is separated by means of pure zinc, and oxidised with nitric acid. The stannic oxide obtained is sufficiently pure for a technical assay. The filtrate from the nitric acid may contain a little copper and lead, and is added to the main portion and diluted to 100 c.c. as described under brass. The zinc used for reprecipitating the tin must, of course, not be dissolved. Samples of copper borings cannot always be accurately sampled by taking a small portion; the only way to analyse such samples is to weigh out 50 grms., dissolve in nitric acid, dilute it, and use one-fifth part for the analysis.

The electrolytic determination of copper.—As much of the alloy as contains about 0.8 gm. copper is dissolved in 4 c.c. of nitric acid and 4 c.c. of water (in the case of an metal, 5 c.c. of each of acid and water); the solution is heated on the hot plate, without boiling, until greasy streaks run down the side of the beaker, diluted with water (any tin present being now filtered off), 2 c.c. of sulphuric acid added, and diluted to about 250 c.c., any lead being allowed to settle. The solution is now electrolysed in the usual way. I have never found any difficulty in precipitating 0.8 gm. of copper in 18 hours, using 4 Daniell cells. If the current can be obtained through a resistance from a lamp, 1.5 grms. can easily be separated in 12 hours, but in this case 12 c.c. of sulphuric acid must be added.

The rapid electrolytic method was recently described by Price and Humphries (this J., 1909, p. 121).

The only other reliable method of copper assay is the iodide method. It has been stated that the thiosulphate solution must be standardised every day as it does not keep, but this is not so. I have repeatedly tested solutions after keeping them 6 weeks and using them every day, and there has not been the slightest alteration in strength. Certain precautions must be taken—the solution must be kept in a bottle with a well fitting stopper, in a dark

cool cupboard, free from acid fumes. The burette, containing the solution, when not in use, must be kept full and corked with a sound cork. Another objection urged against the method is that the blue colour returns after a time; but with careful working, there is no danger of this. The solution must be free from nitrites and not too dilute. For all commercial work I use a solution (1 c.c.=0.01 gm. of copper) made by dissolving 40 grms. of "Hypo" crystals in 1000 c.c. of distilled water and filtering the solution; this is standardised against pure copper, the copper contents of which have been accurately determined electrolytically. Three lots of about 0.4 gm. each are dissolved by warming in 500 c.c. flasks, with 4 c.c. of nitric acid and 4 c.c. of water, and the solutions heated on the hot plate until the neck and sides of the flasks appear greasy, and diluted to about 70 c.c.; sodium carbonate solution is added till a decided precipitate forms, when 4 c.c. of 50 per cent. acetic acid is added, the neck of the flask washed, and the solution diluted to about 150 c.c.; the solution is now well shaken with 3 grms. of potassium iodide and allowed to stand for one minute, and then titrated with the thiosulphate solution, 1 or 2 c.c. being run in at a time, and 4 c.c. of starch solution being added when within 3 or 4 c.c. of the end.

An assay of brass, accurate within 0.2 per cent., can be obtained in half an hour by the iodide method; the results are as accurate as the electrolytic methods.

Analysis of commercial coppers.

It is not possible to use one standard method for all coppers. Separate quantities must be weighed out for nearly every estimation.

Copper and lead.—The best method to estimate these two metals in electrolytic copper is to dissolve about 2 grms. in 8 c.c. of nitric acid and 8 c.c. of water as described above, then add 10 c.c. of sulphuric acid, and electrolyse. The lead may be weighed on the spiral as peroxide, but it will probably only be present in traces. When the electrolysis is completed the cone and spiral are rapidly transferred to a beaker of clean water and washed in the usual way. There is no danger of either copper or lead redissolving if this is done quickly; the elaborate washing and syphoning described in some text books is unnecessary. The lead oxide must be washed in distilled water only, not in alcohol.

The analysis of a tough copper or Chili bar is carried out as above, using 1 gm., or 2 grms., if the highest degree of accuracy is required. In the case of a copper containing over 0.2 per cent. of lead the latter should be separately estimated in 1 or 2 grms. in a solution containing only nitric acid, the copper being estimated in a separate lot. Copper cannot be correctly determined in a solution containing only nitric acid, especially if the copper contain arsenic. In the presence of 10 c.c. of sulphuric acid and sufficient nitric acid, arsenic and antimony are never deposited with the copper.

Bismuth must be accurately determined to 0.001 per cent. This can only be done by the colorimetric method. The modification I use is as follows:—10 grms. of the copper are dissolved in 35 c.c. of nitric acid and 35 c.c. water, excess of acid boiled off, and ammonia added until the solution is neutral. Ammonium carbonate solution is then added in excess and the solution kept nearly boiling for 6 hours, when the precipitate is filtered, washed, and dissolved in 4 c.c. of dilute sulphuric acid, and the solution diluted with water to about 150 c.c. 5 grms. of potassium iodide and 5 c.c. of dilute sulphurous acid (1 part of the saturated solution and 10 parts water), are now added, and the solution is boiled, and the cuprous iodide filtered off. If the solution is yellow 2 or 3 c.c. dilute sulphurous acid solution are added; if the colour is permanent, bismuth is present. The solution may be diluted to 500 c.c. and 100 c.c. compared colorimetrically in a Nessler glass, against the colour formed by adding a standard solution of bismuth to a solution of potassium iodide containing a little sulphurous acid. No gravimetric method of estimating bismuth in copper is of any value.

Arsenic.—Various methods of estimating arsenic in copper have been described, the most generally used being the various distillation methods. I have not

found it necessary to add calcium chloride to the ferric chloride mixture to get the whole of the arsenic over, provided fuming hydrochloric acid is used and the distillation carried out slowly. For this estimation, from 2 to 5 grms. of the copper are slowly boiled for $\frac{1}{2}$ hour with 20 grms. of ferric oxide dissolved in 200 c.c. of fuming hydrochloric acid. The solution is then distilled slowly till about 50 c.c. are left. The whole operation takes about 2 hours. All the arsenic is found in the distillate, and is estimated by titration with iodine solution (1 c.c. = 0.001 gm. of arsenic) in the usual way, after neutralising with ammonia, faintly acidifying with hydrochloric acid, and adding a decided excess of sodium bicarbonate (about 3 grms.). If calcium chloride is added to the ferric chloride, the arsenic can be distilled over in a shorter time, but if antimony is present it is liable to come over at the higher temperature and give high results.

Antimony is also conveniently estimated by distillation. The method is described fully by Gibb (this J., 1901, 184). It is best to make a separate distillation for arsenic. The precipitate of iron carbonate containing the arsenic and antimony is dissolved in hydrochloric acid as described by Gibb, the solution evaporated to incipient dryness, after about 0.25 gm. of pure copper is added to reduce arsenic and antimony, hydrochloric acid is added and the solution distilled again (there is no need of a thermometer); the arsenic is completely removed. Zinc chloride solution is added and the antimony distillate separately collected. It is necessary to add 3 additions of 5 c.c. each of fuming hydrochloric acid to remove all the antimony, and the solution must consist practically of fused zinc chloride. For tough coppers 5 grms. are sufficient, for "Best Select" 10 grms., and electrolytic 20 grms.

The electrolytic method gives good results, the antimony and arsenic being precipitated together with iron as basic carbonate, as in the distillation method. The precipitate is dissolved in 5 c.c. of dilute hydrochloric acid and the solution diluted to 100 c.c., treated with hydrogen sulphide, and filtered through a hardened paper, the precipitate being well washed with hydrogen sulphide solution. The antimony and arsenic are dissolved out by passing 10 c.c. of warm sodium sulphide solution several times through the filter, and the solution diluted to 50 c.c., and electrolysed after adding 5 c.c. of hydrogen peroxide solution. It is best to use electrodes of platinum foil about 2 in. by 1 in. The antimony is deposited in from 6 to 8 hours, it can be identified by the usual tests. Owing to the purity of commercial copper nowadays antimony is seldom present except in traces.

Tin is seldom found in copper. If a slight white precipitate forms on dissolving 10 or 20 grms. in nitric acid free from chlorine, the solution is diluted to about 500 c.c., and allowed to stand for 48 hours, after decanting the top liquid, the solution is diluted and digested with 5 grms. of tartaric acid for 4 hours on the hot plate; if the precipitate does not dissolve, it consists of tin and can be filtered off and weighed.

Phosphorus does not occur in refined copper except in minute traces. The method of estimation depends upon the kind of copper. Many manufactured coppers, such as tubes, rods, etc., contain phosphorus. If arsenic is not present 10 grms. are dissolved in nitric acid, and the phosphorus precipitated with ammonium molybdate, and then converted into magnesium phosphate in the usual way. When arsenic is present it must be removed by means of hydrogen sulphide, and the phosphorus estimated in the filtrate.

Sulphur occurs in refined copper in traces only. 10 grms are dissolved in nitric acid, the solution is diluted, 2 or 3 drops of hydrochloric acid added, let stand overnight to remove any silver, filtered through two ashless papers, evaporated twice to dryness with hydrochloric acid, and precipitated with barium chloride. In Chili bar copper 2 grms. are sufficient.

Iron and nickel are estimated by dissolving 10 grms. in 35 c.c. of nitric acid and 35 c.c. of water, boiling off acid fumes, diluting, and electrolysing. If the electric current can be obtained from a main supply, most of the copper can be precipitated after adding 10 c.c. of sulphuric acid, the remainder being precipitated with

hydrogen sulphide. The solution is evaporated to dryness, adding 2 c.c. of nitric acid towards the end. The iron is precipitated with ammonia, and the filtrate electrolysed after adding 1 gm. of ammonium oxalate. If hydrogen sulphide has to be used to separate the copper, the solution is diluted to $\frac{1}{2}$ litres and hydrogen sulphide passed through it for 2 hours. The precipitate is filtered through several filters, previously washed with hydrochloric acid and distilled water to remove iron. The filtrate is boiled to dryness, adding 2 c.c. each of nitric and sulphuric acids towards the end. The iron and nickel are separated as above. It is not necessary to separate cobalt.

Oxygen.—Several processes by reduction in hydrogen have been proposed for this estimation. Archbutt's method is simple and very accurate. The process is described in detail in the Analyst (25, p. 253). The analysis of mattes and similar material can be carried out similar to pure copper, using 5 or 10 grms. according to its purity.

Analysis of spelter.

The only impurities present in sufficient quantity in modern spelter to concern a metallurgist are tin, lead, copper, and iron, very rarely cadmium, and in some splatters aluminium. There is usually a difference in price of 10s. and £1 a ton between distilled spelter and remelted splatters. Very often remelted spelter is of better quality than some distilled splatters, and it is sold as distilled spelter. It is often possible to say whether a spelter is distilled or remelted from the analysis. If copper is detected the spelter is almost certainly remelted. If from 0.2 per cent. to 0.5 per cent. of tin is present as well as copper there is no doubt the spelter is remelted. Nearly all remelted splatters contain over 0.1 per cent. iron. It is said that aluminium is put in remelted spelter to brighten it; but I have never come across any. The effect of cadmium is to cause the spelter to have a fine grained fracture, quite different to ordinary spelter. For lead, tin, copper, and iron, 20 grms. are dissolved in 40 c.c. of sulphuric acid and 240 c.c. of water. If the action is too vigorous, it must be modified by cooling. When the zinc is nearly dissolved the solution is filtered and the precipitate well washed. Iron is determined in the filtrate by titration with permanganate. The precipitate is washed into a beaker, 15 c.c. of nitric acid added, and the whole boiled, diluted to 100 c.c.; if a precipitate of stannic oxide is present, it is filtered off, the filtrate evaporated until copious acid fumes are evolved after adding 10 c.c. of sulphuric acid, diluted with water, allowed to stand 3 hours or better overnight, and the lead sulphate filtered off and washed with dilute sulphuric acid in the usual way: the filtrate can be electrolysed for the remainder of the lead and the copper. This solution frequently contains some of the iron, which can be precipitated with ammonia.

Aluminium, if present, goes into solution with the bulk of the iron; it must be determined on a separate 20 gm. lot.

Cadmium is estimated on a separate 20 gm. lot; part of it dissolves with the iron and can be precipitated by passing a slow current of hydrogen sulphide for at least 2 hours. The portion left with the lead is precipitated by hydrogen sulphide after separating lead as sulphate and any copper by electrolysis. The cadmium is weighed as sulphide on dried filter papers.

In high grade splatters containing 99.8 per cent. of zinc, upwards, the only metals present are lead and iron. It is best to work on 40 grms. At present there is no sufficient accurate electrolytic method of estimating zinc direct in spelter—it is always found by difference. Any method of sampling zinc by rubbing it to powder in a hot ladle is valueless. Several plates must be drilled through in several places to get a good sample.

The complete analysis of lead, tin, and antimony is not required in a copper works, the commercial metals being sufficiently pure. The analysis of aluminium presents no special difficulty. 10 grms. should be taken for the estimation of silicon, copper, and iron. No other metal is present as a rule. The aluminium is calculated by difference.

Nickel.—In the case of cube nickel, a large number of cubes should be broken up, and 10 or 20 grms. dissolved in 80–160 c.c. nitric acid, the solution is evaporated to dryness, after adding 200 c.c. of hydrochloric acid, heated on the air bath for $\frac{1}{2}$ hour, treated with 20 c.c. of hydrochloric acid and water, and the silica filtered off. The filtrate is received into a 1000 c.c. flask; an aliquot part, equal to 1 gm. of nickel, is treated with hydrogen sulphide to remove copper, evaporated to dryness, and 1 c.c. of nitric acid added to oxidise iron, which is precipitated by ammonia as usual. The filtrate is received into a porcelain dish, dilute sulphuric acid added till the free ammonia is neutralised, then a further 5 c.c. of sulphuric acid in excess; it is now evaporated until sulphuric acid begins to volatilise, when water is added, then ammonia in excess and 1 gm. of ammonium oxalate, and the solution electrolysed at 60° C. A separate portion (equal to 5 grms.) of the 1000 c.c. is used for determining copper and iron.

Carbon is usually present in cube nickel, but is not required to be determined for the German silver trades. If necessary, the carbon, which is present in the free state, can be estimated by combustion.

Sulphur is estimated on a separate portion of the 1000 c.c. by precipitation as barium sulphate.

Analyses of alloys.—Alloys can be divided into several classes, such as various brasses, gun metals, manganese bronzes, aluminium bronzes, white metals, and the miscellaneous alloys.

In the analysis of brass copper and zinc are determined on 1 gm. by electrolysis as described for copper, but only 2 c.c. of sulphuric acid is added. The zinc is determined either electrolytically or the ferrocyanide method. From a large experience of the volumetric ferrocyanide method I believe it to be far more accurate than usually supposed provided it is carried out under standard conditions. The solution containing the zinc is evaporated to about 100 c.c., ammonia is added in excess, and the solution just heated to boiling and filtered into a 9-inch basin, with hot water containing a little ammonia; the solution is made just acid with hydrochloric acid, a further 2 c.c. is added, and the solution is diluted to about 700 c.c. and heated to boiling. The ferrocyanide solution (1 c.c. = 0.1 gm. zinc) is added, 2 or 3 c.c. at a time with continuous stirring, to within 3 or 4 c.c. of the end, the solution is again boiled, 1 c.c. of a saturated solution of uranium acetate is added, and the ferrocyanide added a drop at a time, until the solution is faintly brown. The end reaction is very sharp. If a trace of copper is present the end reaction is best obtained with spots of uranium acetate on a white tile in the usual way. The ferrocyanide is standardised against pure electrolytic zinc. The assay is accurate to within .05 per cent., working on 1 gm. of brass.

The determination of traces of tin, lead, and iron is done on 5 or 10 grms. by dissolving in nitric acid to separate tin, evaporating with 20 c.c. of sulphuric acid. All copious fumes are evolved, taking up with water and filtering off the lead sulphate after standing overnight; the iron is precipitated with ammonia as usual. This method is sufficiently accurate for commercial purposes, for exact work the small amount of lead in solution must be separated by electrolysis, and added to the main percentage. An exact analysis requires the separation of the small amount of nickel, which is often present, about 7 grms. are dissolved in nitric acid and the copper separated by hydrogen sulphide or by electrolysis; the solution is evaporated to dryness and the zinc separated by sulphide in an acetic acid solution, as described under German silver. A double separation is usually necessary if it is difficult to get rid of all the zinc by one precipitation. The nickel is determined by electrolysis. In special cases arsenic may be looked for and determined, as described under copper.

The commercial analysis of gun metal is simple, but the detailed accurate analysis is very complex. An ordinary analysis requires copper, tin, zinc, lead, and iron. 1 gm. dissolved in 5 c.c. of nitric acid and 5 c.c. of water, the solution is evaporated until the sides of the beaker appear greasy, diluted to about 50 c.c. with hot water, allowed to stand, and the stannic oxide filtered off,

and washed with hot water. For commercial analyses it can be ignited and weighed as stannic oxide, as it will not contain more than 0.2 per cent. copper. The copper and zinc are determined as in brass, the iron and lead on a separate sample, using from 3 to 5 grms., according to the amount of lead present. If an exact analysis is required the following must be looked for: copper, tin, antimony, arsenic, lead, iron, nickel, zinc, phosphorus, and sulphur. The copper, tin, and zinc are determined on 1 gm., but the small percentage of copper (and lead in gun metal containing over 2 per cent. of lead) must be determined, by fusing with about 2 grms. of a mixture of dry sodium carbonate and sulphur in equal parts, boiling with water, and filtering off the lead and copper sulphides, which are then dried and ignited; the ash is dissolved in a few drops of nitric acid and diluted to 50 c.c. in a small beaker and electrolysed. I use small electrodes of platinum foil. The copper and lead are calculated to oxide and deducted from the stannic oxide, the percentage of copper being added to the main bulk.

The percentage of antimony (which is counted as tin in commercial analyses) is determined on a separate 2 gm. lot. The impure tin oxide is fused with 2 grms. of sodium hydroxide in a silver crucible, the melt dissolved in water, the solution acidified with hydrochloric acid and the antimony precipitated by boiling with iron wire. The antimony is dissolved in 10 c.c. brominated hydrochloric acid and estimated by the bromate method (Chemical News, 95, No. 2462). The percentage of antimony is deducted from the percentage of tin; both oxides contain practically the same percentage of metal.

Arsenic is determined by distillation and the percentage calculated to arsenic oxide and deducted from the tin. Phosphorus is determined on a separate 5 gm. lot; the tin oxide is fused with potassium cyanide and the phosphorus obtained in solution.

If the lead exceeds 3 per cent., it is determined on a 2 gm. lot; the small amount carried down with the tin must be separated by fusion with sodium carbonate and sulphur, and the amount in solution from the lead sulphate precipitate must be estimated electrolytically. Iron is determined in the lead portion. Nickel may be present in small quantity and is separated as described under brass. Sulphur is very often present in quantity up to 0.2 per cent. It is determined by digesting 2 grms. with nitric acid, removing tin, evaporating to dryness with hydrochloric acid, and precipitating as barium sulphate. In the analysis of manganese bronzes, sterling-metal, etc., copper and zinc are determined on 1 gm., practically as described for brass, the only difference being that after evaporating the solution is made just alkaline with ammonia, then bromine is added until a deep red colour appears, when the solution is allowed to stand for one hour, and boiled with excess of ammonia to precipitate iron and manganese; the zinc is estimated in the filtrate. Tin and lead are estimated as in brass, using 5 grms.

Manganese, iron, and aluminium are estimated in a 5 gm. lot, separating the tin as oxide, and copper with hydrogen sulphide or by electrolysis. The filtrate is evaporated to dryness, adding 4 c.c. of nitric acid towards the end; the residue is dissolved in HCl, and iron and aluminium separated by the acetate process; the acetate precipitate is dissolved in hydrochloric acid, and diluted to 250 c.c. In one lot of 100 c.c. the iron and aluminium are precipitated together with ammonia and the iron is titrated in another 100 c.c. The manganese is precipitated with ammonia after adding bromine in the usual way. For the accurate analysis of German silver 1 gm. is dissolved in nitric acid, and the copper separated by electrolysis as for brass. The solution containing nickel and zinc is evaporated to dryness, the residue taken up with water and a few drops of hydrochloric acid, transferred to a 500 c.c. beaker, a solution of sodium carbonate added till a decided precipitate forms, when 100 c.c. glacial acetic acid are added; the bulk of the solution must not exceed 300 c.c. When perfectly cold, a stream of H_2S is passed through the solution for one hour, at the rate of about 2 bubbles per second; the zinc precipitates as pure white zinc sulphide, which can be filtered through 2 Swedish filters, washed with a solution of hydrogen sulphide, and weighed as sulphide. The nickel filtrate

is evaporated with 20 c.c. of sulphuric acid till copious fumes are evolved, diluted, electrolysed for nickel, after adding ammonia and 1 gm. of ammonium oxalate. The above separation is complete so long as the acetic acid solution is perfectly cold and saturated with hydrogen sulphide.

The small quantities of tin, lead, and iron are determined on a 10 gm. lot as for brass. The analysis of cupro-nickel for copper and nickel is best carried out by electrolysis, the copper being separated as under brass, using 0.8 gm., and the nickel in the solution. Nickel electrolyses should always be carried out in a sulphate solution containing ammonium sulphate and 1 gm. of ammonium oxalate. Cupro-nickel coins usually contain 1 per cent. zinc, and are analysed as German silver.

Cupro-manganese is tested for copper, iron, and manganese, 1 gm. is dissolved in nitric acid and the copper separated by electrolysis. The small amount of manganese deposited on the spiral is dissolved in a few c.c. of hot hydrochloric acid, and added to the main bulk, the manganese and iron being separated by the acetate process.

Phosphor-copper is tested for copper and phosphorus. 1 gm. is dissolved in nitric acid and the copper separated by electrolysis, the phosphorus being separated by the magnesia process in the solution from the copper.

Silicon-copper is tested for copper and silicon. 1 gm. is dissolved in 10 c.c. of *aqua regia*, evaporated to dryness, and heated in an air bath to render silica insoluble; the residue is taken up with hydrochloric acid and filtered to remove silica, and the filtrate is evaporated with 10 c.c. of sulphuric acid till copious fumes are evolved and then electrolysed for copper.

Aluminium bronzes.—1 gm. is dissolved in nitric acid and the copper determined electrolytically; the aluminium is determined by precipitation with ammonia for technical purposes, the iron is not determined, as it is only present in small quantity. For its determination 5 grms. are dissolved in nitric acid and the copper separated by electrolysis or hydrogen sulphide; after evaporating the filtrate to dryness and oxidising with nitric acid, the iron is separated by a double precipitation with sodium hydroxide and finally redissolved in hydrochloric acid and precipitated with ammonia.

Aluminium brass is ordinary brass containing 1 per cent. or 2 per cent. of aluminium. The aluminium is separated with ammonia, after separating copper. It is analysed practically the same as ordinary brass.

Phosphor tin.—The only constituent required is the phosphorus. 1 gm. is digested with 10 c.c. of nitric acid, the tin oxide and phosphorus are filtered off, dried, ignited and fused with potassium cyanide, the phosphorus being weighed as magnesium phosphate.

Ferro-zinc.—The only constituents required are iron and zinc. 10 grms. are dissolved in 90 c.c. of hydrochloric acid and 10 c.c. of nitric acid, and diluted to 500 c.c. The zinc is determined in 25 c.c. volumetrically and the iron in another 50 c.c. by bichromate.

White metals may be divided into three groups: 1. The rich tin alloys. 2. The rich lead alloys. 3. The zinc alloys.

There is no satisfactory and simple method which can be applied to all these alloys. In the case of an unknown alloy, a qualitative test must precede the quantitative analysis. The method described by Fresenius is the most accurate; antimony is estimated by the bromate method. In the case of a Babbitt metal containing over 70 per cent. of tin, after getting a representative sample in fine powder, 1 gm. is digested with 6 c.c. of nitric acid and 6 c.c. of water, diluted, and the precipitate, which contains the whole of the tin and antimony, and a little copper and lead is filtered off. The filtrate is evaporated with 10 c.c. of sulphuric acid to remove lead, which is filtered off and weighed. The filtrate is electrolysed for copper and any lead left in solution as for brass, the zinc being determined in the solution. The precipitate of tin and antimony oxides is ignited and weighed, then fused with a mixture of dry sodium carbonate and sulphur, and the sulphides of copper and lead filtered off and determined as described under gun metal. The weights of copper and lead found are calculated to oxides and deducted from the tin and

antimony oxides, as these latter contain the same percentages of metal. From the percentage of mixed metal found, the percentage of antimony found by the bromate method (Chemical News, 95, No. 2462) is deducted, leaving the pure stannic oxide. The bromate method of antimony assay is very accurate; as much as 10 per cent. copper has no effect on it provided the solution after reduction with sodium sulphite is boiled long enough to reoxidise the copper. In the case of rich lead alloys, the oxide precipitate may contain 2 or 3 per cent. of lead, and in alloys containing zinc, some of it is nearly always found with the tin oxide. The potassium bromate standard solution must be kept in a well corked bottle, in the dark and in a cool place, it must be standardised every week.

Bismuth occurs in small quantity up to 1 per cent. in some white metals; it may be separated with ammonium carbonate after removing the lead.

It has recently been suggested in America that standard methods of analysis should be adopted by the copper trade; there is much to be said in favour of such a proposal but there is no one method which will suit every alloy. Two or three methods are wanted which have been proved to give accurate results, and the exact conditions of working must be known, and it is with a view to help to get standard conditions in the copper and brass industry that this paper has been written.

DISCUSSION.

The CHAIRMAN said similar standardisation work was undertaken some years ago, as far as iron and steel were concerned, by a committee of the British Association, and although he believed no standard methods had been laid down, the investigation was a most useful one, as it had brought to light errors in processes that were in constant use in many laboratories. In agriculture—particularly in America—official methods of analysis had been laid down and in this country, too, quite recently the Board of Agriculture had scheduled processes to be followed in the valuation of feeding stuffs and manures. Mr. Lewis suggested that in a certain material the moisture should be determined by heating the sample in a porcelain capsule over a naked flame, a second heating at a higher temperature being employed to ascertain the organic matter. That was a barbarous procedure, which ought not to find a place in any laboratory—works or otherwise—for the valuation of copper-containing material. As regards the uniform relative accuracy of the electrolytic method and the iodide method for the determination of copper, his personal experience was distinctly in favour of the former. The analysis proceeded automatically, and the turn of the balance did not permit the uncertainty that the returning colour occasionally did in the volumetric method. Mr. Lewis stated that the presence of cadmium altered the fracture of the spelter. What was the least percentage present in the metal that could readily be detected by the eye of an experienced man?

Dr. T. S. PRICE said he did not consider one evaporation with hydrochloric acid sufficient to get rid of nitric acid; he always evaporated several times. Why were 250 c.c. of electrolytes used for the electrolysis of copper solutions? In his paper (this J., 1909, 117) Mr. Lewis rather criticised the small volume of electrolyte used. Now an essential principle in electrolytic analysis was to use a small a volume of electrolyte as possible in order to get out the last traces of copper. He thought 150 c.c. was plenty. Had the author accurately calibrated his measuring flasks, pipettes, and burettes, and did he take those calibrations into account when doing his assay? If he did not, the iodide assay could not be as correct as the direct electrolytic analysis. Thio-sulphate solution might keep well in a concentrated solution, but it did not keep in dilute solution, say a N/50 or N/100.

He (Dr. Price) also called attention to the molar apparatus in which the bottle was directly connected with the burette all the time. In the electrolytic assay of lead in fairly pure brass, to what temperature was it necessary to heat the lead peroxide formed, in order to drive off the water and get it of constant weight? He believed it was about 230° C. In regard to the suggestion of estimating nickel electrolytically from a solution containing ammonium oxalate he (Dr. Price) pointed out that

in numerous papers it had been shown that carbon was always deposited with the nickel. The accurate method was to use a strongly ammoniacal solution of the sulphate, ammonium sulphate being added to make the electrolyte conduct better. It was not even necessary to have the nickel present as sulphate, as had been recently shown; it could be present as nitrate or chloride, so long as the solution was strongly ammoniacal and contained ammonium sulphate.

Prof. T. TURNER said the first move in the direction of standardisation of metal analyses was the production of a series of samples of standard steels by the International Committee, through its English section, in connection with the British Association. He (Prof. Turner) was the custodian of these samples, which were still available for reference. A great deal had been done recently in other directions in connection with the analysis of cast iron; and the American Foundrymen's Association had appointed a committee and issued suggestions for standard methods for cast iron. The Brassfounders' Association of America was considering the question of standard methods for the analysis of brass. Mr. Stead was reading a paper at the forthcoming International Congress of Applied Chemistry on the standard methods for iron and steel. He (Prof. Turner) had recently received a copy of a report prepared by a number of American chemists, the object of which was to introduce standard methods for the sampling and analysis of iron ores. Some of the suggestions in this report were very interesting. For instance, they had been in the habit of estimating moisture on a relatively small sample. The standard method now adopted by the whole of the chemists in connection with the Carnegie steel plants and others in America was to use 2 kilos. for the estimation. Another suggestion made in this report was the precipitation of manganese by ammonium persulphate. Personally he thought that method was likely to be an improvement on the bromine method, as the use of bromine in the laboratory was always somewhat objectionable. He would be glad to have fuller particulars of the cyanide process for separating phosphorus from the tin residue—the phosphor-bronze.

Mr. J. M. LEVY pointed out, in connection with the assay of copper materials at the smelters, that one generally required to know the percentage of copper very rapidly to control the furnace working. One had to use either the cyanide assay or the rapidly rotating electrode. Many smelters still relied on the cyanide assay as being sufficient to give a good idea of the amount of copper in the matte during the furnace run. He regarded the use of zinc for separating copper as an extremely good method. He had done a fair amount of work on this method; it had an advantage in that one was enabled to do two assays at once, if one had to estimate iron as well as copper. The iron could be determined at once, and the reduction of iron acted as an indicator, for when the iron was reduced all the copper had been precipitated. Would not Mr. Lewis recommend the ferric chloride method in precipitating arsenic and antimony as the arseniates and antimonates of iron instead of the prolonged complex distillation?

Mr. A. E. JOHNSON said he preferred the electrolytic method with rotating electrodes for determining copper, iron, and nickel, both on account of its rapidity and accuracy. Mr. Lewis mentioned in his description of the arsenic distillation method that no thermometer was needed, but if antimony were present, and one did not carefully watch the distilling flask, it was liable to go up to such a temperature that the antimony would come over and would then be titrated as arsenic to give high results. He testified to the usefulness of the suction method for filling burettes by clamping each burette to a bottle and arranging it that the solution might be sucked from the bottle. This method saved much time. Why did Mr. Lewis separate the copper in estimating manganese and iron in manganese bronze? Why not take a large quantity, separate out the tin and lead in the way done for brass, then precipitate the iron and manganese together by ammonia, filtering off and estimating them separately after re-solution and re-precipitation from the combined precipitates?

Mr. F. H. ALCOCK said that thiosulphate solutions weaker than 40 grms. per litre did not keep at all well. It

was thought that the decomposition was set up by sulphur-loving bacteria. The addition of a few drops of carbon bisulphide improved its keeping properties. He kept his decinormal solution in a stoppered amber-coloured bottle and in the dark. The starch solution mentioned would keep six months or more if a little benzene were added to the mucilage at the time of making. A mixture of potassium iodide solution and starch mucilage would not keep; it would quickly develop a blue colour, but with a little benzene it would keep for at least three years. Had Mr. Lewis met the presence of cobalt in spelter? He had found recently spelter containing traces of this element, but did not know its source. Some of the methods described were rather costly. For example, in separating zinc from nickel, 100 c.c. of glacial acetic acid were used. He thought the word determination of percentage should be used in "estimation," for the latter applied more to pecuniary value. Had Mr. Lewis ever determined the amount of zinc in white metals by rendering the solution slightly alkaline with sodium bicarbonate and then adding a solution of potassium cyanide in excess as passing through the solution so prepared sulphuretted hydrogen which eliminated the zinc as sulphide? He could then proceed easily with the copper and nickel determinations.

Mr. LEWIS, in reply, said that all methods of analysis in the copper trades were adopted solely from a commercial point of view, copper being a comparatively expensive metal. It might seem a barbarous method to determine moisture in copper scale by heating in a porcelain dish until all fumes are driven off, yet if scale were bought, the moisture contents of which had been determined by heating in a steam oven for 5 or 6 hours, and then sold it to a smelter who removed 2 per cent. of oil by heating in an iron pan, each percentage of oil meant a loss of 10s. per ton. He did not know the smallest percentage of cadmium required to alter the fracture of zinc, but 0.5 per cent. turned the coarse crystalline fracture into a very finely crystalline one, and 0.2 per cent. gave quite a different fracture to ordinary zinc. To remove nitric acid completely he always evaporated to dryness twice with fuming hydrochloric acid. In regard to the bulk of solution used in an electrolytic copper assay, when using stationary electrodes and about 1 gm. of copper, if the deposition of copper is facilitated by using a concentrated solution the deposition of impurities such as arsenic is also facilitated. There was a great difference in depositing copper from a chemically pure salt and depositing it from commercial bar copper.

Accurately graduated apparatus for the iodide assay could be obtained at rather a higher price than ordinary graduated apparatus. He used one burette for that work only. He used to keep the thiosulphate solution in a self-filling burette, but abandoned it, as it was impossible to keep the solution under the conditions necessary to keep it from deteriorating, namely, in a cool, dark place, free from acid fumes; such a condition was difficult to obtain in an assay laboratory.

As regards the weighing of lead peroxide deposited electrolytically, he only estimated the small amount left in solution after separating the bulk with sulphuric acid; as it only amounted to a few mgrms. it made no practical difference whether it was dried at 100° C. or 200° C. In the case of commercial copper containing over 0.2 per cent. of lead, he heated it at about 200° C. He never estimated large quantities of lead electrolytically. It was quite true that in presence of 5 or 6 grms. of ammonium oxalate in a nickel electrolytic assay, using a concentrated solution, the deposited nickel contained carbon, but if only 1 gm. were added and the solution diluted to 250 c.c. the nickel did not contain carbon. He had noticed a deposition of carbon on the spiral. The presence of ammonium sulphate was essential to get a good deposit. The estimation of arsenic by co-precipitation with iron was doubtless necessary in the assay of ores and mattes, but was not necessary in refined copper.

Mr. Johnson's remarks about distillation of arsenic and antimony were quite correct when using a concentrated solution and very little acid, but in presence of a large amount of hydrochloric acid the arsenic came off long before the temperature is raised sufficiently for the antimony to come over. In the precipitation of iron,

manganese, and aluminium together in an ammoniacal solution of copper, it was difficult to get all the aluminium out of solution, and the separation of the copper from a large bulk of iron precipitate was difficult. The copper must be separated first. He had never come across cobalt in zinc. He had not tried separating zinc from nickel and copper in a cyanide solution. The separation of phosphorus in the tin oxide precipitate was an old process; the precipitate was fused with about 2 grms. of pure potassium cyanide for 2 or 3 minutes to reduce the tin to metal, the phosphorus forming phosphate. It was extracted with hot water and filtered into a porcelain dish, 40 c.c. of hydrochloric acid added, the filtrate evaporated to dryness, and the residue taken up with a few drops of hydrochloric acid and about 20 c.c. of water; the solution is filtered, 1 gm. of citric acid dissolved in water added to the filtrate, then ammonia in excess, any precipitate formed being filtered off. 20 c.c. of magnesia mixture were then added, and the precipitated phosphate weighed in the usual way; the total volume of solution should not exceed 150 c.c.

New York Section.

Meeting held at Chemists' Club on Friday, April 23rd, 1909.

MR. MAXIMILIAN TOCH IN THE CHAIR.

THE DETERMINATION OF COTTONSEED HULLS IN COTTONSEED MEAL.

BY G. S. FRAPS.

Comparison of the composition of cottonseed meal and cottonseed hulls leads one to suppose that it should be possible to secure a reagent which would remove cottonseed meal almost completely, while affecting the hulls to a slight extent only. This is the principle upon which the proposed method for estimating hulls in cottonseed meal is based. The method adopted after a considerable number of trials is as follows:—

Two grms. of the meal are extracted with ether on a hardened filter paper, transferred to a tall beaker, and

200 c.c. of boiling water and 20 c.c. of $N/5$ sodium hydroxide solution are added. A round-bottomed flask filled with water is placed on the beaker to act as condenser, and the whole is boiled for thirty minutes, filtered through a thin layer of asbestos and a three-inch Hirsch funnel, the residue washed thoroughly, transferred to a porcelain crucible, and dried to a constant weight, weighed, ignited, and weighed again. The loss in weight is the insoluble residue. In order to apply this method, it is necessary to know the quantity of insoluble residue yielded by cottonseed hulls, and by cottonseed meal of high purity.

Seventeen samples of meal were sifted to remove hulls as thoroughly as possible. The quantity of insoluble residue was found to be as follows:—Maximum, 13.33 per cent.; minimum, 8.22 per cent.; average, 10.46 per cent.

Sixteen samples of meals of high purity were selected. They contained from 4.85 to 6.73 per cent. of crude fibre, and yielded the following amounts of insoluble residue:—Maximum, 14.09 per cent.; minimum, 9.75 per cent.; average, 11.38 per cent. None of these samples was free from hulls. It appears probable that a meal free from hulls should contain less than 10 per cent. of insoluble residue, estimated according to our method. While a meal containing 10 per cent. insoluble residue contains some hulls, a meal yielding this quantity of insoluble residue is certainly of high purity.

Twenty samples of cottonseed hulls were subjected to analysis, with the following results:—Maximum, 77.87 per cent.; minimum, 69.01 per cent.; average, 75.22 per cent. It appears that hulls yield 75 per cent. insoluble residue, on an average. For the approximate estimation of cottonseed hulls in cottonseed meal, the following method is therefore proposed:—

Determine the quantity of insoluble matter as previously described. Subtract 10 per cent. from the percentage found to be present, and add one-third of the residue. The total is the approximate percentage of hulls in the meal, in excess of the quantity in meals of highest purity. Suppose, for example, 15 per cent. of woody fibre is present in a given meal; subtracting 10 per cent. and adding one-third of the remainder gives us 6.66 per cent. excess hulls present. The quantity of hulls which should be allowed in meal is a subject of further study.

Credit is due to assistant chemist, J. T. Cruse, for most of the analytical work referred to above.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

English.—8d. each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Raising liquids; Apparatus for — H. P. W. Esping, Nässjö, Sweden. Eng. Pat. 9283, April 29, 1908.

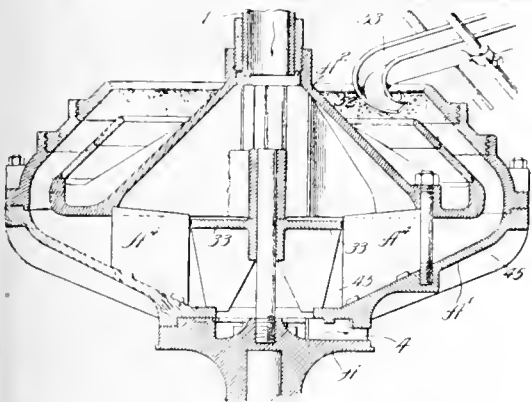
A VESSEL provided with a valved liquor inlet and a liquor outlet is suspended in the body of the liquid which is to be elevated, being hung from one arm of a bent lever supported above the liquid tank. A second similar vessel or a counterpoise is suspended from the other arm of the lever. The fulcrum of the lever is situated below the level of the point of attachment of the vessels. The first vessel is also connected to a supply of compressed air by a flexible pipe and the liquor outlet is connected to the valved rising main by another flexible pipe. The supply of compressed air is controlled by a valve operated by the lever. The apparatus works in the following manner: When the vessel is full of liquid, it sinks and pulls over the lever, opening the air valve. Compressed air enters the vessel and forces the liquid out through

the rising main. As soon as the liquid has been forced out by the compressed air, the vessel rises, the lever is reversed, shutting the air off, and the vessel commences to fill again.—W. H. C.

Mixing, kneading and working up materials. O. Bertram Halle a/S., Germany. Eng. Pat. 12,076, June 3, 1908. Under Int. Conv., March 25, 1908.

To ensure thorough mixing, either the material or the support carrying the kneading tool, or both, are subjected to an intermittent rotary movement relatively to the operating movement. This is effected by imparting to the material or the vessel containing it an intermittent movement and to the tool a continuous swinging or rocking movement.—W. H. C.

Separating solids [peat] from liquids; Centrifugal machine for — A. J. Boulton, London. From W. H. Bradley Chicago, Ill., U.S.A. Eng. Pat. 25,300, Nov. 24, 1908. The peat is first crushed until it forms a mixture of the consistency of cream and this is then fed continuous



through the pipe, 1, into the centrifugal separator chamber, A, A¹, A², which is rotated from below. It passes over the spreader plate, 33, into the separating chamber, 45, provided with radial plates, A⁴, to prevent the liquid washing away the solid matter. The latter passes to the annular compacting chamber, 2, from the upper part of which it is forced out by means of the plough, 52, through the conduit, 53. The liquid is discharged through the radial openings, 4.—W. H. C.

Separating and sorting materials. C. Seck, Dresden, Germany. Eng. Pat. 4684, Feb. 25, 1909.

THE materials to be separated are passed between rollers and fed through a shoot formed by two endless webs rotating in the same direction on to a rapidly rotating roll or disc formed either of hard or resilient material. The particles rebound from the roll or disc at different angles according to their size and specific gravity, and are collected in separate receivers placed below.—W. H. C.

Pyrometer. C. B. Thwing, Philadelphia, Pa. U.S. Pat. 919,399, April 27, 1909.

THE pyrometer consists of a tube having a non reflecting, heat-absorbing inner surface. The tube has an opening at the outer end provided with a protecting shield of mica and a thermo-electric couple at the inner end. The heat radiations gathered by the tube are concentrated upon the junction of the thermo-couple by a bright unnel-shaped reflector.—W. H. C.

Distilling apparatus. M. B. Blouko, Chicago, Ill. U.S. Pat. 919,685, April 27, 1909.

THE still has a corrugated bottom which is provided with a flushing discharge port on one side. The still is fed with warm water from the condenser jacket, the inlet being on the opposite side to the flushing discharge port and provided with a deflecting plate within the still to direct the water on to the bottom during the flushing operation.—W. H. C.

Kiln. F. Macarthy, Assignor to Sayre and Fisher Co., Sayreville, N.J. U.S. Pat. 919,902, April 27, 1909.

THE claim is for a kiln built above a series of flues having re-grates at one end. The fire-gases pass from the flues to the kiln through openings in the floor of the latter. The openings in the floor are provided with dampers operated through openings in the side walls of the kiln.—W. H. C.

Drying apparatus. R. Grauer, Los Angeles, Cal. U.S. Pat. 920,050, April 27, 1909.

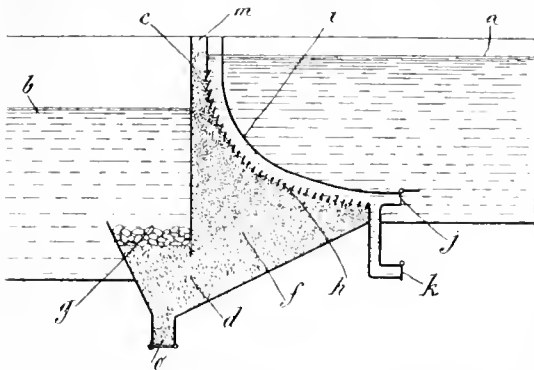
A NUMBER of semi-cylindrical perforated troughs having semi-cylindrical perforated covers and screw-conveyors adapted to move the material forward are arranged one above the other in a casing. Fans are arranged between the troughs to produce a current of air through the perforations. The material to be treated is fed into one end of the uppermost trough and is discharged from the opposite end into the trough next below and so on to the

lowest trough from which the material is discharged. It may then, if desired, be elevated to the uppermost trough of a second series and so on.—W. H. C.

Heating solid, liquid, or gaseous bodies, by utilising the heat of reaction of the combination of sulphur with other bodies, chiefly metals. A. Lang. Fr. Pat. 395,536, Oct. 21, 1908.

A MIXTURE of powdered or melted sulphur with an appropriate metal is placed in a tube and the reaction is started by the application of a high temperature, obtained by igniting an incandescing mixture, to any point of the sulphur mixture. The tube is placed in contact with the material it is desired to heat.—W. H. C.

Filter with laths (Venetian shutters) for liquids or gases. A. Tixier. Fr. Pat. 395,542, Oct. 21, 1908.



THE principle of the filter is based upon the arrangement of the filtering material (sand) in what is practically a U-tube having one leg longer than the other, the sand being confined by laths, and filtration being possible in either direction. The impure liquid from the reservoir, a, passes through the valve, j, and enters the space behind the curved shield, i, which prevents the disturbance of the surface of the sand, f, retained by the laths, h, and the partition, c. The liquid passes through the sand, f, d, and is discharged through the layer of pebbles, g, into the filtered-liquid reservoir, b. When it is necessary to clean the filter, the valve, j, is closed, and k opened and the water flows out of k, carrying away any deposit and some of the sand. The sand thus carried away is washed and returned to the filter through m. When it is necessary to change the whole of the sand, the valve, o, is opened and the sand flushed out.—W. H. C.

Filtering liquids. C. H. Perrin. Fr. Pat. 396,061, Dec. 16, 1907.

THE apparatus is practically a filter-press arranged vertically, the pasty or fibrous filtering medium being supported on perforated trays.—W. H. C.

Filtration of liquids. J. Resines. Fr. Pat. 396,173, Nov. 9, 1908.

THE liquid is fed into the drum of a centrifugal machine and is driven by the centrifugal force through the cylindrical portion of the drum, which is formed of a suitable filtering medium, the impurities being retained by the latter.—W. H. C.

Pulverisation, dispersion, and mixing of liquids; Process and apparatus for the —. Pagès, Camus, et Cie. and P. Bardy. Fr. Pat. 396,476, Jan. 27, 1908.

THE claim is for an atomising jet in which the angle of dispersion and the length of the jet of atomised liquid are adjusted and regulated by simply adjusting the speed and pressure at which the liquid or liquids enter the gyratory chambers or channels of the atomiser.—W. H. C.

Vaporisation and concentration of liquids by atomisation. Pages, Camus, et Cie. and P. Bardy. Fr. Pat. 396,622, Jan. 31, 1908.

THE claim is for effecting the evaporation of liquids, the generation of steam, the washing of gases with liquids, and other analogous operations by delivering the liquid into the apparatus in the finely-divided condition produced by atomisation.—W. H. C.

Absorption and reaction towers; Automatic sprinkling device for —. F. Klute and H. Ising. Ger. Pat. 209,276, April 16, 1907.

THE sprinkling liquid flows from the supply tank into a vessel provided with a float-valve. From this vessel several valved outlet pipes lead into a common pipe connected with the supply pipe of the distributing device above the tower. In order to vary the amount of liquid supplied to the distributing device, one or more of the valves are completely opened or closed. In the usual forms of apparatus in which the supply is regulated by partially opening or closing the valve in the single pipe leading from the vessel containing the float-valve, the narrow opening thus left is liable to become obstructed by foreign matter.—A. S.

Drying machine; Continuous —. J. Black, A. H., II., and A. B. Lennox. Newcastle-on-Tyne. U.S. Pat. 924,351, May 11, 1909.

SEE Eng. Pat. 4155 of 1908; this J., 1909, 234.—T. F. B.

Filter; Mechanical pressure — for water. E. H. Alvord. Fr. Pat. 396,481, July 25, 1908.

SEE U.S. Pat. 891,996 of 1908; this J., 1908, 886.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

National Physical Laboratory. Memorandum as to photometric units. May, 1909.

IN order to determine as accurately as possible the relations between the photometric units of the United States, France, Germany, and Great Britain, comparisons have been made at different times during the past few years between the unit of light maintained at the Bureau of Standards, Washington; at the Laboratoire Central d'Electricité, Paris; at the Physikalisch-Technische Reichsanstalt, Berlin, and at the National Physical Laboratory, London.

The unit of light at the Bureau of Standards has been maintained through the medium of a series of incandescent electric lamps, the values of which were originally intended to be in agreement with the British unit, being made 100/88 times the Hefner unit.

The unit of light at the Laboratoire Central is the bougie decimale, which is the twentieth part of the standard defined by the International Conference on Units of 1884, and which is taken, in accordance with the experiments of Violle, as 0.104 of the Carcel lamp.

The unit of light at the Physikalisch-Technische Reichsanstalt is that given by the Hefner lamp burning at normal barometric pressure (76 cm.) in an atmosphere containing 8.8 litres of water vapour per cubic metre.

The unit of light at the National Physical Laboratory is that given by the 10 candle power Harcourt pentane lamp prescribed for use by the Metropolitan Gas Referees, burning at normal barometric pressure (76 cm.) in an atmosphere containing 8 litres of water vapour per cubic metre.

As a result of all the comparisons the following relationships are established between the above units:—

The pentane unit has the same value within the errors of experiment as the bougie decimale. It is 1.6 per cent. less than the standard candle of the United States, and 11 per cent. greater than the Hefner unit.

The Bureau of Standards (U.S.A.) proposed to reduce its standard candle by 1.6 per cent. provided that France and Great Britain would unite with the United States in maintaining the common value constant, and with

the approval of other countries would call it the International candle. The National Physical Laboratory, London, and the Laboratoire Central d'Electricité, Paris, have agreed to adopt this proposal in respect to the photometric standardisation which they undertake, and the date agreed upon for the adoption of the common unit and the change of unit in the United States is April 1, 1909.

The following simple relations will therefore hold after that date:—

Proposed New Unit = 1 Pentane Candle.
= 1 Bougie Decimale.
= 1 American Candle.
= 1.11 Hefner Unit
= 0.104 Carcel Unit

Therefore 1 Hefner Unit = 0.90 of the proposed New Unit.

The proposal to call the common unit of light to be maintained jointly by the national standardising laboratories of the United States, France, and Great Britain the "International candle" has been submitted to the International Electrotechnical Commission, and through it to all the countries of the world which are represented on that Commission.

It is hoped that general approval will be secured, and that in the near future the term "International candle" for the new unit will have official international sanction.

Natural gas at Baku. See III.

Determining thorium in monazite sand. Borelli. See XX.

Determining cerium. Metzger. See XX.

PATENTS.

Dehydration of moist materials, more especially peat. Oberbayerische Kokswerke und Fabrik Chemischer Producte A.-G. Fr. Pat. 395,637, Oct. 24, 1908.

THE moist peat, spread in layers, is brought into close contact, but without great pressure, with a layer of sphagnum (bog-moss) or other similar absorbent material, the capillarity of which is greater than that of the material to be dehydrated. The moisture absorbed is afterwards expressed from the layer of sphagnum which is thus rendered fit for use again.—W. H. C.

Nitrogen hydrophosphide; Preparation of — for carburetting alcohol for use in all kinds of explosion motors. A. Barbier. Fr. Pat. 396,366, Jan. 24, 1908.

A solution of white phosphorus in benzol is saturated with a mixture of hydrogen and nitrous oxide and sealed up. After about twelve hours a slight smell of garlic will be observed indicating that the reaction is complete. The liquid so obtained is mixed with alcohol for use in explosion motors.—W. H. C.

Gas generating plants. C. F. Botley, Hastings, and S. Cutler, jun., London. Eng. Pat. 8524, April 16, 1908.

THE claim is for the provision of a spare or reserve generator for a water-gas plant to be used when the ordinary generator has to be thrown out for repairs, in order to avoid the necessity of keeping the whole set idle. One such spare generator is arranged to two units of plant, and can be connected to either set as required.

—W. H. C.

Producer-gas; Method of making —. E. E. Slick. Pittsburg, Pa. U.S. Pat. 921,173, May 11, 1909.

FUEL is burned in an up-draught producer having a vertical front wall and an inclined rear wall, so that the sectional area of the fuel column is greatest at the top of the producer. The coal descends gradually as ashes are removed from a water-trough at the bottom of the producer and fuel is admitted at a regulated rate from a hopper fixed on the front wall of the producer, so that the fresh fuel passes across the top of the fuel bed towards the rear wall. A regulated supply of air under pressure is admitted at the bottom of the fuel column.—A. T. L.

Electric incandescence lamps; Process and apparatus for the reduction of metallic filaments for — J. M. Canello. Fr. Pat. 396,425, Nov. 17, 1908.

The apparatus is for the reduction of metallic filaments by heating electrically in an atmosphere of hydrogen. It comprises a glass bell in which the reduction is effected, a main switch for connecting the circuit to either of three leads supplying current at 300, 500, or 1500 volts, an ampèremeter, a regulating switch for adjusting the voltage by means of a secondary battery, a commutating switch, and a circuit-breaker, the whole being arranged on one base board. The glass bell is held between two horizontal arms, adjustable vertically on a standard. The bell rests on a rubber ring in an insulated plate on the lower arm, and is pressed down to make a tight joint by means of a leaf spring fixed to the upper arm and depressed by a cam. A passage formed in the lower arm is open to the interior of the bell, and is connected to the vacuum pump. The insulated plate carries vertical supports for the filament which also form the leads and one of these supports is hollow and serves for the introduction of hydrogen. The tubes leading to the vacuum pump and to the source of hydrogen are flexible, and may be closed when desired by pressing them against the base board by means of small cams. The circuit-breaker comprises two mercury contacts, and is normally held open by a spring; rubber discs are arranged on the wires which make contact with the mercury, in order to prevent splashing when the switch is suddenly closed. In carrying out the process of reduction, the bell is filled with hydrogen, and the filament brought to incandescence. The bell is then removed, and the filament is given the desired elongated or V-shape by means of a small pivoted weight, carried on one of the filament supports and moved by a magnet. The filament is again heated in hydrogen, the voltage being regulated according to its resistance. To prevent distortion of the filament, a strong permanent magnet is placed beneath the bell to neutralise the earth's field, and if necessary the current reversed by means of the commutator.—A. T. L.

Electric incandescence lamps; Process for preventing the formation of cavities in filaments for — in their manufacture from colloidal filaments. H. Kuzel. Fr. Pat. 396,899, Nov. 30, 1908. Under Int. Conv., Oct. 15, 1908.

FILAMENTS made from colloidal metals by the processes described in Fr. Pat. 359,025 of 1905 and in the second, third, and fourth additions thereto (this J., 1906, 308, 384, 1085; 1907, 919), are liable to contain small or elongated cavities, formed during the rapid shrinkage which occurs when the colloidal filament is heated by the passage of a current. According to this invention the formation of these cavities is prevented by heating the colloidal filaments in a non-oxidising atmosphere at a pressure not exceeding 150 mm. of mercury, and preferably below 40 mm., instead of at atmospheric or slightly reduced pressure. In carrying out the process, a current of gas at low pressure is passed through the vessel in which the filaments are heated, and this vessel is in constant communication with the vacuum pump. In order to carry away the gases liberated from the filaments, and to prevent any rise of pressure due to heating, the gases used consist of a mixture of an inert gas and a reducing gas, for example, a mixture of 80 per cent. nitrogen and 20 per cent. of hydrogen, so that any air leaking into the vessel may not attack the filaments. The filaments are preferably kept under tension during the heating. The process is specially advantageous when the colloidal filaments are prepared in the manner described in Fr. Pat. 371,799 of 1906 (this J., 1907, 434). —A. T. L.

Fuel for internal combustion engines of the reciprocating type; Manufacture of — S. Barth. Düsseldorf-Obercassel, Germany. Eng. Pat. 19,928, Sept. 22, 1908. Under Int. Conv., Aug. 6, 1908.

SEE Fr. Pat. 394,386 of 1908; this J., 1909, 301.—T. F. B.

Coke ovens. T. von BAUER, Berlin. Eng. Pats. 6575, March 24, 1908, and 6845 of 1909 (date of appl. March 24, 1908).

SEE Fr. Pat. 390,720 of 1908; this J., 1908, 1103.—T. F. B.

Coke ovens. L. Bansart, Wolimont, Belgium. Eng. Pat. 9377, April 30, 1908. Under Int. Conv., May 15, 1907.

SEE Fr. Pat. 390,204 of 1908; this J., 1908, 1010.—T. F. B.

Gas retorts. E. Gennotte, Brussels. Eng. Pat. 21,489, Oct. 10, 1908.

SEE Fr. Pat. 390,563 of 1908; this J., 1908, 1103.—T. F. B.

Incandescence filaments for electric incandescence lamps from colloidal elements; Process for the avoidance of hollow spaces in the production of — H. Kuzel, Baden, Austria. Eng. Pat. 25,443, Nov. 25, 1908. Under Int. Conv., Oct. 15, 1908.

SEE Fr. Pat. 396,899 of 1908; preceding.—T. F. B.

Separating solids [peat] from liquids. Eng. Pat. 25,300. See I.

Measuring the explosive and calorific values of gaseous mixtures. Eng. Pat. 9150. See XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Natural gas and white petroleum at Baku. J. Gasbelencht., 1909, 52, 435.

At Surachany and Amiradschan in the Baku oil-field, there are occurrences of natural gas. The gas has been used for a long time on a small scale by the natives as fuel for burning lime, and more recently on a larger scale in the petroleum distilling plants. Such a large supply of gas was opened up in the Surachany plain in 1903, that it became possible to use it as fuel in the adjacent Balachany oil-field as well as in the district of its origin. The use of natural gas as fuel at Baku is of considerable importance, for in this oil-field 15 per cent. of the total production of crude oil are used in producing power for boring and transporting purposes; moreover the yield of crude oil is steadily falling and the price rising. The amounts of gas obtained and used as fuel for the past four years were as follows: 1905, 46.53 million cb. m.; 1906, 96.30; 1907, 117.13; and 1908 (Jan. 1 to June 1), 27.92 million cb. m. About 1037 cb. m. of the gas are equivalent in fuel value to 1 metric ton of crude oil.

The so-called "white" petroleum is obtained in the Sabuntchy district. It has the sp. gr. 0.776–0.788, and is used almost exclusively as an adulterant in the preparation of a duty-free but dangerous illuminant. Its use as an adulterant consists in filtering it through animal charcoal and then adding it to ordinary illuminating oil to the extent of 50 per cent.

In other parts of the Baku oil-field the natural gas is used for firing steam boilers and for driving gas-engines, etc.—A. S.

Petroleum production in California. Board of Trade J., May 20, 1909. [T.R.]

PETROLEUM now ranks first among the mineral products of California, its output surpassing that of gold for the first time last year. During 1908 there were remarkable developments, and many new discoveries were made in different parts of the State. Probably the most important one was in northern Santa Barbara County, where several producing wells have been opened, while work is in progress on many others with indications that oil will be found in paying quantities. The Santa Marina district yielded only 99,000 barrels (of 42 gallons) of oil in 1902, while last year 10,000,000 barrels were obtained there. In Contra Costa County, not far from Antioch, it is reported

that oil of high quality has been found. Oil drillers have been at work for some years in that section, but the output has not yet reached commercial proportions. Important discoveries were also made during 1908 in Fresno County. In San Joaquin County there have been some indications of oil in paying quantities. In the Livermore foothills a good grade of oil, with an asphaltum base, has been found at a depth of about 1000 feet.

Mineral lubricating oils: New values in the analysis of — R. Kissling. Chem.-Zeit., 1909, 33, 521–522.

In determining the "coke value" of mineral oils (this J., 1908, 1053; 1909, 84) it is essential to wash the coke-like substances free from alkali by means of hot water, or the results will be too high. This direction was omitted in the previous communications. It has been urged against the author's method that the values obtained with a given oil may vary very widely at different times owing to unavoidable irregularities in the distillation and refining processes. In reply to this the author gives results obtained with 4 samples of the same oils taken from the works at intervals of several months. In the case of a Pennsylvanian machine oil the tar value varied from 0.11 to 0.12; the tar-forming value from 0.52 to 0.57; and the coke-forming value from 0.31 to 0.40. The results obtained with a heavy Russian machine oil were equally concordant, but greater deviations were observed in the results given by another oil of the same kind (tar value, 0.18 to 0.22; tar forming value, 0.49 to 0.63; and coke-forming value, 0.22 to 0.47). Such variations, however, are not great enough to vitiate the method, and in any case it is open to manufacturers to fix limits for the respective values.—C. A. M.

PATENTS.

Calcination, carbonisation, or distillation of mineral or organic materials. Pagès, Camus, et Cie. and P. Bardy. Fr. Pat. 396,623, Jan. 31, 1908.

In those processes in which a gas is circulated through the retort to facilitate the evolution of vapours and gases from the heated material, an unexpected decomposition may sometimes arise owing to the unsuitable nature of the gases used. To avoid this difficulty the gas evolved during the process is collected in a gas holder and used for circulating through the retort after being superheated to the requisite temperature. The materials may be previously heated to nearly the temperature of reaction by circulating other gases through them, e.g., waste furnace gases. By passing the gas from the holder through the residue in the retort before the former enters the superheater, the residue is cooled and the heat contained in it recovered.—W. H. C.

Distillation of industrial fuels: Process of — M. Ferrari, J. Robert, and E. A. Mégret. Fr. Pat. 396,738, Feb. 1, 1908.

The process consists in carrying off the volatile products from the distillation of wood, peat, coal, or other fuel by means of a current of gases at a comparatively low temperature (300°–600° C.). The gases may be hydrocarbons, hydrogen, carbon monoxide, inert gases, or steam. In one method of carrying out the process, the heat of the gaseous current causes the distillation and no external heat is supplied, but in other cases, the retort may be heated sufficiently to make good the loss by radiation, or if necessary, distillation may be effected by external heat.

—A. T. L.

[Mineral] Oil: Means for reducing the freezing-point of — W. R. Whitney, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 919,506, April 27, 1909.

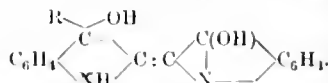
The claim is for the preparation of a low freezing-point insulating fluid formed by adding a hydrocarbon containing a substituted halogen atom, e.g., benzyl chloride, to a high flash-point mineral oil.—W. H. C.

Porcelain mould for paraffin candles. Fr. Pat. 396,744. See XII.

IV.—COLOURING MATTERS AND DYESTUFFS.

Fat dyestuffs: Action of Grignard's reagent on — Part I. Indigo. F. Sachs and H. Kantorowicz. Ber 1909, 42, 1565–1576.

The authors find that when Indigo is added to an ethereal solution of Grignard's reagent, it dissolves with an intense brownish-yellow coloration and heat is generated. When magnesium-phenyl bromide is used, two substances are formed, namely an orange substance soluble in alcohol and a small amount of a colourless acid. The constitution of these substances has not yet been definitely settled, but it is considered that the most probable formula for the principal (orange) substance is



The Grignard reagents employed were ethyl-, methyl-, propyl-, isobutyl-, isomyl-, phenyl- and *p*-tolyl-magnesium bromides and benzyl-magnesium chloride. The product obtained varied in colour from orange to red and resembled that described above. The authors state also that flavanthrene and Thioindigo react with the reagent and they are engaged in the study of these reactions.

—J. C. C.

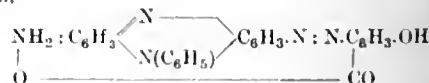
Naphthol Yellow S. H. Finger. J. prakt. Chem., 1909, 79, 441–445.

By reducing Naphthol Yellow S with stannous chloride and hydrochloric acid, Lauterbach obtained a nitro aminonaphtholsulphonic acid of which an isomeride is produced when the reduction is effected by means of alkali sulphide. As the latter acid forms azo-dyestuff which can be chromed on the fibre, its constitution has been supposed to be OH : NH₂ : NO₂ : SO₃H = 1 : 2 : 4 : 7 whilst the isomeride acid was assigned the formula OH : NO₂ : NH₂ : SO₃H = 1 : 2 : 4 : 7. The author now brings forward evidence to show that these suppositions are correct.

When Lauterbach's acid is diazotised with amyl nitrite it yields a yellow crystalline diazonium compound, which on boiling with alcohol and copper powder, yields 2-nitro-1-naphthol-7-sulphonic acid, forming small, lemon-yellow needles. On reduction with stannous chloride and hydrochloric acid, this gives 2-amino-1-naphthol-7-sulphonic acid, which, in alkaline solution, becomes dark green on exposure to the air. On condensation with nitrosodimethyl-*m*-aminophenol hydrochloride, it yields an oxazine dyestuff which dyes wool intensely blue from an acid bath.—J. C. C.

Safranine: Some derivatives of — Sealed packet No. 937 (deposited Dec. 14, 1896) by C. Gassmann and Report on same by E. Noelting. Bull. Soc. Ind. Mulhouse, 1909, 79, 84–88.

By the combination of diazotised safranines with phenol-carboxylic acids, the author has obtained a series of blue-violet to blue-black dyestuffs which can be printed with chromium acetate. The dyestuff produced from diazosafranine and salicylic acid has probably the constitution,



and forms small brilliant crystals with a greenish reflex. The dyestuff prepared from tolusafraanine and salicylic acid is the reddest of the series and those from the same acid and phenosafranine, Fuchsia, Clematine, and Girofle increase in blueness in the order mentioned. Dyestuffs prepared from ortho- and meta-cresotinic acids are greener, those from α -hydroxynaphthoic acid are deep blue and those from β -hydroxynaphthoic acid are blue-black but are difficult to fix. All the dyestuffs can be

applied by means of tannin, giving redder and duller shades. The indamines and rubramines also give dyestuffs of this series.

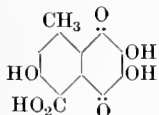
Noelting reports on the above to the effect that the dyestuffs are new: in a review of the patents for allied dyestuffs he points out that the use of phenolcarboxylic acids has not been claimed.—J. C. C.

Dyestuffs of the Induline series; Note on the formation of —. Sealed packet No. 938 (deposited Dec. 14, 1896) by C. Gassmann, and Report on same by E. Noelting. Bull. Soc. Ind. Mulhouse, 1909, 79, 89–90.

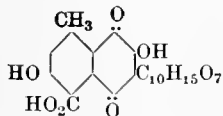
The author finds that when the products of oxidation of primary amines, such as Aniline Black, react with aniline and its hydrochloride, Induline Blues are obtained. With α -naphthylamine, dyestuffs are produced which are probably identical with rosinduline and its phenyl derivative. The products of oxidation of α -naphthylamine when heated with α -naphthylamine in acetic acid solution give Magdala Red. Diamines such as *p*-phenylenediamine and Aniline Black furnish blue-violet to Indigo-blue dyestuffs fixed by tannin and tartar emetic and, in the case of the product of oxidation of α -naphthylamine, a red violet which is fixed by a tannin mordant. Noelting reports that Nietzki has already studied the dyestuff produced by the action of aniline on Aniline Black, of which the formula is $C_{26}H_{29}N_5$, but he is of the opinion that the other dyestuffs described by Gassmann are new.—J. C. C.

Carminic acid. O. Dimroth. Ber., 1909, 42, 1611–1627.

By oxidising carminic acid with potassium permanganate in sulphuric acid solution at 0° C. (in which operation 7–8 equivalents of oxygen are required), the author has isolated an acid of the constitution:



to which, from its close resemblance to isonaphthazarin, he assigns the name carminazarin. The substance forms garnet red-needles containing 4 mols. of water and dissolves in boiling water with a yellowish-red colour. From carminazarin, by oxidation of the alkaline solution with oxygen, is produced cresotinglyoxyldicarboxylic acid, which on warming with sulphuric acid loses carbon monoxide and forms cochenillic acid, previously obtained by Liebermann and Voswinkel by oxidising carminic acid with potassium permanganate in alkaline solution. In the above oxidation the carminazarin is not formed at once but an intermediate unstable carboxylic acid is first produced which, on warming the solution, loses carbon dioxide with production of carminazarin. From these facts the author deduces that carminic acid is to be regarded as a carminazarin in which the residue, $\frac{1}{2}O_7$, replaces a hydroxyl group thus:



It is seen therefore that, in opposition to the view hitherto generally held that carminic acid possesses a symmetrical structure, it really consists of the fusion of two entirely different groups of which the one is a substituted naphthoquinone and the other must belong to the aliphatic or hydroaromatic series. The latter group has still to be investigated.—J. C. C.

PATENTS.

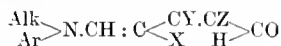
Brominated indigo sulphide and process of making same. E. Kraus, Frankfurt-on-the-Maine, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 920,156, May 4, 1909.

Indigo is heated in the presence of suitable diluting agents with sulphur and bromine. The product is a

dark blue powder almost insoluble in alcohol, benzol, and chloroform, but soluble in boiling nitrobenzene and naphthalene. It dyes from a hydrosulphite vat in clear blue shades.—P. F. C.

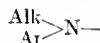
Basic dyestuffs; Production of —. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Nov. 23, 1908, to Fr. Pat. 395,793, Oct. 29, 1908. Under Int. Conv., Mar. 7, 1908.

DYESTUFFS similar to those described in the chief patent (this J., 1909, 469) are prepared by condensing aldehydes of the general formula,

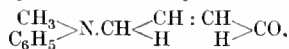


(Alk = alkyl; Ar = aryl),

and their oximes or hydrazones with dihydroindole or phenmorpholine or their substitution products, or by condensing with secondary aromatic amines such aldehydes or oximes or hydrazones of the above formula in which



represents the residue of the dihydroindole or phenmorpholine or their substitution products. Further, dyestuffs are also obtained by treating the pyridine dyestuffs described in Ger. Pat. 155,782, June 3, 1903, with such secondary amines as are more strongly basic than the primary or secondary amines of which the residues are contained in the dyestuffs referred to. Example: A mixture of 187 parts of the aldehyde of the formula,



500 parts of alcohol, 200 parts of 30 per cent. acetic acid, and 133 parts of dihydro- α -methylindole are heated in an apparatus fitted with a reflux condenser for 4 hours on the water-bath until the colour of the mass does not change further. The alcohol is distilled off and the remainder poured into water containing hydrochloric acid and salt. The dyestuff is precipitated in the form of microscopic red needles which dye tannin-mordanted cotton in blue-scarlet shades fast to washing and light. The same product is obtained when an alcoholic solution of one molecule of the aldehyde or its oxime or phenylhydrazone and one molecule of dihydromethylindole is kept for several hours. Blue dyestuffs are obtained by employing substituted derivatives of the above aldehyde. Further the dyestuff mentioned in example 1 of the principal patent can be obtained by heating 4.5 kilos. of the dyestuff described in example 4 of Ger. Pat. 155,782 (from sulphanilic acid and cyanopyridinium bromide) with 2.7 kilos. of dihydro- α -methylindole and acetic acid in alcoholic solution. By heating 4 kilos. of the dyestuff described in the German patent (example 2: from cyanopyridinium bromide and monomethylaniline) with 1.4 kilos. of tetrahydroquinoline, a dyestuff is obtained which gives orange shades on tannin-mordanted cotton.—J. C. C.

Monoczo dyestuff; Production of a new —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 396,381, Nov. 16, 1908. Under Int. Conv., Feb. 24, 1908.

SEE U.S. Pat. 912,356 of 1909; this J., 1909, 304. The dyestuff is prepared by combining diazotised 1,8-amino-naphtholsulphurous ether with 1,8-dihydroxynaphthalene-4-sulphonic acid, and subsequently eliminating the SO_2H group.—T. F. B.

Gallocyanine series; Production of new dyestuffs of the —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 396,564, Nov. 20, 1908. Under Int. Conv., Feb. 28, 1908.

THE condensation of gallocyanines with aromatic amines, described in Fr. Pat. 378,923 of June 17, 1907 (this J., 1907, 1194) as being effected in the presence of aromatic nitro-hydrocarbons, is very conveniently carried out in the cold by the aid of oxygen, air or other mixtures of gases containing oxygen, preferably with the addition of a catalyst such as manganese, iron or vanadium salts. When gallocyanines derived from gallic acid have been

used, the product of condensation loses carbon dioxide when heated and the residue can readily be sulphonated, whereby dyestuffs are obtained which are purer and faster to chlorine than those described in Fr. Pat. 201,465, Oct. 21, 1889. Example: A mixture of 300 parts of aniline and 50 parts of the galloyaniline prepared from nitrosodimethylaniline and gallic acid is thoroughly stirred and a current of air introduced. After the condensation is finished, the mass is heated to about 100° C. and the resulting dyestuff is isolated and added (50 parts) at 10–15° C. to 200 parts of fuming sulphuric acid (25 per cent. of sulphur trioxide) or ordinary sulphuric acid. The mixture is warmed to 30–40° C. until a sample dissolves in sodium carbonate, and is then poured into water and the precipitated sulphonic acid converted into the ammonium salt. It dyes chrome-mordanted cotton in greenish-blue shades.—J. C. C.

Azo-dyestuffs dying on a mordant; Production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 396,833, Nov. 27, 1908. Under Int. Conv., May 29, 1908.

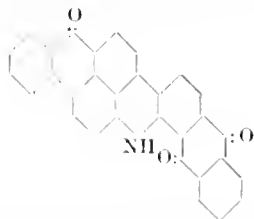
THE azo-dyestuffs prepared by combining the diazo-compounds of derivatives of 4-nitro-2-aminophenol containing a nitro-group or a halogen atom in position 6, with *p*-chlorophenol or its homologues, can be dyed in one bath with the addition of potassium bichromate. They can also be used to dye wool previously mordanted, or the wool may be chromed after dyeing. Brown shades are produced which are very stable towards light. Example: 200 parts of picramic acid are diazotised and combined with 150.5 parts of *p*-chlorophenol (sodium salt) in the presence of 200 parts of sodium carbonate. The dyestuff is isolated in the usual manner.—J. C. C.

Azo-dyestuffs; Production of new —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 396,949, Dec. 1, 1908. Under Int. Conv., Mar. 2, 1908.

THE azo-dyestuffs prepared by combining diazotised *p*-nitraniline-*o*-sulphonic acid with β -naphthylamine or 2-amino-8-naphthol or their derivatives in acid solution dye wool from an acid bath in violet-red to blue or black shades which are fast to washing and light. The combination with β -naphthylamine is carried out in acetic acid solution and in the case of the aminonaphthol the diazo-compound is first salted out and then combined in hydrochloric acid solution.—J. C. C.

Vat dyestuffs; Production of —. Badische Anilin und Soda Fabrik. Fr. Pat. 396,583, Nov. 21, 1908. Under Int. Conv., Oct. 2, 1908.

By condensing 1-aminoanthraquinones with halogenated benzanthrone, imino-compounds, termed benzanthranyl-1-aminoanthraquinones, are produced which, when treated with condensing agents, furnish new vat dyestuffs of which the constitution is represented by the formula:—



Examples: A mixture of 6 kilos. of benzanthranyl-1-aminoanthraquinone and 40 kilos. of potassium hydroxide is heated slowly to 240°–245° C. and maintained at this temperature for 15 minutes. After cooling, the mass is boiled with water and the dyestuff is precipitated with a current of air. It forms a greenish-black powder and with alkaline hydrosulphite gives a blue-violet vat from which vegetable fibres are dyed in violet-blue shades becoming green on washing and drying. The condensation may also be effected with alcoholic potash at 155°–160° C. A derivative of this dyestuff can be prepared by condensing the imine by means of sodium ethoxide in the presence of aniline. The dyestuff produced by condensing benzanthranyl-1-amino-7-hydroxyanthraquinone by means of

alcoholic potash gives a violet-blue vat (with alkaline hydrosulphite) from which vegetable fibres are dyed the same colour, becoming bluish-green on washing and drying.—J. C. C.

Indigo dyestuffs; Preparation of leuco-derivatives of —. Badische Anilin und Soda Fabrik. Fr. Pat. 396,794, Nov. 26, 1908. Under Int. Conv., Oct. 14, 1908.

THE difficulties met with in maintaining the cold indigo vat may be overcome by mixing the leuco-compound with molasses, syrup, or glycerin and inorganic reducing agents such as zinc dust, stannous chloride, stannous oxide, etc. Example: 667 kilos. of a paste containing 75 per cent. of indigo white are mixed with 283 kilos. of glycerin and 50 kilos. of zinc dust. A viscous paste is obtained which even in hot climates does not require the addition of aids to fermentation.—J. C. C.

[Azo] Dyestuffs; Manufacture of new —. Farbwerke vorm. Meister, Lucius, und Brining, Höchst on Maine, Germany. Eng. Pat. 3602, Feb. 13, 1909. Under Int. Conv., March 28, 1908.

SEE Ger. Pat. 208,968 of 1908; this J., 1909, 517.—T. F. B.

p-Amidophenyl-2-azimido-5-naphtholsulphonic acid; Manufacture of —, and [azo] dyestuffs therefrom and an intermediate product. Soc. pour l'Ind. Chim. à Bâle, Basle, Switzerland. Eng. Pat. 15,463, July 21, 1908. Under Int. Conv., July 22, 1907.

SEE Fr. Pat. 390,223 of 1907; this J., 1908, 1015.—T. F. B.

Trisazo dyestuff. H. Jordan and W. Neelmeier, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 920,151, May 4, 1909.

SEE Fr. Pat. 395,960 of 1908; this J., 1909, 469.—T. F. B.

Azo dyestuff. O. Günther and L. Hesse, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 921,239, May 11, 1909.

SEE Fr. Pat. 396,949 of 1908; preceding.—T. F. B.

Phenoxazine derivatives; Process for preparing —. Act.-Ges. f. Anilinfabr. Fr. Pat. 396,514, Jan. 28, 1908.

SEE Ger. Pat. 200,736 of 1906; this J., 1908, 1107.—T. F. B.

Monoazo dyestuffs; Process for preparing —. Act.-Ges. f. Anilinfabr. Fr. Pat. 396,672, Feb. 1, 1908.

SEE Ger. Pat. 202,016 of 1907; this J., 1908, 1147.—T. F. B.

Extracting lac-dye. Eng. Pat. 12,877. See XIII B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Wool fibre; Effect of various mordants and dyestuffs upon —. A. Kertesz. Färber-Zeit., 1909, 20, 137–140.

THE results of an earlier investigation upon this subject indicated that the strength and elasticity of the wool fibre may increase during treatment, and although the general character of the wool cannot be said to improve, the results of the dynamometric tests are so regular that (whether they are better or worse than those given by the original wool) some value must be attached to them. In determining the general character of the wool fibre, its shrinking or milling capacity must be considered as well as its strength and elasticity. The results of the trials are tabulated and from these it is seen that untreated wool mills better than that which has been treated in a hot bath of acid sodium sulphate, and the addition of potassium bichromate to this bath lowers the milling capacity still further, the loss depending upon the proportion of bichromate added. As regards the strength and elasticity before and after milling, and the degree of shrinkage, it is found that wool which has been treated with hot distilled water loses about 7 per cent. in strength compared with untreated wool. The elasticity increases

by about 18 per cent., but after milling it is some 7 per cent. less than that of the untreated milled wool, the milling power of the latter being also better. Both strength and elasticity are improved by treating with acid sodium sulphate, but after milling, the figures are almost identical with those obtained with wool which has been boiled with water only, but the milling power has been still further diminished. Treatment with formic acid increases the strength and elasticity of unmilled wool and after milling, the figures are still slightly higher than those with acid sodium sulphate though the milling power is not quite so good. An "afterchrome" treatment of wool prepared with acid sodium sulphate increases both the strength and elasticity, and these do not suffer so much in milling. Formic acid apparently affects the milling power more than does acid sodium sulphate. Mordanting with bichromate, and tartaric or formic acid, or with chromium fluoride lowers both the strength and elasticity compared with the above methods of treatment, but the milling power is slightly better except in the case of the fluoride treatment. Treatment with chlorine diminishes both strength and elasticity, and milling power. Samples of loose wool were treated with the agents above mentioned or were dyed with mordant dyestuffs or indigo; the wool was then spun under identical conditions and the yarn tested. Compared with untreated wool the loss in strength, elasticity, and milling power was but slight and the author maintains that in general the loss is due to the mechanical treatment, and not to any effect of the mordant or dyestuff. —F. M.

Dyeing; Influence of the colloidal state on — L. Vignon. Compt. rend., 1909, 148, 1195—1197.

THE author has examined the action of water on jellies made with starch (which may be regarded as a polyalcohol) and gelatin (which belongs to the class of aminoacids) dyed with Rocceline, Magenta, and Congo Red. Each jelly, weighing 105.5 grms., was left in contact with 1 litre of water for 24 hours at the ordinary temperature. The amount of dyestuff which passed into the water was then estimated. It was found that the starch jellies behaved like cotton and those made with gelatin like wool and silk. The experiments show the double influence of molecular attraction, due to the colloidal state, and of the chemical constitution of the ellies, in the dyeings obtained. —J. C. C.

White reserve with red prussiate for Indanthrene dyestuffs in association with Aniline Black printing. Sealed packet No. 1493 (deposited Aug. 23, 1904) by C. Raczkowski, and Report on same by M. Battagay. Bull. Soc. Ind. Mulhouse, 1909, 79, 91—92.

ANILINE Black or Diphenylamine Black is printed with a reserve composed of 250 parts of potassium ferricyanide and 750 parts of gum and kaolin. After drying, the fabric is printed with Indanthrene Blue colour paste containing tartaric acid, tin salt, and ferrous sulphate together with a thickening of starch and tragacanth, and steamed. In the case of Aniline Black the fabric is steamed before the second printing to develop the black. The material is finally passed through sodium carbonate solution (20° B.) at 75° C. in presence of manganese dioxide, then washed in sulphuric acid (40° B.) and soaped at 75° C. for some minutes. The process can also be applied to the green produced with a mixture of 6 parts of Indanthrene and 5 parts of Flavanthrene.

Battagay reports on the above to the effect that he has confirmed the results described and they are satisfactory provided the shades are not too dark. He considers that the process is new. —J. C. C.

PATENTS

Elastic and supple material [artificial horsehair], and method of manufacturing the same. P. Brosse, Paris. Eng. Pat. 24,110, Nov. 10, 1908.

100 KILOS. of glue are dissolved in 100 litres of water, and about 10 kilos. of glycerin are added, followed by about 5 kilos. of formaldehyde of 90 per cent. strength,

or, alternatively, 10 kilos. of alum. The pasty mass is then forced through very small holes, and passes out in the form of crisp or curly threads, resembling horsehair in appearance. (Reference is directed to Eng. Pat. 15,522, of 1894.) —E. W. L.

Fibrous plants (espa to and others); Treatment of — with an electrolytic recuperating apparatus to obtain textile fibres and paper pulp. F. E. M. Dubrot. Fr. Pat. 396,647, Nov. 14, 1908.

THIS apparatus consists of a vat which is placed in connection with a circulating pump. The inner walls of the vat form the cathode of an electrolytic system whilst the anode consists of a slab of a conducting and unoxidisable substance suspended inside the vat from a bell-shaped support of an inactive and insulating material. The material to be treated is put into the vat together with a suitable electrolyte and a current is passed through the system. The gases liberated at the anode ascend into the bell from which the anode hangs, and are led away through an exit pipe. The electrolyte is kept in constant circulation by means of the pump. —P. F. C.

Artificial silk, etc.; Apparatus and process for the recovery of ether and alcohol from sulphuric acid employed in the manufacture of —. Crépelle-Fontaine. Fr. Pat. 396,664, Feb. 1, 1908, and First Addition thereto, dated July 9, 1908.

THE aqueous alcohol and acid flow from suitably arranged vessels into the top of a distilling column, in the base of which is a vaporiser and which is fitted in the usual manner with distribution plates. The temperature and pressure may be regulated and the vapours of the ether and alcohol after passing through a saturator, in which they are washed by means of a solution of soda, are condensed in a cooling apparatus. The temperature and pressure are regulated automatically, as is also the rate of flow of the liquors into the distilling column. Before entering the column the liquids are slightly warmed, and it is possible to separate the ether and alcohol fractionally. —F. M.

Fibroin from silk; Process for obtaining —. C. D. Baumann and G. G. Diesser. Fr. Pat. 396,305, Nov. 6, 1908. Under Int. Conv., Dec. 21, 1907.

THE solution of fibroin in the usual acid or alkaline solvents is accompanied by a certain amount of decomposition, and the industrial application of such solutions has not hitherto been successful. It is now found that formic acid is a very suitable solvent: it dissolves freshly spun silk readily in the cold, and although ordinary raw silk (grège) dissolves much more slowly, even this is dissolved on heating. From the solution, films may be obtained, or threads which are almost as strong as those from boiled-off silk and possess the same properties as the latter. The solubility of fibroin in formic acid may be applied in the production of thin films (for insulating, etc.) or rendering woven fabrics impermeable to air and water. —F. M.

Washing machines; Rotary —. Entwistle and Kenyon, Ltd., and R. Bradley, Accrington, Lancs. Eng. Pat. 391, Jan. 7, 1909.

THE machine comprises a perforated drum or wince revolving within a fixed vessel holding the liquid, the drum being provided with a removable midfeather or partition. Various arrangements are described for securing the midfeather in position. —B. N.

Printing rollers; Process for preparing —. Weaver Print Co. Fr. Pat. 396,332, Nov. 14, 1908.

AN inclined plane engraved in relief with the required design is coated with an acid reserve and the plain roller is rolled along the coated surface, the reserve being transferred to the roller, which is then completed by the usual engraving process. To ensure the design being transferred to the roller without a break, the parts of the engraving at each extremity of the plane are made to correspond exactly, the engraved part of the plane is slightly longer than the periphery of the roller, and the latter is made to give

slightly more than one complete turn. By a rack and pinion arrangement, the speed of the roller as it rolls down the coated plane can be accelerated or retarded, so that, with practice, the operator can make sure that the overlapping ends of the design are transferred to the roller exactly over one another. The right intensity is given to these double impressions by a mechanical arrangement which relieves the weight of the roller at either end of the plane.—H. P. P.

Printing on textile fibres; Process of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 396,983, Nov. 11, 1908. Under Int. Conv., Dec. 2, 1907.

DYE-STUFFS of the thiazine and oxazine classes, with the exception of those of the galloxyamine series, can be fixed upon the fibre by printing with a mixture containing their leuco-compounds, a mordant, and a suitable thickening, and afterwards steaming for 2–5 minutes in a Mather-Platt apparatus. Example: A printing colour is prepared containing 21 parts of a solution of the leuco-compound of Methylene Blue BB obtained by reducing 3.3 parts of the dyestuff with hydrosulphite, 63 parts of water, 24 parts of acetic acid (30 per cent.), 200 parts of starch-tragacanth thickening, 20 parts of a solution of tannic and acetic acids (1:1), and 2 parts of Rongalite C. The material is printed with this colour, steamed for 2 minutes, and finally passed through a solution of tartar emetic.—P. F. C.

Colouring superficially, artificial or natural bodies such as fabrics, leather, artificial leather and analogous substances; Process for —. B. Polack Akt.-Ges. Fr. Pat. 396,299, Oct. 31, 1908.

THE colouring matter is incorporated with a layer of fibres or with a fabric which is afterwards fastened to the outside of the material to be coloured. This can be effected either by adding the colouring matter to the size which is employed to make the fabric adhere to the material, or by first colouring the fabric and afterwards fastening it to the material.—P. F. C.

Lustreing and finishing silk filaments; Apparatus for —. E. Pohl, Paterson, N.J. U.S. Pat. 920,775, May 4, 1909.

THE filaments are first passed through a tank containing a finishing solution and are afterwards led over a roller and across a heated contact surface which may be stationary or movable. The apparatus is also provided with devices for cleaning the roller and contact surface whilst the filaments are passing over them.—P. F. C.

Silk thread finishing machine. E. Pohl, New York. U.S. Pat. 920,776, May 4, 1909.

AFTER finishing and lustreing, the filaments are gathered together in parallel to form a single thread which is passed over drying, ironing, and polishing devices. The machine is also provided with a device for taking up the thread which is automatically stopped by the breaking of any of the individual filaments. This device comprises a bobbin, rotated by friction, which can be thrown out of action by a stop-lever. This lever is normally out of engagement with the bobbin, but can be thrown into action by the fall of any of a number of guiding levers which are so supported by the individual filaments that the breakage of one filament causes the fall of one guiding lever.—P. F. C.

Waxed cloth and paper, and their substitutes; Process of manufacture of —. Gebr. Siebert. Fr. Pat. 396,467, Nov. 19, 1908.

THE usual process of manufacture, which consists in covering the material with successive layers of linseed oil (drying after each application), embossing as required, and finally varnishing, requires a great deal of time and the claim in the present patent is for the employment of a solution of acetylcellulose. A single coat is sufficient and the film which remains, being transparent, the material may be suitably dyed, printed, or embossed beforehand without the effect suffering in the least.—F. M.

Drying chamber [for cloth, etc.] heated by warm air, by combined radiation and convection, with recovery of the heat without admixture with the saturated air, with methodical and progressive drying. C. H. Vandamme Fr. Pat. 395,802, Oct. 30, 1908.

THE web of cloth or other material to be dried is caused to pass over rollers through the chambers into which the apparatus is divided and which are provided with gilled radiating pipes heated by steam. Fresh air is blown into the apparatus by a fan, after being heated by the exhaust air in a counter-current apparatus having thin walls. The air passes through the dryer in the opposite direction to that taken by the material being dried and is withdrawn from the apparatus by fans and delivered into the counter-current apparatus.—W. H. C.

Straw of flax or other plants; Chemical process for the treatment of the —. A. M. de M. de Ballore, Assignor to Soc. Anon. pour la Fabr. des Pâtes à Papier de Lir et Succédanés, Tunis, Africa. U.S. Pat. 921,502, May 11, 1909.

SEE Fr. Pat. 365,046 of 1906; this J., 1906, 951.—T. F. B.

Dyeing and printing; Process of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 396,451, Nov. 18, 1908. Under Int. Conv., Feb. 8, 1908.

SEE Ger. Pat. 208,845 of 1908; this J., 1909, 519.—T. F. B.

Printing in colour with resists on half-wool fabrics; Process for —. O. Ostersetzer. Fr. Pat. 396,548, Nov. 20, 1908. Under Int. Conv., Nov. 21, 1907.

SEE Eng. Pat. 25,801 of 1907; this J., 1908, 746.—T. F. B.

[Soap] Emulsions. Fr. Pat. 396,493. See XII.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Sodium nitrate; Consumption of — in the United States. C. E. Munroe. J. Ind. and Eng. Chem., 1909, 1, 297–299.

THE consumption of sodium nitrate in the United States in 1900 and 1905 is shown in the following tables, the figures being classified (1), according to the industry in which the nitrate was used both directly and indirectly, and (2), according to the products in the manufacture of which sodium nitrate was used directly. For example, sodium nitrate is used in the manufacture of sulphuric acid in the fertiliser industry, as well as a direct component of fertilisers.

(1). Consumption of sodium nitrate by establishment classes.

Class.	1900.	1905.
	Short tons.	Short tons.
Fertiliser industry	19,518	42,213
Dyestuffs industry	223	261
General chemicals industry	35,900	38,043
Glass industry	10,770	11,915
Explosives industry	88,024	133,034
Sulphuric, nitric and mixed acids industry	27,406	29,301

(2). Consumption of sodium nitrate classified according to products in the manufacture of which it is directly used.

Products.	1900.	1905.
	Short tons.	Short tons.
Compound fertilisers	13,058	34,705
Dyestuffs	223	261
General chemicals	30,287	31,324
Glass	10,770	11,915
Explosives	76,696	100,985
Nitric acid	30,213	50,301
Saltpetre	5,703	6,724
Sulphuric acid	15,481	18,467

If the totals shown in the above tables, 182,431 and 54,772 short tons respectively, be deducted from the quantities available in the corresponding periods as shown by the import tables, it is found that there are 23,926 short tons in 1900 and 67,937 short tons in 1905, which may be regarded as the quantities used in smelting, as a metallurgical flux, in pickling, in the manufacture of minor chemicals, etc. The relatively small consumption of sodium nitrate in the fertilizer industry is accounted for by the extensive use of other nitrogenous substances in the United States. For instance, in the census year 1905, there were used as fertilisers, 1,540 tons of ammonium sulphate, "923,305 thousand lb," 125,888 tons of "ammoniates," 1160 tons of salt-stre, £495,093 worth of cottonseed meal, and £1,061,281 worth of bones, tankage, and offal. The chief factors which tend to prevent increase in the consumption of sodium nitrate in the United States are:—(1). Increased production of ammonium sulphate owing to more extended use of by-product ovens for coking coal. In the census year 1905, only 3,317,585 tons of coke out of a total production of 37,376,251 tons, were produced in by-product ovens. (2). Substitution of the contact process for the lead chamber process in the manufacture of sulphuric acid. (3). The introduction of calcium cyanamide as a fertiliser. (4). The manufacture of nitrates from atmospheric nitrogen.—A. S.

Nitrate combine; Expiration of the —. Oil, Paint, and Drug Rep., May 17, 1909. [T.R.]

At a meeting held March 29, 1909, it was definitely decided to discontinue the combination among the Chilean producers of nitrate of soda, for the control of the production and exportation of that article. Forty-one producers, representing seventy-seven "oficinas" (nitrate works), accepted quotas of production aggregating 40,480,000 Spanish quintals of 101.61 pounds each, and forty-six producers, representing seventy-seven oficinas, refused to accept the quotas assigned to them. Those refusing to accept demanded quotas aggregating 10,800,000 quintals more than was proposed to them. As a consequence the rate combination ceased to exist on March 31, 1909. In the future, or until a new combination be formed, there will be unlimited production and exportation by several oficinas. This condition is desired by many of the producers who possess rich deposits and whose cost of production is low, and the general opinion is that the nitrate market will suffer at least only a temporary depression as a result. The "Asociacion Salitrera de propaganda," however, still continues as an advertising medium, and as a statistical department for the industry.

Ferric chloride and potassium ferricyanide; Reaction between —. Y. Kato. Mem. Coll. Sci., Kyoto Univ., 1908, 1, 352—374.

In adding potassium ferricyanide to ferric chloride dissolved in water and in various solutions of other salts, was found that potassium ferricyanide reacts with ferric chloride, not only in concentrated solutions of the latter but also in those of many other salts. Salts of metals having the same valency in solutions of equal concentration have nearly equal capacity for promoting the reaction. The reaction takes place in a more dilute solution of the salts of metals of higher valency than those of salts of metals of lower valency. It is suggested that the precipitation of Prussian blue by the salts plays an important part in the reaction, an opinion which is confirmed by the study of the interaction between ferric nitrate and sulphate and potassium ferricyanide. The explanation that the reaction is caused by the composition of ferric chloride due to a change in the concentration is not considered plausible.—E. F. A.

PATENTS.

Oxides of nitrogen; Recovery of — from air or other gases with which they are mixed. Sir. W. Ramsay. London. Eng. Pat. 26,981 of 1907; date of application, July 3, 1908.

When nitrogen and oxygen unite in an electric furnace, the percentage of oxides of nitrogen in the escaping gases

is so small that when they are absorbed for the production of nitric acid or nitrates, the efficiency of absorption is low. If the percentage is increased, the efficiency of absorption is greatly increased. To achieve this, the mixed gases are liquefied, after having been cooled by the gaseous products of the liquefying apparatus; the products of liquefaction are then subjected to evaporation and rectification to concentrate the oxides of nitrogen; the concentrated liquid obtained is evaporated, and the products passed through water or other suitable liquid or material. A modified method effects the preliminary cooling of the mixed gases to such a degree that the oxides of nitrogen are separated by fractional liquefaction.

—H. H. S.

Nitric acid, free from nitrous compounds and of increased concentration; Production of —. J. J. E. Douzal. Fr. Pat. 396,367, Jan. 24, 1908.

NITROUS gases, before hydration, are cooled to 24° C. and are then treated with a stream of oxygen, rich in ozone, in the presence of a shower of cold water; nitrous acid is thus transformed quantitatively, as produced, into nitric acid, without the formation of nitric oxide, and an acid of a concentration hitherto impossible is obtained.—F. SODN.

Nitrous products [nitric acid and nitrogen peroxide]; Production of — by combustion. Badische Anilin und Soda Fabrik. Fr. Pat. 396,375, Nov. 16, 1908. Under Int. Conv., April 10, 1908.

OXIDES of nitrogen are produced by burning carbon monoxide in an atmosphere containing oxygen and nitrogen under pressure. For the rapid cooling of the products, in order to prevent the decomposition of the oxides of nitrogen, the flame is given a long pointed form and is made to lick the sides of the tube in which it burns, the tip of the flame being directed against a cold surface. Before allowing them to expand, the gases are further cooled, so as to give liquid or solid nitrogen peroxide; or, concentrated nitric acid is prepared directly by the addition of sufficient steam or hydrogen or other combustible to the gases before combustion. The refrigeration may be effected by the expansion of gas already refrigerated, and the heat produced by combustion may be utilised in obtaining the required compression.

—F. SODN.

Hydrofluosilicic acid and fluosilicates; Manufacture of —, principally by utilisation of residues from superphosphate factories. L. Rivière. Second Addition, dated Jan. 29, 1908, to Fr. Pat. 375,989 of May 28, 1906 (this J., 1907, 936; 1908, 281).

THE absorption of the fluorine compounds cannot always be realised in the way indicated in the first addition. The aspirating arrangement must sometimes be replaced by one for pulverising the absorbing solution, the gases being diverted from the chimney into a side channel for treatment. Soluble or insoluble fluosilicates may be made in this manner, but the claim is particularly for the manufacture of the former (those of aluminium, magnesium, zinc, lead, etc.); these are found to replace hydrofluosilicic acid with advantage in the treatment of residual liquids obtained in distilling, soap-making, and wool-washing, and the raw materials of the beetroot industry, also for the purification of saccharine juices and syrups and the precipitation of potash from must.

—F. SONN.

Alkali carbonates; Process of manufacture of —. 1. Rivière. Fr. Pat. 396,448, Nov. 16, 1908.

POTASSIUM fluosilicate is produced, either directly by adding hydrofluosilicic acid or soluble fluosilicates to vineasses, wines, molasses, saccharine juices, or syrups, or by slowly digesting these alcoholic or saccharine liquids on beds of sodium fluosilicate, in order to transform the contained potassium carbonate into potassium fluosilicate, and following this by a second rapid digestion, at an increased temperature, in order to convert the potassium sulphate and chloride present into potassium fluosilicate, the digestions being effected in groups of vessels communicating with each other and arranged

stepwise. Alkali carbonates are then prepared from the fluosilicates by dissociating them at a red heat in a suitable furnace, the fluorides thus obtained being converted into carbonates by double decomposition with chalk, in the presence of water, without heating. The silicon fluoride, also produced, is absorbed by hydrogen fluoride to give hydrofluosilicic acid again, the hydrogen fluoride for this purpose being obtained by decomposition of the calcium fluoride previously formed.—F. SODX.

Sodium carbonate and all grease-removing products with a sodium carbonate basis; Crystallisation of — on sawdust. G. M. J. Dieres-Monplaisir. Fr. Pat. 396,951, Dec. 1, 1908.

THE claim is for a product, capable of removing grease from floors, rubber tyres, and other surfaces, which is prepared by the crystallisation of sodium carbonate, or other cleansing agent with a sodium carbonate basis, on sawdust of any kind. It is used with cold water, the sawdust acting as a scouring agent and retaining the moisture on the surface, if prolonged treatment be desired.—F. SODX.

Zinc oxide; Methods of making —. L. S. Hughes, Assignor to Picher Lead Co., Joplin, Mo. U.S. Pat. 920,336 and 920,337, May 4, 1909.

ZINC sulphide, in a state of fine division, is injected upwards by means of an air jet into a vertical furnace, heated internally by a non-reducing gas flame to a temperature at which the sulphide is roasted to oxide, but cooled sufficiently to avoid injuring the oxide formed. The impurities are allowed to settle from the gases leaving the top of the furnace, and then the zinc oxide is separated from these gases by screening. Zinc oxide is made from zinc carbonate in a similar manner.—F. SODX.

Litharge; Method of manufacturing —. L. S. Hughes, Assignor to Picher Lead Co., Joplin, Mo. U.S. Pat. 920,335, May 4, 1909.

FINELY-DIVIDED lead carbonate is injected upwards into a vertical furnace maintained at an internal temperature sufficient to convert the carbonate into litharge in a substantially non-reducing atmosphere. The litharge is carried out with the gases at the top of the furnace and, after the impurities have settled, is itself separated from the gases. The walls of the furnace are of thin iron and unlined, so that their temperature may be kept below that at which litharge will adhere to them.—F. SODX.

Zinc sulphide; Manufacture of —. Soc. Chim. des Usines du Rhône (formerly Gilliard, P. Monnet, et Cartier) and J. C. A. Meyer. Fr. Pat. 395,541, Nov. 19, 1908. Under Int. Conv., Dec. 3, 1907.

NEARLY all the zinc may be precipitated as sulphide, by means of hydrogen sulphide, from an almost saturated solution of zinc sulphate, or other salt of zinc with a mineral acid, if contact between the gas and solution be intimate and prolonged. This may be done, for example, in the case of a 45 per cent. solution of crystallised zinc sulphate by pulverising it in an atmosphere of hydrogen sulphide and maintaining contact as long as the gas is absorbed. The zinc sulphide is precipitated in a form which is claimed as new, being non-colloidal and readily filtered, and the filtrate may serve for regenerating the zinc solution by neutralising it with an appropriate mineral containing zinc.—F. SODX.

Carbide; Treatment of —. A. R. Frank, Berlin, Germany. U.S. Pat. 920,857, May 4, 1909.

CARBIDE "fines" of a high degree of purity are obtained by comminuting the carbide, at a temperature above the normal, in an atmosphere of nitrogen or other inert gas that will not decompose the carbide.—F. SODX.

Alumina; Process of making —. C. M. Hall, Niagara Falls, N.Y., Assignor to Aluminium Co. of America, New Kensington, Pa. U.S. Pat. 921,699, May 11, 1909.

BAUXITE is heated in admixture with calcium chloride, with or without the addition of common salt, in an

atmosphere containing oxygen or in the presence of steam. The calcium chloride is used in sufficient quantity to combine with the alumina and silica of the bauxite, and to form an insoluble "silicate of alumina-silicate," and the alumina is obtained by the decomposition of the calcium aluminate.—A. T. L.

Nitric acid; Process of manufacturing —. F. S. Valentiner, Assignor to Valentiner und Schwarz, Leipzig-Plagwitz, Germany. U.S. Pat. 920,224, May 4, 1909.

SEE Fr. Pat. 374,902 of 1907; this J., 1907, 872.—T. F. B.

Oxides of nitrogen; Process and apparatus for producing — by means of a rotary flame. O. Mosicki, Freiburg, Switzerland. U.S. Pat. 920,610, May 4, 1909.

SEE Fr. Pat. 395,424 of 1908; this J., 1909, 529.—T. F. B.

Sodium sulphate and sulphuric acid; Process of making —. O. Zahn, Berlin. U.S. Pat. 921,329, May 11, 1909.

SEE Fr. Pat. 389,898 of 1908; this J., 1908, 1018.—T. F. B.

Ammonia; Manufacture of —. F. W. Frerichs. Fr. Pat. 396,348, Nov. 16, 1908.

SEE U.S. Pat. 905,415 of 1908; this J., 1909, 21.—T. F. B.

Metal sulphates; Process of making —. O. Meurer, Cologne, Germany. U.S. Pat. 920,601, May 1, 1909.

SEE Fr. Pat. 382,230 of 1907; this J., 1908, 226.—T. F. B.

Alkali aluminates; Process of making — from aluminous minerals and alkali sulphates, directly utilising the sulphurous acid liberated for the recovery of the sulphuric acid or alkali sulphate. D. A. Peniakoff. Fr. Pat. 396,584, Jan. 29, 1908.

SEE Eng. Pat. 14,707 of 1908; this J., 1909, 425.—T. F. B.

Alkali salts of hydrosulphurous acid; Process for the production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 396,636, Nov. 23, 1908. Under Int. Conv., Jan. 27, 1908.

SEE Ger. Pat. 203,910 of 1908; this J., 1909, 90.—T. F. B.

Cryolite; Process of making artificial — by means of fluorspar. G. Loesekann. Fr. Pat. 396,703, Nov. 25, 1908.

SEE Ger. Pat. 205,209 of 1907; this J., 1909, 140.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Earthenware glazes; Leadless —. M. Schmidt. Sprechsal. 1909, 42, 284—286.

MANY so-called leadless glazes contain lead. It is difficult to dispense with it on account of the superior appearance and enduring qualities of lead glazes. Borax must be used in leadless glazes to keep the melting-point low, and borax interferes with colours. After various trials which were unsatisfactory owing to the rapid settlement of the glaze in the tub, and to the flaking-off of the raw glaze on the crockery when handled, the author chose a glaze of the molecular formula: $(0.175K_2O, 0.175Na_2O, 0.650CaO, 0.55Al_2O_3, 5SiO_2, 1B_2O_3)$. This glaze was found to be suitable in all respects. It is fired at cone 2, and, if finely ground, comes up at cone 02. The glaze is made from 0.1 equivalent of felspar-sand, 0.25 of washed kaolin and 0.9 of the following frit— $(0.139K_2O, 0.139Na_2O, 0.722CaO, 0.178Al_2O_3, 3.768SiO_2, 1.11B_2O_3)$. The felspar sand has the molecular formula: $(0.5K_2O, 0.5Na_2O, 1.33Al_2O_3, 8.73SiO_2)$, and the kaolin, $Al_2O_3, 3SiO_2, 2H_2O$.—H. H. S.

Enamel; Manufacture of, and influence of clay on —. J. Grünwald. Sprechsal. 1909, 42, 287—289.

THE manufacture of first-class enamels demands the most scrupulous care in every operation. The raw material should be mixed in sufficiently small lots, e.g., about 150 kilos. The mixture is then fired; as it melts, it

separates into two layers, the upper containing the lighter constituents such as borax and alkali. With insufficient stirring, the melted mass would vary in composition and in physical properties. The enamel then goes to the mill. The time of grinding is very important; the blue obtained with cobalt oxide, for example, depends more on prolonged grinding than on the amount of cobalt present. The older the enamel and the more carefully it is cleaned, the better in appearance, the more pliable, and the more profitable it will be. On this account, cleansing apparatus should be in every works, and after the grinding and cleansing, the enamel should be allowed to rest in a scrupulously clean wooden tub for at least 14 days. The author gives the following figures for a good enamel: Melt together 32 kilos. of borax, 5 of tin oxide, 60 of felspar, 20 of cryolite, 1 of calcined sodium carbonate, 3 of saltpetre, 2.5 of clay, 0.2 of calcined magnesia, and 0.1 of fluorspar. To 100 kilos. of the melted enamel, add in grinding 7 of cleansed clay, 7 of tin oxide, and 0.3 of calcined magnesia. The percentage composition of the finished enamel will be: boric anhydride, 16.13; alumina, 14.25; sodium oxide, 15.88; potassium oxide, 7.37; calcium oxide, 0.05; silica, 31.31; tin oxide, 9.78; magnesia, 0.5; and fluorine, 0.17. An enamel ready for use should contain from 10—18 per cent. of total alumina. The addition of clay in grinding is of fundamental importance. Without it, a finely-ground enamel with 30 per cent. of water would quickly sink, and so make enamelling and transfer-work impossible. The colloidal properties of clay enable the enamel to remain a suspension, even when it is of a creamy consistence. The relative costs of enamel and clay should be considered. As clay is less expensive than enamel, the cheaper enamels might contain 15 per cent. of clay, whereas the better class would contain only 10 per cent. The cheaper enamels would thereby lose in lustre, but gain in opacity. The clay used should not be very "fat"; it should contain 1—55 per cent. of silica, 31—34 of alumina, less than per cent. of iron oxide, and should be quite free from alkali. The clay must not be ignited, as it would thereby lose its characteristic property of holding the enamel in suspension in the "slop." It is important to know the shrinkage of the clay at the temperature of the enamel-urn (850°—950° C.). If after firing, the enamel has cracked, the clay is too "short." Before use, the clay should be stirred in wooden tubs for days, passed through fine sieve, and scrupulously cleansed. For coloured enamels, clays containing iron oxide may be used, as they are cheaper and do not spoil the colours.—H. H. S.

PATENTS.

Glass plates; Process and apparatus for manufacturing — P. T. Sievert, Dresden, Saxony, Eng. Pat. 25,042, Nov. 20, 1908. Under Int. Conv., Nov. 21, 1907.

Rolling glass for forming plates by means of iron rolls. The glass surfaces get a rough hammered appearance. The hammered appearance is due to the sudden and strong absorption of heat from the glass by the thick iron rolls, which causes a shrinkage of the glass skin and great brittleness of the plate. The rough appearance is due to the coarse structure of the cast iron. The inventor therefore introduces between the glass and the rolls, a layer withdrawing very little heat, such as a thin metal plate, or layers of pulp, asbestos, or fibrous material suitably distended in order to prevent combustion. These separating layers may be made in endless bands, and one may serve for several pairs of rolls.—H. H. S.

Kn; Continuous or intermittent — for the burning of refractory or ceramic products. H. Renard, Fr. Pat. 396,911, Nov. 30, 1908.

KILN consisting of two long parallel chambers connected at the ends is provided with a series of fire-bars which extend over the whole bottom of the kiln, the joints between adjacent sections of the fire-bars being transverse to the length of the chambers. The solid fuel burnt is placed on these fire-bars. Even heating is ensured by providing a flue in the roof of the furnace above each section of fire-bars. The hot gases on their way to the chimney from the chambers are forced to pass through serpentine passages

in the masonry of the kiln, and in so doing heat the incoming air, which passes through other similar passages. —A. G. L.

Ceramic, glass, and similar articles; Application of metallic coatings to — H. L. Sulman, H. F. K. Picard, and F. P. Heath, Fr. Pat. 396,531, Nov. 19, 1908. Under Int. Conv., April 1, 1908.

SEE Eng. Pat. 7230 of 1908; this J., 1909, 523.—T. F. B.

Porcelain mould for candles. Fr. Pat. 396,744. See XII.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Portland cement; The "swelling theory" of — H. Kühl, Tonind. Zeit., 1909, 33, 556—557.

FROM his own experiments (Tonind. Zeit., 33, 465), Schumann thinks that any swelling up of cement particles under the influence of water, must be made obvious in an external increase in volume of the cement paste. The author however considers that the hypothesis proposed by Michaëlis was that only a swelling up of each individual cement grain takes place, in consequence of which the empty spaces between the grains of the mixed cement or mortar mass are filled up. In this way the pore spaces disappear, becoming filled with a gelatinous mass, whilst the mixing water previously contained in the pores is sucked up. The cement grains swollen up into a jelly come into the closest mutual contact, and then under the crystallising action of calcium hydroxide and "internal desiccation" the setting takes place. The mixing water too would dissolve certain constituents of the cement particles, chiefly lime, and the residual bodies would thus acquire a porous structure which would allow them to absorb mixing water. Alite is the most important crystalline constituent of Portland cement clinker, and a certain quantity of it would pass into solution as such, and then, probably be very quickly decomposed, with formation of calcium hydroxide and basic calcium aluminates and silicates. As alite dissolves more easily in water than some of its decomposition products, after a certain time, these less soluble compounds would begin to separate out. In this way the alite in solution would be continuously diminished, and the deficiency would be supplied by fresh quantities passing into solution, which would in turn be decomposed and the products thrown out. Finally the mixing water would become saturated with the easily soluble decomposition products, besides the calcium hydroxide, and these would also begin to separate out. Though little is known of these products, or of their order of separation, they appear to be crystalline in nature. If in the course of the hardening, colloidal substances separate, these would form, by coagulation, a gelatinous mass, though not exactly a swelling-up of the cement in the sense used by Michaëlis. In most of his experiments Michaëlis used concentrated lime water, and as most of the compounds concerned in the reactions are sparingly soluble, the excess of water over cement was not as great as would appear at first sight, and in nearly all cases he found that the resulting products in the process of hardening were very voluminous. If amorphous products are actually formed, these would separate from the solution as a jelly, which would become more and more dense as the hardening process went on, and this would be in agreement with the increasing resistance of the mass, and the decreasing permeability by water which are seen in mortar. The author argues that it is not a swelling-up of an insoluble residual body, but rather the formation of a bulky precipitate, possibly in conjunction with the separation of a gelatinous mass, which forms the actual process in the setting and hardening of cement.—W. C. H.

PATENTS.

Water-, acid-, and alkali-proof articles; Manufacture of — [from wood-pulp]. I. L. Roberts, Lockport, N.Y. U.S. Pat. 921,000, May 11, 1909.

ARTICLES made of woody material are rendered proof against the action of water, acid, and alkali, by heating them in a bath of suitable resistant material under reduced pressure, until the articles are partially carbonised, and also permeated by the bath liquid employed. The articles are left in the bath while the pressure is relieved and the bath allowed to cool.—A. T. L.

Waterproof and fire-, water-, and oil-resistant articles; Manufacture of — from fibrous materials [cellulose]. I. L. Roberts, Lockport, N.Y. U.S. Pat. 921,001 and 921,002, May 11, 1909.

PULPED or fibrous cellulose is formed into articles of the desired shape, and these are rendered waterproof by heating to 240–400° F. for two hours or longer. The articles may then be impregnated with a hot aqueous solution of an alkali silicate in order to render them resistant to fire and to oil or grease.—A. T. L.

Bricks, stones, and other products of hard materials; Manufacture of —. J. J. Loke. Fr. Pat. 396,468, Nov. 19, 1908. Under Int. Conv., Oct. 29, 1908.

TITANIFEROUS iron sand is fused, preferably in an electric furnace of the resistance type, and cast into moulds, very hard and resistant bricks, etc., especially suitable for paving, being obtained. The sand, if poor, may be concentrated, magnetically or otherwise; conversely, silica may be added to a rich sand.—A. G. L.

Mortar and artificial stone made from it; Process of rendering — waterproof. J. Kathé. Fr. Pat. 396,486, Aug. 29, 1908.

MORTAR is rendered waterproof by adding bituminous products (obtained by distillation) mixed with clay. In place of, or together with, the bituminous products, there may be added oils, fats, waxes, resins, or soaps.—A. G. L.

Marble or cement; Process for colouring or artificially veining —. E. G. Prats. Fr. Pat. 396,748, Nov. 13, 1908.

MARBLE or cement is coloured or veined by applying to the whole or part of the surface one or more solutions containing alcohol, acids, or alkalis, and oils, fats, gums, resins, etc., mixed with a colouring matter. The process may be carried out in the cold or with the aid of heat. Thus, marble coated with sulphur and heated, becomes black.—A. G. L.

Artificial and coloured wood; Method for making —. C. Müller. Fr. Pat. 396,912, Nov. 30, 1908.

A PRODUCT named "artifakt" is produced by impregnating sawdust or wood planings with potassium silicate, adding about 10 per cent. of asbestos powder, mixing with magnesium cement and magnesium chloride, and moulding. A colouring matter may be added to the mixture; or else the empty moulds may be lined with a design in one or more colours, and the mixture then introduced.—A. G. L.

Bitumen and other substances; Treatment of — for the manufacture of mortar and concrete used for paving, roads, hydraulic works, tuyères, etc. M. G. C. R. d'Olivier-Mansan. Fr. Pat. 396,981, Nov. 9, 1908. Under Int. Conv., Nov. 12, 1907.

A WATERPROOF and resistant binder is obtained by adding to 30–35 per cent. of melted pitch or bitumen, 60–65 of dried aluminium silicate (clay), 4–5 of calcium sulphate (plaster of Paris), and lastly 0–10 of manganese dioxide. The whole is then heated and stirred for 20–30 minutes at 200–250° C. The hardness and resistance of this so-called "gangue" increase with the proportion of manganese dioxide added, and the duration of the heating. The binder is mixed with the usual aggregate.—A. G. L.

Meadow lime ["Wiesenkalk"]; Process of burning —. Chem. Lab. für Tonindustrie und Tonind.-Zeit. H. Seger und E. Cramer, Ges. m. b. H. Ger. Pat. 209,925, June 1, 1907.

A MIXTURE of meadow lime ["Wiesenkalk"] and peat is formed into heaps, dried, and then burnt either in the heaps or in kilns.—A. S.

Cement-burning apparatus. H. S. Spackman. Ardmore, Pa. U.S. Pat. 920,784, May 4, 1909.

THE lower end of a rotary kiln is surrounded by a substantially air-tight hood. Through the lower part of the hood extends an air-passage provided with a deflecting arch at the upper end so as to direct air into the kiln close to and parallel with the top of the kiln. A gas-burner tube fed with hot gas from a number of contiguous gas-producers projects through the hood below the deflecting arch, and on the ascending side of the kiln axis, an inspection hole provided with a door being provided on the other side. The air delivered into the kiln is heated by passing through a rotary cooler and shoot, through which the burnt clinker is delivered from the kiln.—A. G. L.

Cement [from lime used in sugar purification]; Manufacture of —. R. Tornay-Schosberger. Fr. Pat. 396,600, Nov. 23, 1908.

SILICIOUS materials are added either to the lime used in defecating beet-sugar, or else to the saccharine liquid itself, before or after adding lime. The precipitate produced on carbonation is freed as far as possible from liquor, and burnt to cement. The quantity and kind of silicious material added are chosen so as to yield any desired cement, e.g., Portland cement.—A. G. L.

Concrete and mortar; Process of making waterproof —. P. Mecke. Fr. Pat. 396,694, Nov. 25, 1908.

SEE Ger. Pat. 200,968 of 1908; this J., 1908, 1021.—T.F.B.

X.—METALS AND METALLURGY.

Mineral production of Japan in 1908. Mining World, May 22, 1909. [T.R.]

THE total output of minerals in Japan during 1908 amounted to \$51,614,000 gold in value, a falling off of \$1,799,000, compared with 1907. The production of the principal minerals in 1908 is shown below in quantities (1 momme=58.21 grains; 1 kin=132 lb.; 1 kwamme=8.27 lb.; 1 liquid koku=47.65 gallons):—

Mineral.	Amount.
Gold, momme	795.571
Silver, momme	28,356.05
Copper, kin	67,805.63
Lead, kin	4,899.62
Iron, kwamme	41.60
Coal, kwamme	14,468.66
Mercury, kin	1.15
Petroleum, koku	1,568.38
Sulphur, kin	53,815.07

The total number of mining disasters recorded during last year was 14,749, resulting in 506 people killed and 14,673 injured. Miners in employment at the end of last year number 214,439.

German iron industry; Development of the —. F. Wüst. Metallurgie, 1909, 6, 265–295.

THE production of Bessemer steel commenced in German, in 1861, and by 1867, 73,000 tons were produced, Germany then taking the third position among the steel producing countries. In 1870 Bessemer's patent expired and the German steel production increased rapidly, the increase being somewhat retarded but not stopped by the crisis of 1873. Owing to the more favourable condition with regard to the supplies of suitable ores, the Bessemer process was utilised more largely in England than in

Germany, and still more largely in the United States. In 1879 the Thomas-Gilchrist process was introduced and was immediately adopted in Germany, where by 1879 the production of Thomas steel amounted to million tons. Thomas steel was for a considerable time looked upon with some disfavour in England, and late as 1890 was not allowed in shipbuilding by the British Admiralty and Lloyds. The cost of production of Thomas steel in Germany was considerably less than that of Bessemer steel in England, and Germany became a position not only to supply the whole of the home market, but also to export considerable quantities. In 1903 Germany took second place among the steel-producing countries, displacing England, and has since kept its position. In the author's opinion, however, the development of the Siemens-Martin furnace and its more modern modifications (Bertrand-Thiel and Talbot furnaces) tends to be taken into serious consideration by Germany. Here the Thomas process is still the one most extensively used. Apart from the fact that Martin steel is more valuable than Thomas steel, it is pointed out that the cost of production by the Thomas process is at its lowest point and is likely to rise owing to the increased price of pig-iron. On the other hand the Martin process must be considered as only in the period of development, so that the difference in the costs of production by the two processes should become less and less, until finally the Martin process becomes the cheaper. Curve-diagrams are given showing for England, Germany, the United States, and France, the production of pig-iron and steel, the production of Martin steel, the consumption of pig-iron, the production and consumption of pig-iron per head of population, and the consumption of iron per sq. m. of land, all for the period of 1890—1907, and the estimated future production of pig-iron up to 1920.—A. S.

blast furnace gas engines. Times, Eng. Suppl., May 12, 1909, 17.

The largest plant for the utilisation of blast-furnace gases by gas engines, has just been installed at Barrow. The gases from four blast-furnaces, which have a weekly output of 1200 tons of iron per furnace, have hitherto been used for firing boilers to drive blowing-engines. In the present plant, in addition to furnishing the power required to supply the blast for the furnaces, the gas is used to run electric generators which supply all motor and lighting power required, including that for the fitting shops, furnace hoists, pumps, and hammers. Sufficient gas is left to fire the boilers for driving the wheels of the Bessemer steel producing plant. The gas plant consists of five 1250 b.h.p. gas blowers, one 1250 p.p. generator, and two 750 b.h.p. gas generators. The gas is passed through dust-catchers and washers, the treated gas only containing 0.015 grm. of dust per cu. m. During the first week's run, a saving of 1000 tons of coal effected, which, together with other economies, works out at a saving of about £1000 per week. This proves that large gas engines are practical and economical power sources, especially where fuel is comparatively costly, at Barrow.—F. R.

Cupola gases; Quantity and composition of —. G. Buzek. Stahl. u. Eisen, 1909, 29, 712—714.

The percentage of carbon dioxide in cupola gases does not alone give a correct indication of the completeness of the combustion of the coke. Free oxygen may be present in such quantities that of two different cupola gases, that with the lower percentage of carbon dioxide correspond with a more complete combustion of the coke. The efficiency of the combustion, expressed as the ratio of the percentage of the coke burned to carbon dioxide to the percentage burned to carbon monoxide, can be calculated from the percentages of these gases present in the cupola gases. To ascertain the excess of oxygen, it is necessary to determine also the percentage of oxygen in the gases. An excess of 10 per cent. of oxygen is usually required for the processes of oxidation which occur in the cupola. The paper contains a table giving the calculated volume and composition of the

gases formed from 1 kilo. of coke, assuming different values for the percentage of coke burned to carbon dioxide, and for the excess of air used.—A. T. L.

Cast irons; The nature of —. G. B. Upton. J. of Physical Chem., 1909, 13, 388—416.

THE author's equilibrium diagram of the iron-carbon alloys (this J., 1908, 1114) is stated to give an entirely satisfactory explanation of the constitution of the cast irons. The effect of other elements on the percentage of carbon in cast irons of the eutectic composition or "saturated" cast irons is summarised by the formula: $4.25 - 0.27\text{Si} - 0.32\text{P} - 0.3\text{S} + 0.03\text{Mn}$, and the percentage of graphite that may be expected is the "equivalent total carbon" (total carbon $+ 0.45\text{Si} + 0.1\text{P} + 0.05\text{S} - 0.03\text{Mn}$) minus a constant which depends on the rate of cooling. This constant has a value of 1.35 in the case of very slow cooling and of 2.1 in the case of very quick cooling, an average value being 1.7. The author considers that a grey cast iron consists of graphite in a metallic matrix which "is a conglomerate of γ solution crystals with varying contents of silicon and carbon in solution," phosphides and sulphides of iron and manganese being mixed with this metallic matrix. White cast iron is stated to be a supersaturated solution of carbon, with some silicon, in γ -iron, the crystals varying in composition. Thus the cementite crystals "are those crystals of γ solid solution which first froze out of the melt," and pearlite "is the mass of the melt, caught and held as a supersaturated solid solution."—O. F. H.

Ferro-manganese; Preparation of carbon-free —. E. Wright. Iron and Steel Inst. (Carnegie research report), May, 1909. [Advance proof.]

In a previous report to the Institute (1907) E. Roberts and the author described attempts to prepare carbon-free ferro-manganese by:—1. Replacement of the combined carbon by silicon and aluminium. 2. Prolonged cementation with various oxides. 3. Bessemerisation of the alloy. 4. Fusion at a high temperature with metallic oxides. They found that the only practical process was to fuse the alloy at a high temperature with manganese oxide in a basic-lined furnace. The author has continued the experiments on the decarburisation of ferro-manganese, and has also attempted to prepare carbon-free manganese from its ore. Ferro-manganese was heated to 1600° C. with both 30 per cent. and 40 per cent. of manganese dioxide for three hours. The resulting alloy contained about the same amount of carbon with less manganese and more iron. There was a loss of 30 per cent. of metal in the first case, and 43 per cent. in the latter. The loss was not due to volatilisation of manganese. Fusion of ferro-manganese with copper oxide resulted in a slightly altered alloy, and a copper-manganese not containing carbon. Fusion with zinc oxide lowered the percentage of manganese while raising the iron, without altering the carbon content. In addition the following materials have all been tried, hematite, silica, barium peroxide, alumina, lime, magnesia, titanite oxide, ferrous and manganoous carbonates, hydrogen, oxygen, carbon dioxide, calcium and aluminium. They mostly failed, and where there was a reduction of carbon content, the method was not economically practicable. The author believes that the commercial production of a carbon-free alloy is an impossibility, because the manganese has a greater affinity for carbon than for any other element, the only elements capable of replacing carbon being aluminium and silicon, the latter yielding a silico-spiegel. In attempting to obtain a carbon-free manganese by the reduction of manganese dioxide containing 3.4 per cent. of iron oxide, heating with carbonaceous materials and with coal gas gave a carbon-ferro-manganese, while heating with carbon monoxide and hydrogen gave no metal at all. Calcium gave manganoous and calcium oxides. Zinc and iron gave no reduction. The author believes that reduction is only effected by a reagent having a greater affinity than manganese for oxygen. Aluminium and carbon are the only available elements; the former is not economical, and the latter yields a carbide, and not metal, and this carbide cannot be reduced by any practical method.—A. H. C.

Steel; Influence of treatment on the solubility of — in sulphuric acid. E. Heyn and O. Bauer. Iron and Steel Inst., May, 1909. [Advance proof.]

The authors have investigated the relationship between the mechanical and thermal treatment of steel and its solubility in sulphuric acid. A number of samples of a tool-steel containing 0.95 per cent. of carbon, were heated to 900 C., quenched in water at 14—18° C., and reheated to various temperatures from 100 to 640° C. The samples were immersed in a 1 per cent. solution of sulphuric acid and the loss in weight, after 24, 48, and 72 hours respectively, was determined. Instead of the solubility curve showing a gradual transition from the martensite of hardened steel to the pearlite of annealed steel, the curve ran up to a sharply defined maximum with the steel reheated at 400 C. and then rapidly fell away when the reheating had been carried further. The material which has this well defined state of maximum solubility has been termed by the authors osmondite, the transition stages between it and martensite being termed troostites and those between osmondite and pearlite being called sorbites. On dissolving troostites in 10 per cent. sulphuric acid out of contact with the air, they leave a residue rich in free carbon, but containing no carbide. Sorbites similarly treated yield a steadily increasing amount of carbide as the pearlite stage is approached, the carbon in pearlite being entirely in the carbide condition. Tests made on mild steel containing 0.07 per cent. of carbon gave similar results. The quenching temperature appears to have no definite relation to the solubility of carbon steels in acid, but, in the case of tungsten-chromium steels, the solubility is proportional to the quenching temperature and together with scratching-hardness tests, etc., may be employed to determine the temperature used for quenching. The solubility of steel is increased by cold-working and is proportional to the work done; as little as 2 per cent. of cold-stretching or compression can be determined by the solubility test. Micrographs and 42 tables of tests accompany the paper.—F. R.

Steel; Gases occluded in —. T. Baker. Iron and Steel Inst. (Carnegie research report), May, 1909. [Advance proof.]

HAVING reviewed previous work on the subject, the author investigated: (a), the nature and volume of the gases evolved when steel is heated *in vacuo*; (b), the relation of the critical points to the extent of this evolution; (c), the part played by the gases in the formation of blowholes. Equal quantities of converted bar having been melted were cast in an iron mould, giving one sound ingot by the addition of aluminium, and a second full of blowholes. They both contained 0.8 to 0.9 per cent. of carbon, and were heated for 11 hours a day for 10 days in a vacuum. The sound ingot gave 10.4 times its volume of gases consisting mainly of hydrogen and carbon monoxide, while the unsound ingot gave 5.2 times its volume. The maximum rate of gas evolution coincides with the Ar 1.2.3 point in both steels, and the author considers that it is not clear whether the evolution of the carbon monoxide is due to its inferior solubility in γ -iron, or to the decomposition of a ferro-carbonyl. Aluminium appears to prevent the formation of blowholes by preventing the liberation of gas during the period of solidification, and not by any prevention of the formation of carbon monoxide.—A. H. C.

Steels for gears; Contribution to the study of —. L. Revillon. Iron and Steel Inst. (Carnegie research report), May, 1909. [Advance proof.]

THE metal suitable for employment as a cogged gear-wheel should not only be easy to machine, but capable of being hardened by suitable heat-treatment without deformation, in order to prevent wear. The author has examined twenty-six steels grouped in the following classes. 1. Steels containing neither nickel nor chromium. 2. Nickel-chromium steels with low carbon-content, capable of water-hardening with or without subsequent annealing. 3. Nickel-chromium steels low in those elements, oil- or water-hardened. 4. High-percentage

nickel steels, with or without chromium. They were in the form of bar, 20 mm. (0.78 in.) in diameter, and served not only for the tests but for two pairs of gear pinion and crown, for the third speed of a speed-changing mechanism of a 12 h.p. type of motor. These gears were run under a full load continuously for seventy hours to cause wear of the teeth. The chemical composition of the steels, their recalcence points, mechanical tests and hardness both in the annealed and in the quenched and tempered states are tabulated according to the class. The variations in the properties of each of the steels under the heat treatment are discussed, and also the best methods for the employment of each in the annealed state for machining, and in the quenched state for use in a gear. The author draws the following conclusions:—1. All four classes give samples more or less suitable for gears. 2. Steels not containing nickel can be made to give a hard gear, but are relatively brittle and require a heat treatment closely adjusted to their composition. 3. Soft nickel-steels quenched in water are not sufficiently hard, but may be case-hardened and then give excellent results. 4. With an increasing percentage of carbon, steels quenched in oil or air are improved by the presence of nickel as regards resistance to shock and elongation. 5. When the nickel content is increased it is possible to obtain by a well adjusted carbon content, a steel which under simple treatment yields the best result. After annealing, air quenching is sufficient to give good hardness and good resistance to shock for machining. Very great care is however necessary in the manufacture of this class of steel as regards composition. 6. It is always possible to obtain a nickel steel answering all the requirements of a special manufacture by simple quenching without subsequent annealing.—A. H. C.

Nickel-steel riveted joints; The strength of — with special reference to resistance to slip. E. Preuss. Iron and Steel Inst. (Carnegie research report), May, 1909. [Advance proof.]

NICKEL steel having been used for the rivets of the Manhattan and Blackwell Island bridges between New York and Brooklyn, without extensive tests being carried out, the author has tested four kinds of nickel steel to ascertain whether they were suitable for rivet material and has also tested ninety-three nickel steel riveted joints. In addition to having a high shearing strength, rivet material should have a high yield point at elevated temperatures. The author has therefore tested the tensile strength at high temperatures and finds that the tensile strength and especially the yield point of nickel steel at high temperatures are higher than those of wrought iron. It was also found that nickel-steel does not become more brittle by over-heating. The ultimate strength of the most interesting joints are tabulated, and are found to be twice as strong as similar wrought-iron joints. Nickel-steel made in the electric furnace was found to be too brittle, whereas the remaining three kinds were so tough that the heads, 0.63 in. in diameter, were pulled through plates 0.3 in. thick without damage. It is suggested that the rivet shanks may be made thinner and the heads larger than those of wrought iron or mild-steel rivets as generally employed. Fairbairn, Reed, Harkness, Schwedler, Wildish, and later, von Bach have pointed out the importance of the resistance to slipping, due to the friction of the plates joined, produced by the contraction of the rivet, and the condition of the surfaces in contact. The latter was of opinion that riveted joints should be designed more with special reference to this resistance to slipping than to the shearing resistance of the rivet shanks. The author is of an opposite opinion, having found that the important part of the slipping of nickel-steel and wrought iron riveted joints took place before the working load was reached, and not, as stated by von Bach, after the joint was loaded above 50 per cent. above the working load. The author found that the slip was different on different sides of the joint, as did von Bach; that the same amount of slip took place at equal loads with rivets of both large and small diameters; that fulling reduced the slip a little, the effect of the rivet heads having more effect than that of the

lges of the plates; that nickel-steel and wrought iron rivets were equally efficacious; and that the slip of butt joints was greater than that in lap joints of the same ultimate breaking strength. The state of the two surfaces in contact had more influence than the difference in the methods of riveting employed.—A. H. C.

in-plate production; Development and present position of —. O. Vogel. Chem.-Zeit., 1909, 33, 507.

Present England produces about 650,000 tons of tin-plate per annum, the United States 600,000 tons, Germany 44,500, Austria-Hungary 10,000, Italy 24,000, and Spain 16,000. France produces a considerable quantity, Belgium none; the Russian industry is developing, the Swedish has died out. The value of the 50,000 tons produced in England is £7,900,000, of which the 17,000 tons of iron account for £3,250,000, coal for £280,000, sulphuric acid for £90,000 and palm oil for £55,000. The tin in American tin-plate varies from 2.32—1.16 per cent., or 145—57 mgrms. per 25 sq. cm. Germany, in 1907, imported 43,085 tons corresponding with 861,700 boxes or about 96.5 million plates. The five German works, at Rasselstein near Neuweid, Dillingen on the Rhine, Hayingen in Lothringen, and Hüsten and Nachrodt in Westphalia (of which the two first are the oldest and most considerable) are united in a syndicate with an office at Cologne.—A. G. L.

Pin holes in tin plate; Detection of —. W. H. Walker. J. Ind. and Eng. Chem., 1909, 1, 295—297.

For the detection of pin holes in tin plate the author makes use of the blue coloration developed at such spots with a solution of potassium ferri-cyanide stiffened with gelatin and containing a small quantity of acid to accelerate its corrosive action on the iron. The reagent contains 100 grms. of gelatin, 450 grms. of water, 1 gm. of potassium ferri-cyanide, and 1 gm. of sulphuric acid. The ferri-cyanide is added to the gelatin solution, and after cooling about 40° C., the acid is added, the reagent being prepared just before use. When a large number of plates are to be examined, the sensitiveness of the reaction may be increased by soaking the plates overnight in a dilute solution of ammonium chloride or by dipping them for 1 minute in 5 per cent. sulphuric acid.—A. S.

Iron and steel; Preservation of —. A. S. Cushman. Iron and Steel Inst., May, 1909. [Advance proof.]

The author explains the electrolytic theory of the corrosion of iron and steel (see this J., 1907, 1051), and the action of certain oxidising agents, such as chromic acid, and reducing agents, such as pyrogallol, in inhibiting rusting (see this J., 1907, 1201). The value of the different protective coatings used is then discussed, and the results of tests recorded. The use of soldering solutions, such as zinc chloride, in ordinary galvanising is considered to be a dangerous practice since some of this solution may be included under the zinc coating, and so promote electrochemical action. The same objection applies to the cold galvanising process, owing to a similar inclusion of some of the electrolyte, and the formation of electro-negative elements of iron and zinc is a possible difficulty in the hardening process. The author shows that tin does not give such an efficient protecting coat as it should do on account of the difficulty in applying it economically to the surface of steel so that it shall give a coating free from pinholes. In the case of pigments it had been previously suggested by the author that, owing to their inhibitive action against rusting, the slightly soluble compounds should constitute the most suitable material for the first coating on iron and steel surfaces. It has, however, since been shown that this protective power may be destroyed by the presence in the pigment of a trace of iron or any soluble impurities that tend to stimulate corrosion. About fifty commercial pigments were tested in the following manner:—A series of bottles, all of the same size, were fitted with two-hole stoppers and connected by glass tubes, so that a current of air could be drawn readily through the whole series. Two carefully weighed samples of sheet steel, each having a surface area of 4 sq. in. were placed in each bottle, together with 10 c.c. of one

of the pigments and 100 c.c. of distilled water. A rapid current of air was then drawn through the series of bottles for seven days in some experiments and for three weeks in others, the loss in weight of the steel after this treatment being taken as a measure of the corrosion. From the results of these experiments the pigments are classified into three groups, *viz.*, Inhibitors such as zinc oxide, white lead (Dutch process), and willow charcoal; Indeterminates such as white lead (quick process), red lead, and litharge; Stimulators such as lampblack, ochre, and graphite. It is also shown that pigments that are good conductors of electricity should not be applied directly to iron and steel. The following rapid test of corrosive action was found to give reliable results:—"The pigments to be tested are rubbed up with sufficient water to make thick water-colour paints, and are then flowed or brushed upon the clean blades of table knives. After the coatings are dry, the knives are laid on a wet blotter and covered with a sheet of blotting paper. At the end of 48 hours the surface is cleaned off with running water and a stiff brush." Large scale tests of paints are now in progress near Atlantic City, N.J., 600 large plates, representing three kinds of steel, mounted in wooden frames facing the sea shore having been painted with single paints and various mixtures. Similar tests are being carried out in Pittsburgh to test the resistance to corrosion of steel wires of varying composition galvanised in various ways. In the case of steel that must be used without any protective coating, resistance to corrosion is dependent on the purity of the material, its freedom from segregation, and the care with which it has been worked.—O. F. H.

Platinum production of Russia. Chem. Ind., 1909, 32, 270.

The production of platinum in Russia increased considerably during the past year. The figures for the last three years were as follows:—

	Quantity.	Value.
	lb.	£
1906.....	11,592	801,000
1907.....	10,761	1,126,000
1908.....	13,975	1,570,000

—A. S.

Platinum; Melting point of —. W. Waidner and G. H. Burgess. Compt. rend., 1909, 148, 1177—1179.

The fact, observed by Féry and Chéneveau (this J., 1909, 313), that the melting point of platinum, as determined with the optical pyrometer, is dependent on the nature of the atmosphere in which the fusion is effected, does not account for the different values obtained by previous experimenters with this method, since the fusions in these experiments were made under similar conditions in the presence of air; the discrepancies are probably due to inexact knowledge of one of the constants in Wien's equation. —F. SODN.

[Cyaniding.] Utilisation of waste heat in slimes treatment. A. Salkinson. J. Chem. Met. and Min. Soc., S. Africa, 1909, 9, 308—309.

The chief advantage gained by using heated cyanide solutions in the treatment of slimes is the greater rapidity with which the slimes settle, in consequence of which a smaller number of settling tanks are required. Usually the waste heat from the mill engine can be employed to heat the solutions, the latter being used in place of the cooling water employed in the condensation of the exhaust steam. A large amount of data are tabulated in which the extraction during one month while using cold solutions is compared with that obtained during a similar period when using heated solutions. The result shows that six vats did more work with heated solutions than nine did with cold solutions, the respective extractions being practically the same, also that 20 per cent. more of the hot solution was precipitated for the same amount of zinc with a precipitation of 94.5 per cent. compared to only 91 per cent. from cold solutions.—F. R.

[*Gold cyaniding*] *Notes on precipitation.* M. Smith. J. Chem. Met. and Min. Soc., S. Africa, 1909, 9, 300—302. In the precipitation of gold and silver from cyanide solutions, the amount of zinc usually allowed is 1 cb. ft. of shavings per ton of solution per 24 hours. This amount the author considers excessive and tends to load the solutions with compounds of zinc which subsequently form "white precipitate" in the precipitation boxes. He has found it possible to reduce the amount of zinc to three tons of solution per cb. ft. of zinc per 24 hours, in the sands precipitation boxes, and to 4 and 5.4 tons of solution respectively in the two slimes precipitation boxes. The zinc was packed quite loosely in the trays to a depth of only 9 in. and a system of dressing the boxes was adopted to prevent the mixing of the old and new shavings. The zinc from the top compartment in the weak or slimes precipitation box was used to replenish that in the strong or medium solution boxes, and each of the trays from the other compartments in the slimes box were lifted up bodily and moved up one place, the last compartment being then filled with fresh zinc. Since adopting these modifications practically no "white precipitate" has been formed and the sump solutions, which previously were found to contain 0.6 dwt. of gold per ton of solution in the strong sump and 0.225 dwt. in the medium and weak sumps, now assay only a trace of gold.—F. R.

Gold and tellurium: Fusibility of mixtures of —. H. Pélabon. Compt. rend., 1909, 148, 1176—1177.

GOLD is readily soluble in molten tellurium, a pasty solution being obtained if the proportion of gold exceed 60 per cent. The fusion curve indicates the existence of a compound, Au_2Te_3 (43.59 per cent. of gold), solidifying at 472° C., but no other compound appears to be formed between these elements. On strongly heating the pasty mixtures, rich in gold, tellurium is driven off and finally, at 1065° C., pure liquid gold remains.—F. SOBES.

Silver ore treatment in Mexico. R. Linton. J. Chem. Met. and Min. Soc., S. Africa, 1909, 9, 307—308.

For the treatment of refractory manganiferous silver ores, the author mixes the crushed ore with salt and adds a 5 per cent. solution of sulphuric acid, allowing the mixture to stand, with occasional agitation for 24 hours. The manganese present in the ore causes an evolution of chlorine which renders the ore amenable to treatment by cyanide. The acid solution is filtered off, the ore washed and then leached with a 2 per cent. solution of potassium cyanide. Extractions of from 60 to 94 per cent. have been obtained in the laboratory.—F. R.

Cupellation experiments; the thermal properties of cupels. C. O. Bannister and W. N. Stanley. Inst. Min. and Met., May 20, 1909. [Advance proof.]

In seeking an explanation of the differences known to exist between bone-ash and patent (magnesian base) cupels when in actual use, the thermal properties of cupels have been investigated by the authors. By means of a special apparatus which is described, the relative diffusivities of heat were determined for various brands of cupel, both at 100° C., and during the actual cupellation process. The patent cupels were found to have a higher diffusivity and a greater specific heat than the bone-ash cupels, and it was noticed that during cupellation at the same muffle temperature, the actual temperature of the cupelling button was much lower in the former than in the latter case. During experiments in the cupellation of silver with lead, considerable differences were also noted in the rate of cooling and in the time required for the solidification of the silver beads. It was thus found that, after being withdrawn from the same muffle temperature, silver beads take longer to solidify and "spit" on patent than on bone-ash cupels; and that spitting is more liable to occur when the latter kind of cupel is used.—W. E. F. P.

Alamosite: a new lead silicate from Mexico. C. Palache and H. E. Merwin. Amer. J. Science, 1909, 27, 399—401.

The new mineral, which was found near Alamos, Sonora, Mexico, has the composition, PbSiO_3 , and is closely

analogous to wollastonite (CaSiO_3) in form, habit, and composition. It occurs in radiated aggregates of minute colourless and transparent fibres, which give a snow-white appearance to the mass. The optical and physical properties were determined. It is easily reduced to charcoal to metallic lead; and is soluble in nitric acid with strong gelatinisation. Alamosite is very similar in appearance to barysilite, but may be readily distinguished from it by its optical characters.—F. R.

"Hardhead" [residue from tin smelting]; Bessemerising of —. D. M. Levy and D. Ewen. Inst. Min. and Met., May 20, 1909. [Advance proof.]

THE objects of the investigation, which is still proceeding are to determine the suitability or otherwise of a Bessemerising process for the profitable recovery of value from hardhead, and also the rate at which the constituent (mainly tin, arsenic, and iron) are oxidised and eliminated during such process. The material used in the experiments contained 17.92 per cent. of tin, 21.92 of arsenic and 52.90 of iron. On heating a charge to fusion in a crucible covered with a clay hood, and blowing a gentle current of air through it, a considerable evolution of heat occurred, indeed sufficient to keep the charge fused without external heat. Cooling curves taken with 500 grm. charges under exactly similar conditions, both with and without blowing, indicated an increase in temperature of 362° C. during a 15 minutes' blow with cold air. Similar charges were subjected to the Bessemerising process for periods ranging from 15 seconds to 15 minutes, the products—consisting of "metallic button," slag, and fume—being examined in every case. It was found that although a high degree of concentration of the nickel and cobalt had occurred in the metallic button, the small increase obtained in the tin content was of no practical advantage. The amount of tin in the slags varied, the lowest obtainable under laboratory conditions being 7 per cent. (much of which appeared to be in the form of hardhead held mechanically), with 2 to 3 per cent. of arsenic, 50 of iron, and 25 of silica. The condensed fume adhering to the crucible cover was found to contain about 90 per cent. of tin oxide and 0.1 per cent. of arsenic, while the fume condensed in the flues consisted of arsenious oxide, tin oxide, and fuel-ash in varying proportions, the percentage of tin increasing, and that of arsenic decreasing as the furnace end of the flue was approached. The authors claim that the feasibility of Bessemerising hardhead has been clearly demonstrated, and are of opinion that actual practice alone will show whether slags of sufficiently low tin content can be obtained to make the process a commercial success.—W. E. F. P.

Tantalum; Analysis of ores of —. E. S. Simpson. Chem. News, 1909, 99, 243.

THE following method of analysis of tantalum ores used in the laboratory of the Geological Survey of W. Australia, gives results for the combined oxides of tantalum and niobium, which, in the absence of appreciable quantities of titanium oxide, are accurate to within 0.1 per cent. The ore is fused with potassium hydroxide the fused mass extracted with water, the liquid acidified with a definite amount of hydrochloric acid, boiled to effect complete solution of the bases, and then diluted and boiled to precipitate the hydroxides of tantalum and niobium ($\text{Ta}_2\text{O}_5 + \text{Nb}_2\text{O}_5$). The moist precipitate is dissolved in water acidified with hydrofluoric acid, the solution treated with potassium fluoride and concentrated and the successive crops of crystals removed (see this J. 1906, 681). The niobium in the final mother liquid is precipitated as hydroxide, weighed as oxide, and its amount deducted from the amount of mixed oxide determined in a second portion of the sample. The difference gives the amount of tantalum oxide. A solubility allowance of 2 mgrms. of tantalum oxide, Ta_2O_5 , is made for each 1 c.c. of liquid from which the final crystallisation of the potassium tantalum fluoride is made. Tin, iron, manganese, etc., are determined in the original filtrate from the mixed hydroxides. In reply to criticism made upon this method by Giles (Chem. News, 99, 1), the author points out that in order to obtain a fused mass readily soluble in water (with the exception of carbonate

of iron, yttrium, etc., which are dissolved by subsequent addition of hydrochloric acid) a proportion of 6 parts of potassium hydroxide to one part of the mineral is required. Under these conditions the decomposition of manganotantalite was complete at a low red heat in 10 minutes, whilst 20 minutes were required for the decomposition of ferrotantalite, euxenite, fergusonite, and stibiotantalite. In each case the powdered ores were passed through a 90-mesh sieve. The decomposition of cassiterite (finely ground in an agate mortar) required 45 to 60 minutes. A nickel crucible is best for the determination of tantalum, niobium, and tin, whilst for the determination of iron, manganese, yttrium, etc., the fusion is made in silver, and the hydroxides of tantalum and niobium (which are contaminated with silver) are rejected. Antimony, in, *e.g.*, stibiotantalite, is precipitated with the tantalum and niobium. The precipitate is digested with ammonium sulphide to remove the antimony, and the residual oxides again fused, reprecipitated and again digested. "Creeping" of the alkaline mass during the fusion is prevented by fixing the crucible in a hole in asbestos millboard one-eighth inch in thickness in such a manner that only about a quarter of the crucible is below the board. The bottom of the crucible may then be heated to dull redness, whilst the upper edge is too cool for "creeping" to take place. As a further precaution the lid of the crucible should be made distinctly convex, so that particles of material projected against it drop back from the centre into the crucible instead of travelling to the side.

—C. A. M.

Tungstic acid: Determination of — in low grade wolfram ores. H. W. Hutchin and F. J. Tonks. *Inst. Min. and Met.*, May 20, 1909. [Advance proof.]

THE process described is a modification of the mercurous nitrate method, in which fusion with alkalis is replaced by digestion with caustic soda solution, by which means a large sample may be conveniently and quickly operated upon. It consists in digesting the finely-powdered ore with 20 c.c. of a 25 per cent. solution of caustic soda (free from chlorides) on a water-bath for 30 to 45 minutes, filtering, adding a little sodium peroxide to oxidise any decomposition products of sulphides, and diluting to 50 c.c. An aliquot portion, after filtering, is acidified with dilute nitric acid, then made alkaline with ammonia, boiled, and filtered. The filtrate, after being slightly acidified with dilute nitric acid, is precipitated with excess of mercurous nitrate solution followed by a few drops of dilute ammonia, and is warmed and stirred to promote rapid settling of the precipitate. After filtering and washing with weak mercurous nitrate solution, the precipitate and paper are ignited together in a porcelain, in the absence of arsenic, a platinum, crucible, the residue being tungstic acid. The above quantity of caustic soda is stated to be sufficient for the decomposition of charges containing up to 0.4 gm. of tungstic acid, the attack being very rapid. The mercurous nitrate solution is prepared by heating 2 or 3 oz. of mercury with 5 c.c. of nitric acid of sp. gr. 1.4 and 75 c.c. of water early to boiling for 1½ hours, allowing to stand overnight, and then diluting to 400 c.c.; 20 c.c. of this solution are sufficient for most assays. The method is not applicable in the presence of scheelite, which is only partially attacked under the conditions of the assay. Arsenic, if present in the ore, is partly dissolved out by the caustic soda and subsequently precipitated by the mercurous nitrate; but the authors find that by burning the precipitate and filter-paper together, as above stated, the effect of arsenic is practically a negligible factor in the case of ores containing 100 lb. or less of tungstic acid per ton. The great discrepancies existing between the assay-results obtained on the same ore by the above and the *aqua regia* methods has led the authors to determine the solubility of tungstic acid in *aqua regia* under various conditions. They find that the presence of arsenic and fluorides in the ore greatly increases the amount of tungstic acid retained by the acid liquor, indicating that these substances should be removed before applying the *aqua regia* treatment.—W. E. F. P.

Aluminium welding. [Aluminium; Action of acids on.] M. U. Schoop. *Electrochem. and Met. Ind.*, 1909, 7, 193—194.

No entirely satisfactory solder has yet been discovered for uniting aluminium, but for men skilled in "lead burning," the operation of autogenous welding presents no special difficulty. Large aluminium vessels for distillation and similar purposes are now made by this means. An illustration is given of a container about eight feet both in height and diameter. For welding thin sheets the oxy-hydrogen blowpipe is sufficient, but for thick sheets it is advisable to use the oxy-acetylene burner. It is necessary that the gases be intimately mixed as they leave the burner, and to avoid back-lighting, the flow of gas must be greater than the speed of propagation of the explosion. Special so-called "saving burners" may be used in which the oxygen supply is automatically cut off and the hydrogen supply reduced as soon as the burner is laid aside. A long series of tests have been made in Zürich to determine to what extent aluminium is attacked by acids. It was found that the English metal withstood the attack better than that of other European manufacture. The structure and condition of the surface, however, largely affects the results. Hard rolled aluminium with a highly polished surface is the least attacked, but if it is heated until a chip of wood on its surface begins to char, the resistance of the metal to acid attack is reduced to that of cast aluminium.—F. R.

Direct reactions; Conditions necessary for —, and the direction of the electric current generated by the action of sulphur on metals. A. Colson. *Compt. rend.*, 1909, 148, 1183—1186.

IF two bodies are capable of combining with a third, the compound produced at a given temperature is not necessarily that which gives rise to the liberation of most heat. Copper, for instance, is attacked by oxygen or sulphur at a much lower temperature than is aluminium, although the heat developed in the latter reactions is much greater than in the former. Similarly, when rods of copper and aluminium are placed in yellow ammonium sulphide, the direction of the electric current set up, as well as the appearance of the copper, shows that this metal is attacked by the sulphur, and if the copper is replaced by silver, in spite of the large difference between the heats of formation of silver sulphide and aluminium sulphide, the direction of the current indicates that silver is the metal attacked. In order to prophesy the course of such a reaction, it is considered necessary to know the "zones of reaction" of the compounds concerned, *i.e.*, the temperatures at which they are formed and dissociate. For example, the action of aluminium on chromic oxide is thought to depend on the fact that alumina, unlike chromic oxide, has no dissociation pressure at about 2000° C., and not on its heat of formation being greater than that of chromic oxide.—F. SODX.

PATENTS.

Ore concentrators. H. J. Haddan, London. From C. W. Eccleston, Los Angeles, Cal., U.S.A. Eng. Pat. 19,163, Sept. 11, 1908.

THE concentrator consists essentially of a table having a flexible surface suspended by wires from its sides and held in a state of high tension. The surface is furnished with riffles extending part or the whole length of the table and at right angles to the tension. Means are provided for imparting a rapid longitudinal reciprocating motion to the table. Blocks supported by truss-rods passing under the table at different parts enable the level of the surface to be variably adjusted if required. Ore pulp is fed on to the table and gradually moves to the discharge end owing to the reciprocating motion of the table. It is subjected to a transverse stream of water which carries the tailings over the lower side, the concentrates being discharged at the further end.—F. R.

Ore concentrators. P. M. Justice, London. From H. S. Duell, New Rochelle, U.S.A. Eng. Pat. 28,365, Dec. 29, 1908.

THE apparatus comprises a table having a sloping concentrating surface, which may be flat or concave. The inclination of this table may be altered at will, and means are provided by which the whole system can be agitated in a direction perpendicular to the angle of slope. The essential feature of the apparatus consists however in the number of sinuous "riffles" or small vertical partitions which extend from the elevated portion diagonally across the surface of the concentrator and tend to converge at the opposite lower corner. The undulation of these "riffles" progressively decreases in amplitude from the upper to the lower corner of the table. Along the top edge of the concentrator extends a longitudinal trough divided into two or more divisions by adjustable stops. In this way the ore, fed into a hopper at the right hand corner, travels towards the other end, so that before being washed on to the surface by a stream of water, it becomes roughly classified. A series of hoppers is arranged along the lower edge of the table for the reception of the classified products.—C. A. W.

Ores; Process for testing or reducing — E. P. Welch, Denver, Colo. U.S. Pat. 919,663, April 27, 1909.

FINELY powdered ores are mixed with a material containing 20 parts of potassium chlorate, 2 of sodium peroxide and manganese dioxide, 13 of wheat flour, and 4 of argol, and the whole is ignited.—A. G. L.

Steels; Treatment of — for industrial purposes. Soc. Schneider et Cie, La Cressot, France. Eng. Pat. 24,241, Nov. 11, 1908. Under Int. Conv., Jan. 25, 1908.

THE treatment is to prevent the liability of armour plates, etc., made of certain steels, developing blowholes and rents caused by internal tension, during cooling. The metal is cooled from well above the critical point in heating, and the cooling retarded for a time at about 250° C. above the critical point in cooling, or the metal is partially cooled and then re-heated, care being taken not to heat to the critical point in heating. Cooling is then allowed to proceed and the exothermic reactions that usually occur at the lower critical point are entirely prevented, the steel cooling without strain.—F. R.

Tool-steel. J. M. Darke, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pat. 919,544, April 27, 1909.

A LOW-CARBON steel is claimed containing 13.5 per cent. of tungsten, less than 0.5 of chromium, and more than 2 (e.g., 3) of manganese; 0.25 of vanadium may also be added.—A. G. L.

Steel; Manufacture of — J. dit V. Fattelay. Fr. Pat. 396,248, Jan. 20, 1908.

IN the method proposed, a gyratory movement is imparted to the steel as it is poured out of the receptacles into the ingot moulds. To this end, the tap-hole at its upper portion is of helicoidal form; the lower portion, however, is made round in order to regulate the jet of metal. In this way the emerging stream offers less surface to the surrounding air and oxidation is prevented. Moreover, in the movement of rotation, the slag becomes pulverised, and, not being sufficiently heavy to be drawn down into the mass of the metal, remains floating on the surface.—C. A. W.

Steel; Manufacture of — F. P. Jones. Fr. Pat. 396,635, Nov. 23, 1908.

THE process relates to the manufacture of steel from crude cast iron or iron scrap together with iron ore or other oxides. The method is advantageous when the metals contain such high percentages of phosphorus or silica as to retard injuriously the working of the ordinary basic open hearth process. The metal undergoes two distinct treatments, being first submitted to a process whereby the silicon, carbon, phosphorus, and sulphur are wholly or partially eliminated, and then to a process of oxidation.

IN practice, the molten metal is transferred directly from the cupola furnace to a Bessemer converter with basic lining. It may there be subjected to two distinct blowings or to a single continuous blow. In the first method, a small charge of lime is added, the converter raised and the metal freed from silicon and partially from carbon. The converter having been turned over as much of the slag is poured out as is possible without loss of metal. The necessary amount of lime, together with oxides, if these are required, is added, the converter raised and the blow continued until the metal is decarburised. The slag, rich in phosphorus and valuable as manure, is poured off and the molten metal directed to the hearth of a furnace with basic lining, where it comes into contact with a mass of the unrefined metal, the quantity of the latter being regulated according to the quality of the steel it is desired to obtain, and being such that it is rapidly freed of its silica and phosphorus. If lime and oxides be added to the basic furnace before or during the charging of the latter, the final operation will be hastened so that more of the unrefined metal may be employed and a greater economy of working obtained. Finally, after removal of the unrefined metal, the slag may be retained on the hearth for the purification of subsequent charges. If the oxidation in the converter be carried out in one blow, the whole of the lime is added to the charge at once, after which the operation goes forward as before.—C. A. W.

Leaf-metal and the like, particularly leaf-gold; Process and apparatus for manufacturing — L. Kurz, Fürth, Germany. Eng. Pat. 28,081, Dec. 24, 1908.

3.7 GRMS. of castor oil and 26.25 grms. of nitrocellulose are dissolved in each litre of a colourless mixture consisting of 50 parts by measure of amyl acetate, 45 parts of benzene, and 5 parts of methyl alcohol. Sufficient finely powdered metal or alloy to form a thin paste is stirred in, and a thin stream of the mixture poured on to water or other suitable surface, over which it spreads, forming a floating film which rapidly becomes solid owing to the evaporation of the amyl acetate, accelerated by the benzene. When solid, the leaf is lifted off, dried, and polished. Details are given of an apparatus for carrying out the process.—F. R.

Precious metals; Process of extracting — from their ores. W. L. Imlay, Conestoga, Pa., Assignor to W. L. Imlay Rapid Cyanide Process Co., South Dakota. U.S. Pat. 919,434, April 27, 1909.

THE ores are powdered in, or conveyed through, a series of lixiviators, in which they are exposed to the solvent action of potassium cyanide solution, both ores and solution being alternately heated and cooled, and also agitated and scoured whilst exposed to the action of light and air.—A. G. L.

Gold; Process for the recovery of — from solutions [see water] containing it. J. D. Riddel A.-G. Ger. Pat. 208,859, March 19, 1907.

THE solution containing gold, for example sea-water, is filtered through ordinary zeolites, or through zeolites containing stannous oxide, ferrous oxide, or other bases capable of precipitating gold; or bases capable of precipitating gold are added to the solution in the form of salts before filtering through ordinary zeolites. It is stated that by this process the recovery of gold from sea-water becomes remunerative. The filter may be suspended in the sea at places where the water is in continual motion owing to currents, etc.; or they may be fastened to travelling ships.—A. S.

Tin; Process of removing and recovering — J. Elkes, Mt. Pleasant, Pa. U.S. Pat. 919,839, April 27, 1909.

TIN is removed from scrap by immersing in a heated bath of ammonium sulphide containing excess of sulphur. Hydrochloric acid is then added to precipitate tin sulphide, which is converted into tin dioxide by heating. The tin dioxide is then reduced by means of a carbonaceous substance, e.g., coal.—A. G. L.

urnace for volatilising zinc ores; Revolving —. H. H. Hughes, Springfield, Mo. U.S. Pat. 920,143, May 4, 1909.

HE furnace consists of an inclined cylinder provided at its upper end with a central longitudinal tubular trunnion bearing, and a fixed annular hood of greater diameter than the furnace. This hood communicates with the interior of the furnace by means of openings corresponding with similar openings in the wall of the cylinder. At the same end of the cylinder is placed a hopper provided at its bottom with a cylindrical feed-tube which projects into the furnace through, and fits closely within, the trunnion bearing. Means are provided for withdrawing volatilised ore from the hood.—A. G. L.

metal; Process for refining —. J. H. Reid, Newark, N.J. U.S. Pat. 920,391, May 4, 1909.

HE ore is first melted (by electric means) and then "mixed" with a reducing gas (e.g., carbon monoxide), as to produce a frothy mass. This mass is then rotated and its surface exhausted.—A. G. L.

soldering; Autogenous —. J. Knappich. Fr. Pat. 396,306, Nov. 7, 1908. Under Int. Conv., Nov. 9, 1907.

HE coal gas employed is increased considerably in calorific power by saturating it with the vapours of volatile hydrocarbons such as benzol, gasoline, petroleum ether, &c. To this end, the gas may be made to bubble through the liquid hydrocarbon contained in a carburettor of suitable design, or allowed to pass through a porous mass saturated with the liquid. The same end would be attained by allowing the latter to fall in drops into the carburettor.—C. A. W.

aluminium and its alloys; Method of soldering pure —. O. de Andrade. Fr. Pat. 396,345, Nov. 14, 1908.

HE solder employed has the composition: zinc, 150 parts; tin, 50; aluminium, 40; silver, 12; and phosphorus, 1 part, all the constituents being quite pure. The metal is melted in a plumbago crucible and the other metals added in order of fusibility, the liquid being kept well stirred. The phosphorus is added, with stirring, only at the moment of pouring, when the crucible has been removed from the fire. The solder is employed without flux, but, while the work is still hot, a little stearine paraffin is passed over the weld. All the tools employed are of aluminium.—C. A. W.

slags [Blast-furnace]; Treatment of — with a view to facilitating their transport. Ges. für Förderanlagen E. Heckel m.b.H. Fr. Pat. 396,769, Nov. 20, 1908.

HE molten slag without previous granulation is brought directly into contact with the jet of water of a hydraulic motor. In practice, the water emerging from a tuyère is along the bottom of an open receptacle of V-shaped section, where it meets with the slag which is run in at the top, the mixture passing away into a chamber tube. The diameter of this tube being enlarged progressively in the direction of the motion, a considerable hydraulic pressure is set up, so that the mixture of slag and water may be conveyed to any desired distance or height. The granulation is subsequently effected in the ordinary way by bringing the whole into contact with a large quantity of water.—C. A. W.

iron; Process for increasing the ductility of —. Siemens und Halske A.-G., Berlin. Eng. Pat. 17,610, Aug. 21, 1908. Under Int. Conv., Sept. 26, 1907. Addition to Eng. Pat. 17,350 of 1908.

SEE Fr. Pat. 393,595 of 1908; this J., 1909, 149.—T. F. B.

iron, from tinned scrap; Process for recovering —. J. C. Higgins, Bayonne, N.J., U.S.A. Eng. Pat. 23,068, Oct. 29, 1908.

SEE U.S. Pat. 902,581 of 1908; this J., 1908, 1158.—T. F. B.

Detinning; Process of —. K. Goldschmidt and J. Weber, Essen on Ruhr, Germany, Assignors to Goldschmidt Detinning Co., Jersey City, N.J. Reissue No. 12,956, dated May 11, 1909, of U.S. Pat. 831,223, Sept. 18, 1906.

SEE Fr. Pat. 356,228 of 1905; this J., 1905, 1311.—T. F. B.

Furnace; Metallurgical —. L. S. Hughes, Assignor to Pieher Lead Co., Joplin, Mo. U.S. Pats. 920,333 and 920,334, May 4, 1909.

SEE Fr. Pat. 392,991 of 1908; this J., 1909, 27.—T. F. B.

Iron or steel; Manufacture of — by the basic Bessemer process. J. Flohr, Rodange, Assignor to Soc. Anon. des Hauts-Fourneaux et Forges de Dudelange, Dudelange, Luxemburg. U.S. Pat. 920,560, May 4, 1909.

SEE Eng. Pat. 9554 of 1908; this J., 1908, 904.—T. F. B.

Steel for armour plates and other purposes; Process for treating —, avoiding the formation of blowholes and facilitating working. Schneider et Cie. Fr. Pat. 396,405, Jan. 25, 1908.

SEE Eng. Pat. 24,244 of 1908; preceding.—T. F. B.

Metals; Process of separating — from ores. P. Germain, Paris. U.S. Pat. 921,227, May 11, 1909.

SEE Fr. Pat. 391,032 of 1907; this J., 1908, 1158.—T. F. B.

Pyrites liquor; Treatment of — for winning metals therefrom. J. H. Thwaites, Peterborough. U.S. Pat. 921,312, May 11, 1909.

SEE Eng. Pats. 24,847 and 27,506 of 1907; this J., 1909, 203.—T. F. B.

Zinc and analogous furnaces; Means for protecting operatives of — from heat, fumes, and dust. E. Dor-Delattre, Liege, Belgium. U.S. Pat. 921,375, May 11, 1909.

SEE Eng. Pat. 15,288 of 1908; this J., 1908, 1069.—T. F. B.

Alloy of silicon. H. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 921,607, May 11, 1909.

SEE Ger. Pat. 199,193 of 1907; this J., 1908, 948.—T. F. B.

Copper; Metallurgy of — and processes of purifying, melting, and alloying the metal. Titanium Alloy Manufacturing Co. Fr. Pat. 396,774, Nov. 23, 1908.

SEE U.S. Pat. 905,232 of 1908; this J., 1909, 27.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A).—ELECTRO-CHEMISTRY.

Carbon electrodes; Manufacture of —. G. A. Roush. J. Ind. and Eng. Chem., 1909, 1, 286—295.

THE materials used in the manufacture of carbon electrodes are coke, hard and soft pitch, coal tar, and petroleum oil; in some cases when it is desired to obtain electrodes of better mechanical wearing properties, a small portion of the coke is replaced by lampblack. Except in special cases where a relatively high content of ash is not objectionable, petroleum coke, containing 6—10 per cent. of volatile matter and 0.02—0.06 per cent. of ash, is used. The hard pitch should soften at 160°—170° F. and contain 40—45 per cent. of matter insoluble in benzene. The petroleum oil is so-called "summer oil," the last distillate in the refining of crude oil. The coke is crushed to $\frac{3}{4}$ -in. size and freed from volatile matter by calcining in cylindrical firebrick retorts arranged in a furnace so that the fire plays all round them. The cost of calcination, including fuel, labour, loss of weight, etc., is about £1

per ton. The calcined coke is ground to dust of varying degrees of fineness according to the size of electrodes to be made (see following table).

	Small sizes.	Medium sizes.	Large sizes.
	Per cent.	Per cent.	Per cent.
On 100-mesh sieve	0.8	5.0	10.0
" 140-mesh "	7.7	17.3	20.5
" 200-mesh "	27.5	21.7	19.0
Through 200-mesh sieve	64.0	50.0	50.5

For producing the finest dust a Raymond impact pulveriser is used, in which a grinding wheel, suspended from one end of a rotating arm, is forced by centrifugal action against a heavy ring. The crushed material is caught by an ascending current of air from a fan, and the fineness of the dust collected is controlled by regulating the speed of the fan, the heavier particles being allowed to fall back into the pulveriser. With this machine it is possible to obtain without bolting, dust of such fineness that 98 per cent. will pass a 100-mesh sieve, and 92 per cent. will pass a 200-mesh sieve. Coarser dusts are produced either in the same machine, or in the ordinary burr mill, with or without bolting. The hard pitch is crushed to $\frac{1}{2}$ -in. size. The composition of some of the mixtures commonly used is as follows:—(1). For ordinary electrodes: coke, 325 lb.; hard pitch, 110 lb.; oil, 1 gall. (2). For a somewhat finer dust or a pitch of higher melting point: coke, 325 lb.; hard pitch, 115 lb.; oil, 2 galls. (3). For a coarse dust: coke, 325 lb.; hard pitch, 40 lb.; melted soft pitch, 4 galls.; oil, 1 gall. (4). For a "carbon" to stand heat and wear but not to be used as electrode: coke, 325 lb.; lamp-black, 20 lb.; hard pitch, 30 lb.; tar, 10 galls. The ingredients are mixed for about 20 mins. in steam-jacketed kettles provided with revolving blades. The hot mixture, having a temperature of 265°–275° F., is placed in heavy cast-iron hoops, and by means of a hydraulic press is compressed into cheeses or plugs about 6 ins. thick and of the same diameter as the opening in the press in which the "carbons" are subsequently formed. The plugs are allowed to cool to 200°–240° F. and then forced through dies which are usually about 3–5 per cent. larger than the desired diameter of the finished "carbons." The hydraulic press used is provided with a steam coil to keep the material at the requisite temperature. The pressure used must not be too high, otherwise the material expands so rapidly on emerging from the die that the "carbon" splits radially from end to end. The "carbons" are cut to length whilst hot, spoiled or defective ones being rejected. The "green carbons" are then packed firmly in sand in a gas-fired furnace having flues in the bottom and walls so that the furnace-chamber is heated uniformly. The top layer of "carbons" is damaged by oxidation during the cooling of the furnace, and is therefore usually made up of "green carbon scrap," which is afterwards ground and used in making battery carbons. The baking of the electrodes occupies from 10 to 14 days, the temperature being increased steadily, finally to 1020° C. The furnace is allowed to cool for 4 or 5 days before being opened. The finished "carbons" should have a resistance of about 0.0016 ohm per 1 inch cube, and be capable of safely conducting a current of 25 amperes per sq. in. of cross-section. They are also tested for apparent density, real density, and content of ash. In the case of ordinary electrodes the apparent density varies from 1.55 to 1.70, the real density from 1.95 to 2.05, and the ash content from 0.1 to 0.3 per cent. Electrodes of amorphous carbon to be converted into graphite by the Acheson process are prepared in a similar manner, the composition of the mixture used being: coke, 325 lb.; hard pitch, 103 lb.; soft pitch, $\frac{1}{2}$ gall.; oil, 1 gall.; iron oxide, 5 lb. The finished "carbon" ready for graphitisation should contain about 1.5 per cent. of ash and have a real density of at least 2. All the scrap produced must be ground and worked up again in the process, since carbon containing iron cannot be used for battery purposes.—A. S.

Electrolysis of glycerol and glycol. Löb and Puivernmacher. See XVI.

PATENTS.

Electrical effluvia; [Ozonising] Apparatus for producing and utilising —. L. Gerard, Brussels, Belgium. Eng. Pat. 1253, Jan. 18, 1908. Under Int. Conv. April 19, 1907.

CONCENTRIC metallic tubes are employed as electrodes the distance between the latter gradually increasing towards the ends of the cylinders. The electrodes are separated by dielectrics, in the form of tubes of glass mica, etc., these being supported at one place only so that they are free to expand in all directions, and the electrodes are split or cut in order to allow for expansion. The apparatus is supported in an insulated metallic bath, containing a "cooling medium of non-conducting liquid of high calorific and specific inductive capacity," such as petrol, Canada balsam, resinous solutions, mineral oils, etc., and the inner electrode is cooled by the current of gas entering the apparatus.—B. N.

Ozone; Apparatus for the production of —. A. Vosmaer. Assignor to the United Water Improvement Co. Philadelphia, Pa. U.S. Pat. 919,403, April 27, 1909.

THE air to be ozonised is passed through a vessel in which a number of ozonisers are placed parallel to the path of the air. The ozonisers consist of rods provided with electrodes around which are concentrically supported tubular dielectrics surrounded by outer tubular electrodes. The rod, dielectric, and outer electrode of each element are spaced equally apart, the air being passed through the tubular dielectric.—W. H. C.

Insulating material; Process of manufacture of an —. A. Kraenzlé. Fr. Pat. 396,766, Nov. 17, 1908.

BITUMINOUS substances, dissolved in alkali, are mixed with barium peroxide, the latter being transformed into barium hydroxide and carbonate. The elimination of oxygen induces a rapid hardening of the bitumen, and this, uniting with the barium carbonate, forms a compact and homogeneous mass, which is impermeable to water, and which is a bad conductor of electricity, sound, and heat.—B. N.

Electrolyte for electric batteries. The New Ignition Syndicate, Ltd., and W. J. L. Sandy. Fr. Pat. 396,905, Nov. 30, 1908. Under Int. Conv., May 14, 1908.

THE electrolyte contains chromic acid, an acid alkali sulphate, and hydrochloric acid, the following proportions of substances being employed:—600 grms. of sulphuric acid, 60° B., 400 grms. of hydrochloric acid, 21° B., 1000 grms. of chromic acid (or an equivalent quantity of sodium or potassium bichromate), 200 grms. of sodium or potassium hydroxide, and 4200 grms. of water. —B. N.

Ozone producer. S. M. Kintner, Pittsburg, Assignor to Westinghouse Electric and Manufacturing Co. U.S. Pat. 920,965, May 11, 1909.

SEE Eng. Pat. 14,586 of 1906; this J., 1907, 54.—T. F. B.

Insulating material; Process of making a transparent, flexible, and infusible —. K. Winkler. Fr. Pat. 396,340, Nov. 14, 1908. Under Int. Conv., Nov. 18, 1907.

SEE Ger. Pat. 208,753 of 1907; this J., 1909, 529.—T. F. B.

Electrolysis of liquids; Process for the —. J. Billiter. Fr. Pat. 396,369, Nov. 16, 1908.

SEE U.S. Pat. 903,951 of 1908; this J., 1909, 28.—T. F. B.

Reduction of filaments for electric incandescence lamps. Fr. Pat. 396,425. See II.

Preventing formation of cavities in filaments for electric incandescence lamps. Fr. Pat. 396,899. See II.

Electrolytic treatment of fibrous plants. Fr. Pat. 396,647.
See V.

(B).—ELECTRO-METALLURGY.

Copper sulphate; Electrolytic preparation of — from "cement waters." G. B. Rambaldini. L'Ind. Chimica, 1909, 9, 1—4. Chem. Zentr., 1909, 1, 1675.

The author describes a method of obtaining pure copper from "cement copper waters." An electrolytic cell is divided into two compartments by a non-conducting partition extending only to half the height of the cell. In one compartment is placed the "cement water," and in the other a dilute acid solution of copper sulphate. The level of these liquids is below the top of the partition, but they are covered with dilute sulphuric acid to a height above the top of the partition. On passing a current between copper electrodes placed in the two compartments, copper separates from the "cement water" at the cathode, whilst at the anode, copper is dissolved. By changing the electrodes at intervals and renewing the liquids in the two compartments, the production of a pure solution of copper sulphate proceeds continuously.

—A. S.

PATENTS.

Electrotypes; Apparatus for the production of — and for electroplating. S. O. Cowper-Coles, London. Eng. Pat. 9695, May 4, 1908.

The apparatus is intended for the production of electrotypes such as voice records or printing surfaces. It comprises an electrolytic vat in which a convenient number of printing blocks, rendered capable of conducting electricity by a coating of graphite, are secured by means of adjustable grips on the under surface of a flat holder, so that they constitute a cathode. This cathode can be rotated over anode plates arranged beneath it in the vat, and is connected to the source of electricity by means of brushes which impinge directly on the shaft. This last being hinged, the whole system of plates can be raised to a perpendicular position, so that the condition of the deposits may be inspected at any moment. The electrolyte is circulated through spraying pipes directly on to the surface of the records, a more rapid circulation being assured by means of vanes secured to the cathode holder. If desired, the apparatus may be arranged so that each record rotates about its own axis as well as about the central axis of the holder.—C. A. W.

Distillation-furnace. W. M. Johnson, Assignor to The Continuous Zinc Furnace Co., Hartford, Conn. U.S. Pat. 920,473, May 4, 1909.

The furnace is an electric furnace consisting of a vertical chamber provided with an interior casing of non-conductive and refractory material at a distance from the walls of the chamber. The casing is built up in sections and is provided with a number of upwardly inclined perforations. Electrodes are placed at top and bottom of the casing. A hopper is provided at the top of the chamber, a discharge door near the lower end, and an outlet for the vapour near the upper end.—A. G. L.

Uminium and other metals; Art of extracting —. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 920,893, May 4, 1909.

SUBSTANCES containing the metal to be produced are maintained in the fused state by means of an alternating current, the metal being liberated by the action of a direct current, in the presence of a substance capable of uniting with the electro-negative constituent with which the metal is combined.—A. G. L.

Electric furnace for metallurgical purposes. P. Girod, Ugine, France. U.S. Pat. 921,228, May 11, 1909.

See Fr. Pat. 350,524 of 1905; this J., 1905, 739.—T. F. B.

XII.—FATTY OILS, FATS, WAXES,
AND SOAPS.

Catalytic actions of colloidal metals of the platinum group. Reduction of fats. C. Paal and K. Roth. Ber., 1909, 42, 1541—1553.

In a previous communication (this J., 1908, 864) the authors described the products obtained by the hydrogenisation of castor, olive, and cod-liver oils in the presence of colloidal palladium (see this J., 1904, 208). Only in exceptional cases was the iodine value of these and other fats reduced to *nil*; but on again treating the partially hydrogenised fats in the same way the reduction was, in most cases, complete. Not only were the unsaturated glycerides altered, but the unsaponifiable matter was also acted upon, and the hydrogenised fats no longer gave the characteristic colour reactions, or possessed the physiological properties of the original oils. They were also completely stable, and showed no rancid taste or odour after being kept for 6 months to a year in loosely closed vessels. The hydrogenisation in these later experiments was carried out in the manner described (*loc. cit.*), and it was found that preparations of colloidal palladium containing 46.1 and 61.7 per cent. of the metal proved equally effective. As was observed before, the amount of hydrogen absorbed was in all cases greater than the theoretical amount calculated from the iodine value, this being attributed by the authors to reduction of glycerides of hydroxy-fatty acids to ordinary glycerides, or of the latter to aldehydes, etc. *Castor oil* yielded a hard white crystalline mass softening at 78° C. and melting to a clear liquid at 81° C. The product was readily soluble in carbon bisulphide and hot chloroform, but only dissolved with difficulty in hot ether and alcohol. The iodine value, after two reductions, was *nil*. *Croton oil*, when completely reduced, yielded a hard reddish-brown fat melting at 49°—51° C., and having an iodine value of 0. It was readily soluble in carbon bisulphide and chloroform, but was somewhat less soluble than the original oil in alcohol. On cooling the alcoholic solution a crystalline deposit was obtained. The hydrogenised croton oil was completely devoid of the original burning taste, and was proved by physiological experiments to have no poisonous properties. *Olive oil* gave, after one reduction, a solid melting at 43°—47° C., and having an iodine value of 9. On complete hydrogenisation it yielded a soft crystalline mass softening at 61° C., and melting at 68.5° C. *Sesamé oil*, after two reductions, yielded a soft, white, almost tasteless solid, melting at 65°—69° C., and having an iodine value of 2. It gave a very faint reaction in Baudouin's test, but after standing for 8 months gave a much stronger reaction. This indicated a partial re-oxidation of the active substance in that test, although the fat itself had not altered. *Cottonseed oil*, after one reduction, yielded a yellowish-white solid melting at 56°—60° C., iodine value 1.9. After the second reduction it gave a hard, white, nearly tasteless, mass melting at 57°—60° C., and having an iodine value of *nil*. This product gave no reaction in Becchi's or Halphen's tests, even after standing for 10 months. *Linseed oil* gave a product with m. pt. 56°—63° C., and iodine value of 5.58; and this when again hydrogenised, yielded a hard white friable mass with iodine value *nil* and m. pt. 61°—65° C. *Butter fat* was in some cases completely hydrogenised in one reduction. The products were hard white friable fats which became soft at about 36° C., and melted at 44° C. (41°—42° C. in the case of another sample). They had a pleasant nutty flavour recalling that of cacao butter. They showed no signs of alteration after being kept for nine months. *Lard* yielded a hard, white, tallow-like mass, having an iodine value of *nil* and melting at 56°—60° C. The hydrogenised product was almost tasteless, and remained completely unaltered after being kept for 10 months in contact with air. It was readily soluble in carbon bisulphide and hot chloroform, but dissolved with difficulty in alcohol and ether. *Oleomargarine* derived from beef fat gave a quantitative yield of a white, nearly tasteless, crystalline fat, becoming

soft at 47° C., and melting at 55° C. It had an iodine value of 1.2, and behaved towards solvents in the same way as the product from lard.—C. A. M.

Enkabang and teglam fats and katio oil from Sarawak. C. J. Brooks, Analyst, 1909, 34, 205—208.

Enkabang fat is obtained from the seeds of *Shorea Glyberrima*, a large jungle tree belonging to the *Dipterocarpaceae*. In the Singapore market the seeds are termed *sinkawang*, and consist of three varieties of enkabang seeds. Owing to the fact that the fruit season only occurs once in three to five years the seeds are only exported at irregular intervals. For export they are decorticated and dried in the sun, and sold in admixture with teglam seeds. With these may also be mixed a similar seed containing no oil, which is bought by the Chinese for the purpose. The seeds should therefore be bought by Europeans on a basis of oil percentage. Air-dried samples examined by the author contained 31.2 per cent. of fat calculated on the weight of the nut and 46.7 per cent. on the weight of the kernel. The hot-pressed fat prepared by the Dyaks had a slight tallow-like odour and an agreeable taste, and was of a grayish-yellow colour. The following analytical values were obtained:—Sp. gr. at 100°/15.5° C., 0.851; m.pt., 35° to 43° C.; saponification value, 190.2; acid value, 24.7; iodine value, 30; and refractive index (Zeiss) at 40° C., 45.0 (n_D^{40} 1.4559). A sample extracted with carbon bisulphide, was of a yellow colour which was rapidly bleached on exposure to light, but the fat still gave a yellow oil when melted. It had a slightly rancid odour, and an unpleasant taste, and gave the following values:—Sp. gr. at 100°/15.5° C., 0.856; m.pt., 33° to 37° C.; free fatty acids, trace; saponification value, 190.8; iodine value, 30; refractive index (Zeiss) at 40° C., 46.1 (n_D^{40} at 40° C. = 1.4567); unsaponifiable matter, 0.3 per cent.; volatile fatty acids, 1.4 per cent.; Hehner value, 95.8. *Insoluble fatty acids*:—m.pt., 55.5° C.; solidification point, 53° C.; iodine value, 31; and mol. equivalent, 282.

Teglam fat closely resembles enkabang fat, but is prized more highly as a food, since it will keep in good condition for several years. It is expressed by the Dyaks from the seeds of *Isoptera Borneensis*. A sample of native preparation was of a pale yellowish-green colour, and had a sweet butter-like taste and a slight odour. It gave the following values:—Sp. gr. at 100°/15.5° C., 0.856; m.pt., 28° to 31° C.; acid value, 11.3; saponification value, 192.1; iodine value, 31.5; refractive index (Zeiss) 40° C., 45.2 (n_D^{40} at 40° C. = 1.4561); unsaponifiable matter, 0.5 per cent.; volatile fatty acids, 1.1 per cent.; Hehner value, 95.2. *Insoluble fatty acids*:—m.pt., 56° C.; solidification point, 51° C.; iodine value, 32.7; and mol. equivalent, 277.

Katio or kachiau oil is derived from the seeds of a species of *Bassia*, the kernels giving a yield of 47.5 per cent. (40 per cent. calculated on the whole seeds). The oil, which is used by the Dyaks for food, but is not exported, is of a bright yellow colour, and has a sweet taste, and an odour recalling that of almonds. It is a non-drying oil. A sample of native preparation gave the following values:—Sp. gr. at 15.5° C., 0.917; solidification point, 14° C.; acid value, 1.8; saponification value, 189.5; iodine value, 63.2; refractive index (Zeiss) 40° C., 53.4 (n_D^{40} at 40° C. = 1.4616); unsaponifiable matter, 0.41 per cent.; volatile fatty acids, 2.2 per cent.; Hehner value, 94.0. *Insoluble fatty acids*:—m.pt., 37.5; solidification point, 36° C.; iodine value, 62.5; and mol. equivalent, 185.—C. A. M.

Fat-hydrate, a constituent of kola-nuts. W. P. H. Van den Broek, and J. van Marrewijk. Pharm. Weekblad, 1909, 46, 346.—Cham. Zentr., 1909, 1, 1585.

20 c.c. of the oil were left in contact for 2 days at a constant temperature with 4 grms. of kola powder in presence of the absence of other substances. It was found that potassium ferrocyanide, salicylic acid, sodium carbonate, ether and petroleum ether had a favourable effect on the fat-hydrolysing action of the enzyme contained in the kola nut; uranyl nitrate, mercurous and mercuric chlorides, potassium chromate, bismuth nitrate,

oxalic, tartaric, and citric acids, alcohol, benzene, chloroform, and water acted injuriously, and potassium cyanide was without influence (compare Mastbaum, this J., 1907, 262). Experiments with "kola-red" showed that this is not identical with kola-lipase.

For the preparation of kolatin, the author recommends immersing the kola nuts for 3 minutes in aniline at 110° C. The nuts so treated yield a greyish-white powder from which kolatin can be easily isolated by the method of Goris (this J., 1908, 996).—A. S.

Cryoscopy of fats. Pailheret. See XVIII.A.

PATENTS.

Porcelain mould for paraffin or stearine candles. Mme. Lewy. Fr. Pat. 396,744, Oct. 27, 1908. Under Int. Conv., Oct. 28, 1907.

The mould, which may be used for the preparation of paraffin, paraffin-stearine, or stearine candles, consists of a porcelain tube or cylinder glazed on its interior surface.—W. P. S.

[Soap] *Emulsions; Process for the production of — and their use.* Crefelder Seifenfabrik Stockhausen und Traiser. Fr. Pat. 396,493, Oct. 5, 1908. Under Int. Conv., Oct. 8, 1907.

EMULSIONS for use in washing wool, etc., are prepared by dissolving 1 part of sodium soap (obtained by saponifying sulphonated fats or oils, oleic acid, etc., with 6 per cent. or more of sodium hydroxide) in 1.5 parts of water and adding from 1 to 2 parts of tetrachloroethane, pentachloroethane, trichloroethylene, or tetrachloroethylene. The mixture is emulsified thoroughly. Turkey-red oil or ordinary soap may be used in place of the sodium soap described above, and the solubility of the tetrachloroethane, etc., may be increased by the addition of a dilute solution of sodium hydroxide.—W. P. S.

Acid water produced in the decomposition of the soaps formed by the saponification of fats by means of metals or metallic oxides; Process for working up the —. J. Kellner. Ger. Pat. 208,806, Jan. 16, 1908.

The acid water is heated and treated with sodium carbonate or hydroxide in order to precipitate the carbonate, basic carbonate, or hydroxide of the metal used in the saponification process. The precipitate is separated by means of a filter-press and washed with water and steam. It is then ready for use as saponifying agent in the first stage of the process. The solution is neutralised with sulphuric acid, and evaporated until crystals of sodium sulphate separate; the mother liquor is crude glycerin containing only 1.5 to 1.6 per cent. of ash (sodium sulphate).—A. S.

Washing and bleaching; Preparation of a liquid product for —. F. Gallati-Grob. Fr. Pat. 396,721, Nov. 26, 1908.

SEE Eng. Pat. 23,725 of 1908; this J., 1909, 241.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

Red lead; Physico-chemical and technical investigation of —. J. Milbauer. Chem.-Zeit., 1909, 33, 513—514; 522—523.

Is the author's experiments to determine the effect of varying the conditions in the production of red lead, litharge or pure lead oxide was heated in a rotatable reaction-tube in a furnace, a current of air or oxygen being meanwhile passed through the tube. The temperatures were measured by means of a pyrometer, precautions being taken to prevent contact of the thermoelements with the gases, and the amounts of red lead formed were determined by Töpf-Diehl's iodometric method (Z. anal. Chem., 1887, 296). Under the same

conditions of pressure, temperature, time, and speed of rotation of the tube, the yields of red lead from different quantities of material were practically identical. Thus 3.67, 7.6, and 11.6 grms. of pure lead oxide yielded respectively 17.9, 18.4, and 18.2 per cent. of red lead. The other conditions being kept constant, the quantity formed does not increase in direct proportion with the time, the formation being more rapid at first. Thus the following proportions of red lead were obtained in the respective times:—60 minutes, 4.5 per cent.; 120 minutes, 12.9; 180 minutes, 18.5; 270 minutes, 27.5; 375 minutes, 37.1; 420 minutes, 38.1; and 480 minutes, 43.5 per cent. An excess of oxygen has no influence on the reaction, but rapid introduction of the gas results in somewhat lower yields. With regard to the influence of the temperature, the following mean results were obtained in experiments in which all the other conditions (time, 3 hours; quantity of lead oxide, about 3.7 grms.; rotations, 75 per minute; velocity of current of oxygen, 80 c.c. in 2 minutes 25 seconds) were kept constant:—

Temperature.	Red lead.	Temperature.	Red lead.	Temperature.	Red lead.
°C.	Per cent.	°C.	Per cent.	°C.	Per cent.
240	0.6	380	8.9	450	18.1
310	0.7	390	10.1	470	19.1
320	1.8	418	15.0	500	20.2
350	4.7	430	17.3	550	20.9
360	7.1				

The products formed at temperatures of 320° to 450° C. were light or dark brown in colour, never red. Above 450° C., and with a time of 3 hours, red lead was invariably obtained. The partial pressure of the gases producing the reaction is a more important factor than the temperature. The following yields of red lead were obtained in experiments in which the lead oxide was acted upon for 3 hours at 480° C. by oxygen containing varying proportions of nitrogen, the speed of rotation and velocity of the current of gas being as before:—100 per cent. oxygen, 19.9 per cent. of red lead; 80 per cent. oxygen, 11.1 per cent. of red lead; 60 per cent. oxygen, 6.6 per cent. of red lead; 40 per cent. oxygen, 2.8 per cent. of red lead; and 20 per cent. oxygen, 0.3 per cent. of red lead. The proportion of moisture in the oxygen has no appreciable influence on the results.—C. A. M.

PATENTS.

Sublimed white lead; Method of manufacturing — L. S. Hughes, Assignor to Picher Lead Co., Joplin, Mo. U.S. Pat. 920,332, May 4, 1909.

SEE Fr. Pat. 392,990 of 1908; this J., 1909, 98.—T. F. B.

Condensation product suitable for the production of colour lakes. Badische Anilin und Soda Fabrik. Fr. Pat. 396,917, Nov. 30, 1908. Under Int. Conv., June 26, 1908.

SEE Eng. Pat. 26,714 of 1908; this J., 1909, 210.—T. F. B.

Treating argentiferous lead ores. U.S. Pat. 920,388. See X.

(B.)—RESINS, VARNISHES.

Shellac; New process of purifying — P. Singh. Chem. and Druggist, 1909, 74, 784.

THE author has found that, whereas both lac and lac-dye are soluble in ethyl alcohol, only the resin is dissolved by

wood spirit. He suggests that shellac should be purified on a commercial scale by a process based on this fact, and has found that the whole of the resin may be extracted from 100 lb. of crude lac in 3 to 4 hours in an apparatus made on the lines of Soxhlet's extractor. Samples thus prepared have been submitted to the U.S.A. Consul in Calcutta for trial in American factories, and are claimed to be equal to the best shellac in the market. A further suggestion is that shellac should be put on the market in the form of a coarse powder. This would obviate the cost of "stretching" the resin, to obtain the familiar "shell" form, and the necessity of adding rosin to lower the m. pt. to facilitate this process.—C. A. M.

Colophony; Contributions to the knowledge of American — I. The resin of the Norway pine. G. B. Frankforter. J. Amer. Chem. Soc., 1909, 31, 561—565.

THE resin used in the author's investigation was obtained by the ordinary method from the Norway pine, *Pinus resinosa*. It had a sp. gr. of 0.8137 at 20°/4° C.; a specific rotation of $[\alpha]_D^{20} = +4$; and a refractive index of 1.4788 at 20° C. The turpentine (about 20 per cent.) was removed by heating the resin *in vacuo*, and the residue was a white brittle solid (m. pt. 81.5° C.), which was very soluble in absolute alcohol, ether, chloroform, glacial acetic acid, acetone, benzene, toluene, and xylene; but was only slightly soluble in 70 per cent. alcohol, and quite insoluble in 60 per cent. alcohol. A crystalline substance could be obtained by dissolving the powdered residue in the smallest possible quantity of ether and pouring the solution into 80 per cent. alcohol. The crystals melted at 83.7° C., and contained 72.62 per cent. of carbon and 9.24 per cent. of hydrogen. They could be fractionated into two apparently distinct constituents by dissolving the dried powder in ether, cooling the solution in a freezing mixture and passing into it a current of anhydrous ammonia gas. A white crystalline powder was precipitated. This was found to be an unstable ammonium salt, melting at 98° C. to 112° C. (complete fusion) and having the composition, $C_{25}H_{36}O_5(NH_4)_2$. The liberated resin acid, purified by repeated precipitation from 80 per cent. alcohol, melted at 97° to 98° C., and had the composition, $C_{25}H_{38}O_5$. It differed from abietic acid, $C_{19}H_{30}O_2$, not only in composition, but also in physical and chemical properties. It yielded a barium salt, which was so unstable that it was decomposed by carbon dioxide, with the liberation of the acid. The ethereal filtrate from the ammonium salt was found to contain the ammonium salt of common abietic acid, though the m. pt. (129°—130° C.) of the recrystallised acid was somewhat lower than that previously recorded for abietic acid. In the author's opinion abietic acid or an isomeric acid is a constituent of most resins, whilst there is also probably present in each at least one distinct acid to which the resin owes its characteristic properties. This resin acid separated from the resin of the Norway pine differed from any such acid hitherto described, although in some respects it resembled Tschirch's palabietic acid.—C. A. M.

Scammony resin. F. O. Taylor. Amer. J. Pharm., 1909, 81, 105—111. Analyst, 1909, 34, 220—221.

SAMPLES of pure scammony resin, prepared from *Convolvulus scammonia*, and of the so-called "Mexican scammony," from the root of *Ipomoea Orizabensis*, were examined by the author, with the following results. The table also includes the figures obtained with samples believed to be mixtures of the two resins.

No.	Resin.	Yield of resin from root.	Moisture.	Ash.	Substances soluble in ether.	Acid value.	Saponification value.	Iodine value.
		Per cent.	Per cent.	Per cent.	Per cent.			
1	True scammony (?)	8.1	2.18	0.12	99.0	21.1	232.4	13.3
2	Mainly "Mexican scammony"	12.2	1.94	0.08	99.5	14.6	198.4	8.7
3	"Mexican scammony"	16.75	1.77	0.09	99.6	15.5	186.6	8.7
4	True scammony	7.93	1.71	0.05	99.7	15.6	238.1	10.8
5	do. do.	8.06	1.74	0.09	99.3	18.2	239.0	13.0
6	do. do.	7.71	1.86	0.09	99.3	18.8	240.5	14.3
7	do. do.	8.52	1.65	0.20	99.0	21.3	239.4	14.6
8	True scammony (?)	—	2.09	0.15	98.8	14.5	232.8	10.5
9	Mexican scammony	16.83	2.03	0.22	96.5	21.5	187.1	11.5

The saponification value thus appears to afford the best means of distinguishing between the two resins. According to the results of this test, samples 1 and 8 would seem to have contained a small proportion of "Mexican scammony." The root of the latter yields about twice as much resin as the genuine scammony.—C. A. M.

PATENT.

Shellac and lac-dye: Extraction of — [from stick-lac]. G. J. Fowler, Manchester, and E. J. O'Meara, Mirzapur, India. Eng. Pat. 12,877, June 16, 1908.

SHELLAC is soluble in cold alcohol or acetone, whereas the wax which accompanies it in stick-lac is not. In order to effect a separation, therefore, the stick-lac (100 lb.) is extracted either (1), with methylated spirit (15 to 20 gallons) at about 70° C., the residue being further treated with spirit (10 to 15 gallons) until extraction is complete; or, (2), with methylated spirit at the ordinary temperature. In the first case the alcoholic solution is allowed to cool and clarify, and is then distilled, the shellac being afterwards run off from the still and cast into convenient form. The residue in the extractor is next treated with a hot or cold solution of caustic soda of 0.2 to 1 per cent. strength, or with an equivalent solution of sodium carbonate, and the solution obtained is acidified with hydrochloric or sulphuric acid. The lac-dye is precipitated and may be filtered off, washed, and dried, and, if necessary, purified by re-solution and salting-out. When the cold extraction method is employed, the alcohol can be at once distilled off, and the shellac obtained as before. The wax is then extracted from the residue with hot methylated spirit, or with chloroform or carbon tetrachloride, and recovered from the solution by distillation. The lac-dye is obtained as in the hot extraction process. To obtain a pale-coloured shellac, the alcoholic solution is added to very dilute alkali; the shellac is precipitated, the small amount of dye present remaining dissolved in the aqueous liquid.—E. W. L.

(C).—INDIA-RUBBER, &c.

Rubber: Commercial analysis of manufactured — Pontio. Bull. Soc. Chim., 1909, 5 [9], 428—442.

A SPECIAL form of apparatus is described in which the various operations involved in the author's method of analysis may conveniently be carried out. This consists essentially of a large flask—capable of holding about 700 c.c. of solvent—surmounted by a second glass vessel of somewhat less capacity connected with it, at a constricted portion, by means of a ground glass joint. The apparatus is fitted with a reflux condenser. Digestions are carried out in the lower flask, lixiviations in the upper. *Free sulphur, resins, and paraffin wax* are estimated by determining the loss in weight suffered by the sample on digestion with absolute alcohol, and subsequent lixiviation with the same solvent. *Substitutes, with their combined sulphur* are estimated in a similar manner from the loss in weight suffered by the alcohol extracted sample on digestion with an 8 per cent. solution of sodium hydroxide in 95 per cent. alcohol. *Asphaltum, bitumen, mineral oils, and tar* are found by the loss in weight on extraction of the same sample with a mixture of 40 parts of oil of lavender and 60 parts of acetone. *Caoutchouc and combined sulphur, as well as remaining organic and inorganic constituents* are determined by extraction with cumene (this J., 1909, 431). *Free sulphur* is determined by a separate extraction of a 2-grm. sample with absolute alcohol, oxidation of the extract with a mixture of 10 c.c. of soda lye of 36° B. and 20 c.c. of hydrogen peroxide (12 volumes), evaporation to dryness and moderate calcination, and precipitation from the acidified solution of the residue by means of barium chloride. *Sulphur in substitutes* is determined in the same sample by subsequently extracting with alcoholic soda, and oxidising the extract as in the case of free sulphur. *Sulphur in minerals* is determined in the residue from the cumene extraction by fusion with a mixture of equal parts of sodium and potassium carbonates, in the ordinary way. *Total sulphur* is determined in the original sample by the manganese dioxide method (this J., 1909, 431). *Sulphur of vulcani-*

sation is estimated by difference. *Moisture* is determined by drying at 115—120° C., preferably in an atmosphere of carbon dioxide. In the analysis of manufactured gutta-percha the following determinations are made:—*Resins* by loss of weight on digestion with 96 per cent. alcohol for about 12 hours. *Bituminous matters*, by extraction with ether, which dissolves about 38 per cent. of ordinary asphaltum, and subsequently with carbon bisulphide or toluene, in which the remaining 62 per cent. is soluble. *Gutta and remaining ingredients* are separated by means of cumene as in the case of vulcanised rubber, or the gutta may be determined direct, by dissolving the acetone-extracted sample in boiling ether, filtering, concentrating, and precipitating the gutta by pouring into hot alcohol, dissolving again in ether and reprecipitating.—E. W. L.

Rubber goods: Determination of vermilion [mercuric sulphide] and of "golden sulphide" [antimony sulphide] in — F. Frank and D. Jacobsohn. Gummi Zeit., 1909, 23, 1046—1047.

THE sample, cut up into small pieces, is oxidised, as in the estimation of sulphur, by a double evaporation with nitric acid. Potassium chlorate is then carefully added, and evaporation with nitric acid on the water-bath repeated several times. Finally the nitric acid is driven off by evaporation with hydrochloric acid, the residue taken up with hydrochloric acid, and filtered hot, after dilution with water. If, at this stage, unoxidised organic material renders filtration difficult, the sample should be oxidised by repeated heating with fuming nitric acid and potassium chlorate in an Erlenmeyer flask. This is not generally necessary. Insoluble mineral constituents (silicates and barium sulphate) remain on the filter and are determined by incineration. The antimony and mercury are precipitated from the hot filtrate—after most of the acid has been driven off, and, advisably, a considerable quantity of ammonium chloride added to assist precipitation—by means of sulphuretted hydrogen. The mixed sulphides are collected on a weighed filter, or Gooch crucible, washed with alcohol, ether, carbon bisulphide, and ether, to remove free sulphur, dried, and weighed. The antimony sulphide is then removed by means of ammonium sulphide, and the mercury sulphide washed as before, dried, and weighed. To confirm the result obtained, the antimony in the filtrate may be converted into tetroxide, by evaporation and oxidation with nitric acid, and weighed as such. Other mineral constituents are estimated in the usual way in the filtrate from the mixed sulphides.—E. W. L.

PATENTS.

Raw rubber: Purification of — and recovery of the solvents employed. A. Joly. Fr. Pat. 396,300, Oct. 31, 1908.

THE resins and other soluble impurities are removed by treating the rubber, in a suitable state of division, with mixtures of acetone, methyl alcohol, and ethyl alcohol with the ordinary rubber solvents, or with crude or rectified wood-spirit, excise methyl alcohol ("méthylène rigé"), or mixtures of these with ethyl alcohol, or acetone and ethyl alcohol, and the solvent is recovered by distillation.—E. W. L.

Rubber: Process and apparatus for vulcanisation of — M. Lamy. Fr. Pat. 396,620, Jan. 30, 1908.

THE unvulcanised rubber sheet, or rubber-coated fabric is wound on a drum, either alone, or in alternate layers with a thin sheet of metal, and the whole is placed in an autoclave, into which an inert gas, e.g., carbon dioxide or nitrogen, is then introduced under pressure. The autoclave is in its turn enclosed in a heater, which may be either a hot-air stove or a second autoclave heated by steam. Means are provided for rotating the inner autoclave within its jacket, in order to avoid irregular heating. The process is particularly applicable to the vulcanisation of rubber-coated fabrics, which might be damaged by vulcanisation in open steam or by means of sulphur chloride, and which cannot be cured in hot air in the ordinary way on account of the absence from the mixing of facilitating agents such as litharge.—E. W. L.

Elastic mass resembling rubber. K. Lengfellner. Fr. Pat. 396,814, Nov. 27, 1908. Under Int. Conv., Nov. 29, 1907.

THE following compositions are claimed:—(1), a mixture of celluloid, nitrocellulose, and cellulose (e.g., powdered cork); (2), a mixture of rubber with celluloid or nitrocellulose, or with both celluloid and nitrocellulose; (3), a mixture of rubber and cellulose (particularly powdered cork) with celluloid or nitrocellulose, or with both celluloid and nitrocellulose. The superposition of these various mixtures in layers, to form solid tyres, as well as the heels, soles, and other portions of shoes, is also claimed.—E. W. L.

Rubber; Process and apparatus for the separation of — from resin in latex and resinous products whether natural or not, containing rubber. G. F. Flamant and L. G. Worms, Paris. Eng. Pat. 20,896, Oct. 3, 1908. Under Int. Conv., Oct. 4, 1907.

See Fr. Pat. 382,571 of 1907; this J., 1908, 235.—T. F. B.

Rubber waste of all kinds; Process for regenerating —. J. H. L. Neilson, Hanover-Linden, Germany. U.S. Pat. 921,148, May 11, 1909.

See Fr. Pat. 357,336 of 1905; this J., 1906, 83.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning materials; Determination of water in —. J. Jedlicka. Collegium, 1909, 162—164.

THE author has made experiments with a method published by Thörner and also by Schwalbe (this J., 1908, 94) for the estimation of water, by distillation of the material with petroleum having a higher boiling point than water. The distillation flask employed, was a glass one surrounded by copper to prevent breakage, and the receiver, a measuring cylinder kept cool by immersion in cold water. The method was applied to the estimation of water in fresh and leached-out oakwood, blood albumin, and liquid extracts and a table is given showing good concordance between results obtained by the distillation method and those obtained by the official gravimetric method. In the case of liquid extracts, however, the distillation process gave results about 2 per cent. higher than the official. Correction can be made for the small quantity of water suspended in the petroleum, but this is generally negligible, 15 c.c. of petroleum being found to contain only 0.05—0.1 c.c. of water.—S. H.

Belting leather; Determination of the tensile strength of —. J. Paessler. Collegium, 1909, 45—52, 53—57, 62—68, 69—88, 95—100, 103—109.

MINIMUM resistance to tearing of 3 kilos. per 1 square mm. cross-section is generally required in belting leather. The test-piece used by the author consisted of a strip of leather 30 mm. wide and 100 mm. long, with an extension at either end of 40 mm. width and 50 mm. length which was clamped in the machine. It was found that pieces taken from different parts of a hide gave very different results. Previous work by Bach and Rudeloff also pointed to this fact and the latter investigator showed that variation of moisture also influenced the results, and recommended that for comparative work, leather should be kept in a room of constant humidity for a period of 7 days. This precaution was taken in these experiments. 8 different samples of belting leather, representing different grades and different degrees and methods of stuffing, were examined. Strips were taken from several places on each leather at measured distances from the middle of the back, in all 12 samples from each. Strips taken from the neck, in practically all cases showed greater resistance than those from the tail end of the butt, the respective resistances being 3.19 kilos. and 2.65 kilos., which fact is in accordance with results obtained by Bach. Further experiments on samples taken down the middle of the back showed that the greatest resistance was obtained in strips taken midway between the neck and the tail end of butt. To test the resistance to tearing, test pieces of leather clamped at one end only and having

a round hole of 6 mm. diameter near the other end, were used. A pin of the same size was passed through the hole and the strain applied. It was found that for all leathers, results varied very little and were always lower than the breaking resistance. Measurements were also made of the stretching shown by different leathers during the breaking test, and it was found that generally if the resistance was higher so was the stretching. The stretching was similar in strips taken from the neck and tail ends of the butt, but varied according to the distance from the middle line of the back. A table is given comparing results obtained in leathers of: (1), pit tannage; (2), mixed tannage; (3), drum tannage. While the average breaking resistance was greatest in the drum-tanned leathers, the tearing resistance and stretching were highest in the pit-tanned specimens, while in the mixed tannage, the breaking resistance was lower than in the other two, and the tearing resistance and stretching results were intermediate between those for pit and drum tannage. A large number of tables of results accompanies the article.—S. H.

PATENTS.

Casting plastic masses; Process for —. G. S. A. Appelquist. Ger. Pat. 208,764, Sep. 13, 1906.

It has been almost impossible hitherto to prepare moulded articles by casting from plastic masses prepared from glue, hygroscopic substances (glycerin, calcium chloride, etc.), and chromates or other oxidising agents, since under the influence of light, the masses set so rapidly that it was not possible to completely fill the mould. Even when moulded articles of simple shape are prepared by casting, the outer surface becomes hard and brittle, whilst the interior remains soft. In order to overcome this difficulty, it is proposed, according to the present patent, to add to the mass before casting and before or simultaneously with the chromate, one or more colouring matters or coloured substances of a black, red, blue, or yellow colour. By this means the hardening of the mass under the influence of light is retarded.—A. S.

Colouring leather, artificial leather, etc. Fr. Pat. 396,299. See V.

XV.—MANURES, &c.

Potassium in soils; Rapid method for the determination of total —. O. M. Shedd. J. Ind. and Eng. Chem., 1909, 1, 302—304.

THE process recommended by the author is a combination of two known methods. The potassium is brought into solution by the method of J. L. Smith (see Fresenius' "Quantitative Analysis," Amer. Edit., p. 426; also Crookes' "Select Methods in Chem. Analysis," 3rd Edit., pp. 26—39), and is then determined by the cobaltinitrite method of Drusel (this J., 1907, 1256).—A. S.

Potash in commercial fertilisers; Loss of —. F. B. Porter and E. G. Kenny. J. Ind. and Eng. Chem., 1909, 1, 304—307.

WHEN water-soluble potassium compounds are added to commercial fertilisers, there is an apparent loss of water-soluble potash when this is subsequently determined by the method of the Amer. Assoc. of Agricultural Chemists. This is due to the fact that acid phosphate has the power of withdrawing certain soluble compounds from solution. The authors' experiments show that acid phosphates of different ages and from different kinds of rock all exhibit practically the same activity in this respect. The amount of potash withdrawn from solution increases with the proportions of potassium compounds and of acid phosphate present. Part of the apparent loss of potash is also due to retention by the precipitate produced by ammonia and ammonium oxalate in the analysis. "No. 1 tannage" has no tendency to retain potash itself and partially prevents the retention of potash by acid phosphate. From experiments in which the insoluble residue containing the retained potash

was treated with neutral ammonium citrate solution, citric acid solution, and water respectively, the authors conclude that about 25 per cent. of the retained potash is dissolved on the first contact with rain water, and about 56 per cent. on the first contact with soil water.

—A. S.

Phosphoric acid; Gravimetric molybdate method for the determination of — for the international trade of raw phosphates. Ullmann. Proposed at the VII Int. Cong. of Applied Chem., London, May 26, 1909.

THE following reagents and solutions are required:— (1). *Aqua regia*: 3 parts of hydrochloric acid of sp. gr. 1.12 mixed with one part of nitric acid of sp. gr. 1.2. (2). *Ammonium molybdate solution*: 150 grms. of ammonium molybdate are dissolved in 500 c.c. of hot water and the solution is mixed with 400 grms. of ammonium nitrate also dissolved in water, the mixture being then diluted to 1 litre; this solution is added to 1 litre of nitric acid of sp. gr. 1.2, the whole is allowed to stand for 12 hours at a temperature of 60° C. (or for 24 hours at the ordinary temperature), and then filtered. (3). *Solution for washing the molybdate precipitate*: 32 parts of nitric acid of sp. gr. 1.2 and 50 grms. of ammonium nitrate (free from phosphate) are diluted to 1 litre with water. (4). *2.5 per cent. ammonia solution*. (5). *Neutral magnesia solution*: 50 grms. of magnesium chloride ($MgCl_2 \cdot 12H_2O$) and 150 grms. of ammonium chloride are dissolved in 1 litre of water.

Method. Five grms. of the sample are treated in a 500 c.c. flask with 50 c.c. of *aqua regia* and the mixture is evaporated to the consistence of a syrup in order to eliminate silica. The residue, which when cold is almost solid, is boiled with a mixture of 10 c.c. of nitric acid of sp. gr. 1.2 and 50 c.c. of water, cooled, diluted to a volume of 500 c.c. and filtered. Fifty c.c. of the filtrate (equivalent to 0.5 gm. of the substance) are mixed with a sufficient quantity of the molybdate solution (at least 100 c.c. of the latter for each 0.1 gm. of phosphoric anhydride present) and kept at a temperature of 50° C. for 1 hour. The precipitate is then collected on a small filter and the filtrate is treated with a further quantity of molybdate solution and allowed to stand for 12 hours at 60° C. in order to ascertain whether all the phosphoric acid has been precipitated. The precipitate is washed with the acid ammonium nitrate solution until the filtrate is free from calcium salts, at least five washings, using 20 c.c. each time, being necessary. The test for calcium is made by adding a little sulphuric acid and 2 c.c. of alcohol to 1 c.c. of the wash-water; the mixture remains clear in the absence of calcium salts. The yellow precipitate is then dissolved in about 80–100 c.c. of 2.5 per cent. ammonia and the filter is washed five or six times with hot water; the volume of the solution and washings should not exceed 150 c.c. The solution is heated to between 60 and 80° C., and the phosphoric acid is precipitated by the addition, to the hot solution, of 20 c.c. of neutral magnesia solution, drop by drop and with constant stirring. At the end of 4 hours the precipitate is collected on a filter and washed with 2.5 per cent. ammonia until free from chlorine. The filter and precipitate are then heated in a platinum crucible until the filter is charred completely, (care being taken that no flame is produced during the ignition of the filter) and the ignition is continued over a blast lamp until the weight is constant. The ignited residue should be quite white.

Factors.—From $Mg_3P_2O_8$ to P_2O_5 , 0.63780; from P_2O_5 to $Ca_3P_2O_8$, 2.185.—W. P. S.

Consumption of sodium nitrate in U.S.A. Munroe. See VII.

PATENTS.

Fertilisers; Manufacture of — and apparatus therefor. C. Harrison, Queenstown, S. Australia. Eng. Pat. 11,644, May 28, 1908.

This process consists in the incineration or roasting of animal matter, such as scrap leather, wool waste, etc., in closed retorts, conveying the gaseous products of

combustion or incineration into a water trough for its extraction and collection of ammoniacal fumes, conducting the solution so formed into a vat, neutralising the solution preferably by means of sulphuric acid, and subsequently depositing the incinerated material, while still hot, into such solution; in this way the gaseous products are incorporated in the incinerated material.—T. H. P.

Hydrofluosilicic acid and fluosilicates from residues from superphosphate factories. Addition to Fr. Pat. 375,988. See VII.

Treating distillery vinasses. Fr. Pat. 396,288. See XVI.

XVI.—SUGAR, STARCH, GUM, &c.

Juice [Sugar]; Quantities of non-sugar precipitated from raw — by defecation and saturation, and the examination of saturation muds. H. Claassen. Ver. dent. Zuckerind., 1909, 385–402.

THE author points out that the calculation of the amount of non-sugar precipitated from the raw juice and carried away with the saturation mud, from the purities of the raw and thin juices, gives inaccurate results, and that the amount can only be determined from the weight and composition of the mud. The percentage of organic non-sugar in the mud is best determined by deducting the percentages of water, carbon dioxide, and sugar, from the percentage loss on ignition. The quantity of inorganic non-sugar withdrawn from the raw juice and carried away with the mud is small in comparison with the quantity of organic non-sugar, and an average value of 0.17 per cent. of the weight of beetroots may be assumed to represent it without involving appreciable error. In factories in which similar methods of working are used the total non-sugar precipitated from the raw juice does not vary much; with employment of normal quantities of lime, it ranges between 0.8 and 1.1 parts per 100 parts of beetroots. The quantity of organic non-sugar precipitated, increases with the quantity of lime used, from about 0.6 per cent. with 1.2 per cent. of lime to 0.8 per cent. with 2–2.5 per cent. of lime, per 100 parts of beetroots. The quantity of the lime in the mud which is combined with non-sugar substances, varies with the quantity of lime used; thus, with additions of 1.2 and 2.5 per cent. of lime, the percentages of lime combined with non-sugar in the mud were found to be 0.34 and 0.57 respectively. Hence in the more complete defecation and saturation, a larger quantity of organic matter is converted into insoluble lime compounds. The author also shows that if, in the diffusion process, all the diffusion water is returned to the battery, the calculated loss of dry substance in working (i.e., the difference between the dry substance-contents of the beetroots and the sum of the dry substance-contents of the products) is practically identical with that found from analysis of the mud.—L. E.

Sugar; Application of temperature corrections to the polarisation of raw — and other products with the quartz-wedge saccharimeter. C. A. Browne. Z. Ver. dent. Zuckerind., 1909, 404–431.

SEVERAL workers have shown that the polarisation of a normal solution of pure sucrose in quartz-wedge compensation saccharimeters, decreases by about 0.03° V. per 1° C. rise of temperature, and, in 1897, the U.S. Treasury Department adopted a method, depending on the employment of a standardised quartz-plate, for correcting the influence of temperature on the polarisation of imported and dutiable sugars. As a result of the litigation which ensued, the decision of the Treasury Department was finally upheld (see this J., 1903, 721; 1904, 806; 1905, 217). The author points out, however, that the temperature corrections for pure sucrose are not always valid for raw sugars, molasses, etc. He has made experiments on the influence of temperature on the polarisation of: (1), mixtures of sucrose and cane molasses in varying proportions; (2), commercial cane sugars

conversions were effected by diastase precipitated from the aqueous extract of a well-grown malt rich in protein by the addition of ammonium sulphate; the concentration of the starch varied from 1 to 5 per cent. One gram of starch is found to correspond with 4 divisions on the refractometer scale. The following method is given for the determination of starch in cereals. 2—3 grms. of the finely-powdered material are pounded in a mortar with a small quantity of water and introduced quantitatively into a 100 c.c. flask, the volume being made up to about 80 c.c. 0.2 c.c. of a 1 per cent. solution of diastase is then added and the flask heated for 5 minutes in a boiling water bath and then cooled to the ordinary temperature. After the addition of a further quantity of 0.2—0.3 c.c. of the 1 per cent. diastase solution, the flask is kept at 55°—60° C. for half an hour, after which it is cooled and the liquid made up to 100 c.c., well shaken, filtered and the filtrate examined in the refractometer at 17.5° C. To correct for the refraction of the soluble constituents of the cereal, 2—3 grms. of the latter are finely powdered, pounded in a mortar with a little water, the whole being then introduced into a 100 c.c. flask and the volume made up to 100 c.c. After being well shaken, the liquid is filtered and its refraction determined at 17.5° C. With cereals like rye, which contain a large proportion of diastatic enzymes, the cold water extract should not be allowed to stand for long. Measurements of the proportions of starch in a number of different cereals show that this method gives results in close agreement with those obtained by the polarimetric method (compare Lintner, this J., 1907, 281), the greatest difference found being 0.37 per cent.—T. H. P.

Manihot [Tapioca] root as a raw material for spirit and yeast manufacture. H. Lange. Z. Spiritusind., 1909, 32, 200—201.

THE fresh cassava, manihot or tapioca root has already been investigated from the point of view of spirit manufacture; when saccharified by malt it has about double the spirit-value of fresh potatoes. The fresh roots can, however, only be worked in the countries where they are grown; in the European distillery the dried roots would have to be employed. An analysis of these showed: Water, 14.00; starch-value (Maerker), 66.89, (polarimetric), 67.40; protein, 2.06; sugar (as invert sugar), 1.90 per cent. They are therefore richer in starch than maize or rye, and about equal to dried potatoes. The dried roots cannot be saccharified in the form in which they are received, even by prolonged steeping and steaming under high pressure; some form of preliminary disintegration is essential. The pieces of root are best broken up in a ball-mill and then ground in a Gruson mill. For high-pressure steaming, it is sufficient to reduce them to the form of coarse grist, but for an open boil they must be ground to a meal. The best results are obtained in a Henze steamer, 100 kilos. of grist and 250 litres of water being steamed for one hour under atmospheric pressure and for one hour under pressure gradually increased up to 2.25 atmospheres, lastly for 10 minutes at 2.5 atmospheres. The mash is saccharified with 10 per cent. of long-grown green malt. Starting at a density of 19.65° Balling and an acidity of 0.1°, the mash is fermented by distillery yeast, Race XII. Attenuation proceeds normally with a pitching temperature of 20° C., and reaches —0.8° Balling after 60 hours. The yield of alcohol corresponds to 59.8 "litres per cent." on the starch employed, which is very satisfactory. The spirit contains no trace of hydrocyanic acid, which occurs in the spirit prepared from the fresh roots. An analysis of the dry substance of the spent wash showed:—protein, 16.97; fat, 3.86; non-nitrogenous extractives, 3.86; crude fibre, 12.24; ash, 11.03 per cent. Compared with the spent wash from maize mash, it is deficient in protein and fat, and possesses only about two-thirds the nutrient value of the latter; the crude spent wash is also more dilute. For the manufacture of pressed yeast, manihot mash gives normal results and yields; the character of the yeast resembles that prepared from maize more closely than that obtained from potato mash.—J. F. B.

Hop tannin. II. A. C. Chapman. J. Inst. Brewing, 1909, 15, 360—369.

IN a previous paper the author described a method for the estimation of tannin in hops, based on the precipitation of a sparingly soluble cinchonine compound. This compound was stated to contain approximately 4 per cent. of nitrogen, corresponding to 60 per cent. of tannin. The compound is, however, not easily oxidised in the Kjeldahl process, and more careful determinations of the nitrogen by the Dumas method have shown that the product contains 4.3 per cent., corresponding to 54.9 per cent. of tannin. The more correct factor for the tannin would therefore be 0.55, in the case of hop-tannin. In the case of gallotannic acid, the compound contains only 3.45 per cent. of nitrogen, corresponding to 63.8 per cent. of tannic acid. The author has found that the tannin-content of hops does not diminish during storage, as was previously supposed; the statements to that effect are based on Löwenthal's method, which does not appear to be reliable in the case of hop-tannin. This observation of course applies only to normal conditions of storage, at moderately warm temperatures, with and without exposure to air; if the hops were allowed to become moist it is conceivable that tannin might disappear as the result of bacterial activity or other agencies. The author has endeavoured to trace some connection between the brewing value or general quality of the hops and their tannin-content. He has found, however, that, whereas the quality of the hops certainly appears to be related to the resin-contents, the percentage of tannin appears to have no influence. When an infusion of hops is added to a boiled and filtered wort, a precipitate is formed, which re-dissolves on boiling and separates again, in a very finely divided form, on cooling. The quantity of nitrogenous matter removed from a boiled wort by the addition of a hop infusion in the cold only amounts to 3.7—4.3 per cent. of the total nitrogen of the wort. Gallotannic acid, on the other hand, is capable of producing a copious precipitate in malt worts to which an excess of hop infusion has been added. From the behaviour of malt worts towards hop tannin and gallotannic acid respectively, the author concludes that the matters which are precipitated belong to the class of albumoses. Finally, the author considers that the tannin of hops plays a far less important part in the brewing process than has usually been assigned to it, and that it is a constituent possessing little practical significance.

—J. F. B.

Oxidising enzymes: Properties and classification of —
B. Moore and E. Whitley. Biochem. J., 1909, 4, 136—167.

OXIDISING enzymes may be divided into two broad groups: the tyrosinases of Bertrand, the distribution of which is limited, and the peroxidases of Bach and Chodat, which are very widely distributed in organic tissues, and possess the property of colouring guaiacum tincture blue in presence of a peroxide. Bach and Chodat (this J., 1903, 384) state that the oxidising enzymes of plant juices may be split up into two portions: "oxygenase," which is inactive in the absence of the second fraction, and "peroxydase," which is inactive in absence of oxygenase or a peroxide. Some confusion has existed as to the precise definition given by Bach and Chodat of the nature of oxygenase; some authors assume that it was defined as an unstable organic peroxide, whilst others understand that it was regarded as a true enzyme, capable of producing a peroxide from constituents of the juice on exposure to atmospheric oxygen. The authors claim that Bach and Chodat have consistently enunciated the latter view, and that this view is incorrect, since no evidence of the enzymic nature of oxygenase exists. The authors hold that only one type of oxidising enzyme occurs in the kind of plant juice under consideration, the peroxydase, which are active only in presence of a peroxide. In those juices, which apparently contain an oxygenase and produce a blue coloration in guaiacum tincture directly a peroxide is already present, and, so far from this being produced on exposure to air, it is rapidly destroyed under those conditions, as is also hydrogen peroxide if added.

very small quantities. This destruction is due partly to reduction and partly to the action of the "catalase," which again is incorrectly regarded by Bach and Chodat as an enzyme. Guaiacum tincture gives somewhat erratic results with these plant juices, and there was an impression that, whereas an "old" tincture is frequently turned blue by a peroxidase alone, a freshly prepared tincture is only coloured blue in presence of a peroxide, whether already present or added. The authors show that this peculiarity has nothing to do with the age of the tincture, but depends on traces of peroxide introduced by the presence of tissue impurities in the resin employed. When, therefore, a vegetable juice colours guaiacum blue without the addition of a peroxide, the phenomenon is due to the presence of a peroxide, either in the juice itself or in the resin from which the guaiacum tincture was made. These adventitious peroxides are readily destroyed by heat; they may also be eliminated by treating both the juice and the tincture with animal charcoal, after which no juice possesses the property of colouring guaiacum blue unless a peroxide be added. In this way the reactions observed with guaiacum are brought into line with the other colour reactions of the combination—peroxidase + peroxide—with substances such as *p*-phenylenediamine, α -naphthol, etc., which can contain no pre-formed peroxide so far as the tinctures are concerned. The fact remains, however, that the active constituent of guaiacum resin, guaiaconic acid, is more readily oxidisable than these other bodies, and will sometimes show positive results when the latter do not.

Parallelism between hydrolytic enzymes, oxidising enzymes, and active bodies developed in immune sera. The above observations appear to show that the whole difference between the various juices, and other fluids showing an oxidising action, consists in the presence of a variable, small amount of pre-formed, unstable peroxide. There is only one enzyme or type of enzyme concerned, *viz.* peroxidase. Thus these actions may be linked with other ferment actions, all depending on three factors, as sketched in the table below:—

Ferment action.	Substratum.	Combining body.	Catalyst.
Hydrolytic.	Proteins, carbohydrates, fats.	Elements of water with intermediary action of acids or alkalis.	Pepsin, trypsin, diastase, zymase, lipase.
Oxidising.	Tyrosine, phenols, chromogenic indicators.	Oxygen derived from peroxides.	Tyrosinase, peroxidase.
Immunising.	Bacteria, toxic substances.	"Complement" or thermo-labile constituent of serum.	Specific anti-toxin.

The substratum and catalyst have specific relationships within certain narrow limits of molecular configuration, but the combining body is more general, within the limits of type; in many cases it is unstable, but its loss may be more easily replaced.—J. F. B.

Change in composition of unground cereals during storage.
Leavitt and Le Clere. See XVIII.A.

PATENTS.

Yeasts; Process and apparatus for separating inferior yeasts from normal —. O. Selg and C. Gmtrum.
Fr. Pat. 396,869, Nov. 28, 1908.

THIS invention depends on the observation that pure and secondary yeasts are respectively heavier and lighter than water. The apparatus includes an upper and a lower vessel connected by a neck. Water is introduced at the bottom of the lower vessel, and when the upper vessel is partly filled, the yeast to be treated is introduced into it. Admission of water is continued until the upper vessel is nearly filled. A tube, open at its lower end, closed at its upper end by a conical cap, and perforated near its upper end, is now placed in the upper vessel; it is supported by a cross-piece resting on the conical bottom of the upper vessel. The lower end of the tube projects through the neck connecting the vessels, the perforations near the

upper end of the tube being below the surface of the water in the upper vessel, whilst the conical cap is above the surface of the water. The pure yeast slowly descends into the lower vessel, the water thus displaced rising through the tube into the upper vessel, and carrying with it any of the lighter yeast which may have settled with the heavier yeast. After about half an hour, the tube is inverted and its conical cap now closes the neck between the vessels. The pure yeast is then withdrawn from the bottom of the lower vessel.—L. E.

Vinasses; Process for treating distillery —. F. and E. D. Verbière. Fr. Pat. 396,288, Jan. 21, 1908.

THE vinasse is treated, first with a clarifying agent such as ferric chloride or aluminium sulphate, and then with lime, preferably in the form of milk of lime, whereby the metallic oxide of the clarifying agent, suspended matter, phosphoric acid, a large part of the organic nitrogenous matter, certain acids, and organic substances, are precipitated. The amount of lime added must be just sufficient to effect complete precipitation. The precipitate is separated in the form of cakes by means of filter-presses. The cakes may be dried, preferably in a continuous tunnel drying apparatus heated by hot air or steam. The dried cakes are powdered and, if desired, may be mixed with certain fertilisers such as potassium sulphate, ammonium sulphate, phosphates or superphosphates, nitrates, etc., in order to obtain complete fertilisers. On the other hand, the cakes may be submitted to processes whereby certain constituents, *e.g.*, oxalic acid, are removed. A certain proportion of the filter-press residues from the sugar-house may be added, either at the initial stage of manufacture as a substitute for the lime, or at the drying stage.—L. E.

Alcoholometers and the like. P. Desq, Argenteuil, France.
Eng. Pat. 9293, April 29, 1908.

THE author has devised an alcoholometric thermo-

differential meter, giving on one and the same dial the indications of temperature, alcoholic strength, and quantity of the liquid measured as a function of the temperature, and the quantity of absolute alcohol contained in the said measured liquid. It consists of a thermo-regulator acting in combination with two alternative measuring devices or vessels which determine exactly the real volume of the liquid measured with reference to its temperature, the said measuring devices being provided with distributors and check valves automatically operating under the action of floats which act on a reversing device with weight connected to distributors and valves. The measured liquid is discharged on to the movable plate of a balance-aerometer working in connection with floats in a bath of mercury, the movements of which are in direct proportion to the quantity of alcohol contained in the said liquid; these movements are indicated on a dial by means of a mechanism with differential movements, submitted to the simultaneous action of the recording parts for the measurement and the weighing, for the purpose of determining the volume of absolute alcohol contained in the liquid.—T. H. P.

Manufacture of alkali carbonates. Fr. Pat. 396,448.
See VII.

Alcoholometers. Eng. Pat. 9293. See XXIII.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(I.)—FOODS.

Cereals; Change in the composition of unground — during storage. S. Leavitt and J. A. Le Clerc. J. Ind. and Eng. Chem., 1909, 1, 299–302.

THE authors studied the changes which take place in maize, barley, rye, wheat, and oats when these are stored for long periods in their natural (unground) condition. It was found that in the course of two years there was more or less change in all cases, but the changes took place much less rapidly in the unground cereals than in the flours produced from them. The changes took place chiefly in the sugar-content and then in the proportions of proteins soluble in 70 per cent. alcohol, proteins soluble in 5 per cent. potassium sulphate solution, and soluble proteins coagulated by Stutzer's reagent (cupric hydroxide). Maize, barley, and oats were most susceptible to loss of sugar. Unground maize lost about 60 per cent. of its total sugar in 1 year. In the case of wheat, on the other hand, many samples showed a slight loss in the first year and then a rapid gain; in some instances a gain of 24 per cent. of the total sugars present was noted at the end of two years. Maize was also the cereal most susceptible to protein change.—A. S.

Fungus on chilled beef. Klein. Times, May 21, 1909. [T.R.]

IN the course of a report on the nature of brown spots on chilled beef, the author states that the meat arrives in England as "chilled beef" (hind quarters) from the Argentine. Portions of it are often more or less covered with brown spots. Such meat is regularly rejected, at any rate at Liverpool, by the meat inspectors, although the deeper parts of the fat and flesh are apparently normal. An enormous waste is caused by this rejection. The spots are of a light brown, varying in size, from a pin's head to about one-eighth of an inch in diameter, and are, in places, so abundant as to form confluent patches. They are not on the free surface, but are, as a rule, embedded in the superficial part of the subjacent layer of fat, and do not extend deeper than one-twelfth to one-sixteenth of an inch. They are a species of yeast belonging to the *Saccharomyces* group. They are probably derived from water, air, or excremental matter, and are pressed into the meat. There is no justification for suggesting that they are derived from the inside and have been present in the animal itself. The infection takes place before the carcase is placed on the ship. Dr. Klein suggests the sterilisation of the stockinette material in which the meat is wrapped; the use of boiled or condensed water in wiping the meat while dressing it; the uniform circulation of dried air of the requisite low temperature in the chilling rooms; and the separation of the meat, one quarter from another, on the ship. The fungus is harmless for the animal body, and apart from the unsightliness there is no necessity to condemn as unfit for food a large portion of the quarter of which only the superficial part is affected with the brown spots. The removal of the most superficial layer of the fat would fully meet all objection. Therefore it is hoped that some modification may be made in the regulations regarding the condemnation of meat thus spotted.

Fats, in particular butter and margarine; Cryoscopy of —. F. Pailheret. Bull. Soc. Chim., 1909, 5, 425–428.

FOR pure butters, the coefficient of depression of freezing-point in benzene varies with the concentration, but is constant between concentrations of 18 and 22 per cent. In this region, the coefficients of more than 120 samples of butter, of very diverse origins, agreed very closely, the mean value being 0.0885. The freezing-points for equal concentrations of different samples were never found to differ by more than 1/200 °C. from the mean. Margarines give concentration-depression curves which

show a general similarity to, but which are not coincident with the butter curves. The steady value of the coefficient of depression for margarine, at concentrations between 18 and 20 per cent., was found to be 0.0764. The presence of 5 or 6 per cent. of margarine in butter can be detected by the application of this method, but the cryoscopic results should generally be supplemented by the determination of other constants, in order to ensure detection of skilful adulteration with both margarine and coconut oil simultaneously.—E. W. L.

Furfurals; Determination of — in presence of pentosans. [Detection of husks in cacao powder]. D. H. Brauns. Pharm. Weekblad, 1909, 46, 326–331. Chem. Zentr., 1909, 1, 1608–1609.

THE plant constituents which yield furfural on distillation with acid and which are known generally as pentosans, may be divided into two groups, namely "pentosans," which yield furfural on boiling with very dilute (2 per cent.) acid, and "furfurals," which are decomposed only by strong acid. Experiments showed that cacao powder contains practically no furfurals, whereas cacao husks contain 1–2 per cent., and adulteration of the former with the latter may therefore be recognised by means of determinations of pentosans and furfurals.—A. S.

Chocolate; Composition and analysis of —. N. P. Booth C. H. Cribb, and P. A. E. Richards. Analyst, 1909, 34, 134–148.

AS chocolate may be adulterated by the addition of cacao husk, cacao-butter substitutes, starch, and colouring matters, the authors suggest that the following determinations should be made in order to detect and ascertain the amount of adulteration:—moisture, mineral matter soluble ash, silica, fat (and its separate examination), crude fibre, cold-water extract, total nitrogen, foreign starch (if seen under the microscope), and added sugar. The average constituents of cocoa nib and shell were found to be:—

	Nib.	Shell.
Moisture	Per cent. 3.00	Per cent. 4.50
Total mineral matter	3.07	7.30
Silica	0.05	1.11
Fat	50.00	4.40
Crude fibre	2.80	14.00
Total nitrogen	2.50	2.50
Cold-water extract	11.60	22.00

THE quantity of added sugar in a sample of chocolate may be determined polarimetrically in a 20 per cent. solution of the sample, after clarification with lead acetate. As no satisfactory deductions can be made as to the quantity of actual cocoa in a chocolate from the proportions of any single constituent, the best results will be got by taking into consideration as many data as possible. Of these, the nitrogen, crude fibre, ash, and fat are the most important. The analytical results obtained on the examination of various samples of chocolate, adulterated chocolate, cocoa, and milk chocolate are given. In the case of milk chocolate the presence of the milk complicates matters by increasing the nitrogen and introducing a fresh variety of sugar and also of fat. As lactose is the only reducing sugar likely to be added to chocolate, the presence of milk can at once be inferred from the reducing power of the cold-water extract. Allowance must be made for the reducing power of the cold-water extract of genuine cocoa (which, expressed in terms of cupric oxide, is about 5 per 100 parts by weight of dry and fat-free cocoa), after which, the residual figure for copper oxide, multiplied by 1.13, will give a fair approximation to the non-fatty solids of the milk, and from this again the protein of the milk may be calculated. Or, the nitrogen belonging to the milk may be directly calculated from the corrected reducing power by multiplying the weight of copper oxide by the factor 0.0672. The nitrogen due to the true cocoa present can then be deduced, and the quantity of cocoa calculated. The quantity of milk fat will vary according to whether whole or partially

skimmed milk has been used. The following results were obtained on the analysis of various samples of milk chocolate:—

cloth laid in a box and obtained as a colourless tender jelly-like mass. This is cut into smaller rectangular pieces called "chô." Tofu has been stated to be a

	English (10 samples).			Swiss, German, Austrian, and Belgian (10 samples).		
	Lowest.	Highest.	Average.	Lowest.	Highest.	Average.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Total fat	23.7	36.0	31.8	29.2	33.4	30.8
Made up of—						
Milk fat	2.6	8.3	5.5	5.8	13.6	8.1
Cocoa butter	21.0	31.6	26.3	15.6	23.8	22.7
Milk sugar	3.8	11.1	8.04	5.2	11.0	8.26
Cane or beet sugar	32.4	54.3	43.2	35.0	52.7	42.6
Nitrogen (three samples)	0.76	1.08	1.18	1.10	1.30	1.24

All the samples were free from cocoa shell and foreign starch. In the absence of cacao butter substitutes containing the glycerides of volatile fatty acids, the Reichert process will give the amount of milk fat with reasonable accuracy. The United States Department of Agriculture defines chocolate as "the solid or plastic mass obtained by grinding cocoa nibs without the removal of fat or other constituents except the germ, and contains not more than 3 per cent. of ash insoluble in water, 3.5 per cent. of crude fibre, 9 per cent. of starch, and not less than 45 per cent. of cocoa fat." *Sweet Chocolate* is defined as "chocolate mixed with sugar (sucrose), with or without the addition of cocoa-butter, spices, or other flavouring materials, and contains in the sugar- and fat-free residue no higher percentage of either ash, fibre, or starch than is found in the sugar- and fat-free residue of chocolate." Board of Public Health of Victoria—*Definition*.—"Chocolate or sweet cocoa mass or confectioner's chocolate or chocolate coating is cocoa mixed with sugar, with or without the addition or subtraction of cocoa fat, and with or without the addition of spices or other flavouring substances." *Standard*.—"It shall contain in the sugar- and fat-free residue no higher proportion of starch, fibre, or ash than is found in the fat-free residue of standard cocoa mass, which itself is defined as containing not more than 3 per cent. of ash insoluble in water, 4.5 per cent. of total ash, 3.4 per cent. of crude fibre, 12 per cent. of starch (cocoa-starch), and not less than 45 per cent. of cocoa fat." Union of German Chocolate Manufacturers—*Definition*.—"A mixture of roasted and shelled cacao with sugar (beetroot-sugar), and an addition eventually of cacao-butter, vanilla, cinnamon, cloves, and other pieces or essential oils." Swiss Society of Analytical Chemists.—Definitions have been drawn up which will probably be rendered official. Chocolate is described as a mixture of cacao with sugar, either sold moulded or powdered." Amount of sugar varies from 40 to 70 per cent. No other ingredients admitted except spices vanilla, benzoin, Tolu or Peruvian balsams, cinnamon, cloves, nutmeg). Fat and sugar together should not exceed 80 to 85 per cent., and the remainder should consist of fat-free cocoa mass. Ash not to be above .5 per cent. Belgium and Roumania are the only two states with official regulations as to composition. Belgium insists on the presence of at least 35 per cent. of shelled cocoa, otherwise the word "chocolate" must be excluded. Roumania requires that chocolate must be made from cocoa beans and sugar only. The Austrian Codex describes chocolate as a uniform mixture of cocoa mass and white sugar in the proportion of 40 to 50 per cent. of the former and 50 to 60 per cent. of the latter, with a small amount of harmless aromatic substances.—W. P. S.

Tofu; *Physical-chemical studies on* —. Y. Kato. Mem. Coll. Sci., Kyoto Univ., 1908, 1, 325—331.

TOFU, a Japanese table preparation, is made from soya beans, which are soaked in water till they swell, then ground, and water added to give a milky solution. This is boiled and filtered hot to separate the skins, and the silky filtrate is coagulated with "bitter salt" solution, the residue obtained in making common salt by evaporation of sea water. The coagulum is filtered through a

chemical compound of protein with calcium and magnesium. After washing with water the amount of ash in the residue is very small and can be still further decreased by washing with dilute hydrochloric acid. The calcium and magnesium are probably present as phosphates. Tofu behaves as a negative colloid towards an electric current and is coagulated by electrolytes.—E. F. A.

Enkabang and teglam fats and katio oil. Brooks. See XII.

PATENTS.

Cattle food; Process of manufacturing —. T. E. Breyer, Waukegan, Ill. U.S. Pat. 920,108, May 4, 1909.

THE food is obtained from by-products resulting from the manufacture of starch from corn (maize). The steeping water, which remains after the corn has been soaked in a dilute solution of sulphurous acid, is treated with calcium hypochlorite, and sodium carbonate is then added. The precipitated phosphates and proteins are removed from the liquid, and the latter is evaporated to the consistency of a syrup. This syrup, together with the precipitated phosphates and proteins, is mixed with other feeding stuffs, and the mixture is dried.—W. P. S.

Butter; Process for renovating —. M. Montéran. Fr. Pat. 396,282, Jan. 21, 1908.

BUTTER fat (washed and purified as usual) and milk are conducted to an atomising apparatus, thence to a mixer, and the mixture is afterwards cooled and worked. These operations are carried out in an atmosphere of carbon dioxide.—W. P. S.

Margarine and the like; Process for the production of emulsions of —. J. V. M. Risberg. Fr. Pat. 396,456, Nov. 18, 1908. Under Int. Conv., Nov. 20, 1907.

THE mixture (oil, milk, etc.) from which the margarine is to be produced, is introduced into a centrifugal drum. As the latter rotates, the mixture is forced towards the walls of the drum, where it is collected in a tube and discharged through small openings against short baffle-plates fixed to the wall of the drum, the object being the production of a complete emulsion. The heat generated by the motion of the mixture in the drum, and which would retard or prevent the formation of the emulsion, is absorbed by a cold-water jacket surrounding the drum, by withdrawing a portion of the mixture and circulating it through a tube surrounded by a cold-water jacket, or by admitting air or other gas under a pressure of 100 atmospheres into the drum.—W. P. S.

Milk; Process for the control of — [detection of added water]. B. Santon. Fr. Pat. 396,679, Nov. 24, 1908.

THE process is based on the red coloration which is produced when milk is treated with sodium alizarinsulphonate, and the fact that a definite quantity of sulphuric acid must be added to genuine milk so treated in order to change the red coloration to yellow. Milk containing added water requires the addition of less sulphuric acid to effect the change in colour.—W. P. S.

Coffee; Process for the removal of caffeine from —.
L. Seisser. Fr. Pat. 396,930, Dec. 1, 1908. Under
Int. Conv., Dec. 5, 1907.

ABOUT 5 kilos. of unroasted coffee berries are placed in a closed centrifugal drum which is surrounded by a hot-water jacket. After the addition of about 15 kilos. of ethyl acetate, the drum is set in motion, so that the solvent and berries are mixed thoroughly, the temperature being maintained at 68° C. At the end of 3 hours, the solvent is drawn off and replaced by a further quantity of about 10 kilos. and the mixing and extraction are continued for a further two hours. The ethyl acetate is then run off, the berries are heated to 100° C. to remove the last traces of solvent, and finally dried at 40° to 46° C., the drum being rotated meanwhile. The ethyl acetate may be recovered by distillation and the caffeine separated from the residue.—W. P. S.

Coffee, cocoa, and similar substances; Process for roasting —.
T. Vogeler. Ger. Pat. 209,214, June 21, 1908.

In the roasting of coffee, cocoa, and similar substances, pure air or other inert gas is used as heating agent and is circulated over the materials in a closed system, heat being imparted to it only by means of suitable heated surfaces. In one form of apparatus described for carrying out the invention, a regenerative chamber is used which is supplied alternately with fuel gases from a furnace burning smokeless fuel, and with the air to be used as heating agent in the roasting process. Before the roasting process, the materials may be dried by passing a current of dry air through the apparatus and allowing it to escape into the atmosphere.—A. S.

Drying milk. J. R. Hatmaker, Paris. U.S. Pat. 920,952, May 11, 1909.

SEE FR. PAT. 366,751 OF 1906; THIS J., 1906, 1113.—T. F. B.

(B.)—SANITATION; WATER PURIFICATION.

Sewage effluents; The new standards for —. S. Rideal and W. T. Burgess. Analyst. 1909, 34, 193—205.

In the Fifth Report of the Royal Commission on Sewage Disposal (paragraph 322) provisional standards are suggested for the permissible amount of suspended matter in sewage, and for the maximum amount of atmospheric oxygen that the filtered liquid should absorb in definite periods. Adeney's apparatus for measuring the amount of oxygen absorption (this J., 1908, 837) has not proved satisfactory in the authors' hands, chiefly owing to the difficulty of preventing leakage of air during the shaking. They have therefore devised a colorimetric modification of Winkler's manganese method (this J., 1901, 841). The standards for the comparison are prepared by placing in each of 15 square-shouldered stoppered bottles (of 3 to 4 oz. capacity), 90 c.c. of water free from organic matter, 1.5 c.c. of 10 per cent. potassium iodide solution, and 0.15 c.c. of concentrated hydrochloric acid. The iodine tints corresponding to the various proportions of oxygen from 0.1 to 1.5 parts per 100,000 are then obtained by introducing into each bottle the calculated amount of a standard solution of potassium permanganate, after which the bottles are filled with distilled water (a minute bubble of air being left in each), closed, shaken, and kept in the dark. Under these conditions reliance may be placed upon them for more than a month. In testing a sample, the liquid is siphoned into one of the test bottles and treated with 0.5 c.c. of a nearly saturated solution of manganese chloride, followed by 1.5 c.c. of a solution containing 30 per cent. of sodium hydroxide and 10 per cent. of potassium iodide. The bottle is now closed and shaken, and, after the bulk of the precipitate has subsided, 1.5 c.c. of concentrated hydrochloric acid is introduced, and the bottle again shaken, and (preferably) cooled in water. The tint of the liberated iodine is then compared with the tints of the liquids in the standard bottles. If the water contains nitrites their amount should be determined (preferably by the metaphenylene-

diamine test), and a correction made for their oxygen equivalent. Two atoms of nitrous nitrogen correspond to one atom of oxygen. For the determination of dissolved oxygen in sewage effluents, about 1.25 litre of the sample is filtered and aerated by shaking, a note being made of the temperature and barometrical pressure. Three bottles, A, B, and C, of 250 c.c. capacity are completely filled with this liquid; and the stoppers tightly inserted. The remainder of the effluent is mixed with an equal quantity of distilled water, and shaken for two minutes, after which the temperature is noted, and two more bottles of the same capacity, D and E, completely filled with the mixture. To obtain concordant results it is essential that the bottles should be kept as nearly as possible at a constant temperature, say 15° C., during the 5 days over which the test extends. After 24 hours some of the effluent from bottle A is siphoned into a test bottle, the reagents are added, and the tint of the liberated iodine is compared with the standards as described above. In addition to the correction for nitrites it may be necessary to apply a correction for the colour of the effluent itself. For this purpose the tint of the untreated liquid may be compared with iodine standards corresponding to 0.02 and 0.04 part of oxygen. The undiluted effluent in the bottles B and C is examined at the end of 48 hours and 5 days respectively, and should these still contain a considerable proportion of oxygen, examination of the diluted effluent in bottles D and E will not be necessary. For transferring the liquids a siphon of glass tubing 5 to 6 mm. in diameter is used. This is cut above the longer limb, and the two pieces joined by rubber tubing, so that by pinching this with the fingers the flow of liquid may be stopped. With care the increase of oxygen during a single transference of water saturated to about one-fourth of its capacity need not exceed 0.01 part per 100,000. A single determination of nitrous nitrogen is, as a rule, sufficient, since the proportion of nitrite does not vary to any appreciable extent during the period of the tests—at all events in effluents in which the whole of the dissolved oxygen is not absorbed. —C. A. M.

XIX.—PAPER, PASTEBOARD, &c.

Cellulose [wood-pulp] factories; Recovery of by-products from soda —. H. Falk. Svensk Pappers Tidning; through Papierfabrikant, 1909, 7, 469—472.

THE author describes the plant employed in the researches of Bergström and Fagerlind (this J., 1908, 1037) for the condensation of the volatile by-products of the manufacture of wood-pulp by the sodium sulphide process. The vapours discharged from the digesters are first passed through a vessel in which particles of liquor are trapped, the steam is then conducted through a coil, and its heat utilised for warming fresh liquor. Condensation is completed in another coil immersed in a vessel of water and the condensed liquid is collected in the form of a milky, evil-smelling solution. Later, an oil separator at the top, and the water can be drawn off. Since the temperature of the condensate is still about 50° C., a further condenser is necessary, and the liquor collected from this likewise separates into an oily and aqueous portion; the oil consists of 30—50 per cent. of dimethyl sulphide, the rest being oil of turpentine. The gases uncondensable at the temperature of the cooling water contain methylmercaptan. This is absorbed in a vessel containing caustic soda lye, but the issuing gases still possess a bad odour. By passing them through a worm surrounded by ice and water, a further quantity of almost pure dimethyl sulphide, amounting to 500—700 c.c. per charge is condensed. Finally the gases are passed through water and burnt; these gases consist principally of atmospheric nitrogen, the oxygen having been absorbed in the digestion process; the combustible constituent is a sulphur compound. The composition of the condensed liquids collected in the various receivers varies with the temperature. Analyses of the total oily and aqueous

rtions showed the following yields per ton of cellulose
tained (from pine wood):

	In the oil.	In the water.
	Kilos.	Kilos.
mercaptan	0-062	0-06
methyl sulphide	0-927	0-17
methyl disulphide	0-103	0-05
t of turpentine	8-487	0-92
stillation residue	0-721	—
methyl alcohol	—	5-0
monia	—	0-18

he value of the oil is estimated at 5-18 kroner (5s.
4d.) and that of the aqueous portion at 2-60 kroner
s. 9-36d.). The dimethyl sulphide has a value as a
stitute for ether, as a solvent for nitrocellulose; this
ight be increased by converting it into the sulphoxide
the action of nitric acid. This solvent has the additional
vantage of being soluble in water and having a high
illing point. The mercaptan and the disulphide have
present no value. The value of the oil of turpentine
pends on the success of the process now being worked
t for refining it. It is proposed to use the residue
om the distillation of the oil of turpentine for the
anufacture of lampblack. The most important of the
ueous by-products is the methyl alcohol, which exists
the first condensation vessel at a concentration of about
per cent. and in the second of 6-7 per cent.—J. F. B.

ulose testing in the paper works. W. Vieweg. Verein
der Zellstoff und Papier Chemiker. Papier-Zeit., 1909,
34, 1352-1353.

determine the degree of mercerisation (this J., 1908,
3) of cellulose, a quantity of the stuff is weighed into a
sk and shaken for half an hour with a measured quantity
N/2 caustic soda solution. A quantity of the resulting
la solution is then titrated with N/2 acid, using phenol-
thalein as indicator. The difference between the figures
tained before and after the immersion of the sample
es a measure of the degree of mercerisation of that
mple. A figure called by the author the "acid number"
obtained by weighing out a quantity of the cellulose
o a flask, adding a measured quantity of N/2 caustic
la solution and boiling for 1-hour, using a reflux
denser. Again the resulting soda solution is titrated
h N/2 acid. In this case the difference between the
tial and final strengths of the soda solution gives a
asure of the "acid number" of the sample of cellulose.
om a table of results it is seen that oxye-cellulose gives
higher figure than hydrocellulose. A further table
mpares the degree of mercerisation, the "acid number"
l the "copper number" of certain forms of cellulose.
e last-mentioned value has been investigated by
walbe and other chemists (see this J., 1908, 156).

—S. H. H.

panese hand-made paper. Papier-Zeit., 1909, 34, 1351.

many cases the families in Japan have their own
paratus for making paper by hand. But lately pro-
otion has become more organised, the number of families
engaged having decreased from 66,000 to 61,000 and
output increased from £1,250,000 to £1,555,000.
e exports amount to about £170,000, China, America,
l England being the largest customers in the order
ned. Paper of the value of about £200,000 is also
de by machine for export. Europe imports principally
lk-note paper, Japanese vellum and copying papers.
na receives the thinner classes but also some of the
lum variety. Some German works have tried to
tate the bank-note papers. The Japanese printing
l writing papers have been imitated more than any-
; some Swedish papers are imitations of these.
an imports £125,000 worth of papers of this imitation
s principally from Sweden, Germany, and Austria.
ently the Japanese have used imported cellulose
l paper making, sulphite pulp being particularly in
eand. The centre of the Japanese industry is the
lvine of Tosa on the Island of Shikoku.—S. H. H.

PATENTS.

Paper-making machines; Single-cylinder — S. Milne,
Edinburgh. Eng. Pat. 9002, April 25, 1908.

THE patentee claims, in single-cylinder paper-making
machines, the use in combination with a cylinder and
hood thereof, of a heater constructed separately from
the hood and arranged in such relation to it as to permit
of air being passed through it and through the space
between the hood and cylinder; a hood, whole or in
sections, and either corrugated or indented, or provided
with strips or otherwise adapted to baffle the air passing
between the hood and cylinder, and, when made in
sections, also adapted to facilitate access to the space
between the hood and cylinder.—T. H. P.

Papers; Method of manufacture in a paper machine of
coloured —, glazed on one face. L. E. Gossler. Fr.
Pat. 396,572, Nov. 21, 1908.

THE moist web of paper, immediately before reaching
the drying cylinder, is impregnated with the required
colour on the surface which will not be in contact with
the drying cylinder.—G. W. McD.

Cellulose material; Manufacture of a —. C. F. Cross
and J. F. Briggs, London. U.S. Pat. 920,828, May 4,
1909.

SEE Fr. Pat. 383,064 of 1907; this J., 1908, 330.—T. F. B.

Sizing paper; Manufacture of a material for —.
F. Curtius and Co. Fr. Pat. 396,985, Nov. 11, 1908.

SEE Eng. Pat. 25,183 of 1908; this J., 1909, 380.—T. F. B.

Waxed cloth and paper and their substitutes. Fr. Pat.
396,467. See V.

Electrolytic treatment of fibrous plants to obtain paper pulp.
Fr. Pat. 396,647. See V.

Water-, acid-, and alkali-proof articles [from wood pulp].
U.S. Pat. 921,000. See IX.

Waterproof and fire-, water-, and oil-resistant articles
[from cellulose]. U.S. Pats. 921,001 and 921,002.
See IX.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Aconitine from Japanese aconite tubers. K. Makoshi.
Z. allgem. österr. Apoth.-Ver., 1909, 47, 229-230.

Two varieties of Japanese aconite tubers were examined.
"Bushu" tubers ("Kusauzu" tubers from Hokkaido,
the true *Aconitum Fischeri*, Reich) yield an Alkaloid
termed jesaconitine. This substance does not crystallise.
On hydrolysis it yields benzoic acid, anisic acid, and
aconine. The formation of anisic acid distinguishes
jesaconitine from all other aconite bases. "Kusauzu"
tubers obtained from plants grown in Hondo belonging
to a variety of *Aconitum Fischeri*, yielded japaconitine.
The author finds the formula of japaconitine to be
C₃₄H₄₇NO₁₁, and that the triacetyl-derivative melts at
189° C. Japaconine yields a tetraacetyl-derivative melting
at 236°-237° C.—F. SHON.

Sapphire oil; Preparation and chief characters of —.
F. Borde. Bull. Sciences Pharmacol., 1909, 16,
132-142. Chem. Zentr., 1909, 1, 1566-1567.

THE specimens of oil examined by the author were
obtained by distilling with steam, sapphire plants
(*Crithmum maritimum*, L.) collected after flowering was
nearly finished. The plants contained 80-81.5 per cent.
of water. Of those collected in the first half of August,
the leaves and stalks yielded 3 grms. and the fruits 7 grms.
of oil per kilo.; in the second half of August the corres-
ponding figures were 1.5 grms. and 8 grms.; and in the
middle of September, 1.54 grms. and 7 grms. The dark
yellow oil obtained from the leaves and stalks is heavier
than water; the oil from the fruits is lighter in colour,

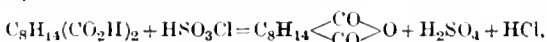
has a more pleasant odour, and is lighter than water. The characters of the oil from the ripe or dried fruits are given as follows:—It is a neutral, mobile, amber-coloured liquid distilling between 170° and 300° C.; sp. gr. at 0/4°, 0.95–0.98 (sp. gr. at 0/4° = sp. gr. at 0/4°–0.00084, t); n_D^{20} = 1.457–1.458; iodine value, 174–200; saponification value, 4–10; acetyl value, 3–4 (or possibly 0); solubility in 90 per cent. alcohol, 1:6; in 70 per cent. alcohol, 1:30.—A. S.

Irritant woods; An examination of —. Part I. Chloroxylonine from East Indian satinwood. S. J. M. Auld. Chem. Soc. Proc., 1909, 25, 148–149.

FROM East Indian satinwood, derived from *Chloroxylon swietenia*, which has been reported to possess irritant properties, have been separated calcium oxalate, a peculiar protein compound, two inert resins, a fixed oil, and an alkaloid, $C_{22}H_{23}O_7N$. As the alkaloid cannot be identified with any known base, it is proposed to call it *chloroxylonine*. Chloroxylonine is a weak monacidic base, and several of its salts have been prepared and characterised. It melts at 182–183° C., contains four methoxyl groups, and is levorotatory ($[\alpha]_D^{18}$ = –9°18'). In certain circumstances it seems capable of causing dermatitis similar to that ascribed to the wood itself.

Camphoric anhydride; New method of preparing —. J. P. Edgerton. Chem. Soc. Proc., 1909, 25, 149–150.

WHEN camphoric acid is treated with chlorosulphonic acid a vigorous reaction takes place according to the equation:



the principal product being camphoric anhydride, which can be quickly prepared as follows: One hundred grams of finely powdered camphoric acid are placed in a capacious flask fitted with a drying tube containing calcium chloride, and 33 c.c. of chlorosulphonic acid are added; the mixture is then warmed on the water-bath, a further quantity of 16.5 c.c. of chlorosulphonic acid is added, and the whole again warmed for about half an hour until the evolution of gas has practically ceased. The mass is then mixed with water, filtered through glass wool, and washed until free from acid. The camphoric anhydride crystallises from methylated spirit in fine needles, which, if not quite pure, can be obtained pure by a second crystallisation.

Terpinene; Action of chromyl chloride on —. Contributions to the chemistry of the terpenes. Part I. G. G. Henderson and W. Cameron. Chem. Soc. Proc., 1909, 25, 151.

WHEN chromyl chloride (2 mols.), largely diluted with carbon disulphide, is added to a similar solution of terpinene (1 mol.), a brown solid is formed which is decomposed by water, yielding a solution of chromic chloride and a brown, oily liquid. The liquid oxidation product contains small quantities of cymene and of a ketone of the formula, $C_{10}H_{16}O$, but is mainly composed of *a-p*-tolylpropaldehyde, $C_6H_4CH_2CH(CH_3)CHO$, and *p*-tolyl methyl ketone, $COCH_3C_6H_4CH_3$, both of which are derivatives of cymene. Hence the behaviour of terpinene towards chromyl chloride is different from that of pinene and of camphene, for whilst each of the latter hydrocarbons yields an additive product, $C_{10}H_{16} \cdot 2CrO_2Cl_2$, terpinene, on the other hand, is for the most part first oxidised to cymene, which then forms the compound $C_{10}H_{14} \cdot 2CrO_2Cl_2$, from which the aldehyde and the ketone are produced by the action of water.

Terpene series; A new method of isomerisation in the —. G. Austerweil. Compt. rend., 1909, 148, 1197–1199.

THE author points out that many of the reactions in the terpene group, which proceed in the vegetable kingdom, take place at a low temperature and under a considerable

pressure, namely, osmotic pressure. It is known that linalool is transformed into geraniol, *in vitro*, when heated with acetic acid in an autoclave to 160°–170° C., and it is pointed out that this reaction is simulated by plants, for essences obtained from plants in latitude 20° contain more geraniol relative to linalool than those occurring in a latitude of 44°–45°; under the influence of osmotic pressure, therefore, the denser substance tends to be formed. As an application of these ideas the author shows that whilst a yield of only 18 per cent. of borneol is obtained when pinene is heated in an autoclave with an organic acid, and resinification ensues if the temperature be raised to increase the pressure, if the pressure in the autoclave is artificially raised (by means of compressed carbon dioxide) and the operation carried out at about 200° C., a good yield of borneol can be obtained. It is necessary that the materials should be quite dry and the yields are still further improved if a small amount of the anhydride of the organic acid used is added.

—J. C. C.

Allyl and propenyl compounds in essential oils; Separation of — [by means of mercuric acetate]. L. Balbiano. Ber., 1909, 42, 1502–1506.

MIXTURES of compounds containing allyl and propenyl side chains, such as anethol and methylehaviol, can be separated by means of mercuric acetate (see this J., 1906, 442). The mixture is dissolved in ether, treated with a molecular proportion of mercuric acetate dissolved in water, and allowed to stand for 24 hours. The ethereal solution contains the unchanged propenyl derivative, whilst the acetomeric compound of the allyl derivative remains suspended in the aqueous portion. After extracting the aqueous solution with ether, the mercury compound can be decomposed by making the liquid alkaline with sodium hydroxide, and digesting with zinc. If steam is passed through, the allyl derivative is recovered. In this way the following mixtures were separated: anethol and methylehaviol, safrol and isosafrol, myristicin and isomyristicin, aniol and isosanol.

—F. SHDN.

Catalytic actions of colloidal metals of the platinum group. VI. Catalytic reductions with colloidal palladium. C. Paal and J. Gerum. Ber., 1909, 42, 1553–1560.

THE authors have continued their experiments upon the reduction of organic compounds by means of colloidal palladium (this J., 1907, 780; 1908, 864, 875). Benzoinitrile reduced by the method already described (*loc. cit.*) yields mono- and dibenzylamine, ammonia, and a little benzaldehyde. In the first stage of the reaction, 2 atoms of hydrogen appear to attach themselves to the $C \equiv N$ group to form benzylideneimine, which is transformed, in the presence of water, into benzaldehyde and ammonia. These two compounds then unite more or less completely to form hydrobenzamide, which, in turn, is reduced to mono- and dibenzylamine. Benzaldehyde-*cyanhydrin* yields on reduction, mono- and dibenzylamine, ammonia, and benzyl alcohol, instead of alcoholic bases as might be expected. The explanation suggested by the authors is that the oxynitrile in aqueous-alcoholic solution is more or less dissociated into benzaldehyde and hydrocyanic acid, and that the latter is reduced, with the formation of ammonia. The ammonia and benzaldehyde then unite to form hydrobenzamide, which, on hydrogenation yields the primary and secondary benzyl base; whilst the benzyl alcohol is derived from the benzaldehyde that has escaped condensation to hydrobenzamide. This reduction of hydrocyanic acid is the more striking, since experiments have shown that acid has a strong restrictive influence on the catalytic action of colloidal palladium. Benzaldoxime when hydrogenated at the ordinary temperature yields the same products of decomposition and reduction as benzonitrile, viz. benzaldehyde, ammonia, and mono- and dibenzylamine. The formation of these compounds may be explained on the assumption that the oxime is first reduced to benzalimine and that this is decomposed into benzaldehyde and ammonia.—C. A. M.

Hydroquinone [quinol]; Oxidation of — by the catalysis of carbon. M. Matsui. Mem. Coll. Sci., Kyoto Univ., 1908, 1, 386—390.

ANIMAL charcoal acts as a catalyst in bringing about the oxidation of quinol. Oxidation only takes place with access of air and proceeds more quickly at higher temperatures. It readily takes place in aqueous or alcoholic solution at ordinary temperature but in ethereal solution it is necessary to heat on the water-bath with a constant supply of air.—E. F. A.

Cinnamic acids; The isomeric —. H. E. Büllmann. Ber., 1909, 42, 1443—1450.

IN view of a recent paper by Liebermann on allo- and isocinnamic acids (this J., 1909, 441), the author has made further experiments. He has considered three acids, Liebermann's allocinnamic acid, m. pt. 68° C., Liebermann's isocinnamic acid, m. pt. 58° C., and Erlenmeyer sen.'s iso-acid, m. pt. 42° C. The author suggests that these should be described as allocinnamic acids. When a small quantity of the acid melting at 68° C. is melted and cooled in a freezing mixture, the acid melting at 42° C. is produced. If more than 0.1 gm. of the acid melting at 58° C. be melted and cooled, the melting point remains unchanged. When 1.0 gm. of the acid melting at 68° C. is melted and dissolved in 10 c.c. of light petroleum, the acid melting at 58° C. crystallises out, but if more of the solvent is used, the acid melting at 68° C. is deposited. Without exception, when a light petroleum solution of the acid melting at 68° C. is inoculated with the acid melting at 58° C., the latter acid crystallises out. The acid melting at 58° C. can be converted into the one melting at 68° C. by inoculating the light petroleum solution with the latter acid.—F. SHDN.

Solubility; Determination of — with the Pulfrich refractometer. Y. Osaka. Mem. Coll. Sci., Kyoto Univ., 1908, 1, 290—303.

THE Pulfrich refractometer may be used for determinations of solubility, including the solubility of organic compounds of volatile solvents, and gives reliable results. Accurate results can be obtained with small quantities of materials. The author's formula: $ax + bx^2 = \Delta$, where a and b are constants depending on the nature of the solvent and the solute, x is the amount in grms. dissolved in 100 c.c. of the solution, and Δ is the difference of the observed angles in the refractometer with the solvent and solution, is available within a wide range of concentration and is also applicable to cases in which a solution is used as a solvent or in which chemical reaction takes place between a solvent and a solute. The constants a and b are different at different temperatures. Tables are given showing results obtained with the refractometer.—E. F. A.

Ether; Solubility of — in water. Y. Osaka. Seventh Int. Congr. Appl. Chem., London, 1909.

THE solubility of ether in water determined by the method described in the preceding abstract, is as follows:—

Temperature:	0° C.	5°	10°	15°	20°	25°	30° C.
Solubility:	13.14	11.18	9.55	8.22	7.08	6.13	5.39

Light; Chemical action of —. G. Ciamician and P. Silber. Ber., 1909, 42, 1510—1515.

THE acid, $C_{10}H_{18}O_2$, corresponding to the aldehyde, $C_{10}H_{18}O$, obtained by the action of light on menthone is J., 1907, 777) was oxidised by means of permanganate in the presence of excess of sodium carbonate and at a temperature of 0° C. By this means β -methylglutaric acid and apparently isobutyric acid were produced, showing the acid, $C_{10}H_{18}O_2$, to have the constitution:



When menthone is exposed for a long time to the action of light in a moist atmosphere of oxygen, a keto-acid, $C_{10}H_{18}O_3$, is produced, which is identical with that obtained from the oxidation of menthol with chromic acid.—F. SHDN.

Thorium in monazite sand; Determination of —. V. Borelli. Gaz. chim. ital., 1909, 39, I., 425—448.

ABOUT 2 grms. of finely-powdered monazite are treated in a platinum crucible with 5 c.c. of sulphuric acid of sp. gr. 1.84 and a few c.c. of hydrofluoric acid, the crucible is fixed in a larger porcelain crucible by means of a ring of asbestos, and is heated gradually so that the hydrofluoric acid is evaporated in 1—2 hours and the sulphuric acid in 4—5 hours. When fumes are no longer evolved, the platinum crucible is allowed to cool, the greater part of the contents detached with a spatula and dissolved in about 10 c.c. of hydrochloric acid (1:1). After diluting with water to 50—60 c.c., the solution is decanted through a filter. The crucible is now half filled with concentrated hydrochloric acid (2:1), heated for a few minutes on the water-bath, the contents poured into a basin, the residue again digested with hydrochloric acid, and then the crucible carefully washed out, the whole of the contents being received in the basin. The contents of the latter are heated for $\frac{1}{4}$ hour on a boiling water-bath, diluted with water, the solution decanted through the same filter as used previously, the residue digested with concentrated hydrochloric acid, and the sequence of operations repeated three or four times until only a small quantity of a greyish-white, sandy residue, insoluble in dilute acid, is left. The solution (about 300 c.c.) is heated to boiling, treated with ammonia until the greater part of the acid is neutralised, i.e., until the precipitate formed re-dissolves only with difficulty, and then to the boiling solution, crystallised ammonium oxalate is added in small quantities at a time, until the precipitation of the rare earth oxalates is complete. After a few hours, the solution is decanted through a filter, and the precipitate washed by decantation and on the filter with a dilute solution of ammonium nitrate. The precipitate is taken up with 15—20 c.c. of nitric acid (1:1), heated to boiling, and potassium permanganate solution added till a pink colour persists. The solution is boiled to destroy the excess of permanganate, ammonia added until the solution is neutral or just faintly acid to litmus, and then 10 c.c. of a 3 per cent. solution of pure hydrogen peroxide added, and the whole heated for a few minutes at 60—80° C. The precipitate of thorium peroxide, coloured a more or less intense orange by cerium peroxide, is filtered off, and washed with a dilute solution of ammonium nitrate. The thorium peroxide is freed from the 5—8 per cent. of impurities it contains by re-dissolving in nitric acid and re-precipitating with hydrogen peroxide. It is then again washed with ammonium nitrate solution, ignited in a platinum crucible, and weighed.—A. S.

Cerium salts; Preparation of pure —, and the colour of cerium oxide. A. C. Neish. J. Amer. Chem. Soc., 1909, 31, 517—523.

THE following process of obtaining pure cerium salts obviates the necessity of tedious crystallisations. (1). *Hydrochloric acid treatment for removal of iron, calcium, etc.*—The crude cerium oxalate (150 grms.) is distributed in three beakers, heated for an hour on the water-bath with 750 c.c. of 1 per cent. hydrochloric acid, and the residues washed with the same acid and with hot water; then treated successively with 350 c.c. of 0.5 per cent., and the same quantity of 0.2 per cent. hydrochloric acid, and washed until no iron can be detected by the colour test with ammonium thiocyanate and amyl alcohol. (2). *Ammonium oxalate treatment to remove thorium, zirconium, and yttrium*—The residual oxalate from the above treatment, was removed from the funnel, a third placed in each beaker, and a hot solution of ammonium oxalate, saturated in the cold, was added. The beakers were heated on the water bath with frequent stirring, for an hour, and allowed to settle. The oxalate settled rapidly, and changed from a fine powder to a distinct crystalline form; it was filtered through a Buchner funnel, washed with 500 c.c. of ammonium oxalate solution, and well with cold water. This treatment is repeated three times with constant stirring and precautions to prevent the formation of lumps. (3). *Potassium hydroxide treatment to remove aluminium, etc.*—The residue from (2) is made into a cream with water and distributed among the three beakers, into

each of which is then introduced 75 grms. of potassium hydroxide and sufficient water to make up 500 c.c. The beakers are then heated, with constant stirring, until their contents boil, and after continuing the heating for 30 minutes, water is added, and the deposits collected in a Buchner's funnel, and washed with about 3 litres of hot water. (4). *Sulphuric acid and potassium sulphate treatment to remove yttrium, erbium, ytterbium, and samarium*.—About a third of the cerium ytterbium, left from the preceding treatment is placed in each beaker, together with 300 c.c. of water and about 30 c.c. of 50 per cent. sulphuric acid, which is added at intervals, and the whole heated to the boiling point. A little more acid is then added, and 10 to 20 c.c. of hydrogen peroxide solution, and the boiling continued until all the peroxide is decomposed. The contents of each beaker are now diluted to about 500 c.c., and cooled to about 10° C. (cerous sulphate being more soluble in cold than in strong acid), the supernatant liquid decanted, and the residue treated in the same way as before, until everything is dissolved. The solution (about 3 litres) is mixed with 100 grms. of potassium sulphate dissolved in 500 c.c. of boiling water, and allowed to stand overnight, after which the supernatant liquid is decanted, and the crystals of the double sulphate washed with warm water to remove the excess of the potassium salt. (5). *Treatment with potassium hydroxide and chlorine to remove lanthanum and didymium*.—The crystals of the double sulphate are mixed with sufficient water to fill about two-thirds of the beakers and with 20 c.c. of strong hydrochloric acid, and digested for 30 minutes on the water-bath. The liquid is then decanted and the treatment with acid repeated until solution is complete. An excess of solid potassium hydroxide is now added to the united liquids, which are heated until the whole of the cerium has been precipitated as hydroxide. The precipitate is collected in a Buchner's funnel and thoroughly washed with hot water, after which it is mixed with about 2100 c.c. of water and 200 grms. of potassium hydroxide in a large cylinder, and mechanically stirred, whilst a very slow current of chlorine is introduced until saturation is complete (20 hours). Further purification from didymium is effected by again converting the cerium oxide into cerous chloride and then into hydroxide by treatment with potassium hydroxide, treating the moist precipitate with 1000 grms. of potassium hydroxide and about 1½ litres of water, and saturating the liquid with chlorine as before. After removal of the supernatant liquid, a litre of potassium hypochlorite solution prepared from a 20 per cent. solution of potassium hydroxide is added, and the stirring continued for 5 hours. The residue from this treatment is mixed with water and 25 grms. of potassium hydroxide, and once more saturated with chlorine. The whole treatment of conversion into chloride and hydroxide and saturation with chlorine is then repeated, and the final deposit thoroughly washed to remove potassium salts. (6). *Hydrochloric acid and oxalic acid treatment to remove iron, etc.*—The residue from (5) is boiled with about 1500 c.c. of water and 150 c.c. of strong hydrochloric acid, final solution being effected by the addition of hydrogen peroxide. The resulting cerous chloride solution is mixed with 500 c.c. of strong hydrochloric acid, heated nearly to boiling point, mixed with a litre of oxalic acid solution (saturated in the cold), and allowed to cool. The first crop of crystals is collected in a Buchner's funnel, and washed with hot water and dried between filter-paper. The mother liquor is mixed with another 1000 c.c. of the oxalic acid solution and again allowed to crystallise. The oxides left on ignition of both crops of crystals should have a slight yellow tint, and be practically pure. A pink or reddish colour points to the presence of oxides of iron, etc., whilst if the oxide is very pale or nearly white, the presence of white oxides as impurities is indicated. The pale "chamois colour" of ceric oxide is not altered by ignition in oxygen, and is therefore not due to the presence of atmospheric nitrogen. Specimens of cerium oxalate thus prepared by the author contained only traces of lanthanum and insignificant traces of yttrium. Such traces may be eliminated by further treatment with chlorine in (5), and by an additional operation in (4) of adding potassium sulphate to a cold solution of the salt in sulphuric acid, and not heating the

liquid after the addition. The double sulphate is dissolved in potassium hydroxide solution, and once more precipitated.—C. A. M.

Cerium; Rapid volumetric method for the determination of — in the presence of other rare earths. F. J. Metzger, J. Amer. Chem. Soc., 1909, 31, 523–525.

The method is based upon the fact that cerous sulphate dissolved in sulphuric acid is quantitatively oxidised by means of sodium bismuthate into ceric sulphate. The excess of the reagent is removed by filtration, the ceric compound reduced by means of ferrous sulphate, and the excess of the latter titrated with potassium permanganate. Fifty c.c. of a solution of, e.g., cerium nitrate, containing about 0.2 gm. of cerium oxide are mixed with 20 c.c. of strong sulphuric acid and evaporated until fumes of sulphur trioxide appear. (If the earths are present as sulphates this evaporation is unnecessary.) The cold solution is mixed with 2 grms. of ammonium sulphate and about 80 c.c. of water, and then heated to boiling point with about 1 gm. of sodium bismuthate. After cooling somewhat, it is mixed with 50 c.c. of 2 per cent. sulphuric acid and filtered through a Gooch's crucible, and the residue washed with 100–150 c.c. of the same dilute acid. Ferrous sulphate solution is added to the filtrate until the yellow colour disappears, and the excess of iron salt is titrated back with standard permanganate solution. The value of the latter in terms of iron, multiplied by the factor 3.08415, gives the corresponding amount of cerium oxide (Ce_2O_3). The test experiments described show that the method gives accurate results, even in the presence of salts containing thorium, lanthanum, neodymium, praseodymium, yttrium, erbium, zirconium, samarium, and titanium. The yellow coloration produced in the oxidation of cerium by means of sodium bismuthate may be used as a delicate test for that metal. A distinct coloration is given by a solution containing 0.2 mgrm. of cerium oxide in 100 c.c. The intensity of the colour increases with the rise in temperature. It is suggested that this may be made the basis of a colorimetric method of determining small amounts of cerium in incandescent mantles, etc.—C. A. M.

Fat-hydrolysing constituent of kola nuts. See XII.

Electrolysis of glycerol and glycol. Löb and Pulvermacher. See XVI.

PATENTS.

Dibromo-behenic acid; Strontium salt of —. E. Fischer, Berlin, Assignor to Farbenfabriken vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 920,305, May 4, 1909.

The salt is obtained by treating an alkaline solution of dibromo-behenic acid with strontium chloride; it has the formula, $\text{Sr}(\text{C}_{22}\text{H}_{41}\text{O}_2\text{Br}_2)_2$. It is a white, tasteless, odourless substance and is almost insoluble in water and alcohol, but soluble in ether and chloroform. It is stated to be a valuable substitute for potassium bromide.

—W. P. S.

Silver compounds, soluble in water; Process for the preparation of stable organic —. A. Busch. Ger. Pat. 209,345, March 3, 1908. Addition to Ger. Pat. 193,740, Dec. 13, 1906.

By using the double salt of hexamethylenetetramine and silver carbonate, $5\text{C}_6\text{H}_{12}\text{N}_4 \cdot 3\text{Ag}_2\text{CO}_3 \cdot 15\text{H}_2\text{O}$, in place of the double salts of silver nitrate and hexamethylene-tetramine mentioned in the main patent (this J., 1908, 645), compounds more easily soluble in water than those previously described are obtained.—A. S.

Radium compound and process of making same. J. Reitz, Schmargendorf, Assignor to P. Simon, Plauen, Germany. U.S. Pat. 920,881, May 4, 1909.

See Eng. Pat. 24,222 of 1906; this J., 1907, 1028.—T. F. B.

Camphene; Process for the production of —. Act. Ges. f. Anilinfabr. Fr. Pat. 396,244, Jan. 20, 1908.

See Ger. Pats. 205,850 and 206,386 of 1907; this J., 1909, 220, 382.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Developers: Comparative study of the reducing power of organic — and of the methods of increasing or diminishing the contrasts of the image developed by each of them. A. and L. Lumière and A. Seyewetz. Seventh Internat. Cong. Appl. Chem., London, 1909.

ALL organic developers (except those which contain solvents for silver bromide) have the same reducing power, i.e., they will develop to the same extent feeble images of under-exposed plates, etc.

The contrasts in negatives can be decreased (1) by diluting the developer (save in the case of "hydramine"); (2) by increasing the proportion of sulphite (only applicable in developers which do not contain alkali, e.g., diamino-phenol); (3) by increasing the alkalinity of the developer especially suitable for pyrogallol, metol, and quinol); (4) by raising the temperature of the solution (principally used for adurol and quinol). On the other hand, contrasts may be increased (1) by reducing the quantity of alkali, e.g., in the case of developers without alkali, reducing the quantity of sulphite; (2) by lowering the temperature of the solution; (3) by addition of an alkali bromide. This last means is applicable to all developers, and gives the greatest increase of contrast with pyrogallol, quinol, durol, glycin, and eikonogen. (See also this J., 1909, 69.)—T. F. B.

PATENT.

Multi-coloured surfaces; Process for making —. Verein. Kunstseidefabr. A.G., Kelsbach on Maine, Germany. Eng. Pat. 21,840, Oct. 15, 1908. Under Int. Conv., July 23, 1908.

EE Fr. Pat. 395,165 of 1908; this J., 1909, 329.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives; Importation of — into India. Board of Trade J., May 20, 1909. [T.R.]

A NOTIFICATION (No. 2721-13) of 14th April, 1909, providing for the amendment of the rules previously in force respecting importation of explosives into India (see this J., 1907, 840). These amended rules provide, *inter alia*, that certain explosives which have undergone the test prescribed by the rules made by the Governor of the Straits Settlements in Council under the Explosives Ordinance of 1899 may be imported by sea from Penang to the port of Victoria Point under license without testing, but subject, in some cases, to the production of a certificate as provided by the rule in force in the Straits Settlements.

It is also provided that certain explosives which have already undergone the prescribed test at the port of Rangoon may also be re-imported into the ports of Kyau, Sandoway, Kyaukpyn, Tavoy, Mergui, or Victoria Point under license without retesting, under certain conditions.

A Notification, dated 23rd April, 1909, states that, in accordance with the provisions of Sec. 17 of the Indian Explosives Act of 1884, picric acid, when kept, conveyed, exported, or sold in Berar shall, for whatever purpose used or manufactured, be deemed to be an "explosive," except in certain specified cases, within the meaning of the above-mentioned Act.

Consumption of sodium nitrate in U.S.A. Munroe. See VII.

PATENT.

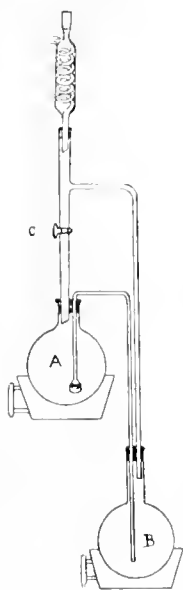
Explosive material. H. Klaffke. Fr. Pat. 396,496, Oct. 16, 1908.

THE explosive, which is said to be particularly suitable for blasting rock, consists of potassium nitrate (73.9), sulphur (13.4), and cellulose (12.7 parts).—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Extraction apparatus for plant products, etc. S. J. M. Auld and S. S. Pickles. Chem. News, 1909, 99, 242.



THE apparatus here illustrated enables large quantities of material to be extracted by a boiling solvent, and also enables the latter to be recovered continuously without the need of separate distillation vessels. It consists of a large flask, A, closed by a stopper with two holes. Through one of these is passed a narrow tube ending in a thistle-funnel packed with cotton wool tied over with muslin or calico. The other part of this tube is bent so as to form a siphon opening into the second flask, B. The other tube passing through the cork of the extraction flask is connected with a condenser, and has a side tube which also communicates with the lower flask. The material is boiled with the solvent in A, until the latter is saturated. The stop cock, C, is then momentarily closed, and the liquid passes through the filter-tube into B. The solvent is then distilled from the flask B, and re-enters the extraction flask through the side tube.—C. A. M.

PATENTS.

Explosive and calorific values; Apparatus for measuring and indicating the — of gaseous mixtures. A. G. Evans, Rugby. Eng. Pat. 9150, April 28, 1908.

THIS apparatus consists, firstly, of a catalytic tube containing long-fibred asbestos or fine platinum (or osmium, palladium, etc.) wires on which finely-divided platinum or platinum black is deposited. The catalytic tube is connected so that a sample of the gaseous mixture to be measured passes through it, and is attached to a specially constructed, tubular, differential thermometer, an indicating mechanism, and a reducing valve. The indicating mechanism and a contact-piece move with the differential thermometer and break circuit with a fixed contact. The gaseous mixture is passed through one tube of the differential thermometer, then through the junction of the thermometer which is free to move, and, after having been heated or cooled by the catalytic action of the platinum, is passed through the second tube of the differential thermometer; the expansion of this second tube and consequent movement of the free end of the differential thermometer may be measured and indicated in any suitable way.—T. H. P.

INORGANIC—QUANTITATIVE.

Carbonates in presence of nitrites, sulphides or sulphates by means of potassium bichromate; Determination of —. E. R. Marle. Chem. Soc. Proc., 1909, 25, 154.

IT was proved that soluble carbonates and carbonates of bases which form soluble chromates are quantitatively decomposed by aqueous potassium bichromate. The action of potassium bichromate on nitrites has been investigated. On distillation with bichromate, a nitrite yields nitrous acid, although the mixed solution apparently contains no free nitrous acid. The yield of nitrous acid increases with the concentration of the nitrite, but is almost independent of that of the bichromate. Prolonged distillation, either adding water at the rate at which the

liquid distils, or making the solution up to its original volume after, say, 100 c.c. has distilled over, gives 60—70 per cent. of the nitrite as nitrous acid. The residual nitrite in the flask is estimated, and the loss of 10—15 per cent. is accounted for by the decomposition of nitrous acid into nitric acid and nitric oxide, some of the nitric oxide remaining dissolved in the bichromate solution. An apparatus was described with which carbonates can be estimated in the presence of nitrites, the mixture being distilled with bichromate under a reflux condenser. The carbon dioxide is thus freed from nitrous acid, and the nitric oxide formed is negligible. The method is found to give accurate results.

Thallium: Volumetric and gravimetric determination of — in alkaline solution by means of potassium ferri-cyanide. P. E. Browning and H. E. Palmer. Amer. J. Science, 1909, 27, 379—380.

The authors used a 1 per cent. solution of pure thallous nitrate, measured portions of which were taken, diluted to about 100 c.c. and an excess of potassium ferri-cyanide with potassium hydroxide added to precipitate all the thallium as the brown thallic hydroxide. The precipitate was filtered off on asbestos, generally without settling, and washed well with hot water. The filtrate was acidified with sulphuric acid, and the reduced ferrocyanide re-oxidised with standard potassium permanganate: $\text{Ti}_2\text{O}_3 + 4\text{K}_3\text{Fe}(\text{CN})_6 + 4\text{KOH} \rightarrow \text{Ti}_2\text{O}_5 + 4\text{K}_4\text{Fe}(\text{CN})_6 + 2\text{H}_2\text{O}$; $5\text{K}_4\text{Fe}(\text{CN})_6 + \text{KMnO}_4 + 4\text{H}_2\text{SO}_4 \rightarrow 5\text{K}_3\text{Fe}(\text{CN})_6 + 3\text{K}_2\text{SO}_4 + \text{MnSO}_4 + 4\text{H}_2\text{O}$. For the gravimetric determination, the precipitated thallic hydroxide was filtered on to asbestos felt in a perforated platinum crucible, dried at about 200° C. till of constant weight, and weighed as thallium sesquioxide. Tables showing the results of twelve determinations by each method are given.—F. R.

Analysis of tantalum ores. Simpson. See X.

Determining tungstic acid in low-grade wolfram ores. Hutchin and Tonks. See X.

Determining potassium in soils. Shedd. See XV.

Determining phosphoric acid. Ullmann. See XV.

Determining thorium in monazite sand. Borelli. See XX.

Determining cerium. Metzger. See XX.

PATENT.

Testing ores. U.S. Pat. 919,663. See X.

ORGANIC—QUALITATIVE.

PATENT.

Detecting added water in milk. Fr. Pat. 396,679. See XVIII.3.

ORGANIC—QUANTITATIVE.

New values in analysis of mineral lubricating oils. Kissling. See III.

Determining vermilion and antimony sulphide in rubber goods. Frank and Jacobsohn. See XIII.1.

Determining water in tanning materials. Jedlicka. See XIV.

Temperature corrections in polarisation of raw sugar, etc. Browne. See XVI.

Determining starch in cereals. Lalin. See XVII.

Cryoscopy of fats. Pailheret. See XVIII.4.

Composition and analysis of chocolate. Booth and others. See XVIII.1.

Determining pentosans in presence of furfuroids. Brauns. See XVIII.4.

Standards for sewage effluents. Rideal and Burgess. See XVIII.B.

Cellulose testing in paper works. Vieweg. See XIX.

Separating allyl and propenyl compounds. Balbiano. See XX.

Trade Report.

Japan: Foreign trade of —. Papier-Zeit., 1909, 34, 1351.

	1908.	1907.
	£	£
Exports—		
Paper and paper articles	487,934	540,028
Lacquered articles	97,683	167,602
Imports—		
Paper and paper articles	650,712	567,250
Aniline dyestuffs	207,140	252,129
Pulp for paper-making	185,114	167,973

—S. H. H.

New Books.

THE RISE AND PROGRESS OF THE BRITISH EXPLOSIVES INDUSTRY. Published under the auspices of the VIIth International Congress of Applied Chemistry by its Explosives Section—Vice-President (Explosives Section), T. G. TULLOCH; and a Publication Sub-Committee, Major COOPER-KEY, OSCAR GUTTMANN, and W. R. HODGKINSON, with E. A. BRAYLEY HODGETTS as Editor. Whittaker and Co., 2, White Hart Street, Paternoster Square, London, E.C. 1909. Price 15s. net. 64 and 66, Fifth Avenue, New York. 1909.

SMALL quarto volume, containing 418 pages of subject matter, with frontispiece, and 39 illustrations. The subject matter is subdivided as follows:—PREFACE (T. G. Tulloch). HISTORICAL. I. History of gunpowder (E. A. B. Hodgkiss). II. Researches on gunpowder (G. W. MacDonald). III. Nitrocellulose (G. W. MacDonald). IV. Nitroglycerine and its explosives (H. de Mosenthal). V. Researches on nitroglycerine (G. W. MacDonald). VI. Permitted explosives (H. de Mosenthal). VII. Percussion caps (E. W. Hulme). VIII. Bickford's safety-fuse (Sir G. J. Smith). IX. Military fireworks (J. R. J. Jocelyn). X. Pleasure fireworks (Ph. Pain). XI. Legislation (E. A. B. Hodgkiss). XII. Bibliography. XIII. Chronology (1242—1700). XIV. List of gunpowder makers up to 1800. DESCRIPTIVE. EXISTING GOVERNMENT ESTABLISHMENTS. I. The Royal Laboratory, Woolwich (Col. Sir H. W. W. Barlow). II. The Royal Gunpowder Factory, Waltham Abbey (Col. Sir F. L. Nathan). III. The Research Department (Major J. H. Mansell). PRIVATE ESTABLISHMENTS. MANUFACTURERS OF PICRIC ACID.

DAS ARBEITEN MIT FARBENEMPFINDLICHEN PLATTEN. Von Dr. E. KÖNIG. Gustav Schmidt's Verlag, Berlin, W. 10. 1909. Price M.2 25.

SMALL 8vo volume, containing 75 pages of subject matter, 30 illustrations, and an alphabetical index. The subject matter is sub-divided as follows:—I. Introduction. II. Sensitizers. III. Preparation of plates sensitive to colours. IV. The light filter. V. Testing plates sensitive to colour. VI. Preparation and use of plates sensitive to colours: (a), Development. (b), Dark-chamber illumination. (c), Photography of portraits. (d), Landscape photography. (e), Photography of plants, &c. (f), Reproductions. VII. Orthochromatic photography by artificial light. VIII. Orthochromatic photography with silver-bromide collodion.

GRUNDRISS DER KOLLOIDCHEMIE. Von Dr. W. O. OSTWALD. Privatdozent an der Universität Leipzig. Theodor Steinkopff's Verlag, Dresden. 1909. Price M.12. Strongly bound, M.13.50.

Svo volume, containing 509 pages of subject matter, with portrait of Thos. Graham as frontispiece, also alphabetical indexes of names of authors and subjects. The subject matter is classified and subdivided according to the following scheme:—I. History of colloidal chemistry, from Graham to Barus and Schneider (1851—1891); and from Barus and Schneider, to the discovery of ultramicroscopy (1891—1903). The newer phases of colloid chemistry (1903 to the present). II. General chemistry of colloids. Theory. III. Special chemistry of colloids. a.) General physico-chemical properties of colloids. b.) Alteration of condition of colloids. Stability of colloid systems.

COLLOIDS AND THE ULTRAMICROSCOPE. A MANUAL OF COLLOID CHEMISTRY AND ULTRAMICROSCOPY. By Dr. RICHARD ZSIGMONDY. Authorised translation by JEROME ALEXANDER, M.Sc. First Edition. John Wiley and Sons, New York. Chapman and Hall, Limited, London. 1909. Price \$3.00, or 12s. 6d. net.

His work, Svo size, contains 238 pages of subject matter, and two coloured plates in addition, with one page of explanations. There are 11 illustrations, and an alphabetical index of subjects. The extent of the subject may be gathered from the classification of the text. Limitation of the field. II. Classification of hydrosols according to two different points of view. III. History of the irreversible colloids. IV. Facts pointing to the homogeneity of gold hydrosols. Development of ultramicroscopy. V. Description of apparatus for making visible ultramicroscopic particles. Principles of the ultramicroscopical investigation of gold solutions, fluids, certain solutions and suspensions, &c. VI. Preparation of colloidal gold solutions. VII. Motion of the gold particles. VIII. Size and colour of the particles, &c. IX. Colour change of colloidal gold; also its precipitation and protection. X. Filtration experiments. I. Amicroscopic nuclei in colourless ruby glass. II. General remarks concerning metal hydrosols; also concerning the formation of hydrosol and hydrogel.

THE MANUFACTURE OF RUBBER GOODS. A PRACTICAL HANDBOOK FOR THE USE OF MANUFACTURERS, CHEMISTS, AND OTHERS. By ADOLF HEIL and Dr. W. ESCH. English Edition by EDW. W. LEWIS. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London. 1909. Price 10s. 6d. net.

Svo volume, containing 231 pages of subject matter, with 100 illustrations, and alphabetical indexes of subjects and names. The subject matter is classified by subdivision into the following groups:—I. Plan and arrangement of a rubber-goods factory. II. The raw material. III. The vulcanisation of rubber. IV. The mixings. V. The manufacture of soft-rubber articles. VI. Manufacture of ebonite. APPENDIX I. The regeneration or reclaiming of rubber waste as carried off in rubber factories.

PRACTICAL TESTING OF GAS AND GAS METERS. By C. H. STONE, Chief Inspector of Gas, Public Service Commission, 2nd District, New York. First Edition. John Wiley and Sons, New York. 1909. Price 15s. net. Chapman and Hall, Ltd., London.

Svo volume, containing 300 pages of subject matter, with additional Appendix, containing tables of numbers, of pages, 324 pages in all (exclusive of the preface), and alphabetical index of subjects. There are 51 illustrations, and the work is divided into Parts I. to IV., which in the sub-sections may be defined as follows:—PART I.—PHOTOMETRY. (i.) The photometer, &c. (ii.) Standards and burners. (iii.) Candle-power tests of oil- and water-gas, using candles as standards. (iv.) Photometric work with other standards and gases. (v.) Interpretation of results, and legal requirements. PART II.—CHEMICAL TESTS. (i.) Carbonic acid and sulphuretted hydrogen. (ii.) Total sulphur. (iii.) Other impurities. (iv.) Analysis of gas. PART III.—CALORIMETRY, SPECIFIC

GRAVITY, AND PRESSURE. (i.) Junker and Boys' calorimeters. (ii.) Other instruments and methods. (iii.) Consideration of results. (iv.) Specific gravity and pressure. PART IV.—TESTING OF METERS. (i.) The cubic foot and meter prover. (ii.) Method of testing meters.

ANLEITUNG ZUR BIOLOGISCHEN UNTERSUCHUNG UND BEGUTACHTUNG VON BIERSWÜRZE, BIERHEFE, BIER U. BRAUWASSER ZUR BETRIEBSKONTROLLE, SOWIE ZUR HEFENREINZUCHT. Von Prof. Dr. H. WILL. R. Oldenbourg's Verlagsbuchhandlung, München und Berlin. 1909. Strongly bound, price M.12.00.

Svo volume, containing 439 pages of subject matter, with 84 illustrations, and 3 tables; also an appendix of 8 pages; 447 pages in all. An alphabetical index of subjects closes the work. The classification of the subject is as follows:—I. Aim and scope of biological research in connection with brewery management. II. Varieties and definitions of beer worts. III. Varieties and definitions of bottom fermentation yeasts. IV. Yeast cells. V. Various groups of yeasts, etc. VI. Morphological and physiological functions whereby to distinguish the groups of culture yeasts and wild yeasts, the varieties of true yeasts, and the remaining budding fungi. VII. Deposits from stored and ripe beers. VIII. The different kinds of turbidity in beers. IX. Course of investigation of beer yeasts, young beer, stability samples, sick beers, beers in cask, and works. X. Biological water analysis. XI. Testing for sarcina (pediococci) according to the Bettges and Heller process. XII. Control of operations. XIII. Pure yeasts culture, and its technology, etc. XIV. Management of the pure yeast department; also, its biological control.

MANUAL OF VOLUMETRIC ANALYSIS FOR THE USE OF PHARMACISTS, SANITARY AND FOOD CHEMISTS, AS WELL AS FOR STUDENTS IN THESE BRANCHES. By HENRY W. SCHIMPF, M.D. Fifth Edition, revised and enlarged. John Wiley and Sons, New York. 1909. Price \$5.00, or 21s. net. Chapman and Hall, Ltd., London.

LARGE Svo volume, containing 697 pages of subject matter, and 102 illustrations, followed by an alphabetical index. The text is subdivided according to the following scheme:—I. General principles. II. Volumetric solutions. III. Indicators. IV. Apparatus used; weights and measures, etc. V. Methods of calculation. VI. Some vicarious volumetric methods. VII. Neutralisation analysis. VIII. Analysis by precipitation; also by oxidation and reduction. IX. Acetic acid and acetates; boric acid and borates; carbonic acid and carbonates; halogens; citric acid and citrates; cyanogen and compounds; nitrogen and compounds; oxalic acid and oxalates; oxygen and peroxides; phosphoric acid and phosphates; salicylic acid and salicylates; sulphur and its compounds. X. Metals: aluminium to zinc. XI. Sanitary and volumetric analyses of organic medicinal substances. XII. Analyses of milk and butter; technical examination methods for fats, oils, and waxes. XIII. Soap. XIV. Starch determination in cereals. XV. Determination of sugars. XVI. Alkaloids. XVII. Vegetable drugs. XVIII. Galenical preparations. XIX. Phenol; glycerin; tannin; formaldehyde; chloroform and chloral hydrate. XX. Assay of surgical dressings. XXI. Determination of compound ethers. XXII. Urine. XXIII. Some gasometric methods. The nitrometer. XXIV. Determination of nitrites; hydrogen peroxide; soluble carbonates, etc. XXV. Determination of urea and uric acid.

Patent List.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

11,988. Draper. Apparatus for separating substances of different specific gravities.* May 21.

12,004. Hansen and Winkler. Centrifugal apparatus for eliminating air or gas from liquid.* May 21.

- 12,154. Lofthouse. Apparatus for separating materials. May 24.
 12,463. Lennox. Revolving drying machines. May 26.
 12,465. Lennox. Machine for drying briquettes of peat or coal, salt, chemicals, etc. May 26.
 12,583. Bowing. Retorts and furnaces. May 27.
 12,661. Kruse, Dines, and Richardson. Filter presses. May 28.
 12,739. Calico Printers' Assoc., Browning, and Barlow. Apparatus for separating solid impurities from viscous or gummy solutions.* May 29.

COMPLETE SPECIFICATIONS ACCEPTED.

- 11,388 (1908). Eijndman. Apparatus for evaporating liquids. June 3.
 16,128 (1908). Steynis. Apparatus and process for simultaneously treating liquids and gases chemically active upon each other. June 3.
 1381 (1909). Hunt (Löve). Lixiviating apparatus, especially for extracting sodium nitrate from caliche. May 26.
 2101 (1909). Bramwell. Filtering apparatus. May 26.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 11,639. Oswald and Oswald. Suction or pressure gas plant.* May 17.
 11,675. Farnham. Gas producer. May 18.
 11,756. George. Gas producers.* May 18.
 11,800. Wilson. Apparatus for distilling coal. May 19.
 11,890. Crossley and Rigby. Gas producer plant for recovery of ammonia. [Comprised in No. 17,978, Aug. 27, 1908.] May 20.
 12,247. Scheidig. Production of power gas from bituminous fuel.* May 24.
 12,363. Koppers. Coking and gas-generating ovens.* May 25.
 12,465. Lennox. *See under I.*
 12,466 and 12,467. Haddan (Bruno-Patente-Verwerthungs). Manufacture of incandescence bodies.* May 26.
 12,474. Grote. Manufacture of filaments for incandescence electric lamps. May 26.
 12,534. Heinen. Gas generators.* May 27.
 12,569. Stearn and Topham. Manufacture of metallic filaments for incandescence electric lamps. May 27.
 12,652. Mehler and Lohmann. Measuring the calorific value of solid fuel. May 28.
 12,686. Bourdos. Manufacture of filaments for electric amps. May 28.
 12,742. Gearins, Fullwood, and Boucher. Manufacture of coke and gas, construction of gas retorts, and recovery of by-products. May 29.

COMPLETE SPECIFICATIONS ACCEPTED.

- 10,625 (1908). Boulton (Wulff et Cie.). Manufacture of briquettes of coal or ores. May 26.
 10,891 (1908). Wolfram Lampen A.-G. Manufacture of filaments for electric incandescent lamps. May 26.
 17,103 (1908). Bone and Wheeler. Gas producers. June 3.
 17,621 (1908). Coolidge. Manufacture of refractory electric conductors. May 26.
 27,144 (1908). Kroll and Saklatwalla. Production of pure and thin filaments for illuminating. May 26.
 28,349 (1908). Rindom. Gas retorts. June 3.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATION.

- 12,001. Knottenbelt. Petroleum and other hydrocarbon oils. May 21.

COMPLETE SPECIFICATION ACCEPTED.

- 10,959 (1908). Seidenschmur. Distilling crude petroleum. May 26.

IV.—COLOURING MATTERS AND DYESTUFFS

APPLICATIONS.

- 11,590. Claus and Co., and Claus. Manufacture of black colouring matters containing sulphur. May 17.
 11,736. Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of blue to violet dyestuffs of the gallocyanine series May 18.
 11,928. Newton (Bayer und Co.). Manufacture of blue dyestuffs of the anthracene series. May 20.
 11,929. Newton (Bayer und Co.). Manufacture of acid wool dyestuffs. [Addition to No. 7820 of 1909.]* May 20.
 11,930, 11,931, and 11,932. Newton (Bayer und Co.). Manufacture of anthracene derivatives. May 20.
 12,205. Newton (Bayer und Co.). Manufacture of azo dyestuffs. May 24.
 12,206. Newton (Bayer und Co.). Manufacture of β -methyltetramethylenediamine. May 24.
 12,207. Newton (Bayer und Co.). Manufacture of dyestuffs of the gallocyanine series. May 24.
 12,371. Meister, Lucius, and Brünig. Manufacture of disazo dyestuffs. [Ger. Appl. July 2, 1908.]* May 25.
 12,456. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of monoazo dyestuffs for chrome-mordanted wool. [Addition to No. 6729 of 1909.] May 26.
 12,568. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series May 27.
 12,653. Ullmann. Manufacture of dyestuffs of the anthraquinone series. [Ger. Appl., March 2, 1909.] May 28.

COMPLETE SPECIFICATIONS ACCEPTED.

- 11,866 (1908). Newton (Bayer und Co.). Manufacture of azo dyestuffs. May 26.
 15,908 (1908). Vidal. Colouring matters for animal fibres. June 3.
 20,368 (1908). Newton (Bayer und Co.). Manufacture of dyestuffs of the gallocyanine series. June 3.
 20,709 (1908). Ransford (Cassella und Co.). Manufacture of dyestuffs. June 3.
 27,095 (1908). Knoll und Co. Phenol-phthalein compounds. May 26.
 2290 (1909). Act.-Ges. f. Anilinfabr. Manufacture of sulphurised dyestuffs soluble in water. May 26.
 7905 (1909). Act.-Ges. f. Anilinfabr. Manufacture of disazo dyestuff. June 3.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

- 11,729. Chem. Fabr. Griesheim-Elektron. Treatment of mercerised cotton goods. [Ger. Appl., Oct. 19, 1908.] May 18.
 11,881. Togo Spinning Co., and Atack. Apparatus for treating fibrous material with dye and other liquor May 20.
 12,772. Denton and Atkinson. Mercerising. May 29.

COMPLETE SPECIFICATIONS ACCEPTED.

- 7345 (1908). Calico Printers' Assoc., and Fourneau. Production of black on textile fibres. June 3.
 7671 (1908). Halliwell, and Mather and Platt, Ltd. Apparatus for dyeing, bleaching, and treating fibrous materials. May 26.
 16,330 (1908). Leachman. Treatment of wool, cotton, flax, and other fabrics. May 26.
 17,267 (1908). Ransford (Cassella und Co.). Treatment of dyeings with sulphide colours. May 26.
 20,200 (1908). Johnson (Kalle und Co.). Production of discharge effects on textile fibres or fabrics. May 26.
 21,280 (1908). Crefelder Seifenfabr. Stockhausen und Traiser. Emulsions for use in washing raw wool and for other purposes. June 3.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

- 11,694. Lawes and Co., and Davis. Manufacture of tartaric acid. May 18.
 11,890. Crossley and Rigby. *See under II.*
 12,106. Carrick and Pattison. Preparation of iron compounds.* May 22.
 12,226. Feld. Treatment of metallic cyanides to obtain hydrocyanic acid.* May 24.
 12,235. Macan. Production of zinc oxide from the residues of calcination of calamine tailings, etc. May 24.
 12,241. Elborne and Keeble. Manufacture of nitrogen compounds.* May 24.
 12,399. Bell. Production and application of oxides of chromium. May 26.
 12,480. Eckford. *See under XIII.1.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 10,781 (1908). England. Treatment of sulphate of ammonia. May 26.
 20,171 (1908). Erste Oesterr. Soda-fabr., and Opl. Manufacture of sulphuric acid. May 26.
 24,264 (1908). Kettler. Production of compounds containing nitrogen and oxygen. June 3.
 26,581 (1908). Telchinnia. Manufacture of sodium cyanide. June 3.
 52 (1909). Firman and Cocksedge. Apparatus for making sulphuric and other similar acids. May 26.
 1381 (1909). Hunt (Love). *See under I.*

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

- 11,633. Heller and Baugartl. Manufacture of ceramic ware.* May 17.
 12,180. Dennis. Kiln for firing pottery, enamel ware, glass ware, enamelling, etc. May 24.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATION.

- 12,587. Hasselmann. Preservation of wood and composition therefor. [Ger. Appl. May 27, 1908.]* May 27.

COMPLETE SPECIFICATIONS ACCEPTED.

- 12,597 (1908). Cawley and Moore. Manufacture of a new building material. May 26.
 14,619 (1908). Brearley and Moorwood. Manufacture of silica, bricks, ganister, and other refractory materials. May 26.
 7197 (1909). Brearley and Moorwood. Manufacture of silica bricks and ganister. May 26.

X.—METALS AND METALLURGY.

APPLICATIONS.

- 11,702. Cowper-Coles. Case-hardening iron and steel. May 18.
 11,703. Cowper-Coles. Desulphurising and dephosphorising iron. May 18.
 11,863. Fennell and Sackett. Furnaces for treating metals and metalliferous ores.* May 19.
 11,914. Wallis. Metallurgy of tin. May 20.
 12,018. Queneau. Metallurgy of zinc. May 21.
 12,198. Huntington. Agglomerating and desulphurising ores and separating volatile from non-volatile or metalliferous substances.* May 24.
 12,266. Wynne. Treatment of ores, etc. May 25.
 12,337. Reid. Separating and refining metals. [U.S. appl., Sept. 23, 1908.]* May 25.
 12,565. Crispo. Extraction of copper from copper residues. [Addition to No. 6730 of 1907.]* May 27.

COMPLETE SPECIFICATIONS ACCEPTED.

- 8534 (1908). Bradley. Treating metals to prevent oxidation and corrosion. May 26.

- 10,625 (1908). Boulton (Wulff et Cie.). *See under II.*
 11,598 (1908). Rübel. Decarburisation of cast iron. May 26.
 12,323 (1908). Boulton (Jones). Reduction of iron ore. May 26.
 12,403 (1908). Hopkins. Apparatus for smelting zinc ore, galvanisers' dross, etc. May 26.
 17,229 (1908). Scott. Methods and apparatus for tin smelting. June 3.
 17,759 (1908). Churchward. Heat treating and quenching alloyed steels. June 3.
 19,035 (1908). McCarty. Smelting and refining iron and steel. May 26.
 19,356 (1908). McCarty. Metallurgical furnaces for iron and steel. May 26.
 22,455 (1908). Baume. Producing a coating of platinum on base metals not easily fusible. May 26.
 25,024 (1908). Davis and Fearon. Process for pickling metals. June 3.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

- 11,760. New Ignition Synd., Ltd., and Sandy. Electrolyte for electric batteries. [Addition to No. 10,520 of 1908.]* May 18.
 11,926. Newlands and Parkinson. Electrolyte for primary batteries. May 20.
 12,507. Ruthenburg. Electrodes for electric furnaces. May 27.
 12,677. Benkö. Carbon electrodes for galvanic elements.* May 28.
 12,709. Electrolytic Alkali Co., Connor, and Stubbs. Electrodes. May 29.

COMPLETE SPECIFICATIONS ACCEPTED.

- 4410 (1908). Gibbs. Production of metallic articles by electrodeposition. June 3.
 10,520 (1908). New Ignition Synd., and Sandy. Electrolyte for use in electric batteries. May 26.
 8443 (1909). Salpetersäure Ind.-Ges. Electric furnaces for treating gases or gas mixtures. May 26.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

- 11,607. Rhodin and House. Manufacture of soap powder. May 17.
 12,062. Böhm. Manufacture of high grade fatty acids. May 21.

COMPLETE SPECIFICATION ACCEPTED.

- 21,280 (1908). Crefelder Seifenfabr. Stockhausen und Traiser. *See under V.*

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.) PIGMENTS, PAINTS.

APPLICATIONS.

- 11,755. Bellet. Manufacture of ultramarines.* May 18.
 12,480. Eckford. Purification or treatment of red or orange lead or lead paste. May 26.
 12,498. Dalby and Benson. Paint and the like compositions.* May 27.

(C.)—INDIA-RUBBER.

APPLICATIONS.

- 12,275. Taylor. Impregnation of canvas with india-rubber, gutta-percha, balata, &c., and recovery of volatile liquids. May 25.
 12,424. Wildermann. Manufacture of ebonite capable of resisting the action of chlorine. [Addition to No. 18,269 of 1908.]* May 26.
 12,526. Robinson. Substitute for rubber. May 27.

COMPLETE SPECIFICATION ACCEPTED.

27,090 (1908). Price. Preparing and packing rubber for preservation and transport. June 3.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c. APPLICATIONS.

12,211. Prutz. Manufacture of leather. May 24.
12,687. Winterbottom and Egerton. Manufacture of imitation leather. May 29.

XV.—MANURES, &c.

APPLICATIONS.

11,713. Lehbauer, Meer, Hollinshead, and Moody. Manufacture of manure. May 18.
11,924. Johnson and Austin. Manufacture of manure.* May 20.

COMPLETE SPECIFICATION ACCEPTED.

26,829 (1908). Ortmann. Preserving the nitrogen in liquid farmyard manure. June 3.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATION.

12,500. Fawcett, Preston, and Co. (Hatton). Treatment of sugar-producing plants. May 27.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

COMPLETE SPECIFICATION ACCEPTED.

12,780 and 12,781 (1908). Loring. Ageing, conditioning, and bleaching flour. June 3.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATION.

12,667. Fieldhouse, and Oxychlorides, Ltd. Purification of sewage or trade waste by the under-drainage system. May 28.

(C.)—DISINFECTANTS.

COMPLETE SPECIFICATION ACCEPTED.

15,931 (1908). Inray (Meister, Lucius, und Brüning). Manufacture of antiseptics. June 3.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

11,625. Lederer. Manufacture of cellulose compounds in definite shapes. [Ger. Appl., July 3, 1908.]* May 17.
11,700. Friedrich. Producing cellulose formations such as threads, ribbons, films, &c.* May 18.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

11,933. Smith and Marshall. Bacilli culture and preservation. May 20.
12,065. Poulverel. Manufacture of synthetic essence of turpentine.* May 22.
12,745. Wetter (Hoffmann-La Roche und Co.). Manufacture of guaiacolsulphonic acid and its salt.* May 29.

COMPLETE SPECIFICATIONS ACCEPTED.

7094 (1908). Justice (Boehringer Sohn). Manufacture of lactic acid. May 26.
11,248 (1908). Hertkorn. Manufacture of esters of borneol. June 3.
12,472 (1908). Wellcome and Barrowcliff. Manufacture of therapeutic compounds. May 26.
18,047 (1908). Austerweil. Production of camphor or camphor-like material. June 3.
20,050 (1908). Hertkorn. Manufacture of camphor. June 3.
8421 (1909). List, and Saccharin-Fabr. A.-G. vorm. Fahlberg, List, und Co. Manufacture of o-sulphamido-benzoic acid. June 3.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

COMPLETE SPECIFICATION ACCEPTED.

19,297 (1908). Boulton (Neue Photographische Ges.). Manufacture of pigment pictures. May 26.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

12,506. Kilburn (Pieper). Explosives. [Comprised in No. 15,916, July 27, 1908.] May 27.
12,552. Easton. Explosives. May 27.

COMPLETE SPECIFICATION ACCEPTED.

8358 (1908). Trench and Lynn-Smart. Manufacture of gunpowder. May 26.

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JUNE 30, 1909.

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PROCEEDINGS OF THE 28TH ANNUAL GENERAL MEETING.

ERRATA.

This Journal, June 15th, 1909, p. 553, col. 2.

Mr. R. FORBES CARPENTER, in moving the adoption of the Report of Council, is reported to have said that "it was a letter from Mr. Reid to Lord Rayleigh which induced the Royal Society to appoint two representatives from that Society on the Board." The actual text was as follows:—"It was due to the action of Mr. Reid in bringing before the Council the proposed draft constitution of the Governing Body of the Laboratory that the Council resolved that the then President, Mr. George Beilby, should bring before Lord Rayleigh the claims of the Society of Chemical Industry for representation. This was the origin of the now celebrated letter of Dr. then Mr. George Beilby, to Lord Rayleigh, which secured to the Society the representation desired." Mr. Carpenter also went on to say:—"He also desired to emphasise the importance to the Society of the proposal of the English Ceramic Society to obtain skilled assistance in considering systematically the questions arising in connection with refractory materials. The Institution of Gas Engineers was already considering this matter, stimulated by the important paper of Mr. Bywater read at its 1908 meeting, and was also preparing to co-operate with the English Ceramic Society. No more important conferences could be held, having regard to the magnitude of the gas and coke oven industries."

Page 580, col. 1, line 2, for "rendu" read "rendus."

kind of plant. Unfortunately these difference-meters, as they may be called, have one defect, namely, that small quantities of steam are not registered. To what incorrect statement this defect can lead may be shortly exemplified as follows:—

If a difference-meter be installed before two engines of 30 and 150 h.p. respectively, then with both engines running the meter gives exact information as to the quantity of steam consumed. But if the 150 h.p. engine be stopped, the difference-meter does not show any measurable deflection, in other words, the steam consumed by the 30 h.p. engine alone cannot be measured. Therefore, in cases where the steam consumption varies considerably, these difference-meters cannot be used if a high standard of exactness is required.

The Farbenfabriken vorm. Friedr. Bayer & Co. used a number of these difference-meters for a long time, until they succeeded in 1902 in devising an instrument considerably superior in every respect to the difference-meter above mentioned. This meter determines the sectional area of the current of steam; hence it applies a principle quite different from that of the differential-meter. The new steam-meter is based on the following simple formula which applies to gases and liquids:—

$$W = S \cdot \gamma \cdot V$$

In this formula, W is the total steam passing through the meter, expressed in kg. per. sec., S the sectional area in sq. meters, V the velocity of steam in meters per. sec., and γ the weight of 1 cbm. of steam of the average pressure expressed in kg.

London Section.

Meeting held at Burlington House on Monday, May 3rd, 1909.

DR. J. LEWKOWITSCH IN THE CHAIR.

A NEW STEAM-METER.

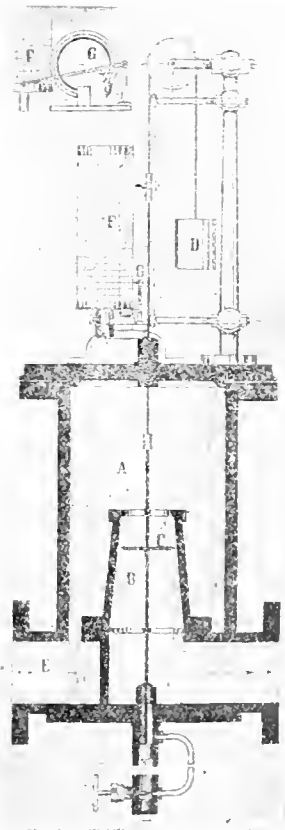
BY E. A. J. KUHNKE.

In most chemical factories, steam is one of the chief items in the cost sheet. In spite of this undeniable fact, hitherto there has been no suitable instrument for accurately determining the amount of steam consumed by each plant and apparatus, and for permanently controlling it, whereas for water, gas, electricity, and similar means for conveying power, available measuring instruments have existed for some time and are frequently used with advantage.

The first measuring instruments for steam were constructed after the type of the screw-propeller-meter, at the high speed at which the blades must run in view of the high velocity of the steam, and, especially, the difficulty of transmitting the motion of the propeller to a counter outside without causing too much friction, very soon led to the abandonment of this system. Other devices which became important in practice were based on the idea of producing artificial throttling of the current of steam and consequently a difference pressure. This difference was then measured and the quantity of steam passing through a conduit was calculated with the aid of Napier's formula,

$$W = v \cdot S \cdot \sqrt{\frac{p_0 - p}{\gamma_0}}$$

A number of apparatus based on such devices have been brought out and these instruments admittedly present an important advance in the measurement of steam, and they are in use with good effect in every



Under all conditions of gases passing through a pipe, S will, as a rule, remain invariable, while γ and V will

vary. However, it is possible, by making S variable, to make V , which can only be measured with difficulty, constant for each γ . This possibility, viz., of keeping V constant in a gas current by varying the sectional area has been effected in a simple manner. In a casing a hollow truncated cone is fixed and within it a disc which can move freely up and down is suspended by a wire. The wire is led through the bonnet of the casing over a pulley and balanced by a counter weight. The steam entering the box must pass through the truncated cone in order to flow to the place of consumption; consequently the disc is forced downwards and stops in a position the sectional area of which is determined by the actual consumption of steam. That is to say, the disc balanced by the weight keeps such a position that the difference of the pressure in front of it and behind it remains constant. If the quantity of steam passing through the box increases, owing to an increase in the consumption, the difference of pressure before and after passing the disc, and consequently the velocity of the steam, would increase if the disc were fixed and the sectional area of the passage constant. But the disc, being free to move downwards, responds to the increase of pressure and opens a larger annular section for the steam and so restores the original difference of pressure and velocity. Of course, the case will be the reverse if the consumption decreases; the disc will then rise in proportion to the diminishing difference of pressure and thus reduce the sectional area. In all cases the difference in pressure is dependent upon the weight hanging on the wire. This weight must be balanced by the pressure of the steam on the disc. The positions of the disc having been once adapted to the actual conditions, the quantities of steam passing through, are registered on a clock-work drum, mounted upon the bonnet without any intervening lever, so that it is possible to ascertain at any time the actual section available for the steam by measuring the distance of the indicator from the baseline, provided, of course, that the construction of the truncated cone is known. If the sectional area available over a long period has to be ascertained, it is necessary—in case the rate of consumption has varied—to ascertain the average distance of the line, traced by the pencil, from the baseline. This can be done most simply and exactly by means of a planimeter. Of course, to make this possible the annular sections passed by the steam must increase in linear proportion, so that the section of the side of what we have called the truncated cone cannot be a straight line—for then the increase of section would be in proportion to the square of the distance traversed by the disc. The section of the side of the "cone" must be a parabola. The disc moving within the hollow truncated cone has exactly the same diameter as the upper opening of the truncated cone, so that in its topmost position it closes tightly the opening. By this arrangement even the smallest quantity of steam passing through the apparatus must be indicated. This is an excellent feature of the sectional meter and herein lies its superiority over all other systems. The specific weight, that is the weight of steam per cbm. is, for saturated steam, proportional to the pressure. Therefore when the pressure is known, the specific weight is also known, and it is only necessary to register continuously the steam pressure. This is done on the same clock-drum, on which the scale distances are traced, at its lower end by means of a spring steam gauge in the usual way. Of the three factors necessary for determining the quantity of steam by means of the above given formula, the velocity is still wanting. This has been kept constant for each specific weight, as shown above, by enabling the sectional area to vary and to adapt itself to the consumption of steam. Thus it had to be determined for all specific weights coming under consideration, and for this purpose the following arrangement was made: A meter, finished and ready for use, was fixed in a steam conduit and the steam passing through was condensed in a cooling-apparatus and weighed. In this manner W was exactly determined; S and γ follows from the diagram of the meter and in the equation $W = S \cdot V \cdot \gamma$ only the quantity V was wanting. This can be obtained by dividing G by $S \gamma$. In this way the velocities for the specific weights

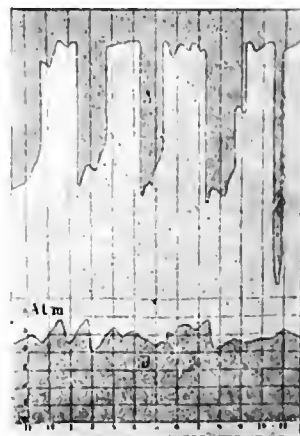
of steam were determined for the different pressures from atmosphere to atmosphere by a large number of experiments. The velocities corresponding to the intermediate specific weights were found by interpolation. Now by multiplying the three quantities, S , γ and V , each required quantity of steam may be ascertained.

As it would be somewhat cumbersome to carry out the calculation for each observation, it may be simplified by tabulating the quantities of steam corresponding to each square mm. of increase of section and for the specific weights from 1/10 to 1/10 of an atmosphere.

The average pressure and the average distance of the sectional line from the base-line being found from the diagram by means of a planimeter, the consumption of steam per mm. pressure during 12 hours can be determined with the aid of the table. This number need only be multiplied by the found distance of the sectional line in order to obtain the total consumption of steam in kilos. for 12 hours.

So far we have spoken only of saturated steam, but by means of the meter superheated steam may be measured as well, without introducing any complication. Only special tables are needed for superheated steam, the specific weight being not only dependent on the pressure but on the temperature as well.

Though the chief use of the instrument is to ascertain the quantity of steam consumed, yet the way it throws light on the manner in which the steam has been consumed by registering the consumption continuously must be mentioned. For further explanation I refer to the enlargement of an original diagram from one of the



plants of the Farbenfabriken. From the curves of the diagram it will be seen that 4 operations have been performed, the duration of which in every case amounted to somewhat less than 2 hours, with the exception of the last one where the workman left the steam valve open unnecessarily for $\frac{1}{2}$ hour. Between 10 and 11 o'clock an extraordinarily high consumption of steam attracted attention and an enquiry as to its cause was made. It was found that at this time steam had been used for warming water, although sufficient warm water was available from another plant. A large number of such characteristic diagrams could be shown but this one may be considered sufficient for explaining the economical value of the instrument, as it informs the manager about the working of his men, and enables him, in case of need, to prevent any waste of steam.

The accuracy of the meter is excellent. The Farbenfabriken guarantee accuracy within the limit of about 3 per cent. The instruments are carefully tested before leaving the workshop and the limit of ascertained error, as a rule, does not exceed 1 per cent. The accuracy of the meter remains unchanged, for the various parts, namely the hollow cone and the disc upon which the accuracy depends, are scarcely subject to any wear and tear, the velocity of the steam passing through the apparatus being so low (on the average about 30 m.

that it does not have any destructive effect on the metal parts. Steam meters, the accuracy of which depends on springs or upon fixed quantities of mercury on the other hand very soon suffer a change.

This apparatus was invented in 1902,* but hitherto it has only been used in the factories of the Farbenfabriken.

The reliability of the meter having been established by six years' practical use, the Farbenfabriken determined, at the beginning of the last year, to offer it for sale. The somewhat large number of apparatus delivered during the short period proves that other factories also have obtained good results with the apparatus. Therefore I am not saying too much if I claim for this steam meter that it constitutes a valuable improvement in measuring the consumption of steam.

DISCUSSION.

The CHAIRMAN said that it was hardly necessary to emphasise the usefulness of such an apparatus as this. One of the chief items in the cost sheet of a works was that of steam; and hitherto there had in many works more or less guess work as to the amount of steam used in certain operations. He could recall experience of his own in trying to ascertain how much steam was required to boil a ton of soap, as to which the most divergent ideas obtained, it being usual to look into the bills for coal at the end of the year and divide the sum total by the number of tons of soap made. He himself had tried, by a series of elaborate experiments, analyses, and calculations to arrive at reliable figures. All this trouble would have been avoided by using an automatic apparatus of the kind shown. Again, in distilling glycerin, he wished to ascertain how much superheated steam was required to produce one ton of finished glycerin. Many years ago, he devised ways and means to condense the steam specially and weigh it; moreover all the glycerin waters had to be analysed. This method was accurate, but was very troublesome. In calculating the cost of the steam required in different departments applied from a range of boilers, guess work was still more prominent. In one works with which he was acquainted, the time was noted during which the steam valves were open, and the number of turns and parts of a turn to which they were open were counted, then by calculating total cost of the steam produced in the works, some kind of guess work the manager persuaded himself that he had arrived at the figure to be charged to each different plant for steam. The Chairman then asked whether the condensed water, or the pulverised water carried away with the steam, might not be calculated as so much steam. It would be, of course, possible to put baffle in so as to trap and lead away the condensed water. In chemical works this might be necessary. He remembered a case where he had guaranteed for evaporating apparatus a certain amount of steam for evaporation. During various stages of the evaporation the partly concentrated liquid had to be boiled up, for which a certain amount of steam was required. Of course the case of a guarantee it was to the advantage of the over-scrupulous people to send through the pipes much wet steam as possible, so as to increase, to the detriment of the guarantor, the amount of water to be evaporated off. In a case like that an extra condensed water meter would have to be inserted, which, of course, did nothing to do with the principle of the present steam meter. He would therefore like to ask whether the condensed water, or that carried away with the steam, might not be calculated as so much weight of steam. The cost of the instrument as compared with other apparatus, say that of Parenty, which he understood worked with mercury, and had come into somewhat general use on the Continent, was also of importance.

Mr. E. HATSCHKE said it was always a matter of very great difficulty to get a paraboloid correct, and he understood that the exactness of this instrument depended entirely upon the paraboloid being right for that parameter. The turning of a paraboloid was found to be

a very difficult problem in connection with mirrors; but of course in a parabolic mirror the apex of the paraboloid only was used, which was even more difficult. However, even a truncated paraboloid, such as was used here, was extremely difficult to make correct; whilst, if it was not correct, it was useless if used with constant ordinates on the recording drum. He would therefore like to know what means were taken to get this correct; or, if not, what means could be taken to calibrate the drum?

Mr. G. N. HUNTLY asked what was the capacity of the meter, *i.e.*, how many gallons of water per hour, in the form of steam, would pass through it. He was also interested in the question suggested by the Chairman as to how far the moisture in the steam would affect the matter, because even a water drip could not ensure steam going through dry. In boiler trials one of the greatest difficulties was to determine the exact dryness of the steam. The density of the steam was one of the factors, and therefore some means to determine the exact wetness of the steam seemed essential to the practical working of the system.

Dr. E. FEILMANN asked if there was not a certain amount of inaccuracy in passing the steam through what would be in the case of small quantities a comparatively narrow slit. One would expect a certain eddying action round the slit which would alter the difference of pressure on the two sides. He did not know whether it would be sufficient to practically affect the accuracy of the registration, but it would be interesting to have some information upon that point.

Mr. J. W. HINCHEY said that a number of experiments had been made upon gases flowing through pipes, and the results went to show that it was necessary to guide the gases in the direction you wanted. It seemed to him that the question raised by Dr. Feilmann would be met by providing a guide at the edge of the disc to prevent eddies. In designing the apparatus a "feeling" for the flow of the steam had not been present at all. The notion apparently was that steam turned corners as easily as possible. But in measuring the velocity of gases passing fans and so on, it had been found necessary to provide a disc guide at the end of the tube inserted in the stream to overcome these eddy currents. Had the edge of the disc been experimentally modified for this purpose, and could they not by that means get rid of some part of the three per cent. error which is said to exist?

Mr. FRANK HEMINGWAY asked whether any slight mechanical defects in construction might not be overcome by carefully calibrating with dry steam before the instrument was sent out.

Mr. J. C. PHILIP said that in constructing a paraboloid of revolution for search-light mirrors a very ingenious method had been used for cheaply reproducing the exact shape of an accurately made and costly pattern-paraboloid. This method might be adopted for preparing paraboloids required in the instrument under discussion. A convex parabolic mould was carefully made of glass and the outside was accurately ground to the exact theoretical shape desired, and on this a silver film was deposited chemically. On that again copper was electrolytically deposited to any desired thickness and the metal paraboloid was afterwards removed from the glass by slightly warming; this separation occurred readily owing to the difference in thermal expansion between the glass and the metal. The concave paraboloid of revolution thus obtained was shown by optical methods to be of extraordinary accuracy in the case of mirrors, equal in fact to that of the pattern paraboloid. The method was described in 1898 in a paper by Mr. Cowper-Coles published in the *Journal of the Institute of Electrical Engineers*, Vol. 27, p. 99.

Dr. L. T. THORNE asked what range of work they could get in this meter. Of course it would depend on the size of the truncated cone. But could they in practice get a considerable range in the quantity of steam measured in one meter?

Mr. KUNKE, in reply, said the condense water was not calculated as steam. The casing in which the hollow truncated cone was placed acted as a separator for the water, and the water which collected in the bottom part of the casing was carried away by a trap. The

Farbenfabriken manufactured at present three different sizes of meters, for pipes with a diameter from 60, 100, and 150 mm., which could be used for any size of piping without affecting the accuracy of the meter. The prices were about the same as those of other meters obtainable in the market. The parabola was made on the lathe; that had, of course, to be done with greatest care, as the exactness of the meter depended on this point. It was impossible to test the accuracy of the meter by a measuring instrument, but the cone was tested in the following way:—The steam meter is fixed behind a normal meter which has been tested in all positions of the disc by condensing the steam which has passed through and weighing the water. Through both instruments the same quantity of steam is passing and consequently the positions of the discs should be the same with all quantities of steam. Whenever it is impossible to obtain exact agreement by changing the weight, the cone is discarded as useless.

The following table shows the maximum of steam passing through in 1 hour for the three different kinds of meters:—

	At 1 atm.	At 2 atm.	At 3 atm.	At 4 atm.	At 5 atm.	At 6 atm.
m.m.	Kg.	Kg.	Kg.	Kg.	Kg.	Kg.
60 ..	640	775	885	985	1070	1140
100 ..	1275	1545	1765	1965	2135	2280
150 ..	2475	2995	3420	3805	4145	4455

	At 7 atm.	At 8 atm.	At 9 atm.	At 10 atm.	At 11 atm.	At 12 atm.
m.m.	Kg.	Kg.	Kg.	Kg.	Kg.	Kg.
60 ..	1225	1295	1360	1420	1480	1535
100 ..	2445	2585	2715	2840	2960	3070
150 ..	4740	5010	5270	5520	5740	5965

In reply to Mr. Hinchley, as the disc could freely move up and down, it was probable that no rotatory motions existed, and if they did exist, they were harmless, as the velocity of the steam was constant at all positions of the disc. The first experiments were made with an apparatus in which the disc was formed like a bell. It was found that the velocity of the steam was much higher in the upper positions of the bell than in the lower ones. Probably rotatory motion must be held to account for this appearance.

Meeting held at Burlington House on Monday, June 7th, 1909.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE COLORIMETRIC DETERMINATION OF LEAD IN THE PRESENCE OF IRON WITH SOME NOTES ON THE PREPARATION OF LEAD FREE REAGENTS BY COPRECIPITATION WITH FERRIC HYDROXIDE.*

BY JOHN M. WILKIE, B.Sc., A.I.C.

The determination of minute traces of lead dates from the reading of Warington's paper (this J., 1893, 97). His work concerned itself with citric and tartaric acids and showed that lead could be determined colorimetrically with considerable accuracy in alkaline solution using ammonium sulphide as precipitant. He insisted on the fact that comparisons must be made between citrate or tartrate solutions and not between one of these and water. To avoid interference due to iron, he advised that the "solution of tartaric or citric acid, made alkaline with ammonia, should be treated with a few drops of potassium cyanide and heated to near boiling."

This conversion of iron to soluble complex cyanides

not affected by alkaline sulphide had been previously recommended by Teed (Analyst, 1892, 142), as follows:—"Iron does not at all interfere with the test. If an iron salt is added to lemonade, for instance, and made alkaline with ammonia the iron is kept in solution by the tartaric acid, and on addition of the potassium cyanide is converted into potassium ferrocyanide or ferricyanide as the case may be. To liquids not containing tartaric acid it is easy to add a little in the event of iron being present."

Teed, apparently, considered that the tartaric acid merely kept iron in solution, and he drew no distinction between ferrous and ferric iron. Citric acid also forms complexes with iron salts. Teed assumes that the complex does not hold the iron so firmly as to inhibit its complete conversion into ferrocyanide or ferricyanide. Experiments were made to see whether this was so, and also if small amounts of iron were so firmly held as not to react to alkaline sulphide in the absence of cyanide. The mode of testing was as follows:—12 grms. of tartaric acid (in the form of a stock solution 2 c.c. of which contains 1 gm. acid) were placed in a Nessler cylinder with 0.05 mg. metallic lead (in solution as nitrate: 1 c.c.=0.1 mg. of lead) and a slight excess of .880 ammonia, and the volume after cooling was adjusted to 50 c.c. Five similar tests were prepared to which were added, before the addition of ammonia, ferrous sulphate, in amounts respectively equivalent to 0.00, 0.05, 0.10, 0.15 and 0.20 mg. of metallic iron.

The tints developed on adding 3 drops of a sodium sulphide solution to each were practically indistinguishable. Larger volumes of ferrous iron however developed colorations corresponding to much more lead than that actually present. Identical tests were next prepared, but to each of these was added 1 c.c. of 10 per cent. potassium cyanide after addition of the ammonia. The maximum amount of iron now coverable was about 1 mg. With citric acid similar results were obtained, but the tints in presence of iron were in all cases somewhat different from those obtained in the absence of iron.

When ferric iron was substituted for ferrous iron much more interesting results were obtained. Taking citric acid first, it was found that with the addition of as much as an amount of ferric iron as 0.10 mg. a persistent yellow coloration was developed which did not disappear on making alkaline with ammonia and adding potassium cyanide. Boiling the alkaline solution discharged the colour to some extent, but on adding sodium sulphide to the cooled solution the tint produced was quite yellow and not comparable with that produced by the same amount of lead (0.05 mg.) in the absence of iron. Tartaric acid behaved somewhat similarly but the tints did not deviate so widely from the normal. That the colorimetric determination of lead in citric and tartaric acid was made impossible by such trifling amounts of ferric iron was so surprising that attention next was turned to inorganic salts. No work appears to have been published on the applicability of the alkaline sulphide method to solutions free from tartaric acid. Hill (Chem and Drug., 1905, I., 388; this J., 1905, 901), while rendering an important service by showing that lead free standards in some cases were not absolutely essential, assumed that tartaric acid played no special part. Unmindful of the fact that ammonia quantitatively precipitates iron from its inorganic solutions, he determined lead in inorganic salts by adding sodium sulphide after addition of ammonia followed by potassium cyanide. He also deprecates heating with the potassium cyanide. He quotes an experiment, confirmed by myself, for ferric iron, to show that in the presence of 0.05 mg. of iron the process thus simplified hopelessly breaks down, that is to say, the colour of the finely divided ferric hydroxide quite covers that due to the lead sulphide. Of course, this difficulty could be removed by filtration through a close textured filter, but ferric hydroxide quantity drags down with it any lead present in solution. The question, now to be solved, was whether ferric iron in amount proportionate to the lead normally occurring in pure chemicals, had the same effect. The substance worked on was sodium chloride and potassium nitrate both of which contained negligible amounts of lead (less than 5 parts per million) and still smaller amounts

* Taken as read.

iron. The mode of working was very similar to that already described.

Substance taken.	Ferric iron added.	Lead added.	Ratio of iron to lead.	Lead in filtered solution.
Sodium chloride .. 12 gr.	mg. 4.0	mg. 0.05	80 to 1	none
" " " 12 "	4.0	0.20	20 : 1	none
" " " 12 "	1.0	0.10	10 : 1	none
" " " 12 "	0.5	0.10	5 : 1	none
Potassium nitrate 12 "	1.00	0.05	20 : 1	none
" " " 12 "	0.50	0.05	10 : 1	none
" " " 12 "	0.25	0.05	5 : 1	none
" " " 12 "	0.10	0.05	2 : 1	none
" " " 12 "	0.05	0.05	1 : 1	0.02 mg. (approx.)

Experiments 7, 8, and 9 were repeated by a colleague, except that the solution of potassium nitrate containing added iron and lead was cooled in each case before adding the ammonia and potassium cyanide. Precisely identical results were obtained. Experiments were next made to show that:—

- 1. Potassium cyanide plays no special part in the coprecipitation of lead by ferric hydroxide, bearing in mind that lead cyanide is an insoluble salt.
 - 2. Subsequent heating with potassium cyanide has no appreciable solvent action.
 - 3. The precipitation of lead is independent of a high acid concentration.
- A mixture of 0.05 mg. lead and 0.10 mg. ferric iron, used in the forms already described, was diluted to a volume of 50 c.c. with cold distilled water, excess of ammonia added and the whole filtered through a close textured filter. No lead was found in the filtrate, thus supporting statements 1 and 3.

A similar experiment was next made in which 1 c.c. of 10 per cent. potassium cyanide solution was present, after excess of ammonia had been introduced, and the whole boiled several minutes. No visible diminution in the amount of the ferric hydroxide occurred and the cooled filtrate showed no lead to sodium sulphide.

Experiments were made with magnesium sulphate as a type of salt of a metal having an insoluble hydroxide. Similar results were obtained, but to insure complete recitipation of lead about ten times as much iron must be added—limited amounts of ammonia being used.

The futility of professing to adopt Teed's process, while omitting tartaric acid, is thus demonstrated (*cf.* an anonymous correspondent in the *Pharm. J.*, 1908, I, 181). The direct bearing of the above on the preparation of lead re chemicals must not be overlooked—all that is necessary

to add a minute amount of a ferric salt (chloride), make distinctly alkaline with ammonia, and filter out the coprecipitated hydroxides. This process is now being used for the preparation of lead-free ammonium chloride. In this connection it has been puzzling to account for the fact that commercial salts, *e.g.* ammonium chloride, sodium sulphate, etc., often show greater freedom from lead than the purer salts. In the light of the above the reason is obvious. It is also curious to reflect that the U.S. Pharmacopeia recommends testing for heavy metals in ferrous sulphate by adding hydrogen sulphide to the filtrate obtained after precipitation of iron as ferric hydroxide.

Since in the presence of ferric iron Teed's process breaks down for citric and tartaric acids, and in the simplified process of Hill entire loss of lead may occur, seemed best to now consider whether the method was heretofore wrong or only in points of detail. For quantitative conversion to soluble complex cyanides it is obvious that precipitation of iron should take place in intimate contact with the potassium cyanide—and at if this were done the tartaric acid might be safely omitted. Preliminary experiments showed that an essential difference existed between ferrous and ferric iron. With the latter the solution always became colourless on treatment with potassium cyanide—no matter to surprise considering the high tinctorial power of

potassium ferriocyanide. Consequently, the first series of experiments was performed with ferrous iron (ferrous sulphate). Brief consideration will show that intimate precipitation of ferrous hydroxide in the presence of potassium cyanide may be effected in one of two ways:—either the acid solution of the iron salt may be added to the potassium cyanide or the potassium cyanide to the iron solution. If the acid is present in considerable excess the alkalinity of the potassium cyanide may be increased by addition of ammonia; in all cases the liquid must finally possess a strong alkaline reaction.

A solution of ferrous sulphate was made of which 5 c.c. contained 1 mg. of ferrous iron, and 0.2 c.c. normal sulphuric acid. In one experiment 1 c.c. of this solution was diluted to 40 c.c., 1 c.c. of 10 per cent. potassium cyanide added slowly with constant rotation followed by 0.5 c.c. 880 ammonia and the colourless solution adjusted to 50 c.c. On addition of sodium sulphide no colour was developed and the solution was practically water white. The experiment was repeated four times, adding .05 mg. lead in each case and 0.05, 0.10, 0.15, 0.20 mg. of ferrous iron respectively.

In all cases colourless solutions were obtained which on addition of sodium sulphide gave perfectly normal colorations. Ferrous iron in larger quantity was next added, viz.:—0.25, 0.50, 0.75, 1.0, 2.0, 3.0, 4.0 mg.

In all these the solution, after addition of the ammonia, had a slight colour which disappeared on heating, but with amounts larger than 0.50 mg. it was found better to mix the ammonia with the cyanide before adding as otherwise a certain amount of Prussian blue was formed.

To extend the method to ferric iron necessitates preliminary reduction to the ferrous condition. Any reducer selected must be efficient, easily obtainable lead free, and not precipitable by alkaline sulphide. Sodium sulphite ($\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$) fulfils most of these requirements, and the mode of using is simplicity itself. 1 c.c. of a saturated aqueous solution is added to the salt solution to which has previously been added 4 drops 1:16 hydrochloric acid—heat is then applied until the colour due to ferric iron suddenly bleaches—to the colourless solution is added a mixture of 1 c.c. 10 per cent. potassium cyanide solution and 2 c.c. 880 ammonia. The whole is again heated and gently boiled, if necessary, until quite colourless, cooled, and treated with sulphide in the usual manner.

The experiments detailed for ferrous iron were now repeated with ferric iron reduced with sodium sulphite as described. Solutions containing 0.05 mg. lead and 0.05, 0.25, 0.5, 0.75, 1.0, 2.0, 3.0, 4.0 mg. of ferric iron respectively gave quite colourless solutions which on addition of sodium sulphide were indistinguishable from each other and from solutions containing the same amount of lead (0.05 mg.) but no iron. The method thus modified worked satisfactorily in presence of the ordinary inorganic salts. Amongst others worked on were potassium, sodium and magnesium sulphate chloride and nitrate, phosphoric acid and ammonium and sodium phosphates—the mode of working in all cases being to add 4 mg. of ferric iron to the maximum amount of any particular salt permitted by its solubility. In the case of salts like ammonium phosphate, for instance, a greatly increased amount of acid must be added to keep iron in solution—in this particular case 7.5 c.c. of 1:16 hydrochloric acid was added to 12 grms. of the salt, a proportionately increased amount of ammonia being demanded.

In view of the extremely unsatisfactory results obtained with citric and tartaric acids these were again examined. It seemed not unlikely that here again better results would be obtained by adding the potassium cyanide direct to the solution of the acid and not after previous neutralisation with ammonia, as from previous work it was thought that the iron would then be more reactive.

It was found possible to add several milligrams of ferrous iron just as satisfactorily as in the absence of the organic acid. But in the case of ferric iron, the greatest difficulty was experienced in finding an effective reducing agent. Sodium sulphite failed to discharge the colour produced by ferric chloride in presence of citric acid. At last, sodium thiosulphate was found to

act perfectly. The actual details of one of the tests may be given here.

12 grms. of citric acid, 1 mg. of ferric iron, 0.05 mg. lead were placed in a Jena flask and water added so as to give a volume of about 35 c.c. 2 c.c. of $N/10$ sodium thiosulphate was added and the whole heated to incipient boiling and the flame removed. After about 5 minutes the solution became perfectly water-white and to it was immediately added 1 c.c. 10 per cent. potassium cyanide and then excess of 880 ammonia (13 c.c.) and the whole gently boiled until colourless.

With tartaric acid the ammonia must be added in slight excess only or a slightly coloured solution will be obtained even in the absence of appreciable amounts of iron.

Theoretically four mg. of iron require 28 mg. of potassium cyanide for conversion to potassium ferrocyanide whereas 100 mg. (about three and a half times this amount) were regularly used. In one experiment, keeping the iron constant, the cyanide was cut down to one half and successful results were obtained if the cold acid ferrous solution was added to the potassium cyanide mixed with sufficient ammonia to give finally a distinctly ammoniacal solution. As considerable dexterity was required to obtain satisfactory results no further experiments were undertaken with amounts of cyanide nearer to theory. In fact for convenient working the ratio of 25 to 1 should not be diminished. A few words may be added on the value of sodium thiosulphate in the reduction of iron for work of this kind. In my experience complete reduction occurs only in acid solution, but unlike sulphurous acid or sulphites the action is not retarded in the presence of large amounts of strong acids, etc. Its reducing action depends upon its conversion to tetrathionate in accordance with the following equation which is practically quantitative under the prescribed conditions. $2\text{Na}_2\text{S}_2\text{O}_3 + 2\text{FeCl}_3 = \text{Na}_2\text{S}_4\text{O}_6 + 2\text{FeCl}_2 + 2\text{NaCl}$.

This amount very little in excess of theory effects complete reduction but considerable latitude in the amount added is given without precipitation of sulphur or lead sulphide occurring, provided the cyanide and ammonia be added successively as soon as the solution becomes colourless. A certain amount of this flexibility is possibly due to the solvent action of sodium tetrathionate on nascent sulphur. Its unique value in the presence of large amounts of citric and tartaric acids has been already referred to.

In conclusion a number of problems concerning the availability of the alkaline sulphide method of colorimetrically determining lead in the presence of iron have been investigated. An essential difference has been shown to exist between ferrous and ferric iron, ferrous compounds alone being capable of conversion by potassium cyanide to colourless substances not affected by alkaline sulphide. Ferric hydroxide has the power of adsorbing lead; and with many salts if the proportion of iron exceeds twice the lead present, precipitation is complete and no lead is left in solution. This property of ferric hydroxide when available greatly simplifies the manufacture of lead free chemicals. Teed's process requires radical modifications: ferric iron if present must be reduced to the ferrous condition and precipitation of ferrous hydroxide must occur within the sphere of action of the potassium cyanide. It is only when these two essential conditions are attended to that the addition of tartaric acid becomes superfluous. Sodium thiosulphate possesses special features as a reducing agent in work of this kind.

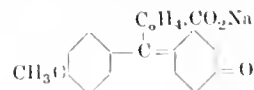
The author desires to express his indebtedness to Messrs. Boots, Ltd., for the use of their laboratory in which the work was carried out.

THE QUINONOID SALTS OF THE PHTHALEINS AND THE CAUSE OF COLOUR IN THE TRIPHENYLMETHANE SERIES.*

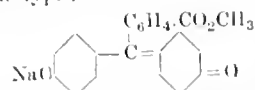
BY ARTHUR G. GREEN, M.Sc., F.I.C.

In a recent series of investigations upon the phtaleins in conjunction with P. E. King† strong evidence has been

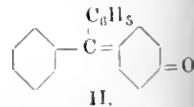
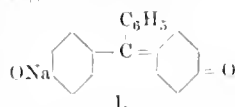
adduced in favour of the quinonoid structure of the coloured salts and ethers of these compounds. This has since received further support from Kurt Meyer and Hantzsch* and from Richard Meyer and Marx.† There still remain, however, some points which require further elucidation. One of these is the remarkable difference in colour between the alkali salts of the phtaleins and their quinonoid dialkyl esters (bluish red to violet in the first case and orange in the second). This difference in shade and intensity of colour would seem to indicate that the structure in the two cases cannot be entirely alike. Another point which is difficult to explain is the fact that the monoalkylphtaleins (lactone ethers) do not form coloured alkali salts, that is to say the substitution of hydrogen in one of the hydroxyl groups either of phenol or of quinol-phtalein suffices to inhibit the formation of coloured salts with metals. A coloured salt of the type:



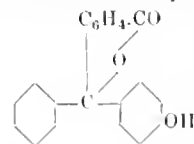
does not appear to be capable of existence. On the other hand, salts of the type:



are deeply coloured (violet red). These observations are exactly comparable with those made earlier with tetrabromophenolphthalein by Nietzki and Bueckhardt. They also stand in complete accord with analogous observations made in other branches of the triphenyl methane group by v. Baeyer and others. For instance benzaurine (oxyfuchson) (I.) gives deep red alkali salts whilst fuchson (or diphenylquinomethane) (II.) is only orange coloured:

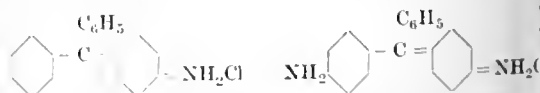


That this difference of colour is not due simply to the occurrence or non-occurrence of salt-formation is shown by the observations already cited and by the fact recently ascertained by v. Bayer that, contrary to the original statement of v. Pechmann, the oxydiphenylphtalide:



dissolves in alkalis with the formation of a colourless salt.

Similar relationships also hold good amongst the amidated derivatives. Thus, although the anhydrid of paraamidotriphenylcarbinol (fuchsonium chloride) is orange, a true dyestuff is not produced until at least one amido group is introduced into the para position of a second benzene nucleus:



The general rule is therefore established that for the production of deeply coloured compounds (true dyestuff of the triphenylmethane series, it is necessary to have an amido or unsubstituted hydroxy group in the second

* Ber., 1907, 40, 3484. This communication, though appearing on an earlier page of the same issue as ours, bears the date July 26th, whilst our paper is dated July 19th. Priority must therefore be accorded to us for those observations which are contained in both papers.

† Ber., 1907, 40, 3603; 1908, 41, 2446.

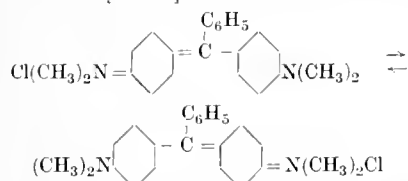
‡ Ber., 1897, 30, 176.

* Taken as read.

† Ber., 1906, 39, 2365; 1907, 40, 3724; this J., 1908, 27, 3.

benzene ring, or, employing the language of Witt's original colour hypothesis, an auxochrome group is required in addition to the chromophore to render the coloured compound a dyestuff.

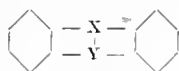
In explanation of these facts a remarkably illuminating theory has recently been put forward by v. Baeyer.* The latter suggests that the deep colour of the triphenylmethane dyestuffs as distinguished from the far less intense colour of the parent quinonoid compounds is due to an oscillation of the quinonoid linking between the two benzene nuclei, accompanied by a corresponding opposite oscillation of the ion of the salt forming group (e.g., Na or Cl) from the para oxygen or nitrogen of one ring to that of the other. This condition in the case for instance of Malachite Green may be represented thus:—



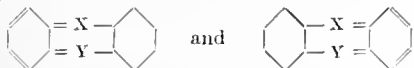
This theory, which seems eminently capable of extension to other groups of dyestuffs, gives for the first time a clear conception of the function and mode of action of auxochrome groups, since in accordance therewith the latter may be defined as groups capable of becoming part of a quinonoid configuration. Even such obscure cases of colour intensification as the relationship of the quinhydrone to the quinones and of Wurster's colour salts to the quinonimides may possibly receive thereby a simple explanation.† It should be observed that these formulae are not intended to indicate an equilibrium mixture of two forms, but a dynamic condition of the molecule which no single formula can exactly represent.

In the triphenylmethane group the theory would likewise seem to give an explanation of another phenomenon which has also been especially studied by v. Baeyer.‡ This is the remarkable accumulation of basicity in the molecule brought about by the introduction of amido or methoxy groups. Thus it has long been known that the basicity of rosaniline greatly exceeds that of the mono- and di-amidated triphenylcarbinols, and of the ordinary amine bases in general (formation of carbonates, etc.). v. Baeyer has shown that the increase of basicity brought about in triphenylcarbinol itself by introduction of one, two, or three para-methoxy groups is approximately represented by the numerical ratio 6.5 : (6.5)² : (6.5)³. If we accept v. Baeyer's hypothesis of oscillatory quinonoid structure it appears that this high basicity of the dyestuff bases may be due to all the amido groups taking part in turn in the salt formation, so that in the hydrochloride of rosaniline for instance a single chlorine ion is held by three amido groups. In a similar manner we may refer the remarkable acidity of the phenolic hydroxyl groups in phenolphthalein (which is shown by our experiments to be greater than that of the carboxyl group) to the oscillation of the metallic ion in the coloured alkaline salts between the two oxygen atoms, which hence hold it more firmly.

* Ann., 1907, **354**, 164. v. Baeyer in illustrating this theory makes use of the old Graebe formula for quinone. This is obviously unnecessary and is open to the objection that it restricts the employment of the theory to para compounds. Ortho dyestuffs of the general form:



would upon the Graebe type be only capable of this one configuration, whilst upon the Fittig type they would be capable of two:

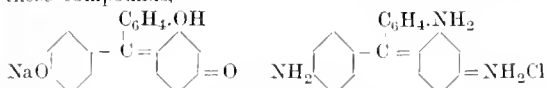


Many facts relating to the dyestuffs of the azonium group speak in favour of such a wandering of the quinonoid bonds.

† Cf. Willstätter and Piccard, Ber., 1908, **41**, 1458; also Acree, Am. Chem. Jour., 1908, **39**, 534 and 789.

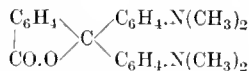
‡ Ber., 1902, **35**, 3020; 1905, **37**, 1158.

This brings us to the consideration of another point, namely, the connection of salt formation with the manifestation of intense colour. Although many coloured bodies are known which are not salts, it has been recognised from a very early date (cf. Witt) that salt formation is frequently accompanied by great intensification of colour. Thus in the triphenylmethane group the quinonimide bases corresponding to Malachite Green, Aniline Blue, Victoria Blue, Doebner's Violet, etc., are all yellow or orange or brownish red of no great intensity. Only on conversion into a salt is the intense colour of the true dyestuff called forth. In the apparent exceptions in which the base has the same intense colour as the dyestuff the base has the structure of a quinonimmonium hydrate to which the same considerations will apply as to the dye-salt itself. V. Baeyer has moreover noted the almost exact correspondence of the absorption spectra of the alkaline salts of the hydroxylated compounds with the acid salts of the amidated compounds. Thus an aqueous solution of the sodium salt of aurine has the same crimson red colour as the hydrochloride of rosaniline. Upon the ordinary formulae for these compounds,

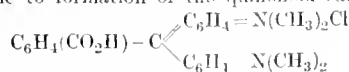


the cause of this analogy is not apparent, since in the first instance the non-quinonoid nucleus, in the second instance the quinonoid nucleus is engaged in the salt formation. This distinction, however, disappears when we regard the Na or Cl ion as oscillating constantly between the two groups, for then both groups may be considered as engaged in the salt formation. In stating his theory v. Baeyer appears to regard this movement of the acid or metallic ion as only a necessary concomitant of the oscillation of the quinonoid bonds, but the question arises whether there are not good grounds for regarding it as the primary cause of the quinonoid oscillation, for otherwise there seems no reason why the latter should not occur also in the case of the free amido or hydroxy compounds. The assumption that this swinging ion is the primary cause of the quinonoid oscillation enables us to arrive at a complete theory of the influence of salt formation upon colour. At the same time it offers a satisfactory compromise to the upholders of the theory of the dependence of colour upon ionic dissociation.

In full accord with the theory here formulated are some observations recently made by P. E. King and myself upon the basic analogues of phenolphthalein. The diamidodiphenylphthalide is not readily obtainable, but the corresponding tetramethyl derivative (the dimethylaniline phthalide):



is easily prepared according to Fischer's method by condensing phthalic anhydride with dimethylaniline in presence of zinc chloride.* We thus obtained it in colourless prismatic crystals which melted at 190°–191° C. It would be expected from the above considerations that just as the addition of alkalis to phenolphthalein calls forth an intense colour formation, so should the addition of acids to the dimethylaniline phthalide. Fischer however states that the salts of this compound are colourless and we find in fact that the base dissolves both in dilute and in strong acids without any production of colour. Nevertheless the formation of intensely coloured salts can be brought about by adopting certain specific conditions. If for instance a fragment of aluminium chloride be added to the alcoholic solution of the base, the solution at once assumes a deep violet-blue colour. That this is due to formation of the quinonoid salt,



and not to any specific action of the aluminium chloride is proved by the fact that the same effect, though less

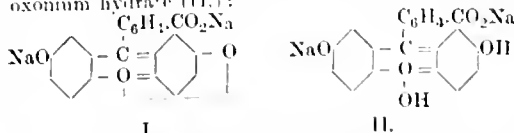
* Ann., **206**, 83. Cf. also Haller and Guyot, Compt. Rend., **119**, 205.

intense, is produced by adding formic acid or a single drop of hydrochloric acid to the alcoholic solution. The colour disappears on adding more acid, a fact which is exactly comparable to the decolorisation of the alkaline phenolphthalein solution by an excess of caustic alkali. The blue solution is also decolorised on dilution with water. A further analogy to phenolphthalein is exhibited upon etherification. Just as the alkaline salts of phenolphthalein ester are much less prone to hydrolysis (decolorisation by excess of alkali) so also a dyestuff much stabler to water and acids is obtained by conversion of the dimethylaniline-phthalein into its ester. This has been ascertained qualitatively by etherification of the phthalein with dimethylsulphate, although owing to difficulties in finding the proper experimental conditions for complete alkylation, the dyestuff has not yet been prepared in a sufficiently pure state for analysis. This dyestuff is probably identical with that described in Ger. Pat. No. 98,863 of 1897 and obtained by condensation of the half-aldehyde of phthalic acid with dimethylaniline, etherification of the leuco base and oxidation with lead peroxide. The product is described as a dark blue powder which dyes silk and cotton in bluish-green shades.

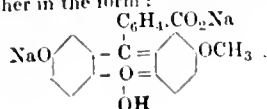
All these relationships are well explained if we assume that both in the case of the dihydroxy and of the diamido derivatives of the phthalein group the oscillation of the quinonoid bonds renders the molecule especially prone to hydration. This tendency would be augmented when a free carboxylic group was present, since such a group would tend to prevent reversion of the carbinol to the quinonoid type by formation of the stable lactone ring with the carbinol hydroxyl. In the case of the carboxylic esters this lactone formation would occur with greater difficulty since it would necessitate the elimination of alcohol. These considerations explain the occurrence of complete decolorisation of the phthalein salts by alkalies or acids in contradistinction to the more or less partial decolorisation of the ordinary triphenylmethane dyestuffs by excess of these reagents. In the case of the dyestuffs an equilibrium is established and complete decolorisation only effected slowly and with difficulty.

One further point in agreement with v. Baeyer's theory is the fact observed by Green and King that the orange quinonoid esters of phenolphthalein give rise with acids to oxonium salts of a pinkish red colour. The formation of oxonium salts therefore influences the colour in a similar direction to the formation of alkaline salts, though much less intensely. Analogous observations have been made by v. Baeyer upon the methoxy derivatives of triphenylcarbinol, though explained by him in a different manner. In all these cases it appears probable that the deepening of the colour is due to an oscillation of the quinonoid bonds between the two benzene nuclei, this fluctuation being set up by the movement of the acid or basic ion.

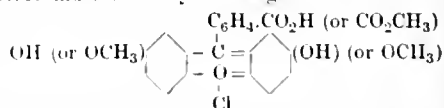
We will now consider the bearing of these views upon the case of quinolphthalein. Here, to judge from the behaviour of the compound and its ethers, a condition of things exists which is closely similar to that occurring with phenolphthalein, and this in spite of the fact that a paraquinonoid configuration is impossible. Being disinclined to assume a metaquinonoid structure, Green and King suggested for the alkali salts of quinolphthalein the formula (I), thus representing them as anhydrides of an oxonium hydrate (II):



This formula, although at first sight appearing to explain the need of two hydroxyl groups for the production of coloured salts, does not seem on closer consideration entirely satisfactory, for it gives no adequate explanation for the non-existence of a coloured sodium salt of the monomethyl ether in the form:

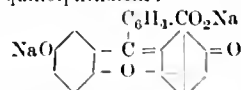


Green and King based the above orthoquinonoid formula for the quinolphthalein salts upon the presumption of an analogous configuration to the corresponding acid oxonium salts, to which they proved an orthoquinonoid structure must certainly be assigned:

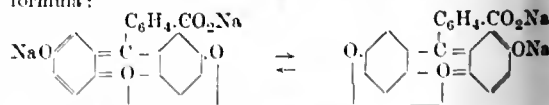


All doubt with regard to the latter has now been removed by the preparation of the quinonoid ester oxonium salts of the parent compound fluorane and of its homologue.* These simple oxonium salts of fluorane ester for which an orthoquinonoid structure is alone possible, are deeply coloured yellow compounds of considerable similarity to the quinolphthalein oxonium salts, but possessing inferior stability and a less intense colour.

The assumption of a metaquinonoid structure for the alkali salts of quinolphthalein:



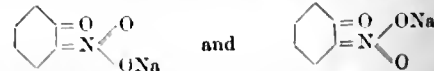
is now definitely advocated by R. Meyer, and gains some support from the recent investigations of Hantzsch upon the chromo salts of nitrophenols. Thus the potassium salt of the 4:6-tribromo-3:5-dinitrophenol exists in two forms, a yellow and red form, to both of which Hantzsch assigns a quinonoid structure.† It may also be noted that amongst the meta-substituted derivatives of triphenylcarbinol v. Baeyer has frequently observed the occurrence of coloured salts. Thus both the metadimethoxy- and the metatrimethoxy-triphenylcarbinol dissolve in concentrated sulphuric acid with a deep bluish red colour forming coloured salts which only differ from those of the para series in being decolorised by alcohol.‡ Although v. Baeyer regards these manifestations of colour in the meta series as differing entirely in kind from those in the para series, his grounds for this belief are not very convincing and it would seem conceivable, even without admitting the independent existence of meta quinones, that an unstable metaquinonoid phase might be possible in these compounds. This phase might indeed be rendered more permanent by the oscillation of the quinone structure between the two benzene nuclei. Such a kinetic condition of the molecule would be very analogous to that suggested for the phenolphthalein salts, and hence would explain their remarkable similarity. Opposed to this assumption is however the fact that it necessitates a change of type from ortho- to meta-quinonoid (a change that is to say to a less stable configuration) when the orange red oxonium chloride of quinolphthalein or of its ester is converted by alkalies into the respective violet alkali salts. On the whole it appears that the facts at our disposal may be best reconciled by the assumption for the violet salts of a kinetic ortho-quinonoid structure as represented by the formula:



Department of Tinctorial Chemistry,
University of Leeds.

* Ber., 1908, 41, 1434.

† Ber., 1907, 40, 339. The existence of two series of coloured salts of the nitrophenols might, it would seem, be explained more simply than in the manner suggested by Hantzsch. In a quinonoid nitrophenol salt the double union of the N to the C should render the compound capable of existence in two geometrically isomeric forms:



In each case the Na ion may be regarded not as fixed to the nitro group, but as oscillating between this and the phenolic oxygen. The difference in colour between the two forms may thus be attributed to the longer path which the metallic ion must traverse in the one case compared with the other.

‡ Ber., 1905, 38, 1158.

Manchester Section.

Meeting held at Manchester on Friday, May 7, 1909.

MR. W. H. COLEMAN IN THE CHAIR.

THE ACTION OF CAUSTIC SODA LYE ON COTTON.

BY JULIUS HÜBNER, M.Sc. TECH., F.I.C., AND F. TELTSCHER, PH.D.

The extent to which caustic soda is absorbed by cotton from strong lyes, and the degree of tenacity with which the absorbed soda is retained by the fibre, were first studied quantitatively by J. H. Gladstone (J. Chem. Soc., 5, 17). Gladstone's method of examination consisted in immersing 20 grm. lots of cotton in caustic soda solutions of various concentrations, expressing the liquor and repeatedly washing the material with absolute alcohol. After drying in a vacuum the amount of soda retained was determined either by noting the increase in weight of the cotton, or by washing the soda out with water, evaporating with sulphuric acid, and weighing as sodium sulphate. On steeping cotton in a lye too dilute to produce Mercer's well-known effect and subsequently treating as above indicated, no increase in weight was observed, and Gladstone therefore concluded that soda was not absorbed by cotton from such weak lyes. On substituting the dilute lye by concentrated soda solution capable of producing the Mercer effect it was, however, noted that the 20 grm. lot of cotton increased in weight to 24.4 grms. and "contained an amount of soda which when dissolved out by water, neutralised by sulphuric acid and evaporated in a platinum dish gave 4.8 grms. of sulphate equal to 2.1 grms. of absolute soda."

In a number of experiments performed as just described, Gladstone found that 20 grm. lots of cotton yielded the quantities of sodium sulphate stated in the following table after treatment with lyes of different concentrations.

Experiment No.	Strength of soda solution, sp. gr.	Amount of sodium sulphate.
III.	(25° Tw.) 1.124	grms. 2.70
IV.	do. do.	2.71
V.	do. do.	2.05
VI.	do. do.	3.12
VIII.	(68.5 Tw.) 1.342	4.25
IX.	1.342	4.70
X. (weight of cotton, 12.05 grms.)	1.124	2.00
XII. (weight of cotton, 14.67 grms.)	(?)	3.15

His mode of treating the cotton after immersion in the soda differed in the various experiments. Thus, in No. III. he extracted with absolute alcohol, in No. IV. re-mercerised the cotton used in No. II., in No. V. "ordinary rectified spirits" was used for washing and in Nos. VI., VIII., and IX. hot alcohol of sp. gr. 0.825 (92.5 per cent.) was used, whilst in experiment No. XII. absolute alcohol was used for washing the cotton.

Gladstone attached special importance to experiment numbered XII., although in this case he does not state the strength of the soda used. From the results of these experiments, he concluded that "it appears that lignine is capable of forming a combination with soda, the proportion of the alkali varying with the strength of the solution employed but in no instance exceeding one atom, and that this compound is decomposed by water, being evolved into its original compounds." The formula which he gives to the soda cellulose is $C_{14}H_{20}O_{20}NaO$ which corresponds in modern nomenclature to $C_{14}H_{16}O_{18}NaOH$.

W. Vieweg (Ber., 1907, 40, 3876) determined the amount of caustic soda which "combines" with cotton during

immersion in the solution for 3 hours in the following manner. 3 grms. of cotton wool were immersed in 150 grms. of soda lye of known strength. The cotton was shaken with the solution for one hour and then allowed to remain in it for two hours. 50 c.c. of the residual soda solution were now titrated, the difference indicating the amount of soda taken up by the cotton. With a solution of caustic soda containing 16 per cent. of sodium hydroxide Vieweg obtains a value which corresponds to the formula $(C_6H_{10}O_5)_2NaOH$ and is identical with certain of the results obtained by Gladstone. He states that with solutions containing more than 35 per cent. of sodium hydroxide, the soda cellulose has approximately the composition $(C_6H_{10}O_5)_2(NaOH)_2$.

From the fact that the curve representing the amount of sodium hydroxide taken up by the cotton wool exhibits two horizontal parts, Vieweg concludes that a chemical reaction takes place during mercerisation.

The method adopted by Gladstone seems to lend itself very well for the purpose of ascertaining the amount of soda which cotton absorbs from caustic soda solutions, although on comparing the results it will be found that they differ considerably; Vieweg's titration method is, however, certainly open to objection. Considering the enormous technical importance of mercerisation at the present moment, it seemed of considerable interest to repeat and to continue Gladstone's experiments.

Unfortunately Gladstone gives comparatively few data as to the manner in which the experiments were carried out, and in one experiment only are we informed as to the kind of cotton which he has employed. No description is given as to the treatments which the cotton had undergone previous to immersion in the soda solutions, and no statement is made as to whether the experiments were carried out with one and the same quality of cotton. These are points which may exercise a considerable influence upon the results. In his experiments Vieweg uses cotton wool as employed for medical purposes; this, however, usually contains oxycellulose and is thus of doubtful uniformity. In the investigation set forth in this paper special care was therefore taken to obtain a pure and uniform material for all the experiments carried out. For this purpose a large quantity of a loosely twisted cotton yarn, made from a very fine Egyptian cotton, was boiled twice with sodium carbonate solution in a high pressure kier, thoroughly washed, and bleached with a sodium hypochlorite solution obtained by electrolysis a solution of common salt. The bleaching operation was carefully regulated so as to avoid the formation of oxycellulose, and both boiling and bleaching were performed under the customary technical conditions. The yarn was well washed and transferred to a drying stove in which it remained for seven days at a temperature of about 60° C. After this treatment the cotton contained 6.77 per cent. of moisture and 0.086 per cent. of ash. The yarn was now cut into pieces of about 2 in. in length and 150 samples, each corresponding to 10 grms. of absolutely dry cotton, were weighed out in the stove. These were then carefully wrapped up and used as required in the experiments.

A considerable number of preliminary experiments had to be carried out with a view to ascertain the method which gave the most reliable results.

Gladstone, in Experiment No. VI., states that he used hot absolute alcohol for washing, and that 20 grms. of cotton which had been immersed in caustic soda of 1.124 sp. gr. after having been freed from the soda retained mechanically, yielded 3.12 grms. of sodium sulphate. 10 grms. of the cotton were immersed for 20 hours in 200 c.c. of caustic soda solution of 51.5 Tw.; after pressing out lightly the cotton was transferred to a Soxhlet and extracted with absolute alcohol. The extraction was carried on until the alcohol syphoned from the cotton did not react with phenolphthalein. It was now treated as described by Gladstone (*loc. cit.*) and found to yield 0.043 grms. of sodium sulphate, corresponding to 0.024 grms. of sodium hydroxide.

Eight other experiments in which the cotton was immersed in solutions of various strengths gave similarly low results. Practically all the soda is extracted by hot alcohol from the cotton; it is therefore evident that the

"soda cellulose" is decomposed by hot alcohol and that no reliable results could be expected by this method. Two parallel experiments were now carried out by immersing 20 grms. of cotton as in the first experiment but washing it afterwards with absolute alcohol at ordinary temperature. The cotton containing the soda was placed in glass stoppered bottles and repeatedly shaken with absolute alcohol (about 280 c.c. of alcohol for each 10 grms. of cotton); the alcohol was frequently changed until phenolphthalein produced a very faint pink coloration when added to the alcohol. The washing of the samples occupied about 18 days. One of the washed samples was decomposed with water in the Soxhlet and the water evaporated, the residue treated with sulphuric acid in a platinum basin and the amount of sodium sulphate remaining was found to be 0.7852 grms.

The second sample was incinerated in a platinum basin, the residue repeatedly treated with sulphuric acid, and finally heated until the weight remained constant. The sample gave 0.7897 gm. of sodium sulphate. This result agreeing so well with the one found by decomposition with water, it was decided to employ this method as the more convenient one in all experiments. In carrying out the tests with phenolphthalein the following interesting observation was made. Cotton which still contains free caustic soda gives a very strong reaction with phenolphthalein, whilst cotton which had been freed from all the soda removable by washing with absolute alcohol does not react with phenolphthalein whilst immersed in the alcohol. On removing the cotton from the alcohol and exposing it to the air for a short time moisture is attracted in sufficient quantities to produce decomposition of the soda cellulose; the free alkali then reacts readily with the phenolphthalein.

Gladstone, in his Experiment No. V., used rectified spirit for the washing in place of absolute alcohol, and it seemed therefore of interest to ascertain whether the results obtained by washing with 90 per cent. alcohol would differ appreciably from those obtained when absolute alcohol was employed. For this purpose two lots of cotton (20 grms.) were treated as in the last two experiments and washed with 90 per cent. alcohol. After washing for about 18 days, the alcohol from both samples still showed a distinct alkaline reaction with phenolphthalein. One of the samples was then incinerated and found to yield 0.783 grms. of sodium sulphate; from this it is seen that the weaker alcohol gives a slightly lower result—no doubt due to a slow decomposition of the "soda cellulose." After washing the other sample for five months the alcohol still showed a distinct alkaline reaction. On incinerating this sample it was found to contain much less sodium sulphate (0.3435 gm.) than the sample which had been washed for 18 days. Washing with 90 per cent. alcohol can therefore not be expected to give satisfactory results. One very important conclusion can, however, be drawn from the two experiments, namely, that there is no danger of any interference with the results by minute quantities of water which the absolute alcohol may attract from the air during the operation of washing and during the changing of the alcohol.

Gladstone immersed the cotton one hour in the soda whilst Vieweg shook the cotton for 1 hour with the soda and allowed it to remain in contact for two hours after shaking. Vigorous shaking of the cotton whilst in contact with the soda solution is open to the objection that disintegration of the fibres is unavoidable. The authors therefore prefer immersion of the cotton for a prolonged period with occasional shaking. This has one further important advantage in that slight variations of the temperature during immersion are without appreciable influence upon the results obtained. It remained, however, to be seen whether the amount of soda absorbed by cotton varies much with the time of immersion in the soda solution, because Miller (Ber., 1907, 40, 7902) first drew attention to the fact that if cotton is immersed in soda lyes of high concentrations for a prolonged period, the amount of soda absorbed by the cotton is slightly less than when immersed for a shorter period. In order to ascertain the influence of time a number of experiments were carried out, and the following results obtained.

Strength of caustic soda solution 50° Tw. cotton.

Time of immersion.	Sodium hydroxide absorbed.
	GRMS.
30 seconds	0.269
1 hour	0.253
24 hours	0.250

It will be seen from these results that no objection can be taken to immersion of the yarn in the caustic soda solution for a prolonged period. All the results obtained during the preliminary experiments indicate very much lower absorptions than those recorded by Gladstone and by Vieweg. It became of interest to ascertain Gladstone's method of working. For this purpose it was considered advisable to use litmus as indicator in place of phenolphthalein, on the presumption that this indicator was employed by Gladstone. In the first experiment 20 grms. of cotton were immersed for 20 hours in caustic soda solution of 45° Tw. and washed with absolute alcohol for about two days or until no alkaline reaction could be detected with litmus. This sample again gave a much lower result than that obtained by Gladstone, namely, 1.02 grms. of sodium sulphate from 20 grms. of cotton, but a much higher value than those obtained in the other experiments. In a further experiment the conditions observed in one of Gladstone's experiments were exactly adhered to: 20 grms. of cotton were immersed in 600 c.c. of caustic soda lye of 1.124 sp. gr. (241° Tw. for 1 hour, slightly pressed out and very quickly washed in about 8 changes of absolute alcohol, using for every washing operation about 1 litre of alcohol; after the last washing the alcohol showed practically no alkaline reaction with litmus. The sample was then allowed to remain over night in a tightly stoppered bottle out of contact with the air. On examination of the alcohol which had run out of the cotton it was found to give a very strongly alkaline reaction. The sample of cotton was then incinerated and yielded 2.39 grms. of sodium sulphate. The average amount of sodium sulphate obtained in Gladstone's experiments was 2.35 grms. A further experiment was carried out by immersing the cotton for one hour in 600 c.c. of caustic soda solution of sp. gr. 1.342 (68° Tw.). The washing of the same with absolute alcohol was conducted similarly to the last experiment and on incinerating 4.59 grms. of sodium sulphate were obtained. By employing the same strength of caustic soda, Gladstone obtained on the average 4.475 grms. of sodium sulphate. It has thus been clearly demonstrated in what manner Gladstone obtained his values and further, that his values cannot be accepted as representing the actual amount of caustic soda which is retained by cotton in such a manner that it cannot be removed by washing with absolute alcohol. Having established by means of our preliminary experiment that cotton retains a definite amount of caustic soda which cannot be removed by washing with absolute alcohol, comparative experiments were carried out with a view to ascertain in what manner the strength of the caustic soda solution used in mercerising influences the degree of the formation of the so-called "soda cellulose."

Experiment No. 1.—All the experiments were conducted at ordinary temperature, the caustic soda solutions were prepared from pure caustic soda (99.9 per cent. NaOH) and the strengths of the solutions were ascertained both by means of the areometer and by titration. The time of immersion of the cotton in the soda lyes was 67 hours. The well stoppered bottles were shaken from time to time; the soda was poured off afterwards and each of the bottles was immediately filled with 400 c.c. of absolute alcohol, and well shaken. After two hours the alcohol was poured off and fresh alcohol added to each sample. The washing was now conducted systematically in accordance with the counter-current principle so as to reduce the amount of alcohol necessary to a minimum. Every two hours the alcohol from the sample which had been treated with caustic soda of a certain strength was transferred to the bottle containing the sample which contained the cotton treated with the next higher con-

centration of soda, whilst fresh alcohol was added to the sample treated with the lowest strength of soda. Thus the alcohol on all the samples was changed 4 to 5 times per day.

The alcohol was from time to time tested with phenolphthalein and when free from alkali it was allowed to remain in contact with the sample over night. When no alkali could be detected in the alcohol after this time the sample was removed and immediately incinerated in the manner described under the preliminary experiments. The results of these experiments expressed as sodium hydroxide are given in Table No. 1. The quantities of soda retained by 100 grms. of dry cotton are given.

Experiment No. 2.—The cotton samples were treated with the different strengths of caustic soda lye in gas wash bottles for 67 hours, in such a manner that the bottles were filled with the soda solution right to the top so as to prevent the solution from coming in contact with the air during immersion of the cotton. 10 grms. of cotton were used in each experiment and each of the bottles contained 600 c.c. of caustic soda lye. The soda lye was then pressed out of the cotton as far as possible and the bottles rapidly filled with absolute alcohol. Connections were made between all the bottles in such a manner that the absolute alcohol could be passed through continuously on the counter-current principle. The fresh alcohol entering the bottle containing the cotton which had been treated with the weakest soda lye, was then passed through all the other bottles in such a manner that it ultimately left the bottle containing the cotton which had been treated with the strongest lye. After washing in this manner continuously during seven weeks it was found that the alcohol discharged from the last bottle still reacted alkaline with phenolphthalein. The bottle containing the cotton which had been treated with soda of 80° Tw. was then disconnected and the alcohol coming from the one which contained the cotton treated with a 70° Tw. lye was also found to give a slight alkaline reaction. On disconnecting this bottle, however, the alcohol discharged from the one containing the cotton treated with the 60° Tw. lye was found on testing to be free from soda. The cotton samples were removed from the bottles and incinerated as described under Experiment No. 1. The results are given in Table No. 1.

It will be noticed that the soda has been almost entirely removed during this very thorough and continuous washing from the cottons which had been treated with soda of 1°, 5°, 10°, and 20° Tw.

The values found for the strengths above 20° Tw., although lower, if plotted in a curve clearly exhibit the same characteristics as those obtained in Experiments I. and III. This seems to prove that whilst practically all the soda can be removed by prolonged washing from cottons which have been treated with soda lyes of strengths up to and including 20° Tw., the "soda cellulose" produced by immersing cotton in lyes above 20° Tw. is much more resistant to the action of the alcohol.

It is of interest to further point out that if the amount of sodium hydroxide obtained in Experiment No. I. with the 20° lye is deducted from the amounts obtained with the higher strength lyes, the resultant figures obtained in Experiments Nos. I. and II. are practically identical. Having established in Experiment No. II. that slight decomposition of the "soda cellulose" takes place during this prolonged washing, a further series of experiments (No. III.), similar to Experiment No. I., was undertaken, in which smaller bottles, which were entirely filled with alcohol each time, were used. It had been shown by Hübner and Pope (this J., 1904, 23, pp. 404 *seq.*) that both the dyeing and the shrinkage curve of cotton yarn which had been treated with caustic soda solution rises very rapidly when soda of from between 20° and about 26° Tw. strength is used, whilst it rises more slowly from between 26° and 30° Tw. Maximum shrinkage was obtained with soda of 45° Tw. It was therefore considered of interest to ascertain whether similar results would be obtained as regards the soda absorption. In Experiment No. III. soda of 23° and 26° Tw. was therefore used in addition to the strengths

used in Experiments Nos. I. and II. The results obtained in Experiment No. III. clearly show that the authors have further substantiated the observation made by Hübner and Pope, in that the absorption of caustic soda by cotton rapidly rises if soda lye of between 23° and 26° Tw. strength is used and further that maximum absorption takes place with a lye of about 40° Tw.

From the results obtained in Experiments Nos. I. and III., it will, therefore, be seen that the amounts of sodium hydroxide absorbed by cotton from solutions of caustic soda from 30° Tw. to 80° Tw. are practically identical. Maximum absorption takes place if cotton is immersed in caustic soda solution of about 40° Tw., whilst it absorbs slightly less from stronger solutions.

As regards the exceedingly slow decomposition of the "soda cellulose" during prolonged washing with absolute alcohol, observed in Experiment No. II., attention might be drawn to the behaviour of wool fibres dyed with Naphthol Yellow S. (Hübner, J. Chem. Soc., 1907, 1057). The excess of the Naphthol Yellow can be readily removed by washing the dyed wool fibres in water. It has, however, been shown that if the fibres are repeatedly soaked in distilled water during a very long time, practically all the colouring matter may be removed.

The authors consider themselves justified, therefore, in stating that the results obtained in the experiments brought forward are to be regarded as a correct explanation of the manner in which caustic soda is absorbed by cotton fibres from solutions of different strengths, but that the results of their experiments do not support the suggestion of the existence of distinct chemical compounds or "soda celluloses," which has been advanced by Gladstone and by Vieweg.

Although Vieweg (*loc. cit.*) has attempted to verify Gladstone's results the amount of caustic soda absorbed by cotton from a solution of about 25° Tw. according to Gladstone is much lower than the amount given for the same strength by Vieweg, and further, a much higher concentration (about 68° Tw.) of soda is required according to Gladstone to obtain approximately the same absorption figures which Vieweg has obtained with soda solutions of from about 37° to 50° Tw.

In the third series of experiments the same amount of absolute alcohol was used in every washing operation, and as in the former experiments, the alcohol was always transferred from the cotton treated with the weaker lye to the one which had been immersed in the stronger one. The number of changes of alcohol required to free each of the samples from excess of caustic soda was noted and is given in the "washing curve," and in the last column in the table.

The authors do not attach any great importance to the numbers thus obtained, but it is interesting to note that whilst 33 additional changes of alcohol are required to free the cotton which has been immersed in the caustic soda solution of 30° Tw. as compared with the one which has been treated with a 20° Tw. solution, the difference in the number of changes of alcohol between cotton immersed in the 80° Tw. solution as compared with the 30° Tw. one is also 33.

Preliminary experiments have also been carried out to ascertain whether the washing with absolute alcohol of cotton which has been treated with strong solutions of caustic soda has any influence on the affinity of such cotton for the substantive colouring matters. It was found that cotton which has been treated with caustic soda solution of 50° Tw. if afterwards extracted with hot absolute alcohol in the Soxhlet apparatus, dyes practically the same depth with Benzopurpurine 4B as cotton which has not been treated. In a further experiment, cotton was treated with caustic soda solution of 50° Tw. and washed practically free from excess of soda with cold absolute alcohol. After this the cotton ("soda cellulose") was washed with water until free from soda, when it was found to dye practically the same shade as cotton which has been treated with the same strength of soda and washed free from soda with water without the preliminary washing with absolute alcohol.

This question, as also those of the dyeing of mercerised and ordinary cotton in alcoholic solutions, will be further investigated.

TABLE I.

Grms. sodium hydroxide in 100 c.c.	Degrees Twaddel.	Grms. sodium hydroxide retained by 100 grms. of cotton.			Times washed with absolute alcohol. Expt. III.
		I.	II.	III.	
0.4	1	0.397	0.025	0.190	6
2.3	5	0.538	0.037	0.198	13
4.10	10	0.740	0.017	0.330	17
8.68	20	1.104	0.179	0.710	30
9.98	23	—	—	1.456	38
11.47	26	—	—	2.752	45
13.39	30	3.237	2.132	3.250	63
15.47	35	3.334	2.292	3.298	70
17.67	40	3.495	2.323	3.600	74
20.03	45	3.117	1.920	3.184	81
22.42	50	2.800	1.544	2.722	86
27.10	60	2.723	1.812	2.824	89
31.74	70	3.253	—	3.030	91
36.54	80	2.675	—	3.024	96

DISCUSSION.

Mr. W. H. PENNINGTON thought experience almost conclusively proved that the soda cellulose compound did not exist. He understood that the cotton was dried in a stove for 18 hours and then contained 6.7 per cent. of moisture.

Mr. R. E. CROWTHER was interested to learn that the authors' results did not corroborate Vieweg's results. He himself had spent considerable time endeavouring to corroborate those results, without success. Vieweg further stated that cotton which had been fully mercerised in the ordinary manner absorbed more caustic soda than did unmercerised cotton; he had been able to corroborate this. It seemed to be a rather suggestive fact. There might not be such changes as were at first supposed in the cellulose resulting from mercerisation, but there appeared to be some. Mercerised cotton did not behave in some of its reactions, *e.g.*, acetylation, as ordinary cotton did. Even when the mercerised cotton had gone through the process of being converted into artificial silk it was entirely different. One point mentioned was the loss of the qualities of mercerisation on washing with alcohol. He had come to the conclusion that mercerised cotton, dried with alcohol, behaved much in the same way as ordinary cotton in regard to the absorption of substantive dyes.

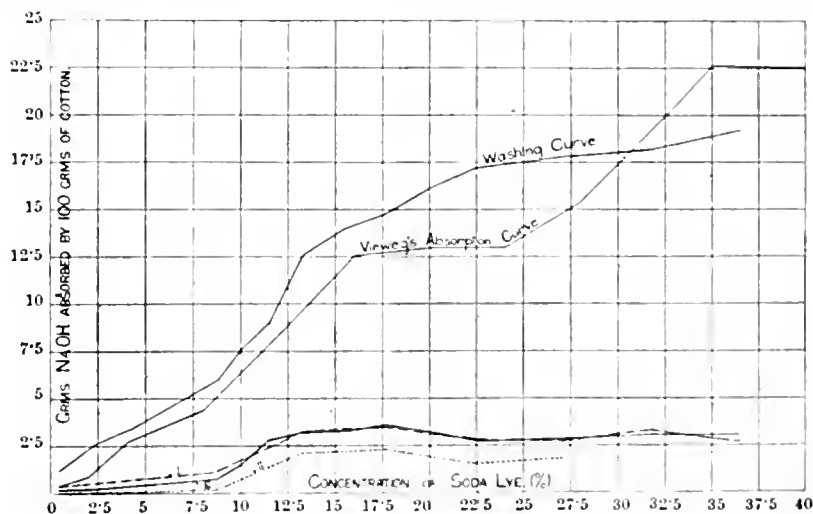
Dr. R. ANSPACH inquired whether the decomposition of the alkali-cellulose in the air was perhaps due to the action of carbon dioxide?

Dr. J. BURGER asked if a microscopical examination had been made of the mercerised cotton which had been treated with hot alcohol?

Mr. W. H. PENNINGTON recalled Mr. Hübner's statement that when the soda was washed out by alcohol the cotton dyed practically the same shade as untreated cotton. He wished to know whether that applied to different strengths of caustic soda lye.

Dr. B. W. GERLAND asked whether the authors had taken note of the temperature at which the caustic soda acted upon the cotton?

Mr. HÜBNER, in reply, said that the particular method of drying the cotton had been adopted in order to obtain a perfectly uniform material as regards moisture. It was well known that cotton which had been dried thoroughly at 100° C. absorbed moisture very slowly and that it was exceedingly difficult to obtain uniform absorption. In regard to the absorption of soda by cotton which had been mercerised, this method was suggested by Vieweg to distinguish mercerised from ordinary cotton. There was a distinct difference in the behaviour of mercerised cotton towards reagents as compared with ordinary cotton. Some manufacturers of artificial silk mercerised the cotton previous to dissolving it in ammoniacal cupric oxide. A number of experiments had been made in which mercerised cotton had been washed free from soda, dried, and had been then extracted in the Soxhlet apparatus with absolute alcohol and with other solvents. That which had been extracted with absolute alcohol invariably exhibited less affinity for the substantive cotton dyes than did the untreated material. These experiments were still in progress and he hoped to lay the results before the Society at a later date. Water by itself decomposed the so-called "soda cellulose," but a joint action of both water and carbon dioxide might take place. A microscopical examination of cotton which had been immersed in soda lye and afterwards washed free from soda by treatment with hot absolute alcohol had not been made. The point possessed interest and would be investigated, but he did not expect that the structure of the fibres would differ much from that of ordinary mercerised cotton which had been washed with water after immersion in the soda lye, because the typical changes, *i.e.*, the untwisting, the swelling, *etc.*, of the fibres took place during immersion in the lye. In the preliminary experiments only one strength of caustic soda had been used but that question would be fully investigated. The temperature of the caustic soda solutions was of great importance, and had been taken fully into consideration in the experiments.



Journal and Patent Literature.

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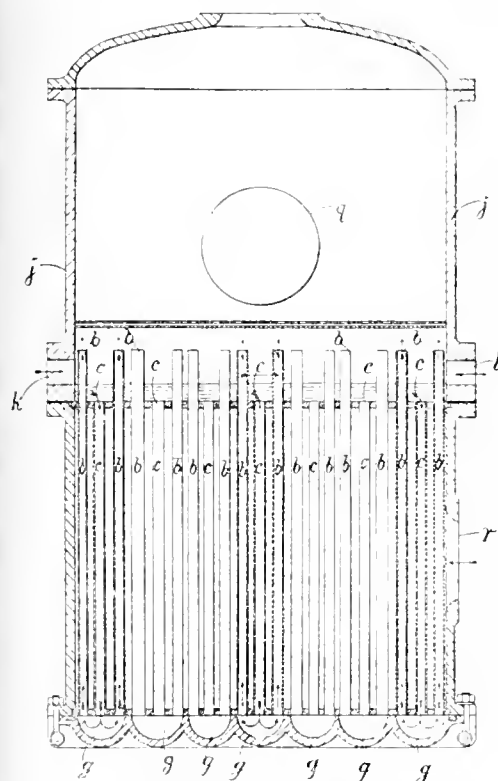
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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Evaporators for the concentration of liquids. J. W. Macfarlane, Cathcart, N.B. Eng. Pat. 11,088, May 22, 1908.



THE liquid enters the evaporator through the opening, *k*, passes down the first group of tubes, *c*, into the cup, *g*, at the bottom, and returns upwards through the tubes, *b*, the upper ends of which project beyond the upper tube-plate. The tubes are heated by steam introduced through *r*, and the vapour given off collects in the upper dome, *j*, and passes away through *q*. By means of cross baffle-plates the liquid is caused to pass through the various sets of tubes in succession and is finally discharged through *l*.—W. H. C.

Vacuum-pan for evaporating apparatus. G. R. Ray, Manistee, Mich. U.S. Pat. 920,997, May 11, 1909.

THE claim is for a system of vacuum-pans each provided with a steam-belt heater and having a ring pipe extending round each steam-belt and communicating therewith to convey air from the steam-belt to a "vacuum line." The first pan of the series is heated by steam from an external source of supply, and the steam-belt of each succeeding pan is connected with the vapour space of the preceding pan.—W. H. C.

Centrifugal machine. K. Krausch, Darmstadt, Germany. Eng. Pat. 16,034, July 28, 1908. Under Int. Conv., July 29, 1907.

IN centrifugal machines having a perforated drum which has the shape of a truncated cone and from which the

dried materials are discharged, without stopping the rotation, by raising the drum, the claim is for rigidly attaching the outer liquid-collecting envelope to the drum in order to facilitate the discharge of the liquid and to prevent its return to the separated solid matter. The lifting of the perforated envelope is effected by a lifting-plate supported by ball bearings on a collar on the spindle and operated by a lever.—W. H. C.

Centrifugal separator. H. D. Dibble, Mystic, S.D. U.S. Pat. 921,371, May 11, 1909.

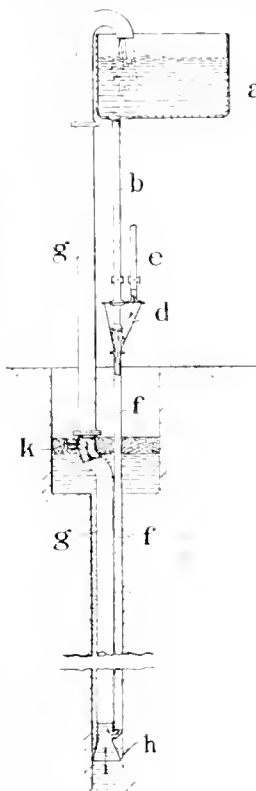
THE claim is for a centrifugal machine the drum of which is provided with peripheral outlets for the liquid, these outlets being closed by valves, operated by levers controlled by the weight of the materials in the bowl of the machine.—W. H. C.

Temperature of heated objects; Determining the —. H. Brearley, Sheffield. Eng. Pat. 21,623, Oct. 13, 1908.

A METALLIC salt or mixture of salts having a definite melting point and used in the form of a powder or made into a paint or paste with oil, vaseline, or wax is scattered or painted upon the object the temperature of which is to be determined. If the temperature of the object is

below that at which the salt or salt mixture melts, the latter remains visible as a light-coloured streak. If on the other hand the temperature of the object is higher, the salt mixture melts and can no longer be observed.—W. H. C.

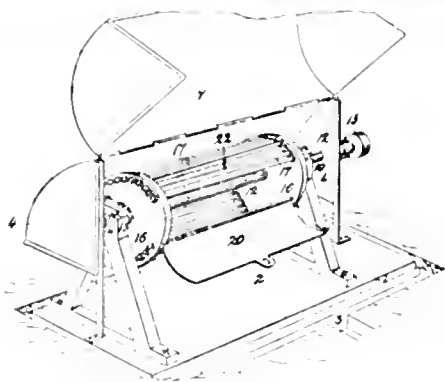
Raising water; Apparatus for —. A. A. Humphrey, London. Eng. Pat. 23,281, Oct. 31, 1908.



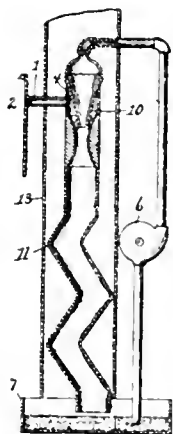
WATER from the tank, *a*, flows down the pipe, *b*, into the box, *d*, and draws in air through *c*. The air and water flow down *f*, the air becoming compressed, and enter the rising main, *g*, provided with a foot valve, *h*. The compressed air carries up the water on the principle of an air-lift pump into the overhead tank, *a*, from which a portion returns, as described, through *b*, to compress the air. In order to facilitate the starting of the pump, a valve, *k*, is fixed at about the normal level of the water in the well and remains open until there is a strong rush of water up the pipe, *g*.—W. H. C.

Centrifugal dryer. O. Keefer, Assignor to I. Lichtenstein, New York. U.S. Pat. 922,149, May 18, 1909.

THE materials to be dried are put into the cylindrical cage, 22, formed by the rods, 17, which connect the discs, 16, and which is provided with a door, 20, and is



mounted on a shaft, 12, rotated by the pulley, 13. The cage is covered by a movable hood, 4, and is mounted on a stand, 2, surrounded by a gutter, 3, to carry away the water.—W. H. C.



Condensing and purifying smoke. S. I. Clawson, Salt Lake City, Utah. U.S. Pat. 922,260, May 18, 1909.

The smoke gases are drawn from the flue, 2, through the pipe, 1, into the water-pump, 10, by the suction caused by water issuing from the jet, 4. The smoke gases and water pass down the zig-zag fall-tube, 11, the bottom of which terminates just above the level of the water in the tank, 7. The smoke particles are condensed and collect along with the water in the tank, 7, and the gases pass away to the chimney by the flue, 13. The water in 7, is lifted by the pump, 6, and returned to the water jet.—W. H. C.

Retort for distilling gases and vapours. P. A. Emanuel, Aiken, S.C. U.S. Pat. 922,407, May 18, 1909.

The claim is for a retort mounted on trunnions so that it can be tilted, which is connected at one end to a smoke-stack by a movable connecting piece and at the other end with a movable furnace, the whole being suitably locked together when in operation.—W. H. C.

Calcination; Process of — J. C. Heckman, Allegheny, Pa., Assignor to W. J. Gilmore, Pittsburg, Pa. U.S. Pat. 922,425, May 18, 1909.

The process claimed consists in introducing the substance to be calcined into the furnace in a liquid or diluted condition, so that the furnace is filled to a substantially equal depth at all points. The heating is arranged so that it is practically uniform and continuous over the whole area of the furnace hearth.—W. H. C.

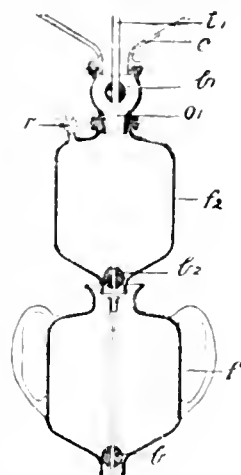
Separating solids from liquids; Centrifugal machine for — A. J. Ericsson, Stockholm, Assignor to Aktiebolaget Separator, Stockholm. U.S. Pat. 921,814, May 18, 1909.

SEE FR. Pat. 392,702 of 1908; this J., 1909, 77.—T. F. B.

Mixtures; Apparatus for obtaining intimate — E. Dor-Delattre, Liège, Belgium. U.S. Pat. 922,863, May 25, 1909.

SEE Eng. Pat. 24,958 of 1907; this J., 1908, 492.—T. F. B.

Deposits; Device for removing — from liquor-receptacles without interrupting the work or altering the level of liquor. Usine Genevoise de Dégrossissage d'Or. Ger. Pat. 209,859, July 27, 1907.



The apparatus is shown in the accompanying figure, and the method of working is as follows:—With the valve, b_1 , open, and the valves, b_2 and b , closed, the deposit produced in the liquor-receptacle, c , collects in the chamber, f_2 . When it is desired to remove the deposit, the opening, o_1 , is closed by the valve, b_1 , and the valve, b_2 , is opened by raising the vessel, f . As the chamber, f_2 , is emptied, air enters through the hollow valve-stem, t_1 , which reaches to above the level of the liquor in c . In order now to again put the vessel, f , into communication with the receptacle, c , without altering the level of liquor in the latter, f_2 is filled with

liquid through r , which is connected with a suitable supply reservoir containing such a head of liquid that there is no difference of pressure on the two sides of the valve, b_1 , which can then be opened.—A. S.

Raising liquids; Means for — H. P. Esping, Nässjö, Sweden. U.S. Pat. 922,870, May 25, 1909.

SEE Eng. Pat. 9283 of 1908; this J., 1909, 590.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Fuels; Maximum temperatures attainable with ordinary — J. von Ehrenwerth. Metallurgie, 1909, 6, 305–315.

THE author calculates the calorific intensity, or maximum temperature theoretically attainable, of various gaseous fuels, and shows to what extent these temperatures are reduced in practice owing to dissociation of carbon dioxide and steam. Thus, the theoretical calorific intensity of water-gas is 1840°C , or, if 0.7 of the heat produced is used for the preliminary heating of gas and air, 2938° ; whilst the temperatures actually attained are only 1460° and 1940° respectively. From the figures given, it appears that where regenerative heating of gas and air is practicable, the temperatures obtained with water-gas are only slightly higher (e.g., 65°) than those obtained with carbon monoxide (producer-gas); but that without preliminary heating of gas and air, considerably higher (e.g., at least 120°) temperatures can be obtained by using water-gas instead of producer-gas.—A. G. L.

PATENTS.

Anthracite briquettes; Producing — J. F. Lovejoy, Assignor to A. Stein, New York. U.S. Pat. 921,550, May 11, 1909.

THE coal is first heated to between 250° and 350°F . and then mixed at about 240°F . with molten pitch having a melting point of about 160°F . and heated to 240°F . The mixture is thoroughly agitated and then briquetted at a temperature of from 160° to 220°F .—W. H. C.

Coke oven. C. Schroeter, Assignor to J. F. Hill, Chicago, Ill. U.S. Pat. 922,201, May 18, 1909.

THE oven comprises a battery of horizontal retorts, with a combustion chamber beneath the sole of each retort. The space beneath the sole of each retort is divided by a horizontal partition into a combustion chamber and an air chamber beneath it. Vertical burner

pipes, connected to horizontal fuel pipes running along the length of the air chambers, project concentrically through apertures in the partitions so that air is drawn in with the fuel into the combustion chambers. The fuel pipes and air chambers are connected to mains running along the front of the oven, and branch pipes are provided for air and fuel for heating the side walls of the last retort at each end of the oven. The heating gases from the combustion chambers pass around the retorts through chambers filled with chequer-brickwork, and finally pass through downtake flues between the retorts to main flues running transversely beneath the oven.—A. T. L.

Retorts; Vertical —. R. M. Brooke, Halifax, and R. Dempster and Sons, Ltd., Elland, Yorks. Eng. Pat. 16,405, Aug. 4, 1908.

THE principle of the invention described in Eng. Pat. 14,637 of 1906 (this J., 1907, 859) is applied to the heating of vertical retorts. The retorts are arranged in a setting divided into compartments by horizontal partitions, and a separate combustion chamber and regenerator are provided in connection with each compartment. The supplies of secondary air and of producer gas to each combustion chamber, and the exit from each regenerator can be separately controlled. One combustion chamber may communicate with several of the horizontal compartments.—A. T. L.

Gas-furnace; Regenerative —. J. B. Acker, New York. U.S. Pat. 921,322, May 11, 1909.

THE claim is for the provision of a single-furnace chamber beneath each bench of "through" retorts. The furnace has a charging opening in one end wall of the bench and a stoking opening in the opposite end wall. The walls of the furnace slope downwards from the above-mentioned openings to a grate which is provided with a slinking door.—W. H. C.

Air-gas producing plants. J. Holroyd, Gringley-on-the-Hill, Notts. Eng. Pat. 14,110, July 3, 1908.

AIR is blown by a fan, driven by a gas-engine operated by a portion of the air-gas produced, into a carburetting chamber. Within the latter is a vane-wheel having its vanes covered with cotton and having wicks of cotton hanging down from the tips of the vanes. The carburetting liquid is supplied from a store tank by wicks which project into the carburetting chamber and from which the liquid drips on to the vane-wheel. Any excess of liquid drains into a pan beneath the wheel and is again brought into action by the wicks attached to the tips of the vanes.—W. H. C.

Gas; Process of manufacturing —. W. H. Cone, Assignor to the Coal Products and Power Co., Detroit, Mich. U.S. Pat. 922,857, May 25, 1909.

THE process is carried out in a pair of producers. Each producer is provided with a central blast-pipe at its lower end, and with an outlet pipe at the upper end leading into the other producer at about the middle of the height of the fuel column. The blast is admitted to each producer in turn, and the producer-gas formed in one producer passes to the centre of the fuel column of the other producer, and then downwards through the lower part of the fuel column to the blast-pipe, which is now connected by a three-way valve to the gas main. At the same time the raw fuel which forms the upper part of the fuel column is coked, the distillation gases passing downwards with the producer-gas. Subsequently the hot gas from the first producer is passed through this coked fuel to bring it to incandescence, and the currents are then reversed.—A. T. L.

Gas producer, especially for moist combustible materials. J. Pintsch Akt.-Ges. Ger. Pat. 209,387, Aug. 21, 1908

THE invention relates to gas-producers provided with a re-grate both at the top and the bottom, the producer-chamber being surmounted by another chamber in which the moist combustible material is subjected to a preliminary drying operation. The steam and waste

gases pass from the drying chamber to a chimney. According to the present patent, the supply pipe for the gas (e.g., the exhaust gas from the gas-engine) used as drying agent, is provided with a branch which ascends and then leads into the chimney, where it ends in a jet and thus acts as an exhauster, improving the chimney draught.—A. S.

Electric incandescent lamps; Production of tungsten filaments for —. Westinghouse Metal Filament Lamp Co., Ltd., London. From The Westinghouse Metallfaden Glühlampen Fabr., Ges.m.b.H., Vienna. Eng. Pat. 14,942, July 14, 1908.

METALLIC tungsten is prepared by Delépine's method, tungsten trioxide being reduced with zinc dust at red heat, and the resulting product treated with acid to remove the zinc oxide and excess of zinc, leaving the metal behind as a fine mud. After thoroughly washing with water by decantation, the mud is concentrated by evaporation until it acquires a consistency suitable for insertion in a press cylinder, from which the filaments are subsequently squirted. The raw filaments, after being heated to 800 C. for half an hour, in the absence of air, are finished in the usual manner, being raised to white heat, in an atmosphere of hydrogen and nitrogen, by the passage of an electric current.—W. E. F. P.

Electric incandescent filaments; Manufacture of — from tungsten or other difficultly fusible metal. Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 25,854, Nov. 30, 1908. Under Int. Conv., Dec. 11, 1907.

THE powder of the difficultly fusible metal is coated, galvanically or chemically, with 10 to 20 per cent. of a very ductile metal (such as gold, nickel, or silver) in such a manner as not to destroy the pulverulent character of the product. The coated metallic powder is then worked up by pressing or rolling, without fusion, into a filament from which the added metal is subsequently expelled in a vacuum by the passage of an electric current; or the coated metallic powder may be stamped into a tube of very ductile metal which is then drawn or rolled to the desired form, the encasing metal being afterwards removed by any of the usual methods.—W. E. F. P.

Electric incandescence filaments; Manufacture of — from tungsten and other difficultly ductile metals. Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 2853, Feb. 5, 1909. Under Int. Conv., Feb. 11, 1908. Addition to Eng. Pat. 4814 of 1907.

IN the process described in Eng. Pat. 4814 of 1907 (this J., 1907, 519), tungsten powder is charged into a tube of ductile metal, such as steel, which is then rolled or drawn into the form of a filament. The improvement consists in inserting a tube of copper or other very ductile metal into the steel tube before the addition of the tungsten powder. When filled, the tube is closed by a screwed or wedged copper stopper, and is then rolled or drawn to a wire of the desired thickness, the external steel covering of which is subsequently removed by means of dilute acid, leaving the tungsten encased in a thin shell of copper. The finished filament is obtained by electrically heating the wire, in a vacuum or suitable rarefied atmosphere, in such a manner as to cause the copper shell to vaporise; or the wire may be so heated as to cause the shell to alloy with the tungsten, thus permitting of a further rolling or drawing process before the final vaporisation of the copper.—W. E. F. P.

Incandescent electric lamp filaments; Manufacture of —, and apparatus therefor. The British Thomson-Houston Co., Ltd., London. From Gen. Electric Co., Schenectady, U.S.A. Eng. Pat. 3951, Feb. 17, 1909.

THE difficulties usually experienced by reason of the sticky nature of the raw filament are obviated by causing the extruded thread to pass over a heated shoot in the special apparatus described.—W. E. F. P.

Briquettes of coal or ores; Manufacture of —. A. J. Boulton, London. From Wulff et Cie., Düsseldorf, Germany. Eng. Pat. 16,625, May 15, 1908.

SEE Fr. Pat. 390,291 of 1908; this J., 1908, 1010.—T. F. B.

Gas from tar: Method of and means for obtaining — in gas producer plant. F. G. C. Rincker and L. Wolter. Watergraafsmeer, Holland. Eng. Pat. 10,422, May 13, 1908.

SEE Fr. Pat. 391,868 of 1908; this J., 1908, 1144.—T. F. B.

Gas: Manufacture of —. W. E. Lake, London. From International Gas Development Co., New York. Eng. Pat. 20,014, Sept. 23, 1908.

SEE U.S. Pat. 899,690 of 1908; this J., 1908, 1052.—T. F. B.

Furnace for gasifying coal. H. Ries, Munich, Germany. U.S. Pat. 922,042, May 18, 1909.

SEE Fr. Pat. 386,554 of 1908; this J., 1908, 742.—T. F. B.

Water-gas apparatus. L. D. Carroll, Assignor to Humphreys and Glasgow, London. U.S. Pat. 922,389, May 18, 1909.

SEE Eng. Pat. 17,986 of 1907; this J., 1908, 153.—T. F. B.

Filaments for electric incandescent lamps; Manufacture of —. Wolfram Lampen Akt.-Ges., Augsburg, Germany. Eng. Pat. 10,891, May 19, 1908. Under Int. Conv., Oct. 7, 1907.

SEE Fr. Pat. 394,585 of 1908; this J., 1909, 302.—T. F. B.

Sulphur from spent oxide. Eng. Pat. 596. See VII.

Sodium sulphate from ashes of brown coals. Ger. Pat. 209,909. See VII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum oils: Optical activity of certain crude —. M. Rakusin, Ber., 1909, 42, 1640—1647.

OBSERVATIONS made by Engler (this J., 1908, 932), Jones and Wootton (this J., 1907, 919) and others, have confirmed the author's conclusions that most natural petroleum oils yield dextro-rotatory distillates (this J., 1904, 816; 1907, 678; 1908, 397). Many oils have been found to be polarimetrically inactive, or only slightly dextro-rotatory, whilst an oil from Java examined by Engler (*loc. cit.*) and an oil from Bornco examined by Jones and Wootton (*loc. cit.*) yielded, on distillation, fractions which were slightly laevo-rotatory. With regard to the question of the optical activity of oils yielding optically active distillates, it is pointed out that Zložiecky and Klarfeld (this J., 1908, 16) found a Galician oil to have only a slight dextro-rotation, whilst Marcusson found that an opaque oil from which the dark colouring matter had been mechanically removed was transparent to polarised light. In the author's experiments on treating petroleum oils with fuller's earth, it was found that those of the deepest colour (*i.e.*, the geologically oldest) were thus rendered transparent in polarised light. An opaque sample of Bibi-Eibat oil with a sp. gr. of 0.8800 at 15° C. yielded, after treatment with fuller's earth, a colourless filtrate with an optical rotation of -1.5° (saccharimeter degrees) in a 200 mm. tube. In like manner, an almost black Binagady oil (sp. gr. 0.9270) gave a light yellow product with sp. gr. 0.8573 and optical rotation of -2.3° . In the distillation of crude oil the optical rotation of the distillates increases with their sp. gr., and the author therefore considers that crude oils with a high degree of optical activity are probably derived from zones nearest to those of the parent oil, and that in the latter is possibly to be sought the origin of the optically-active constituents. In the case of the two polarimetrically transparent petroleum oils mentioned above, the optical activity increased during a fractional distillation from $+1.5^\circ$ to $+4^\circ$ and from $+2.3^\circ$ to $+5.8^\circ$ respectively. Contrary to expectation there was not only no racemisation in the distilled fractions, but also none in the residues. The optical activity is thus, as it were, concentrated in

the residue. Alterations in the direction of the rotation (*Drehungsinne*) such as take place in the distillation of cholesterol do not occur in the distillation of petroleum oils. In the author's opinion the optical activity of petroleum oils is to be attributed, not to the influence of terrestrial magnetism, but, as Walden also assumes, to the asymmetrical constitution of the hydrocarbon molecule in the oils.—C. A. M.

Petroleum distillates: Cause of the lubricating capacity of —. K. W. Charitschkoff. Chem. Rev. Fett-u. Harz-Ind., 1909, 16, 132—133.

THE fact that the increase in the b. pt. of the fractions obtained in the distillation of petroleum is accompanied by an increase in their mean molecular weight and iodine values, points to an increase in the proportion of unsaturated hydrocarbons and a decrease in the proportion of saturated paraffins and naphthenes. On these differences is based the method of Nastukoff, which consists in determining the amount of precipitate yielded by the oil on treatment with formalin and sulphuric acid. Gerr also attempted to separate the naphthenes and unsaturated hydrocarbons by the same method, but only succeeded in separating 8 to 10 per cent. of the naphthenes of high b. pt. from the lubricating oil mixture. In the latest methods of concentration in the lubricating oil manufacture (viscosines), there is a preliminary treatment of the oil with sulphuric acid and caustic soda. It has been found, however, in practice that vigorous treatment with acids, and especially with fuming acids (as used by Gerr), impairs the quality of mineral lubricating oils, and renders them more fluid. Whether this is also the case with the highest fractions is uncertain. The suitability of a petroleum oil for the manufacture of lubricating oils depends not only on the behaviour of its unsaturated hydrocarbons, but also on its naphthenes of high b. pt., which are not oxidised and not affected by superheated steam. Until recently it was commonly accepted by manufacturers that the only Caucasian petroleum oil suitable for the production of lubricating oil was that from Balachani. There are, however, many other Russian oils (*e.g.*, those from Bibi-Eibat and Grozni) which yield good lubricating oils when distilled with steam *in vacuo*, although the products have different physical characteristics. For example from a Grozni oil the following fractions were obtained by distillation with superheated steam in a vacuum of $\frac{1}{2}$ atmosphere.

Temperature of steam.	Temperature of fraction.	Yield.	Sp. gr.	Flashing points (Martens).	Viscosity (Engler).
°C.	°C.	Per cent.		°C.	
200	175	20	0.862	118	{ very fluid.
250	175—200	8	0.843	159	{
280	200—225	10.7	0.901	180	3' 2"
320	225—280	26.8	0.921	188	8' 12"

Residue (asphaltum) 32 per cent.; loss 2.5 per cent.

The last fraction was an excellent lubricating oil, which differed from the corresponding fraction from Baku oil in having a high sp. gr. and b. pt. Both of these qualities would be of importance in an oil for lubricating machinery used with steam under high pressure.—C. A. M.

Paraffin wax and ceresin: Quantitative separation of —. J. Marcusson and H. Schueler. Pharm. Zentralh., 1909, 50, 346.

THREE grms. of the material, free from rosin, are dissolved with gentle heat, under a reflux condenser, in 30 c.c. of carbon bisulphide. The solution is cooled to 25° C. and treated with 300 c.c. of a mixture of equal volumes of 96 per cent. alcohol and ether, also at 25° C. The precipitate is collected on a Büchner filter, washed with 25 c.c. of alcohol-ether, transferred to a tared capsule by means of warm benzene, and weighed after evaporating the solvent. The weight of the residue being *a*, the percentage of paraffin wax = $\frac{1}{3}$ (60—*a*). A ceresin which gives less than 50 per cent. of residue under this test, is adulterated; when the residue exceeds 55 per cent. the

specimen is pure. If the amount of residue is between 50 and 55 per cent., the crystalline structure of the portion remaining in the mother liquor, and its refractive power at 90° C. must be determined.—J. O. B.

Acetone reaction. Bardach. See XX.

Petroleum industry of Mexico. Board of Trade J., June 10, 1909. [T.R.]

OIL-PRODUCING lands have been discovered in the State of Vera Cruz, near the Isthmus of Tehuantepec, and the flow of oil in the wells has been of such quantity and quality that a British company have erected a large refining plant at Minatitlan, which is now in partial operation. A certain part of the production is to be fuel oil, and as the same company also work the Tehuantepec National Railway jointly with the Mexican Government, the latter's engines will be supplied with this fuel oil. Large storage tanks have been erected at Vera Cruz and other places to supply the several railways in this part of the country. When this plant is in operation it is expected that the Mexican market for foreign petroleum will disappear.

Great activity continues in prospecting for and developing oil lands, and options have been obtained on extensive tracts of land in the States of Tamaulipas, Vera Cruz, and Chiapas, and the necessary drilling plants have been brought from abroad. Test borings are being made in every direction, and reports of new wells are of frequent occurrence.

The oil well at Dos Bocas, in the northern part of the State of Vera Cruz, is remarkable for the tremendous force of the flow and the enormous output. Since the extinguishing of the fire the paramount problem has been to control the flow and save the oil. Immense earthen reservoirs and dikes have been built, but the oil has overflowed these and spread over the lagoons for a distance of several miles. The well is now under control.

One of the effects of this development in the oil districts of Mexico has been that petroleum has come into use as a substitute for coal as fuel. Formerly the Mexican railways consumed from 120,000 to 140,000 tons of patent fuel drawn from Cardiff and district, but during the latter half of 1908 they converted 50 per cent. of their engines to oil-burners, and so satisfactory and economical has the result been that it is only a matter of the erection of the necessary storage tanks for the use of coal as fuel to be given up altogether. Many industrial enterprises which were formerly coal consumers have changed, and still others are now changing, their boilers in order to use oil. This has affected the importation of coal and patent fuel to the extent of causing a decrease in imports of about 10 per cent. during 1908.

PATENTS.

Fluorene; Process for obtaining — from materials containing it. Ges. für Teerverwertung. Ger. Pat. 209,432, Oct. 13, 1908. Addition to Ger. Pat. 203,312, Feb. 11, 1908.

In preparing the sodium compound of fluorene for the purpose of separating the latter from mixtures containing it, as described in the main patent (see this J., 1908, 99), it is found that the action of sodium on the fluorene is greatly accelerated by the addition of organic bases such as aniline, benzyllamine, or pyridine or its homologues. —A. S.

Sodium compound of indene; Process for preparing a —. Ges. f. Teerverwerthung. Ger. Pat. 209,694, Oct. 13, 1908. Addition to Ger. Pat. 205,465, Feb. 12, 1908 (this J., 1909, 84).

THE sodium derivative of indene can be obtained by the action of metallic sodium on indene or mixtures containing indene at temperatures above 130° C., or in presence of organic bases (e.g., pyridine) at temperatures above 90° C.—T. F. B.

Petroleum; Method and apparatus for distilling crude —. F. Seidenschneur, Charlottenburg, Germany. Eng. Pat. 10,892, May 19, 1908. Under Int. Conv., Aug. 19, 1907.

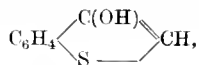
THE crude petroleum is suddenly vaporised by treating it with superheated steam in a vessel in which a high vacuum is maintained, as described in Ger. Pat. 169,952 (this J., 1907, 87). To avoid the formation of coke and to reduce the loss in distillation, the process is carried out in large shallow vessels or stills in the following manner. The still, which is connected to a vacuum pump, is heated to 100° C. and about 200 kilos. of crude petroleum at the same temperature are run in. Superheated steam at 450° to 500° C. is constantly passed through the still and the temperature is raised to 380° to 400° C. Crude petroleum is then admitted in a continuous stream while the temperature is kept within these limits, until the amount of oil reaches 200 kilos. per sq. metre of the area of the still. The supply of oil is then stopped, and the supply of steam is increased so as to raise the temperature of the still to 420° or 430° C. The quantity of steam used is at least 30 to 40 per cent. of the quantity of oil, and the process is stopped when from 5 to 10 per cent. of the volatile material remains in the still. The steam and oil admission pipes are branched in the still so as to admit steam and oil at several points, and the steam outlets are directed obliquely downwards in front of the oil outlets, so as to direct the oil against the bottom of the still.—A. T. L.

Oil-testing apparatus. Ger. Pat. 209,399. See XXIII.

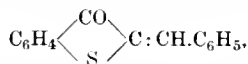
IV.—COLOURING MATTERS AND DYESTUFFS.

Dyestuffs of the thionaphthene series. P. Friedlaender. Monatsh. Chem., 1909, 30, 347—354.

THE author finds that 3-oxythionaphthene,

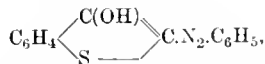


behaves in a similar manner to α -naphthol in that it combines with diazonium compounds to form azo-dyestuffs, and, unlike α -naphthol but similarly to indoxyl, condenses with aromatic aldehydes with the production of compounds resembling Baeyer's "indogenides" but containing a sulphur atom in place of the imino-group. The new compounds are therefore termed "thioindogenides." The benzaldehyde compound,



prepared by heating sodium oxythionaphthene-carboxylate with five times its quantity of glacial acetic acid until carbon dioxide is no longer evolved and then warming for a few minutes with a little more than the theoretical amount of benzaldehyde and a few drops of concentrated hydrochloric acid, separates in yellow needles, m.p. 127° C. Similar condensation products are obtained from derivatives of benzaldehyde. Protocatechuic aldehyde yields brownish, orange-yellow needles, m.p. above 280° C., which dye cotton mordanted with alumina dull orange; with iron oxide, coffee-brown; with chromium oxide, brownish-violet; and with tin oxide, bright orange red.

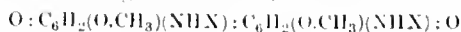
Benzeneazo-3-oxythionaphthene,



prepared in the usual manner from benzenediazonium chloride and oxythionaphthene (carboxylic acid) forms orange-yellow needles melting at 191—192° C. The compound prepared by the use of diazotised *p*-nitraniline forms orange-red needles.—J. C. C.

Lignones; Friedländer's "colour-nomenclature" of —. C. Liebermann. Ber., 1909, 42, 1851—1852.

REFERRING to Bezdzik and Friedländer's recent suggestion (this J., 1909, 468) that the name "lignone" should be used to designate the binuclear *p*-quinones, the author points out that he has already described a number of dyestuffs of the general formula,



(which is now considered more correctly to represent their constitution than that formerly adopted) as "Lignone blues" and this serves to provide relatively simple names for their derivatives. Friedländer's name for "Lignone Blue" would thus be "bis-3:5-methoxyphenylamino-benzolignone" which is much more complicated but, in view of future developments, may be found to be more suitable. Such "lignone" dyestuffs have, however, been known for a long time.—J. C. C.

Preparing benzene sulphochloride. Pummerer. See XX.

PATENTS.

Sulphide colours [dyestuffs]; Manufacture of —. R. B. Ransford, London. From L. Cassella and Co., Frankfurt, Germany. Eng. Pat. 17,352, Aug. 18, 1908.

By treatment of the sulphide dyestuffs derived from indophenols or leucoindophenols with halogen, substitution sometimes accompanied by oxidation takes place and the resulting dyestuffs are distinguished by their fastness to washing, light, and chlorine. The dyestuff to be treated is dissolved in concentrated formic or acetic acid, alcohol, carbon tetrachloride, water, or other suitable solvent and the halogen introduced into the solution; the reaction is controlled by cooling the mixture during the operation.—F. M.

Sulphide dyestuff; Process for preparing a clear red-brown —. L. Cassella and Co. Ger. Pat. 208,109, March 14, 1907.

A DYESTUFF which gives clear, fast, reddish-brown shades, is obtained by melting aminohydroxytolylphenazine (produced by the simultaneous oxidation of *p*-aminophenol and *m*-tolylenediamine) with alkali polysulphides.

—T. F. B.

Azo dyestuff and process of making same. J. and E. Fussenegger, Ludwigshafen, and L. Blangey, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 921,516, May 11, 1909.

CLAIM is made for azo-dyestuffs prepared by diazotising 4:5-disubstituted *o*-nitranilines with β -naphthol. The dyestuff obtained by diazotising 4:5-dichlor-2-nitraniline and combining with β -naphthol is orange-red and is insoluble in water or dilute acids or alkalis.—J. C. C.

Nitrogenous condensation products from aromatic hydroxy- or amino-compounds and aromatic hydrazines; Process for the preparation of —. H. Bucherer and F. Seyde. Ger. Pat. 208,960, Aug. 28, 1906.

CONDENSATION products of aromatic hydrazines with such aromatic hydroxy- or amino-compounds as are capable of forming sulphurous esters, are obtained by the interaction of the components in aqueous solution in presence of a sulphite or sulphurous acid, or by the action of the sulphurous esters of the hydroxy- or amino-compounds on aromatic hydrazines. In many cases the primary condensation product, probably the *N*-sulphonic acid of a hydrazo-compound, undergoes transformation to the corresponding carbazole-*N*-sulphonic acid, from which by heating with mineral acids the carbazole can be obtained. By applying the reaction to various dyestuffs, other dyestuffs of different properties can be obtained. Several examples are given. (See also this J., 1908, 1014).

—A. S.

Anthracene series; Process for preparing a brown red dyestuff of the —. Farbwerke vorm. Meister, Lucius and Brünning. Ger. Pat. 208,969, March 31, 1908.

A BROWN vat dyestuff is obtained by melting with alkali dianthraquinonyl-1:4-diaminoanthraquinone; this again is obtained by heating 1 mol. of 1:4-diaminoanthraquinone or its leuco-derivative with 2 mols. of 2-bromoanthraquinone in presence of cupric acetate.—T. F. B.

Dyestuffs of the anthracene series; Process for preparing blue —. Farbwerke vorm. Meister, Lucius, und Brünning. Ger. Pat. 209,321, April 30, 1908.

SUBSTANCES which dye wool fast blue shades from acid baths are obtained by the sulphonation of symmetrical 1:4-dialkylaminoanthraquinones in presence of boric acid. Two parts of the anthraquinone derivative are heated with 60 parts of fuming sulphuric acid (20 per cent. anhydride) and one part of boric acid, for 4 to 5 hours at 120° C., the mass is poured into water, caustic soda is added, and the dyestuff is salted out.—T. F. B.

Triphenylmethane dyestuffs; Process for preparing red-violet, acid, chrome —. Anilinfarben- und Extrakt-Fabr. vorm. J. R. Geigy. Ger. Pat. 209,535, July 14, 1908. Addition to Ger. Pat. 189,938, Sept. 29, 1906.

THE aldehydes used in the principal patent (see Fr. Pat. 384,979 of 1907; this J., 1908, 497) in conjunction with *o*-hydroxycarboxylic acids for the production of triphenylmethane dyestuffs, may be replaced by the following aldehydes:—*p*-Dimethylaminobenzaldehyde, *p*-diethylaminobenzaldehyde, *p*-methylamino-*m*-tolylaldehyde, *p*-ethylamino-*m*-tolylaldehyde. The dyestuffs give deep red or Bordeaux-red shades from acid baths, changing to red-violet on chroming.—T. F. B.

Azine dyestuffs; Process for preparing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 209,536, May 8, 1908.

By treating with acids the azo dyestuffs obtained from diazobenzenesulphonic acid and 2-arylamino-5-naphthol-7-sulphonic acids, azine dyestuffs are obtained which dye wool and silk yellow shades, very sensitive to alkalis; it is found, however, that if these azine dyestuffs are alkylated, the products dye wool and silk clear greenish-yellow shades, very fast to alkalis.—T. F. B.

Anthraquinone derivatives containing nitrogen; Process for preparing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 210,019, May 1, 1908.

By the condensation of two mols. of aminoanthraquinones or their derivatives with one mol. of succinic acid, new derivatives are obtained which can be used either as dyestuffs or for the preparation of dyestuffs.—T. F. B.

Nitro-1:8-naphthsultamsulphonic acid and 2:4-dinitro-1:8-naphthsultam; Process for preparing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 210,222, July 5, 1907.

By treating 1:8-naphthsultam-2:4-disulphonic acid or its salts with nitric acid, one or both of the sulphonic acid groups can be replaced by nitro groups without fission of the naphthsultam ring, nitronaphthsultam-sulphonic acid and dinitronaphthsultam being produced. The products dye wool clear yellow shades, and form lakes which are suitable for colouring paper, etc.—T. F. B.

Sulphide dyestuffs soluble in water; Process for preparing —. Act.-Ges. f. Anilinfabr. Ger. Pat. 209,850, Feb. 11, 1908.

WHEN solutions of sulphide dyestuffs in sodium sulphite solution are treated with oxidising agents, such as hydrogen peroxide, sodium hypochlorite, or ammonium persulphate, the dyestuff is not precipitated, but the solution changes and becomes much deeper in colour, and does not dye cotton or wool. By evaporating to dryness, products are obtained which dissolve readily in water, the dilute solutions not being precipitated by acids in the cold. The new products are especially suitable for dyeing

leather; their solutions are precipitated by salts of copper, lead, barium, aluminium, etc., the lakes obtained being suitable for colouring paper, etc.—T. F. B.

Isatin derivative containing sulphur; Process for preparing a —. Ges. f. Chem. Ind. in Basel, Ger. Pat. 210,343, Aug. 29, 1908.

A NEW, stable thioisatin is obtained by heating indoxyl with sodium tetrasulphide in alcoholic solution, until a sample of the product, when dissolved in water, gives no precipitate of indigo when treated with air. The alcohol is now distilled off, the residue dissolved in water, and the thioisatin precipitated by addition of hydrochloric acid. It is readily soluble in alkalis, and decomposes without melting above 300° C. When condensed with 3-oxy-(1)-thionaphthene-2-carboxylic acid in xylene solution, it furnishes a bluish-red vat dyestuff.—T. F. B.

Anthracene group; Manufacture of new derivatives belonging to the —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 10,387, May 13, 1908.

SEE Fr. Pat. 390,157 of 1908; this J., 1908, 1014.—T. F. B.

Azo dyestuffs and intermediate products for use therein; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 11,866, June 1, 1908.

SEE Fr. Pat. 391,456 of 1908; this J., 1908, 1148.—T. F. B.

Anthracene derivatives; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 18,107, Aug. 28, 1908. Addition to Eng. Pat. 28,765, Dec. 17, 1906.

SEE Addition of Aug. 27, 1908, to Fr. Pat. 372,676 of 1906; this J., 1909, 133.—T. F. B.

Sulphurised [sulphide] dyestuffs; Manufacture of —. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 20,802, Oct. 2, 1908.

SEE Fr. Pat. 394,832 of 1908; this J., 1909, 305.—T. F. B.

Sulphurised [sulphide] dyestuffs soluble in water; Manufacture of —. Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 2290, Jan. 30, 1909. Under Int. Conv., Feb. 10, 1908.

SEE Ger. Pat. 209,850 of 1908; preceding.—T. F. B.

	<i>Agave rigida.</i>	<i>Agave Americana.</i>	<i>Furcraea sp.</i>	<i>Manila hemp (Madras).</i>	<i>Manila hemp (standard).</i>	<i>Banana fibre from E. Africa.</i>	<i>Agave sisalana (Andamans).</i>	<i>Sisal hemp from E. Africa.</i>
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	9.0	9.7	10.0	11.3	10.2	10.8	11.7	11.1
Ash	1.5	2.0	1.5	3.5	1.1	3.4	3.5	1.0
z-Hydrolysis (loss) ..	11.5	16.2	18.8	20.9	11.2	16.5	14.0	11.2
β-Hydrolysis (loss) ..	14.6	20.0	22.1	27.8	17.8	25.6	16.0	14.1
Acid purification (loss)	2.0	3.8	3.0	5.0	1.6	3.8	4.7	2.3
Cellulose	73.0	77.0	72.0	70.5	78.6	73.0	76.6	78.2

—E. W. L.

Anthracene dyestuff and process of making same. M. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 922,282, May 18, 1909.

SEE Eng. Pat. 20,132 of 1906; this J., 1907, 313.—T. F. B.

Aromatic aldehydes. Ger. Pat. 209,910. See XX.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Fibres from India. Bull. Imp. Inst., 1909, 7, S—14.

(1). *Agave rigida* fibre from Madras. From six-year-old leaves, well-prepared, of good lustre, colour nearly white to pale buff, strength good, staple 3 ft. long. The product was valued at £36 to £38 per ton (Mexican "Sisal" at £34). (2). *Agave Americana* fibre from Madras. From six-year-old leaves, uneven in quality, varying from nearly white and lustrous, to gummy, poor in lustre

and contaminated with greenish pulp. Staple rather short for rope-making. Valued at £27 to £28 per ton. (3). *Furcraea sp.* fibre from Madras. From six-year-old leaves, colour buff to nearly white, fair lustre but a little gummy and stiff. Uneven strength, staple 2 to 3 feet long, therefore poor for rope-making. Valued at £26 to £27 per ton (Mauritius hemp at £24 to £30). (4). *Manila hemp* from Kullar, Madras. Well prepared, pale buff in colour, fair lustre, not so harsh as ordinary Manila hemp, rather resembling plantain or banana fibre. Average length of fibre 4 ft. 3 in. Strength poor compared with ordinary Manila hemp. Valued at £23 to £24 per ton (October, 1908). Well adapted for binder twine manufacture. (5). *Agave* fibre from Assam. Of promising quality but not well cleaned. Colour uneven, fairly lustrous, very good strength, length four feet, but some fibres shorter. Valued at £30 per ton if well cleaned. (6). *Agave sisalana* fibre from Andaman Islands (Port Blair). Buff coloured, well-cleaned, fair lustre, good strength, average length four feet. Contained less cellulose and lost more on hydrolysis and acid purification than E. African sisal hemp. This was probably due to the fibre having been washed in sea-water, since the ash contained 2.9 per cent. of sodium chloride. If this salt were absent, the fibre would be slightly superior to E. African sisal. The sample was valued at about £24 per ton (Mexican "Sisal" at about £25). (7). *Urena* fibre from Nettigandi. Somewhat harsh, greyish fibre, gummy and in parts woody, strength fair but uneven. Fibre insufficiently retted. Resembled "Aramina" fibre from Brazil, and, like it, was decidedly harsher than jute (Bull. Imp. Inst., 1903, 1, 24). Suitable for spinning and mixing with jute. The length of fibre was irregular, varying from 6 ft. to 4 ft. or less. Valued at £12 10s. to £13 (with "medium" jute at £15 to £17 per ton). (8). *Kapok* (seed-floss of *Eriodendron anfractuosum*) from South Arcot District of Madras Presidency, where it is available at 1-9d. to 4-16d. per lb. The sample was clean, but contained a quantity of seeds and occasional fragments of the capsules. Colour light brown, but slightly darker than Javan kapok, very lustrous, resilient, soft and silky. Fibres of poor strength, and 0.7 to 1.0 inch in length, with diameter varying from 0.0006 to 0.0013 inch. Brokers consider it equal to good Javan kapok, and worth about 4½d. per lb. containing seed, but 6d. if fairly free from seed. Care should therefore be taken to remove the seed as completely as possible before shipping.

Table of results of chemical examination:

	<i>Manila hemp (Madras).</i>	<i>Manila hemp (standard).</i>	<i>Banana fibre from E. Africa.</i>	<i>Agave sisalana (Andamans).</i>	<i>Sisal hemp from E. Africa.</i>
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	11.3	10.2	10.8	11.7	11.1
Ash	3.5	1.1	3.4	3.5	1.0
z-Hydrolysis (loss) ..	20.9	11.2	16.5	14.0	11.2
β-Hydrolysis (loss) ..	27.8	17.8	25.6	16.0	14.1
Acid purification (loss)	5.0	1.6	3.8	4.7	2.3
Cellulose	70.5	78.6	73.0	76.6	78.2

Silica with Methylene Blue; The combination of —. L. Pelet-Jolivet and N. Andersen. Bull. Soc. Chim., 1909, 5, 540—546.

THE authors have further investigated the blue compound which is formed when hydrated silica is mixed with Methylene Blue (see this J., 1907, 920) and find that the composition of the compound is variable, depending on the concentration of one or other of the constituents and also on the presence of other substances. The difficulty with which the Methylene Blue is extracted from the silica indicates that the dye does not simply adhere to the silica but that there is actual combination.—W. P. S.

Lead chromate; Colouring properties of —. L. Vignon. Compt. rend., 1909, 148, 1329—1331.

TEXTILES may be dyed with lead chromate by immersion first in a solution of a lead salt and subsequently in a solution of a soluble chromate. The lead chromate is precipitated on the fibre which retains a certain quantity

after repeated washing. Textiles can also be dyed by immersion in suspensions of precipitated lead chromate in water; it is remarkable that under these conditions, silk, wool and cotton all behave alike. A good deal of the colour is removed by washing so that to obtain a given shade it is necessary to employ a great deal more colouring matter than when using a soluble dyestuff. Suspensions in liquids other than water do not give the same intensity of colour. The lead chromate is not chemically fixed to the textile but its retention is probably due to adsorption phenomena. The suspension of lead chromate is comparable to some colloidal solutions.—E. F. A.

Yarns and fabrics: Treatment of — by the Agostini process. M. Prudhomme. Bull. Soc. d'Encour., March, 1909.

THESE processes depend upon a chemical reaction which takes place upon the fibre and results in the formation of an insoluble, highly adhesive soap which becomes incorporated with the fibre itself. According to Fr. Pat. 361,772 of 1905 (this J., 1906, 1160), the material to be treated is impregnated with a mixture containing fatty acids, fats or hydrocarbons, and a metallic oxide, the proportions being so calculated that on drying the material, the metallic oxide is converted into an insoluble soap. The author has examined fabrics which have been industrially treated in this manner and finds that they remain supple, acquire a "cloth" handle, and yet are permeable by air and water. The finish is not removed by water or by soaping though in the latter case the lustre is impaired. The processes are applicable to woollen as well as to cotton goods and to the sizing of warps. Tables are given showing the increase in strength and weight of materials after being submitted to the Agostini treatment.—P. F. C.

PATENTS.

Bleaching; Method and apparatus for — and treating cloth, warps, etc. A. J. Boulton, London. From E. D. Jefferson, Lowell, Mass., U.S.A. Eng. Pat. 10,289, May 12, 1908.

FULL details are given of the construction and method of operation of a closed kier, in which cloth, warps, etc., may be bowked and fully bleached without being removed between the several operations. In connection with the kier is a trap and a ball-valve arrangement, by means of which a motive valve is intermittingly and automatically opened and closed, and whereby steam is admitted and the liquors (which have passed from the bottom of the kier into the trap) are "vomited" over the goods in the kier. Water, bleach liquors, and acid may be run into the kier by a suitable arrangement of pipes and valves. Circulation is effected by compressed air, automatically admitted and shut off as in the case of the steam during the boiling operation.—F. M.

Dyeing, washing or bleaching yarns and slubbing; Machinery for —. Brintons, Ltd., and C. Osborn, Kidderminster. Eng. Pat. 4586, Feb. 29, 1908.

THE hanks or skeins are carried on poles supported in one or more cages, the axes of the latter engaging in suitable guides for up and down movement. The cages are raised by lifting bars, provided with cranked and hooked lower ends with racks, the latter engaging during the up movement with pinions on the axes of the cages, thus turning the latter, but during the down movement of the lifting bars the cages fall by gravity. Two sets of cages may be operated by lifting arms from the ends of levers on the opposite sides of a rocking shaft, the latter being actuated by a suitable eccentric, or the rocking motion may be obtained by the employment of a steam or hydraulic cylinder, a rack engaging with a rocking toothed quadrant, being fixed to the piston rod of the cylinder.—B. N.

Dyeing and the like purposes; Centrifugal drum apparatus for —. G. Wörner, Calw, Germany. Eng. Pat. 12,913, June 16, 1908.

THE apparatus may serve as a dyeing machine or as a hydroextractor. The material to be treated is filled into

the cage, which is supported upon the vertical shaft by cones which are attached to the latter. The shaft is driven from below and passes through the bottom of the outer vessel; it may be raised or lowered in its bearings, and firmly fixed to it is a cone, which when the machine is used as a dyeing machine, closes the opening in the bottom of the outer vessel. When it is required to use the machine as a hydroextractor or for the atmospheric oxidation of such dyestuffs as sulphide or indanthrene colours, the shaft is lowered, whereby the cone is withdrawn and the cage may be revolved. The circulation of the air is assisted by a fan fixed to the upper part of the shaft, or by other means. An arrangement of pump, pipes and three-way cocks, whereby the liquors may be circulated in either direction without changing the direction of the pump, is described and illustrated.—F. M.

Dyeing furs, hair, feathers, and analogous material; Process for —. Farbwerke vorm. Meister, Lucius, and Brünig, Ger. Pat. 209,121, March 8, 1908. Addition to Ger. Pat. 149,676, April 2, 1903.

FURS, hair, feathers, etc., are dyed grey to black shades by treatment with *p*-aminotolyl-*p*-hydroxyphenylamine, in presence of oxidising agents such as hydrogen peroxide. The diphenylamine derivative is obtained by reducing the indophenol produced by the simultaneous oxidation of *o*-toluidine and *p*-aminophenol.—T. F. B.

Red dyeings on fibres; Process for producing — fast to light and washing. Farbwerke vorm. Meister, Lucius, and Brünig, Ger. Pat. 209,576, May 16, 1907.

THE oxidation products of thioindigo (see U.S. Pat. 898,738 of 1908; this J., 1908, 1015) are dissolved in solutions of normal alkali sulphites. By treating fibres with this solution, drying, and developing by means of warm, dilute mineral acids, fast red dyeings are produced.—T. F. B.

Discharge effects on union fabrics; Process for producing coloured —. Englische Wollenwaren-Manufaktur (vorm. Oldroyd und Blakeley), Ger. Pat. 208,998, Nov. 12, 1907.

THE cotton in union fabrics is dyed by means of dyestuffs reduced with difficulty (e.g. sulphide dyestuffs) whilst the wool is dyed with readily reduced dyestuffs; the discharge effects are produced by printing on the fabric a discharge paste, preferably free from tannin.—T. F. B.

Thioindigo Red dyeings; Process for discharging —. Kalle und Co. Ger. Pat. 209,122, June 7, 1907. Addition to Ger. Pat. 200,927, Jan. 18, 1907. (See Fr. Pat. 394,558 of 1908; this J., 1909, 241.)

FABRICS dyed with Thioindigo Red are printed with mixtures containing hydrosulphites and anthraquinone, and the leuco-compound is then removed as described in the principal patent; the addition of anthraquinone prevents the re-oxidation of the leuco-compound.—T. F. B.

Reserves under Aniline Black; Production of coloured — by means of mordant dyestuffs. Fabr. de Prod. Chim. de Thanu et de Mulhouse. Ger. Pat. 209,381, June 29, 1907.

COLORRED reserves under Aniline Black are obtained by printing the fabric with a paste consisting of the dyestuff, a chromium salt, ammonia, glycerin or similar substance, a thickening agent, and powdered chalk, steaming, treating with the aniline solution, and developing the black in the usual manner.—T. F. B.

Textile fabrics; Process for treating —. G. Hoinkes, Aussig-on-the-Elbe, Bohemia. Eng. Pat. 10,316, May 12, 1908.

IN the ordinary "crabbling" process, in which the material is sealded with boiling water or rolled on perforated cylinders and steamed, certain fabrics show cloudy or moiré effects, or become glazed. To obviate these defects it is proposed to pass the goods round cylinders, which are heated by steam at from $\frac{1}{2}$ up to 6 atmospheres pressure and are partially immersed in boiling water.—F. M.

Calendering machines. J. P. Bemberg Akt.-Ges., Barmen Rittershausen, Germany. Eng. Pat. 27,978, Dec. 23, 1908. Under Int. Conv., Jan. 8, 1908.

THE characteristic feature of this calendering machine is that the paper and steel rollers are held by bearing rollers and pressing rollers in a central position, and they are prevented from moving laterally by means of a stop. Both paper and steel rollers run at the same peripheral velocity as the bearing rollers. The bearings for the pressing and bearing rollers are arranged to oscillate in order to distribute the pressure evenly. An arrangement is provided to prevent any tipping or tilting of the bearings of the pressure and bearing rollers.—F. SHDN.

Waterproof and fireproof material or fabric. A. Mayhew. London. Eng. Pat. 10,771, May 18, 1908.

FOR producing resilient and inodorous waterproof and fireproof material or fabrics, suitable for scenery, floor-covering, bed-sheeting, cycle and motor tyres, etc., it is proposed to cover knitted or woven vegetable fabrics with a composition made by mixing a solution of glue or gelatin with glycerin, evaporating the mixture until it has the consistency of molasses, and mixing with it a hot concentrated solution of chrome alum or potassium bichromate. The hot mixture is spread, brushed or calendered on to the fabric and allowed to set under the influence of light. Another suitable composition is said to be obtained by acting upon starch with a solution of magnesium chloride.—F. M.

Vacuum drying apparatus. E. W. Strohn, Buffalo, N.Y. U.S. Pat. 921,307, May 11, 1909.

THE apparatus consists of a vacuum chamber within which a number of heating chambers are arranged. The web of material to be dried is wound on a drum at one end of the vacuum chamber and is unrolled and caused to pass by means of guide rolls around and between the heating chambers and finally wound upon a receiving drum situated at the other end of the vacuum chamber. A second web of material is simultaneously wound upon the receiving drum to keep the layers of dried material from touching each other.—W. H. C.

Dyestuffs; Fixation of — on fibre. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9651, May 4, 1908.

SEE Fr. Pat. 391,388 of 1908; this J., 1908, 1150.—T. F. B.

Printing on textile fabrics; Process for —. L. Caberti, and Manifattura e Stamperia Lombarda, Novara, Italy. Eng. Pat. 7201, April 1, 1908. Under Int. Conv., April 2, 1907.

SEE Fr. Pat. 388,769 of 1907; this J., 1908, 978.—T. F. B.

Discharge effects on textile fibres or fabrics; Production of —. G. W. Johnson, London. From Kalle und Co., A.-G., Biebrich on Rhine, Germany. Eng. Pat. 20,200, Sept. 25, 1908.

SEE Fr. Pat. 394,558 of 1908; this J., 1909, 241.—T. F. B.

Textile fabrics; Schreiner finish of —. P. M. Kraiss, Ilkley. U.S. Pat. 922,295, May 18, 1909.

SEE Eng. Pat. 17,242 of 1904; this J., 1904, 1087.—T. F. B.

Drying textile and other materials; Method of and apparatus for —. E. P. Klug, Crimmitschau, Germany. Eng. Pat. 13,760, June 29, 1908.

SEE Fr. Pat. 391,941 of 1908; this J., 1908, 1202.—T. F. B.

Sodium peroxide composition for washing and bleaching. Eng. Pat. 1150. See XII.

Objects from cellulose acetate. U.S. Pat. 922,340. See XIX.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Sulphuric acid; Concentration of —. H. Friedrich. Chem.-Zeit., 1909, 33, 634. (See this J., 1909, 520.)

THE unsatisfactory point in most systems of concentration is the amount of weak acid (of about 20° B.) obtained by condensing the vapours from the concentrating apparatus. In order to reduce the quantity of this weak acid, the author proposes that the vapours from the concentrating apparatus be passed through a small tower, similar to a Glover tower, down which chamber acid is allowed to trickle, the supply being so regulated that the vapours leaving the tower have a temperature of about 100° C. The acid from the tower is passed to the concentrating apparatus.—A. S.

Caro's acid. R. Willstätter and E. Hauenstein. Ber., 1909, 42, 1839—1850.

CARO'S acid has been regarded from different sides as a dibasic peranhydrosulphuric acid, $H_2S_2O_8$, and as a monobasic sulpho-monoper-acid, H_2SO_5 . The authors have succeeded in preparing acyl compounds of the acid by the action of benzoyl chloride and benzene sulphochloride on the potassium salt. These acyl compounds, $C_6H_5.CO.O.O.SO_3H$, and $C_6H_5.SO_2.O.O.SO_3H$, contain 1 acyl group for each atom of sulphur, and are of an acid character, being obtained in the form of potassium salts, and hence Caro's acid must be sulpho-monoper-acid, H_2SO_5 , for the acyl compounds of peranhydrosulphuric acid (Acyl) $_2S_2O_8$, would not be acids. (See also Ahle, this J., 1909, 363.)—A. S.

Potassium nitrate; Production of — by the interaction of sodium nitrate and potassium carbonate. R. Kremann and A. Zitek. Monatsh. Chem., 1909, 30, 311—340.

IN the authors' experiments to determine the conditions under which the maximum yields of potassium nitrate and of sodium carbonate (as by-product) might be obtained, the salts or mixtures of them were shaken with water in a closed flask and kept in a thermostat at the required temperature until the liquid was saturated. A definite amount of the supernatant liquid was then withdrawn by means of a filter-pipette and analysed. The amount of carbonic acid was found by titration, the potassium and sodium determined in the usual way, and the nitric acid found by difference. Series of determinations were made at 24.2° C. and 10° C., and the solubilities of the various salts involved in the reactions are given in tabular form and expressed graphically by Löwenherz's method (Z. physik. Chem., 13, 459). The results show that the solubility of pure sodium carbonate is reduced by the addition of sodium nitrate, but not constantly, owing to the fact that up to a certain point the deposit contains the hydrate, $Na_2CO_3 \cdot 10H_2O$, but that subsequently this is transformed into the hydrate, $Na_2CO_3 \cdot 7H_2O$. In the case of pure sodium carbonate solutions this change takes place at 31.85° C., but in the presence of a second soluble substance the temperature is lower. Hence at 24.2° C., given a certain degree of concentration of the sodium nitrate, the deposit of sodium carbonate will contain 7 mols. of water of crystallisation. The solubility of pure sodium nitrate decreases, in accordance with the general rule, on the addition of sodium carbonate. On the other hand, the addition of sodium nitrate to a solution already saturated with potassium nitrate increases the solubility of both salts, possibly owing to the formation of a double nitrate. The addition of potassium carbonate to a saturated solution of potassium nitrate causes a fairly rapid reduction in the amount of potassium carbonate dissolved. On the gradual addition of potassium carbonate to a saturated solution of sodium carbonate, the solubility of the latter is increased up to a certain point, after which it rapidly falls. The solution at this point yields, on concentration, a double salt, $Na_2CO_3 \cdot K_2CO_3 \cdot 6H_2O$. In the corresponding experiments at 10° C. the sodium carbonate in the deposit invariably contained 10 mols. of water, and the change observed at

24.2° C. into a salt containing 7 mols. of water did not take place. The solubilities of sodium carbonate and potassium nitrate were reduced to a relatively large extent by the reduction of temperature, whilst the solubilities of potassium carbonate and sodium nitrate were only slightly affected. At the temperatures mentioned sodium nitrate and potassium carbonate cannot co-exist, and saturated solutions can therefore only contain: (1), potassium nitrate, sodium carbonate, and sodium nitrate; (2), the double salt, $\text{KNO}_3 \cdot \text{Na}_2\text{CO}_3$; and (3), the double salt, $\text{KNO}_3 \cdot \text{K}_2\text{CO}_3$. *Technical application.*—In utilising this reaction for technical purposes it is essential that after separation of the potassium nitrate the solution shall give the maximum yield of sodium carbonate. If, after separation of the potassium nitrate, the supernatant liquid contains per 1000 c.c. the corresponding equivalents in grms. of the ions, CO_3 , $(\text{NO}_3)_2$, K_2 and Na_2 , the utilisation coefficients of potassium and sodium may be found by the respective formulae:—

$$U_K = \frac{100(\text{CO}_3 - \text{K}_2)}{\text{CO}_3}$$

and

$$U_{Na} = \frac{100(\text{Na}_2 - (\text{NO}_3)_2)}{\text{Na}_2}$$

At a point, P_2 , representing the stage at which the liquid is saturated with sodium carbonate, potassium nitrate and double salt, the utilisation coefficients of both products are better than at the point, P_1 , (saturation with sodium nitrate, sodium carbonate and potassium nitrate), or than at a point, P_3 , at which the solution is saturated only with potassium nitrate. This is illustrated by experiments of which the following are typical:—

	Solubility in 1000 c.c. of water. grms.				Solubility in 1000 c.c. of water. grms.				Solubility in 1000 c.c. of water. grm.-mols.				Utilisation coefficients.	
	Na_2CO_3	K_2CO_3	NaNO_3	KNO_3	Na_2	K_2	CO_3	NO_3	Na_2	K_2	$(\text{NO}_3)_2$	CO_3	U_K	U_{Na}
P_1 ..	21.7	—	709	282	286	109	123	704	6.22	1.40	5.68	2.05	31.7	8.6
P_2 ..	37.7	2	—	232	164	90	213	142	3.57	1.15	1.14	3.55	67.6	68.0
P_3 ..	7.787	101.49	—	3.154	33.8	586.8	484.4	19.4	0.74	7.52	0.16	8.07	6.8	78.4

In an experiment based on these considerations, 29.5 grms. of sodium nitrate and 24.5 grms. of potassium carbonate were shaken with 50 c.c. of water at 24.2° C., and allowed to stand at the same temperature. The deposit, freed by expression from the mother liquor, consisted of 24 grms. of potassium nitrate (containing 4.5 per cent. of carbonate). This corresponded to a yield of 23.0 grms. of the pure salt (theory: 23.6 grms.). In practice on a large scale the adhering carbonate would be more effectually expressed. The sodium carbonate in the residual liquor may be recovered by adding sufficient sodium nitrate to make the composition correspond with that of a solution at the point, P_1 . The solution at the point, P_2 , contains no nitrate, and the addition of sodium nitrate reduces the solubility of the sodium carbonate to such an extent that it separates out. Whereas at the point, P_2 , the solubility of sodium carbonate is 37.7 per litre, at the point, P_1 , it is only 21.7 per litre. The potassium nitrate cannot separate, for its solubility increases towards the point, P_1 , as is shown in the figures given above. To obtain a solution corresponding to one at P_1 , more potassium carbonate must also be added, and this will react with the excess of added sodium nitrate to form sodium carbonate and potassium nitrate, the former of which separates out, whilst the latter remains in solution. In the above-mentioned experiment 70 grms. of the solution, after separation of the potassium nitrate, contained 46 grms. of water and 24 grms. of solid matter. The difference per litre in the amounts of NO_3 and K between P_1 and P_2 in the table given above, calculated for 46 grms. of water, corresponds to 35.4 grms. of sodium nitrate and 0.6 grm. of potassium carbonate. On adding these quantities to the 70 grms. of the solution, a deposit consisting of sodium carbonate containing 1 mol. of water was obtained. Water corresponding to this amount of

water of crystallisation (1.25 grms.) was therefore added, and the flask shaken for about a day. A deposit weighing 7.07 grms. (theory 7.36 grms.) of anhydrous 99.1 per cent. sodium carbonate was now obtained. Experiments to determine the influence of temperature on the technical application of the reaction showed that at 10° C. the utilisation coefficients were smaller than at about 25° C. It is therefore preferable, in practice, to filter the solution at higher temperatures, say at about 25° C.—C. A. M.

Chlorides; Detection of — in the presence of complex cyanides and other halides. W. Böttger. *Z. anal. Chem.*, 1909, 48, 356—368.

For the detection of chlorides, even in small quantity in the presence of complex cyanides and other halides the following method is given:—0.5 grm. of the mixture is decomposed by boiling for a few minutes with 10 c.c. of 2N sulphuric acid, 20 c.c. of water, and mercuric oxide (3 parts for every part of complex cyanide); the mercury is then precipitated from the cooled solution by hydrogen sulphide; hydrogen cyanide and hydrogen sulphide are expelled by a current of well-washed carbon dioxide, passed through the warm filtered liquid for at least 20 minutes, and silver nitrate is added. In the case of a ferrocyanide, the ferrous salt remaining after this treatment must be oxidised by permanganate, before testing with silver nitrate. In the presence of a bromide, a larger proportion of mercuric oxide, sufficient to react with this also, must be used, and, after driving off the hydrogen cyanide and hydrogen sulphide as above, the bromine ions are oxidised by warming with permanganate and adding alcohol in the usual way, carbon dioxide being passed through the warmed filtrate to gel

rid of the aldehyde and excess of alcohol; when dealing with a ferrocyanide, permanganate must then again be added to the cooled liquid, before adding silver nitrate.

—F. SODX.

Bauxite; Composition of —. H. Arsandaux. *Compt. rend.*, 1909, 148, 1115—1118.

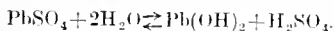
THE author has analysed a number of French bauxites by determining the constituents soluble and insoluble in concentrated hydrochloric acid, when heated on the water-bath for one hour. These minerals were composed essentially of monohydrated aluminium oxide, $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$, ferric oxide, very nearly anhydrous, titanium oxide, apparently in the form of metatitanic acid, and silica, certainly in the form of a hydrated aluminium silicate, $\text{Al}_2\text{H}_4\text{Si}_2\text{O}_9$. The ferric oxide was found to be completely soluble; sometimes also traces of titanium oxide and silica dissolved; in most cases the aluminium oxide was practically resistant, but in the bauxites rich in silica, appreciable quantities of alumina were soluble. The bauxites were found to contain an amorphous silicate having the composition of kaolinite (halloysite). They may therefore be regarded as rocks more or less argillaceous in character, whilst the extreme type corresponds approximately with a true clay. In the insoluble portion, after allowing for the hydrated aluminium silicate, the molecular ratio of combined water to aluminium plus titanium oxides is generally near unity, but always more or less above it. The higher values for this ratio are found in the more silicious specimens, indicating a tendency towards a higher state of hydration of the aluminium oxide than the monohydrate. In the extreme types of silicate bauxites the combined water of the aluminium oxide approximates to the dihydrate. The bauxites may be

considered as argillaceous rocks graduating towards types poorer in silica and richer in free aluminium oxide in the form of monohydrate. This monohydrate, $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$, may be regarded as the stable form and the ultimate term of the decomposition of the feldspars.

—J. F. B.

Lead sulphate; Solubility of — J. Schnal. Compt. rend., 1909, 148, 1394—1396.

THE solubility of lead sulphate in water is the same at different temperatures, but equilibrium is reached more rapidly at high than at low temperatures. Pure water dissolves 0.0824 grm. per litre, or 1 part of salt dissolves in 12,135 parts of water. As sulphuric acid is added to the water, the solubility diminishes, till with 1 part of sulphuric acid per 1000, the salt is absolutely insoluble. Lead hydroxide dissolves in water to the extent of 0.1385 grm. per litre; in water containing 0.0265 part of sulphuric acid per 1000, to the extent of 0.0824 grm. per litre, the same solubility as that of lead sulphate in water. The author considers, therefore, that lead sulphate is itself insoluble, but when brought into contact with water it is slowly converted into sulphuric acid and lead hydroxide, which dissolves till the amount of sulphuric acid formed is enough to cause equilibrium in the reaction,



—J. T. D.

Cuprous sulphate. A. Recoura. Compt. rend., 1909, 148, 1105—1108.

CUPROUS sulphate may be readily prepared by the action of dimethyl sulphate on cuprous oxide under anhydrous conditions. In a small flask, provided with an evolution tube dipping under mercury, 2 grms. of porphyrised cuprous oxide and 20 c.c. of dimethyl sulphate are heated at 160° C. with frequent agitation. The oxide turns greyish-white in colour and a copious evolution of methyl ether occurs. As soon as the evolution of gas ceases, the heating must be stopped, otherwise cupric sulphate will be formed by the further action of the dimethyl sulphate. The cuprous sulphate is washed with anhydrous ether and the ether is evaporated in a vacuum desiccator. The product is unchanged by contact with air so long as it is covered by a layer of ether, but oxidises if the latter evaporates in presence of air. Cuprous sulphate is a greyish-white powder, unalterable in dry air but immediately decomposed by water into cupric sulphate and metallic copper. The heat evolved in this dissociation is 5.2 calories, the product being considered anhydrous. In many of its reactions cuprous sulphate behaves like a mixture of nascent copper and cupric sulphate. It oxidises only slowly in moist air, but rapidly if flooded with ether, to form a black substance. When brought in contact with water this product immediately gives a solution of cupric sulphate and a precipitate of a black oxide which shows all the characters of Rose's suboxide, Cu_2O . When heated in the oven at 200° C. until the weight is constant, cuprous sulphate absorbs 1 atom of oxygen and is converted into a mixture of cupric oxide and cupric sulphate. Concentrated hydrochloric acid and ammonia both dissolve cuprous sulphate giving solutions of cuprous salts; glacial acetic acid also dissolves small quantities giving an intense violet solution which rapidly oxidises in the air.—J. F. B.

Thio-oxalates. H. O. Jones and H. S. Tasker. Chem. Soc. Proc., 1909, 25, 159—160.

THE esters of dithio-oxalic acid are readily prepared by the action of alkyl hydrosulphides on oxalyl chloride; the dimethyl, diethyl, and diphenyl esters are crystalline, and show a distinct yellow colour (the diphenyl compound is a bright sulphur-yellow). These esters are decomposed by hot potassium hydroxide solutions into potassium oxalate and alkyl hydrosulphide, but when heated with a concentrated alcoholic solution of potassium hydro-

sulphide a white solid separated, which was found to be potassium dithio-oxalate, $(\text{KSCO})_2$. This salt is white and crystalline, and is very soluble in water, giving a yellow solution, from which it separates in colourless prisms when evaporated on the water-bath. The salt gives intense colours with solutions of certain metallic salts, and precipitates with others; some of these precipitates decompose on heating, yielding the sulphide of the metal. The most striking reactions are those given with solutions of nickel and cobalt salts, the former give an intense magenta colour, the latter a deep brown colour, in both cases so intense as to be visible in solutions containing one part of the metal in 8,000,000 parts of solution. The coloured compound formed with nickel can readily be obtained in small, black, lustrous needles, resembling small crystals of potassium permanganate; these were found to have the composition required by the formula $\text{C}_2\text{O}_3\text{S}_2\text{K}_2\text{Ni}$. Solutions of this salt and the cobalt salt are stable to acids, and the metals are only precipitated very slowly from them by the addition of potassium hydrosulphide or hydroxide.

Potassium monothio-oxalate is prepared by the action of alcoholic potassium hydrosulphide on diethyl monothio-oxalate, $(\text{COSC}_2\text{H}_5 \cdot \text{CO}_2\text{C}_2\text{H}_5)$, and separates slowly in white needles, which contain one molecule of water of crystallisation. This salt is also very soluble in water, but gives a colourless solution; the solution decomposes on addition of acid, and gives colours and precipitates with metallic salts which are very similar to those given by the dithio-oxalate, but the insoluble salts are in this case more readily decomposed. The corresponding acids are unstable, and have not yet been isolated in the pure state.

Utilising furnace gases poor in sulphur dioxide. Borchers. See X.

Sodium sulphate deposit in California. Oil, Paint, and Drug Rep., May 31, 1909. [T.R.]

LARGE deposits of sodium sulphate are found in the lowest portion of the Carriso Plain, which extends along and within the north-east boundary of San Luis Obispo County, California. The lake known locally as Soda Lake, or Salt Lake, in the bed of which this salt occurs, receives the drainage from the Carriso Plain and the adjoining flanks of the bounding ranges, the total catchment basin being somewhat over 525 square miles in extent. The lake includes an area of nearly 3000 acres. It remains practically dry except in extraordinarily wet seasons. A sample of the salt collected at the surface of the lake, near the present evaporation plant, varies from dull to lustrous pure white in colour, and, though more or less granular, may be easily crushed between the fingers. An analysis of the salt made in the laboratory of the U.S. Geological Survey shows it to contain 49.5 per cent. of sodium oxide (Na_2O), 46.12 per cent. of sulphuric anhydride, 1.66 per cent. of magnesium oxide, and 9.27 per cent. of chlorine. The nearest railway station is 15 miles away, across a mountain range, another and more accessible one being 32 miles distant. Until the contemplated railway to San Luis Obispo is constructed, the profitable working of the deposits appears impossible.

Monazite production of the United States. Mining World, June 5, 1909. [T.R.]

THE production of crude monazite sand in the United States during 1908 amounted to 1,521,866 lb., averaging about 25 per cent. monazite. The crude concentrates yielded 422,646 lb. of refined sand, averaging about 90 per cent. monazite and valued at \$50,718, or 12 cts. per pound. Of this production North Carolina yielded 310,196 lb., valued at \$37,224, and South Carolina, 112,450 lb., valued at \$13,494.

The following table gives the production in pounds and value of monazite from 1893 to 1902, inclusive; of monazite and zircon in 1903; of monazite, zircon, adolinite, and columbite in 1904; of monazite, zircon, and columbite in

Titanium oxides; Production of —. F. A. J. Fitzgerald and P. M. Bennie, Niagara Falls, Assignors to General Electric Co., New York. U.S. Pat. 921,686, May 18, 1909.

CRUSHED ilmenite or other titanite iron ore, mixed with powdered carbon, is heated to about 1800° C., at which temperature the iron oxide only is reduced. The resulting sintered mass is crushed and the reduced iron removed by magnetic separation and treatment with acid.

—F. SODN.

Sulphur; Extraction of — from spent iron oxide [used in coal gas purification]. P. E. Williams, Leytonstone. Eng. Pat. 596, Jan. 9, 1909.

"SPENT oxide," which is a mixture of iron sulphide and sulphur, is treated with a strong ammoniacal solution, whereby the free sulphur reacts with the ammonia to form ammonium polysulphide. After filtering, the remaining iron sulphide is converted into ferric oxide and sulphur by exposure to the air, and the resulting mixture is again treated with ammonia. Sulphur is obtained from the ammonium polysulphide solution by boiling, the escaping ammonia being either mixed with the crude coal gas before it passes into the purifying boxes, or recovered in any other suitable manner.—O. R.

Hydrogen trisulphide and hydrogen disulphide; Process for the preparation of pure — and of mixtures of the two. I. Bloch. Ger. Pat. 209,860, Jan. 12, 1908.

CRUDE hydrogen persulphide obtained from inorganic or organic polysulphides is distilled *in vacuo*, and the distillate collected in two receivers, the first being kept at 5°–25° C. (preferably 10–20° C.) and the second at +5° to –60° C. (preferably –10 to –50° C.). The first receiver then contains pure hydrogen trisulphide, and the second, hydrogen disulphide containing a little trisulphide, which can be removed by a second distillation. Mixtures of hydrogen disulphide and trisulphide can be obtained by using a receiver cooled to +5 to –60° C., or two receivers, one kept at 25–50° C. and a second cooled to about –60° C. Hydrogen disulphide can be prepared by distilling hydrogen trisulphide *in vacuo*, and collecting the distillate in two receivers kept at 5–25° C. and +5° to –60° C. respectively. (See also his J., 1908, 748.)—A. S.

Oxygen; Process and apparatus for the extraction of atmospheric —. A. M. Descours-Desaerens. Fr. Pat. 396,889, Feb. 7, 1908.

ATMOSPHERIC air is subjected to a continuous cycle of operations consisting of dissolving it in water under pressure, whereby a gaseous mixture richer in oxygen is obtained in solution, removing the undissolved gas richer in nitrogen, and subsequently diminishing the pressure on the solution, whereby the dissolved gas is again set at liberty. By repeating the process a sufficient number of times, almost pure oxygen is obtained. The apparatus consists of a battery of reservoirs and compressors so arranged that, when the pressure in any one of the reservoirs reaches a certain amount, the undissolved gas is eliminated, while the liquid passes automatically into the next reservoir, where, under diminished pressure, the previously dissolved gas is set free, and the process is then repeated.—O. R.

Sulphuric acid; Manufacture of —. Erste Oesterr. Sodafabrik, and C. Opl. Hruschau, Silesia. Eng. Pat. 20,171, Sept. 25, 1908.

EE Fr. Pat. 394,739 of 1908; this J., 1909, 309.—T. F. B.

Ammonia; Process of making —. C. Krauss, Assignor to Ges. f. Stickstoffdünger, Westeregeln, Germany. U.S. Pat. 922,003, May 18, 1909.

EE Fr. Pat. 375,979 of 1907; this J., 1907, 925.—T. F. B.

Metall sulphides and alkaline hyposulphites from ores and other metallic compounds; Process for preparing —. P. Pipecaut and A. Vila, Paris. Eng. Pat. 19,148, Sept. 11, 1908. Under Int. Conv., Sept. 19, 1907.

EE Fr. Pat. 394,441 of 1908; this J., 1909, 243.—T. F. B.

Sulphocyanides; Manufacture of —. K. M. Chance, Assignor to British Cyanides Co., Ltd., London. U.S. Pat. 922,564, May 25, 1909.

SEE Eng. Pat. 6268 of 1908; this J., 1908, 1111.—T. F. B.

Cyanide and cyanamide; Production of —. C. Bosch and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 923,012, May 25, 1909.

SEE Fr. Pat. 387,002 of 1908; this J., 1908, 809.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Glass; Permeability of — for gases [iodine vapour]. A. Stock and H. Heynemann. Ber., 1909, 42, 1800–1801.

A LEAF of silver foil was sealed up in an ordinary glass flask, which was first evacuated completely. In a second flask a piece of silver foil was also placed, the flask then evacuated as before, but filled with water-vapour at 5 mm. pressure before sealing. Both flasks were then left for 3 months in a closed vessel containing iodine crystals. The silver foil remained perfectly bright in both cases, and after opening the flask and dissolving the foil in pure nitric acid not a trace of residue remained, showing that no iodine had passed through the glass. These results are at variance with those obtained by C. Zenghelis (Z. physik. Chem., 1909, 65, 341).—E. F.

Glass-cutting by means of an electric wire. F. L. Jouard. J. Amer. Chem. Soc., 1909, 31, 654.

THE glass is scratched with a file or on an emery wheel in order to provide a starting point for the crack, and a thin resistance wire is then wound around the part it is desired to crack, the wire being drawn taut and a piece of asbestos paper inserted between the crossed ends to prevent contact. The ends of the wire are connected to a source of electricity, and a current passed through sufficient to heat the wire to dull redness. The crack follows exactly the path of the resistance wire.—A. S.

Silicates, glasses, and glazes; Formation of —. J. W. Cobb. Chem. Soc. Proc., 1909, 25, 165–166.

ON the assumption that a glass can be regarded as formed by the combination and solution of its constituent oxides, the author has studied the process of formation of the glass represented by the formula, $\text{Na}_2\text{O} \cdot \text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 10\text{SiO}_2$. An investigation on the combination of lime and silica shows that the compounds formed are $2\text{CaO} \cdot \text{SiO}_2$ and $\text{CaO} \cdot \text{SiO}_2$. Lime and alumina interact to form the compounds, $\text{CaO} \cdot \text{Al}_2\text{O}_3$, $\text{CaO} \cdot 2\text{Al}_2\text{O}_3$, and an insoluble calcium aluminat, presumably containing a large amount of alumina.

The general question of chemical interaction between solids was discussed, and the conclusion was drawn that: (1) the temperature of formation of a slag and its fusion point are not identical, nor are they apparently related (in opposition to Bondouard's generalisation); (2) interaction between solids may go far, even to completion, without fusion; (3) from 800 upwards the state of mixed solid particles is one of fairly effective molecular contact, allowing free play to selective chemical affinities.

Porcelain; Preparation of — from its constituents. H. Bollenbach. Sprechsaal, 1909, 42, 332–333.

THE most important ingredient in porcelain is the "clay-substance," $2\text{SiO}_2 \cdot \text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$. The purest source of this is Zettlitz kaolin, but a week's washing is required to remove alkalinity. Attempts to synthesise clay-substance have hitherto failed, the product being a non-plastic mass yielding bodies which melt at a lower temperature than they would had they been made with the natural clay. In glazes, it is known that the substitution of aluminium hydroxide and silica for kaolin is the best method for obtaining "craquelé" ware, but the author claims to have replaced kaolin by its constituents in glazes free from hair-cracks. In a porcelain made from 28 parts of felspar, 25 of quartz, 45 of Zettlitz kaolin, and 2 of bone-ash, the spar was now replaced by an artificial

frit made from 16 parts of aluminium hydroxide, 7 of potassium carbonate, 10 of potassium nitrate, and 36 of Hohenboeck sand, and the kaolin was replaced by sand and aluminium hydroxide, the mixture being made plastic by a rye-meal paste. The results are said to be identical with the porcelain made from natural sources. Zoellner (this J., 1908, 448) found that a porcelain fired at cone 16 is composed of crystals of sillimanite, $Al_2O_3 \cdot SiO_2$, mixed with strongly-attacked particles of quartz and full of bubbles. A porcelain fired at cone 12 contains partially-attacked particles of quartz, melted spar, and an amorphous silicate which may be anhydrous clay-substance, $Al_2O_3 \cdot 2SiO_2$.—H. H. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Portland cement; Water content of set — in the course of hardening. D. Nagy. *Tonind-Zeit.*, 1909, 33, 615.

PORTLAND cement was made into a paste with various proportions of water, shaped into cubes, and the latter were bored after remaining in air and in water for definite periods. The borings were then analysed for hygroscopic water, water of hydration, and carbon dioxide. It was found that set cement lost its hygroscopic water gradually the longer it was kept, both in air and under water. The amounts of water of hydration and of carbon dioxide, on the other hand, in general increased with age, except in the case of set cement exposed to the air, in which the water of hydration reached a maximum after a certain period, and then began to decrease again. This period seemed to lie between 128 and 187 days. Even after 11 months the chemical constitution of set cement was not yet constant, and the author concludes that the volume changes, which take place in consequence of hydration and carbonation, are of a molecular nature and expel the hygroscopic water, thus accounting for the apparent "drying" of cement under water.—O. R.

PATENTS.

Kiln for burning limestone, dolomite, and the like. E. Schmatolla, London. Eng. Pat. 28,549, Dec. 31, 1908.

Is a gas-fired, vertical, shaft kiln, a main gas channel is in direct communication with the gas producer or producers, and intermediate between lower and upper gas channels. The shaft is rectangular in section, with rounded corners, and is divided towards the bottom into two separate chambers by means of a bevelled crossbridge. Four straight gas channels, having openings at their outer ends, cross each other at right angles and communicate with outer or upper gas inlets by means of short flues arranged in the arches of the gas channels, and with the central gas inlet by means of flues in the floors of the gas channels. The arrangement of the central gas channel is such that it is accessible at both ends from the outside through doors, so that it may easily be cleaned, and a series of port holes above the upper gas inlets allows the burning to be watched and any material that may have stuck in the shaft to be dislodged from the outside.—O. R.

Firebrick and the like; Composition of matter for use in — and process of producing the same. L. Houze, Assignor to C. F. Niklaus, R. H. Willey, and A. Brant, Monterey, Cal. U.S. Pat. 921,838, May 18, 1909.

HYDROPHANE, or a similar rock, is roasted, crushed coarsely, and mixed with fireclay; the mixture is moulded and burnt.—A. G. L.

Wood; Process for neutralising solutions used for impregnating —. B. Diamond. Fr. Pat. 396,974, Nov. 3, 1908.

THE waste liquors obtained in the manufacture of cellulose by the sulphite method are made alkaline with sodium carbonate, filtered, and added to the saline solutions used for impregnating wood.—O. R.

X.—METALS AND METALLURGY.

Iron oxide; Melting-point of —. E. J. Kohlmeier. *Metallurgie*, 1909, 6, 323—325.

THE oxide, previously sintered together by a short heat at 1270° C. in an atmosphere of oxygen, was introduced into a platinum crucible placed in an electrically-heated spinel (magnesium aluminate) crucible, which was kept at about 1600° C. until the oxide was completely melted when it was allowed to cool. The melting point of ferrous oxide was determined by the aid of a cooling curve constructed on the basis of the observation of the degree of rate of cooling. A current of oxygen was passed through the platinum crucible during the experiments. Two determinations on different specimens of ferrous oxide gave melting-points of 1565° and 1562° C. respectively, with ill-marked arrest-points at 1350°—1250° and well-defined arrest-points at 1035° and 1028°. The oxides used contained, after sintering, 3—4 per cent. of ferrous oxide and slightly more after melting. The specific gravities after melting, were 5.187 and 5.193; the fused product was strongly magnetic. A similar determination of magnetic iron oxide (Fe_3O_4) gave a melting-point of 1527° C., and an arrest-point at 1350—1250.—A. G. L.

Silicon and its influence on the electrical and magnetic properties of iron. E. Kolben, Runds. f. Technik u. Wirtschaft; through *Engineering*, 1909, 87, 732—733.

THE results of the author's experiments on the influence of silicon on the mechanical, electrical, and magnetic properties of low-carbon iron, are shown in the following table:—

	A.	B.	C.	D.	E.
Percentage of silicon—					
Minimum	0.026	1.07	2.28	—	3.50
Maximum	0.30	1.54	3.15	3.25	3.53
Tensile strength in kilos. (sheets 0.5 mm. thick)	30.8	35.1	47.3	—	61.0
Elongation, per cent.	11.0	7.5	6.0	—	3.5
Electrical resistance, ohms.	0.118	0.287	0.355	0.50	0.595
Increase in resistance per 100° C., per cent.	41.0	19.0	14.0	7.5	2.0
Coefficient of hysteresis.	0.0015	0.0014	0.0010	0.0009	0.000
Hysteresis, watts per kilo.	2.5	2.2	1.65	1.45	1.45
Eddy currents, watts per kilo.	1.3	0.8	0.7	0.6	0.4
Permeability, B for H = 140	17,600	17,300	17,000	16,700	16,400

THE alloys containing 3.5 per cent. of silicon have low temperature-coefficient of electrical resistance, and it is proposed to use alloys of iron containing from 2 to 6 per cent. of silicon and up to 5 per cent. of aluminium for the manufacture of resistances capable of replacing nickel, German silver, and similar alloys. The magnetic properties of iron are, on the whole, favourably influenced by silicon, the watt losses being considerably reduced and the effect of ageing counteracted, whilst the permeability is not much affected. The alloys are however difficult to work, and with 3 per cent. of silicon are very brittle. The brittleness, whilst not of much consequence with respect to the use of the alloys in transformers, would preclude their employment in dynamos.—A. S.

Cyanide solutions; Precipitation of gold from — by carbonaceous matter (in lime). W. A. Caldecott. *Chem. Met. and Min. S. S. Africa*, 1909, 9, 327—330.

EXPERIMENTAL tests on the effect of partly burnt coal in contact with auriferous cyanide solutions showed that it was practically as efficient a precipitant as charcoal, although unburnt coal had little effect. The ordinary lime used in cyaniding, which has been prepared by firing in kilns alternate layers of limestone and fuel, is generally contaminated with traces of partly consumed coal or charcoal, and assuming that only a fraction of one per cent. is present in the lime used, on a large cyanide plant this would represent several pounds of precipitant per day.

with an equivalent loss of gold. If retort lime cannot be procured, it is suggested that the lime should be dissolved in the mill-service water before entering the battery, time being allowed for the removal of impurities by settling. Many millmen, however, consider that much lime in the mill water has a deleterious effect on the plates, besides causing the possible choking up of the pipes leading to the mill.—F. R.

Mercury [in ores]; Volumetric determination of —. W. H. Seamon. Eng. and Min. J., 1909, 87, 1047—1048.

0.5 GRM. of the finely ground ore (200-mesh) is digested with 5 c.c. of concentrated hydrochloric acid for 5—10 minutes at 40° C. and then 3 c.c. of concentrated nitric acid are added and the heating continued for a few minutes at the same temperature, until all the cinnabar is decomposed. Lead is not usually found in mercury ores, but if present, 3 c.c. of strong sulphuric acid are added to precipitate it from solution. As free chlorine must be absent and it cannot be removed by boiling owing to the loss of mercuric chloride by volatilisation, 5 c.c. of strong ammonia are added drop by drop, followed by 25 c.c. of water. The precipitate is filtered off, washed twice with a minimum amount of water, and 2 c.c. of strong nitric acid, which has been exposed to strong light to produce some nitrous acid, are added to the filtrate. When cool, a third of the solution is set aside and the remainder titrated with a standard solution of potassium iodide, using drops of starch paste on a tile for an indicator. When a definite end reaction has been obtained, the reserved portion of the assay is added, and titration continued until a drop added to the starch produces a faint blue coloration. 0.5 c.c. is deducted from the result if the bulk of the liquid is over 50 c.c. Mercuric chloride is employed for standardising the potassium iodide solution, the strength of the latter being 8.3 grms. per litre, 1 c.c. of which is equivalent to 0.005 gm. of mercury. The method is said to be quick and reliable, results agreeing within 0.1 per cent.—F. R.

Antimony alloys; Analysis of —. Nicolardot and Krell. Bull. Soc. Chim., 1909, 5, 559—562.

THE paper deals mainly with the separation of antimony and tin from the other metals contained in various alloys. It is recommended that the alloy be treated with nitric acid, the mixture evaporated to dryness, and the insoluble antimony and tin oxides then collected in a cylindrical filter constructed of porous porcelain. The oxides are washed with dilute nitric acid, dried, reduced to the metallic state by heating at 400° C. in a current of hydrogen, and weighed. The two metals are then separated from each other in the usual manner. Traces of copper which are occluded by the mixed oxides may be deposited electrolytically from the solution of the two metals.—W. P. S.

Calcium alloys as reducing agents; Further experiments with —. O. P. Watts and E. R. Suhm. Chem. News, 1909, 99, 257—259. (See also this J., 1908, 752.)

CONFLICTING results were obtained in the direct comparison of aluminium with the alloys as reducing agents, the action of the latter being too violent in many cases. The authors find that the alloys are distinctly superior to aluminium for the igniting mixture, and are of opinion that this is also the case in all the less violent reductions. The briquetting of the charge was found to be very effective in suppressing undue violence of reaction; and since the alloys richest in cerium and magnesium act with the greatest energy, the authors conclude that those containing only sufficient calcium or magnesium to render them easily pulverisable will be the most serviceable, as well as the cheapest. It was found possible to prevent vaporisation of molybdenum dioxide, during reduction, by causing it to combine with other oxides before the charge attained an extremely high temperature. Attempts to produce solid masses of tungsten and titanium, by various means, were unsuccessful.—W. E. F. P.

Cadmium in soft solders. E. S. Sperry. Brass World, May, 1909; Eng. and Min. J., 1909, 87, 1140.

By adding cadmium to ordinary soft solder, the melting point of the latter is lowered, and its strength increased.

An alloy containing 50 per cent. of tin, 25 of lead, and 25 of cadmium has been found most satisfactory; it melts at 144.5° C., or about 30° lower than the best soft solder (2 of tin to 1 of lead). In preparing it, the metals are melted together in presence of a small quantity of ammonium chloride as flux, and well stirred before pouring. With the present moderate price of cadmium, the cost of the solder is not greatly increased. The new solder is especially useful for soldering Britannia metal, pewter, antimonial lead, etc.—A. S.

Sulphur dioxide; Principles of a process for rendering furnace gases poor in — harmless and useful. F. Borchers. Metallurgie, 1909, 6, 316—319.

THE process is an extension of that of Hünisch and Schroeder (see this J., 1884, 570), and is especially applicable to poor gases containing less than 4 per cent. of sulphur dioxide from roasting-furnaces, and to localities poor in fuel. The process consists essentially in passing the cooled gases up two absorption towers. In the further of these towers the gases meet descending water, which absorbs all except traces of sulphur dioxide. The dilute solution of sulphur dioxide so obtained is passed, repeatedly if necessary, down the first tower, in which it meets the richer gases, and in which it attains a high degree of concentration. The solution so obtained is heated to 90° C., preferably by the hot furnace-gases, which are thus cooled before entry into the towers.—A. G. L.

Platinum industry of the Ural. Ch. of Comm. J., June, 1909. [T.R.]

THE French Ambassador at St. Petersburg reports that the production of platinum in the Ural, which amounted in 1908 to 298 pounds, was 31 pounds less than in 1907, and was obtained from the following districts: Tcherdyn, 14 pounds; Perm, 70 pounds; Verkhotourié, south, 186 pounds; Verkhotourié, north, 25 pounds; Ekaterinburg, south, 3 pounds. The production during 1908 was the lowest for 10 years, and 50 pounds less than the average of the last decade. The restriction of output which has been carried on by producers of platinum with the view of maintaining the price of the metal is the cause of the small production during last year. The mines of Prince Abamelek Lazareff, situated in the Solikamsk district, increased their output by five pounds. It is in the southern part of the Verkhotourié district that the reduction of output has been most marked; the production in the district was 231 pounds in 1907, or 45 pounds more than in 1908. The Nijné-Touryinsk mines, belonging to the Platinum Industry Company, and those of Nijné-Taguilsk in the same district, have also reduced their output. On the other hand in the northern part of the Verkhotourié district the production increased by over eight pounds owing to the installation of a new dredge at the Lialine mines and an increase of activity at the Nicholas-Pavdinsky mines. The mines of Count Chouvalov, in the Perm district, also increased their output by a little more than one pound, but the Sysert mines in the southern district of Ekaterinburg yielded slightly less than in the preceding year.

PATENTS.

Alloys; Metallic —. J. F. Duke, Shortlands, Kent. Eng. Pat. 12,042, June 3, 1908.

THE claim relates to the production of an alloy of the composition:—Copper, 1450; aluminium, 30; nickel, 20 parts. These properties may be slightly modified; thus a slight increase in the nickel content and proportional decrease of aluminium will increase the malleability and ductility of the alloy. The product is easy to work and may be alloyed with gold in all proportions. For general purposes an alloy having the approximate composition: Copper, 1441.50; aluminium, 39.75; nickel, 18.75 parts may be employed.—C. A. W.

Cobalt compounds [and cobalt]; Manufacture of —. The Mond Nickel Co., Ltd., R. Hirtz, and M. D. Cowap, London. Eng. Pat. 13,207, June 20, 1908.

CORALT carbonyls are prepared by heating finely divided cobalt in carbon monoxide under suitable conditions of

temperature and pressure (see this J., 1908, 1017). To extract cobalt from its ores, the latter are first converted into oxide and introduced into a steel tube lined with copper. The tube is heated to 250°–300° C. and hydrogen is passed over the cobalt oxide to reduce it to metallic cobalt. The apparatus is then allowed to cool to 150°–170° C., carbon monoxide is slowly passed through at a pressure of 100–120 atmospheres, and the issuing vapour is cooled to 0° C., whereupon crystalline cobalt carbonyl condenses. Pure metallic cobalt, massive or in the form of plates, is obtained by heating cobalt carbonyl vapour to a suitable temperature.—O. R.

Ores, shale, coal, and the like, more especially iron ores and iron-stone shale; Apparatus for use in subjecting — to the action of heat. J. B. Peat, Redcar, Yorks. Eng. Pat. 17,054, Aug. 13, 1908.

The apparatus is primarily intended for the treatment of iron ores and iron-stone shale by heat, in the absence of air. The lower oxide which results is magnetic and can afterwards be separated by magnetic separation. The ore is fed into a bunker, where it is dried by the heated products of combustion arising from the furnace. Any moisture condensing on the walls is collected and run off through a gutter. The ore discharged from the bunker is carried down an inclined way into a hopper which, under ordinary conditions, is fitted with a removable cover and so rendered gas-tight. From there it is directed by inclined pieces into a series of vertical tubes projecting downwards towards a shoot, where the ore is finally collected and removed through an opening in the bottom. These tubes are heated by the products of combustion of an exterior furnace connected with the apparatus by horizontal flues. To this end, each tube is surrounded by one of greater diameter, so that the hot gases, passing up through the annular space, are carried off and utilised in the manner previously described. Down the whole length of the interior tubes, vertical rods are passed, each of these rods being fitted at the lower end with a cone-shaped disc corrugated on the upper face. By the rotation of these rods a steady passage of the ore into and out of the tubes is assured, and clogging is avoided. The tubes are arranged so as to allow for any expansion in length, their lower ends being capable of moving up and down in stuffing-boxes of fire-clay. The heating effect of the system may be materially increased by collecting the small quantity of gas evolved in the reaction and blowing it in through the bottom of the furnace. If desired, these gases can be utilised in increasing the furnace draught.—C. A. W.

Subjecting materials [sulphide ores] to the action of air or other gases. J. E. Greenawalt, Denver, Colo. U.S. Pat. 921,645, May 11, 1909.

SULPHIDE ores are placed on a bed of porous materials in a furnace and heated, and air is forced upwards through the porous bed into the mass of ore.—W. H. C.

Refractory ores; Process of removing sulphur, arsenic, and other like impurities from —. F. Cotton, Hornsby, N.S.W., Australia. U.S. Pat. 922,088, May 18, 1909.

REFRACTORY ores are first heated and treated with hydrogen under slight pressure to remove sulphur. They are then treated with steam to convert the "base metals" into oxides, the volatile oxides formed being finally driven off by heating.—A. G. L.

Ore-treating furnace. C. C. Medbery, New York. U.S. Pat. 922,609, May 25, 1909.

The furnace is of the rotary kiln type, and comprises two oppositely inclined parts arranged one above the other, so that the upper or charging end of the furnace is immediately above the lower or discharging end. The furnace is provided with regenerators for heating the air and gaseous fuel. A receiving hearth for the molten minerals is arranged at the discharging end of the furnace, and is heated by the combustion products after these have first passed through one of the regenerators. A. T. L.

Separation of metals. R. D. Divine, Chicago, Ill. U.S. Pat. 921,372, May 11, 1909.

THE claim is for the process of separating the oxides of lead, antimony and zinc. The mixture of oxides is mixed with oil-cake and sodium carbonate and heated sufficiently to reduce the oxides to the metallic state and to volatilise the reduced zinc.—W. H. C.

[Steel] plate; Ballistic —, and method of treating armour or deck plates. S. S. Wales, Munhall, Pa., Assignor to Carnegie Steel Co., Pittsburg, Pa. U.S. Pats. 921,924 and 921,925, May 18, 1909.

BALLISTIC armour or vault steel plates are claimed, containing carbon, 0.20–0.35 per cent.; manganese, 0.25–0.35; nickel, 3.5–4.0; chromium, 1.25–1.75, and vanadium, less than 1 per cent. Or, nickel, less than 3.75, and vanadium, less than 1 per cent. Or, an unspecified quantity of nickel, besides chromium, less than 2, and vanadium, less than 1 per cent. Or, finally, nickel, 2.5–5.0 per cent., chromium, 1–2, and vanadium, less than 1. The steel plates are first given a fibrous structure by heat treatment, and are then hardened by heating them to above 875° C. and suddenly cooling them. The plates are finally annealed by heating to 350°–700° C. and cooling slowly.—A. G. L.

Ferro-nickel and nickel-steel; Process of making —. F. R. Carpenter, Denver, Colo. U.S. Pat. 922,388, May 18, 1909.

COPPER-NICKEL-IRON sulphide ores are given an oxidising roasting to oxidise nickel and iron, and then a chloridising roasting to render the copper soluble in water. After leaching out the copper, the residue, which is in the form of "blue billy" or "purple iron ore," and which contains practically all the nickel of the ore and little or no copper, is smelted to ferro-nickel or nickel-steel.—A. G. L.

Copper ores; Process for the lixiviation of —. O. Frölich. Ger. Pat. 209,324, Jan. 29, 1908.

IN processes for the lixiviation of copper ores, where rapid circulation of the liquor is effected by means of a pipe, with open ends, in which a screw rotates (see Ger. Pat. 163,409; this J., 1906, 379), or by Siemens' method of blowing in air at the bottom of a pipe with open ends, it is customary to use finely-divided ore. According to the present patent, the ore is used in relatively large lumps, so that only the liquor is circulated instead of liquor and ore-slime as when finely-divided ore is employed.—A. S.

Metals; Process and apparatus for treating — for the prevention of oxidation and corrosion. J. J. Bradley, Brooklyn, U.S.A. Eng. Pat. 8531, April 16, 1908.

SEE FR. Pat. 389,289 of 1908; this J., 1908, 985.—T. F. B.

Cast iron; Decarburisation of —. W. Rübel, Vienna. Eng. Pat. 11,598, May 28, 1908.

SEE FR. Pat. 391,429 of 1908; this J., 1908, 1157.—T. F. B.

Iron ore; Method of reducing —. A. J. Boulton, London. From J. T. Jones, Iron Mountain, Mich., U.S.A. Eng. Pat. 12,323, June 6, 1908.

SEE U.S. Pat. 890,235 of 1908; this J., 1908, 814.—T. F. B.

Alloys and steels containing silicon; Metallurgical process for obtaining —. L. H. Baraduc-Muller, Paris. Eng. Pat. 14,093, July 2, 1908. Under Int. Conv., July 2, 1907.

SEE FR. Pat. 389,577 of 1907; this J., 1908, 985.—T. F. B.

Iron and steel; Process of and apparatus for smelting and refining —. W. F. M. McCarty, Rocky Ridge, Md., U.S.A. Eng. Pat. 19,035, Sept. 10, 1908.

SEE U.S. Pats. 901,362, 901,546, and 901,547 of 1908; this J., 1908, 1117.—T. F. B.

Metallurgical furnaces for iron and steel. W. F. M. McCarty, Rocky Ridge, Md., U.S.A. Eng. Pat. 19,356, Sept. 15, 1908.

SEE U.S. Pat. 901,363 of 1908; this J., 1908, 1117.—T. F. B.

Zinc; Process for the manufacture of — O. Loiseau, Sclaingaux, Belgium. Eng. Pat. 15,176, July 17, 1908.

SEE Fr. Pat. 390,672 of 1908; this J., 1908, 1117.—T. F. B.

Platinum; Process for the production of a coating of — on base metals not easily fusible, such as iron, nickel, cobalt, or the alloys thereof. M. Baum, Hanau on Maine, Germany. Eng. Pat. 22,455, Oct. 22, 1908.

SEE Ger. Pats. 201,664 to 201,666 of 1907; this J., 1908, 1160.—T. F. B.

Flux for the autogenous welding of aluminium. M. U. Schoop, Bois Colombes, France. U.S. Pat. 922,523, May 25, 1909.

SEE Fr. Pat. 374,089 of 1907; this J., 1907, 828.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A).—ELECTRO-CHEMISTRY.

Nitrates from the atmosphere. Eyde. See VII.

Silicon and its influence on electrical and magnetic properties of iron. Kolben. See X.

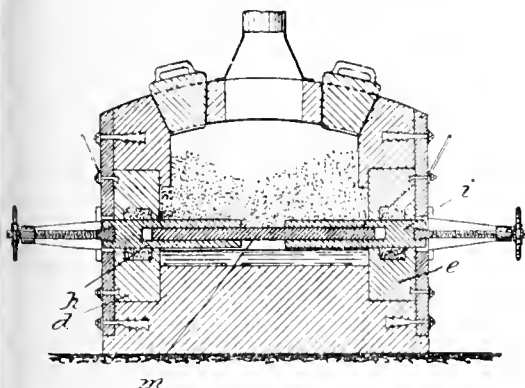
Mercury cathode [in electro-analysis]. Böttger. See XXIII.

PATENTS.

Voltaic arcs; Process for producing long — Centralstelle für Wissenschaftlich-Technische Untersuchungen Ges.m.b.H., Berlin. Eng. Pat. 2216, Jan. 29, 1909. Under Int. Conv., Feb. 1, 1908.

THE process relates to a method of forming steadily burning long voltaic arcs, without the assistance of magnetic or other blowing. Air is introduced into an air chamber, and passes from the latter into the reaction vessel, which encloses the arc, through a number of perforations or through the pores of the vessel, in order to secure a uniform distribution of the gas.—B. N.

Furnaces; Electric — A. Voelker, Bonn, Germany. Eng. Pat. 28,276, Dec. 28, 1908.



THE furnace is provided with two electrodes, *d* and *e*, through the middle of which pass two adjustable prismatic poles, *h* and *i*. A prismatic electric connection, *m*, of smaller cross-section, is adapted to slide in prismatic cavities in the poles, in order to vary the effective heating length of the connection, and at the same time prevent the formation of an arc between the poles. In a modified form, the heating connection is made stationary by placing it on the bottom of the furnace, and the prismatic poles are made to slide on the connection. In a third form, the poles are placed vertically, the upper one being fixed, whilst the lower is movable and directly attached to the heating connection. The lower pole normally closes the

bottom of the furnace, but may be lowered for permitting the electric connection to engage in the plastic mass in the furnace.—B. N.

Cell for electrolytic or other purposes. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 922,079, May 18, 1909.

THE receptacle, used as the cell, contains an electrode, composed of a metallic carbide or acetylide and a binder, together with an opposite electrode and a body of electrolyte.—B. N.

Electrolyte for use in electric batteries. The New Ignition Synd., Ltd., London, and W. J. L. Sandy, Peckham. Eng. Pat. 10,520, May 14, 1908.

SEE Fr. Pat. 396,905 of 1908; this J., 1909, 610.—T. F. B.

Electric insulating compounds; Solid — W. E. Lake, London. From Standard Varnish Works, New York. Eng. Pat. 16,885, Aug. 11, 1908.

SEE Fr. Pat. 393,217 of 1908; this J., 1909, 147.—T. F. B.

Electric furnace. F. M. Chaplet, Laval, and A. Rémond, Paris. U.S. Pat. 923,018, May 25, 1909.

SEE Fr. Pat. 370,005 of 1906; this J., 1907, 210.—T. F. B.

Electric incandescence filaments. Eng. Pats. 2853, 3951, 14,942, and 25,854. See II.

[*Electrical*] *Curing process.* Eng. Pat. 23,183. See XVIII.A.

(B).—ELECTRO-METALLURGY.

PATENTS.

Ores [electrically]; Process of reducing — F. J. Tone, Niagara Falls, N.J. U.S. Pat. 921,183, May 11, 1909.

REFRACTORY ores, or compounds of elements, which at the temperature of reduction are subject to losses by volatilisation, are mixed with a reducing agent, and heated to a reducing temperature within the reaction zone of an electric arc furnace. The maximum temperature of the charge is kept at a point which practically prevents loss by volatilisation. The products are removed, as they are formed, by causing them to descend out of the reaction zone along an electrically heated resistance conductor, the upper end of which constitutes the lower electrode of the furnace, and the fused products are collected in a lower receiving space.—B. N.

Nickel ores; Process of treating — A. G. Betts, Troy, N.Y. U.S. Pat. 923,005, May 25, 1909.

THE ore is smelted so as to obtain an alloy containing nickel, copper, and a considerable proportion of iron. This alloy is refined electrolytically, using as electrolyte a solution containing both iron and nickel salts. A cathode deposit is obtained consisting of 3 parts of iron and 1 part of nickel, and copper or other metals are recovered from the anode slime.—A. T. L.

Furnace; Electric smelting — C. E. Wilson, Hood River, Oreg. U.S. Pat. 921,325, May 11, 1909.

THE furnace comprises a melting receptacle or crucible, the inner walls of which slant inwards toward the bottom. On the top of the melting receptacle is placed a water-cooled jacket or cover, having suitable openings formed therein. A screw conveyor leads to one of the openings, and a hopper, in which the material is placed, is secured above the screw conveyor. Tubes are arranged over a number of the openings, and a valve over one of them, a second set of tubes, slightly larger than the first, being arranged to slide up and down upon the outside of the first named. Electrodes pass through the tubes into the receptacle or crucible, rings being clamped to the upper ends of the electrodes and the rings clamped to the outer tubes. By means of a movable carriage, chains secured to the carriage and eyes formed with or secured to the rings, the electrodes may be moved up or down, or entirely removed from the receptacle or crucible. An open-hearth furnace is placed above the crucible at one side,

and a shoot leads from the furnace to the valve for conveying steel from the open-hearth furnace to the receptacle or crucible.—B. N.

Tin or allied metals: Electrolytically coating with—
J. C. Beneker, Waukegan, Ill., Assignor to The Meaker Co., Chicago, Ill. U.S. Pat. 921,043, May 18, 1909.

The solution employed contains approximately 25 parts of sodium hydroxide, 15 parts of sodium thiosulphate, 10 parts of stannous chloride, and 200 parts of water.
B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Mixed glycerides: Occurrence of—*in natural fats.*
J. Klimont and E. Meisels. Monatsh. Chem., 1909, 30, 341-346.

The fats examined by the authors were those of the domestic goose and turkey. The goose-fat had a sp. gr. of 0.9270 at 15° C., a saponification value of 193.3, and an iodine value of 70.1. On repeated recrystallisation from a mixture of acetone with a little chloroform, it yielded a crystalline powder (m. pt. 59° C.), which resembled tristearin and tripalmitin in appearance. The liberated fatty acids melted at a little above 55° C., and had a neutralisation value of 209.3. They consisted of stearic and palmitic acids in a proportion corresponding to 1 mol. of the former to 2 mols. of the latter (theoretical neutralisation value 210.4). The authors regard the fat as dipalmitostearin. The turkey-fat, examined in the same way, was a soft, granular, pale yellow fat with the following analytical characteristics: Sp. gr. at 15° C., 0.912; m. pt. 27 to 28° C.; saponification value, 193.6; and iodine value, 71.7. By repeated recrystallisation from a mixture of acetone with a little chloroform, a substance showing a constant m. pt. of 59 to 60° C. was obtained. From the mother liquor an oil with properties coinciding with those of triolein, was isolated. The substance of m. pt. 59 to 60° C. had a saponification value of 203.9, and contained fatty acids melting at 54 to 55° C., and having a neutralisation value of 209.7. The authors regard this fat also as a dipalmitostearin. Hansen (this J., 1902, 553) isolated a similar mixed glyceride melting at 55° C. from beef-fat, whilst Guth (this J., 1903, 427) prepared two dipalmitostearins synthetically. The authors suggest that the mixed glycerides isolated by them from these fats may be identical with one or both of the synthetical preparations. In experiments to determine whether mixtures of triglycerides could be obtained with constant m. pts., the authors purified synthetical tristearin and tripalmitin by repeated recrystallisation until they melted at 71° C. and 65° C. respectively. The pure triglycerides were then melted together in equal proportions, and recrystallised from acetone. The first crystals melted at 60° to 61° C., and on further crystallisation their m. pt. was gradually raised to 66° C., which was the highest point that could be reached. This product had a saponification value of 194.1, corresponding to a mixture of about 70 per cent. of tristearin and 30 per cent. of tripalmitin.

These results showed that the products obtained from goose-fat and turkey-fat were not mixtures of tristearin and tripalmitin, but definite compounds. The experiment also corroborates the statement frequently made that from natural fats containing both tristearin and tripalmitin it is impossible to isolate a pure tristearin by crystallisation (cp. also this J., 1909, 182).—C. A. M.

Porpoise oil. F. Hart. Chem.-Zeit., 1908, 32, 819.

Like most cetacean oils, porpoise oil from *Dolphina phocaena* is yellowish and has a fishy odour. It has the following characters:—Sp. gr., 0.9302 at 15° C.; increase of temperature by Maumene's test, from 25° to 86° C. free fatty acids, in terms of oleic acid, 1.39 per cent. iodine value (Hübl), 109.3; saponification value, 222.2 (Hehner value, 91.04; saponification value of insoluble fatty acids, 203. At the normal temperature, the insoluble fatty acids are semi-fluid. On adding a few drops of strong sulphuric acid to a solution of the oil in chloroform a pale violet blue colour is produced, changing to dark red. On adding strong hydrochloric acid to the oil, pale pink colour is given, passing to dull orange-yellow.
—J. O. B.

Petroselinic acid: a new oleic acid. E. Vongerichten and A. Köhler. Ber., 1909, 42, 1638—1639.

Oil obtained from parsley seeds yielded a deposit of needle-shaped crystals on crystallisation from a mixture of alcohol and ether. These crystals melted at 32° C. solidified at 16.5° C., and had a refractive index of 1.461 at 40° C., a saponification value of 191.2, and an iodine value of 84.3. In these values and in elementary composition they agreed closely with the theoretical figures for olein. On saponification they yielded a fatty acid which the authors termed *petroselinic acid*. It gave the following analytical values:—M. pt., 33°—34° C.; solidification point, 27° C.; sp. gr. at 40° C., 0.8681; refractive index at 40° C., 1.4533. Its elementary composition agreed with the formula, $C_{17}H_{33}O_2$, and it was thus isomeric with oleic acid. It yielded an amid crystallising in white needles (m. pt. 76° C.). Its lead salt dissolved with difficulty in cold alcohol and ether, but was readily soluble in hot ether, and its barium salt crystallised in anhydrous needles. It gave an "elaidic" acid meltin at 48° C., a dibromide, which was a heavy oil readily soluble in alcohol and ether, and a "stearolic" acid meltin at 54° C. (m. pt. of ordinary stearolic acid, 48° C.). Oxidation with alkaline potassium permanganate it yielded a dihydroxystearic acid melting at 122° C. The "stearolic acid," examined by Barch's method, gave a ketonic acid (m. pt. 80° C.), and the oxime of this acid, decomposed by Beckmann's method, yielded lauric acid, undecylamine, and pimelic acid. From these results the author concludes that the double linkage comes between the twelfth and thirteenth carbon atoms, and that the new acid has the structural formula, $CH_3.(CH_2)_{10}.CH:CH.(CH_2)_4.COOH$.
—C. A. M.

Cottonseed products in the United States. Oil, Paint, and Drug Rep., June 7, 1909, [T.R.]

The following table shows the production and exports of cottonseed and its various products at intervals from 1870 to date:—

Production and manufacture.

Year ended June 30.*	Cottonseed.		Cottonseed products.			
	Produced.	Manufactured.	Oil produced.	Cake and meal produced.	Hulls.	Linters.
	tons.	tons.	gallons.	tons.	tons.	pounds.
1909	5,003,838	3,669,747	146,789,880	1,491,752	1,330,283	165,138,628
1908	4,952,402	2,564,873	103,049,820	1,043,080	926,705	128,243,639
1907	5,912,646	3,843,981	153,759,240	1,785,804	1,592,506	153,759,233
1906	5,060,205	3,131,175	125,700,928	1,271,740	1,135,080	109,608,379
1905	4,716,591	3,241,426	121,877,618	1,155,568	1,528,322	97,242,787
1904	4,030,314	3,154,417	118,006,079	1,124,550	1,487,308	72,551,591
1903	4,068,316	2,479,386	93,325,729	884,391	1,169,286	57,272,053
1902	3,494,811	873,702	34,948,000	305,800	—	—
1901	2,615,608	235,404	9,416,000	82,400	—	—
1890	1,686,516	84,325	3,373,000	29,500	—	—
1875	1,317,637	52,705	2,108,000	18,400	—	—

Exports.

Cottonseed products.

Year ended June 30.*	Cottonseed.		Oil.				Cake and meal.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	\$	gallons.	\$	tons.	\$		
1909	14,239	353,213	41,029,991	17,226,451	464,644	11,889,415		
1908	8,814	209,493	41,880,304	17,074,403	670,484	17,062,594		
1907	11,859	268,330	43,793,519	13,673,370	555,417	13,073,100		
1906	6,430	141,174	29,013,743	10,717,280	410,175	9,134,088		
1905	28,202	509,627	33,042,848	12,992,393	525,233	12,271,009		
1904	24,928	346,230	46,902,390	14,127,538	571,852	11,229,188		
1903	3,830	74,575	13,384,385	5,291,178	—	—		
1902	6,071	134,116	6,397,796	3,225,414	—	—		
1901	2,658	63,128	417,387	216,640	—	—		
1900	3,180	72,212	547,165	293,546	—	—		

* Statistics of the quantity of seed produced and manufactured and of cottonseed products relate to the seed crop of the year previous, while the statistics of exports are for the year ending June 30.

† Not shown separately.

PATENTS.

grease, and other substances; Filters for —. G. G. Scurfield, Carlisle. Eng. Pat. 8228, Apr. 18, 1908.

filtration of the oil, etc., is accelerated by a preliminary treatment with steam. In the special method claimed, the steam is generated in, or admitted into, the receiving chamber below the filter-bed. Part of it is made to pass through the filter-bed and thus heat the unfiltered oil, whilst the remainder is condensed in the receiving chamber and creates a partial vacuum. The filter-bed is constructed of one or more plates perforated with holes enlarged on the side on which the filtering medium (felt, flannel, etc.) rests. To facilitate leaning, the bottom plate of the filter-bed is made to rest upon a loose S-shaped support, the upper perforated plate being fixed by means of screws, etc.—C. A. M.

Process of separating — from other liquids, and apparatus therefor. F. Nowotny, Bernburg, Germany. Eng. Pat. 24,237, Nov. 11, 1908.

The mixture is cooled to the temperature at which it requires its greatest density, so that the oil is expelled by the contraction, without the necessity of suction. In the type of apparatus claimed for carrying out this process, the liquid is passed through a vessel divided by partitions into a series of communicating chambers and cooled by means of a cooling liquid circulating in the opposite direction through a system of pipes in the vessel. Intermediate partitions separating the chambers are clear of the bottom so that the liquid can pass underneath, whilst the other partitions are provided with siphon tubes near the top. In separating oil from water of condensation, it is essential to prevent the entrance of steam under pressure into the separating chambers. For this purpose the liquid may be first passed into a cooling chamber the communication between which and the separating vessel is controlled by means of a valve and out.—C. A. M.

Apparatus for use in manufacturing —. A. J. Boulton, London. From E. Fischer, Dresden, Germany. Eng. Pat. 23,698, Nov. 5, 1908.

This apparatus, intended to reduce the time of boiling in the manufacture of rosin soap in solid form, consists of a vessel divided by a horizontal partition into a boiling chamber and an overflow chamber above it for the froth. The two chambers are connected in such a way that the cooled froth is conducted, without interruption, round the whole of the boiling chamber. By constructing the overflow chamber with corrugated walls the cooling surface may be increased and the return flow of the oil accelerated, notwithstanding the simultaneous heating of the material.—C. A. M.

Sodium peroxide composition for washing and bleaching purposes; Process for producing —. Firm of F. Gruner, Esslingen, Germany. Eng. Pat. 1150, Jan. 16, 1909. Under Int. Conv., Feb. 28, 1908.

THE sodium peroxide is made into a paste with a non-combustible chlorine substitution product of the paraffin series, such as carbon tetrachloride. Advantages claimed for this preparation are that it sinks in water, and is slowly and uniformly decomposed, and does not, when brought in contact with linen or other organic substances, tend to produce combustion. The carbon tetrachloride also assists in the detergent action. The action of the free alkali formed in the decomposition with water may be more or less neutralised by adding to the paste sodium bicarbonate, boric acid, or the like.—C. A. M.

Fatty acids; Separation of solid from liquid —. P. A. Barbé, F. Garelli, and G. de Paoli, Rome. Eng. Pat. 24,836, May 5, 1908.

SEE Fr. Pat. 372,341 of 1906; this J., 1907, 537.—T. F. B.

Fatty acids; Transformation of liquid into solid —. P. A. Barbé, F. Garelli, and G. de Paoli, Rome. Eng. Pat. 24,837, May 5, 1908.

SEE Addition of April 29, 1908, to Fr. Pat. 372,341 of 1906; this J., 1908, 1028.—T. F. B.

Saponification of fatty materials by means of liquid ammonia under pressure, and apparatus to be employed therein. P. A. Barbé, F. Garelli, and G. de Paoli, Rome. Eng. Pat. 9758, May 5, 1908.

SEE Fr. Pat. 372,341 of 1906; this J., 1907, 537.—T. F. B.

Soda and potash soaps from ammonia soaps; Obtaining —. P. A. Barbé, F. Garelli, and G. de Paoli, Rome. Eng. Pat. 24,838, May 5, 1908.

SEE Addition of April 29, 1908, to Fr. Pat. 372,341 of 1906; this J., 1908, 1028.—T. F. B.

Oil-testing apparatus. Ger. Pat. 209,399. See XXIII.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

PATENTS.

Paint and varnish removers. J. M. Wilson, Montclair, N.J., and H. A. Harris, New York, U.S.A. Eng. Pat. 10,043, May 8, 1908.

CLAIM is made for a paint remover which dries very slowly and on evaporation leaves soft but tenacious films with

little affinity for underlying surfaces. It is obtained by mixing together wax or a solid hydrocarbon or hydrocarbons, with a solvent, e.g., alcohol, preferably methyl alcohol, that will remove dried films of linseed oil and shellac, and a thickening agent (other than wax) such as "various oxy-compounds" of cellulose (nitrocelluloses, acetylcelluloses, etc.). Or the mixture may contain phenol, which promotes the formation of the soft tenacious film, and the beeswax and paraffin wax omitted or added in small proportion as desired. A preparation for which special claim is made consists of approximately 20 to 30 parts of methyl alcohol, 3 to 5 parts of colloid mixture (say, 92.5 per cent. of solvent, with 7.5 per cent. of nitrocellulose), 1.5 to 2.5 parts of phenol, and 1 part each of beeswax and paraffin wax.—C. A. M.

Sublimed white lead; Method of manufacturing—L. S. Hughes, Joplin, Mo., U.S.A. Eng. Pat. 16,520, Aug. 5, 1908.

SEE FR. Pat. 392,990 of 1908; this J., 1909, 98.—T. F. B.

(B).—RESINS, VARNISHES.

Pwé-nyet (black wax of Burma) and certain Indian dammars, D. Hooper, Agric. Ledger, 1908—1909, [3], 31—50.

THE wax is obtained from the nests of a stingless Indian dammar bee, *Trigona laeviceps*, and possibly other dammar bees. The best quality from Moulmein is a light yellow mass wrapped in leaves. It melts between 70° and 80° C., and is only partially soluble in the usual organic solvents. The specimen examined had the following characters:—Moisture, 3.2 per cent.; ash, 0.3 per cent.; soluble in alcohol, 86.2 per cent.; in ether, 72.2 per cent.; in light petroleum spirit, 79.3 per cent.; acid value, 28.3; ester value, 23.9; iodine value, 137.1. The portion soluble in alcohol is an amber-coloured resin, m. pt. 90°—100° C.; the part insoluble in alcohol and other volatile solvents is white and brittle, m. pt. 190°—200° C. The soft resin contains some fragrant volatile oil; it gradually loses this, becoming less aromatic and brittle. Inferior samples give results differing somewhat from the above. In order to trace the botanical source of the material, the dammar resins of several typical *Dipterocarpaceæ* and of a *Canarium* have been examined. The results are thus expressed:—

Kind of dammar.	Solubility in alcohol.	Acid value.	Ester value.	Iodine value.
	Per cent.			
<i>Dipterocarpus</i> resin	96.2	16.0	29.0	117.7
<i>Hopsea</i> "	74.4	33.3	34.8	92.3
<i>Vateria</i> "	57.3	35.4	46.1	62.2
<i>Shorea</i> "	56.0	38.8	81.0	52.5
<i>Canarium</i>	17.4	7.1	36.5	44.0

Pwé-nyet appears therefore to occupy a position between *Dipterocarpus* and *Hopsea* resins. Among the *Dipterocarpaceæ* resins, the iodine value decreases with the solubility, while the acid and ester values increase.—I. O. B.

PATENTS.

Resin and turpentine; Process of extracting—G. Walker, New York, Assignor to H. T. Varyan, Toledo, Ohio, U.S.A. U.S. Pat. 922,369, May 18, 1909.

TURPENTINE and other volatile substances are first distilled from the wood at a temperature insufficient to injure the resin, e.g., by means of a current of steam under reduced pressure at a temperature below the boiling point of turpentine. The residual wood is then dried, and the resin extracted from it by means of a neutral volatile solvent. Special claim is made for the use of neutral distillates of low boiling point from "hard-wood" tar as solvents for this purpose.—C. A. M.

Shellac substitute; Process for the preparation of a—J. J. Bischoff, Ger. Pat. 209,217, May 20, 1906. Addition to Ger. Pat. 206,447, May 8, 1906.

INSTEAD of oleine as mentioned in the main patent (th J., 1909, 251), other fatty acids, animal or vegetable oil fats, or waxes, or mineral oils, soluble in alcohol, may be added to alcoholic solutions of copal resins for the production of shellac substitutes.—A. S.

(C).—INDIA-RUBBER, &c.

Rubber of Sapim Jemmani from British Guiana, Bull. Imp. Inst., 1909, 7, 1—7.

TWO series of samples were examined. *Series A* consists of six samples from six different trees, growing on Fo Island and on the Lower Essequibo River, and a seventh sample obtained from trees in the Pomeroon district. The first six samples were received in the form of biscuits and of scrap (lace rubber). The seventh sample was in ball form. All the samples were inclined to be weak, tearing easily when stretched. The analytical results obtained together with a commercial valuation (Fine Para, 3s. 5½ per lb.), are given in the following table:—

	No. 1.	No. 5.	No. 6.	No. 7.
	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	2.3	1.7	6.8	19.2
Dry rubber—				
Caoutchouc	87.1	87.9	89.8	89.3
Resins	2.8	3.6	3.7	4.2
Protein	5.8	4.0	4.9	2.5
Insoluble impurity	4.3	3.6	1.0	4.0
Ash	1.38	0.82	1.99	1.18
Value of scrap, per lb.	2s. 10d.	2s. 8d.	3s.	—
Value of biscuits or ball, per lb.		3s. 6d.		2s. 6d.

Note.—Nos. 2, 3, and 4 were not analysed, but were valued 2s. 8d. per lb. in the form of scrap, and 3s. 6d. per lb. in the form of biscuits or ball.

Series B consisted of samples from the N.W. district, British Guiana, and comprised:—(1) Three blocks scrap rubber, (2) two balls of rubber, (3) eight samples scrap. Analytical values, and commercial valuation are given in the following table:—

	No. 1.	No. 2.	No. 3.
	Per cent.	Per cent.	Per cent.
Moisture	2.6	8.4	1.1
Dry rubber—			
Caoutchouc	89.6	88.0	92.4
Resins	2.5	2.6	2.0
Protein	4.5	4.6	2.8
Insoluble impurity	3.4	4.8	2.7
Ash	1.26	1.13	0.69
Commercial value per lb. ..	2s. 4½d.	2s. 5d.	2s. 4½d.

A sample of rubber from the same species, exhibited at Olympia in September, 1908, was found to be much superior in physical properties to the above samples, and the analytical figures obtained were also better, viz.:—Moisture, 0.7; caoutchouc (in dry rubber), 94.4; resin 1.8; protein, 3.2; and ash, 0.6 per cent. This sample was valued at 4s. 3d., fine Para being 4s. 3½d.

These results indicate that the rubber of *S. Jenmani* should, if carefully prepared, realise satisfactory prices on the market. In tapping experiments it was found the nine trees averaging 57.6" in girth, tapped four times within 16 days, gave an average yield of 8.33 oz. of dry rubber per tree. The latex of *S. pauciflorum*, Hemsl., is said to be of no commercial value.—E. W. L.

Balata from British Guiana, Bull. Imp. Inst., 1909, 7, 7—8.

A SAMPLE of balata, from *Mimusops balata*, of guaranteed purity, was found to have the following composition:—Moisture, 1.9; gutta, 49.7; resins, 44.0; protein, 3.8; and ash, 0.6 per cent. The sample was valued at 2s. 2½d.

in London. The latex of the "Bastard Bullet" tree yielded, when coagulated by dilution and addition of alcohol, a pink, brittle, resinous substance, which on analysis was found to contain:—Resins, 70.6; and ash, 6.7 per cent., the residue being a white, friable powder quite unlike the gutta of true balata. This latex should therefore not be mixed with true balata latex.—E. W. L.

PATENTS.

India-rubber compound, and process of manufacturing same. F. G. d'Almeida, Rio de Janeiro. Eng. Pat. 11,949, June 2, 1908. Under Int. Conv., Jan. 28, 1908.

INDIA-RUBBER is dissolved in heavy tar oil, and the solution mixed with the other ingredients enumerated, in the following proportions:—India-rubber, 100; commercial brimstone, 36; heavy tar oil, 27; Portland or other suitable cement, 21; potash or rectified soda, 2; and sand, stone dust, and the like, $1\frac{1}{2}$ parts. The mixture is passed between rollers heated to 90° C., in order to render it perfectly homogeneous and drive off the volatile products from the heavy tar oil, and is then formed into prisms or blocks of the required shape. These are subjected to a pressure of 180 to 300 tons per sq. m., and are finally vulcanised by heating for from 5 to 8 hours at a temperature of 130° to 150° C. The composition is known as "vulcanina."—E. W. L.

Filling compositions intended for addition to rubber and other gums; Manufacture of —. Rütgerswerke Act.-Ges., Berlin. Eng. Pat. 14,859, July 13, 1908. Under Int. Conv., Oct. 11, 1907.

SEE Fr. Pat. 392,669 of 1908; this J., 1909, 32.—T. F. B.

India-rubber, guttapercha, and their artificial substitutes; Process for the agglomeration and regeneration of —. E. A. L. Rouxville, Paris. U.S. Pat. 922,339, May 18, 1909.

SEE Fr. Pat. 378,801 of 1907; this J., 1907, 1207.—T. F. B.

Material of nature of leather. Eng. Pat. 10,201. See XIV.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Lactic acid in pine liquors; Formation of active —. W. Eitner. Gerber., 1909, 35, 127—128.

THE author has investigated this somewhat common phenomenon with a view to discovering the origin of the lactic acid fermentation, which produces abnormal swelling of the hides in the liquors, and a dark and horny leather. It is suggested that the ferment must originate either from the air or the water employed and the author has examined three waters used in a tannery where this trouble was experienced. One of these (the general supply for the tannery) was a spring water, whilst the other two were pond waters used when there was a scarcity of the spring water. This was generally in winter when the trouble was usually found to be more severe. Bacteriological examination of the waters showed that while the spring water and one of the pond waters were almost free from injurious ferments, the other pond water contained a large number of lactic acid-producing micro-organisms. A pure culture of this micro-organism introduced on to fresh pine-bark, produced fermentation in a few days, in a cool room. It is stated that the action is more severe at low temperatures, and that warming decreases the rate of fermentation.—S. H.

Tannin of the bark of Eucalyptus occidentalis [mallet bark]. J. Dekker. Arch. néerland. sc. exact. et nat., 1909, [2], 14, 50—80. Chem. Zentr., 1909, 1, 1707—1708.

By extracting the finely powdered bark of *Eucalyptus occidentalis* with 96 per cent. alcohol, a light brown substance is obtained, from which by dissolving in absolute alcohol and fractionally precipitating with ether, mallet-tannin can be isolated (see this J., 1905, 743). It is a brown, non-hygroscopic powder, easily soluble in water and methyl and ethyl alcohols, forming colloidal solutions; slightly soluble in acetone and ethyl acetate, insoluble

in ether, benzene, petroleum ether, and saturated sodium chloride solution. It has the composition, $(C_{19}H_{20}O)_n$, and yields an acetyl derivative, $C_{38}H_{28}O_{17}(C_2H_3O)_{10}$, and a benzoyl derivative, $C_{19}H_{15}O_{12}(COOC_6H_5)_5$. A 1 per cent. solution reduces silver nitrate solution and Fehling's solution on boiling, and gives a voluminous brown precipitate with a 0.5 per cent. solution of gelatin; with ammonia and with sodium hydroxide, a red coloration is produced. By boiling with 2 per cent. hydrochloric acid, mallet-tannin is converted into malletto-red, $C_{37}H_{30}O_{22}$, small quantities of gallic acid being also formed. Malletto-red is an amorphous cinnabar-red powder, insoluble in water and benzene, and slightly soluble in ether. It yields an acetyl-derivative, $C_{37}H_{35}O_{22}(C_2H_3O)_{15}$, and when distilled with zinc dust gives small quantities of a crystalline substance, probably diphenyl, melting at 70° C. Malletto-tannin yields small quantities of gallic acid and phloroglucinol when heated with zinc dust and sodium hydroxide; and pyrogallol and other phenols on destructive distillation.—A. S.

Tannin; The composition of —. L. F. Iljin. Ber., 1909, 42, 1731—1735.

THE author has prepared tannin white and free from ash by employing the methods of purification proposed by Walden (this J., 1899, 181), and by Rosenheim and Schidrowitz (Chem. Soc. Trans., 1898, 73, 882), and also by fractionally precipitating commercial tannin by sodium chloride from its aqueous solution or by chloroform from its solution in a mixture of alcohol, ethyl acetate, and ether. The purity was gauged by the rotatory power, the highest value obtained being $+76.5^{\circ}$. From the analyses of the various samples the author draws the conclusion that none of them corresponds with digallic acid which Nierenstein (Ber., 1908, 41, 78, 3015) considers to be identical with tannin. Tannin gives compounds with phenylhydrazine which are being examined.—J. C. C.

PATENTS.

Material of the nature of leather, and manufacturing same from hides. D. Reddan, Fitzroy, Victoria, Australia. Eng. Pat. 10,201, May 11, 1908.

THE hair of the hide is removed by the action of a solution of lime, and the hide is then well fleshed, rinsed in cold water and placed in a bath of dilute caustic soda and soft soap. It is subsequently worked, on a fleshing barrel, in a warm solution of alum, arsenic, soft soap and caustic soda, and is left in this solution for about four hours. After this treatment the hide is rinsed in cold water, dried, and then dressed with a soft rubber dough of the following composition:—India-rubber, 1 lb.; reclaimed rubber, 1 lb.; "Atmold" (infusorial earth), 2 oz.; "Nantusi" (a mixture of about 30 per cent. by weight of powdered sulphur, with about 70 per cent. of paraffin wax and a quantity of bees' wax and tallow), 4 oz.; "hypo carbon-black," 8 oz.; and "Vulcanine" (a mixture of sulphur and litharge), 8 oz. The atmold is said to act as a preservative against the action of heat, moisture, and oxidation. "Nantusi" is designed to prevent cracking under the influence of the sun. The rubber dough is worked into the hide by passing the coated hide between calender rolls, revolving at unequal speeds, a thin coating of the rubber being left on the surface of the hide, which is afterwards submitted to a temperature corresponding to 40 lb. pressure of steam for 10 minutes or more, either between the plates of a press, or wrapped between layers of canvas round a drum. In the latter case the drum and wrappings are covered with a steam and waterproof oilcloth. An alternative composition for the rubber dough may be employed, viz., reclaimed rubber, 2 lb.; sulphur, 8 oz.; zinc oxide, 7 oz.; lampblack, 1 oz.; and the following baths may be used for colouring the hide before calendering:—*Dark brown bath*: potassium permanganate, 1 lb.; eosin, 4 oz.; water, 2 galls. *Light tan bath*: copper sulphate, 2 lb.; water, 2 galls. *White bath*: arsenic, 1 lb.; potassium cyanide, $1\frac{1}{2}$ lb.; water, $1\frac{1}{2}$ to 2 galls. *Red bath*: eosin, $1\frac{1}{2}$ lb.; potassium permanganate, 4 oz.; water, 2 galls. *Black bath*: copper sulphate, 1 lb.; water, 2 galls.—E. W. L.

Leather product and process of making same. H. Mackay, El Paso, Texas. Eng. Pat. 2504, Feb. 2, 1909.

ORDINARY sole leather is soaked in water until it becomes thoroughly pliant, then allowed to become semi-dry, and is next given a coating of boiled linseed oil, the oil being applied upon the grain side only of the leather. The leather is then immersed in a liquid prepared by mixing 8 oz. of Portland cement and 2 oz. of bonax with sufficient water to make the consistence of the liquid equal to that of milk. When this mixture has permeated the pores of the leather (this takes 24 hours, or more), the latter is removed from the bath, dried, a coating of linseed oil is applied on both sides, and when the oil has dried, the leather is rolled and "finished." It is claimed that the treatment considerably increases the durability of the leather.—W. P. S.

Compound of proteids and amines; Thermoplastic —. B. B. Goldsmith, New York. U.S. Pat. 922,133, May 18, 1909.

THE claims are for a process consisting in the addition of an amino-compound, such as naphthylamine, to an albuminoid, and the subsequent heating and compressing of the mixture, and for the thermoplastic compound thus produced.—E. W. L.

Hide-tanning machine; Automatic —. C. J. Glasel, South Boston, Mass., Assignor to L. Behre, Hanover, Germany. U.S. Pat. 922,415, May 18, 1909.

SEE Fr. Pat. 362,663 of 1906; this J., 1906, 770.—T. F. B.

XV.—MANURES, &c.

Chili saltpetre, calcium saltpetre (calcium nitrate) and nitrolime (crude calcium cyanamide); Comparison of the manurial value of — for the sugar beet. J. Urban. Z. Zuckerind. Böhm., 1909, 33, 535—547.

THE experiments have been carried out during two years. The manurial value of nitrolime for the beet is satisfactory, especially in years of abundant rainfall, but is not equivalent to that of Chili saltpetre. In 1906, a wet year, its value was expressed as 85.6 per cent. of that of Chili saltpetre, whereas in 1907 it was only equivalent to 75 per cent. of Chili saltpetre. The effect on the sugar content of the beet was not marked; in 1906 this was 0.35 per cent. higher, in 1907 0.18 per cent. lower than in beets manured with Chili saltpetre. It is necessary to apply nitrolime a week or more before the seeds are sown. An adverse property of nitrolime is the difficulty of distributing it by hand. Calcium saltpetre was found in 1907 to have a manurial value slightly higher than that of Chili saltpetre (111:100), and the beets contained on the average 0.16 per cent. more sugar. Nitrogenous manures lower the percentage of sugar when the soil has no lack of nitrogenous constituents, but markedly increase it when the soil is deficient therein.—E. F. A.

Ammoniacal manures; Action of —. P. Ehrenberg, Landw. Versuchstat., 1908, 69, 259; Biedermann's Centr., 1909, 38, 302—303.

As the result of his experiments, the author is of the opinion that the assimilation of nitrogen by plants from ammoniacal manures is governed chiefly by the acid reaction of the soil, this acidity increasing as the plant takes up nitrogen from the ammonium salt owing to the liberation of the acid radical of the salt. The addition of calcium carbonate to neutralise the natural acidity of the soil is not sufficient to yield a good crop, especially in the case of plants which do not grow well on acid soils, as the continual formation of acid as the plant absorbs nitrogen tends to inhibit the growth of the plant.—W. P. S.

Lime and magnesia; Influence of the relative proportions of — on the growth of plants. L. Bernardini and G. Corso, Staz. sperim. agrar. ital., 1908, 41, 191; Biedermann's Centr., 1909, 38, 304—305.

FROM the results of the experiments recorded, it is seen that the ratio of lime to magnesia in soils is of considerable

influence on the growth of plants. In the case of rye the best results are obtained when the ratio is as 1 to 1; for wheat, 2 to 1; and for beans, 3 to 1. These results were obtained by experiments on plants growing in nutrient solutions and in pots.—W. P. S.

Colloidal manganese oxide solutions; Action of — in biochemical oxidations. B. Sjöllema, Chem. Weekblad, 1909, 6, 287—294. Chem. Zentr., 1909, 1, 1718.

IF a solution of manganese sulphate or manganese acetate be treated with a solution of Rochelle salt, and then hydrogen peroxide and dilute sodium hydroxide solution added, a colloidal solution of manganese oxide is obtained, which retains its dark brown colour for several weeks. This solution, both before and after dialysis, gives the different reactions characteristic of oxydases, e.g., it produces a blue coloration with fresh guaiacum tincture and with a solution of *p*-phenylenediamine hydrochloride. A colloidal manganese solution produced by adding hydrogen peroxide to potassium permanganate and subjecting the product to dialysis against water, behaves in a similar manner. The manganese solution rapidly decomposes hydrogen peroxide, with effervescence, but hydriodic acid is not oxidised by it. The author suggests a closer investigation of biochemical oxidations, especially those occurring in plants, which contain considerable quantities of manganese; probably manganese plays an important part also in oxidations in soils.—A. S.

Nitrates from the atmosphere. Eyde. See VII.

PATENTS.

Phosphatic chalk; Treatment of —. J. Gathy. Fr. Pat. 396,358, Nov. 16, 1908. Under Int. Conv., Nov. 20, 1907.

THE ground phosphatic mineral is introduced into water in a suitable vessel and subjected to the action of an excess of sulphur dioxide, whereby calcium carbonate is converted first into sulphite, and finally into bisulphite, which is soluble in water. The insoluble residue, rich in phosphate, is then separated by filtration or decantation, and calcium sulphite is recovered from the solution by boiling under diminished pressure.—O. R.

Calcium cyanamide; Process of granulating powdered —. A. d'Ereole. Fr. Pat. 396,403, Nov. 17, 1908.

POWDERED calcium cyanamide is spread out over a convenient surface, rapidly and uniformly moistened with pure water, or with certain solutions, and finally quickly spread into very thin layers and agitated until it is perfectly dry. Suitable solutions are those of sodium, magnesium, manganese, zinc, iron, aluminium, and calcium salts in water. Instead of mineral salts, solutions of gum or gelatin, with or without the addition of alum or aluminates, may be employed.—O. R.

Fertilisers; Production of —. O. F. Carlson, Stockholm. Eng. Pat. 21,590, Oct. 12, 1908.

SEE Fr. Pat. 395,197 of 1908; this J., 1909, 320.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Diffusion waste waters [Sugar]; Return of the —. C. Pfeiffer. Deutsche Zuckerind., 1909, 34, 437—438.

THE author advocates the separate return of the draining water and press water to the battery. In this method of working, the press water is pumped into the last diffuser whilst the battery is receiving a fresh charge; the amount of draining and fresh water subsequently pumped into this diffuser suffices to drive all the press water into the penultimate diffuser. Owing to the fact that no press water is left in the last diffuser, an accumulation of sugar, salts, and organic non-sugar in the waste water is avoided, and hence, the waste water can be returned to the battery continuously. Again, this method insures a more complete extraction of the sugar, since the water poorest in sugar (i.e., the mixture of draining and fresh water) comes in contact with the nearly exhausted slices in the last diffuser,

whilst the press water of higher sugar-content comes in contact with slices which have been less completely extracted. Moreover, the sugar obtained by this method of working is of high purity.—L. E.

Sugar; Adsorption of — by animal charcoal. R. O. Herzog. *Z. physiol. Chem.*, 1909, **60**, 79—84 (Compare this J., 1909, 535).

The experiments described in this paper were carried out in connection with an investigation on tanning processes (this J., 1908, 347). Purified blood charcoal was used as adsorbent, and preliminary experiments showed that (1), adsorption of dextrose is practically complete in half an hour; (2), the charcoal does not cause catalytic oxidation of the sugar; (3), a reversible equilibrium exists between the sugar adsorbed and that left in solution. From experiments in which 100 c.c. of solutions of various sugars of approximately $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{10}$ normal concentrations and 5 grms. of animal charcoal were used, the following values for the constants, k and n , of the equation $C = kB^n$ were deduced (C and B represent the amounts of sugar adsorbed and left in solution respectively).

Sugar	k .	n .
Dextrose	0.766	0.474
Lævulose	0.338	0.539
Galactose	0.916	0.694
Sucrose	0.106 (?)	0.127
Maltose	1.142	0.133
Lactose	1.138	0.135

It is noteworthy, that in the cases of the monoses, the values for k and n differ very considerably, whereas, with the bioses, they differ very little. Hence it is probable that in the case of bodies of relatively small molecular weight, the constitution is of prime importance in connection with adsorption; on the other hand, the experiments with the bioses appear to indicate that similarly constituted substances of high molecular weight present approximately coincident adsorption curves. Experiments were also made in which 3 grms. of charcoal and approximately $\frac{1}{4}$ -normal solutions of sugars were used. The results obtained agreed fairly well with those calculated from the equation $\frac{C}{m} = kB^n$, in which m represents the quantity of adsorbent. The results obtained also agreed fairly well with those calculated from an equation of Freundlich who found that with variable quantities of adsorbent (m), and constant quantities of (originally) dissolved substance, (A), and solutions of constant volume, the adsorbed quantity (C), can be calculated from the equation $\lambda = \frac{1}{m} \log \frac{A}{A-C}$, in which λ is a constant.

—L. E.

Sugars; Compounds of benzidine with — and a method for isolating lævulose. O. Adler. *Ber.*, 1909, **42**, 1742—1746.

The author describes the preparation and properties of didextrose-benzidide, diarabinose-benzidide, and dimaltose-benzidide. These compounds are obtained by heating benzidine with dextrose, arabinose, and maltose respectively, in solution in 96 per cent. alcohol. They reduce copper and bismuth salts on heating in alkaline solution; they are decomposed by sulphuric acid, benzidine being split off in the form of insoluble sulphate. Lævulose does not yield a crystalline substance with benzidine when treated as above described, and the benzidine reaction may therefore be utilised for removing dextrose from mixtures of this sugar and lævulose; to effect this separation the author adopted the following mode of procedure:—The alcoholic solution of the mixture of dextrose and lævulose was heated for 3 hours on the water-bath under a reflux condenser with a quantity of benzidine equivalent to the total quantity of sugar (1.8 parts of hexose correspond to 1.84 parts of benzidine). Two-thirds of the alcohol was then distilled off, and the residue was allowed to stand for 12 hours. The didextrose-benzidide which separated, was filtered off and washed

with a small quantity of absolute alcohol; the filtrate was concentrated as far as possible on the water-bath, and again allowed to stand for 12 hours. The substance which separated was filtered off and washed with a very small quantity of absolute alcohol. The filtrate was evaporated, the residue being taken up with a moderate quantity of water; the bulk of the excess of benzidine and any tar were thus precipitated. This precipitate was macerated with water in order to extract lævulose, filtered off under pressure and washed with water. The filtrate was treated with sufficient sulphuric acid to precipitate the benzidine still present, and to decompose any didextrose-benzidide remaining in solution; after standing for a short time, the solution was filtered, the filtrate thus obtained containing lævulose with only a slight admixture of dextrose. The process is applicable to urine, but in this case, an alcoholic extract of the urine, purified as far as possible, must be used.

—L. E.

Mannose, arabinose, xylose, and hydrolysed lactose; Determination of —. R. O. Herzog and F. Hörth. *Z. physiol. Chem.*, 1909, **60**, 152—154.

The authors have carried out determinations with the pure sugars according to Kjeldahl's proposals (*Z. anal. Chem.*, 1896, **35**, 344). 30 c.c. of Fehling's solution and 30 c.c. of the sugar solution were placed in an Erlenmeyer flask of about 150 c.c. capacity, and made up to exactly 100 c.c. with water. A current of hydrogen was then led through the solution, and the latter heated for exactly 20 minutes in a boiling water bath. The reduced cuprous oxide was collected on asbestos in a Soxhlet filter-tube, washed with hot water, alcohol, and ether, oxidised to cupric oxide in a current of air, and weighed. The experimental results for different concentrations of the sugars are given in four tables, and from them four other tables were constructed, of which the following is a combination:—

Weight of sugar.	Weight of copper.			
	Hydrolysed lactose.	Mannose.	Arabinose.	Xylose.
mgrms.	mgrms.	mgrms.	mgrms.	mgrms.
15	—	34.6	35.0	34.4
20	42.2	44.5	45.2	44.0
25	51.6	54.0	55.5	53.5
30	61.3	63.8	66.2	63.5
35	70.9	73.5	76.2	72.7
40	80.5	83.0	86.5	82.5
45	90.0	92.6	96.6	92.3
50	99.6	102.3	107.0	101.7
55	109.3	112.0	117.2	111.5
60	118.9	121.5	127.3	121.0
65	128.5	130.7	137.5	129.5
70	138.0	140.0	146.6	137.6
75	147.7	148.9	156.2	146.0
80	157.3	158.0	165.5	154.3
85	166.7	166.0	175.0	163.4
90	175.4	174.2	—	172.6
95	183.3	182.2	—	182.0
100	191.2	190.5	—	191.4
105	199.5	198.7	—	—

The lactose was hydrolysed by heating 50 c.c. of a 1 per cent. solution with 1 gram. of concentrated sulphuric acid for 4 hours on a boiling water bath, the evaporated water being occasionally replaced; the solution was then cooled, neutralised, and made up to 250 c.c.—A. S.

Manurial value of Chili saltpetre, calcium saltpetre, and nitrolime for the sugar beet. Urban. *See XV.*

XVII.—BREWING, WINES, SPIRITS, &c.

Maltases of maize; Influence of the reaction of the medium on the activity of the —. R. Hueie. *Compt. rend.*, 1909, **148**, 1121—1123.

It is known that the activity of enzymes depends very closely on the reaction of the medium, and that whilst maltase is most active in faintly acid media, it is completely paralysed by the presence of an organic acid

equivalent to 0.2 per cent. of sulphuric acid. The various maltases of different varieties of maize studied by the author (this J., 1909, 254, 431) behave differently in this respect, some showing their maximum activity in distinctly alkaline media, others acting best in neutral or very faintly acid media. This is another point in favour of the specific difference of the various maltases studied. The reaction of the medium has no influence on the temperature relationships of the various maltases. These temperature relationships, which serve for the classification of the maltases, have no connection with the behaviour of the enzymes towards basic or acid media. The maltases which show their maximum activity in media very slightly alkaline to methyl orange are those of the yellow maize of the Landes, "King Philipp" and "Auxonne." These maltases behave like the amylase of malt, but they are still capable of hydrolysing maltose when the reaction is distinctly acid. The optimum alkalinity for these varieties corresponds to 1 c.c. of *N* 10 acid per 100 c.c.; they are paralysed by acidities equal to 0.019–0.029 per cent. of sulphuric acid. The maltase of the early white maize of the Landes, shows a maximum activity when 1–3 drops of *N* 10 potassium hydroxide are added to 10 c.c. of the medium; the addition of acid is distinctly unfavourable. In the case of "Cuzco red" and "Cuzco white" maizes, on the other hand, the maximum activity is exerted when the natural alkalinity of the medium towards methyl orange is neutralised or even when 2–3 drops of *N* 10 acid per 10 c.c. are added in excess.

—J. F. B.

Bulgarian ferment (yoghourt); Action of — on various sugars. G. Bertrand and F. Duchéck. *Compt. rend.*, 1909, 148, 1338–1340.

THE Bulgarian ferment (yoghourt) when grown in milk hydrolyses lactose and converts the monosaccharides formed into a mixture of *d* and *l*-lactic acids, in which the former predominates. The action has now been studied on several sugars contained in a fluid consisting of malt extract to which has been added 1 per cent. of Chapoteau's peptone and 3 per cent. of calcium carbonate. This was sterilised at 120° C. and maintained at 32° C. with an active culture of the ferment. Yoghourt is totally without action on arabinose, xylose, sorbose, maltose, sucrose and mannitol, but attacks dextrose, mannose, levulose, galactose and lactose. The products are the same in each case; mainly *d* and *l*-lactic acids, a small proportion of volatile acids (formic and acetic acids) and some succinic acid. The mixture of lactic acids is inactive, however, and it is suggested that when grown in milk the organism, after the decomposition of the lactose, cause the *l*-lactic acid to disappear more rapidly than *d*-lactic acid, whereas in the artificial nutrient medium, it attacks malt peptone preferentially to lactic acid. The Bulgarian ferment contains neither invertase nor maltase.—E. F. A.

Ferment action; Influence of boric acid on —. H. Agulhon. *Compt. rend.*, 1909, 148, 1340–1342.

ENZYMES, with the single exception of that of the castor oil seed, have their action only very feebly affected by the presence of boric acid. Some enzymes are even rendered more active by certain proportions of the acid, and invertase in particular is most active in presence of a considerable quantity, but it is well known that the maximum activity of this enzyme is exercised in presence of acid. Boric acid is not a sufficiently strong acid to render pepsin active.—E. F. A.

Lager beers. J. Grant. *J. Inst. Brewing*, 1909, 15, 376–386.

LAGER beer, the name originally given to Bavarian beers, is now applied to most of the beers brewed by the decoction system and stored in the cold or lager cellars. In addition to the ordinary lager beers there are a number of others consumed on the Continent, the chief of which are:—"Schenk" or winter beers, decocted in winter, and rapidly fermented, for immediate consumption. They usually come into condition in 3–7 weeks, and being brewed from a very light-gravity wort, they are not very stable.

"Bock" beers formerly occupied a position intermediate between the "Schenk" and the ordinary lager beers but are now usually brewed of a higher gravity, 21–26 lb., for export trade. These are brewed for spring consumption and from an extra strong wort. The "White beers" vary greatly according to the locality; they are characterised by a very pale colour, decided acid flavour, and richness in gas which causes them to foam strongly. The well known Berlin "white beer" is brewed from two parts of wheat malt and one part of barley malt. The Belgian spontaneous fermentation beers are also of interest; they are brewed in three strengths from equal parts of barley malt and raw, crushed wheat; they are very dextrinous and take 2–5 years to come into proper condition. Of the true lager beers there are four recognised types. The Bavarian or Munich beers possess a light to dark-brown colour, they are lightly hopped and are characterised by their palateness, sweet taste and malt flavour. Their gravities range from 18.2 to 22 lb. for light beers and from 22 to 26.7 lb. for export beers. The Bohemian beers are light-yellow to greenish-yellow in colour. They taste somewhat sharp, dry and wine-like, with a prevailing bitter flavour of hops; their gravities range from 15.1 to 16.6 lb. for the light and from 16 to 18.6 lb. for the heavy. The Vienna lager beers come midway between the Bavarian and the Bohemian in colour, hop-flavour, and taste; their gravities vary from 15.1 to 19.7 lb. for the light and from 19.7 to 22.8 lb. for the heavy or export beers. Most of the common beer in Vienna is brewed at a gravity of 19.7 lb. The American lager beers generally follow the German rather than the Austrian type. The author describes the methods of mashing, the two-mash and the three-mash decoction systems, the methods of fermentation and cellaring. The beers are run into the lager casks containing a considerable quantity of fermentable extract; the temperature of the cellar ranges from 32° to 41° F. Some beers are treated with "Krausen" taken from normally fermenting beers, but this is never used when the beers are to be carbonated. The average composition of lager beers is given in the following table:—

	Water	Carbon dioxide.	Alcohol, by weight	Extract.	Acidity (as lactic acid).	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Ordinary lager ..	90.000	0.196	3.890	5.794	0.151	0.305
Carlsberg lager ..	90.000	0.193	4.270	5.286	0.149	0.309
Export lager ..	89.000	0.209	4.410	6.292	0.160	0.321

—J. F. B.

Grape musts; Variations in the proportion of dextrose and levulose in —. P. C. Mestre. *Ann. Chim. analyt.*, 1909, 14, 185–187.

RESULTS are given showing that whilst about equal quantities of levulose and dextrose are present in musts obtained from healthy, ripe grapes, the quantity of dextrose is always less than that of the levulose when the grapes have been attacked by insects or fungi. The ratio of the sugars to one another in such musts is similar to that in musts which have been partially fermented.—W. P. S.

Acetic aldehyde in wine; The action of — on some of the other constituents. A. Trillat. *Bull. Soc. Chim.*, 1909, 5, 546–555.

THE acetic aldehyde present in wine and brandy results from the oxidation of the alcohol under the influence of atmospheric oxygen; the aeration of the wine, the presence of micro-organisms, the age of the wine, etc., are factors which govern the quantity of aldehyde present. The free aldehyde which is formed disappears gradually; it combines with the colouring matters of the wine to form a more or less insoluble precipitate, and also combines with the alcohol to give acetals which in their turn are con-

verted into colouring matters. A portion of the aldehyde is also oxidised to acetic acid which forms esters contributing to the quality of the wine. The aldehyde and acetal also in course of time polymerise or are converted into bitter substances.—W. P. S.

Wine; The presence of inositol in — and its detection.
G. Perrin. Ann. Chim. analyt., 1909, 14, 182—183.

INOSITOL occurs in all natural wines and its presence may be used as a criterion for distinguishing between pure and artificial wines, the latter being free from this substance. It may be detected by treating 200 c.c. of the wine with basic lead acetate and a few drops of an alcoholic solution of tannin, filtering the mixture, removing the excess of lead from the filtrate by hydrogen sulphide, treating the filtrate from the lead sulphide with animal charcoal, and evaporating the clear liquid to a volume of about 10 c.c. Two drops of this liquid are then mixed on a piece of platinum foil with one drop of silver nitrate solution, evaporated to dryness, and the residue cautiously carbonised; a red coloration is produced if inositol be present. Or, a few drops of the concentrated liquid may be evaporated with a drop of nitric acid; after charring the residue, a drop of ammonia is added, and the evaporation repeated, when a red coloration appears.—W. P. S.

Citric acid fermentation by Citromyces. E. Buchner and H. Wüstenfeld. Biochem. Zeits., 1909, 17, 395—442. (Compare this J., 1909, 538.)

THE mechanism of the formation of citric acid from dextrose is of great theoretical interest, since, owing to its branched carbon chain, this acid cannot be formed from the sugar by a simple oxidation process. Comparative experiments with different *Citromyces* showed that *C. citricus* (original race) gives the highest yield of citric acid, and this organism was used in the subsequent experiments. The fermentations were carried out at the ordinary temperature. Apart from the sugar, a decoction of beans (white or green) was found to be the best nutrient medium from the point of view of citric acid formation. To obtain a high yield of citric acid, addition of calcium carbonate is indispensable, the nitrogen-content of the medium should be low, and the fermentation should be carried out in a shallow dish. By cultivating *C. citricus* in 100 c.c. of a decoction of white or green beans (containing 0.02 per cent. of nitrogen) to which 5 grms. of calcium carbonate and 6.5—12.8 per cent. of dextrose had been added, for 57—66 days, yields of citric acid, of 43—56 per cent. of the weight of sugar consumed, were obtained. Experiments in which a bean decoction containing 0.025 per cent. of nitrogen was used, showed that an abundant citric acid formation does not occur until most of the nitrogen has been assimilated; the residual nitrogen-content remains fairly constant owing to equilibrium between assimilation, on the one hand, and proteolysis of older portions of the hyphae, on the other. Besides citric acid, carbon dioxide is the only metabolic product formed in appreciable quantity; in absence of calcium carbonate, the proportion of carbon dioxide is increased at the expense of the citric acid. If fermentation, carried out at first under normal conditions, is subsequently continued *in vacuo*, small quantities of ethyl alcohol are formed. With regard to the mechanism of the citric acid formation, experiments showed that it is improbable that this acid is synthesised from oxalic and acetic acids, or that it is formed by decomposition from the protoplasm of the *Citromyces*. It may be that parasaccharinic acid or a derivative of this acid, or, broadly, a body closely related to the sugar group and perhaps related to the cell membrane carbohydrates of high molecular weight, is an intermediate product in the citric acid formation. Such a substance has not been detected, however; mannitol was the only reserve substance found in the *Citromyces*. Attempts to effect the citric acid fermentation with expressed juice, or with acetone permanent preparations of *C. citricus*, were unsuccessful. Since the formation of citric acid from sugar only involves a partial oxidation of the latter, the citric acid fermentation is not advantageous to the *Citromyces* from the point of view of energy production, and the acid is of little value as a protection against other organisms.

The citric acid formation is not a necessary accompaniment of the growth of the organism. From the fact that a considerable formation of citric acid does not occur until the nitrogen-content of the nutrient medium has been much reduced, it may be supposed that the *Citromyces*, weakened by deficient nitrogen nutrition, have lost the power of consuming citric acid rapidly and completely, or it may be that with deficient nitrogen nutrition, the organisms no longer possess those enzymes which effect the further oxidation of the citric acid.—L. E.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Flour bleaching. H. Snyder. Univ. of Minnesota Agric. Exp. Stat., Bull., 1908 [111], 101—143. (See also this J., 1909, 377.)

THE bleaching of flour is a natural process and takes place when flour is stored in thoroughly ventilated warehouses; this bleaching is due to the action of light and air upon the colouring matter of flour which is an unstable organic compound mechanically associated, as an impurity, with the fat and gluten. With natural ageing and bleaching there is a slight improvement in bread-making value. The colouring matter of flour is also acted upon by a number of chemical reagents such as chlorine, sulphur dioxide, and traces of nitrogen peroxide, but none of the methods proposed for bleaching flour, except the use of minute amounts of nitrogen peroxide as generated by the discharge of electricity in the air, has survived the experimental stage. Air containing from four to eight parts of nitrogen peroxide per 100,000 parts will effectually bleach flour and there is left in the flour a quantity of nitrogen as nitrite-reacting material amounting to less than one part per million of flour. The fats from bleached and unbleached flour milled from the same wheat are identical as far as the iodine value, nitrogen content, and heat of combustion are concerned; the glens from the two flours are identical in physical properties, and show the same index of refraction. The nitrogen peroxide used in small amounts in the electrical bleaching of flour exerts no chemical action upon the flour other than upon the colouring matter; it appears to be a carrier of oxygen without itself entering into chemical combination with the flour. The nitrite-reacting material in flour seems to be in physical rather than chemical combination; when the flour is heated, the nitrite-reacting material imparted by bleaching is expelled. When the bleaching gas is brought into contact with sand, with which it cannot unite chemically, the same amounts of nitrites are absorbed as in the case of flour. In tests where different quantities of gas were used, it was found that the amount of nitrite-reacting material left in the flour increased with the amount of gas used up to a certain point, and that when a larger excess of the gas was employed, there was permanently retained in the flour no more than when less of the gas was used. Breads made from bleached and unbleached flours when baked in a badly ventilated gas oven contained the same amount of nitrites; when the breads were baked in an oven out of contact with the combustion gases, nitrites were absent. Bread cannot contain any appreciable amount of nitrite-reacting material as the carbon dioxide and organic acids produced during bread-making decompose nitrites. In fifteen digestion experiments with men, no difference was observed in the digestibility of breads from bleached and unbleached flours: the bleaching of the flour did not exert any influence on the amount of nutrients absorbed and digested. Artificial digestion experiments with pepsin solution gave similar results. Nitrites are produced as a result of the combustion of all fuels and organic substances containing nitrogen; flour exposed to wood smoke for a few minutes will contain more nitrites than when electrically bleached. Smoked bacon, ham, etc., contain larger amounts of nitrites than does bleached flour. A kerosene lamp will produce in one hour 0.00027 gm. of nitrite-nitrogen. Nitrites are present in air, rain-water, and many drinking

waters, and are found in vegetables such as celery, lettuce, and spinach; they are a normal constituent of saliva and, with nitrates, are often found in milk where the cows have been liberally fed on roots. In bread-making tests of commercially bleached flours, no difference was observed between the breads produced from the bleached and unbleached flours milled from the same wheats, except that the bleached flours produced a whiter bread and also showed a tendency to produce larger sized loaves.—W. P. S.

Milk; Determination of dirt in —. G. Fendler and O. Kuhn. Z. Unters. Nahr. Genussm., 1909, 17, 513—526.

In the process recommended, 100 c.c. of the milk are submitted to centrifugal action in a tube, the lower end of which is constricted. The dirt collects in this narrow portion of the tube, and, after the milk has been poured off, is treated with 15 c.c. of 10 per cent. ammonia; at the end of 30 minutes, water is added, and the contents of the tube are again submitted to centrifugal action. The sediment is then collected on a filter, washed successively with water, alcohol, and ether, dried at 100° C., and weighed. The authors consider that any milk which yields more than 1 mgrm. of sediment per 100 c.c. of milk is to be considered as being dirty.—W. P. S.

Cacao beans; The theobromine content of —. A. Kreutz. Z. Unters. Nahr. Genussm., 1909, 17, 526—528.

It is shown that about one-half of the theobromine present in cacao beans is in the free state and can be extracted directly by means of chloroform; the remainder is present in a combined form and only goes into solution in chloroform after the cacao has been subjected to hydrolysis (heating with dilute sulphuric acid). The fat is extracted together with the theobromine and the two may be separated by treatment with cold carbon tetrachloride (see this J., 1909, 215).—W. P. S.

Formic acid; Determination of — in fruit juices. F. Schwarz and O. Weber. Z. Untersuch. Nahr. Genussm., 1909, 17, 194—197.

From 25 to 50 grms. of the juice is distilled with steam under pressure until 250 c.c. of distillate have been obtained. This is titrated with *N*/10 sodium hydroxide solution, evaporated to dryness, and redissolved in water. This aqueous solution is then oxidised by boiling with an equal volume of a solution of 12 grms. of potassium bichromate, 30 c.c. of strong sulphuric acid, and 100 c.c. of water. After cooling, the mixture is again distilled, as before, and the distillate titrated. The difference between the two titrations gives the equivalent of formic acid, which has been destroyed by the oxidising mixture, whereas acetic acid is unaffected. A Kjeldahl flask with a long neck is most suitable for these distillations.—J. O. B.

Benzoic acid; Detection of — in alimentary products. A. Jonescu. J. Pharm. Chim., 1909, 29, 523—525.

The material is suspended in water, acidified with sulphuric acid, and distilled with steam. The distillate is shaken with ether, the ether extract is evaporated, and the residue taken up with warm water. To 1 c.c. of this aqueous solution, 1 drop of a 10 per cent. solution of 3 per cent. hydrogen peroxide and 1 drop of a solution of ferric chloride (1 part of solution of sp. gr. 1.280:9 of water) are added. The tube containing the mixture is then immersed in boiling water. In the presence of benzoic acid, which will have been converted into salicylic acid by the hydrogen peroxide, the characteristic violet colour-reaction will appear on the surface of the liquid. The tube is then withdrawn and allowed to cool. The absence of phenolic bodies and saccharin in the original material, must be ensured. The presence of 0.25 grm. of sodium benzoate in 500 c.c. of milk is readily detected by this method.—J. O. B.

Coking test. [Its proposed extension to the testing of foods, etc.] O. Bimler. Z. anal. Chem., 1909, 48, 372—375.

NON-VOLATILE organic substances, when heated in a covered platinum crucible, as in the "coking" of a sample of coal, yield definite amounts of coke, of more or less

characteristic appearance. Starch, for example, gives more than twice as much coke as dextrin, although these two substances have the same empirical formula. It is proposed, therefore, to utilise this property as furnishing an additional means of ascertaining the purity of foods and other organic materials.—F. SOPN.

Action of Bulgarian ferment (yoghourt) on various sugars. Bertrand and Duchéck. See XVII.

Sodium benzoate as preservative for foodstuffs; Use of —. Food Inspection Decision No. 104. U.S. Dept. of Agriculture.

In consequence of the report of the "Referee Board" (see this J., 1909, 215), no objection will be raised under the Food and Drugs Act to the use of sodium benzoate in food, providing that each package or container is plainly labelled to show the presence and amount of benzoate. Food Inspection Decisions 76 and 89 are amended accordingly.

PATENTS.

Aerated waters; Manufacture of —. A. J. Harries and R. W. C. Palmer, London. Eng. Pat. 6641, Dec. 15, 1908.

The waters are aerated under a high pressure, say 250 lb. per sq. inch, in the usual way and are then charged into storage vessels for sale under a pressure of about 10 lb. per sq. inch. The reduction in pressure is effected by passing the aerated water through a reducing valve arranged in a conduit between the high-pressure reservoir and the storage vessels. The gas accumulating in the reducing valve is returned to the aerating machinery by means of a pump, the charging of the storage vessels being suspended during the action of the pump.—W. P. S.

Curing process [for meat, etc.]. A. J. Boulton, London. From The Electric Meat Curing Co., Cleveland, Ohio. Eng. Pat. 23,183, Oct. 30, 1908.

The meat is placed in a tank containing strong brine and a current of electricity is passed through the brine, the electrodes being placed in porous cups situated at each end of the tank. The brine is cooled by circulating it through the tank and an outside tank, the latter containing a coil through which a cooling liquid is passed. The production of chlorine and sodium hydroxide about the electrodes is prevented by the use of a switch by means of which the direction of the current may be altered from time to time, or by the employment of an alternating current.—W. P. S.

Milk; Processes of treating — to produce a solid therefrom. G. V. Frye, Lexington, Ohio, U.S.A. Eng. Pat. 5133, March 6, 1908.

SEE FR. Pat. 389,835 of 1908; this J., 1908, 1026.—T. F. B.

Soy or sauce substitute; Process of making —. K. Okazaki, Tokyo. U.S. Pat. 923,070, May 25, 1909.

SEE FR. Pat. 376,373 of 1907 and Addition thereto; this J., 1907, 1025, and 1908, 351.—T. F. B.

(B.)—SANITATION; WATER PURIFICATION.

PATENT.

Refuse and sewage; Conversion of — into manure. Soc. Générale des Engrais Organiques, Paris. Eng. Pat. 25,958, Dec. 1, 1908. Under Int. Conv., Dec. 4, 1907.

The process relates to the manufacture of a manure in the form of a fine powder. The refuse or sewage is delivered into a pit from which it is carried by means of a conveyor to a second pit. From this pit a bucket elevator raises the refuse and discharges it on to a third conveyor which delivers it to the grinding mills. Workmen draw the refuse from the conveyor to the hoppers of the mills, or automatic devices may be employed for this purpose. Any excess of refuse over the capacity of the mills is conducted back again to the first pit. The ground

material from the mills is conducted to a mechanical screening device which delivers the ground and sifted manure into transport trucks.—W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

Bamboo and rice straw; Cellulose pulps from —. T. Knösel. *Wochenbl. Papierfabr.*, 1909, 40, 1603—1604.

PAPER pulp of high quality is now being manufactured in Brazil from bamboo, and the author has procured some of the raw material in use there, for treatment by his own process. The stems, having walls 15 mm. thick, were split and broken up prior to digestion, the oldest and hardest of the knots having been previously cut out. The material soon became softened under the chemical treatment and it was then readily reduced to a clean pulp by means of a wooden stirrer. The unbleached pulp had a brownish-yellow colour, with long, fine and strong fibres suitable for strong wrapping papers. It was easily bleached and then possessed a pure white colour and a silky lustre. On drying, it turned yellow when exposed to the light, presumably because suitable arrangements for thorough washing were not available. The yield amounted to 62 per cent. of air-dry, bleached cellulose. The author has also treated rice straw in a similar manner. This yields to the digestion process far more readily than bamboo and gives an extremely long fibre. The pulp could not be bleached quite white, owing to the presence of a fine brown dust in the material; the yield was 50 per cent. The author considers that both these materials would be capable of affording a cheap and important supply of high-grade pulp.—J. F. B.

PATENTS.

Size composition and method of making the same. C. K. Mills, London. From A. W. Harrington Co., New York, U.S.A. Eng. Pat. 9652, May 4, 1908.

A SIZING material suitable for use by paper-makers is made according to the following process. Rosin and soda ash are boiled in water and allowed to cool, when glue and starchy material which has been boiled in water, are added whilst hot. When cold, glycerin, formaldehyde, and Russian petroleum are added. Cassava can be used instead of the starchy material, and other natural oils in place of the Russian oil.—F. SHDN.

Cellulose acetate; Manufacture of objects from —. A. Schloss, Assignor to Fürst Guido Donnersmarck'sche Kunstseiden und Acetatwerke, Sydowsane, Germany. U.S. Pat. 922,340, May 18, 1909.

THE cellulose acetate is dissolved in formic acid and the solution is then introduced into an aqueous precipitating bath.—W. P. S.

Non-inflammable plastic substances [celluloid substitutes]; Process for the manufacture of transparent or opaque—, and apparatus therefor. S. Assadas, Lyons, France. Eng. Pat. 9982, May 7, 1908. Under Int. Conv., May 8, 1907.

SEE Fr. Pat. 387,537 of 1907; this J., 1907, 873.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Medicinal bark from the Ivory Coast; New —, and its alkaloid. E. Perrot. *Compt. rend.*, 1909, 148, 1465—1467.

IN 1897, A. Chevalier discovered a tree growing on the Ivory Coast, the bark of which was recommended by the natives as a febrifuge. The tree belongs to the family of the *Rubiaceæ*, but its exact botanical characters have not yet been determined, so the author calls it provisionally *Pseudo-cinchona africana*, A. Chev. The bark appears to contain a considerable quantity of an alkaloid. This has been isolated in the form of long needles, soluble in

alcohol, but insoluble in ethyl acetate and ether. A study of the physical and chemical characters of the alkaloid is in progress. Preliminary physiological experiments indicate that it possesses therapeutic value.—A. S.

Pirus toringo, Sieb.; Constituents of the bark of —. Y. Hirose. *Ber. der Pharm. Ges. von Japan*, Yaku-gazanehi, 1909, 1.

IN Japan the bark of *Pirus toringo*, N.O. *Rosaceæ*, is used for the preparation of a yellow lacquer, obtained by boiling this bark with potassium carbonate solution and precipitating the extract with alum solution. The lacquer is termed "Dzumi." The powdered bark is also used for adulterating powdered liquorice, gentian, etc. From the alcoholic extract of the bark, a glucoside, in white, glistening, acicular crystals, has been isolated, which, when recrystallised from methyl alcohol and acetone, has the composition $C_{21}H_{26}O_6 + 2H_2O$. The melting-point of the hydrated product is 135° — 137° , that of the anhydrous, about 240° . On hydrolysis, the glucoside, which has been called *toringin*, is split up as follows:— $C_{21}H_{26}O_6 + H_2O = C_{13}H_{16}O_4 + C_6H_{12}O_6$. The product, $C_{13}H_{16}O_4$, is identical with chrysin; the osazone of the separated sugar has the melting-point, 204° . From the mother-liquor of *toringin*, quercetin (*pirusquercitrin*) is obtained in yellow needles of melting-point 174° — 176° . It yields on hydrolysis quercetin and rhamnose.

Cubebin. E. Mameli. *Gaz. chim. ital.*, 1907, 37, II., 483—506; 1909, 39, I., 477—493, 494—508.

PURE cubebin prepared from specimens of different ages and origins has the composition, $C_{20}H_{26}O_6$. It melts at 132° C., and has the rotatory power, $[\alpha]_D = -45.45$ in chloroform. It contains two hydroxyl groups and its other reactions indicate that it has the constitution represented by the formula, $CH_2O_2C_6H_5[C_6H_3(OH)_2]C_6H_3O_2CH_2$. By the action of dehydrating agents on cubebin, *cubebinic ether*, $C_{20}H_{18}O_5$, is formed. An almost quantitative yield is obtained by the action of hydriodic acid on a cold solution of cubebin in excess of glacial acetic acid. The reaction product is poured into water, and the precipitate is purified by crystallisation from alcohol. *Cubebinic ether*, $CH_2O_2C_6H_5[C_6H_3(OH)_2]C_6H_3O_2CH_2$, m. pt. 78° C., $[\alpha]_D = +23.04^{\circ}$ in chloroform, forms fine white silky needles soluble in alcohol, benzene, acetic acid, and chloroform. It contains no hydroxyl or carbonyl groups, does not decolorize bromine water or potassium permanganate solution, and is not affected by hydrogen peroxide. When reduced with alcohol and sodium, it yields a monohydric, primary alcohol, *cubebinol*, $CH_2O_2C_6H_5[C_6H_3(OH)]C_6H_3O_2CH_2$. *Cubebinol* crystallises in white silky needles, m. pt. 92° C., $[\alpha]_D = +34.81^{\circ}$ in chloroform, soluble in chloroform, benzene, ether, pyridine, acetic acid, alcohol, toluene, and petroleum spirit. It yields an acetyl derivative, m. pt. 71° C., $[\alpha]_D = +23.12^{\circ}$ in chloroform, and a benzoyl derivative, m. pt. 154° — 155° C., $[\alpha]_D = -21.68^{\circ}$ in chloroform.—A. S.

Adrenaline reaction; A new characteristic —. S. Fraenkel and R. Allers. *Biochem. Zeits.*, 1909, 18, 40—43.

ADRENALINE solution when warmed with iodine acid or with potassium di-iodate and dilute phosphoric acid, gives a fine rose-red coloration, or an eosin-red colour in the case of very dilute solutions. 1 part of adrenaline in 300,000 of solution can be detected by this reaction. In carrying out the test, the adrenaline solution is mixed with an equal volume of N/1000 potassium di-iodate solution and a few drops of dilute phosphoric acid, and heated to incipient boiling. The red colour changes to brown on addition of ammonia. The red colour reaction depends upon the addition of iodine to the adrenaline molecule, and the authors hope to base a quantitative method upon it. The reaction is characteristic of adrenaline. (See also this J., 1908, 1082.)—A. S.

Camphor; Points of difference between natural, artificial and synthetic —. W. Lohmann. *Ber. deutsch. Pharm. Ges.*, 1909, 19, 222—230.

THE melting point is of no practical value in distinguishing natural from synthetic camphor, especially if monoxidised

camphene, borneol, or isoborneol be present in the synthetic product. The optical rotation of alcoholic solutions forms the best test, synthetic camphor being optically inactive, whereas natural camphor is markedly dextro-rotatory, so that in a mixture of the two, the amount of natural camphor present might be determined polarimetrically. The statement in text-books that artificial camphor does not give a syrupy liquid when titrated with an equal quantity of chloral hydrate, such as natural camphor affords, is erroneous. Pure synthetic camphor behaves exactly like natural camphor towards chloral hydrate. Probably the error has arisen from the presence of pinene hydrochloride in the synthetic camphor employed. Since borneol melts at 208°C ., camphene at 50°C ., and pure synthetic camphor at 175°C ., it would be possible to have a mixture of the three with the correct m. pt. Consequently small fractional sublimations should be made, and the melting points of the products determined: also the amount of unsublimable matter should be weighed. The presence of pinene hydrochloride as an adulterant of either natural or synthetic camphor is readily shown by heating with twice its weight of calcium hydroxide, free from chlorine, until all the camphor has volatilised. The residue is then treated with hot water filtered, and tested with silver nitrate reagent after acidifying with nitric acid. No opalescence should be evident. In the discussion, Stephan stated that for the celluloid industry (the largest consumer of camphor), it is absolutely necessary that the synthetic product should be free from chlorine. This is readily proved by a modification of Beilstein's test with a copper oxide bead. When the camphor is burned on copper wire and the wire is introduced into a Bunsen flame, the colour should be pure blue with no trace of green. Borneol and isoborneol are readily determined in synthetic camphor by the acetylation method, but if considerable quantities of these impurities are present, the sample should be diluted with xylol or with rectified turpentine oil, the acetyl value of which has been previously determined. The determination of the borneols is then easy. When camphor has been purified by recrystallisation from alcohol, the presence of a mere trace of the solvent will materially lower the melting point. Apart from this, the determination of the melting point affords a good indication of the purity or otherwise of artificial camphor. For celluloid manufacture, it is also important that the camphor should be free from all traces of acid, and its content of ash should in no case exceed 0.02 per cent.—J. O. B.

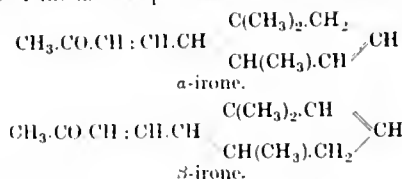
Pinene; *New method of hydration of* ——. P. Barbier and V. Grignard. Bull. Soc. Chim., 1909, 5, 512—526.

THE method described previously (this J., 1908, 90) is modified by the addition of 100 c.c. of acetic anhydride to the hydrating mixture, this addition being made in order to diminish the concentration of the water in the mixture. The experiments carried out with the modified process show that α -pinene is transformed into terpineol, small quantities of other substances being formed when the temperature of the reaction is raised. β -Pinene is hydrated almost completely in one operation, the disappearance of the pinene being correlative with the formation of fenchyl alcohol. As the pinene is hydrated, the residue left consists of a purer pinene than the original, a number of other hydrocarbons being the first to be acted upon. Hydrocarbons, which are hydrated less rapidly than α - and β -pinene, can be isolated by repeating the hydrating operation, and in this way the authors have separated from French pinene the following substances:—An impure hydrocarbon boiling at 150° – 152° C.; a camphene melting at 42° C.; and a saturated liquid hydrocarbon boiling at 157° – 160° C. W. P. S.

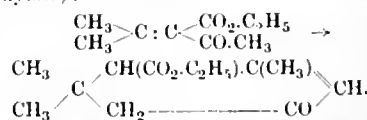
Perfumes of the violet; Synthesis of —, G. Merling and R. Welde. *Annalen*, 1909, **366**, 119—216.

The authors have succeeded in synthesising ironone (the odoriferous principle of the violet) which they term β -ironone (the perfume of which is even purer than that of the natural product) and also a new isomeride, termed

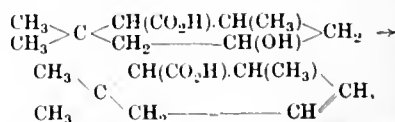
α -irone which has a perfume closely resembling that of β -irone or the natural product.



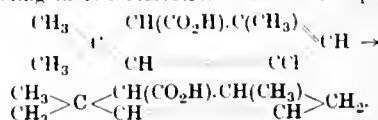
These compounds differ from α - and β -ionone only in the position of the cyclic double linking. The long side-chain is introduced by condensing acetone with the appropriate cyclic aldehyde (a cyclogeraniol) and the remarkable fact has been discovered that only those aldehydes of this class furnish compounds having the odour of violets in which the aldehyde group is adjacent to the methyl or the *gem*-dimethyl group; further the intensity of the perfume increases with the number of methyl groups adjacent to the aldehyde group. The starting point for these syntheses is isopropylidenacetoneacetic ester which when condensed with sodium acetoacetic ester yields ethyl isophoronecarboxylate (or ethyl δ -ketocyclogeraniolcarboxylate):—



When this is reduced with sodium and alcohol, three pairs of *cis-trans*-isomeric hydroxy-acids are produced, of which two pairs belong to the class of δ -hydroxydicyclogeranic acids or, as the authors call them, δ -hydroxy-cyclogeraniolcarboxylic acids. These four stereoisomeric acids can be converted one into the other at will. By elimination of water the acids furnish Δ^3 -cyclogeranic acid.



which exists in two stereoisomeric modifications, and by reducing δ -chlorocyclogeranioladienecarboxylic acid (one of the products of the action of phosphorus pentachloride on ethyl isophoronecarboxylate), Δ^4 -cyclogeranic acid, also existing in two stereoisomeric forms, is produced.



In the same reaction are also obtained the Δ^3 - and Δ^2 -cyclogeranic acids, the aldehydes of which yield α - and β -ionone respectively when condensed with acetone. The Δ^3 - and Δ^4 -acids are converted into the corresponding aldehydes as previously described (Merling, this J., 1908, 767), and by condensation with acetone give α - and β -irone respectively. For the mass of experimental detail reference to the original paper must be made.—I. C. C.

Benzene sulphonic-chloride; Preparation of —. R
Pummerer. Ber., 1909, **42**, 1802—1804.

The author has found that under suitable conditions (low temperature and large excess of chlorosulphonic acid), a yield of over 60 per cent. of the theoretical quantity of benzene sulphonie-chloride can be obtained by the direct action of chlorosulphonic acid on benzene. 400 c.c. of chlorosulphonic acid are cooled to -15°C . in an enamelled vessel of $\frac{1}{2}$ -litre capacity provided with an agitator, and then 78 grms. of benzene are added gradually in the course of 3—4 hours, the mixture being kept cooled and well agitated. The reaction product is allowed to flow in a thin stream on to ice, the temperature not being permitted to rise above 20°C . The mixture of benzene

sulphonic-chloride and sulphobenzide which separate is extracted with ether, the ethereal solution dried with sodium sulphate, concentrated, and the sulphobenzide precipitated by addition of petroleum ether. From the solution, after evaporation of the solvent, the benzene sulphonic-chloride (b. pt., 144° – 145° at 17 mm.) is recovered by distillation *in vacuo*; yield, 70–80 grms. With 10 times the quantities mentioned, the crude oil obtained can be freed from sulphobenzide by direct distillation *in vacuo* and a much better yield of benzene sulphonic-chloride obtained, viz., 1100 grms. or 62 per cent. of the calculated quantity.—A. S.

Acetone; Reaction [for the detection] of —. B. Bardach. Chem.-Zeit., 1909, 33, 570.

For the detection of acetone, 1 c.c. of a 3 per cent. solution of peptone is added to about 5 c.c. of the clear and nearly neutral liquid, and then Lugol's solution (4 grms. of iodine, 6 grms. of potassium iodide, and 100 c.c. of water), until an intense red-brown colour is obtained. On now adding 3 c.c. of ammonia, a dark brown coloration is produced which lasts about ten minutes (unless too little iodine be present), and in about an hour a precipitate separates, from which most of the liquid is poured off, the remainder, containing the precipitate, being acidified with hydrochloric acid. The development of a crystalline precipitate indicates the presence of acetone; but if the liquid become quite clear and remain so for an hour and a half, acetone may be regarded as absent. 0.01 per cent. of acetone is readily detected, and even smaller quantities with the aid of a microscope. The reaction is common only to compounds containing the group, $\text{H}_3\text{C}\cdot\text{CO}\cdot\text{C}$, and may, therefore, be used for the detection of acetone in the presence of alcohol. The value of the test is not affected by the colour of the solution to be examined.—F. SODN.

Ketones and aldehydes; Compounds of — with acids. A. Shukow and F. Kassatkin. J. Russ. Phys.-Chem. Ges., 1909, 41, 157–166. Chem. Zentr., 1909, 1, 1760–1761.

On adding the calculated quantity of camphor to cooled anhydrous nitric acid, a colourless viscous liquid is obtained, from which on continued cooling, long needles of the compound, $\text{C}_{10}\text{H}_{16}\text{O}\cdot\text{HNO}_3$, separates. This melts at 24°C . is easily soluble in alcohol, ether, petroleum spirit, and acetone, and deliquesces when exposed to the air. Another compound, $(\text{C}_{10}\text{H}_{16}\text{O})_2\cdot\text{HNO}_3$, melting at 2°C ., can be obtained by mixing solutions of nitric acid and camphor in petroleum ether. The compound, $\text{C}_{10}\text{H}_{16}\text{O}\cdot\text{H}_2\text{P}_2\text{O}_7$, is obtained in large crystals melting at 3°C . by heating a mixture of molecular proportions of camphor and phosphoric acid. On leading hydriodic acid gas into a solution of camphor in petroleum ether, reddish-brown crystals of the compound, $\text{C}_{10}\text{H}_{16}\text{O}\cdot\text{HI}$, m. pt. 29° – 30°C ., separate. A colourless compound of hydrochloric acid and camphor, m. pt. $4\cdot2^{\circ}\text{C}$., which decomposes in the air, is produced by the action of hydrochloric acid gas on powdered camphor. A liquid compound, which does not solidify at -35°C ., is also produced by the action of nitrogen trioxide on camphor. Compounds of nitric acid with benzophenone, benzaldehyde, naphthol, and methylonylketone were also prepared. (See also Ger. Pat. 206,695; this J., 1909, 383.)—A. S.

hydrocyanic acid; Formation of — by the action of nitric acid on phenols and quinones. A. Seyewetz and L. Poizat. Bull. Soc. Chim., 1909, 5, 489–492.

HYDROCYANIC acid is produced by the action of boiling nitric acid on a considerable number of phenols and quinones, or on compounds containing a phenol or quinone group in their molecule. The quantity of hydrocyanic acid produced by the reaction varies with the phenol or quinone employed; it is large in the case of simple monod poly-phenols and diminishes as the molecule becomes more acid. Resorcinol yields about 5.8 per cent. of hydrocyanic acid. The formation of this acid is always accompanied by the production of nitrous acid and the authors find that if substances be added which prevent the production of nitrous acid, such as urea, aniline,

etc., hydrocyanic acid is not formed. Further, considerable quantities of hydrocyanic acid are yielded by heating certain phenols with nitrous acid. (See also this J., 1909, 219.)—W. P. S.

Oilate and stearate of mercury. D. B. Dott. Chem. and Druggist, 1909, 74, 785.

MERCURIC oleate prepared by the B.P. method was found to contain 23.13 per cent. of mercury, when analysed by the method in which the mercury is reduced with hypophosphorous acid, washed, dried, and weighed. By treating the same preparation with hot nitric acid, adding hydrochloric acid to the solution, evaporating the liquid nearly to dryness, taking up the residue with water, and determining the mercury in the form of sulphide, the amount of that metal found was 22.27 per cent. The lowness of the result was attributed to the difficulty of complete extraction of the mercury. On the other hand, the reduction method with hypophosphorous acid tends to give results somewhat too high, and it is therefore advisable to heat the product of the reduction in order to volatilise the mercury, and then weigh any non-volatile residue. Mercuric stearate is more stable and generally more satisfactory in its properties than the oleate. A suitable method of preparing it is to dissolve 20 parts of commercial stearic acid in a boiling solution of $3\frac{1}{2}$ parts of sodium hydroxide in 140 c.c. of water. To this solution is added hydrochloric acid until a slight permanent oily layer separates, and this layer is then dissolved by the addition of just sufficient sodium carbonate solution. The solution is now mixed with a hot solution of $18\frac{1}{2}$ parts of mercuric chloride in about 70 parts of hot water, and the precipitate washed till free from chloride, dried below 100°C ., and powdered. A sample thus prepared yielded, on reduction with hypophosphorous acid in the presence of alcohol, 24.28 per cent. of mercury.—C. A. M.

PATENTS.

Therapeutic compounds [mercury derivatives of phenylarsonic acids]; Manufacture of —. H. S. Wellcome, London, and M. Barrowcliff, Dartford. Eng. Pat. 12,472, June 10, 1908.

MERCURY derivatives of phenylarsonic acids are obtained by heating these acids or their substitution products or derivatives or their salts (e.g., aminoazo or azoxy compounds), with mercuric oxide, mercuric or mercurous acetate, or other mercury salts. The derivatives thus formed combine with acids and with bases to form salts. The following substances, together with their salts and acetyl derivatives, and the salts of the acetyl derivatives, are claimed:—3-oxymercury-4-aminophenylarsonic acid, $\text{NH}_2\cdot\text{C}_6\text{H}_3(\text{HgOH})\text{AsO}(\text{OH})_2$; 3,5-dioxymercury-4-oxyphenylarsonic acid, $\text{C}_6\text{H}_2\text{O}_6\text{AsHg}_2$; 3-methyl-4-amino-5-oxymercuryphenylarsonic acid, $\text{C}_7\text{H}_{10}\text{O}_4\text{NAsHg}_2$; 3-methyl-4-oxy-5-oxymercuryphenylarsonic acid; 3,5-dioxymercury-4-oxy-1'-methylazobenzene-4'-arsonic acid; 3,5-dioxymercury-4-aminophenylarsonic acid.—T. F. B.

Therapeutic compounds [Salts of dibromobenzenic acid]; Manufacture of new —. P. A. Newton, London. From Farbenfabrik, vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,132, Aug. 14, 1908.

CLAIM is made for the manufacture and medicinal use of the calcium, magnesium, and strontium salts of dibromobenzenic acid. All these salts are white powders almost insoluble in water and alcohol.—F. SHDN.

Salt; Preparation of alimentary, ferruginous —. C. Millet and L. Massi, Paris. Eng. Pat. 23,917, Nov. 7, 1908.

10 GRMS. of a 10 per cent. solution of pure hydrochloric acid are added to 1 kilo. of sea salt, and 1 gm. of ferric oxide or of a ferric salt is thoroughly incorporated and kneaded with the acidified mixture for about one hour. The excess of free acid is afterwards neutralised by adding 40 grms. of tricalcium phosphate to each kilo. of the ferruginous salt mixture.—O. R.

Phenolphthalein compounds. Knoll and Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 27,095, Dec. 14, 1908. Under Int. Conv., Dec. 21, 1907.

THE esters of phenolphthalein with carbonic acid, the middle or higher fatty acids, or with substituted aromatic acids may be used as aperients in place of phenolphthalein or its diacetate, dibenzoate, or dibenzenesulphonate. They are prepared by the usual methods of treating phenolphthalein with the halogenides, anhydrides, or esters of the acids. The preparation of the following esters is described:—The di-isovalerate, dibutyrate, salicylate, and carbonate.—T. F. B.

Lactic acid; Process of manufacturing —. P. M. Justice, London. From C. H. Boehringer Sohn, Nieder-Ingelheim on Rhine, Germany. Eng. Pat. 7094, March 24, 1909.

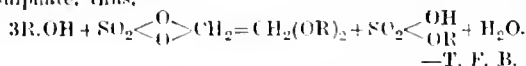
IN decomposing concentrated solutions of calcium lactate with sulphuric acid, a stiff paste is produced, which is exceedingly difficult to work up. It is found that a more or less thin paste is formed if concentrated lactic acid be added to the acid used for decomposition, or the lactic acid solution may first be added to the calcium lactate solution. Or the calcium lactate solution may be evaporated to dryness, and then treated with lactic acid and sulphuric acid. For example, 300 litres of calcium lactate solution of 10° B., coming from the fermentation process, are evaporated to 50 litres; 50 kilos. of a 50 per cent. solution of lactic acid are added, and then decomposition is effected by means of sulphuric acid. The lactic acid solution thus obtained is of 50 per cent. strength. —T. F. B.

Vanilla beans; Process of extracting essences and tinctures from —. E. M. Howell, New York, U.S. Pat. 921,251, May 11, 1909.

RAW ground vanilla beans, contained in a suitable closed vessel (the length of which is about $3\frac{1}{2}$ times its diameter), are treated with dilute alcohol which, by means of a jacket surrounding the lower part of the vessel, is heated until the temperature of the top layer is about 100° F. The column of solvent and beans is then cooled to the ordinary temperature, the liquid portion percolated through the ground mass, and the percolate returned to the vessel to complete the extraction.—J. C. C.

Sulphuric acid esters of the terpene series; Process for preparing acid —. Chem. Fabr. von Heyden A.-G. Ger. Pat. 208,790, March 29, 1908.

ACID sulphuric esters of terpene alcohols are formed in good yield by treating the alcohols with methylene sulphate, thus,



Peru balsam and formaldehyde; Process for obtaining a preparation, soluble in water, from —. O. Boerner. Ger. Pat. 208,833, July 28, 1906.

GASEOUS formaldehyde is led into a solution of Peru balsam in alcoholic alkali, which is warmed during the treatment. The product is soluble in water and in ammonia solution.—A. S.

Aloin and ferric compounds; Process for the preparation of compounds, soluble in alkali, from —. A. Dieffenbach and R. Meyer. Ger. Pat. 208,961, May 6, 1908.

A SOLUTION of aloin in aqueous ammonia or potassium hydroxide solution is treated with a ferric salt, preferably a basic salt, and the dark brown solution is evaporated under diminished pressure.—A. S.

Aromatic hydroxyalcohols; Process for preparing tertiary —. P. Hoering and F. Baum. Ger. Pat. 208,962, July 22, 1908.

By treating aromatic hydroxycarboxylic esters or their alkali salts with excess (two or three molecular proportions) of alkylmagnesium halides in ethereal solution in the cold, tertiary hydroxyalcohols are obtained: they are

isolated by treating the reaction product with dilute acids, extracting the ethereal solution with alkali, and precipitating by means of carbon dioxide. The preparation of *o*-amylolphenol, $HO.C_6H_4.C(OH)(C_2H_5)_2$, isopropylol-*m*-cresol, and *m*-isoamylolcresol, are described.—T. F. B.

Oxalic acid; Process for the preparation of — Oxidation of carbohydrates with nitric acid. A. Naumann, L. Moeser, and E. Lindenbaum. Ger. Pat. 208,997, June 4, 1907. Addition to Ger. Pat. 183,022, Aug. 1, 1905.

ACCORDING to the main patent oxalic acid was produced by the oxidation of sugar with nitric acid in presence of vanadium compounds, the latter acting as oxygen-carrier (this J., 1908, 183). It is now found that other carbohydrates such as starch, dextrin, gums, or cellulose which has been treated with sulphuric acid, may be used in place of sugar.—A. S.

Formic acid from formates; Process for the preparation of —. D. Strauss. Ger. Pat. 209,418, June 2, 1907.

THE claim is for the decomposition of formates by hydrofluoric acid for the production of formic acid. In the case of sodium formate, sodium fluoride is obtained as a valuable by-product, which may be sold as such, or may be decomposed with quicklime, with production of caustic soda and calcium fluoride, the latter being then treated with sulphuric acid to regenerate the hydrofluoric acid.—A. S.

Guanidine; Process for preparing —. C. Ulpiani, Portici, Italy. Ger. Pat. 209,431, Oct. 16, 1907.

DICYANODIAMIDE is converted almost quantitatively in guanidine by means of *aqua regia*. 500 c.c. of hydrochloric acid (sp. gr. 1.16) and 200 c.c. of nitric acid (sp. gr. 1.384) are added to a solution of 100 grms. of dicyanodiamide in 500 c.c. of water, and the solution is evaporated to about one-fifth of its original volume at a temperature of 60–65° C.; on cooling, practically pure guanidine nitrate crystallises out, the yield being about 90 grms.—T. F. B.

Alkylene-iminosulphonic acid salts; Process for preparing —. Chem. Fabr. von Heyden A.-G. Ger. Pat. 209,502, Feb. 19, 1908.

THE salts of aminosulphonic acid readily condense with aldehydes to form the salts of alkylene-iminosulphonic acids, $R.CH:N.SO_3M$, where R represents hydrogen, a carbon-containing radical, and M a metal or other acid-forming radical. The preparation of the methylene-iminosulphonates of sodium and ammonium, and barium ethyldeneiminosulphonate, are described in detail.—T. F. B.

Alkylloxymethyl ethers of aromatic hydroxy-compounds; Process for the preparation of —. P. Hoering and F. Baum. Ger. Pat. 209,608, May 2, 1907.

ALKYLOXYMETHYL ethers are produced by the action of halogenomethylalkyl ethers of the general formula $X.CH_2.O.R$ (X=halogen, R=alkyl) on alkali salts of phenols or their substitution products, polyhydric phenols or their monoalkyl ethers, aromatic hydroxyaldehydes, or aromatic hydroxycarboxylic acids.—A. S.

Hydroxyaldehydes and hydroxycarboxylic acid esters of organomagnesium compounds; Process for producing reactions between —. P. Hoering and F. Baum. Ger. Pat. 208,886, June 9, 1907.

AROMATIC hydroxyaldehydes or hydroxycarboxylic acid esters which cannot be satisfactorily treated according to Grignard's reaction, are converted into the corresponding alkylalkoxyalkyl ethers by the action of chloroalkyl ethers on their alkali salts. The alkylalkoxyalkyl ethers are then treated in the usual manner with alkylmagnesium halides, and the products treated with hydrolysing agents in order to remove the alkylalkoxyalkyl group. (See preceding abstract.)—A. S.

Aromatic aldehydes containing at least one hydroxyl group adjacent to the aldehyde group; Process for preparing —. Kalle und Co. Ger. Pat. 209,910, Jan. 9, 1908.

By condensing α -isatin derivatives with aromatic compounds which contain the grouping, $-(CH_2.CO)-$ or $-CH_2.C.OH-$, dyestuffs are formed which give coloured addition products with alkali hydroxides; by further treatment with alkali, these are decomposed, anthranilic acid or a derivative being eliminated, and an o -hydroxy-aldehyde formed. Thus, 1-hydroxy-2-naphthaldehyde is obtained from β -naphthol, 2-hydroxy-1-naphthaldehyde from α -naphthol, 2,6-dihydroxybenzaldehyde from resorcinol, and 1-hydroxy-4-methoxybenzaldehyde from monomethylresorcinol ether.—T. F. B.

serum capable of neutralising the action of typhus aggrassinæ; Process for the preparation of a —. Chem. Fabr. auf Actien, vorm. E. Schering, Ger. Pat. 209,816, May 3, 1907.

TYPHUS cultures are cultivated on liquid nutrient media, and the filtered solution, which contains a considerable quantity of the so-called aggrassinæ, is used in the customary manner for the preparation of an anti-aggrassinæ serum.—A. S.

dine, resorcinol, and formaldehyde; Process for preparing a condensation product from —. N. Weiss and A. Horowitz, Ger. Pat. 209,911, Dec. 1, 1906.

RESORCINOL (50 grms.) is dissolved in water (150 grms.), and iodine (8 grms.) is slowly added to the solution warmed to 50°C .; the solution is kept at 50°C . until it becomes yellow, when it is heated at 70°C . for five minutes. A 40 per cent solution of formaldehyde (9 grms.) is now added in two portions, and the brick-red mass thus formed is maintained at a temperature of 60°C . for a further period. The product is an odourless crystalline mass containing no free iodine, and 3.87 per cent. combined. It is of value as a dry antiseptic.

—T. F. B.

glycerol esters; Process for preparing mixed —. V. Vender, Ger. Pat. 209,943, April 27, 1906.

GLYCEROL acid esters of glycerol or polyglycerol, which contain α -hydroxyl-groups (especially the acetic or formic esters) are nitrated by means of sulphuric-nitric acid mixtures containing more nitric acid than sulphuric acid. It is stated that pure nitroacetin is obtained in good yield by nitrating acetin by this process. Mixtures of nitroacetin and nitroglycerin are obtained also from mixtures of acetin and glycerol, if the ratio of nitric acid to sulphuric acid is increased in proportion to that of acetin to glycerol. Nitroformins can also be obtained by the above process from formins.—T. F. B.

phthaliminoacetyl catechol ethers; Process for preparing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 209,962, April 9, 1908.

PHALIMINOACETYLCATECHOL ethers are readily formed by the condensation of phthalimino-fatty acid chlorides with catechol ethers in presence of aluminium chloride. Phthaliminoacetoveratrol and α - and β -phthalimino-p-nitrophenylveratrols are described in the specification.

—T. F. B.

lecithin from the seeds of lupins and the like; Process for obtaining —. H. C. Buer, Ger. Pat. 210,013, March 21, 1908.

LEICITHIN and similar seeds are freed from the skin, dried, extracted with hot 96 per cent. alcohol. The extract is evaporated to about 30–50 per cent. of its original volume, or until its alcohol content is not more than four-fifths that of the dissolved matter; it is then treated with water until its alcoholic strength is 80 per cent., and allowed to stand for a long time. The tinous mass of lecithin which is precipitated, is separated from the alcoholic solution which contains the bitter principles, and freed from all traces of fatty substances by agitation with 96 per cent. alcohol.—T. F. B.

Lecithin, fatty oil, and cholesterol; Process for the production of —. C. A. Fischer, Berlin. Eng. Pat. 11,597, May 28, 1908. Under Int. Conv., May 28, 1907.

SEE Fr. Pat. 390,683 of 1908; this J., 1908, 1176.—T. F. B.

Methylsuccinic acid; Alkyl esters of —. R. Berendes, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 921,944, May 18, 1909.

SEE Fr. Pat. 395,447 of 1908; this J., 1909, 490.—T. F. B.

Aryl-alkyl-para-aminophenol. P. Rehlander, Charlottenburg, Assignor to Chem. Fabr. auf Actien vorm. E. Schering, Berlin. U.S. Pat. 922,040, May 18, 1909.

SEE Fr. Pat. 382,367 of 1907; this J., 1908, 246.—T. F. B.

Santalol esters. E. Sprüngers, Assignor to Verein. Chininfabr. Zimmer und Co., Frankfurt on Main, Germany. U.S. Pat. 922,538, May 25, 1909.

SEE Ger. Pat. 204,922 of 1907; this J., 1909, 108.—T. F. B.

Acylsalicylic acid; Anhydride of —. F. Hofmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 922,766, May 25, 1909.

SEE Fr. Pat. 388,167 of 1908; this J., 1908, 917.—T. F. B.

Salicylic acid derivative and process of making the same. L. Ach and T. Sutter, Assignors to C. F. Boehringer und Soehne, Mannheim-Waldhof, Germany. U.S. Pat. 922,995, May 25, 1909.

SEE Eng. Pat. 11,457 of 1908; this J., 1909, 382.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Development with diaminophenol; Correction of errors of exposure in —. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1909, 25, 180–184.

IN developing negatives by means of diaminophenol in presence of sodium sulphite, contrasts can be diminished, and consequently under-exposed plates improved, either by increasing the proportion of sulphite in the developer, or by diluting the normal developer with water or with a 5 per cent. solution of sodium sulphite, the last method producing the best results. In developing over-exposed plates, contrasts may be increased either by adding sodium bisulphite or, preferably, potassium bromide to the normal developer. It has not been found possible to devise a method of correcting development similar to that worked out for pyrogallol (see this J., 1909, 109 and 627.—T. F. B.

PATENTS.

Colour screens for photography; Method of manufacturing —. G. S. Whitfield, Watford, Eng. Pats. 9044, April 25, 1908, and 9693, May 4, 1908.

A FILM of collodion or other vehicle is mounted on a suitable support of glass, etc., and dyed with an aqueous or alcoholic solution of one of the required colours. A protective coating of indiarubber, gutta-percha, bitumen, or paraffin wax, is then applied to cover a portion of the coloured film in the form of small spots; this is preferably done by spraying a solution of the protective agent in naphtha, etc., on the film by means of an aerograph spray or similar device. The dyestuff is now removed from the uncovered portions of the film by dissolving or bleaching, and these are then dyed with a second colour, and a further series of spots of the protective agent applied to the film. This treatment is repeated with as many colours as required (usually three), and the protective coatings are finally removed, the result being a screen composed of a number of small adjacent areas coloured with the different colours used.—T. F. B.

Developing panchromatic sensitive surfaces in non-actinic light; Process for —. R. Krayn. Ger. Pat. 209,937, Oct. 4, 1907.

It is found that photographic emulsions which have been colour-sensitised by dyestuffs capable of being decolorised by acids (*e.g.*, pinachrome), entirely lose their sensitiveness towards non-actinic light after a brief treatment with dilute acids: when dried, or when treated with alkalis, their colour sensitiveness returns. It is proposed, therefore, to treat exposed colour-sensitive emulsions for 10–20 seconds, in the dark, with an acid solution, *e.g.*, a 0.5 per cent. solution of sulphuric acid and then to develop them in an acid developer (*e.g.*, ferrous oxalate) in ordinary red light, or to treat them with the acid developer in the dark before exposing them to red light.

—T. F. B.

Coloured images; Process for producing — by bleaching-out. H. Stobbe. Ger. Pat. 209,993, Sept. 20, 1907.

The dyestuffs of the group known as "Fulgides" (anhydrides of the fulgemic acids, obtained by condensing certain aldehydes and ketones with esters of itaconic and terecaonic acids) are decolorised by the action of light, especially in presence of ether, chloroform, gelatin, collodion, etc.; their sensitiveness is further increased by iodine, nitrobenzene, phenol ethers, and essential oils, decolorisation being complete in less than one minute in some cases. It is proposed to utilise these "fulgides" for the production of coloured prints; for example, a red and a yellow "fulgide" and a dicyanine or pinacyanol may be applied to paper, which is sensitised by phenetol and exposed under a suitable negative. After removing the sensitisers by benzene, the prints are stable in light for a short time by treating them with a gum or resin, which delays further bleaching of the dyestuff. —T. F. B.

Pigment pictures; Process for manufacturing —. A. J. Boulton, London. From Neue Photographische Ges., Steglitz-Berlin, Germany. Eng. Pat. 19,297, Sept. 14, 1908.

SEE Ger. Pat. 202,108 of 1907; this J., 1908, 1132.—T. F. B.

Photographic dry-plate. L. Husson, Assignor to A. F. Boinot, Philadelphia. U.S. Pat. 922,908, May 25, 1909.

SEE Eng. Pat. 25,728 of 1906; this J., 1908, 38.—T. F. B.

Photography. F. W. Donistrophe, Bath. U.S. Pat. 923,030, May 25, 1909.

SEE Eng. Pat. 13,874 of 1907; this J., 1908, 140.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Nitrocelluloses and smokeless powders. Ignition points of —. G. Finzi. Gazz. chim. ital., 1909, 39, I., 549–553.

In the author's first experiments, a test-tube containing 0.1 gm. of the explosive, dried at 50° C., was immersed in a paraffin bath at 100° C., and the temperature of the bath raised at the rate of 5° per minute. Numerous experiments showed that the ignition point of stabilised nitrocellulose powder varies from 185° to 187° C., and is not influenced by the nitrogen-content (11.55 to 13.44 per cent.) or by the method of stabilising (with water or with sodium carbonate solution). The ignition-point is lowered by heating more slowly, by compressing the wet powder, or by gelatinising the product. If the gelatinisation be effected with an ester, *e.g.*, ethyl acetate or nitroglycerin, then the ignition point of the gelatinised explosive is lower, the higher the nitrogen content. Small quantities of acid cause a considerable depression of the ignition point. A sample of nitrocellulose taken after the first boiling and containing a quantity of acid equivalent to about 0.2 per cent. of sulphuric acid had an ignition point of 124–125° C., whilst another sample containing only the merest trace of acid ignited at 165°–175° C.; in these tests the temperature was raised 5° per minute.

In the case of samples containing acid, the ignition point is raised by heating more slowly; for instance with the samples mentioned the respective ignition points were 132°–138° and 175°–178° C. when the temperature was raised 2° per minute. Tests of nitrocelluloses which have not been stabilised or were of inferior stability did not yield concordant results. Some tests were also made with smokeless powders. The results are summarised in the following table:—

Explosive.	Nitrogen content, per cent.	Ignition point with rise of temperature of	
		5° per min.	2° per min.
		°C.	°C.
Nitrocellulose powder, ...	11.55–13.33	185–186	176–177
Nitrocellulose compressed while wet (25 to 30 per cent. of water) into rods of sp. gr. 1.1–1.2, ...	11.60–13.33	180–182	174–176
Nitrocellulose gelatinised with acetone, ...	11.55–13.33	176–179	170–173
Nitrocellulose gelatinised with ethyl acetate, ...	11.55	178–179	175–176
	12.09	177–178	172–173
	12.35	175–176	172–173
	13.33	172–173	168–169
Nitrocellulose and nitroglycerin (equal parts), ...	11.55	185–186	175–176
	11.84	183–184	174–175
	12.09	181–182	173–174
	13.33	175–176	167–168
Smokeless powder (nitrocellulose and nitroglycerin, the whole gelatinised with acetone), ...	—	170–171	164–165
Ballistite in grains, ...	—	183–185	177–177
Ballistite in cubes, ...	—	184–185	176–177
Troisdorf powder (gelatinised nitrocellulose), ...	—	179–180	170–171
Rottweil powder (gelatinised nitrocellulose), ...	—	179–180	170–171

—A. S.

PATENT.

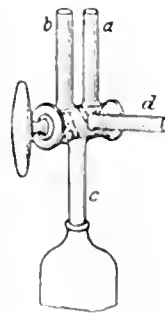
Gunpowder; Manufacture of —. G. Trench and Lynn-Smart. Eng. Pat. 8358, April 15, 1908.

An explosive mixture is obtained by combining with gunpowder (100 parts), potassium or ammonium perchlorate (5 to 20 parts). The incorporation is carried out under edge runners in the wet condition. By the addition of perchlorate, the strength and regularity of the explosive force are said to be increased. (Reference is directed to Eng. Pats. 1939 of 1865, 1375 of 18, 9190 and 25,838 of 1898, and 20,216 of 1903; this J., 1898, 872; 1900, 71; 1904, 836).—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Hempel gas-burette; Modification of the —. J. F. Spence. Ber., 1909, 42, 1786–1787.



The four-way cock shown in the figure is substituted for the ordinary stopcock of the burette. Its object is to expel completely the air in the connecting-tube between the burette and the pipette. Either of the tubes, *a* or *b*, can be connected with the burette, or with the side-tube, *d*, but *c* cannot be connected with the burette. Either of the tubes being connected with the pipette, the liquid is drawn over till it fills the tube, *d*, and the connection between pipette and burette is then made. The other tube in the cock can be similarly used in taking a sample of gas.—J. T. D.

PATENT.

Lubricating] *Oil-testing apparatus.* S. v. Kapff. Ger. Pat. 209,399, May 6, 1909.

In this apparatus the oil to be tested is placed in a chamber in which a vertical spindle is rotated, the lower end of the spindle bearing with a definite pressure on a corresponding friction-surface fixed on the bottom of the chamber. In order to exert pressure on the spindle, this is enlarged at the lower end, and on the enlargement rests a cylindrical piece surrounding the spindle, and provided at its upper end with two projections on which rests the arm of a lever which can be loaded as desired. The cylindrical piece does not rotate.—A. S.

INORGANIC—QUALITATIVE.

Detecting chlorides in presence of complex cyanides and other halides. Böttger. See VII.

Thio-oxalates. Jones and Tasker. See VII.

INORGANIC—QUANTITATIVE.

Mercury cathode; Use of the — [in zinc electro-analysis]. W. Böttger. Ber., 1909, 42, 1824—1839.

EXPERIMENTS on the separation of zinc from solutions of zinc sulphate are described. Before cutting off the current the author adds sodium acetate to the liquid in suitable excess. The zinc amalgam is then washed, first repeatedly with water, then with alcohol and ether successively. The ether which remains after removing the bulk with a pipette is mopped up with filter paper and the amalgam then dried by passing over it a current of air for at least 10 minutes. Blank experiments show that no loss of mercury occurs in this process. From 5 to 0.001 grm. of zinc as sulphate was dissolved in 10 to 30 c.c. of water to which 4 drops of strong sulphuric acid were added; the liquid was then electrolysed in an apparatus like a small weighing bottle, with a platinum rod sealed through the bottom, a current of 0.5 to 1 ampères being used by preference. The operation takes from 30 to 45 minutes for the actual electrolysis; when this is finished, 10 c.c. of 2*N*-sodium acetate solution is added. From 50 to 62 grms. of mercury were used; the cathode, which had an exposed surface of 6.6 to 15 sq. cm. The screw-shaped anode was placed 2 cm. above the cathode and made 500—800 revolutions per minute. The alcohol and ether may be replaced by ethyl alcohol for washing the amalgam. The results are very accurate, the error never exceeding 0.7 mgrm. of zinc when proper precautions are taken. (Compare *J.*, 1909, 545, 546).—E. F.

Nitric acid; Determination of — gravimetrically, by Busch's method. P. Pooth. Z. anal. Chem., 1909, 48, 375—376.

It is recommended that the solution of "nitron," used for the determination of nitric acid by Busch's method (*J.*, 1905, 291, 638), should not be made up in unnecessary quantity and should be kept in stoppered bottles, protected from the light. Also, the sulphuric acid may be replaced by hydrochloric acid, the maximum proportion being 100 c.c. of *N*/1 acid for every 0.1 grm. of nitrate, and, in this way, accurate results may be obtained in the presence of alkaline-earth metals.—F. SODX.

Copper oxalate; Precipitation of — in analysis. F. A. Jooch and H. L. Ward. Amer. J. Sci., 1909, 27, 448—458.

In connection with the volumetric estimation of copper by the oxalate method, Peters has shown (this *J.*, 1901, 1) that from solutions of copper sulphate, the precipitation of the metal by oxalic acid is practically complete when the volume of liquid is not too great, and the amount of copper present exceeds a certain minimum, the latter varying with the concentration and the quantity of precipitant used. Not only is copper oxalate appreciably soluble in oxalic acid, but, if the amount of copper present is small, supersaturation of the liquid occurs,

no precipitate being formed until sufficient copper is added to make the total exceed the required minimum, when practically the whole is precipitated. It is thus evident that for the complete precipitation of small as well as large amounts of copper by this method, the supersaturation of the liquid must be prevented, and the normal solubility of copper oxalate reduced to a minimum. With this end in view, the authors have experimented with solutions of copper sulphate and nitrate, and studied the effect upon the precipitation, of variations in the temperature, time of standing, quantity of precipitant used, and degree of concentration of the liquid. Precipitations were also made in the presence of varying quantities of nitric acid, sulphuric acid, acetic acid, and alcohol; and it was found that the most satisfactory medium consisted of a 50 per cent. acetic acid solution of the copper salt containing 5 to 10 per cent. of nitric acid. The addition of 4 grms. of oxalic acid to 100 c.c. of this liquid precipitated the copper completely, the presence of the nitric acid rendering the filtration more effective without influencing the solubility of the precipitate.—W. E. F. P.

Chromium, iron, aluminium, and zinc; Separation of — from each other. E. Pozzi-Escot. Bull. Soc. Chim., 1909, 5, 558—559.

THE solution containing the four metals is heated to boiling and treated with a strongly alkaline solution of sodium hypobromite. The ferric hydroxide precipitated is collected on a filter, dissolved in hydrochloric acid and re-precipitated by means of sodium hypobromite. After washing, the ferric hydroxide is again dissolved in hydrochloric acid and precipitated with ammonia in the usual way. The united filtrates, containing the aluminium, chromium, and zinc, are acidified with hydrochloric acid, boiled to expel the bromine, and the aluminium is then precipitated by the addition of ammonia. The filtrate from the aluminium hydroxide is acidified, boiled after the addition of a little alcohol, and the chromium is precipitated with an excess of ammonia. The zinc is finally thrown down as zinc sulphide in the filtrate from the chromium hydroxide.—W. P. S.

Determining mercury in ores. Seamon. See X.

Analysis of antimony alloys. Nicolardot and Krell. See X.

ORGANIC—QUALITATIVE.

Inositol in wine. Perrin. See XVII.

Benzoic acid in foods. Jonescu. See XVIII.A.

Adrenaline reaction. Fraenkel and Allers. See XX.

Distinguishing natural, artificial, and synthetic camphor. Lohmann. See XX.

Acetone reaction. Bardach. See XX.

ORGANIC—QUANTITATIVE.

Separating paraffin wax and ceresin. Marcensson and Schueler. See III.

Determination of mannose, arabinose, xylose, and hydrolysed lactose. Herzog and Horth. See XVI.

Determining dirt in milk. Fendler and Kuhn. See XVIII.A.

Coking test [for foods, etc.]. Binder. See XVIII.A.

Formic acid in fruit juices. Schwarz and Weber. See XVIII.A.

PATENT.

Uric acid in urine; Estimation [determination] of —. R. Weiss, London. Eng. Pat. 9726, May 5, 1908.

URIC acid in urine can be estimated by a process of titration with a standard solution of iodine in potassium iodide and an indicator such as carbon bisulphide. The titration is carried out in a glass tube sealed at one end,

and fitted with a cork or stopper, and provided with marks. The tube is filled to these marks with the indicator and a standard solution of iodine. Urine is added, followed by shaking till the carbon bisulphide is completely decolorised. From the amount of urine added, the amount of uric acid present can be ascertained.

— F. SUDS.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Polyhydric alcohols: Oxidation of — by a peroxylase system. E. de Stoecklin and E. Vulquin. *Compt. rend.*, 1909, 148, 1404–1406.

Iron tannate and hydrogen peroxide (this J., 1909, 111, 327) do not oxidise polyhydric alcohols effectively; but a solution of quinhydrone, to which ferric sulphate or chloride has been added in such quantity that the solution contains 1 mgrm. of iron per c.c., is much more active in this direction. The author calls this solution iron quinhydrone; and small quantities of it convert relatively large amounts of polyhydric alcohols to reducing sugars, both aldoses and ketoses. Glycol thus yields glycollic aldehyde; glycerol gives glyceric aldehyde and dihydroxyacetone; mannitol yields mannose and a substance giving the reactions of a ketose; dulcitol gives a ketose, and in all probability an aldose also; and sorbitol yields sorbose, the amount of material not being enough to allow of search for an accompanying aldose.—J. T. D.

Acetylation: Acids as accelerators in —. A. E. Smith and K. J. P. Orton. *Chem. Soc. Proc.*, 1909, 25, 166.

The speed of acetylation of *s*-tribromophenol in the presence of sulphuric, perchloric, and orthophosphoric acids has been measured. Whereas in acetic acid and chloroform solution, acetic anhydride has no perceptible action on *s*-tribromophenol at the ordinary temperature, even after keeping for several weeks, in the presence of perchloric and sulphuric acids, acetylation takes place very rapidly. Orthophosphoric acid (or phosphoric oxide) comes far behind as an accelerator. When the quantity of acid is small, the rate of the reaction is approximately proportional to its concentration. Comparing gram-molecular proportions, perchloric acid is about 2.5 times as effective as sulphuric acid. Chloroform is the medium in which acetylation is the most rapid, but acetic acid is only slightly inferior. Benzene and acetone are unfavourable to acetylation. A comparison of pyridine, acids, and sodium acetate as accelerators of acetylation by acetic anhydride, shows that both the two former are far superior. Pyridine is approximately as effective as perchloric acid and therefore superior to sulphuric acid.

Trade Report.

German chemical industry in 1908. *Chem.-Zeit.*, 1909, 33, 542–543, 551, 559, 566.

THE German chemical industry in 1908 participated in the general depression and was also adversely affected by foreign legislation, specially by the new English Patent Law, with its provision for compulsory working of patents. This necessitated the erection, in many cases, of branch works in England. It is hoped that an agreement will be arrived at between Germany and the United States in order to obviate a similar effect following the proposed new American Patent Law. The demand of the large colour works for acids and other heavy chemicals was considerably less than usual, and the prices of acids were forced down to a level at which the cost of production was no longer covered. Even at the reduced prices the production of sulphuric and hydrochloric acids could not be disposed of. The prices of nitric acid and ammonium sulphate fell in accord with the lower price of sodium nitrate. The market for soda products, especially caustic soda, was also unsatisfactory, although the price was maintained at about the same level as at the end of 1907. The potash industry, which depends mainly upon the export trade, suffered owing to the crisis in the United States and also owing to difficulties

attending the entry of new works into the Syndicate and the renewal of the agreement which expires at the end of 1909. The sales of crude potassium salts have not kept pace with the increase of the number of works and the sales of concentrated potassium salts have retrogressed. With regard to the by-products, the price of bromine increased somewhat, in consequence of a provisional agreement with American producers, that a magnesium chloride increased by 10 per cent.; the prices of calcium chloride and Stassfurt Glauber salt were somewhat lower, and the price of "bitter salt" fell almost to the level of the cost of production. The price of bleaching powder also fell, and is not likely to rise again owing to the unsatisfactory condition of the paper and textile industries. Increased home and foreign competition caused a reduction of the prices of phosphates and superphosphates. The home demand for ammonium sulphate showed no appreciable increase, but the exports were larger. A decreased production of coke, and hence also of ammonium sulphate is anticipated in 1909. It is probable that the reduced prices of sodium nitrate and ammonium sulphate are due partly to the introduction of the new nitrogenous fertilisers prepared from atmospheric nitrogen. The German producers of "Stickstoffkalk" have combined to form a syndicate. The trade in pharmaceutical chemicals was not so good as in 1907. The dyestuffs industry experienced a bad year; for the first time the exports showed a decrease, this being almost entirely due to diminished imports from the United States, China, and Japan. The trade in mineral colours was exceptionally bad, the exports being considerably less than in 1907. The ceramic colour industry had to meet increasing English competition. The industry of varnishes and lac-colours was satisfactory in the first half of the year, but the sales diminished considerably during the latter half, owing in some measure to the depression in the building trade. The price of oil of turpentine and its substitutes, linseed oil, shell and rosin all fell considerably, but the high prices of copals were maintained. In consequence of new commercial treaties, German exports of varnishes, especially to Switzerland, suffered considerably, and new branch works have been erected or existing ones enlarged, in Switzerland and Austria. The figures relating to the petroleum industry were as follows:—crude petroleum imports, 35,252 metric tons (26,944 in 1907); refined petroleum or mineral illuminating oil, consumption, 1,015,469 (993,719); imports, 1,016,331 (995,214); petroleum lubricating oils, imports, 216,887 (226,609) metric tons. The preparation of lubricating oils in Germany from the crude petroleum from Hanover has made great progress, and the German product now competes with foreign oils. The reduction of the abnormally high price for fats which began at the end of 1907 went on up to the end of February, 1908, after which the prices remained firm. The soap industry suffered from the competition of cheap washing powders. The trade in scented toilet soaps, which already has to meet severe foreign competition, would be seriously prejudiced by the proposed Government spirit monopoly and the increased tax on spirit. In most cases it would not be possible to raise the price sufficiently to cover the increased tax. Not only would the domestic trade suffer, but the export trade would probably, to a large extent, be lost. The German glycerin industry made considerable progress in 1908, owing, on the one hand, to the convention established in the spring to regulate the sale of refined glycerol, and, on the other hand, to the introduction of fat-hydrolysing processes into many works. Whilst previously the German demand for crude glycerin was met almost exclusively by imports, much larger quantities are now produced in Germany. The exports of matches diminished steadily, whilst large quantities were imported, especially from Belgium, at extremely low prices. The paper industry had a very unsatisfactory year. In the porcelain industry those firms producing articles for export to the United States suffered most, although sales were also even in the home market. Exports of cement from Germany diminished by 25 per cent. in 1908. The figures (in metric tons) for the German iron and steel industry in 1907 (in brackets) and 1908, were as follows:—production

on of pig-iron, 11,813,511 (13,045,760); consumption, 205,745 (9,020,196); imports (in terms of pig-iron), 4,244 (1,066,789); exports (in terms of pig-iron), 352,010 (5,092,353). The production of zinc, which amounted to 205,000 tons in 1907, increased by about 900 tons, Germany thus taking first place among the zinc-producing countries. The consumption amounted to 185,000 tons, and both imports and exports increased. Attempts to form a syndicate of the German, Belgian, and English zinc producers, had not come to a satisfactory issue at the end of 1908. The production and exports of copper showed a slight decrease; the imports increased from 157,585 to 188,095 metric tons, and the consumption from 160,217 to 188,095 metric tons. In the case of tin, the imports increased and the exports decreased. The exports of lead rose from 74,973 to 77,218, and the exports from 27,708 to 29,988 metric tons. The price of aluminium is considerably owing to the largely increased production.

—A. S.

Japanese trade in 1908. E. O. James. Chem. and Drugg., June 12, 1909.

THE annual return of the foreign trade of Japan has just been published; imports and exports combined show a falling-off of 112,377,084 yen when compared with the figures of 1907. Imports were again in excess of exports, the difference during the year being 58,011,789 yen. The following are the principal chemical imports:—

In consequence of the general depression in trade the import of aniline colours shows a decrease in 1908 of 808,072 kin against that of 1907. The total imports were 4,615,771 kin, drawn from the following sources: Great Britain, 55,353 kin; France, 55,798 kin; Germany, 3,718,959 kin; Belgium, 14,524 kin; Switzerland, 701,363 kin; Holland, 68,566 kin; and other countries, 1,318 kin. The trade in colours and dyes being closely connected with the Japanese export trade, more particularly as regards the spinning and weaving industries, its rise and fall much depends upon the state of those industries. Alizarin colours showed a slight increase, the figures for 1908 and 1907 being respectively 124,950 kin and 121,451 kin.

The output of sulphate of ammonia is still limited, the monthly output of various companies being 20 tons from the Osaka Gasworks, 10 tons Nagoya Gasworks, 10 tons Tokyo Gasworks, 5 tons Osaka Seimei, and 180 tons from the Government Ironworks. The Japanese article is much inferior to the imported, as it contains too much sulphuric acid.

Among exports of chemicals and drugs from Japan for 1908 were the following: Sulphur, 50,885,719 (over 29,000,000 went to Australia); Camphor, 1,807,565 (America and Germany largest buyers); Camphor oil, 1,259,983 (America and Germany largest buyers); Menthol, 55,406 (Germany and Great Britain largest buyers); Peppermint oil, 103,906 (Hong Kong 59,098

Name.	Quantity.	Total imports.	Of which Great Britain contributed	Of which Germany contributed	Of which U.S.A. contributed
Acetic acid	Kin	1,395,521	419,904	477,997	3,271
Alumina	"	6,074,583	520	15,053	5,774,559
Alumina techn.	"	936,710	—	500	—
Ammonia	"	202,378	—	49,537	—
Antimony	"	119,260	996	38	11,710
Barium	"	121,322	28,233	73,242	—
Bismuth	"	193,095	92,077	18,165	24
Borax (red or amorphous)	"	167,214	116,422	30,367	—
Boric acid	"	412,189	126,402	285,716	33
Calcium	"	905,929	158,781	395,757	—
Carbonate	"	86,218	43,131	39,701	1,693
Calcium	"	216,845	847	213,028	—
Carbonic	"	899,851	307,759	570,958	—
Chlorine	"	40,201	30,871	7,560	—
Chlorine	"	6,189	—	—	—
Chlorine	"	15,766,780	15,292,201	473,987	96
Chlorine	"	24,387,481	24,350,780	34,781	1,920
Chlorine	"	5,756,050	5,496,055	64,556	8,477
Chlorine	"	9,890,877	—	—	254,016
Chlorine	"	349,998	185,454	164,217	327
Chlorine	"	31,439	—	31,439	—
Chlorine	"	4,431,865	2,420,640	544,681	108,381
Chlorine	"	554,536	344,611	187,750	160
Chlorine	"	401,061	205,197	190,784	—
Chlorine	"	70,477	2,117	64,126	4,234
Chlorine	"	284,337	263,584	18,393	2,360
Chlorine	"	383,407	—	—	—
Chlorine	"	23,741	12,401	11,340	—
Chlorine	"	110,627,601	103,411,790	389,817	—
Chlorine	"	308,847	—	—	—
Chlorine	"	519,470	118,406	369,864	—
Chlorine	"	463,390	323,364	50,236	25,016
Chlorine	"	72,509	9,256	54,943	—
Chlorine	"	7,008	—	6,674	—
Chlorine	"	865,196	9,570	816,026	—
Chlorine	"	89,091	5,113	67,500	65
Chlorine	"	41,113	31,440	9,506	—
Chlorine	"	16,888	808	14,455	—
Chlorine	"	48,821	17,653	23,168	—
Chlorine	"	1,991,348	358,958	932,712	321,667

(The kin is equivalent to 1.32 lb. avoird., and 10 yen equal approximately £1.)

Among the principal chemical imports from other countries may be mentioned:—

Phosphorus—red and yellow, kin	103,278	France.
Sodium nitrate of soda,	9,297,396	Chile.
Potash carbonate,	1,358,163	France.
Ammonium sulphate,	95,269	China.
" "	6,561,565	Belgium.
" "	169,170	Holland.
Chlorine	757,977	Straits Settlements.
Sodium carbonate	8,000	Switzerland.
Mercury	51,597	Spain.
Acetic acid	23,266	Denmark.

(in *tr.*) and Great Britain 24,816 were the largest buyers); Sulphuric acid, 2,689,991 (China, Hong Kong, and Dutch India being largest buyers); Fish and whale oil, 38,480,222, almost the whole going to Germany and Great Britain; Colza oil, 11,913,954 (Great Britain purchased 9,413,454); Vegetable wax, 3,817,374 (Hong Kong in *tr.*); Iodine (crude), 16,133 (Great Britain, Germany, and U.S.A. largest buyers); Potassium iodide, 22,969 (Great Britain, Germany, and U.S.A. largest buyers).

New Books.

ANNUAL REPORT OF THE CHIEF INSPECTOR OF FACTORIES AND WORKSHOPS FOR THE YEAR 1908. Reports and Statistics. [Cd. 4661.] Wyman and Sons, Fetter Lane, E.C. Price 2s. 4d.

THIS publication contains the general report of the Chief Inspector upon the work of the Factory Department in 1908, as well as statistical tables. Reports are included by the Divisional Superintending Inspectors, the principal Lady Inspector, the Inspector of Textile Particulars, the Inspector for Dangerous Trades, and the Electrical and Medical Inspectors.

At the end of the year there were upon the registers 110,691 factories and 149,398 workshops, not including men's workshops, warehouses, docks, wharves, quays, "buildings," railway lines and sidings, and factories and workshops under the charge of H.M. Inspectors of Mines.

DIE DESTILLATION INDUSTRIELLER UND FORSTWIRTSCHAFTLICHER HOLZARBEIT. VON WALTER B. HARPER. Erweiterte deutsche Bearbeitung. VON INGENIEUR R. LINDE. Julius Springer's Verlag, Berlin. 1909. Price, M.10. Bound M.11.

Svo volume, containing 299 pages of subject matter with 128 illustrations, an appendix of 9 additional pages, forming a compendium of patents taken out on the subject of the work in the United States and Germany, and the alphabetical indexes of subjects and names of authors. The subject matter receives the following classification and arrangement:—I. Historical and general. II. Principles of distillation. III. Necessary apparatus and plant for dry distillation. IV. Purification of the crude products. V. Apparatus and general arrangements in modern distillation works. VI. The process of wood distillation. VII. Purification processes. VIII. General considerations as to the erection of distillation plants. IX. The composition of wood and of its distillation products. X. Yields, and the valuation of the products. XI. Chemical oversight and management of a wood distillery.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

12,906. Lee. Furnaces. [U.S. Appl., June 27, 1908.]* June 1.

12,958. Seaver. Apparatus for separating finely-divided materials.* June 2.

13,034. Schmidt. Liquefying and separating mixtures of gases. [Ger. Appl., Dec. 12, 1908.]* June 3.

13,440. Pawle. Vacuum filters. June 8.

13,551, 13,551, 13,555, 13,556, and 13,558. Gayley. Drying air. June 9.

13,553 and 13,557. Gayley. Drying air particularly for metallurgical purposes. June 9.

13,559. Aktiebolaget Separator. Centrifugal separators. [Swed. Appl., June 25, 1908.]* June 12.

COMPLETE SPECIFICATIONS ACCEPTED.

5011 (1908). Hodgkinson. See under VII.

12,077 (1908). Tarver and Coulson and Co. Apparatus for washing, separating, or concentrating substances of different specific gravities. June 9.

12,565 (1908). Humphrey. Compressing air or gases. June 16.

25,881 (1908). Fothergill and Clark. Mechanical filter. June 9.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

12,827 to 12,830. Harrison. Manufacture of metal filaments of incandescent electric lamps. June 1.

12,915. Maul. Treatment of fuel. June 1.

13,026. Clinie. Gas producers. June 3.

13,097. Burnett. Apparatus for extracting liquid from washed coal, &c. [Addition to No. 10,062 of 1907. June 3.

13,516. Cotton. Burning fuel for heating furnaces, kilns, and ovens.* June 9.

13,604. Simmonds. Manufacture of gas. June 10.

13,796. Zindler. Manufacture of gas by dry distillation of fuel.* June 11.

COMPLETE SPECIFICATIONS ACCEPTED.

12,446 (1908). Jabs. Gas generators. June 16.

12,720 (1908). Soc. Franç. d'Incandescence par le Gaz. Manufacture of incandescence electric lamp filament. June 16.

982 (1909). Koppers. Gas and coke oven plant. June 9.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

COMPLETE SPECIFICATION ACCEPTED.

16,881 (1908). Testelin and Renard. Apparatus for making a spirit by treating petroleum. June 9.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

13,323. Johnson (Badische Anilin und Soda Fabrik). Manufacture and employment of anthracene colouring matters. [Addition to No. 9888 of 1909.] June 7.

13,727. Newton (Bayer und Co.). Manufacture of dyestuffs. [Addition to No. 5383 of 1909.] June 11.

COMPLETE SPECIFICATIONS ACCEPTED.

13,789 (1908). Imray (Meister, Lucius, und Brünig). Manufacture of pentabromindigo. June 9.

15,355 (1908). Imray (Meister, Lucius, und Brünig). Manufacture of dyestuffs of the anthracene series. June 9.

18,023 (1908). Meister, Lucius, und Brünig. Manufacture of brominated derivatives from indigo white, its substitution products, and dyestuffs thereof. June 9.

6272 (1909). Chem. Fabr. vorm. Sandoz. Manufacture of dyestuffs of the gallocyanine series. June 9.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

13,227. Kleinewefers. Machine for mercerising cotton. June 5.

13,276. Naylor and Naylor. Dyeing machine. June 5.

13,483. Robertson. Calico-printing machines. June 5.

13,493. Dobson. See under XIX.

13,672. Adam (Erste Triester Reisschul-Fabr.). See under XIV.

13,772. Laverigne. Manufacture of waterproof fabrics. [Fr. Appl., June 12, 1908.]* June 11.

13,790. Keller. Treatment of alkaline fluids to render them fit for further use after boiling cotton and other goods therewith in connection with bleaching.* June 11.

COMPLETE SPECIFICATIONS ACCEPTED.

11,959 (1908). Dreaper. Manufacture of artificial materials. June 9.

12,455 (1908). Hübner. Production of designs or ornamental and colour effects on fabrics. June 16.
22,097 (1908). Ransford (Cassella und Co.). Dyeing with chrome colours. June 9.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

12,837. Jennison. Manufacture of bleaching liquid. June 1.
12,966. Marks (Willson). Production of calcium carbide.* June 2.
13,697. Greenwood. Manufacture of tubes, crucibles, and other articles of magnesia. June 11.
13,718. Scales and Manbré. Manufacture of zinc chloride. June 11.
13,848. Carriek and Pattison. *See under XIII.A.*

COMPLETE SPECIFICATIONS ACCEPTED.

5011 (1908). Hodgkinson. Apparatus for evaporating liquid from brine for producing salt, or for evaporating other solutions. June 16.
11,864 (1908). Newton (Bayer und Co.). Manufacture of alkali hydrosulphites. June 9.
16,690 (1908). Craig. *See under X.*
27,878 (1908). Erlenbach. Manufacture of ammonium sulphate. June 16.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATION.

13,515. Cotton. *See under IX.*

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

13,068. Perpignani and Candlot. Lime and cement kilns.* June 3.
13,183. Lodge. Manufacture of cement for building purposes. June 5.
13,515. Cotton. Producing heat in furnaces for firing brick and pottery kilns. [Australian Appl., June 9, 1908.]* June 9.

COMPLETE SPECIFICATION ACCEPTED.

11,522 (1908). Timofeff. Manufacture of cement for building, &c. June 9.

X.—METALS AND METALLURGY.

APPLICATIONS.

12,894. Gibb. Treatment of oxidised ores or products of copper mixed with gangue. June 1.
12,927. Harries. Calcining and smelting furnace for ores. June 2.
13,073. Dellwik. Agglomerating fine ores, metalliferous residues, &c. June 3.
13,081. Halvorsen and Johansen. Treatment of iron ores. June 3.
13,218. Richardson. Manufacture and treatment of steel. June 5.
13,240. Auchinaebie. Treating ores of vanadium, uranium, chromium, &c., and manufacture of vanadium and other iron or steel therefrom. June 5.
13,291. Ruthenburg. Smelting sulphide ores, &c. June 7.
13,330. Ackermann. Manufacture of fluxes for use in soldering.* June 7.
13,427. Reynolds. Manufacture of steel. June 8.
13,445. Clark. Method of copperising iron.* June 8.
13,512. Cowper-Coles. Production of aluminium. June 9.
13,513. Cowper-Coles. Annealing iron and steel. June 9.

13,552. Gayley. Operating blast furnaces and converters.* June 9.
13,553 and 13,557. Gayley. *See under 1.*
13,625. Merton. Ore roasting furnaces. June 10.
13,839. Wheatley. Red-coloured alloy. June 12.
13,849. Carriek and Pattison. Treatment of pyritic copper and copper-nickel ores.* June 12.

COMPLETE SPECIFICATIONS ACCEPTED.

11,996 (1908). Hess. Extracting copper from its ores, mattes, &c. June 9.
12,324 (1908). Boulé (Jones). Manufacture of iron and steel. June 16.
12,494 (1908). Finfroek. Aluminium solder. June 16.
13,120 (1908). Pearlite Steel Co., and Charlier. Treatment of low-grade steels. June 16.
16,056 (1908). New Delaville Spelter Co., and Shortman. Refining zinc during extraction by distillation. June 9.
16,690 (1908). Craig. Extraction of alkaline salts from blast-furnace tar. June 9.
18,653 (1908). Côte and Pierron. *See under XI.*
19,380 (1908). Howard and Hadley. Treatment of fumes of spelter furnaces. June 9.
19,882 (1908). Angél. Reduction of complex sulphide and other ores. June 16.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

13,036. Cowper-Coles. Electrodeposition of metals. June 3.
13,037. Cowper-Coles. Electrodeposition of iron. June 3.
13,295. Nathusius, and Westdeutsche Thomasphosphat Ges. Electric furnaces. [Addition to No. 7188 of 1908.]* June 7.

COMPLETE SPECIFICATION ACCEPTED.

18,653 (1908). Côte and Pierron. Electric furnace for the continuous extraction of zinc from ore. June 16.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

[COMPLETE SPECIFICATION ACCEPTED.

21,822 (1908). Bloxam (Jacobi). Soap frames. June 9.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

12,862. Mayer. Gold, silver, bronze, and aluminium paints. June 1.
13,679. Hopkins and Barnett. Recovery of the ingredients of oily inks.* June 10.
13,848. Carriek and Pattison. Black magnetic iron oxide utilisable as a pigment. June 12.
13,865. Machtoff. Production of carbon black.* June 12.

(C.)—INDIA-RUBBER.

APPLICATIONS.

13,570. Kautschukges. Schön und Co. Production of caoutchouc. [Ger. Appl., April 29, 1909. Addition to No. 4692 of 1906.]* June 9.
13,715. Bradley, Thew, and Gilbey. Manufacture of artificial or synthetic rubber. June 11.

COMPLETE SPECIFICATIONS ACCEPTED.

4484 (1908). Gare. Manufacture of hard rubber or ebonite. June 9.
7302 (1909). Soc. Franç. de la Viscose. Manufacture of a product from caoutchouc and cellulose. June 16.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

- 12,908. Svedberg. Production of colloidal sols or gels.* June 1.
 13,601. Schütze. Manufacture of a solid plastic material from curd or casein. [Ger. Appl., Sept. 23, 1908.]* June 10.
 13,672. Adam (Erste Triester Reisschal-Fabr.). Manufacture of sizing or finishing media. [Addition to No. 29,130 of 1904.] June 10.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

- 12,881. Boulton (Henius). Brewing apparatus.* June 1.
 13,415. Epstein. Treatment or utilisation of yeast. June 8.

COMPLETE SPECIFICATIONS ACCEPTED.

- 19,348 (1908). Carroll. Distilling spirits. June 16.
 6087 (1909). Valentin. Mashing malt for brewing. June 9.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A).—FOODS.

APPLICATIONS.

- 13,767 to 13,769. Henri, Helbronner, and Von Recklinghausen. Sterilisation of liquids. June 11.

COMPLETE SPECIFICATION ACCEPTED.

- 12,672 (1908). Gabler-Saliter. Drying milk and the like. June 16.

(B).—SANITATION; WATER PURIFICATION.

APPLICATIONS.

- 13,488. Adams. Sewage purification apparatus. June 9.
 13,702. Coplans. Rapid preparation of potable water. June 11.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

- 12,976. Reeser. Manufacture of sheets or objects of acetylcellulose.* June 2.
 12,992. Vieweg. Manufacture of concentrated cupro-ammoniacal solution of cellulose. June 2.
 13,365. Preatoni. Production of transparent or translucent designs, &c., in paper. June 8.
 13,493. Dobson. Bleaching cellulose, wood pulp, and other fibrous materials. June 9.

COMPLETE SPECIFICATIONS ACCEPTED.

- 24,809 (1908). Brandenberger. Treatment and application of cellulosic films. June 16.
 7302 (1909). Soc. Franç. de la Viscose. *See under XIII C.*
 7430 (1909). Marino. Preparation of soluble cellulose. June 9.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

- 13,125. Wellecome and Thompson. Preparation of substances for therapeutic use. June 4.
 13,828. Wellecome and Pyman. Manufacture of therapeutic compounds. June 12.

COMPLETE SPECIFICATIONS ACCEPTED.

- 12,405 (1908). Buer. Obtaining lecithin free from bitter alkaloids from the seeds of lupinus and other podded plants. June 16.
 1532 (1909). Chem. Fabr. auf Actien, vorm. E. Schering. Manufacture of sticks, tablets, and filaments of camphor. June 9.
 4128 (1909). Imray (Meister, Lucius, and Brüning). Manufacture of 1-p-dialkylaminoaryl-2,4-dialkyl-3-oxymethyl-5-pyrazolones. June 16.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

- 13,328. Brandenberger. Manufacture of photographic films.* June 7.
 13,331. Lesmüller. Flash-light powders.* June 7.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

- 12,988. Burgess. Compound for neutralising the noxious fumes produced by blasting. June 2.
 13,103. Carré. Manufacture of matches. June 3.
 13,376. Garroway. Manufacture and use of explosives and explosive shells, mines, &c. June 8.

COMPLETE SPECIFICATION ACCEPTED.

- 22,555 (1908). Lezinsky. Explosive compounds and their manufacture. June 16.

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Official Notices.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.

The KING, who was accompanied by the Queen, the Prince and Princess of Wales, and Princess Victoria, laid the first stone of the new buildings of the Imperial College of Science and Technology at South Kensington, on July 8th. The ceremony took place in a marquee erected on the site of the new buildings.

Lord CREWE delivered an address to the King on behalf of the governors, professors, students, and staff of the College, in the course of which he said:—

"The Imperial College, founded under a Royal Charter granted by your Majesty on the 8th of July, 1907, represents the latest and, as we trust, the most effective development of the great movement towards scientific and technical education which arose out of the Exhibition of 1851.

"Standing at South Kensington, in the midst of the imposing buildings which mark the progress of that education in its various branches, we cannot forget that it was to your Majesty's father, the illustrious Prince Consort, that the movement largely owed its original inspiration. At a time when small regard was generally paid to either scientific or artistic instruction, the wise foresight of his Royal Highness anticipated what is now universally recognised as one of the prime needs of our national life.

"Of the institutions now comprised in the Imperial College, the Royal School of Mines was not entirely transferred from its original home in Jermyn Street until the year 1890. The Royal College of Science did not receive its title until 1890, having gradually gathered under one roof the scientific departments, such as those of chemistry, physics, geology, and biology, which had grown up round the Royal School of Mines, with which it was then incorporated. In 1906 the new buildings in Imperial Institute Road provided accommodation of the most improved kind for the study of chemistry and physics. Meanwhile the Corporation and Livery Companies of the City of London had planned the Central Technical College, of which your Majesty laid the first stone in the year 1881, for the study of chemistry and, in particular, of engineering. As the result of the report of a Departmental Committee, instituted by the Board of Education in 1904, the three colleges were welded into the new Imperial College, with the declared object of giving the highest specialized instruction and of providing for the most advanced training and research in the various branches of science, especially in its application to industry.

"The further development which we trust will result in the rising of an important group of buildings in the neighbourhood of this stone has been rendered possible, in the first place, by the Royal Commissioners for the Exhibition of 1851, who have given the sites, by the liberal grants provided by the Government and the London County Council, and by the generosity of private donors, among whom the late Mr. Alfred Beit, other members of the firm of Wernher, Beit, and Co., the Goldsmiths' Company, and the Bessemer Memorial Committee have been conspicuous.

"It is the earnest, and we believe, well-grounded hope of the governors that this Imperial College, thus honoured to-day by your Majesty's countenance and approval, and by that of her Majesty the Queen, may in the coming years justify its title by providing a centre of the most advanced teaching and research in science on its practical side, not only for the United Kingdom, but for the whole of your Majesty's dominions, and that it may stand second in dignity and character to no other kindred institution in the world."

The King then read the following address, which his Majesty afterwards handed to the Chairman of the governing body:—

"I thank you most heartily on behalf of the Queen and myself for the address from the governors, professors, students, and staff of the Imperial College of Science and Technology. It is a great pleasure to me to lay the foundation-stone of your new buildings.

"The concentration of various associated colleges into one institution, which was effected by our Order in Council of July, 1907, has always seemed to me to be an admirable scheme for the furtherance of scientific instruction, which my dear father had so much at heart; and the names which appeared in the first list of the members of the governing body were sufficient in themselves to give the College a very high status in the educational world.

"The purposes of the College, as stated in the charter, are to give the highest specialized instruction and to provide the fullest equipment for advanced teaching and research in various branches of science, especially in its application to industry. In recent years the supreme importance of higher scientific education has, I am happy to say, been fully recognised in England; and as time goes on I feel more and more convinced that the prosperity, even the very safety and existence, of our country depend on the quality of the scientific and technical training of those who are to guide and control our industries. The rapid growth of knowledge makes it necessary for the teacher of any branch of applied science to be a specialist of a high order, and the most accomplished specialist cannot impart the full advantage of his knowledge without that complete provision of apparatus for research and instruction which this College will supply.

"The College has already given admirable results, and we may well look for a steady increase in the number of students and in the efficiency of the instruction provided.

"The thanks of the country are due to those public-spirited donors through whose generosity a large portion of the funds have been provided for this great work, and I join in your appreciation of their munificence. I think it is especially fitting that the great discoveries of the late Sir Henry Bessemer, to which the remarkable development of the engineering industries in the last half-century is largely due, should be commemorated by the equipment of the new laboratories of this institution.

"I pray that the blessing of God may attend the future of the College and the high destinies which I anticipate for its work."

The King then laid the foundation-stone, and the brief ceremony concluded.

The land on which the new buildings will be erected, consists of three plots in Prince Consort Road, one to the north and two to the south, containing a total area of about five acres, and having a combined frontage of about 1000 ft. towards the Prince Consort Road and a return frontage of about 190 ft. towards Exhibition Road.

The new buildings will accommodate the mining, metallurgical, geological, and engineering departments. The three former will occupy the west end of the building; engineering will occupy the east end and will adjoin the City of London and Guilds Institute, thus greatly increasing the facilities for the engineering work at present carried on in that building.

The mining department will include on the lower floor a large top-lighted court about 250 ft. long and 120 ft. wide, designed to accommodate mining plant illustrative of the machinery and methods of ore extraction. The equipment for this is being supplied by the Bessemer Memorial Committee.

Another court adjoining will contain the roasting and smelting furnaces, in connection with which are the laboratories for wet and dry assay, with balance-room, lecture room, laboratories for micrography, pyrometry, electric metallurgy, the advanced course of metallurgical operations, and the equable temperature room. In connection with the mining department are two large

lecture rooms, museum, and drawing office, machinery, assay, laboratory, and departmental library.

The geological department on the second floor contains laboratories for paleontology, petrology, mineralogy, economics, and rock cutting, a museum 86 ft. by 40 ft., elementary laboratories, large drawing office, and research room.

The engineering department will occupy the whole east block on all floors. On the lower floor is a hydraulic laboratory 180 ft. by 16 ft., the equipment for which is being provided by Mr. G. Hawksley. There will also be large top-lighted courts, 112 ft. by 102 ft. and 112 ft. by 42 ft., to accommodate extensions, testing, and other engineering plant.

The other floors will consist of lecture rooms, class rooms, professors' rooms, and drawing and examination rooms for the various departments as may be from time to time required—such as railway and traction engineering, naval architecture, and bridge construction.

It is hoped to provide a students' union on the plot which lies to the north of Prince Consort Road. This building will contain on the ground floor a lounge hall, large dining room, and kitchens, smoking room, ladies', guests', and committee rooms. On the upper floor will be provided a large concert and debating room, to be used also as gymnasium, library, and reading room, and rooms for staff with a separate entrance.

INTERNATIONAL EXHIBITION, BRUSSELS, 1910.

The British Section of the International Exhibition, to be held next year in Brussels, from May to October, is in charge of a new Department of the Board of Trade, which furnishes the following information:—The Royal Commission, of which the Prince of Wales is the President, has its offices in Queen Anne's Chambers, 30, Broadway, Westminster. The Chairman is the Earl of Lytton, and the Vice-Chairman Sir Swire Smith. Committees have been formed for the various staple industries and for groups of allied industries. Mr. V. F. Wintour, the British Commissioner General, is approaching all the staple trades of the country with a view to secure an exhibit showing the scope and real importance of British manufactures.

A prominent position in the Exhibition has been secured for the general section; visitors must pass through the British Galleries to reach those of Germany, the United States, France, Italy, and other nations. In the Machinery Hall a space of 263,410 square feet has been allotted to Great Britain in the centre.

Except in the case of machinery, the only charge made within the Exhibition itself is a low charge for space; and tenders will be obtained from Belgian contractors for the installation of machinery. This charge for space covers the provision of showcases, the cost of the general decorative scheme, the handling of exhibitors' goods, and the publication of a catalogue in French and English.

"Handling" means that officials of the Commission will take delivery of packages at the Exhibition entrance; unload and place them on the space allotted; take away, store, and return the packing cases; and re-load at the close of the Exhibition. Further, the Commissioners will provide, free of cost, as far as possible, an adequate supply of unskilled labour to assist exhibitors with the installation of their goods. Machinery will involve, of course, the additional cost of foundations and shafting; that of main-switches, safety fuses, and motors for electricity, stop-valves for steam, and valves and motors for water; and that of the power used for driving. Crane power is free of charge.

Showcases in a uniform style will be provided for exhibitors in the British Section. Exhibitors are not required to use these cases, or any cases. They may provide their own, so long as these are not destructive to the national scheme. But the provided cases may be had in all sizes and for all positions, and they are dust-proof and made of seasoned mahogany. Samples may be seen at the offices of the Royal Commission, 30, Broadway, Westminster.

The tariff of charges for space is as follows:—

	Per sq. ft.	s.	d.
Including the use of an isolated showcase, or part of a case having more than one frontage	6	0	
Including the use of a wall case	4	0	
Including the use of a platform and ornamental facade without glass	4	0	
Including the use of a platform only	2	6	
On wall or screen	2	6	
In the Machinery Hall, including the use of platform and hand railing where required	2	6	

Motive power.—The Royal Commission will defray half the charges made for motive power by the Belgian Administration, on all machinery driven to illustrate processes of manufacture. Thus exhibitors will pay:—

For steam (133 lb. pressure), $\frac{1}{2}$ centime per kilogramme	
For gas	1s. 3d. per 1000 feet
Electricity (2 by 220 volts continuous), $\frac{1}{4}$ d. per kilowatt hour.	

Water will be supplied free for pumps or condensers. The charge for pure water in the Machinery Hall will be 1s. 10d. per 1000 gallons (50 lb. pressure), and in the Industrial Hall 1s. 8d. per 1000 gallons for domestic and 10d. for industrial purposes.

Not only will there be crane power, but the laying of foundations by Belgian contractors will be superintended by a competent engineer employed by the Royal Commission. With the above particulars, the railway and shipping freights, and the contractors' tender, an exhibitor of machinery can make his calculations with a degree of confidence not hitherto possible.

Other facilities.—The special catalogue for the British Section, published in English and French, will give a free insertion of twelve lines; the general catalogue a free insertion of four shorter lines.

All necessary steps will be taken by the Belgian Government for the protection in Belgium of inventions, industrial designs, and trade marks.

A suite of rooms will be provided for exhibitors' agents. There will be a reference library and a staff of high-class interpreters attached to the establishment, and it will be furnished with all the necessary equipment for transaction of business, correspondence, and so forth.

Reduced transport.—The Belgian State Railways, charging full rates on the outward journey, will return exhibit to their termini free of charge. The British railway companies will make a reduction of 50 per cent. on returned exhibits not sold, and travelling by the same route to the station from which they were sent out. Twelve shipping companies have also agreed to this 50 per cent. reduction.

London Section.

Meeting held at Burlington House on Monday, June 7th 1909.

DR. J. LEWKOWITSCH IN THE CHAIR.

DISCUSSION ON INDUSTRIAL FELLOWSHIPS

Prof. ROBERT K. DUNCAN (University of Kansas) in opening the discussion, said that, in an article in the "North American Review" for May, 1907, and later in a work ("The Chemistry of Commerce," Harpers) intended to draw the attention of American manufacturers to the applicability of modern science to industrial operations he had advocated the establishment of Industrial Fellowships.

It was not the function of a professor of industrial chemistry in a University to establish courses and laboratories for undergraduates who proposed to become chemists. Current industrial practice was always ahead of the text book, and laboratories of industrial chemistry notwithstanding all their apparatus and small scale

processes, failed to teach adequately, and gave the student an exaggerated idea of his utility in factory life. Moreover, this teaching was obtained at the expense of pure chemistry and culture, for by taking industrial chemistry, the student must sacrifice some physical chemistry, organic chemistry, and analysis, to say nothing of cultural studies.

The condition of American manufacture in respect of chemical progress and efficiency had been bad. A wealth of raw material ready to hand, an excessive tariff, a facility for business intrigue which compensated for waste in the factory by combinations to eliminate competition, and the needs of an expanding and not too particular population, all these had combined until a few years ago to cause waste in manufacture. Then came over-production, in business intrigue there was no more to learn, raw material had accumulated in the hands of a few, and the tariff, high as it was, could no longer exclude many goods made under scientific supervision, and was moreover itself in unstable equilibrium. American manufacture was approaching a crisis, and began to realise that safety lay only in efficiency. To-day, few men had any idea of the ever-increasing anxiety of the American manufacturer to secure factory efficiency. Already the supply of research chemists was inadequate, and during the next five years the need must increase.

At the present moment, the American manufacturer—with certain notable exceptions—had neither the knowledge nor the experience requisite to establish successful scientific research. He did not know what his problems were nor their relative importance, what kind of knowledge or what men were required to solve these problems; nor how to judge the qualifications of the men available for his purpose. He could not estimate a proper expenditure for laboratory space and supplies or for the libraries which such men would require, nor could he co-ordinate their work with the factory operations, or the work of one with another, so that they might be mutually helpful. Finally, he did not know how to systematise the work of his scientific staff, how to estimate their progress as an indicator of real efficiency, nor how to treat a man of science in giving him either power or trust. This last was responsible for the failure of much American factory research, the condition of the research chemist in an American factory being often actually pitiable.

The above considerations were, taken together, responsible for a scheme by which, in a spirit of sympathetic co-operation, the University and the manufacturer might both profit, and the public through both. This scheme of Industrial Fellowships had, during the last two years, undergone a somewhat notable development, not only in the number and value of the Fellowships established, but also in the increased advantages for the University which had been obtained from the donors. It made no pretension of having reached its ultimate development; all that could be said was that it had shown more strength than weakness in every one of its constituent factors.

Most of the Fellowships so far established had arisen through letters of inquiry from without. Owing to the fact that they had no relation to ordinary Fellowships, and that the scheme was essentially a new one, it had been thought advisable to establish them at intervals.

Profiting by experience, the scheme had undergone a natural evolution. While wholly experimental and tentative, two years' experience of its working seemed to show that this form of relation between the University and industry was to the advantage of all concerned. The tenure of all Fellowships was for two years; but one, which was to expire shortly, was to be continued at double the value for three months, at the end of which time the donors would either take the Fellow and his process into the factory, or continue his Fellowship through a third year at the enhanced rate; and in another case the donors had already indicated their intention to continue it throughout a third year.

There had been so far accepted by the University of Kansas the following Fellowships:—

1. An investigation into the chemistry of "laundering," with the object of saving laundered fabrics: \$500 a year, together with 10 per cent. of the net profits.

2. A search for a new diastase, with an attempt to make a new fodder upon scientific principles: \$500 a year and 10 per cent. of the gross proceeds for three years.

3. Utilisation of the constituents of waste buttermilk, primarily casein, and secondarily, lactic acid and milk sugar: \$500 a year and 10 per cent. of the net profits.

4. An investigation into the chemistry of baking, established by the National Association of Master Bakers, with the object not only of improving the chemistry of bread, but, as well, of providing for the association a trained expert upon whom they could afterwards rely: \$500 a year, together with a sum to be settled by arbitration.

5. An investigation into the constituents of crude petroleum: \$1,000 a year, and 10 per cent. of the net profits.

6. Improvement in the enamel upon enamel-lined steel tanks: \$1,300 a year, together with an additional consideration to be decided upon later.

7. An investigation into the relation between the optical properties of glass and its chemical constitution: \$1,500 a year and 10 per cent. of the net profits.

8. The discovery of new uses for Portland cement and of improvements in its manufacture: \$1,500 a year and a large additional consideration dependent upon success.

9. An investigation into certain glands of deep-sea mammals: \$1,500 a year and an additional consideration to be decided upon by arbitration.

10. The discovery of new utilities for ozone: \$2,000 a year and 10 per cent. of the net profits.

The Fellows for Nos. 7 and 8 had not yet been selected, and Fellowships Nos. 9 and 10 were assured but not yet established.

It must be borne in mind that the Fellowships differed from one another owing to the circumstances and, occasionally, to the idiosyncrasies of the donors. The scheme in its present state might perhaps best be understood by presenting the following specimen of an agreement thereunder, for example Fellowship No. 7:—

Memorandum of Agreement.

"For the purpose of promoting the increase of useful knowledge, the University of Kansas accepts from the A.B.C. Glass Co., having head offices at New York, the foundation of a temporary industrial scholarship to be known as the A.B.C. Fellowship.

"It is mutually understood and agreed that the conditions governing this Fellowship shall be as follows:—

"The exclusive purpose thereof is an investigation into the optical properties of glass in relation to its chemical constitution, to the furtherance of which the holder shall give his whole time and attention, with the exception of three hours a week, which he shall give to work of instruction in the chemical department.

"The Fellow shall be appointed by the Chancellor of the University, the Director of the Chemical Department, and the Professor of Industrial Chemistry; he shall have made previously a reputation in research; he shall be a member of the University, and shall pay all regular fees with the exception of fees for laboratory and supplies, for which the instruction given by him shall be taken in lieu, unless in the opinion of the appointers his demands become excessive, in which case the donor shall reimburse the University; he shall work under the direction and advice of the Professor of Industrial Chemistry; and he shall forward, periodically, through the Professor of Industrial Chemistry, reports of the progress of his work to the A.B.C. Glass Company.

"For the support of this Fellowship, which shall extend through a period of two years from the date of appointment of the Fellow, the A.B.C. Glass Company agrees to pay \$1,500 per year, payable annually to the University on the date on which the Fellow begins work at the University. This sum shall be paid by the University in monthly instalments to the holder of the Fellowship.

"Any and all discoveries made by the Fellow during the tenure of this Fellowship shall become the property of the A.B.C. Glass Company, subject, however, to the payment by them to the Fellow of ten (10) per cent. of the net profits, to be commuted at the desire of either party

through the arbitration provided for herein, arising from such discoveries, it being understood that the Fellow shall be regarded as the inventor. At any time during the tenure of his Fellowship the holder shall, at the option of the donor, take out patents at the expense of the donor on condition that at the time of making application therefor he shall assign his right to the donor under the conditions of this agreement. At or before the expiration of the Fellowship, the business services of the Fellow may be secured by the A.B.C. Glass Company for a term of three years on condition that the terms of such services are satisfactory to both parties at interest.

"In the event of any disagreement between the donor and holder of this Fellowship, it is understood and agreed that the Chancellor of the University, or one whom he may appoint, shall act as arbiter as to all matters of fact, that his decisions shall be binding upon the parties at issue, and that they shall obtain such decision before having recourse to the courts.

"It is also understood and agreed that during the tenure of this Fellowship the holder may publish such results of his investigation as do not, in the opinion of the Company, injure its interests, and that on the expiration of the Fellowship the holder thereof shall have completed a comprehensive monograph on the subject of his research, containing both what he and others have been able to discover. A copy of the monograph shall be sent to the A.B.C. Glass Company, and a copy shall be signed and placed in the archives of the University until the expiration of three years from that date, when the University shall be at liberty to publish it for the use and benefit of the people.

"Signed on behalf of the University of Kansas.

"Date.....

"Signed on behalf of the A.B.C. Glass Company.

"Date....."

Some of the advantages accruing from these Fellowships were that the University gained increased opportunities of promoting research; it obtained three hours a week of gratuitous instruction from men of ability, knowledge, and enthusiasm; the Chemical Department, in particular, obtained the catalytic influence of these men. The manufacturer obtained the advantages of enormously increased laboratory facilities; adequate library facilities, a most important advantage, the lack of which had seriously hampered much factory research; consultative advantages, for the Fellow appointed was at liberty to question specialists in the different fields of chemistry, or in other fields of scientific knowledge; complete freedom from supervisory responsibility over the work; and on the termination of the Fellowship, the services of a man educated to his particular needs. The Fellow obtained all the foregoing advantages ascribed to the manufacturer, and in addition the all-important sympathetic co-operation of the manufacturer, together with inside knowledge of the factory processes, and the University's environment sympathetic to research; also a freedom from all petty interferences and jealousies of shop people, and the pot-shot judgments of factory officials. Finally, if he proved worthy of it, he obtained a position for which he had become, through his training, peculiarly qualified.

Since at the end of three years all work done under any Fellowship must be published free to the public, the public thus obtained new implements of civilization. It was only through the industries that any useful discovery went to the people. The insertion of this clause had been occasionally resisted for a time, but the donor had always in the end acquiesced, when it was pointed out that a really progressive manufacturer would find three years a sufficient start.

Since this whole scheme depended upon sympathetic co-operation, it could only be carried out through a Professor who regarded it as a sacred trust. It was, therefore, positively necessary that the Professor of Industrial Chemistry should, so far as any material sense was concerned, gain absolutely nothing, otherwise his

donors would not trust him with the details of their secret processes, nor would his Fellows trust him with their progress.

The CHAIDMAN said they must all admire the modesty as also the earnestness with which Prof. Duncan had put his scheme forward. He was evidently an enthusiast who wished to do the best for the young chemist and the benefit of humanity at large. Of course, the manufacturer was bound to be benefited as well. Prof. Duncan had spoken of the American manufacturer as he knew him, and no doubt he did know him. Those members of the Society who had been in America would endorse his view, for, however far advanced the chemical manufacturers in America might be in handling materials, so far as the chemistry was concerned in 1904 they were much behind England. In that respect they in England had little cause to be afraid of the American manufacturer. If he made small profits per ton of product but could multiply them by hundreds and thousands, he might be successful for a time, but not in the long run. He might even for some time try to protect himself by a tariff, and get as much as he could out of his fellow-countrymen, but that system could not go on for ever. In fact, the tariff had done great service in pointing out where the weakness lay. This unselfish scheme into which the author of the paper threw all his individuality and knowledge was bound to lead to good results, and the younger members should get into touch with Prof. Duncan, because he had come over to Europe with the view of offering a number of these Fellowships to English chemists. Anyone who was willing to risk some time, and was able to trust to his own capabilities, should try and obtain one. Prof. McDola was unfortunately prevented from being present that night, but wished it to be known that he was strongly in favour of advancing chemical industry by Industrial Research Scholarships.

Dr. E. DIVERS pointed to the importance of the fact that manufacturers had accepted this scheme, and had shown themselves willing to work it. Many chemists who had felt for years the great need for just such a matter, had feared the case to be almost hopeless, because manufacturers were not to be found who would trust their affairs in the hands of someone over whom they had not sufficient control, or outlay money on an investigation the results of which were very uncertain. But they had now learnt that they had only to act on the lines laid down by Prof. Duncan to find themselves able to carry out what was so important for all our technical schools and colleges. They now saw that it was possible, in Kansas at any rate, to get Fellowships endowed, even well endowed, which gave admirable opportunities to young men of promise, to investigate and to work upon problems in chemical technology with confidence, that could they discover anything of value, a career would be opened to them. The scheme presented a promising method for the development of technical institutions, and he congratulated Prof. Duncan upon its inauguration, and upon the success which had so far attended it. There could be no doubt from what Prof. Duncan had said that greater success would follow, and he thought the scheme might be imitated in this country with every prospect of success.

Dr. H. W. WILEY said there were two points of view with regard to industrial education: Should the State undertake the industrial education of its citizens, or let the citizens take care of themselves? These two points of view were well illustrated by the two countries Great Britain and the United States. The United States had become essentially a paternal Government, the view held being that the State should do practically everything; while in this country it seemed to be held that the individual should take care of himself and serve the State, while in the United States the State was supposed to serve the individual and the citizens. At the time of the Civil War, when one might have thought that all energies would be turned to military affairs, the foundations of industrial education were laid. In 1862 an Act was passed in Congress giving to each State a certain part of the public domain corresponding to its population; so that for each member of Congress and member of the Senate, a certain amount of public lands was devoted to each State for the purpose

of beginning industrial education. This was first of all intended to be agricultural, but at the same time it was provided that instruction should be given in the arts and industrial science and also in military tactics. The States could accept or reject those grants as they thought fit, and, in point of fact, all the States had accepted the grant. Some States had administered the trust with great financial success, so that now they had a very large income from the public lands; for instance, New York, which received the largest amount, had kept its lands and leased them, while other States sold them. The State of Indiana, of which he was a citizen, sold the whole of the land for 60 cents an acre, though, had it retained those lands till now, it could have got an annual rent out of them of at least an equal amount. This was the beginning of industrial education in America, and every State now had an Agricultural College in which were taught the mechanical arts of all kinds and also military science. Having founded these schools, Congress proceeded to found Agricultural Experimental Stations in every State, and large grants of money were made to them annually; and at present \$20,000 a year was granted to each State for agricultural education annually and \$26,000 for Experimental Stations. These funds were well utilised. What was the result? These young men were engaged for industrial purposes even before they got their diplomas. Scarcely one ever graduated who had not already a situation in view. They at once began their industrial activity; they did their work well, and made good the result of their training. Thanks to the generosity of the late Mr. Mackay, Harvard University had founded a school of applied science which no one was allowed to enter who did not hold a degree equivalent to that of B.Sc. or B.A. It was, in fact, a school where they would only take trained men and give them additional training in the higher branches of applied science. That seemed to him one of the marks of progress in America. They not only wanted to train the mass of mankind to do industrial work, but to give a chosen few the very highest training which could be given to a young man to fit him for success in industrial life. The school was only just organised, and it was too early to say what it could do, but the first branch it had organised was that of Forestry, having bought a large area of forest land where it took graduates from other schools and taught them the applied science of forestry. It had schools of applied science in agriculture and also in veterinary science, in electro-chemistry and civil engineering, all fully organised, and they would soon be full of students. Thus in America they not only had the State generally supporting industrial training, but the individual. This meant that in the race for success, that nation was going to be foremost which trained its young men best. Up to this time America had not been a scientific country. When he was young, they came to Europe for scientific training, but now crowds of Europeans were coming to America for that purpose—the balance of trade had turned in their favour, because they were offering the most abundant prizes for applied chemistry and other sciences which could be found in the world. That was the hope of American industry of all kinds, the training of the young men, in agriculture first and then in applying science to manufactures. They had a country rich in raw material, with abundant energy and enterprise; and they had money; but now they were going to have science and skill. He believed that every natural resource was now taken up, but it was not going to put an end to their progress. They were going along and were not going to rest content until they could all grow 30 bushels of wheat per acre, as they did in this country. They had no more acres to cultivate, but they had enterprise to make the acres they had more productive, and that was what applied science would do in all branches of production. They did not want more hands, but they would make the hands more skilful. So far as the production of food and clothing was concerned, the capacity of the mouth remained constant, while the capability of the hands was constantly increasing, and we had two hands to one mouth, so that there was no need to look forward to any disaster to the mouth of the future—the hands would take care of it.

Dr. ROBERT MOND said the question of how to bring the higher University education into closer touch with actual manufacturing operations was one which had occupied all University Professors and manufacturers ever since there had been any. It was an extremely difficult question to solve, and the difficulty lay, as Prof. Duncan had pointed out, in the fact that it must remain so entirely a question of personality—of the personality of the manufacturer, the professor, and the research student. Every industrial question which had to be submitted to research work required and opened out a large number of new lines of research, and it was impossible to say beforehand whether the information thus conveyed was in a fit state for publication, or whether it was advisable from the manufacturing point of view to make it public or not. That was the fundamental difficulty. The manufacturer was faced with a large number of questions which might appear to be entirely academical, but would cease to be academical as soon as he tried to experiment with them or asked anybody else to do so. This had always been one of the great stumbling-blocks in the way of getting the University Professor and the manufacturer to work together. The manufacturer was always working in the dark, not knowing from day to day what was going to be the industrial application of the most impossible-looking piece of scientific research. It branched out in all possible directions. One might start upon what appeared to be a clearly defined line of research, and might run into all kinds of difficulties, with regard to apparatus, which had to be solved in order to continue the work, and in the solution of that difficulty an entirely new thing might be discovered. For instance, the whole of the nickel carbonyl process which his father had discovered was based on the fact that the nickel valves of his ammonium chloride process became coated with a black deposit, the examination of which put them on to the track of the nickel carbonyl process. Supposing there were some one working on ammonium chloride research, who got hold of this powder, and began working on it. The employer could not by any possibility claim the benefit of this new process, to which he had no moral claim. It would be entirely the work of the investigator, and he defied any University Chancellor to arbitrate successfully as to what claim the employer would have against the research chemist, or what the research chemist would have on him as to the property in the invention. He heartily congratulated the members of the Society in Kansas in having succeeded in obtaining the services of a personality like Prof. Duncan, who was capable of differentiating these things. When they were able to secure such men to arbitrate between them and to work in harmony they would progress at a much more rapid rate. It was a remarkable thing that higher education had begun by degrading or putting on a lower plane what they were accustomed to look upon as a University education. The whole of what was now called regular post-graduate education implied that the man who obtained his degree was not a finished article—not a man capable of doing research and standing on his own feet; not a man like the students now being trained all over the Continent of Europe, who were fit to become the private assistants to the professors or lecturers, but one who must go in for a second course of University education. Dr. Wiley told them how they were arranging it at Harvard, but it had been done much earlier at the Johns Hopkins University at Baltimore, which only took as a student one who had taken a degree somewhere else. There was a tendency, both at Oxford and Cambridge, to follow suit with research degrees, and it was a moot point whether it was advisable to put our Universities and Technical Colleges of equal rank on a basis of inferiority, so that those to whom they accorded degrees should require additional education before they could be considered the finished product of the University. That involved the whole question of the secondary education which came before it. Should secondary education be received before going to the University, or should it be given at the University during the first year? In England, unfortunately, there was not that co-ordination between secondary and University education which enabled the teaching to be done properly. In some countries they had a system of secondary education, but our students

only had it in a few institutions. Secondary education should be made more general so as to raise the average of knowledge before the University education began. The difference between secondary education and University education was that secondary education consisted of teaching on a regular, well-defined plan, where every hour of the day was arranged for and every subject was properly digested and assimilated for the student; the University expected a man to take his own meal from the menu provided. It was this selecting and choosing of the sympathetic University teacher and going to the place where the subject was treated in the most sympathetic way, which enabled the mind to be formed and independence developed while acquiring knowledge. This stage only began here with the research student. Even now, after 600 years, at Cambridge they were still in a position of flux with regard to the whole question. They had to try to find quite as much the lesser evil as the greater good; but in his opinion the greater good was the teaching in the University of that independence of mind by which a man would stand on his own feet and assimilate the information which was serviceable to him. The University was not there to encourage people to obtain the greatest possible number of marks; the man was not there to pass a competitive examination. That might be all right on the race-course, but not in a University. The object of a University was to gradually prepare men's minds to assimilate knowledge, and to so use it that they could go on assimilating it all their lives. The more a University was made like a school bench, the more that was prevented. There was only one way of getting at any generally applicable scheme of University education, and that was, in the numerous teaching institutions now at work, to make experiments, and of these different experiments they would have to know the constants and be able to determine their coefficients, with as much, if not greater accuracy than in any dilute solution, so that they would be able to find out gradually what was the method in which the human mind, as normally constituted, could best proceed to develop itself for the general benefit of the country.

Prof. C. BASKERVILLE said the work that was being done in America in this direction needed no defence. Their method was not perfect; they knew the defects, and they were trying to cure them. It was simply one of the many ways of trying to knit pure and applied science more closely together. His only fear with regard to Prof. Duncan's scheme was this: if institutions and corporations put into his hands researches and money at the rate of \$2,000 a year each for three years, and he had to stand the mental strain of directing them in 30 different directions, he might lose his enthusiasm.

Mr. GRANT HOOPER said it seemed to him that when they talked about the research chemist they lost sight altogether of the fact that a research chemist was not merely a chemist well trained. An ideal research chemist was a man possessed of imagination, for without imagination it was impossible to do anything in the way of research. He was rather surprised at some of the remarks which fell from Dr. Mond. From the large number of chemists working under his supervision he, surely, could have sorted out a small proportion who were possessed of imagination or resource as it was sometimes called, and it was only of such men that he could ever make anything in the direction of research. In connection with the very problem he specifically referred to, the origin of the nickel-carbonyl compounds, he might have placed that investigation in the hands of a man altogether incapable of seeing to what great result it might lead; he might, in other words, have selected a man who was a very able analyst, but so utterly devoid of imagination as to fail to see the thing which stood straight before his eyes as the result of his work. He took it that Dr. Ludwig Mond was actually the one who did see it, though of course it might have been the chemist making the examination who called attention to the possibilities that resulted from this investigation. At all events someone saw the possibility, and that somebody had the making of the ideal research man. Turning now to a criticism of the scheme as it had been placed before them, he observed that one of the conditions laid down for the selection of these

research men was that they should have proved their capacity as researchers, and he should like to know how this capacity was to be proved—what kind of research work was to be taken as evidence of capacity to deal with the particular problem upon which the man was to be set to work. It seemed to him to be most important if success was to be obtained that a man to be employed upon a particular subject should have his mind saturated with that subject, should, in other words, be acquainted with all that had already been done in connection with the science of the industry or of the matter in hand. It was not a man well versed in general chemistry, not merely a good chemist in other words, but one who, in addition to a good general training, had had his mind specially directed towards the subject of the particular problem. He would say therefore to Prof. Duncan and others who might follow in his path that they ought to look first to the laboratories connected with the industry in question and endeavour there to find among the men engaged in that particular industry one possessed of the imagination and resource which were the first essentials to the solution of problems. In connection with the cement question, for which a scholarship had been offered, he would suggest that among chemists connected with cement works, it was most likely that one would be found who, in a reasonable time, would most nearly approach a solution of the given problem. He quite agreed that there was a difficulty, because the best men were not willingly spared, but, at all events, this particular question should be placed before someone who had already been engaged in the cement or a cognate industry. A purely organic chemist, for instance, would be out of place. Again there were two entirely different questions involved in some of the instances which had been given them; there was the case where a manufacturer said, Is this particular process which I employ carried out in the best possible way? or, Here is a difficulty that I meet with every day, can you show me a means of avoiding it? The other case, altogether different, was that of the utilisation of a substance either natural or of the nature of a by-product so far unused, but which it was desired to turn into money. In this instance the qualifications called for were somewhat different to those demanded in the former case, though again the first essential was imagination. Closely connected with the subject they were discussing was the question, could they merely by education turn out what Prof. Duncan called researchers? He said they could not. A man might acquire chemical skill and knowledge, which undoubtedly formed the foundation on which alone progress could be made, but imagination could not be created where it did not exist. Imagination might be cultivated and developed, but this special capacity as a general rule was most clearly seen in connection with practical, responsible work. It was not until the general education was completed and the man undertook and successfully solved the definite problems which arose in connection with responsible work that it could be satisfactorily settled whether or not he had the capacity which made a research chemist.

Prof. H. E. ARMSTRONG said Prof. Duncan's scheme was characteristically American. Were they to understand, that the steps Prof. Duncan was taking were with the object of helping the particular kind of manufacturer he described, or was the object to help a higher class of manufacturer? At all events the scheme might be valuable as a means of driving the thin end of the wedge, home and of interesting a certain class of persons in scientific inquiry who at present had no understanding of its methods; they must therefore congratulate him on the success he seemed to have achieved. Anything done in such a direction must help; the only question was whether the class pictured ought not to be destroyed as soon as possible. It would be to the advantage of America to introduce a proper class of manufacturer in his place, who understood more or less how to set about the work himself. They had tried here over and over again to interest the ignorant manufacturer and had failed; they would continue to fail until a different class of manufacturer came into existence, until the Universities so altered their methods that the cultured, educated general public were able to understand the position. At the present time, they did not want to ask themselves what they had

to do to succeed in these matters; they had an example of success before them and knew exactly what constituted success. They knew the extent to which Germany had succeeded, not only in chemical industry but in every branch of industry to which scientific method was applicable; and at the present day that included all industries. They knew that Germany had succeeded not through any such means as had been brought forward to-night, but through its system of University training. He did not agree with Dr. Mond that German success had much to do with secondary training. He did not believe, as a matter of fact, that the secondary training was much better in Germany than it was in England. The fact was that the German material was somewhat different from the English. The German would apply himself and work harder than the average Englishman; that was in a large degree the secret of German success. The German was not above his business in the way that so many young Englishmen were; until young Englishmen of position, who commanded capital and who were going into the businesses made by their fathers, were brought up not to be the dilettanti they were at present but to take an interest in things and to know what research was (no average Englishman had the remotest idea what the word connoted), they would not make much progress. He thought they were much indebted to Dr. Wiley; his remarks must have impressed the meeting with some sense of the feeling which pervaded America at the present time, which came out everywhere—the feeling of earnestness and determination to succeed and carry on good work in the future. Dr. Wiley had said that they were going to bring up their young men to be highly skilful; no doubt they were making great efforts to do that. The question was whether a method such as Prof. Duncan had put before them was likely to give that result. Was his scheme of research a scheme of research at all? Listening to the list of subjects on which the Fellows were to work, he had felt that it was not really a research scheme. The list included finding a use for butter-milk and finding new uses for cement. That was not what he should call research. Such inquiries were obviously to be made with the object of extending a business, and were not in any proper sense of the term research work. After all, if they were going to help young men in the future to be of value in works, they ought to train them not merely to apply themselves to subjects of that kind, but to train themselves broadly, so that they could deal effectively with the very large number of problems which came before a man in any average small works. In this country and in America most of the works were run by a relatively small staff of chemists—a very small staff in most cases. A man went into the works to deal with a complex business, not to deal with one particular thing; he was faced with a great number of problems, and he needed to be more or less a man with a business head and at the same time one who had sufficient knowledge of science to develop the various problems which came before him. As Dr. Mond had pointed out, you never knew where you were at the present day, or what would be of value. In listening recently to Dr. Fleming's lecture at the Royal Institution on wireless telegraphy, a case of this kind had been impressed on his mind: one of the most striking points made by the lecturer was that a method which was going to be of great service was the outcome of research on the electrical conductivity of crystals; the unilateral conductivity observed in certain crystals was made use of for the purpose of rectifying the currents by causing them to go in one direction instead of two. For industrial purposes they needed men to be very widely and thoroughly trained. A scheme such as was described might be put into practice to a limited extent, but no man could stand the racket of supervising a scheme of that sort if it were carried very far; and after all, the attainment of success would depend entirely on the kind of man under whom the students were working—whether he were capable of initiating and supervising research work. Prof. Duncan's Fellows might be expected to know to a limited extent what were works' requirements, but they would not be put under works' conditions and be subject to works' discipline; they would not be gaining much which would be of subsequent advantage to them in the works. They would be turning their

attention to some particular subject, which would perhaps be a good thing if it became their future employment; but, on the whole, the scheme did not promise to produce men who were highly trained from a scientific point of view, such as would be required by the manufacturers of the United States in the future. Dr. Wiley had referred to the Harvard scheme, which seemed to be a more promising one and likely to produce men who had really learnt to work as individuals—not merely to order and under direction. They had, however, to thank Prof. Duncan for having brought the subject before them; no doubt his account would give food for thought.

Prof. W. L. DUDLEY said the suggestion of Prof. Duncan was undoubtedly unique, but he agreed with what had been already said about the difficulties, and doubted very much if, as had been stated, it would be possible to get the proper subject attached to the proper research worker. Those who had done research realised that it was like playing an instrument. One man was suited well for one research and not at all for another; each man had his peculiar *forte* which interested him most, and with which he felt he was best able to deal. Two men of the same ability as chemists could not possibly pursue the same research with the same degree of facility and success. He should therefore feel great doubt as to the success of these workers when the subject was picked out for them. He knew many subjects upon which research was needed, and yet at the same time out of the many he knew there were very few he should be willing to undertake himself, because he should feel as though (reverting to Dr. Fleming's lecture) he was not exactly in tune from the standpoint of radio-telegraphy with most of these researches. It seemed to him that the only place to educate a research worker in an industrial process was where he was in contact with the works; he could not get in tune with it unless he was. Now Prof. Duncan might have produced the impression that American manufacturers worked by a sort of rule of thumb method, but no doubt many present knew to the contrary, and he wanted to emphasise the fact that they had an exceedingly large number of corporations which carried on regular scientific work. Some corporations he knew had a large number of research chemists in their laboratories, and they were the successful ones and were becoming more successful day by day. Those whom Prof. Duncan referred to were the smaller manufacturers who were gradually being pushed out of existence. Dr. Wiley had told them they were going to do a great work in industrial education, and, as he said, out of the young men who were being trained all over the United States, probably 5000 or 6000 graduated each year, and they were all snapped up immediately by manufacturers, railroad companies, and engineering corporations. He knew that at the institution with which he was connected they could not supply the demand for engineers and chemists of all sorts and students who had been trained on scientific lines. These men went into these establishments, and if they were the right kind of men, and had been trained properly, the manufacturer would be a very stupid one who did not realise that man's ability and give him an opportunity to do the work he was specially fitted for. Take the Steel Corporation—the great "Trust" about which so much was said—there were men he knew who had come out of colleges within the last ten years, men not over 25 or 26, who were superintending some of the finest plants and getting \$8000 a year, men who had never had any training at all except the college training, and then went in at the bottom of the Steel Corporation's works; their ability was soon recognised and they were pushed on. They would be surprised to see how young the men were who were in charge of works of that character. He believed Prof. Duncan's plan a good one, though he had never tried it, but he did not think it was one which could be adopted generally. The great uplifting of the scientific manufacturer was going to come from the institutions which were carrying on the industrial education of the United States.

Professor DUNCAN, in reply, said that he had listened to the discussion with the most anxious interest, to discover if there were any weaknesses he had not detected. A few additional words about the scheme would constitute a reply to most of the remarks that had been

made. The first action that followed the appointment of the Fellow was usually to send him to his donor in order that he might enter the factory and become practically acquainted with the difficulties to be met. He had taken that action in every case in which it applied, the young man going at the expense of the donor. For example, the National Association of Master Bakers had appointed a Fellow to investigate the chemistry of baking. The first step was to send him on an extended tour of inspection of the best baking practice to be found in Washington, Philadelphia, New York, and Chicago; he was met by the bakers and was frankly told the condition of affairs, because he was recognised as a man in a position of trust. The second step was to place him in a bakery as a workman, and it was only after that, that he proceeded to his research. Wherever it was applicable the man went into the factory until he became acquainted with the actual conditions he had to meet, and from time to time, if necessary, he returned there. It was not to be inferred that all factory problems would fall under this scheme. There were many which could only be solved within the walls of the factory itself, but there were certainly others which could be solved as well, or better, in the University with the sympathetic co-operation of the manufacturers, and those were the only ones in which he was interested. The manufacturers who had established these Fellowships were not Western manufacturers, but nearly all of them large Eastern corporations, and if he could mention their names it would be seen that they represented splendid factory practice; but they realised that their work should be investigated and the processes of the factory improved. The scientific men they employed in the factories themselves were often by that very fact cut off from the power of solving the factories' problems—they could not see the wood for the trees—they were hampered by tradition. They were often men who at the beginning were well trained in contemporary knowledge, but as time went on and they became involved in routine work, and took on executive responsibilities, they fell behind. One speaker said that if he wanted a man to investigate the chemistry of cement with the idea of discovering new uses for it, he should apply to one in the cement business. Such a man would be almost useless unless he had in him that creative spirit which had been referred to. Certainly, if he had that, together with contemporary knowledge, it would be best. He wanted a man who was particularly well informed in contemporary chemical knowledge, well trained; a man in whom he could arouse a creative spark. It was a difficult matter to find such a man. They had been reminded by Dr. Wiley of the progress of industrial education in America, and amongst other things he had told them that such men often became engaged before they

received their diplomas. That was the trouble; too often they were turned out "half-baked." That was why he had to seek abroad for men, because in America there were more opportunities than men, whilst in England there were more men than opportunities, at any rate at a reasonable remuneration. It was unquestionably true that the difficulty of obtaining the right man was extreme. The available man must not only be well trained both in hand and in brain in contemporary chemistry, but he must be at the same time a man in good health, for these men had to work. He must also be a man of positive integrity, and, finally, he must be a sensible and reasonable man. That brought him to Dr. Mond's difficulty, which certainly was one, of the remuneration for results. That could only be met by computation, because no corporation was going to continue to pay the 10 per cent. indefinitely. Manufacturers of the type with which he had to do were reasonable men—they were business men, and it was possible to do business with them; as for the researchers it was quite possible for the man in charge of them to make them feel that with reasonableness only might they expect to succeed in life. There seemed to be a consensus of belief that the best thing that could be done was to leave it to the University. Possibly all that could be done at the best was a crude approximation, but suppose that instead of the man being engaged in this particular relation he were engaged by the corporation itself to make a certain research, how was his contingent remuneration to be secured? It could only be secured on the basis of reasonableness—10 per cent. on the net profits of most innovations in factory practice could not be onerous but 10 per cent. on all factory innovations would not do at all; in certain cases 2 per cent. would be sufficient.

Dr. Mond said that the investigation might lead to an entirely different industry, and the people conducting it might be incompetent to deal with it. If it were left to them they could not take it up. The question was, whose property was the discovery; it was not a question of remuneration.

Professor DUNCAN said that a serious question cropped up with regard to the contingent remuneration. It might be that a man succeeded in carrying out a certain achievement and thereby improved a process in such a fashion that while it gave satisfaction to the donor it did not actually increase his income. How was such a matter to be dealt with? This had been pointed out to him by certain donors, and it had been a subject of great anxiety to arrange the agreement that it should be on a reasonable foundation. Throughout they had been earnestly desirous of making reasonable arrangement, because it was recognised that only in that way could such a scheme succeed.

Journal and Patent Literature.

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I. PLANT, APPARATUS, AND MACHINERY.

Water for power; National and international conservation of—. E. R. Taylor. Faraday Soc., June 15, 1909. [Advance proof.]

THE author began by pointing out that the water power capacity of the United States with proper conservation is not less than 150 million H.P., without considering the storage capacity of brooks. The annual stream flow in the same country is 70 million million cub. ft., of which less than 1 per cent. is restrained and utilised for municipal supply and such purposes, less than 2 per cent. is used for irrigation, 5 per cent. for navigation, and less than 5 per cent. for the production of power. From 85 to 95 per cent. is wasted in floods. This illustrates the kind of waste that is going on all over the world, and typical examples of such wasted resources were described and

illustrated by the author, who strongly advocates the impounding of flood-waters in the uplands with accompanying afforestation of the hills, and the simultaneous conservation of sources of power, which a vast in the aggregate, and which at present are almost entirely uncontrolled and untapped. Many instances were given of the advantages that have accrued from the proper utilisation of this waste water, both on small farms from the impounding of a mere brook, to the damming of great rivers and the consequent enrichment of vast tracts of country. The electrochemical industry in particular would benefit by the creation of cheap and abundant sources of power, on which their very existence depends. The lecturer strongly urged the necessity for this problem being considered internationally. A beginning will be made in 1910, when an international conference will be held at the Hague.

PATENTS.

Filtering apparatus. B. Bramwell, Belfast. Eng. Pat. 2101, Jan. 28, 1909.

THE filter consists of a horizontal cylinder with dished or convex ends, mounted on trunnions and supported by rollers, so that it can be rotated, when the contained filter ed is being cleansed by reversing the flow of the liquid. The liquid to be filtered enters through one of the trunnions and the filtered liquid escapes through the opposite trunnion.—W. H. C.

Filter-press. S. K. Behrend, Denver, Colo. U.S. Pat. 924,131, June 8, 1909.

THE frames of the filter-press are connected together by loose links and move upon horizontal tracks. Means are provided for automatically separating them and forcing them together again.—J. W. H.

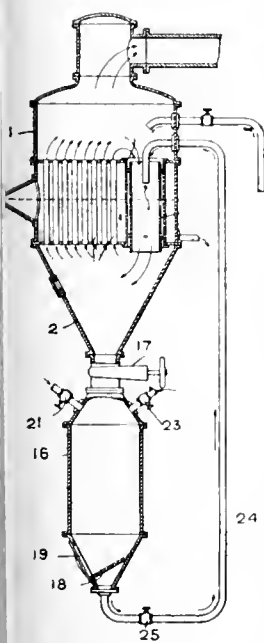
Filter-press; Continuous —. C. C. Leclaire. First Addition, dated Feb. 24, 1908, to Fr. Pat. 394,450, Nov. 26, 1907 (this J., 1909, 236).

THE outlet for the solid matter terminates in a conduit, the side of which is formed by a hinged flap which is kept closed against the other side by a spring. The solid matter can only escape when it has attained such consistency as to overcome the pressure of the spring. —W. H. C.

Filters; Construction of —. Suero-Filter-Werk, Suero und Co. Ges.m.b.H. Fr. Pat. 397,114, Dec. 5, 1908.

THE filtering material is prepared in the following manner. A mixture of finely-divided asbestos, pulverised marble or gypsum and an acid, is treated with an alkali, until the reaction is approximately neutral, and then mixed with a silicate as binding agent, a solution of magnesium silicate of 25° to 28° B. being most suitable. Asbestos cloth is coated with this mixture and the whole filter is then calcined and washed.—W. H. C.

Crystallisation vessel; Continuous —. T. Suzuki. Fr. Pat. 397,186, Dec. 8, 1908.



THE crystals separated during the evaporation of the liquid in the vessel, 1, collect in the conical portion, 2, the tap, 17, being closed. As soon as a sufficient quantity of crystals have accumulated in 2, the valve, 17, is opened and the crystals and mother liquor fall into the chamber, 16, after which the valve, 17, is closed again. The crystals are retained by the inclined, perforated draining plate, 18, and the mother liquor is aspirated by the vacuum through the pipe, 24, into the evaporator. If necessary the crystals may be washed in 16, by admitting wash water through the tap, 23, the wash water being afterwards aspirated into the evaporator through the pipe, 24. The tap, 25, is then closed, and after admitting air through the tap, 21, the door, 19, is opened and the crystals are removed.—W. H. C.

Recovering valuable vapours or gases; Process for —. from apparatus or machines from which they are evolved during work. W. G. Perks and The Volatile Solvents Recovery Co., Ltd. Fr. Pat. 397,435, Dec. 15, 1908.

THE object is attained by the use of a double system of ventilation. The first system operates in the immediate

neighbourhood of the apparatus from which the gas or vapour is given off, and which may be partially or entirely surrounded by a screen to keep off air currents. This system aspirates the vapours mixed with only a small proportion of air and delivers the mixture to suitable recovery apparatus. The second system deals with the noxious vapours which escape from the first system into the air of the workroom and aspirates these vapours along with large volumes of air, discharging them into the atmosphere or elsewhere as desired.—W. H. C.

Vacuum; Process for ascertaining the degree of — in receivers. Soc. Centrale d'Electricité. Fr. Pat. 397,440, Feb. 24, 1908.

THE vacuum receiver is connected to a glass globe provided with electrodes between which an electric discharge is caused to pass. The degree of vacuum attained is judged from the appearance of the discharge.—W. H. C.

Distillation; New process of —. A. Montupet and L. Jamin. Fr. Pat. 397,519, Feb. 26, 1908.

THE vapours are withdrawn from the upper part of the still, below the rectifying column, by an injector placed without the still and actuated by a steam jet. The mixture of steam and vapour is then injected into the body of liquid in the still.—W. H. C.

Circulation of liquid, especially in cellulose boilers; Apparatus for producing —. E. Mortend. Ger. Pat. 209,443, Feb. 27, 1908.

THE pump used to effect the circulation, and its connecting parts, are all arranged within the boiler, the movable parts being disposed in a special cover or casing on the wall of the boiler, which cover can be easily detached from outside when it is desired to examine or repair the pump.—A. S.

Evaporation of liquids; Apparatus for the —. F. H. Eijlman, Ryswyk, Holland. Eng. Pat. 11,388, May 26, 1908.

SEE Ger. Pat. 199,145 of 1907; this J., 1908, 929.—T. F. B.

Evaporating apparatus; Cast-iron — with field tubes. G. Sauerbrey Maschinenfabrik, A.-G. Fr. Pat. 397,545, Dec. 17, 1908. Under Int. Conv., Jan. 4, 1908.

SEE Ger. Pat. 207,478 of 1908; this J., 1909, 465.—T. F. B.

Raising liquids; Apparatus for —. V. Schwaninger, Oggersheim, Germany. U.S. Pat. 923,587, June 1, 1909.

SEE Eng. Pat. 23,175 of 1908; this J., 1909, 235.—T. F. B.

Diffusion apparatus. W. Bock, Prinzenenthal, Germany. U.S. Pat. 923,760, June 1, 1909.

SEE Fr. Pat. 390,629 of 1908; this J., 1908, 1101.—T. F. B.

Atomising liquids; Machine for —. P. Kestner, Lille, France. U.S. Pat. 923,856, June 8, 1909.

SEE Eng. Pat. 20,697 of 1905; this J., 1906, 915.—T. F. B.

Solids from liquids; Separation of —. H. T. Durant, Assignor to L. T. Dechow and R. Tweedale, Bulawayo, Rhodesia. U.S. Pat. 924,043, June 8, 1909.

SEE Eng. Pat. 15,350 of 1907; this J., 1908, 617.—T. F. B.

Desiccating apparatus. J. Mecredy and D. M. A. G. Hawes, London. U.S. Pat. 924,561, June 8, 1909.

SEE Eng. Pat. 1473 of 1906; this J., 1907, 110.—T. F. B.

Liquids and gases chemically active upon each other; Apparatus for simultaneously treating —. J. Steynis, New York. U.S. Pat. 924,592, June 8, 1909.

SEE Addition of Aug. 31, 1907, to Fr. Pat. 390,598 of 1907; this J., 1908, 1173.—T. F. B.

Distilling and concentrating liquid mixtures; Process for simultaneously —. Salpetersäure-Ind.-Ges. Fr. Pat. 397,666, Dec. 19, 1908.

SEE Eng. Pat. 27,473 of 1908; this J., 1909, 465.—T. F. B.

II. FUEL, GAS, AND LIGHT.

Coaldust [explosions]. W. Galloway. Seventh Int. Congr. Appl. Chem., London, 1909.

MINES less than 500 feet deep are damp; those between 500 and 700 feet are damp in hot weather and dry in cold weather; whilst those beyond 700 feet deep are always dry. Coal dust which first begins to appear in a dry state at a depth of 600 or 700 feet, is formed in all mines, and, in the author's opinion, has been the principal agent in all great explosions in which the presence of firedamp could not be accounted for. A great explosion is initiated in a dry and dusty mine, when a cloud of dust is raised and a large flame is simultaneously projected into its midst by the explosion of a larger or smaller body of firedamp, or by a blasting shot. The author advocates the damping of the dust for a certain distance in front of blasting shots about to be fired, and considers this precaution is not insisted on with sufficient urgency, and that it should not be overlooked even when permitted explosives are employed. Could the deposition of coaldust in roadways be altogether prevented or rendered innocuous, great explosions would become impossible. Dust-tight mine wagons are advocated, conveyed at such a speed that the shaking to which their contents are subjected is insufficient to cause dust to arise. Floors should be watered at frequent intervals, so as to keep them continuously damp. Hygroscopic salts sprinkled upon the coal dust in sufficient quantity to destroy its inflammability would effect the same result as water (see this J., 1909, 511). As a means of preventing the spread of explosions from one district to another, in mines in which water cannot be used, it is suggested that 100 yards of each roadway might be lined with brick or concrete, and kept always wet. G. W. McD.

Solid fuels; Determination of the amount of volatile matter in —. E. J. Constam. Int. Congr. Appl. Chem., London, 1909.

THE amount of coke yielded by, and the moisture and ash contained in average samples of coals (or solid fuels), form data from which the amount of volatile matter ("gaseous content") is calculated.

Different methods of determining the yield of coke are used in different countries; and from one and the same sample different values are thus obtained for the proportion of volatile matter. Consequently, in districts where coal from different places of origin is used, the need of a uniform method of determining the yield of coke is strongly felt. The author and his collaborators have therefore investigated the various methods extant with the different crucible methods, and the Belgian, American, and Bochum methods of determining the quantity, chemical composition, and calorific power of the coke produced.

The yields of coke found by these methods, and the chemical and calorific properties of the coke formed in the crucible, were compared with the coke formed from the same fuels by distillation at 830° C. in a small gas-retort. The composition and the calorific power of the combustible substance in these retort cokes proved to be very similar to those of the cokes produced in gasworks and in coke-ovens, after making allowance for ash and moisture. Pyrometric determinations showed that different temperatures prevailed in the different coking methods in which the crucible was used. Further, it was established that no portion of the coke was burnt in coking by either the Bochum or the American method. When, however, the younger fossil substances, such as lignite and peat, and wood, are coked, the samples should be previously air-dried, pressed into tablets, and then carbonised and cooled to room temperature in a current of hydrogen, carbonic acid, or nitrogen. The experimental results obtained, lead to the conclusion that the differences in the yield of coke by the various methods are primarily due to more or less thorough carbonisation of the fuels. The chemical composition of the coke produced in a crucible from coals is not affected by the composition of the original coal, but depends only on the temperature and

the duration of the heating. The crucible coke produced according to Finkener's method at 700° C., resembles coal more closely than the cokes obtained at 900° to 910° C. according to the Bochum or the American method. The latter approach nearest in composition and calorific power to the cokes formed on the large scale in gas-works and in coke-ovens. The slower rise of, and the lower final temperature in dull platinum crucibles, cause the yield of coke to be greater in them than in polished crucibles. Notwithstanding the contentions of Hinrichsen and Tuczak, and of Geipert, to the contrary, the author is of opinion that it is not possible to find a crucible coking method which will afford the same yield of coke as different working methods, which, indeed, differ among themselves. On the other hand, the author would prescribe as a standard method one which gives a coke most closely resembling in composition and calorific power the gas and oven coke. Such a method is the American one, which is convenient to carry out, is applicable to all solid fuels (including those which carbonise without luminous flames), and affords very closely concordant results in parallel tests. As this method is already in general use in those countries—viz., the United States of America and Great Britain—which produce the most coal, it appears to the author that its general adoption is desirable in all conclusive analyses of fuels. The results of the examination are only comparable for different coals if they are referred to the coal or coke free from moisture and ash. The author therefore proposes in general to take for the volatile matter in a fuel—referred to the dry and ash-free substance—the figure obtained by subtracting from 100 the yield of coke as determined by coking 1 grm. of the fuel in a polished platinum crucible according to the prescription of the American Committee on Coal Analysis. This prescription is as follows: "One gramme of the fresh, undried, powdered coal is heated for 7 minutes over the full flame of a Bunsen burner in a platinum crucible weighing 20 to 30 grms., and provided with a tightly fitting cover. The bottom of the crucible, which is supported on a platinum triangle, should be from 6 to 8 cm. above the top of the burner. The flame when burning free, should be 20 cm. high; and care should be taken to protect it from draughts during the determination. The under surface of the cover should remain coated with carbon; but the upper surface should always keep free from it." Analyses for arbitration purposes made in different places by this method on the same sample show differences for the most part of less than 1 per cent. in the yield of coke, and only rarely of as much as 2 per cent.

Alcohol; Highly carburated — as a motor fuel. O. Mohr. Seventh Int. Congr. Appl. Chem., London, 1909.

A MIXTURE of equal quantities of alcohol and benzene has a calorific value within 10 per cent. of that of an equal volume of petrol. This mixture, however, is unsuitable for use as a motor fuel, since the benzene solidifies in cold weather. By using petrol in place of a part of the benzene, a mixture is obtained which will remain unaltered at temperatures down to -25° C.; it boils at -42°-78° C., and can be used in ordinary carburetors.—A. T. L.

Exhaust gases in motor vehicles; Deodorisation of the —. Frenkel. Seventh Int. Congr. Appl. Chem., London, 1909.

THE chief cause of the production of evil-smelling gases by motor-vehicles, apart from imperfect lubrication, is the incomplete combustion of the explosive mixture in the engine. In well constructed motors about 5 per cent. by weight of the petrol escapes complete combustion, or about 18.75 grms. per h.p.-hour. The author proposes to effect a supplementary combustion in the exhaust box or silencer, with the aid of a catalytic agent. The catalytic material tried was finely-divided platinum, deposited on mountain flax, cardboard prepared from the same, or porous porcelain, bundles of the platinised material being enclosed in an iron cylinder closed at both ends by gratings. For a car of about 25 h.p., an element containing about 30 grms. of platinum would be sufficient. Exhaust boxes of the dimensions at present

use would be large enough to accommodate the contact ment or elements, in the case of cars of average power, t for cars of higher power, both the diameter and ight of the exhaust box would have to be increased. e temperature of the gases is sufficiently high to der the catalytic material active without external at, and the heat developed by the combustion may utilised for warming the car in cold weather, or the terior of the exhaust box may be provided with prot- ing wings to increase the cooling by radiation. The ply of air requisite for combustion is furnished by ans of a ventilator (fan) placed between the motor d the radiator, this delivering air to the contact element ough a system of pipes into which the exhaust pipe the motor opens.—A. S.

periments with explosives in regard to explosion of firedamp and coal dust. Mente and Will. See XXII.

Alkali, etc., works report. See VII.

PATENTS.

at; Process and apparatus for the treatment of — W. H. Bradley. Fr. Pat. 397,022, Dec. 2, 1908.

Peat is cut by a machine having rotary knives, and a mixture of peat and water is pumped along a conduit provided with a relief valve to a disintegrating machine where the fibres are broken up and the mixture is rendered homogeneous. The mass is then passed through a vacuum apparatus to extract the dissolved gases and next through centrifugal machine to separate the water. The treated peat is finally dried out of contact with the air a multiple effect apparatus.—W. H. C.

at briquettes; Manufacture of — F. Gaertner. Fr. Pat. 397,071, Feb. 12, 1908.

claim is for the addition of from two to five per cent. humic acid to the peat before briquetting in order to rease the calorific value of the product.—W. H. C.

ke-oven. G. W. Thompson, Collinsville, Ill. U.S. Pat. 924,293, June 8, 1909.

COKE-OVEN, of the beehive type, with an opening at top, has also an opening in its front through which a celed truck may pass. When the truck is drawn out the oven, its brick rear end wall closes the opening in front of the oven completely, and when inside the n, its front end wall closes the lower part of the nging, leaving a free space (for draught regulation), e size of which can be varied by means of an adjustable nper on the wall of the truck.—J. W. H.

s producers. W. A. Bone, Leeds, and R. V. Wheeler, Altofts, Yorks. Eng. Pat. 17,103, Aug. 14, 1908.

E producer, which is mounted above a water trough, nprises an upper cylindrical portion, and a lower tion of inverted conical form, the heights of these two tions being in the ratio of 5 to 2. An outer shell of ilar form, but having the height of the cylindrical tion only one-half that of the conical portion, surrounds conical portion of the producer, so as to form an annular mber to which air and steam are admitted. The lower l of the producer is provided with a grate in the form an inverted truncated cone, and steam jets are provided cooling the grate-bars when the fuel column is allowed descend after the removal of ash. A cylindrical rging bell with its lower end curved inwardly extends vwards from the top plate of the producer for oned the height of the cylindrical portion. The gas outlet ear the top of the producer.—A. T. L.

retorts. A. J. P. Rindon, Copenhagen. Eng. Pat. 8,349, Dec. 29, 1908. Under Int. Conv., July 16, 1908.

order to save space and to facilitate the setting of izontal retorts, the flanges of the retorts are made agonal, with two vertical and two horizontal edges. e retorts may rest one upon another, being supported

by the horizontal edges of the flanges, or they may be arranged with the inclined edges of the flanges in contact. —A. T. L.

Tar from hydraulic mains of coking plants; Device for removing the thick — A. Bremer. Ger. Pat. 209,645, Aug. 6, 1908.

THE device consists of a scraper in combination with a movable framework: when the scraper is drawn in one direction it is held in position with its face in contact with the framework, and is able to displace the tar, but when drawn in the other direction, it is not supported by the framework and glides over the surface of the tar. —A. S.

Filaments of any length for illuminating purposes; Production of pure and thin — A. Kroll, Bruckhausen a/Rhine and B. Saklatwalla, New York. Eng. Pat. 27,144, Dec. 14, 1908. Under Int. Conv., Dec. 13, 1907.

THE filament is made by an adaptation of the Wollaston process for drawing very fine metal wires. Two concentric jets are employed, the colloidal metal or other material being extruded from the central jet and the collodion or other binding paste from the outer, annular jet. The compound rod so obtained is drawn down through a die and the protecting paste is then burned off.—W. H. C.

Alcohol; Process of making a solidified — V. Perelzveich and G. Rosenbusch. Fr. Pat. 397,092, Dec. 4, 1908.

SEE Eng. Pat. 26,915 of 1907; this J., 1908, 826.—T. F. B.

Ammonia from coal gas; Process and apparatus for extracting — Akt.-Ges. f. Kohlendestillation. Fr. Pat. 397,179, Dec. 8, 1908. Under Int. Conv., July 10, 1908.

SEE Eng. Pat. 26,027 of 1908; this J., 1909, 516.—T. F. B.

Incandescence bodies for electric lamps. F. J. Planchon. Fr. Pat. 397,398, Feb. 22, 1908.

SEE Eng. Pat. 4956 of 1908; this J., 1909, 83.—T. F. B.

Filaments for electric lighting; Process of making — from tungsten or other difficultly fusible metals. Siemens und Halske A.-G. Fr. Pat. 397,478, Dec. 10, 1908. Under Int. Conv., Dec. 11, 1907.

SEE Eng. Pat. 25,854 of 1908; this J., 1909, 647.—T. F. B.

Electric conductors. Eng. Pat. 17,621. See XI.A.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Wood distillation; Investigations on — P. Klason, G. v. Heidenstam, and E. Norlin. Z. angew. Chem., 1909, 22, 1205—1214.

IN the present communication the results obtained in the destructive distillation of cotton and of sulphite-cellulose from pine (*Pinus sylvestris*), fir (*Picea excelsa*), birch (*Betula alba*), and red beech (*Fagus sylvatica*) woods, are described. In the tests, 1 kilo. of the cellulose in the form of briquettes of sp. gr. 1.2—1.4, was used. The retort consisted of a vertical copper cylinder surrounded by three concentric jackets. The outer annular space was heated by means of a gas burner, and the products of combustion passed down through the middle space, and then up through the inner annular space. The temperature inside the retort and outside (in the inner annular space) was measured by means of thermocouples. The temperature inside the retort was raised to 270° C. in 4—5 hours, and then the outer temperature was kept constant for some time. The distillation was almost completed in 1—2 hours, during which period so much heat was developed that the temperature inside the retort exceeded that outside by about 80° C. (The amount of heat developed was about 5 per cent. of the

heat of combustion of the cellulose.) The retort temperature was subsequently raised gradually to 380° C., the temperature in the annular space being then 400° C. It was observed that the evolution of gas was insignificant below 260° C., but then increased strongly; the amount of gas was still fairly large between 300° and 375° C. and always increased rapidly when the temperature was raised accidentally. The gas evolved between 275° and 350° C. contained about 75 per cent. of carbon dioxide; but towards the end, more carbon monoxide was formed, the carbon dioxide content falling to about 50 per cent.; methane was also formed in larger quantity towards the end of the distillation. The gas did not contain hydrogen or aromatic hydrocarbons. The heat of combustion of the gas was about 3.5 per cent. of that of the original cellulose. The chief proportion of the distillation products came over during the first stage of the process, the amount gradually increasing between 250° and 300° C., and only a small quantity coming over between 300° and 380° C. The chief results of the tests are shown in the following table:—

	Cellulose from:				
	Cotton.	Pine.	Fir.	Birch.	Beech.
<i>Percentage composition of material carbonised.</i>					
Water	4.82	5.6	6.44	6.65	7.81
Ash	0.13	0.41	0.19	0.92	0.77
Organic matter	95.05	93.96	93.07	92.43	91.42
<i>Relative percentage proportions of distillation products.</i>					
Charcoal	38.82	36.93	34.86	33.39	32.91
Carbon dioxide	10.35	12.83	11.94	11.14	11.96
Ethylene	0.17	0.21	0.19	0.41	0.25
Carbon monoxide	4.15	3.40	3.92	3.49	3.80
Methane	0.27	0.27	0.22	0.47	0.39
Methyl alcohol	traces	traces	0.07	—	0.19
Acetone	0.07	0.08	0.13	0.15	0.26
Acetic acid	1.39	2.18	2.79	3.89	3.50
Org. matter in sodium acetate	5.14	4.22	8.50	7.72	8.67
Tar	4.18	4.85	6.28	9.58	7.23
Water	34.52	34.17	29.99	29.35	31.88
Loss	0.94	0.86	1.11	0.40	0.93

It will be noticed that the cellulose from birch and beech yielded more acetic acid than that from cotton, pine, and fir. Also the charcoal from birch and beech celluloses contained about 2 per cent. more carbon than that from cotton, pine, and fir celluloses. (See also this J., 1909, 132, 417.)—A. S.

Kerosene; Relation between the temperature of — and the explosion pressure of the supernatant mixture of air and vapour. W. P. Bradley and C. F. Hale. J. Ind. and Eng. Chem., 1909, 1, 345—351.

SAMPLES of kerosene were placed in a strong brass cylinder provided with a pressure indicator, and after heating in a water-bath to a definite temperature, air was caused to bubble through the oil, and the mixture of vapour and air exploded. Measurements were made over a range of temperature from a few degrees below the flashing point, as determined by the closed cup test, to several degrees above the fire point (ignition point) as determined by the open cup test. The results are given in tables and curve-diagrams. They show that at the flashing point (closed cup), a mixture of air and vapour is produced which will yield an explosion pressure of from 15 to 25 lb., whilst at the open cup flashing point, the mixture gives an explosion pressure almost equal to the maximum attainable with the sample. The flashing point determined by the closed cup test indicates most nearly the temperature at which danger from explosion is to be feared. At the ignition point, the oil vaporises so rapidly that the mixture of air and vapour, rich in vapour, gives an explosion pressure less than the maximum attainable.—A. S.

Pyridine; Commercial — and its value as a solvent K. G. MacKensie. J. Ind. and Eng. Chem., 1909, 1, 360—362.

COMMERCIAL pyridine, which consists of pyridine, picoline and water, was found to be unsatisfactory as a solvent for bitumens and rubber. This is due mainly to the presence of water, which forms with pyridine a definite hydrate, b.pt. 94.4° C. (compare Goldschmidt and Constan this J., 1884, 159), having very little solvent action on bitumens. If the commercial pyridine be distilled, the hydrate comes over at its boiling point, and the distillate obtained subsequently, namely "pyridine" (115°—118° C. and "picolines" (134°—144.5° C.) have a much greater solvent power than the original sample. The "picolines" are superior to pyridine in this respect and in some cases are even superior to carbon bisulphide. The flash- and ignition points of commercial pyridine and its distillation products, as determined in a 4 oz. open tin dish of 2½ in. diam., are shown in the following table:—

	Flashing point, °C.	Ignition point, °C.
Pyridine hydrate (40% H ₂ O)	35	55
Pyridine (b.pt. 115°—118° C.)	17	17
Picoline (b.pt. 125°—131° C.)	25	30
" (b.pt. 131°—136° C.)	33	40
" (b.pt. 144.5° C.)	42	48
Crude pyridine	31	38

—A. S.

Petroleum production of the United States. U.S. Geological Survey, June, 1909. [T.R.]

State.	1907.		1908.	
	Quantity barrels.	Value, \$.	Quantity barrels.	Value, \$.
California	39,748,375	14,699,056	41,854,737	23,433,5
Colorado	331,851	272,813	379,053	346.4
Illinois	24,281,973	16,432,947	33,085,106	22,648.2
Indiana	5,128,637	4,586,930	3,283,620	3,203.8
Kansas	2,409,521	965,134	1,801,781	746.6
Kentucky	820,844	862,396	727,767	706.8
Tennessee	820,844	862,396	727,767	706.8
Louisiana	5,000,221	4,063,033	6,835,130	4,131.1
Michigan	4,000	6,500	15,246	22.5
New York	1,212,300	2,127,748	1,160,128	2,071.6
Ohio	12,207,148	14,709,888	10,858,797	14,178.6
Oklahoma	43,721,128	17,513,524	45,798,765	17,694.8
Pennsylvania	9,999,306	17,579,706	9,424,325	16,881.1
Texas	12,322,696	10,401,863	11,206,464	6,700.7
Utah	9,339	21,883	17,775	27.9
Wyoming	9,095,296	15,852,428	9,523,176	16,911.1
West Virginia	9,095,296	15,852,428	9,523,176	16,911.1
Totals	109,095,335	120,108,749	179,572,479	129,706.1

THE increased activity in the three great fields—California, Oklahoma, and Illinois—was the dominant feature of the situation rather than the discovery and opening of a considerable new fields. The principal new field to give prominence was the Caddo pool, in North-West Louisiana.

Bitumens; Experimental contribution to the knowledge of the —. G. Maderna. Seventh Int. Congr. Appl. Chem., London, 1909.

THE bitumens contained in the asphaltums from different parts of Italy have similar properties to those derived from other sources. They dissolve partially in alcohol and in ether, and completely in chloroform. The portion soluble in alcohol is a yellowish viscous mass at ordinary temperature, possessing the characteristic odor of bituminous substances; that soluble in ether is a black substance melting at about 60°—70° C., and the portion insoluble in alcohol and ether is a shining black substance, which is inodorous and melts at a high temperature. All three portions contain unsaturated compounds, the iodine value varying according to the origin.

the substance, but being tolerably constant for a particular fraction of a given bitumen. On the other hand, the percentage of sulphur increases sometimes considerably from the less condensed to the more condensed portions. The bitumens give the cholesterol action. From the results of experiments on the distillation of mineral oils in presence of air and of sulphur the ordinary pressure and under increased pressure, the author concludes that bitumens are formed by the action of sulphur on hydrocarbons, leading to the formation of unsaturated compounds. Sulphur may have participated in the formation of bitumens, although not present in the products. The formation of bitumens probably takes place in two stages, *viz.*, (1), condensation of unsaturated compounds, and (2), polymerisation. The action of light on the different fractions of the bitumens is quantitatively different although qualitatively the same: under similar conditions, the more condensed portions are rendered insoluble to a greater degree than the less condensed fractions.—A. S.

Determining sulphur by catalytic method. Maderna. See XXIII.

Alkali, etc., works report. See VII.

Ethylglyoxal as a colour reagent [for phenols, etc.]. Denigès. See XX.

Bituminous road binders. Forrest. See IX.

PATENTS.

Retort [for peat]. L. Augustin, St. Hyacinthe, Canada. Assignor to L. Daudelin, St. Hyacinthe, and Peat, Gas and Coal Co., Montreal, Canada. U.S. Pat. 924,305, June 8, 1909.

The retort consists of a cylinder with a fixed cover at one end carrying a hollow shaft for the removal of the peat, and a removable cover at the other end for charging and discharging the peat which is contained in a loose stridge or cylindrical frame. The retort is mounted for rotation in a brickwork furnace with a central fire grate, a fixed bearing being fitted to the hollow shaft and a swinging bearing for the shaft on the removable cover. While charging and discharging, the open end of the retort is carried by a roller bearing arranged in the brickwork and surrounding the body of the retort.

—J. W. H.

Ammonia and tar; Process of obtaining — H. Koppers, Essen-on-the-Ruhr, Germany. Re-issue No. 12,971, June 8, 1909, of U.S. Pat. 862,976, Aug. 13, 1907.

Gases from the dry distillation of fuels, after being cooled to condense the tar and water, which are removed in a separator, are superheated and led, for the absorption of the ammonia, into an acid bath. This bath is kept at uniform concentration by the constant addition of acid and the removal of the crystals formed, the drainings in the latter running back into the bath.—J. W. H.

Petroleum; Distilling — F. Seidenschmied, Charlottenburg, Germany. Eng. Pat. 10,959, May 20, 1908. Under Int. Conv., Nov. 5, 1907. Addition to Eng. Pat. 10,892 of 1908.

Steam and oil outlets described in the original patent (S. J., 1909, 649) are combined to form injectors or spraying nozzles and are directed against one another at the end of being arranged radially, in order to prevent dead space, where there is no circulation, being formed at the centre of the still.—W. H. C.

Petroleum sludge; Process of treating and separating acid from — J. L. Gray, Elizabeth, N.J. U.S. Pats. 23,427, 923,428, and 923,429, June 1, 1909.

A major portion of the acid is allowed to separate and then drawn off. The sludge is next heated, and steam is injected into the mass. The lighter grades of hydrocarbons rise successively to the top and are removed, leaving a residue of pitch or asphaltum. In order to

facilitate the separation of the acid, the acid separated from a previous operation is used to wash the untreated sludge.—W. H. C.

Nitro compounds; Process of producing — O. Boeters and R. Wolfenstein, Berlin. U.S. Pat. 923,761, June 1, 1909.

See Eng. Pat. 17,521 of 1907; this J., 1907, 1194.—T. F. B.

Petroleum; Apparatus for the industrial manufacture of a new spirit by the treatment of — A. Testelin and G. Renard, Brussels. Eng. Pat. 16,881, Aug. 11, 1908.

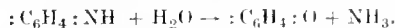
See Fr. Pat. 393,554 of 1908; this J., 1909, 133.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

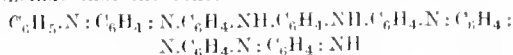
Aniline Black. II. R. Wüstätter and S. Dorog, Ber., 1909, 42, 2147—2168. (Compare this J., 1907, 755.)

THE authors discuss first the oxidation of aniline to quinone. They show that in this process phenylhydroxylamine can play no part for it does not yield quinone on oxidation with bichromate and sulphuric acid but only nitrosobenzene. In oxidising aniline with this oxidising mixture, Aniline Black is the first intermediate product and this is then further oxidised to quinone. This Aniline Black contains no oxygen and is no derivative of phenylhydroxylamine or aminophenol; as a matter of fact neither of these gives Aniline Black. Neither is it possible that phenylhydroxylamine is formed and then condenses with aniline to aminodiphenylamine as Nover suggested (this J., 1907, 145), for (1) the latter compound, when oxidised with bichromate and sulphuric acid gives mostly Emeraldine which is not produced in oxidising aniline by the same means; (2), aminodiphenylamine gives with bichromate and sulphuric acid only about 60 per cent. of quinone under the same conditions in which aniline gives more than 85 per cent. of quinone; and (3), in a mixture of phenylhydroxylamine and aniline a mixture of bichromate and sulphuric acid oxidises first the former to nitrosobenzene and then the latter to Aniline Black. With regard to the actual formation of quinone from Aniline Black, by oxidation with bichromate and sulphuric acid under Nietzki's conditions, the authors have obtained 88—89 per cent. of the theoretical amount of quinone; about one-eighth part is thus lost. When however the necessary amount of bichromate for producing Aniline Black is added to aniline sulphate and then oxidation by lead peroxide is effected, the remarkable fact has been discovered that the yield of quinone is now increased to 95 per cent. of the theoretical amount, which is as much as is obtained by the oxidation of *p*-phenylenediamine or *p*-aminophenol. This is considered to prove that the leuco-compound of Aniline Black consists of the indamine chain, $C_6H_5.NH.[C_6H_4.NH]_6.C_6H_5.NH_2$.

A molecular-weight determination of Aniline Black has been carried out by hydrolysing it with dilute sulphuric acid. By this operation one-eighth part of the nitrogen is evolved as ammonia thus:—



The Black produced is of a much deeper colour than the original substance. Further the composition of the Aniline Black produced by the cold oxidation of aniline with bichromate and sulphuric acid has been investigated and it is found that: (1), for 1 mol. of aniline, 1.27 atoms of oxygen are required, the formula of the authors ($C_6H_4.4N$), requiring 1.25 atoms; (2), the maximum yield (97 per cent. of the theory) is obtained by using $1\frac{1}{4}$ atoms of oxygen; and (3), repeated analyses agree with the composition $C_6H_4.5N$. From these facts the authors conclude that the constitution of Aniline Black is:—



the position of the internal quinonoid linking being arbitrarily selected.—J. C. C.

1-Methoxy-4-aminobenzene-2-sulphonic acid. R. Bauer. Ber., 1909, 42, 2106—2111.

p-ANISIDINE (10 grms.) is added to 20 c.c. of cold, concentrated sulphuric acid and when all is dissolved, 22 c.c. of fuming sulphuric acid (containing 20 per cent. of sulphur trioxide), are added and the whole warmed for 15—20 minutes at 55° C. On pouring on ice, the sulphonic acid is precipitated and is purified by crystallising from water. This acid has been proved to be 1-methoxy-4-aminobenzene-2-sulphonic acid by methylating the known 1-hydroxy-4-aminobenzene-2-sulphonic acid (through the benzylidene derivative) when the two preparations were found to be identical. The diazo-compound of this anisidinesulphonic acid is well crystallised and gives a blood-red dyestuff with β -naphthol. —J. C. C.

meri-Quinone-imines. III. R. Willstätter and J. Piccard. Ber., 1909, 42, 1902—1907

WHEN a dilute solution of *p*-aminophenol hydrochloride (1.45 grms.) is oxidised in the cold with half the theoretical amount of ferric chloride (161 grms.), a violet dyestuff, $C_{12}H_{10}O_2N_2.HCl$, is precipitated which is very unstable. On reduction with stannous chloride it yields a leucobase which is 5 (or 2)-amino-2(or 5) : 4-dihydroxydiphenylamine. On oxidation with chromic acid this leuco-compound yields benzoquinone. —J. C. C.

Triphenylmethane dyestuffs; Substituted —. H. Finger. J. prakt. Chem., 1909, 79, 492—497.

TRICHLOROMAGENTA is prepared from methylenedi-*o*-chloroaniline by first converting this into *pp'*-diamino-*mm'*-dichlorodiphenylmethane by heating it with *o*-chloroaniline and the hydrochloride of the latter in alcoholic solution for 8 hours under a reflux condenser. The dihydrochloride of the base melts at 201° C. This base is heated with *o*-chloroaniline, the hydrochloride of the latter, and arsenic acid, thereby being transformed into Trichloromagenta. The dyestuff forms a dark red powder with a metallic green reflex. The dyeings obtained are slightly brighter than those produced by New Magenta. For the preparation of Trimethoxy-*p*-magenta, *pp'*-diamino-*mm'*-dimethoxydiphenylmethane, obtained from methylenedi-*o*-anisidine is converted into the diacetyl derivative; this is oxidised with potassium bichromate and sulphuric acid to diacetyldiaminodimethoxybenzophenone and, after eliminating the acetyl groups, this is reduced with sodium amalgam in alcoholic solution to diaminodimethoxydiphenylcarbinol; or diaminodimethoxydiphenylmethane or methylenedi-*o*-anisidine is heated with *o*-anisidine hydrochloride, *o*-nitroanisole, and ferric chloride when Trimethoxy-*p*-magenta is obtained. It forms a copper coloured mass with a green reflex and the dyeings obtained from it are more violet than those produced by New Magenta. —J. C. C.

Coal-tar dyestuffs; Manufacture of — in the United States. J. F. Schoellkopf. Seventh Int. Congr. Appl. Chem., London, 1909.

THE reasons for the retarded growth of the coal-tar dyestuff industry in the United States, which, prior to the Tariff Act of 1883, was in a flourishing condition, is considered to be due to the unfavourable tariff legislation of 1883, when no less than five distinct coal-tar dyestuffs factories retired from the field. The Tariff Act of 1897, however, made progress in the United States possible, and in the ten years next succeeding, the industry made greater strides than it had in the preceding 30 years. With a prospect of better tariff protection and of suitable modification of the Patent Laws, combined with a renewed supply of suitable coal-tar hydrocarbons to be obtained by the new systems of coking coal now being adopted in the United States, it seems not at all impossible that the United States may, in the course of time, become exporters of coal-tar dyestuffs instead of being importers.

Aside from alizarin and anthracene colours, which have been duty-free, the list of dyestuffs manufactured is fairly complete. American needs of Magentas, Chrysoidines, Bismarck Browns, Aniline Blues, Nigrosines, and the like are practically supplied by makers in the United States;

large quantities of direct cotton dyestuffs, Acid Blacks, Acid Reds, and Acid Blues are also made in the United States.

The total output of coal-tar dyestuffs made in the United States is placed at 4,000,000 pounds, valued at considerable above 1,000,000 dols., and for the last ten years the rate of increase in domestic production has been about twice as great as the rate of increase in importations.

Alcohol; Tax-free denatured grain — in the manufacture of coal-tar dyestuffs in the United States. G. A. Prochazka. Seventh Int. Congr. Appl. Chem., London, 1909.

THE author states that the use of tax-free denatured alcohol made possible by United States legislation in force since January 1st, 1907, has had no effect on the manufacture of coal-tar colours within the United States; this he ascribes to the regulations established by the Commissioner of Internal Revenue in order properly to protect the revenue, and characterises them as cumbersome, inquisitorial, annoying and not at all feasible, and as making the use of the tax alcohol preferable to the use of the denatured alcohol under such restrictions.

Dyestuffs derived from gallic acid. E. Ehrmann. Seventh Int. Congr. Appl. Chem., London, 1909.

WHEN gallic acid is condensed with diphenyl-*m*-phenylenediamine, a dyestuff is produced which gives blue shades on cotton mordanted with iron, aluminium, or chromium. From gallic acid and *m*-hydroxydiphenylamine a dyestuff of similar properties is obtained, but the shades produced are red. —J. C. C.

Paranitrosomethylaniline; a new intermediate product for the manufacture of dyestuffs. J. C. Cain. Seventh Int. Congr. Appl. Chem., London, 1909.

IN view of the very extensive use of paranitrosodimethylaniline in the colour industry it is surprising that the corresponding derivative of methylethylaniline has not yet been described. *p*-Nitrosomethylethylaniline, $NO_2.C_6H_4.N(CH_2CH_3)_2$, is readily prepared by treating methylethylaniline hydrochloride with nitrous acid as in the case of the analogous dimethyl compound. The hydrochloride forms yellow needles, and the free base crystallises from dilute alcohol in green plates melting at 66°—67°. The author is engaged in studying the reactions of this compound. Paranitrosomethylethylaniline can obviously be used in the manufacture of a large number of dyestuffs, and as an example of these the author has prepared the corresponding Methylene Blue in which the dimethyl groups of ordinary Methylene Blue are replaced by the methylethyl groups. This new dyestuff may conveniently be called Methylene Blue M.E. (i.e., methylethyl); it dyes tannin-mordanted cotton in shades which are much greener than those produced by ordinary Methylene Blue.

Monoacetyl derivatives of diamines of the benzidine type. Preparation of —. J. C. Cain. Seventh Int. Congr. Appl. Chem., London, 1909.

THE monoacetyl derivatives of benzidine, tolidine, dianisidine and dichlorobenzidine (of which the first was obtained in very small yield by Schmidt and Schuch in 1879 (Ber., 12, 489), can very readily be prepared in good yield by treating a cold dilute alcoholic solution of the base with acetic anhydride. One molecular proportion of acetic anhydride is added to one molecular proportion of the dissolved base, the solution is neutralised with ammonia, filtered hot (from any diacetyl compound), and water added until a turbidity is produced when, on cooling, the pure monoacetyl compound separates. Under the conditions benzidine yields about 2 parts of the monoacetyl to 1 of the diacetyl derivative, tolidine about 3 to 1, dichlorobenzidine, mostly monoacetyl, with very little of the diacetyl compound, and dianisidine gives only the monoacetyl derivative. Monoacetyltolidine, $CH_3.CO.NH.C_6H_3(NH_2)_2.H_2O$, has already been described by the author (Trans. Chem. Soc., 1909, 95, 714). The following compounds are here described for the first time. Monoacetyldianisidine, $CH_3.CO.NH.C_6H_3(H_2O.NH_2)_2$, is readily soluble in alcohol and crystallises from water

hite nodules, m.p. 67°. The water of crystallisation is lost at 100° and the anhydrous substance melts at 116°. 3:3'-*ichloromonoacetylbenzidine*, $\text{CH}_3\text{CO.NH.C}_{12}\text{H}_6\text{Cl}_2\text{.NH}_2$, dissolves easily in alcohol but sparingly in water, and forms feathery crystals m.p. 104°—105°. 3:3'-*Dichlorodiacylbenzidine*, $\text{C}_{12}\text{H}_6\text{Cl}_2\text{(NH.CO.CH}_3\text{)}_2$, crystallises from glacial acetic acid in fine white needles, m.p. 302°.

The ready production of the above monoacetyldiamines makes it now possible to obtain asymmetrical diazo-estuffs or other compounds in the preparation of which an exact "half-diazotisation" of the diamines is necessary, an acetyl group being hydrolysed after the combination of the first component. It is well known that the "half-diazotisation" of benzidine, etc., cannot be satisfactorily accomplished.

Triphenylcarbinol and tritolylcarbinol; Action of amines on —. A. G. Green and A. E. Woodhead. Seventh Int. Congr. Appl. Chem., London, 1909.

THERE are considerable grounds for regarding the so-called phenylation" of rosaniline salts, on heating with aniline, as a typical "quinonoid" reaction consisting in the direct lifting off of a quinonimide group and replacement by a quinylimino-group. Upon this view the trimethoxyd trihalogen derivatives of triphenylcarbinol, which also readily give rise to Aniline Blue on heating with aniline, could likewise be regarded as reacting in their quinonoid state:

- (a) $\text{R}_3\text{C:C}_6\text{H}_4\text{:NH}_2\text{Cl}$.
- (b) $\text{R}_3\text{C:C}_6\text{H}_4\text{:O(CH}_3\text{)}_3\text{Cl}$.
- (c) $\text{R}_3\text{C:C}_6\text{H}_4\text{:I.Cl}$.

In view of the possible quinonoid structure of the coloured salts of triphenylcarbinol itself, this body was omitted to the action of aniline and of other bases in the presence of their hydrochlorides. On heating triphenylcarbinol with aniline (two parts) and aniline hydrochloride (six parts) for ten or twelve hours at 180° a deep red melt was obtained, from which, however, only a small quantity of dyestuff could be isolated, the main product of the reaction being the aminotetraphenylthane of Ullmann and Münzhuber (Ber., 36, 407). The properties of the product do not correspond to those of a triphenylmethane colouring matter, but to a dyestuff of the Induline class. It appears, therefore, that an reduction of the phenylimino-group does not occur; that the triphenylcarbinol merely acts as an oxidising agent on the aniline. This is confirmed by the fact that paratoluidine is substituted for aniline, no colouration occurs. On the other hand, orthotoluidine gives a red very similar to Magenta, and dimethylaniline a violet similar to Methyl Violet. Triparatolylcarbinol is found to give quite similar reactions with the reactive amines. In all cases the yield of dyestuff is small.

Sanderswood; Colouring matter of —. J. C. Main and P. May. Seventh Int. Congr. Appl. Chem., London, 1909.

SANDERSWOOD, the colouring matter contained in red sanderswood (*Petrocapus santalinus* L.) has the formula, $\text{C}_{15}\text{H}_{11}\text{O}_5$, contains one methoxyl group.

Dyestuffs in aqueous solution; Condition on some —. L. Knecht and J. P. Batey. Seventh Int. Congr. Appl. Chem., London, 1909. (See also J. Soc. Dyers and Col., 1909, 25, 194–203.)

IN the present work a number of dyestuffs have been prepared in a state of purity, and the conditions of their aqueous solutions examined by determinations of their electrical conductivities, ebullioscopic determinations of molecular weights, and experiments in simple diffusion. Direct cotton colours investigated were Benzopurpurine B, Erika B, and Chrysophenine. The other dyestuffs used were Soluble Blue (free sulphonic acid) and Methyl Yellow S. The electrical conductivities of aqueous solutions of these substances, measured at 15° and 18°, showed that they behaved as normal electrolytes, being highly dissociated in weak solutions.

Similarly, the determinations of their molecular weights by the boiling point method indicated that dissociation was taking place.

Experiments with solutions of the above dyestuffs showed that they all possessed the property of diffusing into pure water, in the absence of a diaphragm. Comparative tests on the rate of diffusion of picric acid, Benzopurpurin and Soluble Blue indicated that the two latter compounds were dissociated and non-colloidal. Positive and corroborative evidence is thus adduced to prove that the aqueous solutions of the dyestuffs experimented with are not colloidal in character.

Dyes in solution; State of certain —. S. E. Sheppard. Seventh Int. Congr. Appl. Chem., London, 1909.

(a) IN the aqueous solutions of certain dyestuffs—Isocyanine, Pinacyanol, Cyanine—the dyestuff is present partially or wholly in colloid solutions, and the absorption spectrum differs markedly from that of a true solution. (b) In other aqueous solutions of dyestuffs, the change from true to colloid solution is accompanied by a broadening and diffusion of the absorption band, due to increase in number and size of the particles, a physical change greatly modifying the absorption. Deviations from Beer's law result. (c) The state of dyestuffs in solid media is comparable to that in liquids, and the absorption spectrum may in many cases be used as a criterion. (d) The solution of dyestuffs appears to be due to a combined process of disaggregation of the solute—the dyestuff—accompanied by a progressively increasing combination with the solvent. If the same state of solution be attained in different solvents, the absorption maxima are displaced in accordance with Kundt's law.

Certified food colours (U.S.A.). Kohnstamm. See XVIII.1.

Application of physico-chemical methods to technical problems. [Examination of inks.] Hinrichsen. See X.

PATENTS.

Disazo-dyestuff; Manufacture of a —. Act.-Ges. f. Anilinfabr., Berlin, Germany. Eng. Pat. 7905, Apr. 2, 1909. Under Int. Conv., Apr. 14, 1908.

A DISAZO-DYESTUFF can be made by combining one molecular proportion of the diazo-derivative of *p*-aminophenylarsinic acid with one molecular proportion of 1:8:3:6-aminonaphtholdisulphonic acid in acid solution, and then combining the intermediate product thus obtained with another molecular proportion of the diazo-derivative of *p*-aminophenylarsinic acid in alkaline solution. There is thus obtained a blue dyestuff easily soluble in water which is useful in medicine.—P. F. C.

Thioaniline sulphonic acids; Process for preparing —. Act.-Ges. f. Anilinfabr. Ger. Pat. 210,564, July 21, 1907.

p-NITROCHLOROBENZENESULPHONIC acid is condensed with *p*-nitrothiophenol or one of its sulphonic acids in alkaline solution; the dinitrodiphenylsulphide sulphonic acids thus obtained are converted into the corresponding sulphonic acids of thioaniline by reduction, e.g., with zinc dust in alkaline solution.—T. F. B.

Dyestuffs; Manufacture of —. R. B. Ransford, London. From L. Cassella und Co., Frankfurt-on-Maine, Germany. Eng. Pat. 20,709, Oct. 1, 1908.

IF sulphonic acids of carbazole (preferably the disulphonic acid), are condensed with tetraalkyldiaminodiphenylcarbinol, valuable green acid dyestuffs are obtained. Example: 8.5 kilos. of carbazole are introduced into 90 kilos. of sulphuric acid monohydrate at the ordinary temperature and the solution is heated to about 90° C. until a sample is completely soluble in water. The mixture is then cooled to 20° C. and 13.5 kilos. of tetramethyldiaminodiphenylcarbinol are added and the whole is heated to 50° C. until the latter has disappeared. The mixture is then cooled and stirred into 45 kilos. of ice and 90 litres of water. The leucosulphonic acid separates in colourless needles which are filtered off, washed and dried. To obtain the dyestuff, the leuco-

compound is dissolved in water together with the necessary quantity of sodium hydroxide and firstly lead peroxide and then acetic acid are added to the well-cooled and briskly stirred solution. When the oxidation is complete, the lead is precipitated as sulphate and the dyestuff is separated in the usual manner. It dissolves in hot alcohol with a bluish-green colour and in concentrated sulphuric acid with a pure yellow colour. In an acid bath, wool is dyed a green shade fast to alkali; the baths are completely exhausted.—P. F. C.

Vat dyestuff; Red —, and process of making same. G. Engli, Assignor to Soc. Chim. Ind. in Basle, Switzerland. U.S. Pat. 923,959, June 8, 1909.

A RED vat dyestuff is obtained by boiling one molecule of a derivative of phenylthioglycol-*o*-carboxylic acid with one molecule of an acetyl derivative of isatin, in the presence of a condensing agent capable of transforming the phenylthioglycol-*o*-carboxylic acid derivative into an intermediate oxythionaphthene compound. The shades produced by the dyestuff are fast to washing, light and chlorine.—J. C. C.

Anthraquinone series; Production of various of the —. Soc. pour l'Ind. Chim. a Basle. Fr. Pat. 397,444, Feb. 24, 1908.

By treating mono- and di-aminoanthraquinones with carbonyl chloride, corresponding ureas are produced which are vat dyestuffs giving fast yellow, gray and brown shades. The operation is carried out by passing carbonyl chloride into a solution of the amine in nitrobenzene at the boiling point. If a mixture of two different aminoanthraquinones is employed in molecular proportions, a mixed dianthraquinoylurea is produced.—J. C. C.

Dyestuffs [Azo] insoluble in water; Production of —. Badische Anilin und Soda Fabrik. First Addition, dated Dec. 5, 1908 (Under Int. Conv., March 2 and Aug. 31, 1908), to Fr. Pat. 373,475 of Jan. 11, 1907.

THE lakes described in the chief patent (this J., 1907, 680) are not entirely insoluble in oil and it has now been found that if the amines there mentioned are replaced by 2-chloro-5-nitro-*p*-toluidine, 6-chloro-4-nitro-*m*-toluidine, or 4:5-dichloro-*o*-nitraniline, the lakes produced are not only extremely fast to light, heat, alcohol, lime, etc., but are absolutely insoluble in oil. 6-Chloro-4-nitro-*m*-toluidine is prepared by nitrating 6-chloroaceto-*m*-toluidide and subsequent saponification. It is easily separated from the 6-chloro-2-nitro-*m*-toluidine which is formed at the same time, as it is less soluble in alcohol. It crystallises in brown yellow prisms melting at 158°—159° C.—J. C. C.

Dyestuffs dyeing cotton direct; Process for the production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 397,613, Dec. 18, 1908. Under Int. Conv., Feb. 18, 1908.

DYESTUFFS dyeing cotton direct are prepared by combining the tetrazo-derivative of a paradiamine with one molecular proportion of a 1-acetyl-amino-8-naphthol-mono-, di- or poly-sulphonic acid and with one molecular proportion of a monoacetylated metadiamine in which the para-position with regard to the free amino-group is free. The dyestuffs can be diazotised and developed on the fibre, furnishing pure blue shades which are discharged by hyposulphite (hydrosulphite) to a pure white. In the example given, the tetrazo-derivative of dianisidine is combined with one mol. of 1-acetyl-amino-8-naphthol-4:6-disulphonic acid and with one mol. of 4-acetyl-amino-2-aminotoluene. This dyestuff gives violet shades on cotton which when diazotised on the fibre and developed with β -naphthol are transformed into greenish-blue.—J. C. C.

Monoazo dyestuffs; Process for preparing mordant —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 210,597, Feb. 20, 1908.

MORDANT-DYEING azo dyestuffs are obtained by combining the diazo compounds of such *o*-aminophenol or *o*-amino-

cresol derivatives as contain nitro groups or halogens or both, but not sulphonic or carboxylic acid groups with alkyl or aryl derivatives of *m*-aminophenol or *m*-aminocresols. Seventeen such dyestuffs are described which produce shades on chromed wool varying from red to brown and black.—T. F. B.

Pentabromindigo; Manufacture of — and of an intermediate product. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brünig, Höchst on Maine, Germany. Eng. Pat. 13,789, June 29, 1908. SEE Fr. Pat. 392,638 of 1908; this J., 1909, 17.—T. F. B.

Indigo white or a substitution product thereof; Manufacture of brominated derivatives from —, and of dyestuffs from such derivatives. Farbwerke vorm. Meister, Lucius, und Brünig, Höchst on Maine, Germany. Eng. Pat. 18,023, Aug. 27, 1908. Under Int. Conv. Aug. 31, 1907.

SEE Fr. Pat. 393,279 of 1908; this J., 1909, 18.—T. F. B.

Colouring matters for animal fibres and compounds processes and methods allowing these colouring matters to be obtained. H. B. Vidal, Paris. Eng. Pat. 15,000, July 15, 1908. Under Int. Conv., Aug. 29, 1907.

SEE Fr. Pat. 391,465 of 1907; this J., 1908, 1150.—T. F. B.

Dyestuffs of the galloquin series; Manufacture of new —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 20,368, Sept. 28, 1908.

SEE Fr. Pat. 396,564 of 1908; this J., 1909, 595.—T. F. B.

Azo dyestuff. J. Jansen and W. Neelmeier, Leverkusen Assignors to Farbenfabr. vorm. F. Bayer und Co. Elberfeld, Germany. U.S. Pat. 924,231, June 8, 1909. SEE Fr. Pat. 395,824 of 1908; this J., 1909, 469.—T. F. B.

Azo dyestuff. J. Jansen and W. Neelmeier, Leverkusen Assignors to Farbenfabr. vorm. F. Bayer und Co. Elberfeld, Germany. U.S. Pat. 924,232, June 8, 1909. SEE Ger. Pat. 208,498 of 1908; this J., 1909, 469.—T. F. B.

Azo dyestuffs; Production of new mordant —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 397,577, Nov. 1, 1908. Under Int. Conv., Feb. 19, 1908.

SEE Ger. Pat. 210,597 of 1908; preceding.—T. F. B.

Hair dyestuff. E. Erdmann, Halle on Saale, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 923,616, June 1, 1909.

SEE Eng. Pat. 14,212 of 1905; this J., 1906, 532.—T. F. B.

p-Phenylenediamine, its homologues and substitution products; Process for producing —. Act.-Ges. f. Anilinfabr. Fr. Pat. 397,443, Feb. 24, 1908.

SEE Ger. Pats. 202,170, 202,564, 202,565, and 204,811 of 1908; this J., 1908, 1147, and 1909, 86.—T. F. B.

Aniline, its homologues and substitution products; Process for producing —. Act.-Ges. f. Anilinfabr. Fr. Pat. 397,485, Feb. 25, 1908.

SEE Eng. Pat. 3966 of 1908; this J., 1908, 1147.—T. F. B.

p-Aminophenol and its derivatives; Process for producing —. Act.-Ges. f. Anilinfabr. Fr. Pat. 397,515, Feb. 26, 1908.

SEE Eng. Pat. 4044 of 1908; this J., 1908, 1147.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Colloidal state; Recent developments of the theory of — and their bearing on the dyeing and cleaning of textile fibres. E. Feilmann. J. Soc. Dyers and C., 1909, 25, 158—160.

THE distinction between colloidal and crystalline chemical compounds is becoming untenable; it was formerly

considered to be a characteristic of colloids that they could not diffuse through a semipermeable membrane, as crystalloids would, but Bechhold and others have shown that such membranes can be graded so well so that "colloids" can be separated from one another according to the size of their particles and other factors. According to von Weimarn all matter is essentially crystalline, a view which he has supported by much experimental evidence. H. Wislicenus has prepared aluminium hydroxide and oxide in a fibrous form which shows most of the essential properties of the natural fibres, including their strong adsorptive power. Pelet-Jolivet and Wild (this J., 1908, 1106) have shown that dyestuffs in solution are ionised electrolytes, containing large organic dyestuff ions and small inorganic ions. V. Spring (this J., 1909, 430) in a study of the cleansing action of soaps, shows that soap solutions, especially at certain definite concentrations, form suspensions with defatted, finely divided charcoal and other materials which can be filtered unchanged through ordinary filter paper. The soap appears to exercise a kind of "peptonising" action, and is itself partially decomposed into more acid and more basic portions. It may be supposed, in accordance with the views of Pelet-Jolivet and Andersen (this J., 1908, 1149), that in the process of dyeing the colour ions are attracted by the oppositely charged fibre, which may be considered to be built up of ultimate crystalline particles felted together with their crystalline axes promiscuously arranged: the dye liquor, carrying the colour ions, will penetrate this network. The forces of attraction may be pictured as sufficient to enable the colour ions to penetrate deeply into the fibre substance, where they are surrounded by the fibre particles. They may be supposed to be retained there either because the fibre substance acts as a protective colloid or because the neutralisation of the electric charges is accompanied by chemical action between dyestuff election and fibre substance.—E. F.

Indigo; Further notes on the determination of — in dyed cotton fabrics. E. Knecht. J. Soc. Dyers and Col., 1909, 25, 160—161.

THE method recently described (this J., 1909, 518) for the determination of indigo in dyed cotton fabrics, had the disadvantage that the amount of time required for the filtration of the precipitated indigotin varied considerably. This difficulty has now been overcome by diluting the solution of the fabric in sulphuric acid with four times its volume of water and boiling for a few minutes. The precipitated indigotin then becomes granular and can be filtered in from 5 to 10 minutes by the use of a filter-bed about one-third of an inch thick made from a layer of coarsely crushed quartz of about the size of millet seeds, covered by a layer of finer quartz of about the size of grain sugar, and lastly by a layer of finely-divided silica. It is not necessary to use the filter pump at first, but a light vacuum is employed later, and finally the full action of the pump is required. The whole estimation can thus be performed in a little more than two hours. The liquid obtained on boiling the dilute acid solution often becomes dark-coloured, but there is no loss of indigotin, and the colour is probably due to caramel. It is best to make the solution of indigotinsulphonic acid alkaline with sodium carbonate and then acidify with tartaric acid before titrating with titanous chloride. Titration with permanganate is not quite satisfactory. Direct cotton colours are sometimes present on the fabric. Diamine Black 3H is destroyed on sulphonation, leaving a brown precipitate on dilution which is filtered off; any further decomposition products which may be present in the filtrate do not affect the result. Columbia Black and Benzopurpurin 4B are completely precipitated on dilution after sulphonation, and can be filtered off. Other colours, such as Diamine Sky Blue and Diaminogene may interfere; in case direct cotton colours have been detected it is best to wash the precipitated indigotin with dilute ammonia, which removes them completely. This method does not apply to direct colours which have been diazotised and developed on the fibre.—E. F.

Bromindigo FB: [Dyeing with —]. R. WETTER. Färber-Zeit., 1909, 20, 185—186.

BROMINDIGO FB is a level dyeing colour, the shades obtained being equal as regards fastness to alkali, washing, etc., to those obtained with indigo. The stock solution may be prepared by reducing the dyestuff with alkaline hydrosulphite, at a temperature of about 60° C.; it is added to the dye-vat (to which a little alkaline hydrosulphite has been previously added), and the material is then entered. The colour of the vat and the material therein should be golden-yellow. Dark shades on yarn are easily dyed at about 60° C., but for light shades it is advisable to commence dyeing at 30° C., and raise the temperature gradually to 50—60°. Level, well penetrated dyeings are obtained from the hot vat and this exhausts well. Piece goods may be dyed on the jigger, extra quantities of hydrosulphite being required when the ordinary form of jigger is employed. After dyeing, the goods are squeezed, oxidised, soured, rinsed, and soaped. Bromindigo FB dyes well in combination with sulphide dyestuffs; it is reduced by boiling with a solution of caustic soda and dextrin and dyeing is carried out in a hot bath, with the addition of salt, the goods being afterwards squeezed, oxidised, soured, rinsed, and soaped. This process gives good results with half-linen and linen. Wool and silk are dyed in the hydrosulphite vat, the exhaustion being so good that it is advisable to dye at a moderately low temperature and in a "long" vat.—F. M.

Paranitro-orthoanisidine; The nitrosamine of —, and its application. C. DZIEWONSKI, W. PHUZANSKI and E. KOPEC. Sealed notes Nos. 1748, 1749, 1752, 1763, 1770, and 1831. Deposited July 11, 1907 to April 14, 1908. Bull. Soc. Ind. Mulhouse, 1909, 79, 169—174.

By substituting paranitro-orthoanisidine for parnitraniline, in the method of the Badische Anilin und Soda Fabrik (Ger. Pat. 81,791) for producing a red without a preliminary preparation of the material with β -naphthol, a much brighter and bluer shade is obtained. By pouring the solution of the diazotised base into caustic soda (in slight excess), the nitrosamine is precipitated as a greenish coloured, voluminous, microcrystalline substance; it is stable in the presence of the excess of caustic soda and may be purified by recrystallisation from hot water. In alkaline solution it does not react with phenols. The addition of the oxides of zinc or aluminium to the printing paste retards the development of the colour, but excellent results are obtained with sodium aluminate. The printing paste contains β -naphthol, caustic soda, sodium sulphurinate, sodium aluminate, nitrosamine, and sodium acetate, with gum tragacanth as thickening. After printing, the goods are dried, left to lie for a few hours in the air, and then passed through a warm bath of acid. Good results are obtained with the colour as a reserve under Aniline Black and, by mixing sodium bichromate with the printing paste, bright red discharge effects are produced on indigo-dyed cloth.—F. M.

Paranitro-orthoanisidine; The nitrosamine of — and its application on unprepared white and indigo-dyed material. E. Bourcart. Sealed note 1798. Deposited Jan. 2, 1908. Bull. Soc. Ind. Mulhouse, 79, 175—178.

THE nitrosamine is prepared by precipitating a cooled 10 per cent. solution of diazotised paranitro-orthoanisidine with cold caustic soda. It is better adapted for use upon material which has not previously been prepared with β -naphthol than is the nitrosamine of parnitraniline: mixed with Turkey red oil, β -naphthol, and a slight excess of caustic soda and printed (with gum tragacanth), the red is partially developed upon drying, apparently by the absorption of the excess of caustic soda by the cotton. The addition of castor oil to the paste assists the development as, upon drying on the fibre, the excess of caustic soda saponifies the oil and the soap produced does not retard the formation of the colour. Other substances which may be employed are potassium ethyl sulphate, chloroform, carbon tetrachloride, acetanilide, sodium thiosulphate, etc. For a coloured indigo discharge, sodium bichromate is added to the printing paste and

after the colour has been developed by drying and light steaming, the material is passed through acid, rinsed and dried.

In a report on the above communication, C. Favre draws attention to the similarity of the above method with that of Dziewonski (see preceding abstract). Both methods give good results, producing a beautiful red.

—F. M.

Cellulose: Action of oxalic acid on — E. Knecht. Seventh Int. Congr. Appl. Chem., London, 1909.

It is known that if a strong solution of oxalic acid, thickened with British gum, is printed on calico and allowed to dry at the ordinary temperature, and the calico be then well washed, the printed parts, while not being tendered, exhibit a marked affinity for Methylene Blue and a decreased affinity for direct colours like Erika. Tartaric and citric acids do not show this behaviour. The author shows that the portions which had been printed with oxalic acid lose their characteristic properties after the fabric has been boiled for a few minutes in dilute caustic soda. No oxalic acid could be detected in the caustic soda extract, so that formation of an oxalate of cellulose is not the cause of the phenomenon. Further investigation showed, however, that the caustic soda contained formic acid, which appears to be formed by the decomposition of the oxalic acid, and to act on the cellulose in the nascent state, yielding formyl-cellulose. Malonic acid acts similarly, yielding acetyl-cellulose, while the action of hexylmalonic acid is still more pronounced. It appears probable that all the acids of this series will behave similarly, and that a new mode of formation of acidic derivatives of cellulose is thus rendered available. Succinic and glutaric acids do not produce the effect.

Wool: Influence of preparing and bleaching agents on dyed — T. Valette. Seventh Int. Congr. Appl. Chem., London, 1909.

The effect of lime, ammonia, sodium carbonate, soap, hydrogen peroxide, sulphurous acid, and hypochlorous acid on the shades produced on wool hanks with acid dyestuffs, chrome- and alumina-mordant dyestuffs and indigo, was investigated. Lime and hypochlorous acid gave the most beautiful shades and manifested the greatest affinity for the colours. The depths of shade obtained in the case of sodium carbonate, soap, and ammonia were much less, while the duldest shades were those obtained with the last-named. Hydrogen peroxide gave still less depth, and sulphurous acid produced the clearest shades. Inert colours such as ultramarine or madder, suspended in cold water, were taken up energetically by the chlorinated wool, whilst wool treated with lime or sodium carbonate was scarcely coloured. Hanks treated with the above reagents and dyed to equal shades with each colour, on exposure to sunlight for three months, all faded practically to the same degree, except that the chlorinated wool appeared to be slightly less fugitive.—H. P. P.

Logwood and its secondary functions. P. Heermann. Seventh Int. Congr. Appl. Chem., London, 1909.

In addition to its tinctorial properties Logwood exerts an important influence by reason of its quality of increasing the weight of silk. The author finds that clean, raw silk has a very definite affinity for both strongly and weakly oxidised Logwood extracts and the silk undergoes a marked increase in weight. At the same time a considerable increase in volume and a less marked decrease in length of the fibre is observed. The increase in weight of the silk depends on its condition and previous treatment, on the degree of oxidation of the Logwood, on the composition of the bath and on other factors. Silk treated with tannin materials has less affinity for Logwood than untreated silk, but Hamatin and Hamatoxylin are absorbed equally well by both kinds. The greatest absorption of silk is attained when it is loaded with tin phosphate: in this condition it can take up more than its own weight of Logwood.—J. C. C.

Dye solutions and inorganic substances: Reactions between — W. P. Dreaper and W. A. Davis. Seventh Int. Congr. Appl. Chem., London, 1909.

THE dye solutions (1 in 10,000) were slowly passed through a 5-inch column of purified and ignited sand, and the volume or weight of colourless liquid passing through noted. The end reaction, when the dye commenced to pass as well, was sharply defined. With sand of standard quality and using a solution of Night Blue, the ratio, weight of dye retained: weight of sand employed, = 0.000147. Two other results gave 0.000148 and 0.000148. With sand of a larger grain the figures were 0.000084 and 0.000076. With Cotton Red 4B, there was practically no "dyeing" action, the figure obtained being 0.000036. Primuline showed a similar result, viz., 0.00004. Thus the "direct" dyes were not absorbed so much as the Night Blue (basic). Anthracene Red 3B (acid) gave a figure of 0.000041. Picric acid gave no "dyeing" action whatever. The effect of the addition of sodium chloride to the solution of the dye was marked in some cases. With Night Blue the dye retained was in the ratio of 1.39 to 2.41 with a solution containing 4 grms. of salt per litre. With a solution containing 10 grms. per litre, the desolution of the dye was complete enough for the whole of the dye to be retained in the upper part of the column of sand, until the passage of the solution was entirely stopped. In this way actual de-solution of the dye was immediately recognised, the lower portion of the sand column remaining colourless. In some cases this was not complete, as with Anthracene Red 3B, where both reactions were noticed. With picric acid and 1 per cent. salt solution there was no dyeing action. With Primuline and Cotton Red 4B, there was no de-solution with a 1 per cent. solution of salt, but the dyeing was increased five-fold.

Charcoal: Decolorising action of various forms of — E. Knecht. Seventh Int. Congr. Appl. Chem., London, 1909.

THE author has already shown (see this J., 1907, 949) that by decreasing the percentage of nitrogen in an animal charcoal, its affinity for acid dyestuffs like Crystal Scarlet is proportionately diminished. In continuation of this work, he now shows that by decreasing the percentage of nitrogen, the affinity of the charcoal for a basic colour like Methylene Blue is not materially altered. If, on the other hand, purified animal charcoal be heated with aluminium powder or zinc dust, and then treated successively with hydrochloric and hydrofluoric acids to remove impurities, its affinity for Methylene Blue is greatly diminished. The affinity for Crystal Scarlet is also diminished by this treatment (probably owing to unavoidable loss of nitrogen), but not in proportion to the decrease in the affinity for Methylene Blue. The opinion expressed by Paterson and by Glassner and Suida that animal charcoal owes its decolorising action to the presence of organic compounds which are stable at a red heat, is upheld by the author. The decolorising action of other forms of charcoal, such as cocoa-nut charcoal, lamp-black, acetylene black, and naphthalene black, is also discussed, and it is shown that the more closely the substance approaches in composition to pure carbon, the less is its decolorising power. It is highly probable that absolutely pure amorphous carbon, however fine its state of division, would be found to be devoid of any decolorising power on either acid or basic dyestuffs. The absorption of iodine from its solution in potassium iodide by animal charcoal was found to depend, like that of Crystal Scarlet, on the amount of fixed nitrogen contained in the charcoal. The absorption of colouring matters by animal charcoal cannot therefore be adduced as evidence that dyeing is a mechanical process. The fact that, under similar conditions, animal charcoal takes up acid colours belonging to a homologous series in the proportion of their molecular weights, shows that here also chemical action is at work.

Aniline Black: Chemical technology of — A. G. Green. Seventh Int. Congr. Appl. Chem., London, 1909. (See also J. Soc. Dyers & Col., 1909, 125, 188—194.)

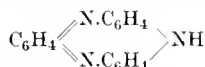
AFTER a description of the chief methods at present in use for the production of Aniline Black on the fibre,

the author proceeds to a discussion of its constitutional formula.

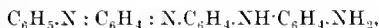
The oxidation of aniline occurs in the following stages:—

1. Emeraldine. 2. Nigraniline. 3. Ungreenable Black.

These products are contained in variable proportion in commercial Aniline Blacks. Whilst Nigraniline is readily reconverted into Emeraldine by reduction with sulphurous acid, Ungreenable Black is stable to sulphurous acid and only reduced by hydrosulphites giving a leuco-compound from which the black is regenerated by air oxidation. The "greening" of ordinary Aniline Black by acids is explained by the observation that Nigraniline is converted by acids into Emeraldine, the reduction being effected by the simultaneous oxidation of another portion of the Nigraniline into quinone. The author assigns to Emeraldine the structure:—

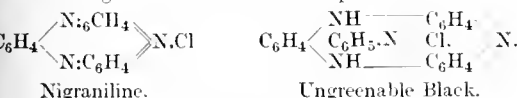


deducing this formula from its behaviour on oxidation and reduction (Nietzki, Liechi and Suida), the analysis of its hydrochloride (Nietzki), and its stability to acids. The base recently described by Willstätter and Moore under the name of "Emeraldine," to which they assigned the constitution:



is almost certainly not identical with true Emeraldine. It differs from the latter in its greater solubility in solvents, its instability to acids, and the colour of its solution in concentrated sulphuric acid, which is crimson instead of violet.

Whilst Nigraniline is derived from Emeraldine by the removal of hydrogen and can be readily reconverted into Emeraldine on reduction, the Ungreenable Black is probably not a product of further oxidation, but a condensation product with aniline. The author assigns the following formulae to these compounds:—



The latter compound is therefore a phenyl-phenazonium salt and bears to Nigraniline the same relationship as Safranine does to the Blue Indamine. This view is substantiated by the fact that the aniline in the condensation with Emeraldine or Nigraniline may be replaced by any primary amine even if para-substituted (for instance, paratoluidine), but not by a tertiary amine such as dimethylaniline. The analyses of Willstätter and Moore for their so-called "Polymerisation Black" also agree with this structure.

In order to obviate the weakening of the fibre which invariably results from the employment of chlorates in "aged" Aniline Blacks, the author has endeavoured to replace this oxidising agent by atmospheric oxygen. This has been successfully effected by making use of the observation that a small quantity of a paradiamine (e.g., para-phenylenediamine) constitutes, when associated with a copper salt, a catalytic system by means of which aniline can be readily oxidised by air alone into Emeraldine and even into Ungreenable Black (Eng. Pat. No. 16,189 of 1907). (See also this J., 1908, 683.)

The first stage of the reaction is undoubtedly the formation of the Blue Indamine: $\text{NH} : \text{C}_6\text{H}_4 : \text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{NH}_2$, which then undergoes further condensations with aniline giving complex indamines, from which the Emeraldine is formed by splitting off the paradiamine. The latter is thus regenerated and able to enter into reaction with fresh quantities of aniline.

Steaming of fabrics. A. Scheurer. Seventh Int. Congr. Appl. Chem., London, 1909.

THE author has investigated the quantity of air remaining in various types of steaming apparatus. Special attention was paid to the Mather-Platt machine which gives a steaming of two minutes' duration. Air in any such apparatus seriously interferes with the action of reducing agents, such as the hydrosulphites, which are

largely employed in printing. Its presence also causes a fall in temperature inside the machine. If the temperature in a continuous Mather-Platt steamer be less than 100° C., the atmosphere is saturated if the steam plate which forms the ceiling of the apparatus is maintained at about the same temperature as the interior of the machine.—P. F. C.

Chemistry of vegetable fibres. Schwalbe. See XIX.

PATENTS.

Cotton waste, &c.; Extraction of oily and greasy matter from —. G. Putnam, Hemel Hempstead, and F. Dunn, Boxmoor. Eng. Pat. 12,312, June 6, 1908.

THE volatile solvent is introduced at the bottom of the chamber into which the waste is placed, and passing upwards through the material overflows into another chamber from which it is distilled and recovered. The chambers are fitted with perforated steam pipes which permit of a rapid vapourisation of the solvent.—F. M.

Silk and spun silk; Process for increasing the elasticity and strength of weighted —. Deutsche Diamant-Ges.m.b.H. Ger. Pat. 210,341, April 18, 1907.

THE process consists in treating the silk in the hank form with enzymic or non-enzymic malt preparations, or with preparations containing maltose. For example, the silk after being dyed, brightened, and dried in the usual manner, is treated for about 1 hour in a bath containing 60 per cent. (on the weight of the silk) of diastase. It is stated that by this treatment the handle, lustre, elasticity, and strength of the silk are all improved.—A. S.

Black upon textile fibres; Production of —. The Calico Printers' Association, Ltd., and E. A. Fourneaux, Manchester. Eng. Pat. 7345, Oct. 2, 1908.

ANILINE or homologous bases are oxidised in the presence of either strong or weak acids and *p*-phenylenediamine by the joint action of a suitable metallic chlorate and a catalytic agent, preferably a vanadium salt. An addition to the liquor of a mineral salt with an acid function, such as aluminium chloride, is beneficial. Example: Two parts of commercial *p*-phenylenediamine are dissolved in 5 parts of hydrochloric acid (23° Tw.) and 30 parts of water. Into this mixture 10 parts of aniline oil are stirred. A solution of 10 parts of formic acid (90 per cent.) in 15 parts of water is next added, then a solution of 7 parts of sodium chlorate in 10 parts of water, and finally 10 parts of a solution of aluminium chloride (45° Tw.). The mixture thus obtained is suitably diluted with water to which has been added enough vanadium chloride solution to correspond to one part of ammonium vanadate in 200 parts of the padding solution. The resulting liquor is applied to the fabric which is then dried and either aged or steamed, and if necessary is finally chromed. It is claimed that by this process, the weakening of the fibre due to the formation of oxycellulose is largely avoided.—P. F. C.

Dyeing, bleaching and treating fibrous materials; Apparatus for —. T. Halliwell and Mather and Platt, Ltd., Manchester. Eng. Pat. 7671, Oct. 7, 1908. Addition to Eng. Pat. 14,780, June 27, 1907 (this J., 1908, 853).

THE modification of the apparatus described in the original patent permits of material being treated in the loose state, or as yarn in hanks, cheeses, etc., or in the piece. Loose material, or yarn, is packed into the annular space between the perforated walls of an outer and an inner cylinder. The base of this hollow drum is solid and is fitted centrally with a tubulure which fits into a hole in the bottom of the dye-vat; the material is pressed down and kept in position by a cover which fits into the drum. Pieces are rolled, between flanges, on to a perforated cylinder the projecting end of which fits into the hole in the bottom of the dye-vessel.—F. M.

Sulphide colours; Method of treating dyeings with —. R. B. Rausford, London. From L. Cassella und Co., Frankfurt a/M., Germany. Eng. Pat. 17,267, Aug. 17, 1908.

It is found that the fastness of the dyeings produced with sulphide dyestuffs is much improved by an after-treatment

with nickel salts. After-treatment with copper salts could not be carried out in iron vessels, but with nickel salts there is no such drawback. The material, after dyeing, is treated in a hot, fresh bath with 2–3 per cent. of nickel sulphate (or with 1–1½ per cent. of nickel sulphate and 1–1½ per cent. of potassium bichromate) and about 5 per cent. of acetic acid. F. M.

Viscose threads or artificial silk: Apparatus for producing and treating — A. Delubac, La Bégude, Assignor to Soc. Franç. de la Viscose, Paris. U.S. Pat. 923,777, June 1, 1909.

SEE Fr. Pat. 377,424 of 1906; this J., 1907, 1087.—T. F. B.

Emulsions for use in washing raw wool and for other purposes, Crefelder Seifenfabr. Stockhausen und Traiser, Crefeld, Germany. Eng. Pat. 21,289, Oct. 8, 1908. Under Int. Conv., Oct. 8, 1907.

SEE Fr. Pat. 396,493 of 1908; this J., 1909, 612.—T. F. B.

Fibrous materials: Apparatus for treating — with liquids. H. Thies, Crefeld, and W. Mathesius, Berlin. U.S. Pat. 923,310, June 1, 1909.

SEE Fr. Pat. 380,864 of 1907; this J., 1908, 72.—T. F. B.

Dyeing apparatus, R. Diederichs, Cologne, Germany. U.S. Pat. 923,342, June 1, 1909.

SEE Addition of Oct. 26, 1908, to Fr. Pat. 390,105 of 1908; this J., 1909, 471.—T. F. B.

Fabrics: Apparatus for impregnating and extracting liquids from — H. Hey, Dewsbury. U.S. Pat. 923,971, June 8, 1909.

SEE Eng. Pat. 26,843 of 1906; this J., 1908, 19.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Alkali, &c., works: Forty-fifth annual report on — by the Chief Inspector. Proceedings during the year 1908, &c. March 18, 1909, 135. Price 61d.

THE total number of works registered in the United Kingdom on Dec. 31, 1908, was 1424, an increase of 35 as compared with 1907; this includes 163 works in Scotland. The number of registered alkali works is 81, of which 9 are in Scotland. The total number of separate processes of manufacture under inspection is now 1839, as compared with 1821 for 1907. There is a noticeable increase in the number of works manufacturing sulphate and chloride of ammonium, these, with gas liquor works, accounting for over 31 per cent. of the processes under inspection.

There have been 5 prosecutions under the Alkali Act during the year, all of which were pending at the close of 1907, penalties ranging from £2 to £50 and costs being inflicted. In 3 other cases back fees have been accepted in lieu of penalties incurred for non-registration.

There has been considerable depression in the alkali and wet copper industries throughout the year. 419,693 tons of burnt cupreous pyrites were treated in 1907 by the wet copper process in England and Scotland, the estimated produce of valuable metals being 15,105 tons of copper, 1927 oz. of gold, and 335,683 oz. of silver; the corresponding figures in 1906 being 400,055 tons of burnt ore, 14,401 tons of copper, 1837 oz. of gold, and 320,045 oz. of silver.

Owing to depression, plant has not been fully employed, as a whole, in the alkali waste works. Large scale experiments have been tried and justify extended use of the new contact substance, bauxite, to replace the oxide of iron filling in the Claus kilns, the loss of sulphur as sulphur dioxide being materially reduced.

The imports of pyrites in 1907 were 769,141 tons, about 70 per cent. coming from Spain, the output in the United Kingdom amounting to 10,194 tons. It is estimated that the consumption of pyrites for the manufacture of sulphuric acid alone must exceed 600,000 tons per annum. In three works zinc blende is used as a source of sulphur. The difficulties surrounding the

manufacture of sulphuric acid by catalytic processes are considered to have acted as a deterrent to their extensive use; the number of works requiring acid of the very highest strength that these processes supply is very limited. The advantage of the use of such acid in the manufacture of high strength explosives has, however, led to some increase in demand, and in the colour industry also, increasing demand may be looked for. Experiments have been made in the Widnes District to reduce the white fume so characteristic of sulphuric acid concentrating plant, where high temperature is employed, and it is found that the fume and acidity are greatly reduced by treatment with hot water, but it is noted that the white fume does not indicate unduly high acidity of the chimneys. In District No. 4 (North and East Lancs.) it is reported that the bottom inlet to chambers is being adopted more extensively and at fresh works, and the use of nitric acid in place of nitre is still finding favour, there being no tendency to revert to "potting." The total chamber capacity in this district is slightly less than 6,114,738 cb. ft., the figure for the previous year. The decrease, however, is due to the increased amount of acid made in a given space, 12 and 15 cb. ft. of chamber space per lb. of sulphur burnt being quite common, and 20, 30, and 40 cb. ft. almost a thing of the past. In District No. 6 (South and South-West of England) the use of fans for the purpose of draught on the sulphuric acid plants is said to be extending and is found to have a steady effect on the chamber working. "Fused silica" vessels in place of porcelain ones at works for rectifying sulphuric acid are again reported to have given satisfaction. The Petersen "regulator tower" system (this J., 1907, 870; 1909, 520), after a trial of some months at one works, where tower plant not specially designed for the purpose was utilised, has been found unsatisfactory and given up.

Progress is reported in attempts to improve the method of working at tinplate flux works, an industry which is almost confined to S. Wales and Monmouthshire and the Forest of Dean. As noticed in last year's Report (this J., 1908, 804), considerable losses of tin occur, owing to the oxide being mechanically carried along with the furnace gases. Where the flux-skimmings, which contain large quantities of volatile chlorides, are kept separate from the scruff, the latter alone being furnace, a cleaner tin is obtained from the scruff and the scruff house is free from fume, the scruff also being worked off in two-thirds of the time. It is considered that "the best practical means" for preventing the discharge of noxious gases to the atmosphere and for rendering such gases, where discharged, harmless and inoffensive should include:—(1). Separation of the flux-skimmings from the scruff proper. (2). Depositing flues of length and sectional area adequate for the scale of operations, as conducted. (3). A chimney of adequate height, by which the gases are ultimately discharged. (4). Probably also the provision of a final wash tower. The flux-skimmings are completely disintegrated by continued treatment with hot water.

The total quantity of white salt produced from brine, and salt contained in brine used for making alkali by the ammonia soda process, was, in 1907, 1,738,636 tons, the figure for 1906 being 1,734,593 tons.

There appears to be a marked increase in the quantity of mineral phosphate imported, as compared with 1906. The amounts, in tons, of manure materials imported in 1906, 1907, and 1908 were:—

	1908.	1907.	1906.
Guanos	34,417	31,278	24,906
Mineral phosphates	530,177	504,528	442,970
Sodium nitrate (including that used for the manufacture of acids)	145,724	113,894	108,486

The exports of ammonium sulphate in 1908 amounted to 235,000 tons, as compared with an estimated home consumption (for all purposes) of 83,000 tons. The figures in 1907 were 230,000 and 87,500 respectively.

The number of sulphate and chloride of ammonium works and gas liquor works has risen from 554 in 1907 to 578 in 1908. Where purification by oxide of iron is the method used, an increasing number of works have adopted the form of oxide heap (this J., 1906, 882) in place of the box purifier constructed of brick and cement; in either case an impervious bottom must be prepared, and the arrangements for distribution of the noxious gases among the purifying heap or heaps requires observance of the same precautions as if box purifiers were used. It is insisted upon, that during emptying and recharging, a purifier should, for safety of the workmen engaged, be isolated by valves of the hydraulic type and not by inefficient screw-down valves.

In view of the importance of the exact determination of chloride in gas liquor, the method of determining chloride in the presence of thiocyanate, devised by Resanoff and Hill (this J., 1907, 1197), has been carefully tested. It is found that the use of nitric acid as an oxidising agent to decompose thiocyanate and thio-sulphate requires more time than a mixture of hydrogen peroxide and potassium chromate, and is, moreover, inadmissible in the case of gas liquors, since oxidation is always incomplete. The peroxide method, which is recommended as having given accurate results with liquors from every source of supply, is carried out as follows:—The gas liquor, freed from sulphide and cyanide by boiling, and from any ferrocyanide by precipitation with iron alum, is diluted to 150 c.c., 25–50 c.c. of hydrogen peroxide (10 vols., "free from chloride") are added, the liquid is boiled for 15 minutes, 6 drops of a 10 per cent. solution of potassium chromate are added, and the boiling continued for 2 minutes; a slight excess of sodium carbonate is then added and the solution again boiled for 1 minute, filtered, cooled, and made up to 250 c.c.; an aliquot part is titrated with $N/10$ silver nitrate, after being made neutral with dilute nitric acid, a blank experiment being conducted with 10 c.c. of $N/10$ sodium chloride and the same volumes of water, hydrogen peroxide, and chromate solution, to determine the correction for traces of chloride in the reagents used. A memorandum is also inserted by S. E. Linder to the effect, that ammonium thiocyanate is found to be quite stable in aqueous solution, when pure, the substance suffering no decomposition on boiling the solution.

*Amount of ammonia produced in the United Kingdom
(expressed as tons of ammonium sulphate.)*

	1908.	1907.	1906.
Gas works	165,218	165,474	157,160
Iron works	18,131	21,024	21,284
Shale works	53,628	51,338	48,534
Coke oven works	64,227	53,572	43,677
Producer-gas and carbonising works (bone and coal) ...	24,024	21,873	18,736
	325,228	313,281	289,391

The increase in activity in Cornwall, noted in last year's Report, in the mining of ores containing arsenic, has received some check during 1908, but the output of white arsenic from Cornwall and Devon in 1908 amounted to 1919 tons, as compared with 1473 tons in 1907.

The chemical works in the North of England are reported to have been less busy than in former years owing to the general depression of trade. In the eastern and south-eastern counties, a distinct depression is also reported among all classes of chemical manufactures in the past year. The depression in the cement industry continues, two works having been removed from the register and others having produced no cement. The workable kiln plant in the South-Eastern District at the close of 1908 was as follows:—82 open kilns (mostly idle); 1054 chamber kilns (many of which have also remained idle); 35 Schneider kilns; and 62 rotary cylinder kilns.

A study has been made of the interaction of methane and ammonia at comparatively low temperatures, in the presence of a neutral substance as catalyst, with a

view specially to ascertaining the mechanism of formation of hydrocyanic acid, in the course of coal carbonising. Coal-gas, deprived of its illuminants, was used in the place of pure methane. In the presence of porcelain, methane itself decomposes above 800° C., with the deposition of carbon, as observed by Bone (this J., 1908, 887). Wood charcoal has a similar thermal effect below 750° C., the effect rapidly increasing with rise of temperature. With moist coal-gas, in the presence of wood charcoal, an oxidising effect is to be noticed, besides the thermal effect, carbon monoxide being mainly produced; this has an important bearing on the economy of carbonisation, when steam is admitted, as in the Dessau intermittent vertical retort, towards the close of the carbonisation process. Ammonia is produced at all temperatures between 720° and 935° C. by the passage of coal-gas over wood charcoal, its formation being favoured by high temperature and a slow rate of flow. Hydrocyanic acid is stable at 935° C., in the presence of wood charcoal and moist coal gas, and traces are, moreover, formed at this temperature, probably as a secondary product by the interaction of ammonia and carbon, since its formation is also favoured, like that of ammonia, by a high temperature and slow rate of flow. In gas works and coke ovens, therefore, as observed by Bone (*loc. cit.*), temperature is by no means the only factor of importance, but the amount of contact surface, in proportion to the rate of gas evolution, has also to be considered, having a great influence on the products obtained. With a mixture of methane and ammonia, the critical temperature for the formation of hydrocyanic acid, in the presence of wood charcoal lies between 755° and 805° C. At 805° C. the yield of hydrocyanic acid is only slightly affected by the rate of flow, but above 900° C. increasing rate of flow gives a much larger production. The reduced yield at the slower rate is attributed to the rapid dissociation of ammonia into its elements, since hydrocyanic acid, once produced, is stable at such temperatures. The maximum yield of hydrocyanic acid was obtained at 855° C., 19.7 per cent. of the ammonia used being transformed into this substance. In the light of these results, the working of the continuous vertical retort (Woodhall-Duckham) is considered. A zone of maximum and continuous heat exists perhaps at about three-fifths of the depth of the retort, measuring from above. Here the horizontal section will be well filled, under normal conditions, with incandescent solid, with absence of any central gas channel, such as characterises the horizontal section of an intermittent vertical retort. Here also the gas pressure will be at a maximum, while the rate of flow of gas, from its diminishing evolution, will be much lessened, as compared with higher zones in the retort. These conditions all favour decomposition of methane and any accompanying ammonia and the formation of hydrocyanic acid from its elements. The analyses of gas liquor from the continuous vertical retort show an increased ratio of hydrocyanic acid to ammonia, as compared with that from a horizontal retort; the tar presents generally the characters associated with low temperature carbonisation, being low in naphthalene. Analyses of ammoniacal liquors from coal partially carbonised at very low temperatures (427°–454° C.) are also given, in all of which, however, cyanogen compounds are present, although the critical temperature for the formation of cyanogen from carbon and ammonia is above 750° C., as already stated.

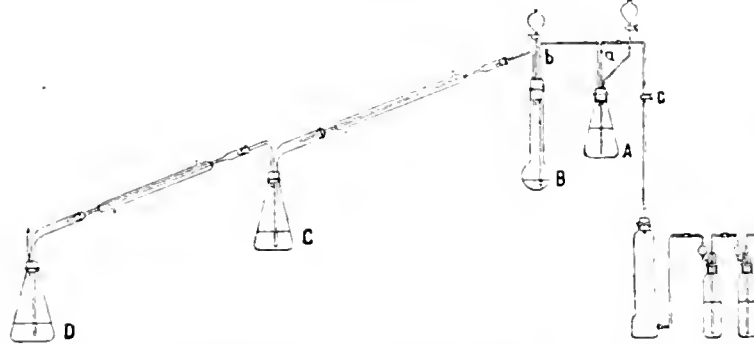
In Scotland the number of works registered, as compared with the preceding year, has increased by 5. The quantity of pyrites burnt for the manufacture of sulphuric acid was 9500 tons less than in 1907. Fan draught is being extended here in connection with the chambers, and the use of water sprays in place of steam jets, as mentioned in the Report for last year, has been found satisfactory. A plant for the recovery of nitric acid from nitrous fumes has continued in successful operation. Spontaneous firing of the contents of a purifier, containing a mixture of 2 parts of lime and 1 part of oxide of iron is said to have occurred at a tar works, and the use of lime alone has been reverted to. The average number of furnaces in blast at iron works, which in 1906 and 1907 was 90.35 and 90.44 respectively, fell in 1908 to 75.95.

The total shale mined in the United Kingdom during 1908 was 2,891,564 tons, and the yield, in lb. of sulphate of ammonium per ton of shale mined, 41.5, the corresponding numbers for the preceding year being 2,675,989 and 43.0. The means taken to prevent the escape of noxious and offensive gases in paraffin oil works, in consequence of the Act of 1906 (see last Report), have been effectual, and considerable amounts of valuable products have been conserved, that formerly escaped to vitiate the atmosphere.

—F. SONS.

Nitrosyl perchlorate: the mixed anhydride of nitrous and perchloric acids. K. A. Hofmann and A. Zedtwitz. Ber., 1909, 42, 2031—2034.

On adding nitric acid which had been coloured reddish-yellow by exposure to light, to the hydrate of perchloric acid, $\text{HClO}_4 \cdot \text{H}_2\text{O}$, colourless crystals of the anhydride of nitrous and perchloric acids were produced. This was obtained in better yield by leading nitrous acid gas into perchloric acid. Pure commercial perchloric acid (about 30 per cent. strength), was evaporated until it attained a temperature of 110°C . and dense white vapours were evolved. After cooling to the ordinary temperature or to 0°C ., the mixture of nitric oxide and nitrogen peroxide produced by the action of nitric acid on sodium nitrite, was led into the perchloric acid, whereupon colourless doubly-refractive leaflets of the new anhydride separated. By removing the crystals, concentrating, cooling, and again leading in nitrous vapours, and repeating these operations, nearly the whole of the perchloric acid was converted. The crystals were left on a porous tile for some hours over phosphorus pentoxide in an atmosphere of nitrous vapours, and then dried *in vacuo*. The nitrosyl perchlorate thus obtained has



the composition, $\text{ClO}_3\text{NO} \cdot \text{H}_2\text{O}$; the molecule of water can be almost completely removed by drying *in vacuo* over phosphorus pentoxide, without sensibly altering the properties of the compound. The anhydride can be kept for several days in a perfectly dry atmosphere without any evolution of nitric oxide; at 108°C . brownish-yellow nitrous fumes are developed, and at a considerably higher temperature, the white residue volatilises without melting. It is only slightly hygroscopic. When treated with a few drops of water, the greenish-blue colour of nitrogen trioxide is produced and brown nitrous fumes are evolved. Nitrosyl perchlorate converts methyl alcohol immediately into methyl nitrite; ethyl alcohol and acetone become ignited and cause slight explosions. Glacial acetic acid has no action at first, but causes evolution of nitrous fumes on warming. With dry ether there is evolution of gas followed by an explosion. With primary amines of the benzene series violent reactions are produced; e.g., with aniline a dangerous explosion may take place. Reactions are also produced with urea, pinene, phenols, pyridine, and chloroform.—A. S.

Ammonia: Electrolytic oxidation of —. A. Brochet and G. Boiteau. Bull. Soc. Chim., 1909, 5, 667—675.

AMMONIACAL solutions of ammonium carbonate or nitrate were electrolysed under varying conditions of temperature and current density, and the yields of ammonium nitrate compared. This yield increases with the current-density,

but there is also a considerable rise in the tension at the terminals and in the temperature. The yield decreases rapidly when the proportion of nitrate is raised. The electrolyses were carried out between electrodes of carbon, platinum, or iron. On electrolysing a dilute solution of ammonia alone between carbon electrodes, a poor yield of nitrate was obtained, but small amounts of carbonate and carbon dioxide were formed, the anode showing a considerable loss in weight. Taking as electrolyte a solution of the carbonate in dilute ammonia (1:1), better results were obtained. The results with electrodes of platinum were very similar. It is noteworthy in this case that while the electrolysis of a solution of ammonium carbonate gives, at the anode, oxygen free from nitrogen, the reverse is the case in the presence of free ammonia, the product consisting of nitrogen free from oxygen. Using electrodes of iron, under ordinary conditions, it was found that no nitrate at all was formed, but that, on the contrary, there was a considerable reduction of that salt by the iron cathode. In the presence of ammonium bichromate, however, the operation went forward as in the case of platinum and a substantial yield of nitrate was obtained.—C. A. W.

Boric acid: Determination of —. R. Mandelbaum. Z. anorg. Chem., 1909, 62, 364—369.

To separate and determine boric acid in borates, the author has modified the method of distillation with methyl alcohol, by conducting the distillation in a stream of air or other indifferent gas, and by receiving the boric acid directly in excess of standard alkali, from which before titration the accompanying methyl alcohol is removed. The apparatus is shown in the accompanying figure.

Air from a gas holder is freed from carbon dioxide and moisture by the two potash wash bottles and the soda-lime tower on the right of the diagram, and passes through the tube, *a*, ending in a capillary opening, to the bottom of the flask, *A* (300 c.c.), which also carries a 100 c.c. stoppered funnel; thence it passes by the tube, *b*, 6 mm. wide and with a capillary ending, into the round-bottomed flask, *B* (150 c.c., neck 20 cm. long and 3 cm. wide), which carries a 25 c.c. stoppered funnel. The flasks, *C* and *D*, hold each 500 c.c. To carry out a determination the weighed substance (0.4—0.7 gm. of borax, for example) is introduced into *B*, and enough 40 per cent. phosphoric acid added to produce monometallic, soluble phosphate—say 4 c.c. to 0.7—0.8 gm. of borax; the whole is gently warmed, avoiding any possible volatilisation of boric acid, till solution is complete. The apparatus is now put together, and all carbon dioxide expelled by a stream of air. A known volume, in excess, of $N/10$ sodium hydroxide is now put into *C*, which is then replaced, and all corks made tight with collodion. The cock, *c*, is closed, and anhydrous methyl alcohol introduced through the funnels. For 0.2 gm. of boric anhydride 150—170 c.c. of alcohol are needed, four-fifths of which are put into *A* and the rest into *B*. The cock, *c*, is opened, and the air regulated so that 2 or 3 bubbles per second enter *C* from the 6 mm. tube which dips into the alkali; then *A* and *B* are cautiously heated, not above 80°C ., and carefully avoiding frothing. In this way 200 c.c. of alcohol can be distilled over in 1—1½ hours; and the distillation of the alcohol from *C* can be proceeded with before all has distilled over from *A* and *B*. When practically all the alcohol has been expelled from *C* (the air-current having been kept up all the time), *C* is rapidly cooled, a little phenolphthalein, and glycerin equal in volume to half the contents of the flask are added, and the excess of alkali is titrated with $N/10$ sulphuric acid. The residue in *B* is tested by Lenher and Wells' method (this J., 1899, 608), to see that no boric acid remains in it. A determination can be carried out in 2—3 hours, and the

results are very accurate. Every care must however be taken to avoid carbon dioxide and to have anhydrous methyl alcohol.—J. T. D.

Calcium; Some double sulphates of —. M. Barre. *Compt. rend.*, 1909, **148**, 1604—1606.

It was found that the solubility of calcium sulphate in water was considerably increased by the presence of ammonium sulphate, and that a double salt having the formula, $\text{CaSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot \text{H}_2\text{O}$, was formed, which was stable between 0° and 100° C. in the presence of excess of ammonium sulphate. The concentration of the latter should be 35 per cent. In the presence of an excess of calcium sulphate at 80° C., another double salt was formed corresponding with the formula, $2\text{CaSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4$. In the presence of potassium sulphate, calcium sulphate was less soluble than in pure water, but the double salt, $\text{CaSO}_4 \cdot \text{K}_2\text{SO}_4 \cdot \text{H}_2\text{O}$, which was formed, was stable between 0° and 99° C. in the presence of excess of either calcium or potassium sulphate, the double salt $2\text{CaSO}_4 \cdot \text{K}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$, described by Ditte, (*Compt. rend.*, 1877, **84**, 86), not being formed within that range of temperature.—O. R.

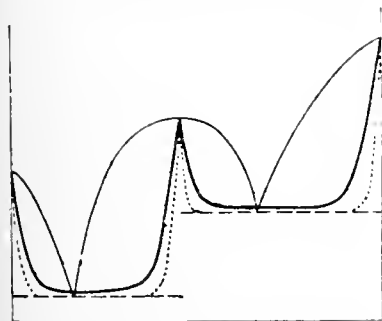
Chemical reactions in gaseous mixtures under great pressure. E. Briner and A. Wroczynski. *Compt. rend.*, 1909, **148**, 1518—1519.

MIXTURES of gases were subjected to very high pressure by condensing them in thick glass tubes surrounded by liquid air, the tubes were then carefully sealed and allowed to return to a temperature above the critical points of the gases employed. In this way pressures of from 500—1000 atmospheres were attained. Mixtures of nitric oxide and hydrochloric acid react in these circumstances with the formation of nitrosyl monochloride, while nitric oxide and sulphurous acid, hydrochloric and sulphurous acids, nitric oxide and methyl-chloride, and sulphurous acid and oxygen all react to produce compounds which have not yet been identified.—R. L. S.

Aluminium nitride; Preparation of —. A. J. Sofianopoulos. *Bull. Soc. Chim.*, 1909, **5**, 614—616.

WHEN powdered aluminium is heated to redness in a stream of pure dry ammonia, until no more gas is absorbed and the production of hydrogen ceases, a grey, amorphous, spongy mass of pure aluminium nitride, Al_2N_3 , is obtained. In the event of any aluminium remaining unchanged, it may be readily removed by treating the crushed product with warm mercury and then separating the nitride by levigation with water. The nitride is very stable, when dry, and is not attacked by oxygen, even on heating; the halogens, however, readily convert it into the corresponding halide with the liberation of nitrogen, and with acids, caustic alkalis, or boiling water, the nitrogen is split off as ammonia, aluminium hydroxide or a corresponding salt being produced. Hydrazine or hydrazoic acid give the same results as ammonia.—F. Sopex.

Sintering point curve, a simple means of detecting the formation of binary chemical compounds. A. Stock. *Ber.*, 1909, **42**, 2059—2061.



THE formation of a definite compound when a mixture of two substances is fused, is indicated by a maximum

on the melting point curve, but if the compound is dissociated in the fused condition, the maximum is not sharply defined and it is difficult or impossible to deduce from its position the composition of the compound. A simple means of overcoming this difficulty is to plot the sintering point curve, *i.e.*, the curve representing the beginning of the melting; upon this curve the formation of a compound is indicated by a sharply defined apex. In the figure are shown a typical melting point curve (the uppermost one) and two sintering point curves. Of the sintering point curves the lower dotted one represents the temperatures at which small drops are first observed when a small quantity of the mixture is heated in a capillary tube, whilst the other thicker line represents the temperature at which distinct sintering takes place when a larger quantity of the material is heated.—A. S.

Phosphorus-sulphur compounds. IV. Existence of phosphorus disulphide, $\text{PS}_2(\text{P}_2\text{S}_5)$. A. Stock. *Ber.*, 1909, **42**, 2062—2075.

AFter a critical discussion of the literature of phosphorus-sulphur compounds, the author describes various attempts to prepare the so-called phosphorus disulphide, PS_2 or P_2S_6 . In every case, however, the product obtained was the sulphide, P_4S_7 . Also by determining the sintering points (see preceding abstract) of a series of mixtures of the sulphides, P_4S_3 and P_2S_5 , and of various other mixtures of the sulphides, P_4S_3 , P_4S_7 , and P_2S_5 with one another and with sulphur and phosphorus, it was found that at about 300° C. in cases where the composition approached that represented by the formula, PS_2 , the compound actually formed was the sulphide, P_4S_7 . The substances hitherto obtained and described as phosphorus disulphide were evidently mixtures of the sulphides, P_4S_7 and P_2S_5 , which could be separated into their components only with difficulty by the methods employed, *viz.*, distillation and crystallisation. There are only three phosphorus sulphides, the existence of which can be regarded as beyond doubt, *viz.*, P_2S_5 , P_4S_3 , and P_4S_7 . (Compare this *J.*, 1906, 264).—A. S.

Colloidal sulphur; Preparation of —. A. Himmelbauer. *Z. Chem. Ind. Kolloide*, 1909, **4**, 307—308.

IF pieces of pure gelatin are placed in a solution of ammonium polysulphide, they gradually become olive-green in colour, opalescent, and finally white; the ammonium sulphide disappears, and after a few days ammonia only is left in solution. The same results are obtained with agar-agar, but in this case finely-divided sulphur is also precipitated in the liquid. Similar results are obtained if the ammonium polysulphide is replaced by hydrogen sulphide solution. Gelatin rendered slightly opaque in this way showed very small granules at a magnification of 225, and also showed the Tyndall phenomenon, though pure gelatin did not. After two days distinct crystalline growths were visible, mainly spherulites, the gelatin itself being optically clear. A parallel experiment without gelatin showed no separation of sulphur in the same time. A further experiment with gelatin in the dark proceeded in the same way as in the light. Colloidal silicic acid caused no precipitation of sulphur from hydrogen sulphide solution.—E. F.

Bromine production in the United States in 1908. U.S. Geol. Survey, June, 1909. [T.R.]

THE following table gives the production and value of the bromine produced in the United States during the years 1900 to 1908, inclusive:—

	Pounds.	Value.
1900.....	521,444	\$140,790
1901.....	552,043	154,572
1902.....	513,893	128,472
1903.....	598,500	167,580
1904.....	897,100	269,130
1905.....	1,192,758	178,914
1906.....	1,283,250	165,204
1907.....	1,379,496	195,281
1908.....	1,055,636	102,344

The bromine industry in the United States is centred in Michigan, Ohio, Pennsylvania, and West Virginia. The low price at the end of 1907 and at the beginning of 1908, when bromine was sold as low as 10 cents per pound in carload lots, f.o.b. at the works, is believed to be below the cost of production to the bulk of the manufacturers. The trade has been exceedingly poor, and much of the bromine made remains unsold on the hands of the producers.

Salt production in the United States in 1908. U.S. Geol. Survey, June, 1909. [T.R.]

In 1908 the quantity of salt produced in the United States was 28,822,062 barrels of 280 pounds, valued at \$7,553,632; in 1907 the production reported was 29,704,128 barrels, valued at \$7,608,323. Expressed on a tonnage basis these quantities represent an output of 4,158,578 short tons in 1907 and of 4,035,089 short tons in 1908. In 1907 the average net value was 25,614 cents per barrel, or \$1.83 per short ton; and in 1908, 26,208 cents per barrel, or \$1.87 per short ton.

The following table shows the quantity and value of salt reported as produced in the United States from 1900 to 1908:—

	Barrels.	Value.
1901.....	20,506,661	\$6,617,449
1902.....	23,849,231	5,608,636
1903.....	18,908,089	5,286,988
1904.....	22,030,002	6,021,222
1905.....	25,906,122	6,065,922
1906.....	28,172,380	6,658,350
1907.....	29,704,128	7,608,323
1908.....	28,822,062	7,553,632

Sodium nitrate statistics. Shipments, consumption, stocks, and prices, from 1907 to 1909. W. Montgomery and Co., London, June 30, 1909. [T.R.]

	1907.	1908.	1909.
Shipments from South American Ports to all parts for the six months ending 30th June Tons	738,000	664,000	777,000
" do. for the twelve months ending 30th June ..	1,729,000	1,852,000	1,829,000
Alloft for Europe on 30th June ..	102,000	355,000	230,000
Stocks in U.K. Ports:—			
Liverpool	6,000	5,600	6,000
London	3,700	3,200	1,400
Out Ports	8,300	8,200	5,600
Stocks in Continental Ports on 30th June	113,000	75,000	172,000
Consumption in U.K. for the six months ending 30th June ..	75,000	62,000	70,000
" in Continent do. ..	870,000	963,000	998,000
" in U.K. for the 12 months do. ..	112,000	99,000	111,000
" in Continent do. ..	1,153,000	1,233,000	1,307,000
" in United States do. ..	354,000	315,000	358,000
" in other Countries do. ..	42,000	55,000	46,000
" in the World do. ..	1,661,000	1,702,000	1,822,000
Visible supply on 30th June (including the quantity alloft for Europe and Stocks in U.K. and Continent) ..	293,000	447,000	415,000

Sulphurous acid in the gases of the lead chamber [for the manufacture of sulphuric acid]; Determination of —. F. Raschig. Seventh Int. Congr. Appl. Chem., London, 1909. Z. angew. Chem., 1909, 22, 1182—1185.

THE determination of sulphurous acid in chamber gases by the method commonly employed in testing furnace gases, namely decolorisation of a known volume of N/10 iodine solution in presence of starch, in Reich's apparatus, fails owing to the presence of nitrous acid. If, however, sodium acetate be added to the iodine solution, then the free acid produced is acetic acid, and the nitrous and sulphurous acids form sodium nitrite and sulphite respectively, which salts, as Divers has shown, do not interact. In presence of sodium acetate, then, the sulphurous acid in chamber gases can be determined by means of iodine solution, and if subsequently the free acid be titrated, and the amount due to the acid liberated in the reaction between sulphurous acid and iodine be deducted, the amount of nitrous gases can also be approximately

ascertained, since these are converted into either nitrous acid or nitric acid, which liberate a corresponding quantity of acetic acid. By applying this method to the determination of the sulphurous acid in the gases entering and leaving the Glover tower, it was found that from one-sixth to one-seventh of the total production of sulphuric acid is formed in this tower, the daily production of the tower being 20—30 times greater than that obtained by so-called "intensive" working in lead chambers. The chief factor contributing to the high acid-producing efficiency of the Glover tower, the author considers to be the intimate contact of the cooling agent (the descending acid) with the gases; the importance of this factor was indicated by Lunge in 1889. By producing similar conditions of cooling, using sulphuric acid as cooling agent, throughout the system, the production of acid per unit of reaction space could be considerably increased, but two points must be borne in mind, disregard of which was probably the cause of past failures of attempts in this direction. It is immaterial whether the cooling is effected in the chambers by means of an acid spray or in towers similar to the Glover tower, but the concentration of the cooling acid must be adjusted in accordance with the composition of the gases, and a sufficiently large volume of cooling acid must be employed. For the weaker gases which leave the Glover tower, an acid of lower strength than 50° B. must be used for cooling, otherwise water vapour would be removed from the gases and the latter rendered more or less incapable of interacting; acid of 48° B. is suitable. With regard to the volume of cooling acid if the amount of acid passing down the Glover tower be taken as a guide, then a quantity equal to the amount of acid produced by a given plant in 2—3 weeks must be circulated daily for the cooling of the gases, the warm acid withdrawn from the bottom of the chambers being cooled, diluted to 48° B., and used over again. For a plant producing 15,000 kilos. of acid daily, the necessary amount of cooling acid would be about 250,000 kilos. Beside the saving in chamber space by the adoption of this

proposal, the consumption of nitric acid would also probably be reduced. Nitrous oxide is most likely to form in places where dilute acid is present, that is where small drops of water condense from the water spray now largely employed. With a spray of acid of 48° B. there would be no possibility of weaker acid being anywhere present in the chamber, so that no abnormal formation of nitrous oxide could take place.—A.S.

Atmospheric nitrogen; Utilisation of — particularly for the manufacture of air-salt-petre. A. Bernthsen. Seventh Int. Congress Appl. Chem., London, 1909.

AFTER discussing the need of nitrogen compounds in agriculture and reviewing the methods which have been proposed for the utilisation of atmospheric nitrogen the author gives a description of the process worked by the Badische Anilin und Soda Fabrik (see Fr. Pat. 357,358 of 1905 and additions thereto; this J., 1906, 7, 1053; 1907, 23, 178). The electric furnace used, consist-

essentially of an iron tube provided at one end with an insulated electrode, from which on passing the current, arc springs to the adjacent part of the iron tube. A current of air is passed through and carries the end of the arc with it, so that a column of arc flame is obtained, burning quietly in the axis of the tube and surrounded by the air passing through the tube. In the furnace for large-scale working, the air passes into the tube through a number of holes bored tangentially in the portion surrounding the electrode. The insulated electrode can be cooled with water or air, and is provided with a central hollow space through which passes an iron rod. The arc springs from the iron rod. The gases which leave the tube pass down through a conduit lined with firebrick concentrically surrounding the furnace, thus heating the air supply. The apparatus is very simple and durable. If the heat produced, 30 per cent. is employed for heating water and 40 per cent. for producing steam, whilst 17 per cent. is lost by radiation. The calcium nitrate solutions obtained in a later stage of the process are evaporated solely by means of heat generated in the arc. The gaseous oxides of nitrogen are usually recovered by the so-called "acid" absorption process, the gases being passed through an absorption tower, down which water is trickling. The absorbing liquid is circulated through the tower until nitric acid of 40 per cent. strength is obtained. This weak acid is concentrated to obtain marketable nitric acid or is neutralised with limestone to obtain calcium nitrate, which is sold as "Norwegian saltpetre" or "air-saltpetre." Calcium nitrate either pure or containing lime or calcium nitrite can be used directly as a manure in place of sodium nitrate. Recent experience has indicated the possibility of dispensing with the "acid" absorption process and treating the gaseous directly with milk of lime. The furnace gases may also be used directly for making nitrites (see Fr. Pat. 63,643 of 1906; this J., 1906, 847). It is claimed that the process as a whole possesses not unimportant advantages over the Birkeland-Eyde process (see this J., 1906, 27; 1907, 177, 293). The Norsk Hydro-Elektrisk Ivelstof Aktieselskab, the owners of the latter process, and the Badische Anilin und Soda Fabrik have combined to form two new Norwegian companies, and a large factory is to be established in the interior of Telemarken at the Rjukan, and is expected to start running in about two years' time with about 140,000 h.p. A scheme is also in progress for the erection of a factory to use 50,000 p. in South Bavaria. It is estimated that within a few years, the annual output of "air-saltpetre" will reach 10,000 tons.—A. S.

Water, ammonium chloride, lead chloride; Equilibria in the system —. Y. N. Brönsted. Seventh Int. Congr. Appl. Chem., London, 1909.

WHEN crystalline lead chloride is treated with concentrated solutions of ammonium chloride, the crystals lose their transparency and grow together, forming a porcelain-like mass. The change is noticeable with solutions of ammonium chloride down to about $N/4$ in strength, but this change is due to the formation of a double salt shewn by the fact that when lead chloride is dissolved in a boiling concentrated solution of ammonium chloride about 21 grms.) a substance separates on cooling in the form of transparent prismatic crystals, having the composition, $2PbCl_2 \cdot NH_4Cl$. These crystals are decomposed by water and by solutions of ammonium chloride to 0.4 N , becoming opaque and again forming a porcelain-like mass. If this latter change be due to the formation of lead chloride as a solid phase, there should be a particular strength of ammonium chloride solution, lying between 0.4 N and $N/4$ which will be in equilibrium with lead chloride and with the double salt. This is confirmed experimentally.

Lead chloride and pyridine; Equilibrium in the system —. L. Kahlenberg and W. J. Wittich. Seventh Int. Congr. Appl. Chem., London, 1909.

SOLUBILITY determinations with silver chloride and pyridine between $-57^\circ C.$ and $+110^\circ C.$ show that there are two distinct crystalline compounds of silver chloride and pyridine. The two compounds are represented as:

$AgCl_2 \cdot 2C_5H_5N$ and $AgCl \cdot C_5H_5N$, hitherto unknown. The $AgCl_2 \cdot 2C_5H_5N$ occurs between the temperatures $-56^\circ C.$ and $-22^\circ C.$ It appears in the form of minute crystals which are very unstable at temperatures above $-20^\circ C.$ The $AgCl \cdot C_5H_5N$ occurs between the temperatures $-20^\circ C.$ and $-1^\circ C.$ This salt consists of minute needle-like crystals, which are more stable than $AgCl_2 \cdot 2C_5H_5N$. It is most interesting to note that the solubility of the silver chloride decreases from -1° to $+110^\circ C.$ as the temperature rises.

Determining sulphur by catalytic method. Maderna. See XXIII.

PATENTS.

Sulphuric and other acids; Apparatus [sampling] for use in the manufacture of —. W. Firman and A. Cocksedge, Ipswich. Eng. Pat. 52, Jan. 1, 1909.

A DRIP pan, made of glazed stoneware or other acid-proof material, is provided with a central groove, with which a number of divergent grooved branches communicate. The central groove terminates in a common outlet, which projects a short distance from the pan and is fitted with a flange, to which a special nozzle is bolted. This nozzle is trapped in such a way as always to retain a small quantity of acid, and to form a seal for the gases contained in the chamber, in which the apparatus is fixed. On the under side of the pan is a ring, which fits on a pedestal, the top of the latter being inclined so that the contents of the pan flow towards the outlet.—O. R.

Sulphuric acid; Process of condensing acid vapours in apparatus for the concentration of — to 60° and $66^\circ B.$ P. Vialleix and F. Perrin. Fr. Pat. 397,080, Dec. 4, 1908.

CONDENSATION of the acid vapours arising from the concentration of sulphuric acid to 60° and $66^\circ B.$ is effected by embedding in the mass of coke used for the condensation, one or more serpentine coils of lead or other material, in which cold water or acid circulates, or by systematically moistening the coke, or by a combination of these means. Very efficient condensation is thus effected, and, at the same time, the size of the condensing apparatus may be reduced.—F. SODX.

Sodium bisulphate; Utilisation of — for the manufacture of hydrochloric acid and sodium sulphate, and finally of sodium carbonate. D. F. Courtois. Fr. Pat. 397,537, Dec. 16, 1908.

SODIUM bisulphate, obtained as a by-product in the manufacture of nitric acid, is ground with common salt, in the proportion, 6000 kilos. of bisulphate to 2500 kilos. of salt, and the mixture is heated for 1 or 2 hours in a muffle furnace at 300° – $400^\circ C.$ The hydrochloric acid, thus liberated, is recovered in the usual way, and the sodium sulphate, also produced, is converted into sodium carbonate by the Leblanc process.—F. SODX.

Alkali carbonates; Process of manufacture of —. L. Rivière. First Addition, dated Dec. 5, 1908, to Fr. Pat. 396,448, Nov. 16, 1908 (this J., 1909, 599).

AN apparatus is described for effecting the dissociation by heat of the alkali fluosilicates obtained as indicated in the principal patent. It consists of a furnace containing a crucible, into which is fed the fluosilicate and from the bottom of which the molten alkali fluoride flows into a second crucible at a lower level in the same furnace; the silicon fluoride is led to a condensing tower, in which it is treated with hydrofluoric acid. The Addition also includes a process of separating undecomposed potassium fluoride and the potassium carbonate, obtained by double decomposition of the alkali fluoride with chalk, by precipitating the former with aluminium fluoride, as potassium fluoaluminate, this being subsequently decomposed by means of hot milk of lime to give calcium fluoride (to be used as a source of hydrofluoric acid) and potassium aluminate which is then treated with carbon dioxide, so as to produce potassium carbonate and alumina.—F. SODX.

Alkali hydrosulphites; Manufacture of — P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,864, June 1, 1908.

ALKALI hydrosulphite solutions, of higher concentration than heretofore obtained, are produced by mixing zinc dust with an aqueous solution of an alkali (caustic soda, ammonia, etc.), or of the salt of an alkali metal with a weaker acid than sulphurous acid (sodium carbonate, etc.), or of sodium sulphite, and then introducing sulphurous acid into this mixture in the proportion of 3 mols. of the acid to 2 mols. of alkali hydroxide or the equivalent quantity of the alkali salts, or in the proportion of 2 mols. of sulphurous acid to 1 mol. of sodium sulphite or its equivalents. For example, 145 parts by weight of caustic soda lye (25 per cent. of sodium hydroxide) are mixed with 200 parts of water, 40 parts of zinc dust are added, and sulphur dioxide is introduced, until the weight has increased by 96 parts, the mixture being cooled meanwhile; the product is left for some hours with occasional stirring, and then milk of lime (40 parts of quicklime to 120 parts of water) is added and the mixture again stirred and allowed to stand for some hours; after filtration, a concentrated solution of sodium hydrosulphite is obtained.—F. SODX.

Alkaline salts; Extraction of — from blast-furnace tar. G. Craig, Glasgow. Eng. Pat. 10,690, Aug. 8, 1908.

THE object of the invention is to recover the potassium salts from blast-furnace tars, in a state of comparative purity for agricultural and other uses. This is effected by washing the tar with acidified water, which may be done without loss of tar. Sulphuric acid is preferably employed, and acidity of the wash water is indicated by its pale yellow tint, a dark reddish colour showing insufficiency of acid. Heat may be applied to keep the tar thin, and in this way the filter-press residues obtained according to Eng. Pat. 2942 of 1907 (this J., 1908, 69) may be successfully dealt with by the process. The aqueous extract is evaporated to dryness and the residue calcined.—F. SODX.

Lixiviating apparatus, particularly adapted for the extraction of sodium nitrate from caliche. W. Hunt, Glasgow. From R. T. Love, Iquique, Chile. Eng. Pat. 1381, Jan. 20, 1909. Addition to Eng. Pat. 7907, March 23, 1906.

IN the apparatus described in the main patent (this J., 1907, 150), the upper end of the downcomer pipe is closed by a cover, and the communication of the circulating gutter with the downcomer pipe is restricted in size, and fitted with a valve, if desired, so that, if the liquid should boil in the pipe, it cannot escape from the upper end with any rapidity. The pressure simultaneously developed in the pipe ensures that the circulation will at once start, or be maintained in the right direction.—O. R.

Sodium aluminate lyes; Process of manufacturing — A. Vergé. Fr. Pat. 397,211, Feb. 17, 1908.

THE process is for the manufacture of sodium aluminate lyes, practically free from soluble silica, and is characterised by the treatment of bauxite, after mere crushing and without preliminary roasting or pulverisation, by a solution of caustic soda in a vessel arranged in such a way, that: (1), the internal temperature (125°–135° C.) corresponds to a pressure of 2.5–3 atmos. in the space above the reacting liquid; (2), a thorough and rapid circulation is maintained throughout the mixture; and (3), the solid particles are kept in constant and violent collision with each other, thus bringing about their disintegration in the liquid. Steam is preferably employed as the means of simultaneously agitating and pulverising the bauxite, but it is found that, to be effective, the pipe leading steam into the vessel must be neither divergent nor convergent, but parallel, and of a diameter depending on the working capacity of the vessel; also, a difference

of about 2.5 atmos. should be maintained between the pressure of the entering steam and its pressure at leaving this latter being 2.5–3 atmos. The apparatus described in Fr. Pat. 380,272 of July 26, 1907 (this J., 1908, 22) arranged to fulfil the above conditions, is particularly suitable for carrying out the process. By way of example it is stated that when 40 litres of mixture are being treated the diameter of the steam pipe should be 3–5 mm., and for a vessel of 4 cb. m. working capacity, 20–30 mm. diameter is necessary. The advantages claimed for this over existing processes are:—(1), a considerable reduction in the cost of plant, power, fuel, wear and tear, and handling; and (2), the possibility of working with cheap silicious bauxites, containing 5–6 per cent. of silica which have hitherto proved useless.—F. SODX.

Zinc sulphide; Process of treating blende for the manufacture of — E. F. Côté and P. R. Pierron. Fr. Pat. 397,631, Feb. 28, 1908.

ZINC blende is melted with iron in an electric furnace and the zinc vapour produced is either treated at once with hydrogen sulphide, in order to convert it into sulphide, or it is first transformed into oxide; the hydrogen sulphide is obtained by decomposition of the iron sulphide formed. The furnace described in previous patent (this J., 1904, 828; 1908, 342, 632, 864) may be conveniently employed, with necessary modifications for treating the zinc vapours. These vapours are made to pass through a supplementary electric furnace filled with glowing charcoal which retains the impurities and reduces any zinc oxide, the zinc vapour being burnt on leaving this furnace and the oxide aspirated to a large depositing chamber. The zinc oxide may be treated with hydrogen sulphide, either in the depositing chamber, or in the apparatus in which the zinc vapour is burnt, or in horizontal rotating cylinders, or in the presence of water with subsequent drying at a low temperature and under reduced pressure. An apparatus is described, which may be used for generating the hydrogen sulphide, consisting of an acid-proof chamber for the reaction between iron sulphide and sulphuric acid, from which the iron sulphate solution gravitates through a series of shallow closed troughs, heated by the passage through them of gases from the furnace below the reaction chamber so as to drive off hydrogen sulphide and promote crystallisation. As a special apparatus for treating the oxide with hydrogen sulphide, twin horizontal iron cylinders are described, which communicate with each other and rotate slowly. These are charged with the oxide and are strongly heated externally, the hydrogen sulphide passing through each successively and the cylinders being discharged alternately; the direction of the heating gas and of the hydrogen sulphide is reversed each time so that the contents of the freshly charged cylinder are treated last.—F. SODX.

Sulphur ores; Furnace for the combustion of — C. Oddo. Fr. Pat. 397,450, Oct. 7, 1908. Under Int. Conv., Oct. 8, 1907.

SEE Eng. Pat. 21,255 of 1908; this J., 1909, 424.—T. F. I.

Compounds containing nitrogen and oxygen [nitrates] Production of — G. Kettler, Osternburg, Germany. Eng. Pat. 24,264, Nov. 12, 1908. Under Int. Conv. Nov. 13, 1907.

SEE Fr. Pat. 396,161 of 1908; this J., 1909, 473.—T. F. I.

Ammonium sulphate; Process of making — F. Erlenbach. Fr. Pat. 397,384, Dec. 14, 1908. Under Int. Conv., Jan. 10, 1908.

SEE Ger. Pat. 203,309 of 1908; this J., 1908, 1204.—T. F. I.

Graphite; Process of making — E. G. Acheson Assignor to The Internat. Acheson Graphite Co. Niagara Falls. Reissue No. 12,964, dated June 1909, of U.S. Pat. 711,031, Oct. 14, 1902.

SEE this J., 1902, 1336.—T. F. B.

bon; *Process for preparing amorphous — by association of a hydrocarbon.* J. Maeholf. Fr. Pat. 37,578, Nov. 21, 1908.

Ger. Pat. 207,520 of 1907; this J., 1909, 482.—T. F. B.

ogen from air; *Process of extracting —.* O. P. urford, Chicago. U.S. Pat. 923,846, June 8, 1909.

Fr. Pat. 394,557 of 1908; this J., 1909, 243.—T. F. B.

gen from air; *Process of separating —.* G. M. A. aude, Paris. U.S. Pat. 924,428, June 8, 1909.

Fr. Pat. 324,460 of 1902; this J., 1903, 554.—T. F. B.

rine; *Process for separating and concentrating — in gaseous mixtures containing chlorine.* T. Gold- hmidt. Fr. Pat. 397,564, July 29, 1908. Under t. Conv., Aug. 5, 1907.

Ger. Pat. 206,104 of 1907; this J., 1909, 243.—T. F. B.

III.—GLASS, POTTERY, AND ENAMELS.

mic industries: *The use of lead compounds in —.* Mouzin. Seventh Int. Congr. Appl. Chem., London. 09.

so to the dangers attending the use of lead compounds in ceramic industries, the author suggests that the Congress should recommend the Governments to appoint a commission to investigate leadless glazes, in collaboration with manufacturers, and to render aid in these tentative experiments, and also that they should restrain the use of plumbiferous glazes, and allow their use only on condition that the soluble lead portion was converted into thoroughly fritted compounds. The Commission should also examine convenient protective appliances, and pay special attention to the hygiene of ceramic trades.—W. C. H.

rine; *Influence of — in hard-fired glazes.* G. Vogt. Tenth Int. Congr. Appl. Chem., London, 1909. Leichsaal, 1909. 42. 345—346.

WH fluor spar has been a constituent of glazes for a long time, its use is not widely extended. What little literature there is on the subject is contradictory, some authors stating that the fluorine escapes as silicon tetrafluoride during vitrification, whilst others maintain that it remains, either wholly or in part, in the melted mass. Differences of opinion are not surprising, as the composition depends on the atmosphere of the kiln, the temperature and duration of firing, and also on whether the glaze was fired in a crucible or spread out in a layer. The author prepared a glaze made from parts of pegmatite, 1.3 of kaolin, 12.0 of quartz, 11.3 of fluor spar. Pieces were dipped in this, and fired at 1300° C. Analyses of the raw and fired glazes showed that the former contained 4.65 per cent. of fluorine, the latter none. Therefore, if fluor spar be added to a glaze that is required to contain a certain amount of fluorine, it will be necessary to add more silica to counteract the action of silicon tetrafluoride. The absence of fluorine in a fired glaze does not mean that chalk could be substituted for fluor spar. The fluor spar melts at the relatively low temperature of 900°, and dissolves colouring matter, thereby giving better finish and a more brilliant surface to the glaze.—H. H. S.

PATENT.

clay; *Preparation of —.* A. G. Salamon and the Exploration Company, London. Eng. Pat. 13,179, Dec. 20, 1908.

et clay, commercially freed from mica by washing, preferably at a concentration of about 66 to 75

per cent. by weight of water, is conducted into filter-presses of any convenient type. It is there subjected to such a pressure that the cake as it comes from the press contains not more than 30 per cent. of admixed water. By the use of a "washing filter-press," the clay at this stage of the process can be freed from any deleterious colouring matter, and so improved in quality, by treatment with a solution of alum or some such reagent, the excess of the latter being subsequently removed by pure water. The compressed clay is finally dried at a suitable temperature in a furnace, although in some cases it may be found that this treatment is unnecessary.—C. A. W.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Refractory materials; Conductivity, porosity and permeability of —. S. Wologdine. Bull. Soc. d'Encouragement, 1909, 3. 879—942.

THE heat conductivity, porosity (*i.e.*, real and apparent sp. gr.), and permeability to air of a large number of refractory materials were determined, in some cases after different degrees of burning. The most important conclusion advanced by the author is that the heat conductivity of refractory materials depends not only on the quantity of contained air, *i.e.*, on the porosity, as stated by Simonis, but also on the degree of isolation of this contained air, or its mobility, *i.e.*, on the permeability to gases. In general, the higher the temperature of burning, the smaller is the porosity, and the higher the conductivity; but in some cases, as with silica bricks, the percentage porosity remains nearly constant, whatever the degree of burning, although the specific gravity increases, and in these cases the heat conductivity also remains practically constant. To measure the conductivity, the lower surface of slightly conical discs of the refractory materials was heated in a furnace to 400°—1200° C. (generally to roughly 1000° C.); temperatures were determined by thermo-couples, the points of which were placed, one close to the lower surface, a second close to the upper surface, and a third at some distance within the disc; when the temperatures became constant, a water calorimeter was placed on top of the disc, through which a constant quantity of water was passed; the quantity of water passing in a given time, and the amount by which it was heated were determined, as well as the temperatures indicated by the thermo-couples, the lowest one of which was always considerably affected by the introduction of the calorimeter. The curve connecting fall in temperature with thickness of material was found to be a straight line; consequently the actual temperatures of the two faces of the discs were easily determined by extrapolation. Two coefficients of conductivity were calculated: One (A), in small calories, being the quantity of heat transmitted through a thickness of 1 cm. across an area of 1 sq. cm. in 1 second, for a difference in temperature of 1° C.; the second (B), in large calories, being the heat transmitted through a thickness of 1 metre, across an area of 1 sq. m., per hour, for the same difference in temperature of the two faces. The porosity was calculated as usual from the real and apparent specific gravities, and expressed in percentage of total volume. The permeability was determined by measuring the quantity of air forced under constant pressure (of a small height of water column) through a short cylinder of the material tightly enclosed in a glass tube, passage of air between cylinder and tube being prevented by a film of paraffin wax. The results are stated as *c.c.* passing through a thickness of 1 cm. across an area of 1 sq. cm. in one second, under a water pressure of 1 cm. (C); and also in litres passing through a thickness of 1 metre across an area of 1 sq. m. per hour, under the same pressure (D). It was found that the permeability varied in different directions along the same piece of refractory material. Some of the results obtained are summarised in the following table:—

Material.	Conductivity.		Specific gravity.		Porosity.	Permeability.		Temp. Burnt
	A.	B.	Real.	Apparent.		C.	D.	
Fireclay	0.0030	1.07	2.61	1.81	30.8	0.015	5.58	°C.
to	to	to	to	to	to	to	to	1050
Brick clay	0.0050	1.81	2.5	1.9	24.1	0.105	37.84	1300
Barvite I.	0.0039	1.42	2.65	1.91	27.8	0.0405	16.74	—
Barvite II.	0.0031	1.11	3.22	1.89	41.5	0.0292	10.50	1050
Silica I.	0.0033	1.19	3.12	1.92	38.4	0.212	76.39	1300
II.	0.0020	0.71	2.75	1.58	42.58	0.0092	3.32	1050
III.	0.0031	1.12	2.62	1.50	42.9	0.536	192.9	1300
Magnesia I.	0.0058	2.08	3.07	2.0	35.1	0.517	186.1	1050
II.	0.0065	2.35	3.39	2.0	41.0	0.0007	3.49	1300
to	to	to	to	to	to	to	to	—
Magnesite from Euboea	0.0029	1.05	3.39	2.02	40.3	0.0084	3.03	—
Glass pots I.	0.0025	0.89	2.65	1.86	29.7	0.0008(?)	0.30	1200
II.	0.0045	1.62	2.50	1.95	21.9	0.0031	1.11	1600
Carborundum I.	0.0145	7.22	—	—	—	—	—	1050
II.	0.0231	8.32	—	—	—	—	—	1300
“ mixture	0.0033	1.20	3.02	1.96	35.2	0.0053	1.90	1050
Plumbago I.	0.0059	2.12	—	—	—	0.0057	2.07	71
II.	0.0185	6.66	2.37	1.7	28.4	0.0012	0.4	130
III.	0.024	8.64	2.42	1.79	26.0	—	—	—
Chrom-iron I.	0.0057	2.05	4.06	3.19	21.3	0.0508	20.45	—
II.	0.0055	1.98	4.03	2.98	26.1	0.0106	38.16	—
“ agglomerated	0.0028	1.00	3.38	2.31	31.7	0.0032	1.15	105
Kieselguhr	0.0018	0.64	2.48	1.03	58.0	0.0057	34.45	—
Stoneware I.	0.0032	1.15	2.56	1.96	23.4	0.0022	0.80	105
II.	0.0048	1.72	2.42	2.18	9.59	—	—	130
Poreclain “ New”	0.0046	1.66	—	—	—	0	0	140
Building brick	0.0037	1.34	2.56	1.90	25.7	0.0015	0.53	105
Terracotta brick	0.0035	1.25	—	—	—	—	—	105
“ Another mixture	0.0028	1.01	2.54	1.95	23.0	0.0021	0.74	105
Light clay	0.0024	0.86	2.60	1.41	45.7	0.0164	5.90	—

—A. G.

Bituminous road binders; Controlling the consistency of ——. C. N. Forrest. J. Ind. and Eng. Chem., 1909, 1, 378—380.

For determining the consistence of semi-fluid bituminous binders for macadamised roads, the author has elaborated a simple form of viscosimeter, originally suggested by E. C. Wallace. It consists of an aluminium float or saucer and a brass collar (see figure). The brass collar is placed upon an amalgamated brass plate, then filled with the bitumen, which has been softened by gentle heating, and after cooling somewhat, placed in ice water at 41° F. for 15 mins. It is then screwed into the float, and the latter placed on the surface of water heated at 90° F. or any other desired temperature. When the bitumen flows and is displaced by water, the float sinks: the time (in seconds) required is a measure of the consistence of the bitumen. Some of the results obtained with

this (N.Y.T.L.) apparatus are shown in the following table, together with comparative results obtained with the Engler viscosimeter.—

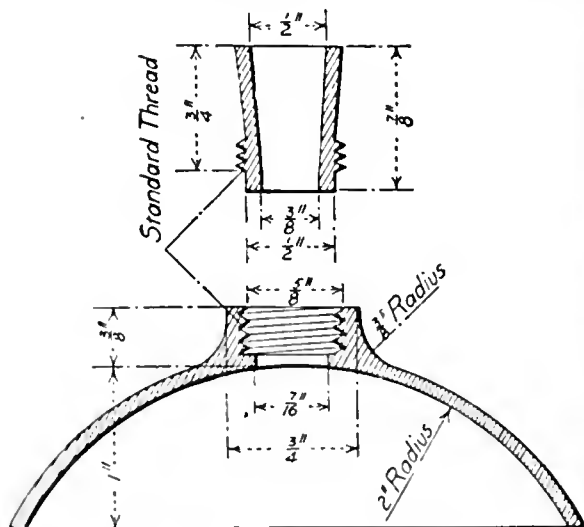
Material.	N.Y.T.L. viscosimeter at 90° F.	Engler viscosimeter, 100 c.c. flow at:		
		77° F.	130° F.	25° F.
Refined water-gas tar	min. sec.	min. sec.	min. sec.	min. sec.
Crude coal tar	0 20	too stiff	9 46	50
Tarvia	1 30	“	9 38	50
Tarina	0 16	17 10	too stiff	32
Texas flux oil	0 51	too stiff	3 18	32
Californian flux oil.	3 40	“	“	14
Headley oil, No. 2	0 35	“	“	30
“ “ No. 4	2 53	“	“	30
“ “ No. 4	6 56	“	“	42
Genasco compound	10 54	“	“	30
“ “	69 55	“	“	too stiff
“ “	11 54	“	“	28
Standard Oil Co. ...	0 6	5 38	1 36	32
“ “ “	0 12	too stiff	3 0	32
“ “ “	0 23	“	“	30
“ “ “	0 39	“	“	18
“ “ “	1 24	“	“	28

* 2 min. 18 sec. at 150° F.

—A.

Cement production in Canada, 1908. Engineer, Jun 29, 1909. [T.R.]

According to returns received by the Mines Branch of the Canadian Department of Mines, the total quantity of Portland cement made in Canada in 1908 was 3,490,601 barrels of 350 lb. net, as compared with 2,491,513 barrels in 1907, or an increase of 40.3 per cent. The total quantity of Canadian Portland cement sold in 1908 was 2,662,889 barrels, as compared with 2,436,093 barrels in 1907, an increase of 9.4 per cent. The total consumption of Portland cement in 1908, including Canadian and imported cements, was 3,141,338 barrels of 350 lb. net, as compared with 3,108,723 barrels in 1907, or an increase of 0.9 per cent.



comparisons of production, sales, and imports of Portland cement in 1907 and 1908.

	1907.	1908.
at sold.....barrels	2,436,093	2,665,289
at manufactured....."	2,491,513	3,495,961
on hand, Jan. 1st....."	299,015	383,349
on hand, Dec. 31st....."	354,435	1,214,921
e of cement sold.....dols.	3,777,328	3,709,139
age price per barrel....."	1.55	1.39
s paid....."	956,080	1,275,638
employed, number....."	1,786	3,029
ts of Portland cement....barrels	672,630	469,049
e of cement.....dols.	837,520	531,045
age price per barrel....."	1.24	1.13
consumption of cement in Canada.....barrels	3,108,723	3,134,338
ber of completed plants erated.....	17	23
daily capacity of operating nts as at Dec. 31st.....barrels	14,400	27,500

23 plants were distributed as follows:—One in a Scotia using blast furnace slag; 1 in Manitoba using a natural Portland cement; 1 in British Columbia, Alberta, and 3 in Quebec using limestone and clay; 15 in Ontario, of which 12 use marl and 3 limestone. Total daily capacity of the plants using marl was 10,400 cels, as compared with 17,100 barrels per day for all r plants. Of the total quantity of cement made in , 1,573,090 barrels were made from marl, and 1,922,871 ls from limestone and slag.

annual production of Portland cement, 1904—1908.

Year.	Cement made.	Cement sold.	Average price per barrel.
	barrels.	barrels.	\$.
.....	908,990	910,358	1.41
.....	1,541,568	1,346,548	1.42
.....	2,152,562	2,119,764	1.49
.....	2,491,513	2,436,093	1.55
.....	3,495,961	2,665,289	1.39

consumption of Portland cement in Canada, 1904—1908.

Year.	Canadian.	Imported.	Total.
	barrels.	barrels.	barrels.
.....	910,358	784,630	1,694,988
.....	1,346,548	917,558	2,264,106
.....	2,119,764	665,931	2,785,695
.....	2,436,093	672,630	3,108,723
.....	2,665,289	469,049	3,134,338

om the foregoing it will be seen that whereas the ration of cement into Canada has decreased very derably, the manufacture and use of Canadian cement f recent years been steadily increasing.

for road building; Composition and physical pro-
rties of —. E. C. E. Lord. Seventh Int. Congr.
pl. Chem., London, 1909.

DES the regular analytical work a series of
were undertaken to determine the solubility of
furnace products in water and dilute acid and to
the effect of calcium hydroxide and calcium car-
te (limestone) on their cementing values. It was found
the materials in question varied in composition from
id glass to a very basic, wholly crystalline slag rock.
samples were grouped according to silica content
three general types, and the characteristic compounds
ch type are described. The solubility tests indicated
only samples having good cementing qualities and con-
g calcium-aluminium double salts were appreciably
ked by water. The cementing properties have been
ded chiefly to the formation of calcium carbonate and
ted silicates of calcium and aluminium analogous to
secondary compounds found in hardened Portland

cement. By the addition of calcium hydroxide and
calcium carbonate (limestone) these cementing properties
were greatly increased. Certain basic, extremely cemen-
tious, converter slags were found to contain silicate
minerals identical in crystalline form and chemical com-
position with the active elements, alite and belite, of
hydraulic cements. As the result of these investigations,
it was found that by means of simple tests, the solubility,
and hence the cementing values of slags might be readily
determined, and that, by using proper precautions,
excellent materials for road construction could be obtained
from the waste products of converter and blast furnaces.

Mortars: Decomposition of — by sulphate solutions.
M. J. Bied. Seventh Int. Congr. Appl. Chem., London,
1909.

CUBES of mortars (1 : 4 or 1 : 5), even when made with
very fine sand, are soon destroyed when placed in a
saturated solution of calcium sulphate (gypsum), although
they resist the action of 12 per cent. magnesium sulphate
solutions, and of (artificial) sea-water. All mortars
free from alumina are rapidly attacked by calcium
sulphate solutions. Puzzuolanas also are decomposed to
a greater extent by solutions of calcium sulphate than
by those of magnesium sulphate. For four years a
French firm has manufactured a cement, consisting of a
mixture of dehydrated alumina and silicious cement,
which has been successfully employed by French railway
companies in regions containing gypsum.—A. G. L.

Wood; New processes of impregnating —. J. Perten.
Seventh Int. Congr. Appl. Chem., London, 1909.

THE author describes the process of impregnating wood
with salts containing fluorine, which is an advance beyond
previous processes both for efficacy and for cheapness.
He also mentions the attempts that have been made to
utilise the strong fungicidal action of organic dinitro-
compounds, which may be used either alone or in con-
junction with fluorides.—W. C. H.

Alkali, etc., works report. See VII.

PATENTS.

Silica bricks, ganister, and other refractory materials;
Manufacture of —. H. Brearley and F. C. Moor-
wood, Sheffield. Eng. Pats. 14,619, July 10, 1908,
and 7197, Mar. 25, 1909.

THE lime and water added as binding agent to silica
bricks, etc., are replaced by a solution of a calcium salt,
preferably calcium chloride, which, on firing, will yield
free lime evenly distributed throughout the mass. The
calcium salt may in certain cases be made *in situ* from
lime and acid. A part or the whole of the calcium salt
may be replaced by a magnesium salt.—A. G. L.

Terra cotta; Manufacture of architectural —. M.
Barrett and The Leeds Fireclay Co., Ltd., Leeds.
Eng. Pat. 26,284, Dec. 4, 1908.

ARCHITECTURAL terra cotta, without any glaze, but
impermeable and capable of being readily cleaned, is
manufactured, by moulding the block or other article of
ordinary clay or clay mixtures, thoroughly drying the
same, and, whilst hot, spraying on a very thin coating of a
mixture consisting of potash felspar, silica (ground),
ammonium alum, calcium carbonate, china clay, zinc
oxide, potassium alum, and water, to which a colouring
oxide or salt may be added. The composition of the
mixture employed will vary according to the conditions
met with, but, as an example, the above mixture, in the
proportions by weight, 277.5, 32.4, 154.2, 80, 193.5, 60.7,
and 474.7, mixed with cold water to the consistency of
a cream, is suitable for Leeds clay, and produces the best
results when baked at about 1340° C. The surface is
as impermeable as glass and similar to natural stone;
it does not become coated with efflorescence.—F. SONS.

Cement ingredient. W. V. B. Ames, Chicago, Ill. U.S. Pat. 923,238, June 1, 1909.

The cement ingredient consists of phosphoric acid, a metallic compound (e.g., aluminium phosphate), and a fluosilicate.—A. G. L.

Wood; Art of transforming —. W. A. Hall, New York. Eng. Pat. 42,051, June 3, 1908.

SEE U.S. Pat. 901,097 of 1908; this J., 1908, 1113.—T. F. B.

Cement for building and like purposes; Manufacture of —. P. Timofeeff, St. Petersburg. Eng. Pat. 11,522, May 27, 1908. Addition to Eng. Pat. 17,006, July 27, 1906.

SEE Addition of May 6, 1908, to Fr. Pat. 368,339 of 1906; this J., 1908, 1021.—T. F. B.

X.—METALS AND METALLURGY.

Alloys; Formation of —, by pressure, and reactivity of metals in the solid state. G. Masing. Z. anorg. Chem., 1909, 62, 265—309.

FINE filings of the metals were mixed, and then submitted to pressures up to 5000 atmospheres. The solid rods so obtained were examined micrographically and thermally (heating and cooling curves), and in some cases the electrical conductivity was determined and compared with that of the components. In no case were compounds or mixed crystals produced by pressure; the rods obtained immediately after the operation were found to consist always of fine particles of the individual metals in juxtaposition. These conglomerates therefore resemble in their properties the alloys obtained by fusion and cooling, only where these consist of separated crystals of the individual metals, and differ entirely from them when mixed crystals or compounds separate during the cooling of the fusion. The close juxtaposition of the particles produces, however, in time, changes in the metals even in the solid condition, which are disclosed by the thermal or electrical examination of the pressed blocks. When the metals on fusion can form compounds but no mixed crystals, evidence of the formation of such compounds in the solid pressed block is found, combination doubtless occurring at the surfaces of contact, so that the metals are afterwards everywhere separated by a thin film of the compound; and when the block is heated up to the melting-point of the lowest eutectic formed by the compound and one of the metals, the further formation of the compound goes on with greatly increased rapidity. Similarly, where the metals can form mixed crystals, diffusion of the metals through one another is found to go on in the pressed block, at a rate greatly increased if the temperature be raised; so that by keeping such a block hot, its structure becomes in time identical with that of an ingot of the same ultimate composition cooled from fusion, though the block has been all the while solid. Where in addition to mixed crystals, compounds are formed from the melted alloy, these compounds are also formed in the solid pressed block, much more rapidly than in those cases where only compounds, and no mixed crystals, exist.—J. T. D.

Copper production of the United States in 1908. B. S. Butler. Mineral Resources, 1908. [T.R.]

THE production of copper in the United States in 1908 was 942,570,721 lb. This is the largest production ever made, exceeding that of 1906 by 24,765,039 lb., and that of 1907 by 73,574,230 lb., or 8.4 per cent. The details of production for 1908 are shown in the following table:—

1908.		
	Domestic origin.	Foreign origin.
Electrolytic	656,179,349	218,716,268
Lake	195,503,009	—
Casting	24,166,681	134,726
Total	875,849,129	218,850,994
Total output, domestic refineries	1,094,700,123	

Returns from all smelting and refining companies show that the following stocks of electrolytic, lake, and cast copper were on hand at the beginning and end of the year: January 1, 1908, 125,745,796 lb.; January 1, 1909, 121,876,759 lb.

	1907.	1908.
Total refined output	1,032,516,247	1,094,700,123
Stock beginning of year	40,497,181	125,745,796
Total available supply	1,079,013,428	1,220,445,919
Refined copper exported	465,496,007	*618,613,333
Stock at end of year	125,745,796	121,876,759
Total withdrawn from supply	591,241,803	746,490,000
Apparent consumption	487,771,625	479,955,555

* Exports of pigs, bars, ingots, plates, etc., reported by Bureau of Statistics, less 43,262,285 lb. of blister exported without refining.

Lead production of the United States in 1908. C. Siebenthal. Mineral Resources, June, 1909. [T.R.]

THE following table (in tons of 2000 lb.), showing source of lead smelted or refined in the United States, is based as far as possible on smelter figures. No lead ore from the United States was treated elsewhere during the period covered by the table:—

	1906.	1907.	1908.
Domestic ore	350,153	365,166	310,700
Foreign ore and base bullion	68,546	76,849	97,700
Total from all sources	418,699	442,015	408,400

Production of refined lead.

	1906.	1907.	1908.
Desilverised lead	288,792	284,432	265,500
Soft lead	90,783	99,948	101,000
Desilverised soft lead	20,094	29,800	29,800
Refined primary lead	404,669	414,180	396,400
Antimonial lead	10,546	9,010	13,000

The production of secondary lead was as follows:—

	1907.	1908.
Pig lead	9,990	7,800
Lead in alloys	15,508	10,400
Total recovered lead	25,498	18,200

The domestic exports for 1908 were:—

Type	304
Lead manufactures	\$680,097

Iron, carbon, and phosphorus; Alloys of —. J. T. Stead. Seventh Int. Congr. Appl. Chem., London, 1909. (See also this J., 1900, 1019.)

THE article partly bears reference to the work of W. (this J., 1908, 406) and others. In addition, it is stated that the eutectics formed in grey and white pig-iron are practically identical at the moment when solidification begins; but that in white pig-iron the ternary eutectic containing about 2 per cent. of carbon and 7 per cent. of phosphorus, remains as such in the metal during solidification and subsequent cooling, whilst in grey pig-iron this ternary eutectic is changed into a binary eutectic practically free from carbon. This is shown by squeezing the eutectic out of the almost solid metal and analysing, as well as by microscopic examination of the residual grey pig-iron. It is also stated that as the carbon increases in mild steel from 0.1 to 0.5 per cent., the ferrite surrounding the crystals increases in the same proportion, and that the ferrite envelope contains more phosphorus than do the

als first formed. This envelope at first also contains carbon than the interior, but the carbon passes into latter during the subsequent cooling. Rolled steel n carbon, *c.g.*, boiler plate, nearly always contains s of ferrite free from carbon, as well as bands of pear- embedded in ferrite, so-called "ghost-lines." The ntage of phosphorus is higher in the ferrite bands than e pearlite bands, and the bands become more marked increasing content of phosphorus. The formation ese bands cannot be avoided without complete ation of phosphorus.—A. G. L.

illet. *Remarks on the thermal treatment of* —. L. Seventh Int. Congr. Appl. Chem., London, 1909.

CTION is drawn to the influence of the time factor e quenching, annealing and tempering of ordinary special steels. According to the author, this factor often neglected. It is known that, at the temperature enching, the combined carbon (cementite) in the ded steel passes to the state of solution in the iron. explains the increase of hardness observed when s steels of sufficiently high carbon content are heated quenched several times successively. The successive gs which precede each quenching play the same part single but more prolonged heating. This fact is ated by experiments on a manganese-silicon steel. nfluence of time is still greater in the case of special . These can be divided into two classes, since the n elements may exist as double carbides in the itite, or they may be dissolved in the iron. In either t is observed that the solution of the carbide takes with difficulty. It is therefore necessary to increase e duration of heating before quenching, or the reature. However it is always advantageous to the quenching in the neighbourhood of the trans- tion point. The influence of time may be further red in the operation of tempering. Thus it has been a that the same state of temper can be obtained in a y working at different temperatures during variable . The effect will be so much the more accentuated nger the metal is maintained in the neighbourhood e tempering point.—C. A. W.

; *Study of the gases liberated by the action of cupric s on* —. E. Goutal. Seventh Int. Cong. Appl. m., London, 1909.

ction of a slightly acid concentrated solution of the e chloride of copper and potassium at 40° C. on steels a gas containing a small proportion of carbon ide. This carbon monoxide appears to be occluded steel, and its volume varies from one-third to four of that of the steel. (See also this J., 1907, 477.) —A. T. L.

ten-steel; *Analysis of* —. F. W. Hinrichsen. venth Int. Congr. Appl. Chem., 1909, London.

e analysis of tungsten-steels, great difficulty occurs e phosphorus determination, and hitherto literature orded no enlightenment. The following method d to give satisfactory results. The nitric acid on of the tungsten-steel is evaporated to dry- and the residue is fused with sodium peroxide. ubsquent solution in water, together with all ngsten (and chromium), also all the phosphorus overed. From one portion of this solution, ree elements just mentioned, are precipitated itatively by mercurous nitrate, and after ignition, ure of tungstic acid, chromic oxide, and phosphorus ide, is obtained. In another portion of the n, the chromium is determined volumetrically. a third, the phosphoric acid is estimated as follows: r neutralising, and rendering alkaline with ammonia, itation is effected by magnesia-mixture (Jørgensen's d). In this way, very minute quantities of tungstic re precipitated. In order to remove these the sia-mixture precipitate is dissolved off the filter by

the aid of nitric acid, and the phosphoric acid separated by Finkener's method of precipitation in presence of tartaric acid.

Physico-chemical methods; Applications of — to technical problems. [Extraction of silver by Pattio process, and examination of inks.] F. W. Hinrichsen. Seventh Int. Congr. Appl. Chem., London, 1909.

PHYSICO-CHEMICAL methods of investigation were applied to several technical processes, the first being the Pattio-process. In this process, finely divided silver sulphide ores are intimately mixed with a solution of sodium chloride, and then stirred for some time with ferric and copper salts and mercury. According to Kröhnke the reactions which take place are as follows: $2\text{CuCl}_2 + \text{Ag}_2\text{S} = \text{Cu}_2\text{Cl}_2 + 2\text{AgCl} + \text{S}$, and $\text{Cu}_2\text{Cl}_2 + \text{Ag}_2\text{S} = \text{Cu}_2\text{S} + 2\text{AgCl}$. The silver is then reduced by the metals present and forms an amalgam with the mercury. Kröhnke also states that mercury alone can reduce silver from its sulphide. The different equilibria possible in the system: silver sulphide, mercury, sodium chloride, water, were studied by the author. As regards the binary mixtures possible, both mercury and silver sulphide are practically insoluble in water, and neither substance reacts with solid sodium chloride. The equilibria between sodium chloride and water are known. In the remaining mixture of mercury and silver sulphide it was found that a reaction takes place slowly and is apparently only slightly influenced by temperature. With the ternary mixtures possible, it was found that a saturated solution of sodium chloride has no action, either at the ordinary temperature or at 100° C., on mercury or on silver sulphide. By acting on silver sulphide with mercury in the presence of water, it was found that the amount of silver produced was smaller than when no water was present. Probably the effect of the water is mechanical in preventing intimate admixture of mercury and silver sulphide. The system: mercury, silver sulphide, sodium chloride, was not studied, since solid sodium chloride cannot be expected to influence the reaction between mercury and silver sulphide. Investigation of the quaternary system: silver sulphide, mercury, sodium chloride, water, showed that reduction of silver increased with increasing concentration of sodium chloride and with increase in temperature. The yield of metallic silver was also increased if zinc amalgam was employed instead of mercury; the E.M.F. of zinc towards silver sulphide in presence of sodium chloride was found to be nearly 1 volt. Iron shows a much lower tension, and was without favourable influence on the reaction. When sulphuric acid or potassium cyanide solution was substituted for the sodium chloride solution, however, the addition of iron resulted in a greatly increased yield of silver. It was found that with these solutions the mercury remained with an unbroken surface, whilst with sodium chloride solution it broke up into small globules. The favourable action of zinc with this solution is probably due mainly to its diminishing the cohesion of the mercury. The action of iron in presence of potassium cyanide solution is probably mainly mechanical; in fact, equally good results were obtained when a small glass plate was substituted for the sheet-iron, both bodies helping to bring the mercury in contact with the silver sulphide.

Physico-chemical methods have also been used in the analysis of inks. It is customary to extract gallic and tannic acids with ethyl acetate, to free the extract from dissolved ferric chloride by shaking with water, and then to re-extract this aqueous solution with ethyl acetate in order to recover the small quantities of organic acids dissolved. The law according to which a solute divides itself between two solvents shows that exact results cannot be obtained in this way. Better results are obtained by shaking the ferric chloride out of the ethyl acetate extract with a salt solution (*e.g.*, with a half saturated solution of potassium chloride) in which tannic and gallic acids are insoluble. The titration of the extracted acids with iodine in presence of sodium bicarbonate was also studied; constant results are obtained only under certain conditions, as the sodium bicarbonate itself consumes iodine, in quantity depending on the sodium hydroxide formed owing to hydrolysis, which in turn is dependent on time and temperature. Lastly, the

quantity of free acid present in inks may be approximately estimated by salting out the bulk of the colouring matter with sodium chloride and then absorbing the solution in filter-papers previously immersed in indicators sensitive to different concentrations of hydrogen ions.—A. G. L.

Platinum; Alloys of — with the alkali metals and with thallium. L. Hackspill. Seventh Int. Congr. Appl. Chem., London, 1909.

PLATINUM dissolves in sodium and potassium at temperatures above 450° C., and is wholly deposited in a crystalline condition before the solidification of the alkali metal. With thallium, platinum forms a definite compound, PtTl (see this J., 1908, 450), having properties corresponding with those of the lead compound, PtPb, obtained by Bauer, which presents another analogy between lead and thallium.—R. C. P.

Lead; Limit of — in culinary utensils and tinned articles. Padé and Kohn-Abrest. Seventh Int. Congr. Appl. Chem., London, 1909.

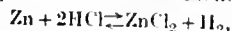
VESSELS of tin, such as measures of capacity, intended for daily use may contain such a proportion of lead as is strictly necessary to give a sufficient malleability in the working of the alloy. This quantity, however, should be less than 5 per cent. In the preparation of tin-plate intended for use in the manufacture of preserve-tins and other cooking utensils, the tinning should be made with refined metal, containing not more than 0.5 per cent. of lead and 1 part of arsenic per 10,000. No solder containing lead should be brought into direct contact with the preserved substances.—C. A. W.

Tellurium; Preparation of pure —. [Determination of tellurium in ores.] R. Schelle. Seventh Int. Congr. Appl. Chem., London, 1909.

CRUDE tellurium, containing 30 to 70 per cent. of the element, with copper and antimony as the chief impurities, is boiled with a solution of sodium sulphide with admixture of powdered sulphur. Copper remains undissolved, and pure tellurium is precipitated from the solution by the addition of sodium sulphite. Selenium, arsenic, antimony, tin, gold, and platinum, if present in the solution, are not thrown down. The precipitation is complete, and tellurium may be estimated in its ores, by fusing the ore with sodium carbonate and sulphur, or with anhydrous sodium thiosulphate, extracting with water, and precipitating with sodium sulphite.—A. T. L.

Precipitation of metals by hydrogen from aqueous salt solutions at high temperatures under pressure. W. Ipatjew and W. Werkowsky. Seventh Int. Congr. Appl. Chem., London, 1909. (See also Ber., 1909, 42, 2078—2088.)

For every metal examined, a definite critical temperature has been found, below which it is not precipitated by hydrogen from aqueous solutions of its salts, even when very high pressures (e.g., 600 atmospheres) are employed. Copper is completely precipitated from solution of its sulphate, acetate, nitrate, and chloride only at a temperature of 130°—140° C. At 70° C., however, hydrogen precipitates cuprous oxide from cupric acetate solution, whilst at 120°—130° C., metallic copper is precipitated quantitatively. Nickel is precipitated at 200° C. from solutions of its acetate, sulphate, and chloride, the reaction being incomplete in the last case. Cobalt is precipitated at 180°—200° C. from solution of its acetate and sulphate. Lead and bismuth are completely precipitated at 240°—250° C. Experiments are in progress to study the equilibrium of the reaction:



in presence of hydrochloric acid of sp. gr. 1.19.—A. G. L.

Action of alcohol, its impurities, and denaturant on common metals. Duchemin. See XVII.

Alkali, etc., works report. See VII.

Action of paper on metals. Klemm. See XIX.

PATENTS.

Smelting zinc ore, galvanizers' dross, etc.; Apparatus for use in —. E. H. Hopkins, Addlestone, Surr. Eng. Pat. 12,403, Nov. 16, 1908.

IN place of the plain tubes containing coke, which is inserted in the ends of the condenser to prevent the escape of zinc fumes, and to trap the lead at the entrance to the condenser, special tubes are used having longitudinal corrugations, internally, externally, or both, where choking of the tubes is avoided. Externally the tubes are of the shape of double cones, or they may be curved so that the condensed lead may be retained in them.—F. R.

Greasy mixtures; Apparatus for eliminating — from solids, or material to be detained, and drying and filtering same. London Electron Works Co., and E. Kardos. London. Eng. Pat. 12,641, June 12, 1908.

METALLIC scrap, or the like, is placed in a vessel having perforated bottom or grid, which is encased in an outer vessel, the latter being filled with water to the level of the grid. The double vessel is closed, and live steam admitted below the grid, causing the grease to liquefy and float to the surface of the condensed water. On opening the outlet pipe in the upper vessel, the released pressure of steam flows through it, carrying by its velocity, part of the condensed water and the whole of the grease floating on it. The heat of the steam left in the vessel, dries the cleansed metallic scrap. The steam and grease pass into another vessel having a number of filter grids, where the steam expands and condenses, depositing the grease on the filters, the heat remaining serving to dry the grease.—F. R.

Defining; Apparatus for preparing scrap tin for —. London Electron Works Co., and E. Kardos, London. Eng. Pat. 12,642, June 12, 1908.

TIN scrap or the like, is placed in the first of a series of five perforated cylinders having their axes in line, and revolving at a small inclination to the horizontal, which causes the material to automatically travel along the length. The material is subjected to a different treatment in each cylinder, viz. 1. Dry and frictional, to remove dry deposit. 2. Sprinkling, from external or internal sprinklers, to remove grease, etc. 3. Washing, the lower portion of the perforated cylinder revolving in an external bath of liquid. 4. Draining. 5. Heating, to remove solder, paint, etc.—F. R.

Tin smelting; Methods and apparatus for —. R. Scott, London. Eng. Pat. 17,229, Dec. 11, 1908.

FINELY-DIVIDED tin oxide is placed in a series of horizontal tubes having their ends fitted with screw caps. The tubes are placed in a furnace with means for rotating them about their long axes. Water-gas or producer gas, is passed through them and they are then heated to reduce and rotated. The tin oxide is reduced to prills of metallic tin, which are subsequently fused into an ingot. The waste heat from the furnace is used for preheating the tubes.—F. R.

Crucible furnaces; Tilting —. J. Newton and Billington, Stoke-on-Trent, Staffs. Eng. Pat. 20,441, Sept. 29, 1908.

THE air holes in the bottom plate or grid of the furnace are arranged concentrically between two raised annular rings integral with the plate, so that the direction of the air blast is controlled, and it does not impinge directly against and cut away the bottom part of the crucible.—F. R.

Pickling metals; Process for —. G. K. Davis and R. Fearon, Manchester. Eng. Pat. 25,024, Nov. 1908.

SULPHURIC acid of about 110° Tw. is added to the previously used hydrochloric acid pickling bath, (which is preferably at 45° to 50° C.) in order to convert the dissolved metal chlorides into sulphates and set free hydrochloric acid for further use. When the bath is saturated with

lphates, the sulphates are allowed to crystallise out, and the residual liquor made up with water and acid to the original volume.—F. R.

Silicon [tellurium] alloy. J. T. H. Dempster, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 923,152, June 1, 1909.

An alloy of silicon with 1–15 per cent. of tellurium is produced by melting together silicon and tellurium in presence of a material (e.g., a decomposable carbonate) which will combine with silica to form a protective layer of slag upon the fluid mass. A decarburising agent may be added.—A. G. L.

Leels; Heat treating and quenching alloyed —. J. Churchward, Mount Vernon, N.Y., U.S.A. Eng. Pat. 17,759, Aug. 24, 1908.

EE U.S. Pat. 899,713 of 1908; this J., 1908, 1069.—T. F. B.

Steel; Method of consolidating fine-dust for use in the manufacture of —. W. Thomlinson, Seaton Carew. U.S. Pat. 923,605, June 1, 1909.

EE Eng. Pat. 21,428 of 1907; this J., 1908, 1068.—T. F. B.

Manganese steel; Process for treating — to obtain rolled articles, etc. Manganese Steel Rail Co. Fr. Pat. 396,871, Nov. 28, 1908.

EE Eng. Pat. 24,685 of 1908; this J., 1909, 527.—T. F. B.

Copper; Extracting — from its ores, mattes, or the like. H. K. Hess, Philadelphia, U.S.A. Eng. Pat. 11,996, June 2, 1908.

EE Fr. Pat. 391,917 of 1908; this J., 1908, 1117.—T. F. B.

Copper; Process for obtaining pure — from a solution of a salt of copper. L. Juman, Paris. U.S. Pats. 924,076 and 924,077, June 8, 1909.

EE Addition of Oct. 27, 1906, to Fr. Pat. 367,452 of 1906; this J., 1907, 419.—T. F. B.

Zinc dust; Manufacture of —. S. O. Cowper-Coles, London. U.S. Pat. 923,411, June 1, 1909.

EE Eng. Pat. 13,977 of 1907; this J., 1908, 758.—T. F. B.

Alkaline salts from blast-furnace tar. Eng. Pat. 16,690. See VII.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Manganese; Electrochemical behaviour of —. C. N. Otin. Z. Elektrochem., 1909, 15, 385–386.

WHEN manganese salts are electrolysed with high current densities, weighable amounts of manganese are often deposited on the cathode. Different salts behave differently in this respect, the amount of cathodic deposition being less with the nitrate or the double ammonium sulphate than with the sulphate. The addition to the liquid of a sufficient amount of ammonium sulphate completely prevents this cathodic deposition in all cases. —J. T. D.

Manganese; Electrolytic determination of —. C. N. Otin. Z. Elektrochem., 1909, 15, 386–389. (See preceding abstract.)

THE whole of the manganese from pure manganese salts (sulphate, nitrate, manganese-ammonium sulphate) can be obtained on the anode as a coherent deposit of pure anhydrous peroxide, under the following conditions:—Cathode, platinum spiral of 17–18 sq. cm. surface; anode a platinum basin with matt surface; voltage about 4 (two accumulators in series); current density 0.1 to 0.8 ampere per 100 sq. cm. of anode; time, about 12 hours at ordinary temperature or about 2 hours at 60°–65° C.; amount of salt corresponding to 0.3–1.0 gm. of manganese dioxide; addition to bath, 1–2 grms. of ammonium sul-

phate and 3–8 c.c. of alcohol. At the end of the electrolysis the deposit is carefully washed with water, dried till of constant weight (1½–4 hours) at 200°–220° C., and weighed with the basin. Without the addition of alcohol the deposit is not so firmly adherent, though even then it is dense enough to allow of washing by decantation without loss. When alcohol is added the deposit shows a deficiency of oxygen, too slight, however, to affect the result as determined by the weight of the deposit. —J. T. D.

Electrolytic oxidation of ammonia. Brochet and Boiteau. See VII.

Electrolytic production of white lead. Yunc. See XIII.A.

PATENTS.

Electric cables; Manufacture of — and of material for use therein. E. S. Ali-Cohen, Nymwegen, Holland, P. A. M. Cramer, Amstel, Holland, and W. Geipel, London. Eng. Pat. 10,535, May 14, 1908.

THE electric cable, comprising one or more conductors, is covered with layers of paper tape coated with a semi-liquid bituminous insulating material, and, if necessary, textile fabric, impregnated or not with insulating material, may be interposed between the layers of coated paper, and also wound round the cable as an outer protective covering. The waterproofing and insulating material may be such as is described in Eng. Pats. 8071 of 1902 or 5279 of 1908 (this J., 1903, 425; 1908, 816), with liquid paraffin in such proportions as to render the mixture semi-liquid at ordinary temperatures; e.g., comprising 63 per cent. of purified asphaltum, 18.4 per cent. of solidified petroleum, and 18.6 per cent. of liquid paraffin. Such a material, when wound in concentric layers, forms a cable which will resist injury due to bending or like strains, owing to the flowing action of the bituminous substance. If necessary, the cable may be afterwards vulcanised by heating.—R. N.

Galvanic element of the Bunsen type. K. Heintz, München, Germany. Eng. Pat. 13,671, June 27, 1908.

IN place of nitric acid for the depolarising solution, a solution of sulphuric acid, 30 per cent. or higher, with nitric acid of 36° or 40° B. is used. This mixture depolarises until the nitric acid is quite used up and can be renewed by the addition of nitric acid and concentrated sulphuric acid in approximately equal parts by weight. For continuous operation the exciting solution should consist of a neutral solution of zinc or iron sulphate, in place of the usual 5 per cent. sulphuric acid solution.—F. R.

Cell or condenser; Electrolytic —. E. E. F. Creighton, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 923,774, June 1, 1909.

THE condenser consists of a number of water-tight cups of aluminium, arranged one within another, and separated by a solution of citric acid. The whole is surrounded by an oil-bath, which insulates the edges of the cups and leaves a free passage for the escape of gases.—A. G. L.

Electric conductors; Manufacture of refractory —. W. D. Coolidge, Schenectady, N.Y. Eng. Pat. 17,621, Aug. 21, 1908. Under Int. Conv., Aug. 24, 1907.

TUNGSTEN or other suitable metallic powder is incorporated with a ductile alloy or other metallic binder and formed into conductors. The latter are then heated in an oven or furnace until the alloy is vaporised and the tungsten is sintered into a coherent body.—W. H. C.

Furnaces; Electric — for the treatment of gases or gas mixtures. Salpetersiure Ind.-Ges. m. b. H., Gelsenkirchen, Germany. Eng. Pat. 8443, April 7, 1909. Under Int. Conv., May 22, 1908.

THE furnace comprises a series of superposed annular elements, alternately provided with air inlet orifices and gas suction pipes, and surrounding an axial shaft, at the extremities of which the electrodes are placed. The elements having gas suction pipes are box-like, and contain cooling coils, or equivalent cooling apparatus.

surrounding the shaft, for the purpose of cooling the gases sucked through, but the gas outlet orifices nearest the electrodes communicate with a conduit separate from the main gas conduit.—B. N.

Filaments. Eng. Pat. 27,144. See 11.

(B.) ELECTRO-METALLURGY.

One [Iron]; Electric furnace reduction of —. J. W. Richards. Amer. Electrochem. Soc., Niagara Falls, May, 1909. *Electrochem. and Met. Ind.*, 1909, 7, 253-254.

The author compares the reduction process in the blast-furnace with that in the electric furnace. In the case of the first, the combustion of the carbon to carbon monoxide before the tuyères fulfils two functions; it provides the high temperature necessary for the smelting of the iron and slag, and it generates a large quantity of reducing gas which performs in the upper part of the furnace the greater part of the reduction. The amount of fuel used in a blast-furnace is determined solely by the amount which must be burnt at the tuyères in order to produce the necessary temperature. From this it can be shown that only one-third of the carbon monoxide produced at these points is used in the reduction of the ore, the remaining two-thirds escaping unchanged. On the other hand, in the electric furnace, where there is no blast and where the heat is supplied from outside by electrical energy, practically the whole of the solid carbon is utilised for reduction. It can then be shown that the amount of carbon utilised in the electric furnace is between one-third and one-fifth of that required in the ordinary blast-furnace, according as the reaction takes place in the hottest parts, with sole production of the monoxide, or in the cooler portions, where a mixture of dioxide and monoxide is produced. Since no air is blown into the electric furnace, any excess of carbon above that consumed in the reduction must remain unused, accumulate, and tend to clog the furnace. The author therefore recommends a combination of blast and electric furnace provided with a variable supply of air. Under ordinary conditions this supply would be a minimum and only sufficient to keep the tuyères open, the full blast being turned on when the falling resistance of the furnace indicated an accumulation of carbon.—C. A. W.

Steel; Automatically circulating furnaces of the Gin type for the electrical production of steel. G. Gin. Faraday Soc., 1909, June 15. [Advance proof.]

Induction furnaces are described in which the molten material is in continual circulation, thus causing a better distribution of heat and of the purifying reactions than in the ordinary induction furnace. The furnaces are composed of two crucibles communicating by inclined channels, the whole arrangement forming a closed circuit in which the heat generated causes a general circulation. Every portion of the molten mass comes rapidly into contact with the oxidising slag, and the very high temperature attained does not introduce the "pinch" effect in the heating channels. It is claimed that with this type of furnace the ohmic resistance of the circuit can be increased with corresponding alteration of the self-induction, thus allowing furnaces with a high-power factor to be constructed, and generators and transformers of normal frequency and size to be employed. A 5-ton, 420-k.w. furnace is illustrated, designed to take current at 4800 volts at a frequency of 5. The author also describes an electrode furnace in which the same system of automatic circulation is applied, by cross-connecting the separate crucibles, into which the electrodes dip, by means of inclined channels, sloping in opposite directions. Finally, the author describes a combined induction and electrode furnace similarly arranged for automatic circulation of the fluid steel. In this, internal heating in the channels, generated inductively, and superficial heating at the electrodes in the two connected crucibles are simultaneously made use of. To the paper is added an appendix which gives the calculations necessary for the design of these types of furnaces.

Silicon sulphide in the desulphurisation of iron; Formation of —. W. Fielding. Trans. Faraday Soc., June 15, 1909. [Advance proof.]

In order to ascertain why the addition of ferro-silicon, in the refining of steel in the electric furnace, assisted complete desulphurisation, a mixture of pure ferrous sulphide and ferro-silicon was placed in a graphite tube and heated in an electric resistance furnace. Carbon monoxide was first evolved and at 1700° C. a yellow vapour was given off, which partly condensed in the tube, the carbon monoxide when ignited smelling strongly of sulphur dioxide. The yellow substance was found to contain about 50 per cent. of silicon sulphide (SiS₂), as determined from the amount of sulphuretted hydrogen evolved on the addition of water, the remainder being ferrous sulphide, silica, and a little ferric oxide. Under reduced pressure the sublimate began to form at 1500° C., but the silicon sulphide could not be obtained pure as even *in vacuo* no volatilisation occurred up to 1100° C., above which temperature the iron sulphide also volatilises.—F. R.

Vanadium; Production of —. G. Gin. Amer. Electrochem. Soc., Niagara Falls, May, 1909. *Electrochem. and Met. Ind.*, 1909, 7, 264.

By the electrolysis of a solution of vanadium trioxide in fused calcium fluovanadate, V₂F₆·3CaF₂, metallic vanadium is obtained, the principle being analogous to that employed in the manufacture of aluminium. The lining of the bath is composed of pure electrically fused alumina agglomerated with tar and a little vanadic anhydride. Carbon anodes are employed, and the cathodes are composed of conical conductors of pulverised and agglomerated ferro-vanadium. On these the metal is deposited in solid sheets which are subsequently removed when the bath has been emptied. A current density of 4.5 amperes per square inch of anode section is recommended.—C. A. W.

Silico-vanadium. G. Gin. Amer. Electrochem. Soc., Niagara Falls, May, 1909. *Electrochem. and Met. Ind.*, 1909, 7, 264.

The silicide, SiV₂, was obtained by reducing in an electric furnace a mixture of vanadic acid (10 parts), silica (1 part), and coke (1 part). The current density employed amounted to 1290 watts per square inch of cross-section of electrodes. The volatilisation of vanadic acid could be almost prevented by using vanadium trioxide, according to the equation:



Employing an intimate mixture of rich ferro-silicon with the trioxide, the whole being agglomerated with 4 to 6 per cent. of coal-tar pitch and charged into the furnace in the form of briquettes, a double silicide of the approximate composition, Fe₄Si₅V₆, was obtained.—C. A. W.

PATENTS.

Electroplating; Apparatus for —. R. E. Phillips. London. From The Meaker Co., Chicago, Ill. Eng. Pat. 5087, March 2, 1909.

The articles to be plated are continuously passed, during the process of plating, through the bath, and means are provided for rotating or turning the articles, in order to direct every portion toward the anodes and prevent uneven deposition of metal.—B. N.

Metals; Process for the electric dissociation [deposition] of — by the wet method. A. Levy. Paris. U.S. Pat. 923,861, June 8, 1909.

SEE FR. Pat. 385,058 of 1907; this J., 1908, 818.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Fatty acids of fish oils. L. M. Tolman. J. Ind. and Eng. Chem., 1909, 1, 340-345.

The oils used in the investigation were Norwegian and American cod-liver oils, pollock-liver oil, hake-liver oil,

ing-liver oil, dogfish-liver oil, trout-liver oil, and seal blubber oil, all of known origin and purity. Determinations were made of the iodine value (Hanus), saturated fatty acids, and the brominated fatty acids and glycerides insoluble in ether and petroleum ether respectively. For the determination of the brominated compounds precipitate, very satisfactory results were obtained by separating the precipitate by means of a centrifugal machine. Comparison of the bromine precipitates obtained from the fatty acids and from the glycerides respectively indicates that the oils contain mixed glycerides. There is a remarkable similarity among the oils from salt-water fish, fresh-water fish, and animals, such as the seal, which live chiefly on fish. (See also his J., 1906, 382).—A. S.

Halphen's reaction [for cottonseed oil]; Modification of —. L. Garnier. Ann. Chim. analyt., 1909, 14, 209—210.

MORE definite results may be obtained with Halphen's reaction by employing a suspension of sublimed sulphur 2 per cent. in carbon bisulphide, instead of the 1 per cent. solution originally prescribed, and by comparing the maximum depth of colour obtained under definite conditions with a series of colour standards previously prepared. The carbon bisulphide and sulphur reagent is well agitated and measured off quickly, an equal volume of the oil and of amyl alcohol are then added in a tube of 25 mm. diameter and 20 c.c. capacity. The height of the liquid (9 to 10.5 c.c.) is then marked with a diamond, the tube is attached to a reflux condenser, and heated for one hour in a boiling water bath. On cooling, a slight deposit of sulphur is formed. The mixture is then made up to its original volume by the addition of a little carbon bisulphide, and the depth of colour noted. Standard tubes are prepared by the above method containing 5, 10, 20, 25, 30, 40, 50, 75 and 100 per cent. of cottonseed oil, the diluent being an indifferent oil, such as poppy seed oil. These standards should be kept in the dark, in well corked tubes of 14 to 15 mm. internal diameter. The presence of an excess of sulphur in the reagent ensures the production of a maximum depth of colour under the above conditions.—J. O. B.

Wax plant; New —. J. Soc. Arts, 1909, [2953], 66.
It has been recently found that the candleilla plant contains wax of good quality, and in sufficient amount to make it valuable. The plant is found growing in the following States of Mexico: Tamaulipas, Coahuila, Nuevo Leon, Chihuahua, Durango, Zacatecas, Sonora, Sinaloa, Baja California, Jalisco, Puebla, and San Louis Potosi. It is said to contain from about three and a-half to five per cent. of a wax of a light colour, very hard, and with a high melting point. It is stated that the wax can be leached perfectly white, and that on burning it gives off an agreeable odour.

Cottonseed and sesamé oils; Importation of — into Australia. Board of Trade J., June 24, 1909. [T.R.]

AN Australian By-law (No. 43) of May 5th last, provides that thickened cottonseed oil used solely in the manufacture of other non-edible oils, may be admitted to duty into the Commonwealth under item 234 (1) of the Customs tariff (*viz.*, 6d. per gall.) when denatured by addition of—
a) The equivalent of 5 per cent. of its bulk of mineral lubricating oil of sp. gr. 86 at 60° F., or (*b*) The equivalent of 10 per cent. of its bulk of mineral lubricating oil of less than the sp. gr. quoted. A Customs notice dated May 5, 1909, directs that a duty of 2s. per gallon shall be charged on sesamé oil on importation into Australia.

Soya bean oil and oil cake. Ch. of Comm. J., July, 1909. [T.R.]

CHINESE Soya beans during the last few months have been imported into the United Kingdom in large quantities. Extensive areas of land in China and Manchuria are cultivated for this crop; the plant possesses the property, common to leguminous plants, of absorbing nitrogen from

the air with the result that its cultivation exhausts the soil far less than other oleaginous plants. The oil-pressing mills at Hull have already imported large consignments and, it is stated, find the oil a valuable product. The oil obtained is of good colour and the residual cake is an excellent cattle food. The price of Soya beans has been up to the present very low on account of the abundance of the product. The quantity of beans already exported this year is estimated at over 150,000 tons, and there are at the present time many cargoes of 4,500 to 6,000 tons from Vladivostok and Dalny on the way to Europe, consigned to Hull, Liverpool, and Hamburg. The condition of the beans on unloading is stated to be perfect, in spite of the long voyage. The product is sold with a guaranteed maximum of 2 per cent. of non-oleaginous foreign matter; it is packed in the original sacks. The qualities are classified in three grades: No. 1, shipped at Dalny; No. 2, at Vladivostok; and No. 3, at Hankow. The value of No. 1 is about 12s. 7d. per 100 kilos, gross, c.i.f. European port direct. Nos. 2 and 3 are of equal value, about 12s. 5d. per 100 kilos, gross. In addition to the excellent results which have been obtained with the oil expressed from the beans, the Soya bean cake has met with great success in this country as a cattle food of the first quality rich in albuminoids. It is used as cake or in the form of meal. The following analysis of the cake has been given: Albuminoids, 44.37 per cent., containing 7.10 per cent. of nitrogen; carbohydrates, 32.36; fibre, indigestible, 4.57; mineral matter, 16.70 per cent.

Oils and fats; industry and analysis. J. Lewkowitzsch. Bull. Soc. Chim., 1909, 5, [10], i.—xliv.

THE author reviews the chemistry, industry, and analysis of oils and fats, with relation to their French aspect, touching among other points on the natural occurrence of mixed glycerides, the "alcoholysis" of oils and fats, rancidity, formation of fatty acids from petroleum hydrocarbons, manufacture of butter substitutes, stearine candle industry, conversion of oleic acid into stearic acid, and manufacture of soap and glycerin. In discussing the hydrolysis of oils and fats, he emphasizes the points: (1), that the actual hydrolysing agent in all processes is water, the acids, bases, or enzymes used acting as catalytic agents; and (2), that the hydrolysis proceeds in three stages, each of which is a bimolecular reaction. As examples of the influence of environment on the oil-content of seeds, the author mentions that in the United States two kinds of maize have been developed: one containing as much as 6.53 per cent., and the other as little as 2.97 per cent. of oil; also that American and Egyptian cottonseed containing about 23 per cent. of oil, when transplanted and cultivated at Bokhara, yields only 17.5 per cent.

With regard to the analysis and characterisation of oils and fats, Bömer's phytosteryl acetate test serves to distinguish vegetable from animal products, and the iodine values may be used to divide oils and fats into the groups of drying, semi-drying, and non-drying products, which groups may be further subdivided by other methods. A scheme of classification is shown in the following synoptic table:—

I. VEGETABLE OILS AND FATS.	II. ANIMAL OILS AND FATS.
A.— <i>Vegetable oils.</i>	A.— <i>Animal oils.</i>
1. Drying oils.	1. Marine animal oils:—
2. Semi-drying oils:—	(a) Fish oils.
(a) Cottonseed oil group.	(b) Liver oils.
(b) Rape oil group.	(c) Blubber oils.
3. Non-drying oils:—	2. Terrestrial animal oils:—
(a) Almond oil group.	(a) Semi-drying oils.
(b) Olive oil group.	(b) Non-drying oils.
(c) Castor oil group.	
B.— <i>Vegetable fats.</i>	B.— <i>Animal fats.</i>
1. Chaulmoogra oil group.	1. Drying fats.
2. Laurel oil group.	2. Semi-drying fats.
3. Palm oil group.	3. Non-drying fats:—
4. Nutmeg butter group.	(a) Body fats.
5. Cacao butter group.	(b) Milk fats.
6. Coconut oil group.	
7. Dika fat group.	

Vegetable drying oils are characterised by their content of linolenic acid, and semi-drying oils by their content of linolic acid. The cottonseed oil and rape oil groups

are differentiated by their saponification values, those of the latter class being lower owing to the presence of erucic acid. The vegetable non-drying oils contain a preponderance of oleic acid, with the exception of the castor oil group which contains considerable amounts of ricinoleic or other hydroxy acids. The almond oil group contains small quantities of linolic acid. Of the vegetable fats, the chaummoogra oil group exhibits optical activity; the laurel oil group contains considerable quantities of oleic acid; the palm oil group contains large amounts of palmitic acid, the nutmeg butter group, of myristic acid, and the cacao butter group, of stearic acid. The coconut oil group contains lauric

acid and notable quantities of volatile acids. The dika fat group contains a preponderance of lauric acid with little or no volatile acids. Of the animal oils, those of marine animals are characterised by the presence of chupanodonic acid, and those of terrestrial animals, by that of oleic acid. Drying and semi-drying animal fats contain acids less saturated than oleic acid. Of the non drying animal fats, the milk fats are distinguished from the body fats by the presence of volatile acids.

In the following table the French imports and exports of oil-seeds, fatty substances, and products derived there from are given in metric tons (except where otherwise stated) for 1906, 1907, and 1908.

	Imports.						Exports.					
	1906.		1907.		1908.		1906.		1907.		1908.	
	Com- merce général.	Com- merce spécial.	Com- merce général.	Com- merce spécial.	Com- merce général.	Com- merce spécial.	Com- merce général.	Com- merce spécial.	Com- merce général.	Com- merce spécial.	Com- merce général.	Com- merce spécial.
Tallow and tallow oil	13,847	13,057	14,693	14,024	10,503	8742	24,570	23,830	19,895	19,252	24,005	22,231
Lard	4393	3299	8301	7184	8119	6977	2405	1666	2030	1705	2470	1296
Other animal fats	5671	5490	5776	5647	4595	4472	6019	5843	5281	5153	5867	6742
Margarine and similar fats	133	66	131	28	95	23	6765	6704	5160	5057	6249	6182
Degras	83	67	54	39	12	12	2168	2153	2327	2312	1900	1900
Animal wax, crude	1027	448	973	425	1025	518	720	165	746	202	685	188
Butter, fresh or melted	5544	5016	6782	6456	5777	5445	11,776	12,248	9458	9130	11,784	11,451
Butter, salted	457	156	318	190	244	89	8809	8509	8860	8720	11,009	10,834
Whale oil	508	618	672	655	776	739	—	—	—	—	—	—
Cod-liver oil	3083	3082	3358	3309	3918	3879	93	71	93	79	96	65
Other fish oils	4128	4093	3979	3979	5087	4536	158	120	473	434	907	301
Spermaceti	6000 kil.	6200 kil.	8600 kil.	8100 kil.	9000 kil.	8600 kil.	—	—	—	—	—	—
Arachis seed, in shells	110,270	109,874	163,386	163,241	154,331	154,114	12,042	11,660	9108	8955	10,786	10,584
Arachis seed, decorti- cated	120,594	114,211	126,102	117,404	88,948	84,807	9257	2982	15,739	7040	9695	5558
Niger seed	410	410	4266	4266	406	356	—	—	—	—	—	—
Ravison seed	214	214	486	486	224	224	—	14	—	17	—	—
Cottonseed	36,967	35,241	41,878	38,548	35,589	34,161	1820	93	3411	81	1455	27
Linseed	150,779	143,997	198,853	189,100	187,672	181,662	10,050	3783	16,574	5475	10,395	4743
Hempseed	11,450	11,254	9969	9638	9750	9090	831	635	887	551	1420	794
Sesame seed	64,591	61,194	71,636	68,502	55,411	51,235	3945	750	4165	1032	7385	3460
Mustard and rape seed from the Indies	50,500	49,824	63,354	60,537	40,509	39,232	815	139	2830	296	909	115
Poppy seed (<i>arille</i>), European	14	14	111	11	13	13	304	304	838	838	322	322
Poppy seed (<i>parot</i>), foreign	26,632	26,508	29,375	29,249	21,335	21,280	192	68	442	315	98	42
Colza (rape) seed, European	558	558	196	138	227	227	1821	1821	3595	3838	2240	2240
Rape seed	1908	1908	436	217	13	13	105	105	219	700 kil.	200 kil.	—
Copra	111,176	102,984	110,009	97,277	160,358	152,005	8866	521	13,243	533	20,369	3099
Palm kernels	6848	6637	7580	7044	3829	3490	203	56	526	1700 kil.	483	162
Mowrah seed, illipic seed, etc.	7675	7654	11,002	10,951	15,340	14,597	—	—	—	—	—	—
Other oil seeds	22,243	21,193	28,374	26,918	26,650	24,616	1653	654	2575	1119	2814	799
Olive oil	41,036	25,265	31,924	21,357	49,263	30,582	22,986	9594	21,858	9878	21,994	6770
Palm oil	18,155	14,333	23,554	16,087	21,303	17,842	436	164	1026	202	1154	651
Coconut and palm kernel oils	2958	2813	2931	2916	3719	3517	15,132	14,983	14,609	14,569	22,938	22,725
Castor and cecrops oils	30	37	533	486	1000	966	3812	3810	3914	3885	2808	2738
Linseed oil	1406	587	1898	893	1878	926	1176	3180	5143	4144	3337	2550
Ravison oil	6500 kil.	7300 kil.	4500 kil.	4300 kil.	4000 kil.	4000 kil.	—	—	200 kil.	—	—	—
Cottonseed oil	36,919	37,431	38,696	34,060	51,667	46,750	6640	2289	5152	2062	8258	2495
Sesame oil	162	140	46	18	294	129	9478	9370	11,935	11,896	6519	6232
Arachis oil	310	165	1043	826	537	112	4819	4650	6446	6261	6845	6457
Colza oil	512	25	479	20	379	17	2217	1707	2010	2362	2086	1549
Rape oil	20	20	8000 kil.	8000 kil.	24	18	—	—	—	—	—	—
Poppyseed (<i>arille</i>) oil	500 kil.	500 kil.	1100 kil.	1100 kil.	14	1100 kil.	1206	1206	1184	1166	818	805
Poppyseed (<i>parot</i>) oil	—	—	—	—	13	300 kil.	353	353	317	299	381	381
Mustard seed oil	300 kil.	300 kil.	300 kil.	300 kil.	100 kil.	100 kil.	—	—	—	—	—	—
Other oils	206	28	447	—	475	183	2003	1828	1250	1032	1108	869
Cacao butter	349	314	367	246	316	267	71	22	34	2800 kil.	43	5800 kil.
Oil-cakes	109,953	107,831	113,226	112,391	91,385	90,612	148,852	146,729	142,565	141,673	150,065	149,597
Glycerin	491	152	916	205	757	343	6592	6254	8597	7881	8016	7581
Scented transparent soaps	25	21	28	23	40	38	1597	1598	1802	1758	1688	1826
Other scented soaps	1085	1034	1108	1067	1513	1453	—	—	—	—	—	—
Unscented soaps	1252	806	2776	2205	1890	1201	33,590	33,139	32,110	31,539	35,882	35,122
Tallow candles	—	24	—	25	—	—	141	104	156	131	127	101
Other candles of all kinds	236	10	150	12	178	9700 kil.	6279	4528	5934	4345	5726	3915
Stearic acid	2445	2198	3288	3052	3981	9600 kil.	457	438	133	124	141	122
Oleic acid	5302	5359	6119	6136	3781	3516	5154	3808	3900	1865	5613	3525

NOTE.—Commerce général represents for imports all goods imported, and for exports all goods exported, without any deduction for goods that only go through the country in transit.

Commerce spécial.—The imports represent the national consumption of the imported goods, either for actual consumption as foodstuffs, or as raw material for home industries. The exports represent the national production.

Glycerin. British and Col. Drug., June 18, 1909. [T.R.]

THE price of chemically pure glycerin has been raised to £75 per ton, and sales of "crude" have been reported from Paris at £60, forward delivery. The scarcity of crude, which is the origin of the rise in price, is traceable to a number of causes. The substitution of paraffin wax for tallow in candle manufacture is coincident with a marked increase in the consumption of glycerin for explosive and blasting purposes. The gold output in South Africa increases every month, notwithstanding that the ore is poorer and deeper, and has to be blasted more extensively. Before the Boer War South African requirements in dynamite-glycerin were 2500 to 3000 tons per annum, whereas to-day they are 6000 tons. Canada eight or nine years ago took 400 to 500 tons, as against 1200 tons or more now. Constructional work on the Panama Canal is also attracting large quantities. The United States is reported to be in the market for more than 3,000 tons of crude, and requires for home consumption more glycerin than it produces. The quantity of crude imported therein during the last decade has ranged from 12,000 to 39,000 tons, the maximum being reached two years ago. There are also many contracts for the explosives industry to be arranged in the forthcoming autumn.

It seems, therefore, that an expansion of demand in conjunction with restricted supplies has placed glycerin at a very high value, which will obtain for some time. Controlling explosive interests in Europe require approximately 9000 tons of crude, and in America about the same; it is possible that they might unload small quantities in order to depress the market for their 1911 purchases. Such an operation could, however, have no lasting effect. On the other hand, most countries are working on new processes for the manufacture of high explosives in which glycerin is not required, and the prevailing high price is hastening their advent.

Solvents; Chlorine derivatives of ethane and ethylene and their industrial importance as non-inflammable non-combustible and non-explosive — G. Koller. Seventh Int. Congr. Appl. Chem., London, 1909.

THE chlorine derivatives of ethane and ethylene are non-combustible, non-inflammable, and non-explosive solvents of oils, fats, resins, etc., with a wide range of boiling points. Their use ensures absolute safety and combines the advantage of lower freight rates with a total absence of vexatious restrictions.

Chinese wood oil; Examination of — E. W. Boughton. Seventh Int. Congr. Appl. Chem., London, 1909.

SEVEN samples of tung oil were examined, six being received directly from China and the seventh pressed from the imported nuts. The constants obtained agreed with those published by other observers, except the iodine value. This was found to vary greatly, if Hanus or Wijs solution was used, the temperature, time of contact, and ratio of iodine solution to oil affecting the result. If the Hübl solution be used, however, the variation is small, and the values thus obtained fell within the limits of those published by other observers. The oxygen absorption of Chinese wood oil (Livache test) is much less than that of linseed oil in 48 and 96 hours. On heating tung oil in the steam oven for one hour the gain in weight is greater than for linseed oil. The Lieberman and Storck rosin test gives with Chinese wood oil a claret colour. Ten per cent. of tung oil may be detected in a mixture of tung and linseed oils by either of the following methods: 1. Place ten c.c. of oil in a test tube. Add ten c.c. of a saturated solution of iodine in chloroform. Heat in steam bath till chloroform is expelled. Then heat one hour in oil bath at 200° C. Pure linseed oil remains liquid, while ten per cent. of tung oil will cause solidification. 2. In a glass stoppered tube place ten c.c. of the oil. Add ten c.c. of strong nitric acid and shake well. Place in ice water for one hour. If as much as ten per cent. of tung oil be present, the oily layer will be semi-solid.

Coconut oil; Constituents of aqueous distillates from —

A. Haller and Lassieur. Seventh Int. Congr. Appl. Chem., London, 1909.

IN the purification of coconut oil by treatment with a current of steam, the volatile products expelled consist of acids and of neutral substances insoluble in alkali solutions. The latter have the characteristic odour of the fat, reduce ammoniacal silver nitrate, and combine to a small extent with sodium bisulphite. When distilled under reduced pressure (15 mm.), fractions are obtained with b. pts. from 85° to 106° C., but the main portion distils at 105°–106° C. This consists of a ketone, $C_{20}H_{40}O$, melting at 8° C., and forming a semicarbazone (m. pt., 122° C.), and an oxime (m. pt., 44° C.). The acetate of this oxime distils at 164° under a pressure of 15 mm. The ketone offers great resistance to oxidising agents, and is scarcely attacked by manganese dioxide and sulphuric acid. It is decomposed, however, by silver oxide in the presence of potassium hydroxide, with the formation of a liquid acid, the silver salt of which has the formula, $C_9H_{17}O_2 Ag$.—C. A. M.

Methyl ricinoleate; Oxidation of — by means of ozone.

A. Haller and A. Brochet. Seventh Int. Congr. Appl. Chem., London, 1909.

OZONISATION of methyl ricinoleate in the presence of 10 per cent. of water yielded a white ozonide, $C_{19}H_{36}O_7$, melting at 80° to 85° C. On systematic treatment with sodium carbonate and sodium bisulphite, this yielded the following products:—(1) Active hydroxynonylic acid melting at 47°–48° C. (2) Azelaic acid. (3) Methyl azelaate. (4) A compound of sodium sulphite with the methyl ester of the semi-aldehyde of azelaic acid. (5) A sodium sulphite compound, which was readily soluble in water, and on decomposition with sulphuric acid yielded a product that could be oxidised by potassium permanganate into heptylic acid. (6) A liquid residue insoluble in sodium carbonate solution and not combining with sodium bisulphite. This consisted of a mixture of methyl palmitate and stearate.—C. A. M.

ERRATUM: This Journal, 1909, page 662, col. 1, under XII, "*Mixed glycerides*," etc., throughout for "turkey" read "duck."

PATENT.

Antiseptics. Eng. Pat. 15,931. See XVIIIc.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

White lead; Electrolytic production of — J. A. Yuncik. Amer. Electrochem. Soc., Niagara Falls, May, 1909. Electrochem. and Met. Ind., 1909, 7, 274.

THE process employed is, briefly, to electrolyse a solution of sodium nitrate, ammonium nitrate, or a mixture of both between anodes of lead and cathodes of aluminium, these being cast in the form of strips and grids connected at top and bottom in order to facilitate a continuous operation. The tank is water-cooled from the outside, and provided at the bottom with a stirring device, so that a slow steady motion of the solution is obtained. During the electrolysis carbon dioxide gas is passed through the electrolyte from small orifices in the lower part of the tank. The nitrate decomposed is continually re-formed, so that the only materials consumed are lead, carbon dioxide, and water. The current density employed is 10 amperes per square foot of anode surface at from 1 to 2 volts. After 2½ hours the operation is stopped, the precipitated white lead allowed to settle, removed, washed, and dried. It is stated that 1 ton of white lead requires for its production 16 kw.-hours and that the product is finer than any producible by mechanical means. By employing as anodes lead in combination with copper, nickel, or iron, pigments of various shades and colours can be obtained.—C. A. W.

PATENT.

Dyestuffs insoluble in water. Addition to Fr. Pat. 373,475. See IV.

(B.)—RESINS, VARNISHES.

Oil varnishes; Recent progress in manufacturing —. C. Collignier. Seventh Int. Congr. Appl. Chem., London, 1909.

The author states that of various methods hitherto proposed for the manufacture of oil varnishes without previous heating, only one has led to successful results, *viz.*, that in which naphthalene under pressure is employed, or by using a mixture of naphthalene and copal oils, or rosin oil, with or without pressure. (See this J., 1906, 939.)

India turpentine factories. Ch. of Comm. J., July, 1909. [T.R.]

It is announced that the Government turpentine factory at Dehra Dun, United Provinces, will soon close down and cease operations. The Government factory at Nampur was also abandoned after six years of operation. One turpentine factory in operation in the United Provinces seems to be doing well. Recent improvements have doubled the capacity of the factory. The manufacture of turpentine in the Himalaya mountains is profitable, provided the business is carried on economically and in a modern way.

PATENTS.

Varnish-gum and producing same. J. J. Kessler, St. Louis, Mo. U.S. Pat. 922,596, May 25, 1909.

The varnish is prepared by treating rosin with nitric acid, washing the product thoroughly with water, drying it, and dissolving it in a suitable solvent.—W. P. S.

Resin-like product. C. Gentsch, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 924,449, June 8, 1909.

SEE Fr. Pat. 384,425 of 1907; this J., 1908, 457.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Vulcanised rubber; Method of determining combined sulphur in —. T. Budde. Gummi-Zeit., 1909, 23, 1143—1144.

The author refers to the possibilities of inaccuracy in the estimation of combined sulphur in vulcanised rubber, as ordinarily carried out. Moreover, he suggests that, even in the case of a pure rubber-sulphur mixing, it is not possible to obtain an accurate result by estimating the sulphur present in the acetone-extracted sample, since the whole of the free sulphur is not extracted by acetone; this may be due either to insufficient penetration of the rubber sample by the acetone, or, more probably, to a portion of the free sulphur having been converted into an insoluble form during vulcanisation; the figures ordinarily obtained for combined sulphur are therefore too high. In further investigation of this possibility, comparative estimations of the combined sulphur in a number of samples of vulcanised rubber by the ordinary method, and by a method based on the tetrabromide process (see also Hübener, this J., 1909, 251) have been made.

One grm. of the sample was soaked in 30–40 c.c. of carbon tetrachloride for 24 hours, and 250 c.c. of Budde's bromine solution were then added. (This solution is composed of 1 litre of carbon tetrachloride, 6 c.c. of bromine, and 1 grm. of iodine). The mixture was allowed to stand for 6 hours, and about half its own volume of alcohol was then added to it, after which it was allowed to stand for a further 12 hours and then filtered. The insoluble bromine-sulphur-rubber derivative was allowed to stand in contact with 10 to 15 c.c. of bromine for 24 hours, when it was found to be completely dissolved. Water was added, and the bromine driven off by gently heating on a sand-bath. By this means the whole of the

sulphur present, except that actually combined with the rubber, is eliminated as sulphuric acid, and the combined sulphur can then be estimated in the bromine-sulphur compound, after this has been thoroughly washed with boiling water by decantation, then with alcohol and ether, and dried. The Henriques' method, as modified by Frank and Marekwald, (Gummi-Zeit., 1903, 17, 71) was used by the author for the sulphur determinations. In four different samples of vulcanised rubber, the results obtained by the new method and by the old acetone-extraction method were as follows:—(1), 3.85, 2.14; (2), 3.36, 1.52; (3), 4.63, 2.85; (4), 4.06, 2.01 per cent. — E. W. L.

Indiarubber in North America. H. C. Pearson. Seventh Int. Congr. Appl. Chem., London, 1909.

In the indiarubber industry, the American practice has been to concentrate on special lines. The investment of about \$20,000,000 in rubber plantations in Mexico and Central America, and the production of rubber from the guayule plant—*Parthenium argentatum*—in the uplands of Mexico, are interesting developments in the crude rubber industry. The utilisation of rubber waste has been carried further in America than in other countries, so that the whole of this material has a market value.

Viscosity of solutions. Dunstan. See XXIV.

Pyridine as a solvent. MacKensie. See III.

PATENTS.

Rubber; Preparing and packing — for preservation and transportation. R. B. Price, Mishawaka, Ind., U.S.A. Eng. Pat. 27,090, Dec. 14, 1908.

The raw rubber is treated so as to drive off the water and certain organic substances of low boiling point which volatilise with the last portions of water. The rubber may be dried in a vacuum or by sheeting on hot rollers, with similar results, provided not more than one per cent. of moisture is left in and the volatile constituents are driven off. The rubber is then compacted into sheets, and packed in a new form of thin tubular metallic case, from which sections can be sheared off to free the contained rubber as required.—J. H. J.

Rubber or caoutchouc; Preparation or regeneration of —. F. W. Passmore, London. U.S. Pat. 924,101, June 8, 1909.

SEE Eng. Pat. 2289 of 1907; this J., 1908, 169.—T. F. B.

Caoutchouc; Preparation of —. A. Tixier, Assignor to Les Produits Chimiques de Croissy (J. Basler et Cie.), Paris. U.S. Pat. 924,117, June 8, 1909.

SEE Fr. Pat. 370,619 of 1906; this J., 1907, 265.—T. F. B.

Caoutchouc, gutta-percha, and the like; Process of obtaining pure —. H. Scholz, Berlin, Assignor to Kautschukges. Schön und Co., Harburg on Elbe, Germany. U.S. Pat. 924,584, June 8, 1909.

SEE Fr. Pat. 363,339 of 1906; this J., 1906, 895.—T. F. B.

Rubber; Process for preparing — for storage and transport. R. B. Price. Fr. Pat. 397,552, Dec. 17, 1908.

SEE Eng. Pat. 27,090 of 1908; preceding.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tannery; Sources of error in the —. B. Kohnstein. Gerber, 1909, 35, 141—143.

The author discusses the many "sources of error" which produce exudations on leather. The use of mineral salts in many ways can cause disagreeable exudations on leather. The employment of alkali in the washing processes or for the removal of fat from skins, the use of alum, salt, saltpetre, etc., to hasten the tanning, bleaching with lead acetate, tin salts, or oxalic acid, the impregnation

of leather with crystallisable salts such as barium chloride, magnesium sulphate, zinc sulphate, etc.—these processes are among many enumerated by the author as being dangerous in the above respect. In the manufacture of two-bath chrome leather, trouble may be encountered by the appearance of a sulphur exudation, and an instance is quoted of a case of white shoes, in which the lead acetate used in bleaching the upper leather came in contact with, and was acted upon by the sulphide in the chrome sole, producing black lead sulphide. The author further deals with fat exudations, the formation of calcium soaps, by the action of lime on the natural fat of certain skins, and the action of free fatty acids on metallic bases.

—S. H.

Tanning analysis; Report on — of the Commission appointed by the German Section of the Internat. Assoc. Leather Trades Chemists. J. Paessler. Collegium, 1909, 201—208.

SAMPLES of chesnut, pine bark, myrobalan, solubilised quebracho, and ordinary quebracho extracts were supplied to the members of the Commission, and these were analysed by four methods, viz.: (1), by the use of American white hide powder, chromed, washed and used in the shake apparatus; (2), by the use of Freiberg white powder used in the same way; (3), by the use of Freiberg lightly chromed powder which only requires washing; and (4), by the use of the latter powder according to the method suggested by Zeuthen (Collegium 1908, 366). In the "blank" control tests, with one or two exceptions, high figures are obtained by all four methods, and poor concordance is shown between results obtained by different operators. Tables of results of analyses of the above extracts, obtained by the different methods are given. It is stated by the author, that, while, on the average, all the methods give very similar percentages of non-tannins, greater concordance is obtained by the use of Freiberg chromed powder, and by Zeuthen's method, than by the present official method.—S. H.

Acid determination [in tannery liquors]. Note on the gelatin-hematin method of —. W. K. Alsop. J. Amer. Leather Chem. Assoc., 1909, 4, 173—175.

THE gelatin-hematin method for the determination of acidity of tan-yard liquors (see this J., 1908, 1166), is at present being tested by American leather chemists and the author gives a table of determinations made by himself, upon liquors from 23 tanneries, which are representative of the liquors used in the country. It is shown that when the liquors are distilled and the volatile acid estimated in the distillate, and the non-volatile in the residue, results are obtained closely agreeing with those obtained for total acidity in the original liquor. Moreover, results obtained from samples made by mixing equal volumes of 5 or 6 liquors from each tannery, also agree well with results obtained in the course of routine work, representing the amount of acid shown by averaging that found in the individual samples that were mixed.

—S. H.

Lactic acid in America. McLanchlan. See XVII.

PATENTS.

Shaving, smoothing, whitening, polishing and cleaning hides and similar materials. Machines for —. The Turner Co., Ges.m.b.H. Fr. Pat. 397,062, Dec. 3, 1908.

THE operating roller of the machine is mounted in the upper open end of a hollow casing, in the lower part of which is a fan or other aspirating device, so that all dust, scrapings, etc., removed from the material are drawn into and collected in the hollow casing. The operating roller is partially surrounded by a hood which, at the part where the roller will come in contact with the material to be treated, is provided with an opening the size of which can be regulated by an adjustable plate. According to the object in view, the operating roller is furnished with blades, or it is covered with emery cloth or similar

material; in the latter case it is constructed in two parts, hinged together, in order to allow of the ready replacement or removal of the emery cloth. The roller used to support the hide is prepared by mounting a series of discs or rings of felt or other suitable material, close together on a central axis; it is so supported that, by means of a lever, it can be brought in contact with the operating roller.—A. S.

Tanned hides and skins; Treatment of —. G. B. M. Spigno. Fr. Pat. 397,650, Dec. 19, 1908. Under Int. Conv., Dec. 21, 1907.

THE tanned skins are treated in a bath containing glue or gelatin free from iron and lime, or the glue or gelatin, or substances containing gelatin, may be added to the ordinary finishing preparations. Or, the skins may be treated with glue or gelatin after having been passed through one tanning bath and before passing through another. After the treatment with glue or gelatin, the skins may be treated with a solution containing a fixing agent, e.g., formaldehyde.—A. S.

Keratin composition; Thermoplastic —. B. B. Goldsmith, New York. U.S. Pat. 922,692, May 25, 1909.

KERATIN is mixed intimately with β -naphthol and the mixture is then subjected to heat and pressure.—W. P. S.

Thermoplastic compound and method of making same. B. B. Goldsmith, New York. U.S. Pat. 924,057, June 8, 1909.

A VEGETABLE albuminoid substance is mixed with a non-hygroscopic converting agent such as β -naphthol, and the mixture is subjected to heat and pressure.—A. S.

XV.—MANURES, &c.

Soils; Changes produced in — by subjecting them to steam under pressure. T. L. Lyon and J. A. Bizzell. Seventh Int. Congr. Appl. Chem., London, 1909.

THE soils, clay loam, sandy loam and silt loam, were heated in an autoclave under two atmospheres' pressure for two or four hours. Steaming increased the water soluble organic and ammonia nitrogen, total ammonia nitrogen, nitrites and total soluble matter, the latter consisting largely of organic matter. The nitrates, however, were decreased by the treatment. On standing 56, 82, or 90 days there were decreases in the soluble matter, soluble and ammonia nitrogen and nitrites, while the nitrates remained practically constant. Wheat grown in the steamed soils appeared at first to be injured by the treatment, but subsequently recovered, and at the end of the experiment was much superior to that grown in the unheated soils. The sandy loam was first to recover, the clay next, and the silt last. The injury seemed to be mitigated somewhat when the steamed soil was inoculated by an infusion of the fresh soil. Plants grown in extract made from steamed soil gave poor growth. Injurious substances seemed to be produced during the steaming process. In the unsteamed soils there was a loss of total soluble matter where crops were grown, but in the steamed soils the reverse was true.

Soil potash. G. S. Fraps. Seventh Int. Congr. Appl. Chem., London, 1909. (See also this J., 1908, 634.)

POTASH minerals were studied to determine the source of the potash dissolved from the soil by various solvents. Nephelite, leucite, glauconite and biotite gave up all their potash to strong hydrochloric acid. Microcline and orthoclase gave up very little. The potash dissolved from the soil by strong acids comes chiefly from biotite, hydrated silicates, or muscovite. Muscovite, nephelite and leucite give up 15 to 60 per cent. of their potash

to N/5 nitric acid, glauconite and biotite less than 10 per cent., and microcline and orthoclase practically none. Potash absorbed by zeolites was highly soluble in N/5 nitric acid, but not completely removed. Although some of the potash dissolved by N/5 nitric acid is removed from solution by the fixing particles of the soil, the percentage of fixation is in no case large.

Potassium: Orthoclase, mica, and nepheline as sources of — for plants. D. Prianichnikov. Seventh Int. Congr. Appl. Chem., London, 1909.

PLANTS can assimilate very little potassium from orthoclase and microcline even when finely powdered, but mica may be used as a source of potassium. Still better results are obtained with a nepheline, as is shown in the following table, giving the relative yields obtained with application of potassium oxide in the form of the minerals named and of potassium chloride.

	No potash.	Ortho- clase.	Mica.	Neph- eline.	KCl.
Peas,	2.5	4.7	7.9	16.9	23.4
Wheat . . .	2.6	3.7	4.7	20.9	—
Buckwheat	1.7	3.2	11.0	15.9	17.3

Plants can avail themselves of about 17 per cent. of the total potassium of mica and 25 per cent. or more of that in the nepheline rock.—E. F. A.

Calcium phosphates: Phase-relationships of the — and bearing upon certain agricultural and biological problems. H. Bassett, jun. Seventh Int. Congr. Appl. Chem., London, 1909. (See also this J., 1907, 199, 317.)

As a result of investigations on the three-component system, $\text{CaO}-\text{P}_2\text{O}_5-\text{H}_2\text{O}$, which the author has been carrying out for some time past, it has been possible to construct to scale a solid model of the region of orthophosphates. The greater part of the available surface on this model is occupied by areas corresponding to the five solid phases:— lee ; $\text{CaH}_4\text{P}_2\text{O}_8\cdot\text{H}_2\text{O}$; $\text{CaH}_4\text{P}_2\text{O}_8$; $\text{CaHPO}_4\cdot 2\text{H}_2\text{O}$; and CaHPO_4 . There are, however, a number of areas of very small extent corresponding to the various phosphoric acids as solid phases, and also a number corresponding to several hydrates of three compounds more basic than dicalcium phosphate. These last compounds, perhaps the most interesting of the calcium phosphates, are:—Tricalcium phosphate (which has been obtained in the pure state for the first time), a compound, $[\text{Ca}_3\text{P}_2\text{O}_8]_3$, CaO , (oxygen apatite), and tetracalcium phosphate, $(\text{Ca}_4\text{P}_2\text{O}_8)_3$. Each of these three compounds is stable in contact with a definite, though exceedingly small, range of solutions over a large interval of temperature. Those solutions in equilibrium with tetracalcium phosphate are alkaline to litmus, while those in equilibrium with the other phosphates are acid. Only those solutions in equilibrium with both tetracalcium phosphate and the oxygen apatite are neutral.

The knowledge of the conditions under which the various calcium phosphates can exist in contact with solution throws considerable light on the following important problems:—

(1.) The conditions under which $\text{CaH}_4\text{P}_2\text{O}_8\cdot\text{H}_2\text{O}$; $\text{CaHPO}_4\cdot 2\text{H}_2\text{O}$; and CaHPO_4 , which are occasionally found as minerals, have been formed, and on the nature of the many naturally occurring, so-called tricalcium phosphates.

(2.) The condition in which phosphoric acid is present in the soil. It is probable that that portion of the phosphoric acid of soils which is easily available for plant life is in great measure present in the form of tetracalcium phosphate. The phosphoric acid of Thomas slag is also present as tetracalcium phosphate, and the great success of the slag as a fertiliser is probably in great measure due to this.

Assimilation of phosphoric acid [by plants] from different sources; Influence of calcium carbonate and ammonium sulphate on the —. Prianichnikov. Seventh Int. Congr. Appl. Chem., London, 1909.

ADDITION of calcium carbonate (together with calcium nitrate or other nitrate) to sandy soils produces different effects according to the phosphate employed: With bone-meal, raw phosphate and pure calcium triphosphate, a marked decrease in the yield is observed; with phosphates of iron and aluminium the decrease is less marked; with basic slag, acid phosphate (superphosphate) and dicalcium phosphate, the yield usually remains the same, even if as much as one per cent. (of the weight of the soil) of calcium carbonate is added; in no case was an increase observed. Different results are obtained when ammonium sulphate, which decomposes phosphates, is used instead of nitrate as a source of nitrogen, the best results being obtained when half the calcium nitrate is replaced by ammonium sulphate. If ammonium sulphate is used alone, however, the plants suffer owing to the physiological action of the acid developed, although they are supersaturated with phosphoric acid. If calcium carbonate is now added in small quantity (e.g., 0.25 per cent.) it diminishes the injurious action of the free acid, and the yield is increased; but if more (e.g., 1 per cent.) calcium carbonate is added, the whole of the free sulphuric acid is neutralised, and the plants suffer from phosphoric acid starvation. These results appear not only in the yields of crops obtained, but also in their content of phosphoric acid.

—A. G. L.

Farmyard manure during storage; Losses of manurial constituents in, and the action of preservatives on —. R. A. Berry. Seventh Int. Congr. Appl. Chem., London, 1909.

The object of the investigation was:—

1. To determine the losses of manurial constituents in the storage of different kinds of dung in exposed heaps in a climate with an average rainfall of 41 inches. 2. To compare the losses of dung stored in the open, and under cover, with the results obtained elsewhere. 3. To show the effect of different preservatives of the nitrogen content during the storage of cow dung. The rainfall in that time was 15.1 inches and the mean temperature 39.5°F . The average effect of storage upon the total nitrogen content was to increase the ratio of the insoluble nitrogen by 10 per cent., and to decrease the ammoniacal nitrogen by 10.8 per cent. The proportions of nitrogen in the form of soluble proteins, amides and nitrate, remained practically unaltered. The actual losses sustained by the different forms of nitrogen on the average were total nitrogen 29.6 per cent., insoluble nitrogen 20.4 per cent., ammoniacal nitrogen 80.6 per cent. There was a slight increase in the soluble proteid nitrogen in dungs 1 and 4, and a loss in the others. The dungs are arranged in the order of their losses in total nitrogen. No. 1 suffered least, viz., 13.8 per cent.; No. 5 greatest, viz., 44.0 per cent. The average loss in dry weather was 20.1 per cent.

The effect of storage on the mineral constituents was to cause a slight decrease in the ratio of soluble to total phosphates and potash.

The actual losses on phosphates and potash during storage are shown in the following average per cent. figures:—

Total P_2O_5	12.2	Total K_2O	33.5
Soluble P_2O_5	26.2	Soluble K_2O	38.2

(The total potash includes only the potash soluble in strong hydrochloric acid.)

There was a wide variation in the loss of phosphates in the different kinds of dung. The large proportion of soluble to insoluble phosphates, and the considerable losses which this ingredient may undergo during storage, as shown in this investigation, is significant in the sense that the ratio of $\frac{\text{P}}{\text{N}}$ in the fresh compared with the rotted dung is taken as a basis for calculating the losses of nitrogen on the assumption that the total phosphate content did not alter in the process of rotting. This is, of course,

correct assumption (and borne out in the following experiment) when the dung is stored in water-tight compartments, but not when stored in heaps in the field. The following figures show the per cent. losses by storage mixed dung in the open and under cover from November 25th, 1905, to April 4th, 1906:—

Dung.	Nitrogen.				P ₂ O ₅ total.	P ₂ O ₅ soluble.	K ₂ O total.	K ₂ O soluble.
	Total.	Insoluble.	Soluble Protein.	Ammoniacal.				
Stored in open	28.4	22.9	70.0	77.8	21.2	22.2	28.3	31.17
Stored under cover ..	19.9	15.7	17.0	74.7	6.2	—	3.0	8.7

The losses of nitrogen found in this investigation agree with those found by Wood, Voelcker, Hansen and Günther. The losses, however, sustained by the different kinds of dung are not absolute but only relative to the general conditions of this experiment. The losses in mineral constituents are in general agreement with those found by Verhees. These results emphasise the fact that greater attention should be attached to the considerable losses which the most valuable mineral constituents may undergo the rotting of dung. The preservatives used with cow dung in this experiment were as follows:—

Superphosphate, 25 per cent.	6. Bleaching powder, 1 per cent.
acid salt.	
Kainit, 1 per cent.	7. Formaline, 1 per cent.
Gypsum, 2 per cent.	8. Chloroform, 1 per cent.
Sodium acid sulphate, 5 per cent.	9. Soil on top.
Chalk, 5 per cent.	10. Tightly packed.
" 2.5 per cent.	11. Loosely packed.

The dung was stored in boxes of "haskenized" wood from February 11th to May 11th, 1908, under cover. The average effect on the total nitrogen content was to increase the ratio of insoluble nitrogen by 4.5 per cent., and of the ammoniacal nitrogen by 3.0 per cent., and to decrease the soluble protein nitrogen by 3.5 per cent. The losses of total nitrogen sustained in the different boxes were variable. All were greater than in box 10, with the exception of box 9, which showed no loss. To well consolidate and to cover with a layer of earth is from these results the best condition for storing dung.

Nitrogenous fertilisers; Investigations relative to the use of —, 1898—1907. E. B. Voorhees and J. G. Lipman. Seventh Int. Congr. Appl. Chem., London, 1909.

EXPERIMENTS extending over 10 years were carried out to determine whether, in cases where nitrates and animal manures are used together, destruction of nitrates by nitrifying bacteria involves loss of nitrogen. The results obtained are summarised as follows: There was a marked falling-off in the yields between the first and second rotation, especially in soils not treated with animal manure. Liquid manure was much superior to solid manure as a source of nitrogen. Larger applications of nitrogen were invariably followed by larger yields of this constituent in the crops. Applied in equivalent amounts, nitrate was superior to ammonium sulphate, which last was superior to dried blood as a source of nitrogen. Nitrogen from manure and humus was utilised more thoroughly in presence of nitrate than in its absence. Under certain conditions, nitrates or other readily available nitrogen compounds, may hasten the depletion of the soil nitrogen. Ammonium sulphate and dried blood intensified the development of acidity in the soils. The proportion of nitrogen in the crops was readily affected by the nitrogen treatment and by the character of the crop itself. In the first rotation, the fresh manures produced dry matter relatively somewhat richer in nitrogen than that produced by the leached manures; in the second rotation this result was reversed. The solid and liquid manure, fresh, produced dry matter somewhat richer in nitrogen than did the fresh solid material alone. The smaller application of nitrate, used together with manure, yielded relatively less nitrogen than did the larger application, under the same conditions. From the wide range of the nitrogen content in the crops, it appears that

greater care should be used in supplying nitrogen to cultivated crops. Out of every 100 lb. of nitrogen applied in the form of nitrate, there were recovered in the first rotation, 62.76, and in the second, 61.42; for ammonium sulphate, the figures were 49.51 and 37.01; for dried blood, 47.89 and 32.05. The latter figures are ascribed to

the development of acidity in the soils. For animal manures, the corresponding figures obtained were less than 25 and less than 30 lb. It appears that animal manures have a marked cumulative effect. The corn (maize) crops utilised a smaller proportion of the nitrogen applied than did oats and wheat. Fresh manures were utilised better than leached manures; solid and liquid, fresh or leached, better than the corresponding solid; smaller applications of nitrate to about the same extent as the larger applications; and animal manures used together with the larger applications of nitrate better than when used with the smaller application. Nitrate and ammonium sulphate, when used together with solid manure, leached, were utilised in the order named. The proportion of nitrogen recovered in the crops was 62.09—22.31 per cent.

The following table shows the relative availability of the different materials:—

	First Rotation.	Second Rotation.	Third Rotation.
Sodium nitrate ..	100.0	100.0	100.0
Ammonium sulphate	78.9	60.3	69.7
Dried blood	76.3	52.2	64.4
Solid manure, fresh	32.9	39.0	35.9
Solid and liquid, fresh	50.4	55.6	53.0
Solid manure, leached	33.8	44.0	38.3
Solid and liquid, leached ...	36.6	49.7	43.1

Nitrate and ammonium sulphate showed practically no residual effect, dried blood a slight, and animal manures a very pronounced residual effect. Notwithstanding the annually repeated applications of manure, together with large amounts of nitrate, there is no marked evidence of denitrification. All the soils employed lost considerable quantities of nitrogen.—A. G. L.

Nitrogen manures; The new —. H. von Feilitzen. Seventh Int. Congr. Appl. Chem., London, 1909. (See also this J., 1907, 478.)

SINCE 1904 extensive manurial experiments have been made by the Svenska Mosskulturföreningen with the new manures obtained from the atmosphere by means of the electric furnace. The experiments were made partly in pots and in wooden boxes let into the soil, and included also field experiments made at Flahult.

The experiments first described were made with Norwegian calcium nitrate in 1905–8, and included nine different series both in humus sandy soil and in peat soil. The plants grown were oats, potatoes and hemp. In all the experiments the effect of calcium nitrate was at least equal to that of sodium nitrate. In the case of oats the yield of grain in relation to straw was increased more by calcium nitrate than by sodium nitrate. The only drawback with calcium nitrate is its hygroscopicity (compare this J., 1906, 27 and 79). Still more comprehensive experiments were made with calcium cyanamide. Owing to its chemical constitution, its decomposition in the soil gives rise to the production of compounds which may act injuriously on vegetation, and for this reason it is very important to establish by experiments the best modes of employing it with different crops and soils.

Comparative experiments showed that the manure should always be applied some time before sowing the

seed, in order to avoid injury during germination; and as a top dressing it must always be applied very early in order that the plants may not suffer.

In wet seasons calcium cyanamide seems to give better results than under drier conditions.

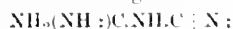
Calcium cyanamide and dicyandiamide. D. Priamichnikov. Seventh Int. Congr. Appl. Chem., London, 1909.

EXPERIMENTS made with pot cultures in different soils show that calcium cyanamide is but little inferior in manurial value to saltpetre. With buckwheat the following relative yields were obtained:—

Soil.	No nitrogen.	Saltpetre.	Calcium cyanamide.
No. 1.....	8.55	44.8	42.65
No. 2.....	14.96	48.55	40.00
No. 3.....	5.50	33.52	33.53

No difference was as a rule observed whether the calcium cyanamide was added at the time of sowing or a week earlier. In pure sand cultures, calcium cyanamide acts as a poison for all plants and also destroys a second sowing a month or more after the first. When calcium cyanamide is exposed in thin layers to damp air, the loss of nitrogen is considerable, but under the reverse conditions it is very small. Only a part of the nitrogen lost is converted into ammonia.

When dicyandiamide is treated with nitrous acid in the cold, only one-quarter of the nitrogen is liberated, but on warming, one-half of the nitrogen is set free. Hence in the dicyandiamide molecule, there can be but one amino-group, whilst another is formed on heating. This is in agreement with Bamberger's formula,



on heating in acid solution, guanylurea, or dicyandiamidine, $\text{NH}_2(\text{NH})\text{C.NH.CO.NH}_2$, is formed.—E. F. A.

Manures; Catalytic — G. Bertrand. Seventh Int. Congr. Appl. Chem., London, 1909.

EXPERIMENTS show that the addition of manganese to soils acts favourably on a large number of plants, the effect probably being catalytic. Enormous quantities of manganese, 40 per cent., and more, may be used. The action depends on the soil, manganese being without action in some cases. Practically, manganese sulphate and carbonate are used, the quantities being 50 kilos, of the first, and 200–250 kilos, of the second, per hectare; these salts may be mixed with the usual fertilisers. The favourable effects due to manganese are not apparent until the time of harvesting the crops. Other catalytic fertilisers are being studied by other investigators: Zinc acts favourably on the lower plants (*e.g.*, mushrooms), and is capable of increasing the yield of higher plants, but with the latter the toxic dose is not far removed from the optimum dose. Boron promises to give results similar to manganese. Iodine, fluorine, and especially bromine also increase the yield of crops, but their price is against their general application.—A. G. L.

Composition of the sugar beet. Saillard. See XVI.

PATENTS.

Ammonium sulphate; Method of treating — R. England, London. Eng. Pat. 10,781, May, 18, 1908.

From 1 to 5 per cent. of phosphatic material, such as dry, degelatinised bone, calcined bone, or a mineral phosphate, is added to commercial ammonium sulphate, thereby neutralising the product and increasing its manurial value.—O. R.

Nitrogen in liquid farm yard manure; Method of preserving the — C. Ortmann, Schependorf, Germany. Eng. Pat. 26,829, Dec. 10, 1908.

THE fresh manure is first carefully separated from solid matter by filtering through material, such as gravel or straw, placed on gratings in the channels in the cattle house. The liquid then passes along the channels, on the bottoms

of which is placed some substance, such as ground gypsum, to fix the ammonium carbonate. Instead of solid fixing substance, liquids of different specific gravity to the manure may be used, in which case the channels contain dams and the manure is made to pass through the fixing liquid. The volatilisation of ammonia from the liquid manure is prevented by the protection of the surface from the air, which is brought about by damming the manure in the channels, so as to form nearly horizontal surfaces, and covering with oil alone or in conjunction with floating covers. If closed pipes have to be used for conveying the manure, they are kept full and the surface of the liquid covered by a layer of oil. From the channels the manure passes into storage tanks which are provided with floating covers in conjunction with oil and some fixing substance may also be added.—J. H.

Fertilising material; Process of making — J. V. Lowman, Nashville, Tenn. U.S. Pat. 922,494, May 2 1909.

DEFINITE quantities of dolomite and fluorspar are burnt separately, then ground and mixed with a definite quantity of ground phosphate material and potash; water is added to the mixture so as to form a plastic mass, which is then heated.—W. P. S.

Ammonium phosphate; Process of manufacturing stable — N. Caro and T. E. Scheele. Fr. Pat. 397,281, Dec. 9, 1908. Under Int. Conv., Jan. 24, 1908.

AMMONIUM phosphate is manufactured by neutralising crude phosphoric acid, containing several per cent. of free sulphuric acid, with ammonia, and evaporating the solution. The product has the advantage of being stable, non-hygroscopic, and easily distributed as a manure also, it is rich in soluble phosphoric acid (40–45 per cent. and in ammonia (20–25 per cent.).—F. SOEX.

Nitrogen in urine or liquid manure; Process for preserving the — C. Ortmann. Fr. Pat. 397,382, Dec. 1 1908.

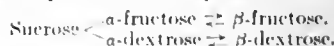
See Eng. Pat. 26,829 of 1908; preceding.—T. F. B.

Alkaline salts from blast-furnace tar. Eng. Pat. 16,690 See VII.

XVI.—SUGAR, STARCH, GUM, &c.

Cane sugar [sucrose]; Inversion of — by *invertase* III. C. S. Hudson. J. Amer. Chem. Soc., 1909, 3 655–664. (See this J., 1908, 822, 1076.)

By using a very active invertase solution prepared by the autolytic digestion of yeast at 25° C., it was found possible to effect the rapid inversion of sucrose at 0° C. Under these conditions there was observed first a moderate rapid decrease of rotation during the first few minutes and then a very slow decrease during many hours until finally the ordinary rotatory power of invert sugar was attained. This result is interpreted as being due first to the rapid change of freshly-formed fructose (α -fructose to its stable form (levulose), and secondly to the slow partial change of α -dextrose to β -dextrose; and from the experimental data the rotatory power of α -fructose was calculated to be $[\alpha]_D = +17^\circ$. That this interpretation is correct is confirmed by the fact that the rapid change corresponds to a unimolecular reaction the velocity-coefficient of which is approximately the same as that of the mutarotation of pure crystalline fructose dissolved in the same solution. The inversion of sucrose by invertase may therefore be represented thus:—

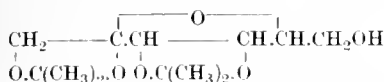


The rotation of sucrose ($[\alpha]_D 66^\circ$) is equal to the sum of those of its constituents α -dextrose ($[\alpha]_D 109^\circ$) and α -fructose ($[\alpha]_D 17^\circ$); in a similar manner the rotation of raffinose ($[\alpha]_D 124^\circ$) is equal to the sum of those of its constituent α -melibiose ($[\alpha]_D 171^\circ$) and α -fructose ($[\alpha]_D 17^\circ$). If the free carbonyl group of the aldose and ketose sugars be denoted by the symbol $<$ or $>$, then the constitutions of sucro

id of raffinose may be expressed as α -dextrose \diamond fructose and galactose \triangleleft α -dextrose \diamond α -fructose spectively. The α - and β -forms of dextrose are fermented at very nearly the same rate by brewers' yeast, the former being perhaps decomposed slightly more rapidly than the latter.—A. S.

monomethyl lavulose and its derivatives. Constitution of lavulosediacetone. J. C. Irvine and A. Hynd. Chem. Soc. Proc., 1909, 25, 176—177.

EVULOSEDIAKETONE yields on methylation by the silver iodide reaction a crystalline derivative (*monomethyl avulosediacetone*), melting at 115° , and having $[\alpha]_D^{20} = -136.4^\circ$ in methyl-alcoholic solution. The compound is very easily hydrolysed by dilute acids to give *monomethyl lavulose*, which is apparently the first definite example of a mono-substituted sugar other than the ucosides or the metallic derivatives. The sugar crystallises from ethyl acetate in the pure α -form, which displays utarotation in the downward sense: $[\alpha]_D^{20} = -70.5^\circ \rightarrow -53.1^\circ$. On the other hand, fusion gives an excess of the form, and the reverse optical change ensues on solution, the methyl group in the alkylated ketose is in the position with reference to the reducing group, and, according to this view, the structure of lavulosediacetone:



In addition, it has been shown that the alkylated sugar condenses readily with acetone or with methyl alcohol, and the products thus obtained are interconvertible under suitable conditions. The specific rotations of the various compounds described show that the total optical effect resulting from complete methylation of the sugar molecule is the additive sum of oppositely directed values.

muic acid; Oxidation of — in presence of iron. F. Ferralboschi. Chem. Soc. Proc., 1909, 25, 178.

THE oxidation of muic acid by means of hydrogen peroxide in presence of iron has been investigated. The principal product is a strongly reducing acid, which appears to be a *hydroxymuic acid*. It may also be regarded as a ditonic acid, namely, *dihydroxydiketonidipic acid*. Its *hydrazone* has been prepared. Parallel experiments on the oxidation of saccharic acid gave analogous results, the products obtained are not identical with those derived from muic acid.

beet sugar industry of the United States. A. H. Bryan. Seventh Int. Congr. Appl. Chem., London, 1909.

WHITE sugar is made direct from beets in the United States, no raw sugar being made to be sent to the refinery. The osmose process for recovery of sugar from molasses is being rapidly replaced by the Steffen lime process. Improvements have been made in this process in the direction of a more uniform saccharate cake of higher purity. The waste materials of the factory are becoming of greater commercial importance, *viz.*, pulp for cattle feeding, molasses for cattle food, and alcohol. But no attempts have yet been made to utilise the lime cake except in a few cases as a fertiliser, the waste water in factories, etc. The home production of beet seed is on the increase.

Java sugar industry; Review of the conditions, progress, and future outlook of the —. Th. Brooks. Seventh Int. Congr. Appl. Chem., London, 1909.

IN 1906–7 the total production of the island was 1,427,673 tons, produced by 186 factories, and this year's crop is estimated at 1,350,000 tons from 170 factories. Of the 186 factories, 74 were owned by Cubans, 36 by Americans, and 76 by British, Spanish, and other foreign interests. During the last years there have been many improvements in the process, in milling especially, the per cent. of sugar obtained averaging 10–16 per cent. weight of cane ground. Chemical control was carried out by few factories in the early eighties, but now many

factories are under this control. On the agricultural side the greatest advancement is yet to come. No attention to scientific agriculture has been paid. The soils being normally very rich and considerable land being available, the necessity for scientific methods of agriculture was not recognised, and as a soil became depleted the cane was grown in fresh soil. The production of sugar in the island can be increased (1) by improving the equipment and methods of manufacture of a majority of factories; (2) by improved methods of agriculture to increase the yield; (3) by extension of cane cultivation into undeveloped lands. The Agricultural Experiment Station is doing good work. Labour is a difficult problem in the island. The average cost of manufacture might be given as 2.25 cents, though some factories operate at a much lower figure.

Cane sugar industry in the Hawaiian Islands. N. Decr. Seventh Int. Congr. Appl. Chem., London, 1909.

IN 1882 the output of the islands was only 54,000 tons, whilst in 1908, 521,123 tons were exported. This increase was brought about by a reciprocity treaty with the United States, and the possibility of irrigation in the arid districts. Two main varieties of cane are planted: Lahaina under irrigation and Yellow Caledonia under natural rainfall. The islands of Oahu, Maui, and Kauai are all irrigated. The yield under irrigation is about 12,000 pounds per acre, under natural rainfall, 5000 to 8000 pounds. Fertilisers are used to some extent. The average production per factory in 1908 was 11,000 tons of 2000 pounds. The mills are mostly 11 rollers; 95 to 98% test sugar is the product, and goes mostly to New York and San Francisco.

Cane sugar industry of Peru. F. Zerbán. Seventh Int. Congr. Appl. Chem., London, 1909.

SUGAR cane is grown mostly in the valleys along the coast region under irrigation. There are about fifty estates producing sugar, with a maximum area of 8000 acres under cultivation. About 150,000 tons of sugar are produced; of this about 120,000 tons are exported, mainly to England and Chili. The factories are mostly old and not equipped with recent improvements. The average yield of cane is between 35 and 45 tons per acre.

Sugar cane seedlings in Java. J. D. Kobus. Seventh Int. Congr. Appl. Chem., London, 1909.

AFTER a short historical review, the author describes the progress made in Java since the first seedling canes were raised in 1887 by F. Soltwedel. He mentions the improvements made by Moquette, the researches about cane flowers by Wakker, the cross fertilising experiments made by Bonricus, and those made on a large scale by himself. By crossing the valuable Cheribon cane (which, however, was liable to several diseases, that spread through Java in the late years of the nineteenth century), with other varieties immune against these diseases, the Java experimenters succeeded in raising several cane varieties with superior qualities. The methods now in use for the raising of new varieties are successively described. The selection of the parents, the choice of the male and female plants, the way in which the cross fertilising is effected, the sowing out of the cane seeds, the manipulation of the young seedlings and the selection of the mature ones are all referred to. The cultivation of seedling canes has saved several factories in Java from ruin and enabled others to pay high dividends in recent years. In fact, in the last 25 years, the output per acre has nearly doubled, and since the new varieties can be cultivated with success on soils where the older ones proved a failure, the area under canes also nearly doubled. Thus the cultivation of seedling canes has contributed in large measure to the increase of the sugar production in Java from 350,000 tons in 1885 to over 1,200,000 tons in 1908.

Sugar beet; Composition of the —. E. Saillard. Seventh Int. Congr. Appl. Chem., London, 1909.

THE sugar beet (leaves and root) contains more nitrogen, per 100 kilos. of sugar produced, in dry than in wet years. Of varieties improved by selective cultivation,

those with most sugar contain in their ash less sodium oxide and more phosphoric acid and lime than do poorer beets. Conversely of a number of roots of one variety, those with least sodium oxide in their ash contain most sugar. The roots contain most nitrogen in dry years; chlorides pass almost entirely into the leaves. With beets containing 15.7 per cent. of sugar, analysis of the entire plant gave the following results expressed per 100 kilos. of sugar produced: Nitrogen, 2.4–2.8; phosphoric acid, 0.6–0.97; potassium oxide, 3.2–3.6; or in all about 8 kilos. of (potassium oxide, sodium oxide, magnesium oxide, calcium oxide, phosphorus pentoxide). This figure is below that of 10.7 kilos. obtained as the normal about 30 years ago, but even lower figures have been obtained in Bohemia, Austria, and Belgium for beets still richer in sugar.—E. F. A.

Beetroot: Determination of crystallisable sugar in the — H. Pellet. Seventh Int. Congr. Appl. Chem., London, 1909. (Internat. Comm. for Unification of Methods of Sugar Analysis.)

THE author makes the following propositions:—(1). The direct determination of sugar in the beetroot, in whatever form it may be, shall be made exclusively by means of the aqueous method of Pellet as described by the author since 1888, under the title of instantaneous diffusion in the cold, and according to the well-known directions for its use; (2). The pulp to be analysed in the cold shall be produced by the special apparatus of H. Pellet and Lomont, Herles, and Mastain and Delfosse and others according as the material consists of the beetroot, chips, coarse pulp, raspings, chopped beet or pieces. Also, for the application of Pellet's method use may be made of various special apparatus, particularly those of Sachs, Le Docteur, etc.; (3). The hot aqueous method shall serve solely as a method of control of the results of the cold method of aqueous digestion in case there is any doubt as to the division of the pulp; (4). Alcohol shall no longer be used for the direct determination of sugar in the beetroot, this solvent having no advantage over water and having, on the contrary, many disadvantages.

—L. J. DE W.

Sugar beets: Optically active non-sugar constituents of — which influence the polarisation results. F. Strohmer and O. Fallada. Seventh Int. Congr. Appl. Chem., London, 1909.

WHEN beet-pulp is extracted for analysis by the hot water method (100° C.) it is frequently found that the sugar value obtained by direct polarisation is more or less in excess of that obtained by Clerget's method. In some cases this excess may amount to 3 per cent. of sugar on the juice. The error is due to the extraction of dextro-rotatory pectic substances by the hot water; these substances are precipitable by basic lead acetate, but for many reasons the quantity of this reagent must be restricted, so that in many cases it is insufficient. The quantity of pectic substances extracted varies, also, with the composition of the beet and, consequently, according to season, locality, and conditions of cultivation. The procedure adopted for the extraction of the sugar in industrial analyses must therefore be to a certain extent elastic and its results controlled by some exact method, such as alcoholic extraction or Clerget's method of polarisation after inversion. The quantity of pectic matters extracted by hot water increases with the temperature, and is only small at 50° C. Still, the cold water extraction methods are preferable and the error introduced by the presence of minute air bubbles in the finely-rasped pulp may be avoided by adopting the means prescribed by Sachs and Le Docteur.—J. F. B.

Beetroots: Influence of pectic matters on the polarisation of — extracted by Zeheye's method (saline digestion) and that of Strohmer and Fallada. H. Pellet. Seventh Int. Congr. Appl. Chem., London, 1909.

THE beetroot contains pectic matters which have a dextro-rotatory power from 3 to 3.3 times as great as that of sugar. When extracted with water, these pectic matters may show a polarisation equivalent to 6.3 per cent. of

sugar on the beet, in extreme cases. They are capable of being completely precipitated by basic lead acetate if the latter is used in sufficient quantity. In Zeheye's method, when salt is added to the digestion liquid, the excess of the salt decomposes the lead precipitate, the pectic matters are re-liberated and still exist in the juice making the apparent sugar-content too high. An aqueous extract of beets polarised without the use of basic lead acetate will contain these pectic matters. In the process of inversion of the sugar the rotatory power of the pectic matters remains unchanged. Consequently the levorotation of the inverted juice is lower than that of pure invert sugar. If the direct polarisation be determined on juice clarified with lead acetate and the inverted polarisation on juice inverted without clarification, the calculated quantity of sugar is too low. If both observations be made on the same juice, whether clarified or not, the correct quantity of sugar is obtained. With this precaution, all aqueous extraction methods, including those of Strohmer and Fallada (without lead) and of Zeheye (with salt) will give correct results. Clerget's method, properly applied, gives the correct quantity of crystallisable sugar and of raffinose if present. There are no such things as "abnormal" beets and "unknown" losses. Beets may contain more or less sugar, raffinose, reducing sugars and pectic matters, but there is nothing "abnormal" about them, and the last may be eliminated by basic lead acetate. Certain of the losses in the sugar factory may be difficult or impossible to determine but they are all known.—J. F. B.

Cane sugar factories: Losses in — H. Pellet. Seventh Int. Congr. Appl. Chem., London, 1909. Internat. Sugar J., 1909, 11, 294–300.

LOSSES in cane sugar factories occur (1), during extraction of the juice; (2), during concentration of the juice; (3), in scums, filter-press cake, etc.; (4), in condenser water, and by entrainment; (5), as mechanical and other losses. The diversity of the methods of extraction causes considerable variations in the working losses, these being usually from 0.5 to 2.5 per cent. on the weight of the cane. In modern factories where milling alone is adopted the loss is generally kept at an average of 1 per cent. on the weight of the canes. With diffusion of the mill bagasse the loss is reduced to 0.6 and even to 0.3 per cent. under favourable conditions. By direct diffusion of the shield cane the loss amounts to 0.6 per cent. Loss during defecation and concentration are largely affected by the nature and amount of the purifying agent employed. The quantity of scums obtained varies between 0.8 and 1.5 per 100 parts of cane and they contain from 6 to 10 per cent. of sugar. This loss, with that arising from saturated filter bags and cloths, amounts to 0.1 to 0.3 per 100 parts of cane. With the carbonatation process and washing the filter-press cakes the loss may be reduced to from 0.05 to 0.1 per 100 parts of canes. There are besides these, inversion losses and those arising from entrainment during evaporation, as also overweight and handling losses, amounting with the bagasse to already mentioned, to a total of 1.5 per cent. on the weight of canes. The author considers the following precautions to be necessary if the true sucrose content of the canes is to be arrived at:—(1). The sucrose should always be determined by Clerget's method. (2). The quantity of juices, syrups, and exhausted molasses should be based on the actual composition of these products as distinct from their apparent composition. (3). All sugars, both pure and impure, should be analysed by Clerget's method. He further states that the loss of crystallisable sugar during manufacture is not nearly so large as was formerly supposed, when the large proportion of reducing sugar contained in the molasses was attributed to inversion.—J. A.

Sugar samples: Drying of raw — and a method of avoiding it. V. Stanek. Seventh Int. Cong. of Appl. Chem., London, 1909.

RAW sugar samples are usually received in small boxes, and on being kept for some time in a warm room there is sufficient drying up to affect the polarisation. Numerous careful tests showed a total loss, calculated

sugar, in 32 days of 0.106 to 1.144 per cent. Wrapping the boxes in a double envelope of stout paper did not prevent drying. Stopped glass bottles are effective at clumsy, particularly for sending samples by post. The author has found a suitable material for hermetically sealing the boxes in ordinary caoutchouc plaster ("lenko-last"). Lenkoplast is sold in strips of various widths and lengths of 10 metres wound on spools. The cotton cloth which serves as support is pasted over with a sticky, hygroscopic layer consisting of zinc oxide, caoutchouc, and a non-drying solvent. With a slight pressure the material adheres firmly to the tin and may be easily loosened again when required. The author prefers strips 1½ cm. wide. If the sample is too cold, the lenko-last is warmed by passing it through a flame.—L. J. DE W.

juices of the last diffusers [Sugar]; Purity of the — compared with that of the diffusion juice. Regularity of diffusion. H. Pellet. Seventh Int. Congr. Appl. Chem., London, 1909.

It has often been shown that the weak juices from the last diffusers yield crystallisable sugar after purification. Hence, it is advisable to carry the extraction of the sugar as far as possible, and even to return the waters (preferably after a preliminary purification) to the battery. With regard to the purity of the juices from the last diffusers, the author points out that if the juices are filtered, prior analysis (since suspended matter ought not to be included in the determination), and if correction is made for the saline matter in the water used in the battery, it will be found that the purity of such juices does not differ much from that of the juices withdrawn from the head of the battery; in fact the purity of the juice does not vary much from one diffuser to another. Variation in the sugar content of the beetroot has very little influence on the purity of the diffusion juice owing to admixture of different juices. The daily average purity of the diffusion juice varies very little; the weekly average purity also varies very little and does not decrease sensibly even at the end of the campaign if this is not of very long duration. If, however, the campaign is long continued, and the roots have been affected by cold weather during storage, the purity of the diffusion juice slowly decreases.—L. E.

beetroot and cane sugar works; Relation between apparent and real purity in products of —. H. Pellet. Seventh Int. Congr. Appl. Chem., London, 1909.

beetroot sugar works.—(1). The study of the relation between the apparent and real purity of pressed juice from beetroot pulp is of no interest. These juices, deprived of air by the action of a vacuum, have necessarily a slightly lower purity than diffusion juice. (2). The apparent purity of diffusion juice is generally slightly lower than the real purity when drawn off at a low temperature, and freed from air, pulp and suspended matters. (3). The difference may be higher when the juice is drawn at a high temperature owing to the smaller proportion of agglutinated organic impurities. (4). When the proportion of "other organic matter" to mineral matters is relatively high, especially when very pure water is used for diffusion, the apparent purity of diffusion juice may be equal or even slightly higher than the real purity when derived from sound beets from silos, though the conditions are changed if the beetroots have suffered deterioration. (5). The apparent purity of carbonated and saturated juice ready for boiling is always lower than the real purity. This difference diminishes *à passu* as the apparent purity increases. Any variations between the two purities from one year to another, under identical conditions of working, are never large nor abrupt. This is clearly shown in the tables by Sachs on the chemical control of the Belgian and Dutch sugar works. The author's results agree with those of Sachs starting from beetroots of 30 years ago with 8 to 9 per cent. of sugar to those containing from 18 to 22 per cent., and it is possible to draw up a table giving the average purity of carbonated juice for beetroots of from 13 to 22 per cent. of sugar which would be fairly correct in most cases of ordinary work. Consequently, using Weisberg's table it is possible to give the real purity with close

approximation when the apparent purity is known. (6). Owing to the presence of raffinose, the real purity calculated from the polarisation by inversion by Herzfeld's formula will be slightly lowered and will approach the apparent purity. (7). In beetroot molasses the difference between the apparent and real purity is greater than in syrups and runnings and may amount to 2 or 3, the difference increasing with increase in ash arising from the use of impure water or the addition of sodium bisulphite or carbonate, or when calcium salts have been allowed to form. It is rare to find a difference in the purities greater than 4 and abrupt variations are greatly minimised by the returned syrups. (8). As in the case of juices, molasses analysed by the Clerget inversion process give a polarisation always lower than the direct polarisation; the difference varies from 0.8 to 2 per cent., but may reach 3 per cent. even when no particular method of extraction of sugar has led to concentration of raffinose in the residues. Here also the formula of Herzfeld should be adopted, taking account of raffinose. The real purity would be lowered and would thus approach very closely the apparent purity. (9). The real purities refer to those obtained by desiccation under suitable conditions and where, normally, large quantities of alkali are not present. (10). For intermediate products the difference in the two purities is greater or less as the product approaches molasses in purity. In any case comparable results necessitate working under the same conditions and with instruments perfectly controlled and corrected. When the accuracy of the instruments is not certain, the various products should be all brought to the same density so as to obtain comparative results. (11). It is not advisable to calculate the apparent purity of molasses from the specific gravity determined with the aid of a flask. (12). For the control of beetroot sugar works, the apparent purity is amply sufficient to follow the working and is easily determined.

Cane sugar works.—(1). The apparent purity of cane juice differs notably from the real purity. (2). This difference is due to reducing sugars and organic matters and ash, the latter largely influencing the Brix determination. (3). The reducing sugars affect the results more when levulose predominates over dextrose. (4). A quantity of 0.7 to 0.9 of reducing sugars per 100 c.c., representing 5 to 7 per cent. on the sugar, alters the sugar by 0.3 to 0.4. (5). The purity may thus be increased by 2 to 2.5 by the presence of reducing sugars in sensible quantity. (6). At times the effect of reducing sugar is *nil* if it is in small quantity and comes from ripe canes, or the effect may be even reversed, less sugar being found by inversion than directly. (7). By desiccation 2 degrees of purity are gained; the total difference between apparent purity and real purity by the Clerget method and desiccation may thus reach 5. (8). The composition of the juice is quite different as given by the apparent and by the real analysis. (9). It is chiefly the organic matters which are greatly lessened. (10). The apparent purity of cane molasses may be as low as 20 to 22 when there is much reducing sugar; very often it lies between 30 and 40. (11). The real purity then increases very much, first owing to the reducing sugar which may equal 60 to 120 per cent. of the crystallisable sugar and secondly by the dry matters which may reduce the apparent Brix by 8 to 10 degrees. Thus there are real purities of 12 to 43 with apparent purities of 27 to 30, and 48 to 50 corresponding to 37 to 40. (12). The results cannot be given so precisely as for the beetroot, the quality of the cane being excessively variable. During the same day's work there may be a minimum of 76.5 and a maximum of 85 of purity, and for the same season 75 and 90 respectively. Taking the various sugar works of the world, canes are worked having 9 to 12 per cent. of sugar, of 68 to 75 of purity and 12 to 20 of reducing sugars per 100 of sugar; others have constantly cane of 13 to 16 and even 17 per cent. of sugar, 1 to 3 of dextrose per cent. of sugar and a purity of 87 to 93, so that even approximate relations cannot be given between apparent and real purity. In view of the considerable number of operations necessary for the analytical control of the works, increased by the necessity of determining the reducing sugar, it is advisable to plot results for the different products graphically, to show

the apparent and real purity. (12). As for beetroot molasses, so also for cane molasses the dense and emulsified condition of cane molasses and the difficulty of removing the contained air, renders the specific gravity method useless for determining the apparent purity. The same product may give from 74 to 80° or 90° Brix. By dilution a constant result is attained.—L. J. DE W.

Sugar house products; Influence of concentration on the determination of the apparent degrees Brix of impure

— H. Pellet and C. Fribourg. Seventh Int. Congr. Appl. Chem., London, 1909.

IN the chemical control of sugar house work the determination of the quotient of purity of the various products necessitates a rapid estimation of the total solids, generally expressed as "degrees Brix" and determined by the density. The relation existing between the real quotient of purity and the apparent quotient calculated in this way should be controlled from time to time. It has long been known that the greater the dilution of the solution of molasses which is used for the determination of the density, the higher is the apparent degree Brix when calculated back to the original molasses. In establishing the relation between the apparent purity and the real purity, some constant dilution of the solution used for the density determination should be selected and adhered to, for instance 3 or 6 times the normal weight in 300 c.c., and the same solution would serve for the determination of the sugar. In this way the factor of dilution would be compensated in calculating the results. When small quantities of water are added to molasses, the influence of the dilution on the degree Brix is large; it is large also when the proportion of molasses is small. For the intermediate concentrations, between 24 and 97 grms. per 300 c.c., there is only a difference of 0.5° Brix over the whole range. In the case of concentrated vinasses deprived of nearly the whole of their sugar (e.g. by the strontia process), the influence of dilution on the degrees Brix is very much greater than in the case of molasses. Cane molasses show the same relationships as beet molasses, and provided the same weight of molasses be always taken, the slight differences in dilution due to variations in the composition of the original substance have no influence. The variation is indeed so slight that the results of different factories, employing standard saccharimeters and working with solutions ranging from 78 to 120 grms. of molasses per 300 c.c., may be compared with one another. The dilution of the molasses for the determination of the density possesses the great advantage of enabling the air to be expelled from the solution. Molasses, especially cane molasses, retain the air very obstinately in their concentrated form and serious errors may thereby arise.

—J. F. B.

Hydrometer readings [Sugar]; Influence of surface tension on — B. Delachanal. Seventh Int. Congr. Appl. Chem., London, 1909.

FROM experiments on the surface tensions of solutions of pure sugar and molasses, the author concludes that the Brix hydrometer, standardised by means of solutions of pure sugar, gives values for the apparent purity which are sufficiently accurate in the case of syrups of high purity, but which may err to the extent of more than 1 per cent. in the cases of mother syrups and molasses.—L. E.

Sugar factory and refinery products; Determination of the dry substance in — H. Pellet. Seventh Int. Congr. Appl. Chem., London, 1909.

THE procedure to be followed in order to obtain satisfactory results in the determination of the dry substance is thus described:—A metal capsule of at least 80 mm. diameter is required, of small height, having a lid with a curved flap, a thin stirring rod and a recess of the shape of a shell reserved in the interior for weighing out the substance to be dried. A measured quantity of powdered pumice, sand, or bibulous paper, always the same for capsules of the same size, and amounting to 10, 12, 15 or 20 grms. for capsules of 90 mm., should be taken. A quantity of the substance is weighed out into the shell-shaped recess, equivalent in dry substance to not more

than 10 per cent. of the weight of pumice employed. Ten c.c. of boiling water are then added to dissolve the substance and distribute it equally throughout the pumice. The capsule is placed in the oven, previously heated to 105°–106° C., and maintained at a constant temperature. The first weighing is made after 3 or 4 hours, and weighing are repeated at intervals of half an hour until two are concordant within 3–4 mgrms.; when everything is properly prepared the second and third weighings should agree. The capsules should be cooled in thoroughly efficient desiccators and not left too long before weighing; they should be weighed with their covers, and as rapidly as possible, the weights being previously placed on the pan. Acid substances, such as cane products, should be neutralised with a drop of ammonia before drying. Substances which are exceptionally alkaline should be neutralised, or nearly so. In the case of liquids, the substance should never be measured, only weighed. All determinations should be made in duplicate together with a blank experiment with pure sugar, dissolved and dried in the same manner as the test substance. In special cases the substance may be dried in a current of dry air at a temperature below 100° C.—J. F. B.

Ash in sugar and syrups; Determination of — by the estimation of the electrical conductivity. H. Main. Seventh Int. Congr. Appl. Chem., London, 1909.

THE method described gives a simple, rapid, and accurate means of estimating the ash in sugar house samples. For practical purposes it may be considered that sugar in solution is a non-electrolyte, and that the conductivity of impure sugar solutions is due to the organic and inorganic salts present. If in a series of samples, solutions of the same concentration are made, the resistances of the solutions are inversely proportional to the amount of salts present. The resistances are measured by Kohlrausch's method of using an alternating current between platinum electrodes. The apparatus required consists of:—1. Accumulator of two cells. 2. Induction coil giving a clear high note. 3. Bridge.—A resistance of 200 ohms is placed in each of two of the proportional arms, while the resistance to be measured and a resistance box occupy the two other arms. 4. Resistance cell.—This should be "continuous" in the same sense as the "continuous tube" for the polariscope. The electrodes are of stout platinum foil attached to wires fused into glass tubes which are filled with mercury for making connection with the bridge. The electrodes should be platinised as directed by Kohlrausch. The cell is placed in a water bath kept at a constant temperature, and is provided with an oblong cover through which pass the two tubes of the electrode and a small funnel. The lower end of the cell is continued into a tube passing through a rubber cork in the bottom of the water bath. The tube is closed by means of a piece of india-rubber tubing and a spring clip. The "cell constant" of the cell used is about 0.38, and is determined by using a $N/100$ solution of potassium chloride. 5. Resistance box with resistances of 1, 2, 3, 4, 10, 20, etc. to 4000 ohms. 6. Telephone.

The temperature of the water bath and solutions when tested must be kept at 20° C. The cell is rinsed out about three times with the solution and then filled always to the same height. On passing the current from the coil a loud note is heard in the telephone. When the resistance in the box is adjusted to equal that of the solution in the cell, the sound decreases to a minimum. Although the sugar in the solutions may be regarded as non-conducting, variations in the amount of sugar in a solution affect the conductivity of the salts present. The disturbing influence of differences in the amount of sugar present can be removed by always making the solutions of about the same density. Taking a series of sugars of about the same quality containing from 2 to 5 per cent. of ash, 5 grms. of each are dissolved in distilled water, made up to 100 c.c., and the resistances of the solutions determined at 20° C. Then the resistances expressed in ohms multiplied by the percentage of ash, as determined gravimetrically in the usual manner, gives approximately a constant product.

Ohms \times per cent. ash = Constant.

having found the mean constant by a short series of experiments, the figure so found serves for the determination of the ash in other samples of similar sugars in the resistance of their solutions is determined in same manner in the same cell.

Constant ÷ ohms = per cent. ash.

The amount of ash so ascertained agrees well within limits of permissible error with that found gravimetrically. In the case of molasses the samples are diluted to B., and 2 grms. are taken and made up to 100 c.c. the constant determined as in the case of the sugars. Instead of using the same weight of all samples of sugars, syrups and expecting to get a simple method of relating the ash from the resistance of the solutions, if it is taken to bring the conditions of series of each into harmony, the ratio between resistance and the amount of ash may be determined in a limited number of samples, and the factor so obtained employed for the estimation of ash in further samples of approximately the same composition. Once the conditions and constants are ascertained, the estimation of the ash can be far more easily, accurately and quickly made than by the gravimetric method. Very little experience is required to get its value within the limits of the gravimetric method, when the apparatus is in order an estimation can be made in less than ten minutes.

ert sugar; Influence of clarification on the valuation of raw sugars and molasses containing —. H. C. Prinsen Geerligs. Seventh Int. Congr. Appl. Chem., London, 1909. Internat. Sugar J., 1909, 11, 276—81.

The author recognises that basic lead acetate, both in the state and in solution, precipitates a part of the chemically active constituents from raw cane sugars and molasses, more particularly if it is used in excess. In the present state of our knowledge, however, he advises the continued use of this reagent for the clarification of such solutions for the purpose of their polarimetric estimation, with the precaution that only the minimum amount necessary for obtaining a distinct reading be added. He further suggests that solutions of sugars, molasses, etc., in which it is desired to determine the *ert sugar* (dextrose, or reducing sugars), should, if alkaline (to phenolphthalein), be neutralised with acetic acid and the neutral or acid solution be clarified with lead subacetate, the excess of the lead salt being removed in the filtrate by the addition of sodium carbonate, sodium sulphate, or other suitable precipitant.—J. A.

ification with basic lead acetate solution; Influence of —, on the valuation of sugar products and the relation between the amount of lead added and that precipitated. L. Eynon. Seventh Int. Congr. Appl. Chem., London, 1909.

EXPERIMENTS have been made to determine the influence of increasing quantities of basic lead acetate solution, of its own lead-content, on (a) the direct polarisation, (b) the sucrose-content determined by Clerget's method, and (c) the reducing sugar-content, of samples of jaggery and Cuban molasses. The lead-contents of the clarified solutions were also determined, the weights and percentages of lead precipitated being calculated therefrom. *Jaggery sugar:* 52.00 grms. of the sugar were dissolved in water, treated with a known volume of basic lead acetate solution (containing 210.36 grms. of lead per c.c.), and 1 c.c. of alumina cream, the whole being made up to 200 c.c. and filtered: the filtrate was used for the above-mentioned determinations. Sixteen such experiments were made, the quantities of lead solution used, ranging from 2 to 50 c.c. (8 c.c. were sufficient for binary analysis). It was found that with increasing quantities of the lead solution, the direct polarisation decreased, the inversion polarisation decreased (i.e., became *levo-rotatory*), and the reducing sugar-content increased. The figures for the sucrose-content showed increase, but this was small in comparison with the

other variations. The following table, giving details of experiments, 3, 4, 12, and 16, illustrates these results:—

Volume of lead solution added.	Direct polarisation.	Sucrose per cent. (Clerget).	Wt. of lead in ppt. from 52 grms. of sample.	Percentage of lead pptd.	Reducing sugar per cent.*	
3	6 c.c.	73.2	76.0	grms. 1.1542	91	9.7
4	8 c.c.	73.4	76.1	1.4570	87	9.6
12	26 c.c.	74.0	76.3	3.2978	60	9.1
16	50 c.c.	75.1	76.5	4.7364	45	8.5

* The percentage of reducing sugar as found from the unclarified solution was 10.2.

These results are in harmony with Prinsen-Geerligs' statement that levulose is partially precipitated (and also dextrose, but to a much less extent) with the non-sugar by basic lead acetate. Special experiments showed that, of the increase in the value for sucrose—0.5°—about 0.1° to 0.2° was due to the influence of the lead left in solution on the rotation of the sucrose. Further experiment showed that the remaining increase of 0.3 to 0.4° was not due to optical alteration of the non-sugar during inversion, and it appears, therefore, that this increase was due to the increased volume of the lead precipitate. The weight of lead is an approximate measure of the weight of the precipitate containing it. The table shows that the amount of precipitate obtained with 6.8 c.c. of lead solution was comparatively small, and that the precipitate obtained with, say, 8 c.c. of lead solution (the amount required for clarification in an ordinary analysis) could not cause an error of more than 0.1° to 0.2°.

Cuban molasses.—26.00 grms. of sugar were weighed out in each experiment, the clarified solution being made up to 200 c.c. Eleven experiments were made; the following table gives the details of experiments 2 and 11:—

	Volume of lead solution added.	Direct polarisation × 2.	Sucrose per cent. (Clerget).	Wt. of lead in ppt. from 26 grms. of sample.	Percentage of lead pptd.	Reducing sugar per cent.†
2	15 c.c.	32.3°	39.25	grms. 2.3746	75	12.5
11	60 c.c.	35.9°	40.0	5.7300	45	10.5

† The percentage of reducing sugar as found from the unclarified solution was 13.9.

Cane molasses; Analysis of —. A. R. Ling and G. McLaren. Seventh Int. Congr. Appl. Chem., London, 1909.

THE authors state that the observations of Eynon (see preceding abstract) that defecation with basic lead acetate has little influence on the sucrose percentage as determined by Clerget's method, which is therefore a value of considerable accuracy, is borne out by the close agreement which they find between the percentage of sucrose as determined by Clerget's method, and by the copper reduction method (volumetrically) from the difference in the reducing power before and after inversion (see Ling and Rendle, this J., 1905, 753). The maximum difference would appear to be 3 per cent., reckoned on 100 parts of sucrose; but usually it is much less than this. Considering the impure nature of the commercial product in question, large differences might be expected, and bearing in mind the fact that in principle the two methods are quite distinct, the agreement must be regarded as satisfactory. The Clerget results are generally the higher. This is doubtless due to the volume occupied by the lead precipitate which Eynon shows to be of some influence.

Bagasse; Analysis of —. D. L. Davoll, jun. Seventh Int. Congr. Appl. Chem., London, 1909.

A COMPARISON of the alcoholic and the aqueous extraction methods for the determination of sugar and fibre in bagasse. It is found that by the alcoholic method more sugar is extracted from bagasse than by Gerlig's aqueous method, provided the bagasse is cut up fine enough:

also that the fibre determination gives a lower figure by this method when both determinations of sugar and fibre are made in one operation. In using the alcohol method the results for ash and protein are higher than with the aqueous method. It is shown that the reason the alcoholic extraction does not remove the sugar from a coarse bagasse is due either to the inefficiency of the solvent or to the precipitation of optically active non-sugars, but that it is not due to the passage of the alcohol through the bagasse in set channels, since continual extraction ultimately removes all the sugar. The preliminary study is begun upon the method of sampling and sub-sampling bagasse at the mill, showing where the errors ordinarily made, occur. It is also shown that formaldehyde cannot be depended upon to preserve bagasse.

Sugar and corn [maize] syrup (starch glucos) as raw materials for the confectionery and preserves industries.

L. K. Bosceley. Seventh Int. Congr. Appl. Chem., London, 1909.

THE author endeavours to bring to the notice of sugar refiners and corn syrup manufacturers, the requirements of confectioners and jam and marmalade makers, as regards the properties of sugar and corn syrup as raw materials. Tests are given, to which such sugars, etc., would be subjected in jam and confectionery factories before they could be passed as suitable, and it is pointed out that the ordinary tests by polarimeter, cupric reducing power, and refractometer are useless to confectioners, as all sugars used are of the highly refined type, polarising over 99.9 per cent. of sugar. The first test used consists in heating the sugar with water and potassium bitartrate to 163° C. Great differences are found to exist in highly refined types of sugar when subjected to this test. Sugars polarising over 99.9 per cent. sugar, and, indeed, showing practically no difference under ordinary analytical tests, will, in some cases, turn dark brown, and in others remain lemon yellow or nearly white. The author then suggests possible reasons for these results, pointing out that the formation of invert sugar, by the potassium bitartrate does not, under the conditions employed in the test, affect the colour. The suggestions are:—(a) Slight alkalinity of the sugar. (b) Presence of minute traces of nitrates causing oxidation. (c) Liberation of an organic acid at 163° C. or slightly under. (d) Preparation of the sugar in certain refineries where the water supply contains a high amount of organic impurity. (e) The presence of sulphates in small amounts. The author's experiments point to the last named as the principal cause of the darkening effect.

The second test to which highly refined sugars would be subjected by manufacturing confectioners consists in the ability of these sugars to grow crystals on fondants, or other confectionery. The confectionery is packed in sieves in a galvanised iron tank, and covered with a 72.75 per cent. solution of the sugar to be tested. The whole is then allowed to stand for three hours, after which the sugar solution is run off. Widely marked differences will be shown in the case of this test, even by highly refined sugars sent out by various well-known firms, and, although the sugars may be of precisely similar grades, some will give a fine brilliant well-marked crystal, while others give nothing more than a coating destitute of any sparkling or well-defined crystals. The author believes, as a result of experiments made by himself and others, that the power of crystallisation exhibited by certain highly refined sugars when compared with others of a similar grade, must be due to some purely physical character, and not to a chemical one. A granulated sugar which exhibited excellent powers of crystallisation was disintegrated and sifted through fine silk, thereby being reduced to a very fine powder, and it was found, on again applying the above test, that its power of crystallisation was very much impaired. It would appear then that the ability of a solution of refined sugar to withstand a temperature of 163° C. without darkening, and its crystallising power, constitute two of the most searching tests which can be applied to it, and, as confectionery sells almost entirely according to its appearance, both tests are of the

greatest moment to the manufacturing confectioner, who is one of the refiners' largest customers. The author has also given some details concerning confectioners' syrup the bleaching of sugars and corn syrup (starch glucos) with ultramarine, and the presence of sulphurous acid and sulphites in corn syrup.

Dextrose, levulose, and maltose: Solution densities of—
A. K. Ling, L. Eynon, and J. H. Lane. Seventh Int. Congr. Appl. Chem., London, 1909.

THE authors have prepared the three sugars above named in a state of high purity, the criterion of the latter being constancy of specific rotatory power under standard conditions of temperature and concentration. The following values were obtained with the final products, expressed in each case on the anhydrous sugars:—Dextrose $[\alpha]_D^{17} + 52.72^\circ$ ($c=10$), levulose $[\alpha]_D^{18.5} = -93.83^\circ$ ($c=10$), maltose $[\alpha]_D^{17.5} = +137.79^\circ$ ($c=5.7$). The specific gravities of solutions of these preparations, varying in concentrations from $c=1$ to $c=24$, have been determined in duplicate. The results practically confirm those of Brown, Morris, and Millar (Chem. Soc. Trans., 1897, 71, 7, 276; this J., 1897, 166), and the excuse for publishing them rests mainly on the fact that the purity of the various sugars employed is beyond all question, and that a considerably larger number of determinations has been made. Brown and Morris (*loc. cit.*) co-ordinate the specific gravities of the sugar solutions and the corresponding solution densities. In this way they express their results in the form of a curve. The authors point out that, although the actual law may be a curve, for practical purposes, the results may be represented graphically by a straight line.

In the following tables containing the mean results: Column A gives the weight of dry substance taken. Column B gives the total weight of solution. Column C gives the specific gravity of the solution at 15.5° C., referred to water at the same temperature. Column D gives the grams of sugar per 100 reputed c.c. (fluid grams at 15.5° C.). Column E gives the divisor for the calculation of grams of sugar per 100 reputed c.c. from the specific gravity.

Dextrose.

A.	B.	C.	D.	E.
0.9992	48.7130	1007.07	2.0675	3.855
1.0034	48.1702	1008.08	2.0909	3.848
1.9994	50.4500	1015.45	4.0243	3.839
3.0003	51.1028	1022.30	5.9705	3.836
4.0176	51.5618	1030.72	8.0311	3.825
4.9977	51.8332	1038.26	10.0108	3.822
5.9990	52.5148	1045.61	11.9444	3.819
7.0012	52.6845	1053.38	13.9984	3.813
7.9990	52.8802	1061.13	16.0513	3.808
9.0015	53.3225	1068.63	18.0398	3.804
9.9864	53.6794	1076.03	20.0182	3.799
11.0002	53.8110	1084.06	22.1483	3.795
11.9125	53.3030	1092.12	24.4141	3.786

Levulose.

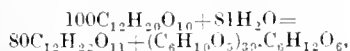
A.	B.	C.	D.	E.
1.1040	51.2864	1008.55	2.1710	3.938
2.0121	50.9200	1015.76	4.0130	3.927
3.0125	51.3828	1023.54	6.0008	3.923
4.0528	52.7696	1031.05	7.9186	3.921
3.9982	51.5144	1031.36	8.0047	3.918
5.0020	51.9567	1039.18	10.0044	3.916
5.9136	52.7690	1048.83	11.7202	3.919
6.9985	52.6476	1054.73	14.0207	3.904
8.2876	54.7342	1062.78	16.0922	3.901
8.9952	53.2702	1070.43	18.0753	3.896
10.0312	54.0708	1077.80	19.9919	3.890
11.0257	54.3531	1085.57	22.0211	3.886
11.6614	52.0094	1093.55	24.1021	3.881

Maltose.

A.	B.	C.	D.	E.
0.0422	50.1806	1007.46	1.8916	3.944
1.9977	50.9160	1015.66	3.9550	3.930
3.1074	51.3990	1024.31	6.1926	3.926
3.8939	51.4710	1030.54	7.7963	3.917
5.0569	52.2945	1039.34	10.0504	3.914
5.9907	53.6860	1045.63	11.6680	3.911
7.0032	52.8330	1054.63	13.9795	3.908
7.9710	53.4580	1061.78	15.8319	3.902
8.0323	52.9098	1062.87	16.1081	3.903
8.9098	53.2972	1069.84	17.8847	3.905
8.9132	53.2600	1069.91	17.9052	3.904
10.0734	53.7766	1078.76	20.2073	3.898
10.9333	53.5393	1086.47	22.1869	3.897
11.7828	54.2558	1092.35	23.7227	3.893

starch; Short review of our knowledge of —. A. R. Ling. Seventh Int. Congr. Appl. Chem., London, 1909.

The author draws attention to the meagre information on starch in the general treatises on organic chemistry, which he ascribes to the fact that it is a colloid, a class of substances to which laws as yet undiscovered apply in addition to those known in conjunction with crystalloids. He points out that the view that the starch molecule may be represented by such a formula $(C_6H_{10}O_5)_n$ is erroneous, since starch like all other polysaccharides must be derived from the monoses by a process of dehydration and condensation. Polysaccharides may accordingly be represented by the general formula $(H_2O)_n - n - 1(H_2O)$, which in a mathematical sense identical with that proposed by H. Kiliani (Chem. Zeit., 1908, 32, 366), namely $(C_6H_{10}O_5)_n - H_2O$. Since the value of n in the higher polysaccharides is a high one, it is not surprising that the results of the elementary analyses of starch agree closely with the limiting formula $H_{10}O_5$ of the text-books. The work of Fernbach on amylocoagulase and that of Maquenne and Roux is regarded as indicative that starch is a mixture of polysaccharides of different complexity, but of similar type. The author regards the molecule like that of all colloids mobile and as a physiological rather than a chemical entity. He is unable to accept the existence of the so-called amylopectin of Maquenne and Roux as established, resting as it does on purely circumstantial evidence. Dealing with starch hydrolysis, the author regards the result No. 8 equation of Brown and Heron as untenable, even in the form in which it is presented by Brown and Heron, who make provision for the now known reducing power of the so-called stable dextrin, thus:—



published work with J. L. Baker having shown that the amount of maltose obtainable from a starch conversion tried down to this limit is much less than indicated by the equation, and that malto-dextrins soluble in 80 per cent. alcohol are present. The author points out also that although when starch paste is treated with malt extract at 55°, the constants of the products ultimately agree with those of maltose, other bodies, notably niewsky's dextrinose, can be isolated. He cannot reject the conclusion of E. Fournard (Compt. rend., 1909, 3, 502; this J., 1909, 433) that, because starch in solution when treated with increasing quantities of alkali is in rotatory power until the constant of maltose is reached, starch is therefore to be regarded merely as condensed maltose. It is well known that under some conditions dextrose is a product of the hydrolysis of starch diastase which enzyme does not hydrolyse maltose.

starch; Hydrochloric acid extraction method for the polarimetric determination of —. L. T. Thorne and E. H. Jeffers. Seventh Inter. Congr. Appl. Chem., London, 1909.

This method, originally proposed by Dubrunfaut, modified by Efront, Ost, Lintner and others, the main sources of error are the risk of hydrolysis if the acid be too strong or the temperature too high, and the risk of perfect extraction or of partial reprecipitation if the

acid be too dilute at any period of the operation. The authors have obtained the best results by the following modified process. Five grammes of material, previously reduced to the finest possible state of division, are placed in a mortar and triturated with successive small additions of water till the mixture just ceases to cling to the pestle in lumps. This generally requires less than 20 c.c. of water. Hydrochloric acid of sp. gr. 1.15 is then added, with continued trituration, in portions of about 5 c.c. at a time, until the mass first swells up into a jelly and finally breaks down into a somewhat viscous liquid. This requires about twice as much acid as the water first used, unless the original material contained much moisture, when the quantity of acid required is somewhat greater. The mixture is allowed to stand for about 10 minutes and is then transferred to a 200 c.c. calibrated flask, into which has been previously measured 10 c.c. of a 4 per cent. phosphotungstic acid solution and 20 c.c. of hydrochloric acid of sp. gr. 1.15. The mortar is rinsed with dilute hydrochloric acid (sp. gr. 1.1) and the whole made up to 200 c.c. with dilute (1:1) acid. After mixing, the contents of the flask are transferred to a wide-necked, stoppered bottle and thoroughly shaken (or placed in a centrifugal machine) till a well-defined flocculent precipitate is obtained and the supernatant liquid is fairly clear. After filtration, the polarimetric reading of the solution is taken. With a 200 mm. tube, the Schmidt-Haensch scale and white light, the percentage of starch is given by the formula

$$P = \frac{R \times 40}{11.6}$$

With this method the concentration of acid never materially exceeds or falls below a sp. gr. of 1.1, danger of hydrolysis or precipitation is obviated, and very accurate and reliable results are obtained. The process may be very conveniently and safely used in the determination of starch in cereals, including malt, and may be employed as a check on malt extract determinations.

Starches; New microchemical distinction between rye and wheat —. W. Lenz. Seventh Int. Congr. Appl. Chem., London, 1909.

If a trace of rye starch, in a hanging drop of a solution of 1 part of sodium salicylate in 11 parts of water, is examined under 200-fold magnification, at the ordinary temperature, it will be found that after the lapse of an hour (more distinctly after 24 hours), most of the large granules have swollen; only a small part resists the action of the salicylate, and still shows the polarisation cross between crossed nicols. In the case of wheat starch, only a few of the large granules become swollen; after 1–24 hours, the outline of the unswollen wheat starch granules is sharply defined, and the granules, unlike those of rye starch, do not become flattened (starch of any kind which has been altered by storage in a moist condition, swells on treatment with the salicylate solution). Barley- and millet-starches only swell to a small extent. Only a few of the granules of oats, maize-, rice-, potato-, bean-, pea-lentil-, and arrowroot starches become swollen.—L. E.

Constituents of Eupatorium rebaudianum. Dieterich. See XX.

PATENTS.

Beet slices; Process for the preservation of hot-pressed —. H. Hoppe. Ger. Pat. 210,554, Dec. 11, 1907.

THE beet slices from the diffusion process after being pressed are immediately cooled, for example by means of a current of air in a rotating drum, in order to preserve them from fermentation or putrefaction during transportation to the silos.—A. S.

Boiling sugar and the like; Machine for —. G. S. Baker. London. Eng. Pat. 11,845, June 1, 1908.

SEE Fr. Pat. 392,948 of 1908; this J., 1909, 103.—T. F. B.

Gum [tragacanth]; Extraction of —. P. C. D. Castle, Bellington. Assignor to Gum Tragacanth Supply Co., Ltd., Hooton. U.S. Pat. 924,319, June 8, 1909.

SEE Eng. Pat. 10,822 of 1905; this J., 1906, 944.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Alcohol: Manufacturing tax on — in France. Board of Tr. J., June 24, 1909. [T.R.]

A PRESIDENTIAL Decree (sanctioned by the Law of the 24th December, 1908) fixes the rate of the manufacturing tax on alcohol and products with an alcoholic base, from the 1st January, 1909, at 2 fr. 52 c. per hectolitre of pure alcohol.

Germinating barleys: Explanation of the beneficial effect of lime water on —. P. Ehrenberg. Z. ges. Brauw., 1909, 32, 253—257, 268—271, 277—280.

THE author reviews the literature of the subject and then describes a number of experiments on barley and linseed treated in various ways. The results show that the real foundation of the beneficial influence of lime on barley lies in the prevention of mould-development. This prevention depends on the alkaline action of the lime water, it being found that mould growth is facilitated by increasing the acidity of the steep-liquor. Solvent or coagulating action of the lime water on injurious mucous walls of bacterial or mycological origin is without influence in this connection.—T. H. P.

Maltase of buckwheat. J. Puerte. Compt. rend., 1909, 148, 1526—1527.

MALTASE has hitherto only been recognised in a few seeds such as maize and *Soja hispida*. The author now finds it is present in relatively large quantities in buckwheat. The critical points for solutions of this maltase are: maximum 72°, minimum 3°, optimum 55° C. The activity of the naturally alkaline solution is stimulated by the addition of acid in quantities of less than 3 c.c. of N/10 acid per 100 c.c., and restricted by addition of more than this amount. Amino-acids and amides exert a similar influence. The soluble maltase disappears rapidly from the grain during germination but an insoluble maltase appears in its place, as the dried residue left after exhaustion with water rapidly hydrolyses a maltose solution with which it may be mingled. (See also this J., 1909, 254, 434.)—R. L. S.

Enzymes of pressed yeast juice: Action of various antiseptics on —. F. Ducháček. Biochem. Zeits., 1909, 18, 211—227.

TRACES (0.1 per cent.) of phenol too small to prevent any action on fragments of living protoplasm hardly affect the fermentative power of yeast juice. 0.5 per cent. of phenol destroys all living protoplasm and reduces the fermentative power by about 40 per cent. 1.2 per cent. of phenol renders the zymase inactive. Chloroform (0.8 per cent.) hardly affects the fermentative power; a reduction to 0.5 per cent. causes a distinct increase in fermentative activity, but larger quantities destroy the enzyme although the chloroform is not completely dissolved. Probably the chloroform is decomposed and the products affect the enzyme. Chloral hydrate (0.7 per cent.) acts as an efficient antiseptic and increases the fermentative power by 27 per cent., the effect being particularly marked in pressed yeast juice preparations of relatively small activity. It is no doubt due to the effect of the antiseptic in destroying the proteoclastic enzymes and so indirectly assisting the fermentative enzymes. An addition of 3.5—4 per cent. of chloral hydrate destroys the zymase, of which the stronger preparations are least affected by large doses. 0.1 per cent. of benzoic or salicylic acid, which is enough to produce aseptic conditions, does not affect the zymase. Quantities of 0.2 to 0.25 per cent. destroy 20 to 35 per cent. of the fermentative activity. All the antiseptics at first act unfavourably and destroy zymase; subsequently the proteoclasts are affected and the fermentative power increases. The experiments yield fresh support to the view that the fermentation by pressed yeast juice is enzymic and not vital in character.—E. F. A.

Saccharin in beer: Detection of —. G. Jörgensen. Ann. des falsific., Feb., 1909; Woch. Brau., 1909, 26 148.

500 c.c. of the beer are concentrated to a syrup on the water-bath, and then extracted with 96 per cent alcohol by trituration in a mortar. The alcoholic solution is poured off, and the residue dissolved in a small quantity of water and again triturated with alcohol, these operations being repeated once or twice. The clear alcoholic solution after standing overnight is distilled and subsequently evaporated, after addition of water, to expel the alcohol and the residual aqueous solution is treated with a few drops of dilute sulphuric acid, filtered if necessary, and shaken with ether. The ethereal extract, containing nearly the whole of the saccharin, is evaporated to a small volume, and after addition of some water and dilute sulphuric acid, is treated with a saturated solution of permanganate until it remains pink. A saturated solution of oxalic acid is added to reduce the separated manganese dioxide, excess being avoided, and the colourless solution is then filtered, shaken several times with a mixture of ether and petroleum ether, and the extract distilled. If saccharin be present the residue consists of white crystals having a very sweet taste. The presence of saccharin may be confirmed by converting it into salicylic acid in the usual manner, any salicylic acid originally present having been destroyed by the permanganate.—A. S.

Saccharin in beer: Detection of —. F. Pawlowsk. Z. ges. Brauw., 1909, 32, 281.

THE author finds that Jörgensen's method (see preceding abstract) is capable of showing the presence of 0.001 per cent. of saccharin in beer. The formation of an emulsion when the residue is extracted with ether and the consequent difficulty of separating the two liquids are both avoided by adding a very small quantity of ethyl alcohol to the liquid.—T. H. P.

Brewers' pitch: Testing —. J. Brand. Z. ges. Brauw., 1909, 32, 265—267.

THE author has devised a method for the estimation of brewers' pitch of the volatile constituents, which have their origin in the colophony used in the manufacture of the pitch and are mainly responsible for the pitchy taste imparted to beer. The method consists in passing a slow current of air for 1½ hours over the pitch (100 grms.) heated at 200° C., collecting the distillation products and weighing them and measuring their acidity. It is found that the purity of a pitch is related directly to the acidity of its distillation products, the degree of acidity diminishing as the purification proceeds. The heating is carried out in a retort, connected with a U-tube and a washing flask to retain the condensable products. A simpler procedure, which quickly gives rough results, consists in heating a small quantity (about 3 grms.) of the pitch in a test-tube in a sand-bath at 200° C. The upper portion of the tube is placed a piece of litmus paper moistened with N/10 alkali containing 20 per cent. by volume of glycerin, the latter being added to prevent the paper from drying. Impure pitch will often cause a reddening of the litmus paper before the temperature reaches 200° C., whilst with purified samples some time elapses before the colour of the paper changes.—T. H. P.

Inversion of sucrose by invertase. Hudson. See XVI.

Catalase of malt and mineral catalysers. H. van Lee. Seventh Int. Congr. Appl. Chem., London, 1909. (See also this J., 1906, 489, 550; 1907, 161).

THE properties shown by the "catalase" of malt are considerably modified by the hydrogen and hydroxyl ion. The catalytic power, measured by the volume of oxygen liberated in the first minute, increases up to a maximum as the hydroxyl ions in the hydrogen peroxide are increased. The maximum is reached when the mixture of grist and hydrogen peroxide has a reaction nearly neutral to phenolphthalein. By reducing the alkalinity of the mixture with methyl orange by the addition of small quantities of acid the catalytic power decreases. Dry malt meal may be

ated at 125° C. for two hours without entirely destroying catalytic activity; this only disappears after heating to 200° C. If c and c' be the volumes of oxygen liberated in one minute by p and p' grms. respectively of two lots of the same malt, one of which has been heated at high temperature (105°—125° C.), and if j be the volume of oxygen liberated by a mixture of $p+p'$ grms. of the two malt grists, then j is always less than c . The difference between j and c is always greater the higher the temperature at which one of the meals has been heated. Thus the influence of the heated meal is equivalent to the introduction of hydrogen ions. The quantity of oxygen evolved in one minute increases with the quantity of malt, but is not proportional to it. This affords a ready means for establishing the identity of two samples of malt or barley. If the volume of oxygen liberated by mixing with p grms. of one sample of malt or barley grist, p' grms. of another sample, is increased, the two samples are probably identical; if the volume is diminished as the result of the mixture, the two samples cannot be identical even if their separate catalytic powers be the same. The progressive increase of the catalytic power of a barley during germination and its decrease during kilning do not necessarily imply an increase or decrease in the quantity of catalase; there may simply be a modification of the conditions due to the action of the hydrogen and hydroxyl ions. The soluble salts of the magnetic metals have no action alone on hydrogen peroxide. They act only when they are more or less converted into hydroxides by the addition of an alkali. The active agent appears to be a couple formed by the metal and the hydroxyl ion, blood charcoal, purified animal charcoal, and reduced platinum show the same relations towards the alkalinity or acidity of the medium as malt catalase. The only difference which appears to exist between the mineral catalysts and malt catalase is that that the latter is destroyed as the result of its action and disappears in whole or in part when heated to a sufficient temperature.

—J. F. B.

Enzymes of barley and malt. M. Holderer. Seventh Int. Congr. Appl. Chem., London, 1909.

THE author has demonstrated the presence of the following enzymes in barley and malt:—Emulsin, rennet enzyme, intensase, trehalase, cellulase, and sucrase. (Cellulase decomposes cellulose into two molecules of dextrose). Barley also contains tyrosinase, and perhaps reductase and lipase; malt perhaps contains tyrosinase and lipase, but does not contain reductase.—L. E.

Bacteria of interest in the fermentation industries; New researches on —. W. Henneberg. Seventh Int. Congr. Appl. Chem., London, 1909.

IN the fermentation industries a complete knowledge of the habits and morphology of all the bacteria liable to affect the products at the various stages is of the highest importance. Of the numerous species of fission fungi adhering to the raw materials, relatively only a small number are capable of developing in the worts and mashes at the concentrations employed. These may be classified as follows:—(a). Lactic acid bacteria; (b). butyric acid bacteria; (c). slime and gas producing bacteria; (d). "coli" bacteria; (e). "hay" bacilli. The following new notes are communicated in connection with these various classes: (a). *B. Delbrücki*, the "culture lactic acid ferment," in the year 1908 about 8000 cultures were disposed of in distilleries and pressed yeast factories; 25 agar cultures were sent to lactic acid factories, "Weissbier" breweries, &c. Most of the lactic acid factories employ this ferment. Important points to observe are: Suitable temperature and nutrition, the behaviour of the ferment in molasses worts, and protection from infection. Volatile acid-lactic acid bacteria are extremely dangerous; the formation of cetic acid is frequently due to these species. Flocculating lactic acid bacteria bring about the flocculation disease of yeast and the failure of the "head" in yeast factories working on the old system. (b). Butyric acid bacteria bring about the fermentation of the yeast crop. *B. Delbrücki* is not very susceptible to this infection. In worts rich in sugar they form only a little acid but a large quantity of gas. Their effect on the culture yeast is to be feared. (c). This class

of bacteria produceropy mashes, large quantities of gas and low yields of alcohol. They have a bad effect on the culture yeast, and induce nitric acid fermentation. (d). "Coli" bacteria cause the production of gas in cereal mashes. They have a bad influence on the culture yeast and induce nitrous acid fermentation. (e). Many of the "hay" bacilli will not grow in mashes and worts because of the natural acidity of the liquid. *B. megaterioides* produces no gas but causes nitrous acid fermentation and has a bad influence on culture yeast and lactic acid ferments. *B. mesentericum* causes the "ropiness" of bread. It does not occur in pure pressed yeast, but possibly exists in the starch which is mixed with the yeast for bakers' use.—J. F. B.

Mulling, malt and lactic digestion in yeast manufacture. A. Sorel. Seventh Int. Congr. Appl. Chem., London, 1909.

DETERMINATIONS of extract, soluble nitrogen and diastatic power of malts are insufficient to allow of the yield of yeast being controlled; the quality of the raw grain and malt used and the method of working exert considerable influence, but lactic digestion has the most potent effect on the yield of yeast. The best procedure, and one which obviates the loss occasioned by the transformation of part of the sugars into lactic acid, consists in concentrating a portion of the vinasse obtained and incorporating it with the yeast when saccharification has been effected. The solution of the phosphates and insoluble nitrogenous compounds of the grain commences immediately and heating is unnecessary, the duration of mashing being greatly reduced. The development of lactic and other organisms is thus avoided almost completely, whilst the solution of the salts and the hydrolysis of the proteins into peptones and amides are enhanced. When saccharification is effected, the necessary well-sterilised vinasse should be incorporated and the whole mass maintained for 2 hours at 55—60° C. before cooling and pitching; in this way, a medium is obtained containing increased proportions of assimilable matters. Further, greater yields of alcohol and yeast are formed, the latter with augmented fermenting power.—T. H. P.

Do the raw cereal products used in brewing contribute any yeast food to beer wort? F. Wyatt and E. Schlichting. Seventh Int. Congr. Appl. Chem., London, 1909.

THE results of the experiments are embodied in three tables, and are considered to show conclusively that: (a) No appreciable amount of protein is contributed from the raw cereal product to beer or distillery worts, either by digestion or by enzymic action, or by prolonged boiling under atmospheric pressure, or under steam pressure of from 10 to 30 pounds; (b) any and all soluble protein existing in raw cereal products is coagulated by boiling with hops; and (c) the amount of nitrogenous yeast food contained in worts, made from mixed malt and unmalted cereal mashes, will always be in direct proportion to the kind and quantity of malt used.

Saccharin [in beer, &c.]; Reaction of —. J. Wanters. Seventh Int. Congr. Appl. Chem., London, 1909.

WHEN saccharin is heated with sulphuric acid and dresorcinol, it yields a product which, when treated with water and filtered, gives an intensely violet liquid. Oxidation of the residue left by the ethereal extract of beer, wine, &c., by means of potassium permanganate yields a product which is sufficiently pure, after extraction with ether, to give this reaction.—T. H. P.

Fermentation process (Guillaume, Eyrol, and Grangi system): Continuous — without dilutions. L. Millet. Seventh Int. Congr. Appl. Chem., London, 1909.

THIS process is applicable in beetroot and artichoke distilleries, but not in the case of products the fermentation of which must be carried out in desired stages. The fresh juice is introduced into continuous fermentation vats which are so contrived that the scums and deposits may be drawn off as desired. The partially fermented juice is withdrawn from these vats into another set of vats, in which the fermentation is completed. This withdrawal

of partially fermented juice is so regulated as to maintain the volume of juice in the continuous fermentation vats, in a state of maximum fermentative activity; if the density of the juice withdrawn tends to increase, the rate of withdrawal is decreased, and inversely. This process insures a uniform fermentation; the fresh juice is introduced into a mass which is always in a state of maximum fermentative activity, and the alcoholic ferments are therefore always in the best possible condition to resist invasion by objectionable organisms. With this process also, it is much easier to keep the temperature at the point most favourable to fermentation.—L. E.

Alcoholic fermentation; Assimilation of malic acid by pure yeast and formation of lactic acid in —; the independence of these two phenomena. W. Mestrezat. Seventh Int. Congr. Appl. Chem., London, 1909. (See also this J., 1908, 763.)

When a must containing malic acid is subjected to alcoholic fermentation, part of this acid disappears, the amount varying with the species of yeast. With one and the same yeast, the amount of malic acid which disappears is greater for a medium rich in nutritive principles, such as grape must, than for an artificial medium, such as yeast water. The amount of malic acid used up in this way may be increased by repeating the fermentation after removal of the alcohol and addition of sugar. Thus, with three different yeasts, after three successive fermentations of yeast water containing 4 grms. of malic acid per litre, it was found that 3.00, 2.70, and 2.20 grms. respectively of the acid had disappeared in the three cases. These observations explain the fact that the acidity of fermented products is usually less than that of the initial must, notwithstanding the formation of succinic acid. The formation of lactic acid, which appears to take place in all alcoholic fermentations, is not a result of the disappearance of malic acid, as it is observed with cheek solutions containing no malic acid. Different yeasts yield widely varying proportions of lactic acid, and some of the organisms occurring in wine, such as *Mycoderma vini*, even consume it with avidity.—T. H. P.

Lactic acid in America. W. H. McLauchlan. Seventh Int. Congr. Appl. Chem., London, 1909.

To prepare lactic acid in the laboratory, about 400 grms. of commercial glucose, known to the trade as 70 per cent. grape sugar, are dissolved in about 1200 c.c. of hot water preferably in an agate ware pot. To the hot solution, about 170 grms. of whiting, or any well-powdered calcium carbonate, is added, and 20 grms. of malt, which has been previously boiled a few minutes in 100 c.c. of water. The whole is kept simmering gently for half an hour to sterilise the raw materials; it is then allowed to cool to 60° or 70° C., and after stirring well to bring the calcium carbonate into suspension, it is poured into a narrow-mouthed bottle, having a capacity of two or two-and-a-half litres. A little more water, used to rinse out the calcium carbonate, is poured into the bottle until the volume amounts to some 1800 c.c. The bottle is then stoppered with a wad of cotton, and placed in the air bath or incubator, which is kept at a constant temperature of 45° C.

For fermentation experiments, an air bath much larger than usual is needed. This can be easily made from a sheet-iron oven, and the temperature should not vary more than one degree. The metal disc thermo-regulators used for incubators are accurate enough for this purpose, but are not satisfactory with much variation in the gas pressure. After the bottle and its contents have cooled to the air bath temperature it is ready to be inoculated with a lactic acid ferment. The pure culture may be prepared by first sterilising in a number of test tubes, sweet milk. These tubes, after sterilising, are closed with a cotton plug and placed in the air bath. Number one tube is then inoculated with a drop of sour milk; a day later number two tube is started from number one tube, and number three from number two, and so on, until the seventh tube is supposed to contain a pure culture. For experimental purposes one may proceed

at once using either sour milk or casein to start the fermentation. Only a few grains are required, and in five or six hours after introducing the ferment, the progress of the fermentation can be noticed by the evolution of carbon dioxide when the bottle is agitated. The shaking should occur every six hours, or oftener, although the bottle may be allowed to stand overnight, and if the fermentation is proceeding properly the evolution of gas upon shaking the calcium carbonate with the supernatant sugar-lactic acid solution will be quite vigorous. Samples of the solution are pipetted out each day and tested for the per cent. of calcium in solution, which indicates the progress of the fermentation and the consequent formation of calcium lactate. At the expiration of a week or ten days the per cent. of calcium remains stationary, or increases very slowly, and a sample is tested to see if any unfermented sugar remains. If this is less than 0.4 per cent., the fermentation may be considered finished. The calcium lactate solution is treated with the calculated quantity of sulphuric acid, and after stirring well, a test tube full is filtered and tested with a drop of sulphuric acid, to be sure that acid sufficient to precipitate all the calcium, as calcium sulphate has been added. When this point has been reached the calcium sulphate is removed by filtration. The impure lactic acid in the filtrate can be freed from volatile constituents by evaporating. On concentrating, more calcium sulphate separates out, which must be again removed by filtering. The final filtrate should amount to about one litre of 25 per cent. lactic acid. The acid thus obtained is not perfectly colourless, but can be decolorised with animal charcoal.

If the calcium lactate solution be allowed to cool after the fermentation is finished, calcium lactate, which is much less soluble at ordinary temperatures, separates from the solution. The mother liquor may be squeezed out and the calcium lactate washed in small quantities of cold water. This washed calcium lactate after being dissolved and decomposed with sulphuric acid yields a colourless strong solution of lactic acid.

The details for preparing lactic acid have been given because the process for making it on a commercial scale is, in principle, identical with the method just given for preparing it in the laboratory. The various operations to be carried out are:—1st. Preparing solution for fermenting. 2nd. Fermenting. 3rd. Decomposing the calcium lactate. 4th. Filtering out the calcium sulphate. 5th. Concentrating.

The solution.—When the raw material consists of starch corn (maize), grain, or other material in which the source of the sugar is starch, this must first be inverted by the action of dilute acids or malt diastase. In either case the grain must be first ground, and if the inverter is to be accomplished with acid, the grain or starch is placed in a large wooden tank, and sufficient water to agitate the material is added, followed by about 2 per cent. of sulphuric acid. The temperature is raised to, and kept at, 95° C. for five or six hours by means of live steam. When inverting with malt, about 10 per cent. of the weight of the material to be inverted is used. The temperature in this case is 65° C. If glucose or other fermentable sugars are used as raw material inversion is unnecessary. The glucose is dissolved and pumped into the fermenting tank. To the sugar solution is now added enough finely powdered calcium carbonate to neutralise all the acid which can be formed by fermentation from the sugar, the object being to remove the free acid, as more than 1 per cent. stops the action of the lactic acid bacteria. Calcium carbonate containing free lime may be used, although it is commonly thought that no lactic fermentation would occur with an alkaline substance present. The lactic bacteria require as nutriment a certain amount of nitrogenous matter. This is present in grain, but when fermenting solutions of sugar, this nitrogen must be supplied. Peptone may be used in the laboratory, but gluten meal, casein, malt, or grain are used in manufacturing. This material is generally "digested" in a weak sulphuric acid solution before running into the fermentation tank. The amount used should be such that the nitrogen corresponds to 0.1 per cent. of the sugar. The use of inorganic salts containing nitrogen, nitrates,

ammonium salts, and phosphates has been recommended seemed unsatisfactory both for a laboratory experiment and in actual practice. When the sugar, calcium carbonate, and nutrient matter have been brought into a tank, water is added, and the solution stirred, until a specific gravity corresponds to 15 to 17 per cent. sugar. In order to sterilise, before starting the fermentation, live steam is blown in through a perforated lid in the bottom of the tank until the temperature rises to 95° C., where it is held for an hour, and then the solution is allowed to cool to 45° C., and is now ready for inoculation with the lactic acid germs. The lactic acid ferment may be prepared as directed for making small amounts of lactic acid, using, however, a large copper pan about one hundred litres capacity, kept at the fermenting temperature in a large incubator or box kept at constant temperature by a steam coil. The fermentation tank, made of cypress wood, is ten to sixteen feet in diameter and six to eight feet in height, provided with a steam pipe for heating, which can also be used as the pipe for stirring with compressed air. These pipes are of lead or copper, and there is a lead pipe connection from the floor of the tank leading into a pipe laid along the side of the fermentation tanks, through which the fermented liquor is pumped. The tank is covered, and has a manhole which can also be used to introduce the materials required for making the solution. The tank is also supplied with a thermometer and a spigot on which samples for daily tests are taken. The fermentation should begin in a few hours after "starting" with the lactic ferment, and should go rapidly the first few days, and then less rapidly as the sugar concentration decreases. Sometimes the fermentation stops before sugar is used up. In this case the liquor is again sterilised should any foreign organisms be present, and started again with more of the lactic acid culture. The worst foe to a "clean" fermentation seems to be the lactic fermentation. Should this appear, the calcium lactate is decomposed and hydrogen is liberated, which is responsible for the explosions which occur when a naked light is used in a tank containing liquor fermenting improperly. Some acetic and formic acids are occasionally produced, but in no case should these volatile acids amount to more than 5 per cent. of the lactic acid present. When the fermentation is over, the solution is heated by steam preparatory to pumping to the tank in which the sulphuric acid is added. After neutralisation, the calcium sulphate is allowed to settle, and the clear lactic acid drawn to a storage tank. One half the volume in the tank, containing the calcium sulphate, is still left. To this, a weak acid from the filter press is added. The contents of the tank are well stirred, and allowed to settle. Again the clear liquid is drawn off, and the remainder, containing the calcium sulphate and the diluted acid, is sent through a plunger pump to the filter press. The liquor from the press is added to that from the decomposing tank. When the press is full it is washed until the wash water is free from acid, the strong wash waters being stored for washing the calcium sulphate in the decomposing tank, the weak wash water being used in making up new charges. The acid, except that to be used for washing the calcium sulphate, is evaporated to 22 per cent., the strength of which most of it is sold. Occasionally some is sold at 50 per cent. This concentration is accomplished in a copper vacuum pan, supplied with a steam belt or coil and a "juice catcher" between the pan and the condenser. The pan may be heated by exhaust steam. The finished acid is light coloured when made from glucose or starch, but dark brown when made from grain or other materials containing colouring matter. The specific gravity of the 22 per cent. acid is about 1.1. The calcium lactate may be crystallised out from the liquor after fermentation, and then washed free from other liquor and dissolved in a small amount of water. The washed calcium lactate, decomposed with sulphuric acid, gives an acid light in colour, and free from soluble impurities. This operation is not followed in America because the consumer is not particular about the colour of the acid, and further, calcium lactate is a difficult salt to handle. It does not crystallise well, and is quite soluble even in cold water. The laboratory

tests, which have been referred to, may be carried out as follows:—

Free acid is determined by titrating a sample, after settling, against N/5 sodium hydroxide, using phenolphthalein as the indicator. *Calcium lactate, or combined acid*.—10 c.c. of clear liquid are diluted to 150 c.c., and heated to boiling. It is then titrated with a standard solution of sodium carbonate, 1 c.c. of which represents 0.5 per cent. of lactic acid. The indicator is phenolphthalein. *Sugar*.—This is determined as given in Lunge's *Chemisch-technischen Untersuchungs Methoden*. 10 c.c. of Fehling's solution, heated to boiling, are titrated against the sugar solution, from which the calcium is first precipitated. In the finished acid it is necessary to determine the total free acidity, the anhydride and volatile acids present, as well as the ash, and sulphuric acid. *Free acid*.—About 20 grms. are weighed out and diluted to 250 c.c. 25 c.c. of this solution are titrated direct for total acidity. *Anhydride*.—25 c.c. more are boiled with a known excess of N/5 sodium hydroxide for ten minutes, and then, after adding enough N/5 acid to more than neutralise the sodium hydroxide, the solution is titrated with N/5 sodium hydroxide, using more phenolphthalein. The difference between the first determination and the second equals the amount of anhydride present. This ordinarily amounts to 5 or 10 per cent. of the total acidity. *Volatile acids*.—They are determined by taking 25 c.c., of the same diluted solution, evaporating to one-half the volume and diluting with water to 20 c.c., repeating the operation two or three times. This is not accurate, as lactic acid is slightly volatile, but it answers the demands of the trade, and will give results which can be duplicated if the operation is carried out in the same manner. *Plant*.—In all chemical processes depending upon a fermentation, it is well understood that a scrupulous cleanliness must be observed; therefore, a lactic acid plant must be arranged so that it can be kept clean and free from all chance of contaminating the fermentation. The floors should be built of cement so that they may be flushed off with water. The fermentation tanks should be placed so that the floors beneath and the walls next to them can be easily kept clean. In addition to the inverting, fermenting, and storage tanks, ten or twelve in all, a steam plant, a 40 horse power engine, air compressor, vacuum pan, filter-press, four pumps, a lead-lined acid tank, and iron sulphuric acid storage tank are required. Such a plant could be built for 15,000 dollars, and would have an approximate capacity of 100 tons of 22 per cent. lactic acid per month. The demand for lactic acid is not great enough to warrant the establishment of a plant for its sole manufacture. In America, at least, it is made only by concerns engaged in the manufacture of other chemicals as well. Most of the lactic acid is sold to the tanneries where it is used as a so-called "plumper." The hides are heated with dilute lactic acid, which prepares them to receive the further treatment in the process of tanning. Lactic acid has thus a restricted market.

Wines of South-West France: Alterations in the sulphurous acid added to the musts of — and causes of variations in the ratio of reducing sugars to polarisation. P. C. Mestre. Seventh Int. Congr. Appl. Chem., London, 1909.

THE principal factors which influence the transformations undergone by the sulphurous acid in grape musts are: the aldehydes, the enzymes, the sugars, the air dissolved in the must, and the air absorbed during its storage in recipients of various nature. Some of these factors are themselves influenced by the degree of maturity of the grapes and by the changes brought about by the attacks of insects or parasitic plants. It is practically impossible to lay down any rule as to the maximum and minimum proportions of sulphur dioxide which determine the starting up of fermentation in musts which have been treated with sulphur dioxide. It depends so much on the biological condition of the must at the moment of removing the sulphurous acid and the quantity of that agent which was present. In any case, vinification proceeds very slowly even when pure yeast is used, not only when polarisation shows a predominance of levulose, but also in musts containing normal proportions of dextrose

and levulose. This sluggishness, which is accentuated when the removal of sulphurous acid is followed by pasteurisation, is, in 80 per cent. of the cases, accompanied by the production of quantities of glycerol far in excess of those calculated by Pasteur. This is why the wines prepared from treated musts are always fuller flavoured than those prepared from the same musts untreated. The ratio $\frac{P}{a}$ represents the ratio of the weight of reducing sugars, determined by Fehling's solution, to the polarimetric reading. This ratio is used for calculating the proportions of dextrose and levulose and for determining whether the sweet taste of a wine is due to the introduction of unfermented grape juice. The author has shown that certain pure musts occur in which this ratio has a value indicating proportions of dextrose and levulose such as occur in partially fermented juices. This anomaly is extremely common in the districts suffering from the attacks of *Cochylis* and *Endemix*, and is produced by the parasitic fungi which follow these attacks. Under their action the dextrose disappears to a greater or less extent, sometimes without the production of alcohol. Often the presence of this latter is observed very distinctly in the juice of the grapes whilst still on the vine. The most numerous cases of these abnormal musts are those in which the grapes have become more or less oxidised on the vine and are more or less rich in by-products of oxidation.—J. F. B.

Pasteurisation of wines; New method of —. C. Mariller. Seventh Int. Congr. Appl. Chem., London, 1909.

THE wine is heated to a definite temperature by the vapours from suitable liquid mixtures. These mixtures are boiled by means of either direct fire or a steam-coil, the pressure of the vapours acting on a regulator which controls the entry of steam to the coil or the access of air to the fire. The vapours, after use, are condensed, slightly cooled, and returned to the liquid bath. By this automatic process, superheating is avoided and the wine preserves its initial composition.—T. H. P.

Fermented liquids; Formation, variation, and evolution of esters in —. Kayser and Demolon. Seventh Int. Congr. Appl. Chem., London, 1909.

IN this investigation, the authors have dealt chiefly with ethyl acetate, which some yeasts produce in relatively considerable quantity, and which constitutes almost the whole of the volatile esters; the study of the fixed esters is more difficult. The authors point out that during fermentation, the formation of esters by chemical interaction of the fermentation products, is quantitatively negligible. If a series of fermentations, in which varying amounts of volatile acids are produced, is carried out in flasks placed under the same conditions, the quantity of volatile esters is approximately proportional to that of free volatile acids. The ratio, free volatile acids : volatile esters, varies with the experimental conditions; it decreases in deep media, and may approximate to 2, no special precaution being taken to avoid losses. Direct addition of acetic acid does not increase the proportion of esters, and hence, the theory of a synthesising enzyme acting in the external medium, should be rejected. The fact that distillation of the yeast itself, in presence of water, always yields a certain quantity of esters, shows that the ester-formation occurs in the interior of the yeast cell. With free exposure to air, the esters rapidly decrease on completion of fermentation, even if mercuric chloride is added to prevent their destruction by the yeast. Experiments, in which ethyl acetate was added to various media, showed that about 60 per cent. disappeared in 9 days at 12° C. It is the escaping carbon dioxide, however, which is largely responsible for the loss of esters formed during fermentation.—L. E.

Brandy; The nature of the esters of — and the factors which influence their proportions. C. Ordonneau. Seventh Int. Congr. Appl. Chem., London, 1909.

THE distillate from 10 hectolitres of lees of wine from Borderies de Cognac has been examined for the characterisation of the volatile acids and esters. There were

found: formic, acetic, butyric, crotonic, caproic, and cœnanthic acids, as well as their ethylic esters and free lactic acid derived from the fermentation of the malic acid. Ethyl acetate represents about 92 per cent. of the esters of the wine and cœnanthic ester about 7 per cent which explains the richness in esters of the "head" products of the distillation. From the rectification of 20 hectolitres of brandy, the author has isolated 30 grms. of ethyl formate and 3400 grms. of ethyl acetate. The chief factors which influence the quantities of the volatile acids in brandy, and consequently those of their esters are: the quantity of volatile acids existing in the wine, the duration of the distillation, and the total acidity of the wine. The proportions of volatile acids in wines are variable, and diseased wines are the richest. The brandies distilled in the old-fashioned stills with a slow fire are always richer in esters than those distilled in a rapid still, because prolonged ebullition of the wine favours the esterification of the volatile acids, as is illustrated by the distillation of a mixture of vinasse and neutral spirit which on slow distillation yielded 40 grms. of esters per hectolitre of absolute alcohol. Whilst admitting that the presence of esters in a mixed spirit in no way implies that wine brandy is present, the author concludes that since the best brandies are obtained by slow distillation in an old-fashioned still, they ought to be rich in esters, but that in practice care should be taken to ascertain that these esters are not derived from damaged wines, which may be done by tasting.—J. F. B.

Alcohol, its impurities, and its denaturation; Action on the common metals of —. R. P. Duchemin. Seventh Int. Congr. Appl. Chem., London, 1909.

THE following table gives the dry residue in grms. per litre of alcohol after being left in contact with the various metals for three months:—

	Iron.	Tin.	Zinc.	Copper.	Brass.
Ethyl alcohol, 95°	0.0	1.3	2.2	1.1	1.4
" " " + 50 per cent. water	10.8	2.5	8.3	1.0	2.1
" " " + 10 per cent. aldehyde	1.5	1.4	3.0	0.8	1.0
" " " + 10 per cent. ethyl acetate	3.4	1.0	4.7	0.8	0.8
" " " + 10 per cent. amyl acetate	1.0	1.2	8.4	2.2	3.0
Methyl alcohol, 95°	1.5	0.3	1.8	0.9	1.1
" " " + 50 per cent. water	13.8	0.9	13.6	0.4	0.5
" " " + 10 per cent. acetone	1.3	1.2	1.6	2.0	2.0
" " " + 10 per cent. methyl acetate	0.9	1.5	3.8	0.6	2.0

It will be seen that it is the impurities present in denatured alcohols which render them inconvenient for use with metallic plant.—T. H. P.

Vinasse charcoal; Losses of salts in the production of —. E. Bauer. Seventh Int. Congr. Appl. Chem., London, 1909.

A CAREFUL comparison of the quantity of salts fed into the furnace in the form of concentrated vinasse with the recovered in the charcoal shows a loss ranging from 5 to 10 per cent. This loss on burning consists principally of potassium sulphate, which fact is apparently not in concordance with the fact that the dissociation temperature of potassium sulphate is considerably higher than that of the carbonate and chloride. A portion of this sulphate is deposited in the flues near the furnace in the form of a fusible crystalline mass as hard as stone, whilst further quantities are deposited as dust nearer the chimney. It is assumed that in the body of the furnace the sulphate is reduced to sulphide, which volatilises on dissociation and is subsequently condensed and re-oxidised in the flues. This re-oxidation is not always complete, and many of the samples drawn from the flues contain sulphide. The quantity of salt recovered from the flues varies, according to the temperature and the length of the flues, from 8 to 12 per cent. of the total loss. The greater portion equivalent to from 5 to 10 per cent. of the calculated

eld of crude ash, goes up the chimney. This loss is greater in the Ganur furnace than in the Porion type, in which latter a portion of the volatilised salt is absorbed by the sprays of liquid vinasse.—J. F. B.

Determining starch. Thorne and Jeffers. See XVI.

Analysis of malt extracts. Hamburg. See XX.

Highly carburetted alcohol as a motor fuel. Mohr. See II.

Alcohol-free alcohol in manufacture of dyes in U.S.A. Prochazka. See IV.

PATENTS.

Maize-ears; Utilisation of — for the production of alcohol. F. L. Stewart, Murrysburg, Pa., Assignor to S. E. Gill, Pittsburg, Pa. U.S. Pat. 923,088, May 25, 1909.

MAIZE-EARS, while the kernel is still "in the milk," are ground and heated with dilute acid; the liquid portion is then separated from the pulp, and rendered slightly alkaline. The precipitate which is reduced is separated and the liquid is fermented, the alcohol formed being then recovered by distillation.

—W. P. S.

Alcohol; Process for making —. A. Woolner, jun., and A. Lassloff, Assignors to Woolner Distilling Co., Peoria, Ill., U.S. Pat. 923,232, June 1, 1909.

DIASTASE-SECRETING fungi, such as *Aspergillus oryzae*, are grown in suitable distillery products, and the resulting medium is combined with a prepared mash containing malt-diastase; the mixture is then fermented and subsequently distilled.—J. H. J.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(A).—FOODS.

Creatinine determination [in meat extracts, &c.]; Factors which influence the —. F. C. Cook. J. Amer. Chem. Soc., 1909, 31, 673—693.

THE author has made a large number of experiments on the colorimetric determination of creatinine under varied conditions (see this J., 1907, 709; 1908, 87). It was found that with commercial samples of creatine and creatinine, slightly higher results were obtained when 10 c.c. of picric acid were used than when 15 c.c. were used; with meat extracts the results were the same whether 15 or 30 c.c. of picric acid were employed. It is advisable to always add 25 or 30 c.c. of picric acid, since an excess does not influence the results. The amount of alkali which gave the most satisfactory results was 10 c.c.; an excess caused the results to come out lower. Serious errors may be caused by the dilution of the creatinine solution before the addition of the reagents. The error due to dilution is a fairly constant one. If the result obtained with 10 c.c. of the creatinine solution be taken as correct, then for each 10 c.c. of dilution, 0.00019 grm. of creatinine less is found. Thus if the solution is diluted to 100 c.c., $0.00019 \times 9 = 0.00171$ grm. should be added to the result. The result obtained is also lower the longer the solution is allowed to stand after the addition of the reagents; it is recommended that the period of standing be 5 minutes. Somewhat low results are obtained if coagulable proteins (egg albumin), proteoses, or peptones are present, and although ordinary meat extracts do not contain sufficient protein to seriously affect the results, yet in exceptional cases, it is necessary to remove the protein before applying the test. For the conversion of creatine into creatinine, a modification of Benedict and Myers autoclave method (Amer. J. Physiol., 1907, 13, 397) proved most satisfactory. 50 c.c. of the meat extract solution are well mixed with 50 c.c. of $N_{1/1}$ hydrochloric acid, heated in

the autoclave for 15 minutes under 15 lb. pressure, then the volume adjusted to 100 c.c., and an aliquot portion taken for the creatinine determination.—A. S.

Jelly-making; Chemistry and physics of —. N. E. Goldthwaite. J. Ind. and Eng. Chem., 1909, 1, 333—340.

THE author defines a jelly of good texture as one that is not tough; that will quiver but not flow when shaken; and that can be easily cut by means of a spatula into pieces, which will preserve their shape. Experiments with crab-apple, sweet apple, grape, pear, peach, and plum juices showed that the essential constituents for the formation of jellies of good texture are pectin and free acid, whilst sucrose is a desirable accessory constituent. For fruit juices of sp. gr. about 1.04, the most desirable proportion of free acid is about 0.5 per cent. (expressed as sulphuric acid). After addition of an acid (organic or mineral) to a fruit juice containing little free acid, good jellies can be made, but the flavour is impaired and in some cases completely spoiled; tartaric acid gives somewhat better results than citric acid. The amount of sugar required appears to depend mainly upon the proportion of pectin in the juice; too much is generally used. It is probably best to add the sugar so that it is boiled with the juice for a period not exceeding one-half the total time of boiling. With crab-apple juice, jellies of excellent texture and with remarkable keeping qualities can be obtained by using glycerin in place of sugar. Tests with different fruit juices showed that hot juice ready to gelatinise on cooling, has a b.p. of about 103° C. and sp. gr. (observed with a hydrometer), 1.28. Pectin was isolated from different fruit juices by boiling them, then cooling and filtering, and adding the filtrate drop by drop, with constant stirring, to an equal volume of alcohol. After standing overnight, the pectin was collected on a filter of fine cotton cloth, and the liquid worked out of the gelatinous mass by means of a spatula. After repeated re-dissolving and re-precipitating, the pectin was obtained as a nearly colourless, transparent solid. By preparing a 1 per cent. solution of the pectin from sweet apple, crab apple, and peach juices in a 0.5 per cent. solution of tartaric acid, heating to boiling, adding 0.75 volume of sugar, and again boiling until a test-portion gelatinised on cooling, jellies of excellent texture and taste, but nearly colourless, were prepared.—A. S.

Rice; "Facing" and other methods of preparing — for sale. J. M. Hamill. Report to the Local Government Board, New Series, No. 4, 1909.

THE normal creamy white colour of rice is changed to one of dead whiteness by the addition during the milling process of ultramarine or aniline colouring matters. Prussian blue or indigo are also used but less commonly. If the grain is not to be glazed, the opacity is subsequently modified by arachis oil or carefully purified petroleum, about 3 gallons of oil sufficing for 200 cwt. of finished rice.—J. W. G.

Flour; Bleaching and conditioning of —. W. Jago. Seventh Int. Congr. Appl. Chem., London, 1909.

RECENT milling developments have had as their object the improvement of the colour of flour. The colour of flour is more or less due to the presence of the following colouring matters: Bran, crease, and other outside, dirt, colouring matter of the endosperm. Bran contains a reddish-brown colouring matter. If very fine particles of bran are allowed to remain in the flour, they darken the colour, and this is intensified when the colour is dissolved out in the act of making dough. Crease dirt, when allowed to get into the flour, gives it a sad, bluish-grey tint. This outside dirt is removed by scouring or washing the wheat, and also by first splitting the grains longitudinally and removing the crease flour before proceeding further with the reduction of the grain. Colouring matter of endosperm.—This is in a different category, being a part of the flour itself. In properties, the colouring matter is somewhat unstable in character, and diminishes very noticeably on keeping the flour some

two or three months. The intensity of such colour varies considerably; some flours, such as that of Walla Walla wheat, are very yellow, while others are comparatively white. Some years ago the writer made experiments on these flours with ozone. The colour was almost completely destroyed, but the flour acquired an unpleasant taint.

Since then other bleaching agents have been proposed, the most important being nitrogen peroxide, and, secondarily, chlorine. The whole of such bodies, and also ozone, are either direct or indirect oxidising agents. But the bleaching is not necessarily an oxidising action, because sulphur dioxide, a reducing agent, also bleaches flour. Nitrogen peroxide is by far the most important of these bleaching agents, and for that purpose is produced either by chemical processes or a flaming electric discharge through air. There has been much discussion as to whether bleaching by nitrogen peroxide is due to oxidation or to nitration. Advocates of the former view point out that nitrogen peroxide undoubtedly acts as an oxidising agent in certain well-known reactions, and that it is fair to assume that it also does so on flour. The fact that ozone bleaches the flour is quoted in support of this argument; but the reply is made that electrically produced ozone contains nitrogen peroxide, which is really the effective bleaching agent. The argument in favour of the nitration theory is that the oil of the flour, with which the colouring matter is closely associated, absorbs the nitrogen peroxide, being chlorinised. In support of this view the oil is shown to be altered in character, and nitrogen compounds of the nitrite type can be detected in the treated flour. One argument is surely not destructive of the other; oxidation of colouring matter may co-exist with absorption of nitrogen peroxide, *i.e.*, there may be both oxidation and nitration. When flour is kept, it "ages" or "conditions." A conditioned flour works rather better during fermentation, usually makes a better coloured and rather larger loaf, and absorbs rather more water. It is claimed for bleaching that it "conditions" the flour. Conditioning consists probably in alterations in the physical characters of the gluten. Gluten may be too tenacious in quality, and while ageing, it may be slightly broken down by traces of acid, so that it can expand more freely. If as a result of such changes the flour as a whole has improved, fermentation goes on more regularly. As bleaching by nitrogen peroxide causes the development of traces of acid, this treatment may cause quickly the same changes as occur more slowly in flour during ageing, but all must depend on whether or not the flour is in such a condition as to be improved by such changes. But bleaching does not change a low-grade flour into a higher one; the colour may be lightened, but the other characters of the flour are not transformed. Bleached flour should therefore be declared as such.

Wheatn flour; Gas-making capacity as a factor in the estimation of strength in — A. E. Humphries and A. G. Simpson. Seventh Int. Congr. Appl. Chem., London, 1909. (See this J., 1907, 985).

THE final conclusion is that the total gas evolved in panary fermentation is of no importance as a measure of strength; the gas evolved in the latest stages of fermentation is of greater significance and it is a factor under the control of the miller and the baker. The progress of these later stages of fermentation is dependent on the action of the various diastatic enzymes present in all wheaten flours.

Milk; Comparative study of the new methods of detecting watering of — G. Cornalba. Seventh Int. Congr. Appl. Chem., London, 1909.

EVEN the milk from large herds exhibits moderately large natural variations in the amounts of residue, fat and casein, so that quite a large addition of water may be necessary in order to bring these amounts down to the minimum values. With the milk from a single animal these variations are still more marked. The author finds that a sure means of detecting dilution of milk with water is furnished by the sum of the soluble components of milk. Taken separately, these soluble components give no reliable data, as their amounts vary somewhat widely; but their sum varies only between such narrow limits as to render possible detection of a dilution as small as 5 or even 4 per

cent. The mean value of this constant for mixed milk from a number of animals is about 6.25, the limiting value being 5.95 and 6.46. For the milk of single cows, the limiting values are 5.80 and 6.60, and with the majority of the cows the value oscillates round the number 6. Taking the mean value 6.15, addition of 5 per cent. of water to the milk would lower the value to 5.81. Determination of the density of the serum, which should not be less than 1.030, is capable of revealing dilution of milk to the extent of 10 per cent.

Evaporated milk and milk products; Analysis of — E. Gudeman. Seventh Int. Congr. Appl. Chem., London, 1909.

A NEW method for the determination of fat in concentrated milk and in milk products is given as follows:—2.5 grms. of the milk product are weighed into a beaker and dissolved, or made into an emulsion with about 100 c.c. of water. In this solution fat, and proteins, and substance insoluble in water (cereals, starch, gums, fibre, etc.) are precipitated with copper sulphate (Fehling solution). The precipitate is filtered off and washed on the filter, and the dried between filter paper, or at a very low temperature, and directly extracted in a continuous extractor with petroleum ether, and the extracted fat dried on the water-bath and weighed. The advantage claimed for the method beside accuracy and rapidity, is the fact that the extracted fat is not modified by excessive drying before or after extraction. The extracted precipitate can be used for the determination of protein, insoluble in water, the Kjeldal digestion being complete within one hour. With product containing a large amount of fats, such as milk chocolate, milk powders and others, a preliminary extraction with dry ether, petroleum ether, or other suitable solvent is recommended. The method was found to have extensive application in the analysis of products containing sugar, starch, cereals and other substances that interfere with direct extraction of the products.

Dried potatoes; Preparation and uses of — E. Parow. Seventh Int. Congr. Appl. Chem., London, 1909.

POTATOES are dried so as to contain not more than 15 per cent. of moisture, either by means of superheated steam or by hot gases. In the first place the washed potatoes are boiled soft, using steam under a pressure of 0.5 atm. The boiled potatoes are then passed between rolls to which steam under a pressure of 2.5 atm. is supplied, the steam given off from the potatoes being removed by an exhaust. The paper-like mass obtained is scraped off the rolls by sharp knives, and torn into flocks. In the second system the washed potatoes are cut up into pieces or discs, which are then passed through fixed or rotating drums through which hot gases from burning coke or coal, plentifully mixed with air, are drawn by an exhaust arrangement. The temperature in the drums is 120°–250° C., that of the exhaust gases 100°. The total cost of drying 100 kilos of potatoes by the first process is from 8½d. to 1s. 2½d. and by the second process from 6½d. to 9½d. Dried potatoes can be used for all purposes for which fresh potatoes are used, and keep indefinitely. In Germany 200 installations, with about 300 machines, have been constructed so far, capable of dealing with about 600 million kilos. of potatoes per annum.—A. G. L.

Cocoa; Presence of oxalic acid in — C. Girard. Seventh Int. Congr. Appl. Chem., London, 1909.

EXAMINATION of authentic samples of cocoa showed that they contain as much oxalic acid as is found in sorrel, spinach and rhubarb, and that the quantity is not diminished by drying. Analyses of the chief brands of cocoa and of their ash are given.—A. G. L.

Oxalic acid in cocoa and chocolate. J. M. Albahary. Seventh Int. Congr. Appl. Chem., London, 1909.

EXISTING methods having failed to give accurate results in the determination of oxalic acid in cocoa or chocolate the author devised the following process, which is based on the fact that in an alkaline solution magnesium salt precipitate phosphates and purino bases, whilst oxalic

did remains in solution as magnesium-alkali oxalate; calcium oxalate is also soluble in an alkaline solution. About 50 grms. of the sample, which has been dried over sulphuric acid till of constant weight, are heated for one hour on the water-bath with 50 c.c. of a 10 per cent. solution of sodium carbonate, fresh water being added to replace that evaporated. The mixture is then treated with 50 c.c. of a solution containing 10 per cent. of magnesium chloride and 20 per cent. of ammonium chloride, a quantity of animal charcoal being also added to retain mucilaginous substances. After concentrating by liquid by heating for another hour, with occasional agitation, the mixture is filtered whilst hot, with the aid of the pump, and the insoluble matter is washed with boiling water. The filtrate is concentrated, made strongly ammoniacal, and after standing for 12 hours, is filtered. The filtrate is treated with a slight excess of calcium chloride, then made faintly acid with acetic acid, and after standing for 12 hours in a warm place, the precipitated calcium oxalate is filtered off, and the oxalic acid determined in the usual way. This gives the total oxalic acid: the preliminary heating with sodium carbonate being omitted, the oxalic acid present as soluble alkali salts is determined, and the difference between the two results gives the quantity present as calcium oxalate. With this method it was found that a specimen of "alkalised" cocoa powder contained per kilo., 3.647 grms. of oxalic acid in the form of soluble salts and 0.188 gm. as calcium oxalate; in a sample of "non-alkalised" cocoa powder, the corresponding figures were 0.159 gm. and 3.763 grms. In two specimens of chocolate, 0.7238 and 0.385 gm. respectively of oxalic acid per kilo. were found.—A. S.

Gelatin; Copper as an impurity in —. W. B. Hart. Seventh Int. Congr. Appl. Chem., London, 1909.

METALLIC impurities, when found in cooked and preserved foods, generally originate from the cooking vessel, the packing vessel, the sealing material such as solder, rubber ring, etc., or from the intentional addition of copper salt for "greening" purposes. The author has traced a further and hitherto unrecorded source of metallic impurity. Pressed beef, alleged to have caused symptoms of poisoning, when microscopically and bacteriologically examined, was found to be quite sound, but a small quantity of copper was detected, the origin of which was eventually traced to the gelatin used as a garnish, the results being as follows:—

	Mgrms. of copper per kilo.
Pressed beef 1	34
Pressed beef 2	0
Gelly preparation	69
Gelatin A	25
Gelatin B	104

The examination of a number of samples of gelatin, sold for household use gave results varying from 0 to 56.3 mgrms. of copper per kilo., and the figure varied directly with the price. Possible sources of copper contamination during the manufacture of gelatin, and the widely divergent opinions of various authorities as to the permissible limit for copper in foods are referred to.

Foodstuffs; Mineral constituents of —. H. Ingles. Seventh Int. Congr. Appl. Chem., London, 1909.

THE necessity for a sufficient supply of "mineral matter" or "ash constituents" in the food of animals has long been acknowledged, but the importance of its composition has not been sufficiently recognised. Sodium, chlorine, fluorine, iron and calcium are apparently of more importance to animals than to plants and are not stored in any considerable quantities in the seeds of plants, which are usually rich in potassium and phosphorus compounds. In seeds and in cereal seeds particularly the proportion of phosphorus pentoxide far exceeds that of lime, while in the stems and leaves of most plants—of *Leguminosae* especially—the lime largely predominates. Further consideration shows that the food supplied to animals, is not sufficiently varied in character, must often be deficient in certain mineral elements which are essential to the proper formation of digestive and other secretions. The various secretions required for normal digestion

and growth in an animal are characterised by containing certain chemical elements, some of which occur but rarely in plants.

Thus, iodine, contained in the thyroid secretion, and fluorine, an essential constituent of bone and teeth, are not abundant in plants, while the ratio of sodium, chlorine, iron and calcium to the potassium and phosphoric acid required by animals is far higher than exists in most plants. As an example of what the writer believes to be a widespread fallacy, the view that wheat bran is particularly valuable as a "bone-forming" food may be cited. This substance is particularly rich in ash and contains a large amount of phosphorus pentoxide (about 3.0 per cent. of its weight) but only about 0.2 per cent. of lime, and, according to the writer's view, should be very unsuited for bone development and nutrition, as indeed is the case, as proved by the existence of a curious bone disease, known as "bran rachitis," among horses fed largely on bran.

Food colours, certified; Difficulties in the way of their manufacture. E. G. Kohnstamm. Seventh Int. Congr. Appl. Chem., London, 1909.

THE coal-tar colours permitted under the Food and Drugs Act of the United States are seven in number, which must be in a high state of purity. The author states that none of the colours on the markets of the world, at the time of testing, would meet these requirements. Of these seven colours, 189 samples from every possible source, and representing all the leading manufacturers, are here reported on, and the results of their examination reasonably establish the necessity of food colour certification. Of these 189 samples the worst were offered for food colouring purposes and seemed to be so offered because unfit for any other purpose. *Naphthol Yellow S*.—Sixty-four samples examined, ranging in shade from clear bright yellow to a dirty brownish or green colour. All contained Martius' Yellow, some more than 1 per cent. thereof; some contained as high as 2 per cent. and even 3 per cent. of unconverted initial material or decomposition products. Forty-one contained excessive arsenic and 29 excessive heavy metals. *Orange 1*.—Twenty-eight samples examined; all contained decomposition products, varying from a slight amount to over 50 per cent.; free α -naphthol was found in most samples, in 12 it was as high as 2 per cent.; insoluble matters were as high as 1 per cent.; lead to the extent of 0.5 per cent. was found in one sample; shading by added colours and excessive amounts of arsenic, lead and iron were frequent. *Amaranth*.—Thirty-eight samples examined; none were pure, and all contained arsenic in excessive amounts, and in one case as high as 0.1 per cent.; all contained added colour, principally an acid-violet. Iron as high as 0.1 per cent.; insoluble matter as high as 1½ per cent.; was most heavily loaded with salt of all seven colours. *Ponceau 3R*.—Thirty-six examples examined; the purest of all colours tested; not toned; heavily loaded with salt; much insoluble matter was present; decomposition products were absent; iron 0.01 per cent.; 12 contained excessive amount of arsenic, and 14 contained excessive amount of heavy metals. *Erythrosine*.—Twelve samples examined; 10 were not erythrosine at all; of the other two, one was low in iodine and one contained arsenic. *Light Green S.F. Yellowish*.—Thirteen samples examined; only one free from arsenic, nine contained lead or copper, one contained manganese; none were loaded. *Indigo-disulphonic acid*.—Eight samples examined; none were pure; the iron content was as high as 1.5 per cent.; all were loaded with salt or Glauber's salt. One contained excessive amount of arsenic and two excessive amounts of heavy metals. The difficulties consist in keeping the undesirable materials out of the dyes, or in separating them from the crude dyes, or both.

Limit of lead in culinary utensils and tinned articles. Padé and Kohn-Abrest. See X.

Sugar and maize syrup for confectionery and preserves industries. Bosceley. See XVI.

Bacteria of interest in fermentation industries. Henneberg. See XVII.

Impurities [lead and arsenic] in tartaric acid, citric acid, and cream of tartar. Buchanan. No. XX.

PATENTS.

Flour: Aping, conditioning and bleaching — F. H. Loring, London. Eng. Pats. 12,780 and 12,781, June 15, 1908.

(1). The process consists in the exposure of flour to the vapours of chlorides or oxychlorides of sulphur, mixed with a large volume of air or other inert gas, either with or without subsequent aeration. To these vapours may be added formic acid or the usual bleaching agents.
(2). The flour is treated with a large volume of air or other inert gas containing small quantities of formic acid or formic aldehyde or other compound of the same type. A smaller quantity of the flour may be treated with excess of the vapours and then be mixed with a large quantity of untreated flour.—J. H. J.

Impregnating liquids with carbonic acid; Apparatus for — H. Kummeler and Co., Aarau, Switzerland. Eng. Pat. 24,813, Nov. 18, 1908. Under Int. Conv., Sept. 22, 1908.

AN improved form of draw-off pipe and gas-inlet passage combined, for attachment to an atomiser impregnating chamber is described. The draw-off pipe is connected with a new form of bottle-filling apparatus by means of an extension tube terminating in a filling nozzle and passing through a hollow arm with which it communicates by a snifting passage. The bottle to be filled is supported in a holder and can be pressed by a spring against the filling nozzle. The draw-off pipe has a cock with a wide bore for admitting the impregnated liquid into the bottle and with a snifting passage for allowing the compressed air in the filled bottle to escape.—J. H. J.

(B).—SANITATION; WATER PURIFICATION.

Putrescibility test for sewage and sewage effluents; Experiments on the — D. D. Jackson and W. A. Horton. J. Ind. and Eng. Chem., 1909, 1, 328—333.

THE authors have tried to ascertain the best conditions for determining the putrescibility of sewage and sewage effluents by the incubation test. It is recommended that the sample be diluted with varying quantities of distilled water saturated with air at 20° C., and incubated for 4 days at 37° C. in presence of an indicator, the decolorisation of which is taken as an indication of putrescence. The most sensitive indicator is commercial "methylene green" (the double zinc salt), 1 c.c. of a solution containing 0.5 gm. per litre being used; larger quantities have a slight antiseptic action. In order to avoid leakage during incubation, the test-bottle is fitted with a perforated rubber stopper carrying a glass tube drawn out at the lower end and closed above by a rubber bulb. After filling the bottle, tube, and bulb, the latter is squeezed flat and will then allow for expansion during the incubation.—A. S.

Water. Influence of chlorides on the determination of nitrates in — [by Grandval and Lajoux's method]. G. Perrier and L. Farcy. Ann. Chim. analyt., 1909, 14, 213—215.

IS the original method, nitrates are determined by evaporating 10 c.c. of the water to dryness on the water-bath, moistening the cold residue with 1 c.c. of a mixture of 12 grms. of phenol and 144 grms. of sulphuric acid of sp. gr. 1.767, and after a few minutes' contact, adding 10 c.c. of water and 10 c.c. of dilute solution of ammonia. The yellow colour is then matched with that produced under similar conditions, by a solution of 80 mgrms. of potassium nitrate in a litre of water. The authors find that the action of hydrochloric acid on this colour reaction is by no means negligible, even when derived from the amount of chlorides usually present in well waters. With waters containing larger quantities of chlorides, such as exist in the wells of maritime districts, the determination of nitrates becomes quite erroneous by this method, since the hydrochloric acid liberated lessens the depth of the yellow colour to a considerable extent. If, however,

an amount of sodium chloride, equivalent to the amount of chlorine found to be present to the water, be added to the standard potassium nitrate solution taken for the colour control, the results obtained will be strictly comparable.—J. O. B.

Trade-effluents; Disposal and purification of — G. J. Fowler and E. Arden. Seventh Int. Congr. Appl. Chem., London, 1909.

The polluting effect of trade-effluents may be due to the presence of:—

- (a) An excessive quantity of suspended solids;
- (b) Substances capable of fermentation or putrefaction and consequent production of nuisance;
- (c) Colouring matters, such as vegetable or artificial dyestuffs;
- (d) Substances poisonous to aquatic vegetation, or fish-life;
- (e) Oily matters, fat and soap.

The detailed description of these various classes of effluent and their respective methods of treatment is briefly indicated in the following paragraphs, it being understood that one effluent may fall under more than one head.

(a) Tannery effluents contain large quantities of lime in suspension, effluents from plants for the recovery of ammonia from liquors produced in the distillation of coal in gas-retorts or coke ovens contain large quantities of calcium salts in suspension, and effluents from coal washing plants contain much fine coal in suspension; potter effluents contain clay, effluents from aniline stills may contain large quantities of magnetic oxide of iron, effluent from dye and bleach works may contain much flocculent matter from waste "filling" or mordanting substance and fibrous material from the cloth itself, paper mill effluents may also contain fibre and "filling." Most of these can be clarified by simple subsidence in suitably constructed settling tanks. In certain cases—e.g., paper mill effluents, mechanical filters or fine screens may be employed.

(b) Among important fermentative or putrefactive effluents are those from breweries or distilleries, from tanneries and hide-dressing works, from beet-root sugar manufactories, starch works, wool-scouring works, bone manure and glue manufactories.

All of these can be purified by suitably arranged biological tanks and filters either before or after admixture with sewage. It should be noted that liquids capable of undergoing acid fermentation—e.g., starch effluents or brewery effluents are not well suited to anaerobic treatment. (c) Colouring matters from dye works may be of vegetable origin such as indigo or logwood or belong to the numberless varieties of so-called "aniline" or artificial dyestuffs. The former and certain of the latter—e.g., alizarin derivatives—which are fixed mordants can be precipitated by means of iron or aluminium salts. A large proportion of artificial colouring matters are not capable of removal in this way. They are generally destroyed in biological filters when mixed with sewage, but, apart from their colour, do not constitute a dangerous element in effluents. (d) A great variety of injurious substances may be discharged under this head, e.g.,—

Alkali sulphides from alkali waste heaps, from the vulcanising of india-rubber, from dyeing process employing sulphur dyestuffs, and in certain cases the effluents from ammonia recovery stills. It is highly important that these should be treated with excess of lime or with a mixture of lime and ferrous sulphate (copperas), and the precipitated sulphide settled off in tanks, before the effluent is discharged either into a sewer or a watercourse, or there is almost a certainty of serious nuisance or even fatal accidents, arising from the evolution of sulphuretted hydrogen due to the contact of such an effluent with free acid.

Acids and alkalis, unless present in very minute portions, should be neutralised before discharge into stream or sewer.

Chlorine, either in the free state or as hypochlorite, bleach works effluents, unless present in very large quantities, is not likely to be very troublesome when

charged into a sewer, but it is important from the point of view of fish life and aquatic vegetation, that only minimum quantities should be allowed to pass direct into a stream.

Numerous tarry products, such as benzol and naphthalene washings containing sulphonic acids of benzene and naphthalene, various phenolic derivatives, etc., are very injurious to the microscopic life of streams, and may in some cases quite upset the natural balance of aquatic life. When sufficiently diluted and mixed with sewage they are amenable in general to biological treatment. The same applies to the very troublesome effluents from ammonia stills treating the liquor from the distillation of coal in retorts or coke ovens. In addition to phenolic derivatives these effluents contain thiocyanates, thiophosphates, and sometimes sulphides. The effluents from paper and cellulose works obtained after boiling away cellulose material with alkali sulphites, is very difficult to treat and is generally evaporated.

(e) Free particles of grease and fat, e.g., from tripe-pressing works, etc., can usually be intercepted by specially devised grease traps. Soaps, e.g., such as are produced in wool scouring works, are first decomposed by acid, when the fatty acids rise to the surface and can be separated and purified. In the case of ordinary laundries it is often simpler to precipitate the soaps with lime.

Law as to trade-effluents.—The difficulties of interpretation of the law are to be found in the liability of local authorities to take trade-effluents into sewers, when these were insufficient in size, or when, the sewers being adequate, the purification works were over-burdened. A further difficulty has arisen in regard to responsibility for pollution of a stream, when a manufacturer discharges into a sewer belonging to a local authority.

All of such cases have been decided on appeal, in a sense favourable to the local authority. It is generally the wish of the local authority to encourage manufacturers as far as possible, and several towns have special bye-laws of their own, obtained generally by mutual agreement with manufacturers, confirmed in some cases by special Acts of Parliament. Thus the towns of Halifax and Bradford have power to impose a charge upon manufacturers according to the volume and quality of the effluents sent into the sewers. Manchester has special powers regulating the composition of the effluent discharged into the sewers, but does not make any charge or treatment. These powers are based on similar ones possessed by the London County Council.

The Royal Commission on Sewage Disposal recommended in their third Report of 1903, that in general, local authorities should receive trade-effluents into sewers, but that either preliminary treatment should be adopted by the manufacturer, or that he should pay a special charge to go to the cost of treatment of his effluent. Points of difference likely to arise between manufacturers and local authorities the Royal Commission recommends should be referred to the Central Authority, which it is of opinion should be appointed.

Sewage; Physical and biolytic factors in the purification of — J. H. Johnston. Seventh Int. Congr. Appl. Chem., London, 1909. (See also this J., 1907, 428.)

Two series of experiments on the practical scale are described to illustrate the retention of colloids and matter in solution in a sewage passing through a filter and the biolytic action on the matter so retained. The first experiment consisted in passing tank effluent, sterilised as far as possible with steam, on to a trickling filter filled with sterilised material. In this way the number of bacteria passing on to the filter was reduced to 200 per c.c., and that in the effluent from the filter was 250 per c.c. It was found that retention of organic matter in colloidal and ordinary solution took place from the very first, the effluent being nearly clear. Absorption of ammonia took place at first and soon decreased, but was resumed when the absorbing surface was renewed by nitrification of the already absorbed ammonia; this latter took place after the twelfth day. The purification was as effective as if the liquid had contained the usual number of organisms.

The second experiment consisted in applying tap water to a mature trickling filter which had been standing unused for a fortnight. The first effluents were low in ammonia and very high in nitrate, showing the great amount of biolytic action which had been taking place on the organic and other matters in the filter while resting. After the products of this action had all been washed out, there was evidence in the effluent of slow formation and nitrification of ammonia and continuous removal of the organic matter which had been absorbed during preceding ordinary operations.

Green seaweeds; Nuisances caused by — in tidal waters; and a special method of sewage treatment to minimise their growth. E. A. Letts. Seventh Int. Congr. Appl. Chem., London, 1909.

THE author's experiments have shown that the growth of green seaweeds of the *Ulva* and *Enteromorpha* species in tidal waters is mainly due to the presence of ammonium salts and, to a less extent, of nitrates, derived from sewage. The following method of sewage treatment has therefore been recommended to the Belfast Corporation:—(1). Removal of solid matter by means of screens, catch pits, and continuous flow sedimentation. (2). Treatment of a portion of the sedimented sewage by percolating filters followed by a short period of sedimentation. (3). A process of denitrification consisting in submitting a mixture of the highly nitrated effluent from the percolating filter with the septic tank effluent, to treatment on a contact bed, so as to effect a destruction of nitrates in the one and purification in the other. Experiments on a large scale have given good results, and it is estimated that the method will effect a reduction of over 80 per cent. in the factors that promote the growth of these seaweeds in Belfast Lough.—C. A. M.

Water for potable purposes by means of chlorine or hypochlorites; Purification of — J. C. Thresh. Seventh Int. Congr. Appl. Chem., London, 1909.

SINCE the process of slow sand filtration was inaugurated early in the last century very little advance has been made in the methods of purifying waters for potable purposes. The great advantage of storing polluted river waters for a period, before filtration, has recently become more fully recognised, but the great expense entailed in the construction of reservoirs, and slow sand filters, leads one to think that processes may yet be devised which will be more economical than storage and slow sand filtration.

The process which appears most likely to be successful is the use of chlorine or hypochlorites. These chemicals have been used in emergencies, but on account of the disagreeable effect upon the palate of the residual chlorine, their use has been abandoned as speedily as possible. The author recently (Dec., 1908) drew attention to the fact, that when waters were fairly free from suspended matter and from organic matter in solution, exceedingly minute quantities of chlorine sufficed for practical sterilisation, far smaller quantities than had hitherto been employed, and that by the subsequent use of sodium bisulphite the residual chlorine could easily be removed and the water rendered as palatable as before. The author has shown that with many waters, one part of chlorine per million practically sterilised them, and that the cost for chemicals did not exceed 5s. per million gallons treated.

His recent experiments have been more especially devoted to ascertaining whether the residual chlorine could not be removed by some process of filtration which would at the same time remove any trace of suspended matter, and wrought-iron turnings appear to give the best result. After passing through the iron the water contains a small portion of the metal, probably as bicarbonate, in solution, and some oxide in suspension. By mere filtration through sand nearly all the iron is removed, but it is preferred to use a filtering material called "polarite," since this removes the iron better, and will also remove any trace of chlorine which has not been taken up by the iron.

Ozone: Sterilisation of water at Nice by —. Beunat.
Seventh Int. Congr. Appl. Chem., London, 1909.

For the last 15 months the water at Nice has been successfully sterilised by means of the Otto ozone apparatus. The plant installed is capable of dealing with 1000 cb. m. per hour, but so far only 228—837 cb. m. per hour have been treated. The ozonised air is generated in 40 elements consisting of adjacent plates of glass covered with tin, which are cooled by a coil containing water; the air is drawn in through a central hole in one of the plates. A continuous electric current of 110 volts transformed into an alternating current of 20,000 volts, with a frequency of 500, is used. The ozonised air obtained contains 0.9—3.3 mgms. of ozone per litre; at least 0.33 gm. of ozone per cb. m. of water is necessary to effect sterilisation. The water is mixed with the ozonised air in 8 emulsifiers, each consisting of a double cone with their apices together; the water issues from the upper into the lower, into which the treated air is also passed. The results obtained are very satisfactory; besides effecting sterilisation, the ozonised air also diminishes the organic matter in solution by 13—34 per cent.—A. G. L.

Nitrites in sanitary water analysis: Fuchsine-S as a permanent standard for the determination of —. J. H. Kastle and E. Elvyne. Seventh Int. Congr. Appl. Chem., London, 1909.

The pink colour produced by a nitrite and Griess' sulphanilic acid- α -naphthylamine reagent can be exactly matched by a solution of Acid Magenta (Fuchsine-S; Acid Fuchsin according to Weigert), which has been acidified with hydrochloric acid. A solution of the dyestuff is prepared by dissolving 0.2 gm. in 50 c.c. of 2N-hydrochloric acid and making up to 2000 c.c. with distilled water. Of this solution 100 c.c. are mixed with 50 c.c. of 2N-hydrochloric acid and diluted to 2000 c.c. with distilled water. From the latter solution (No. 2), standard solutions are prepared containing varying quantities which are mixed with 5.0 c.c. of 2N-hydrochloric acid and made up to 200 c.c. with distilled water. The number of c.c. of solution (No. 2) and the equivalent of "nitrite" nitrogen in parts per million are as follows:—

c.c. of Solution No. 2	1.5	2.4	3.9	5.5	7.1	8.7	12.6	16.5
Equivalent of "nitrite" nitrogen	0.0005	0.001	0.002	0.003	0.004	0.005	0.0075	0.01

The standard solutions are made up fresh about once a month and kept in a cool place away from direct sunlight; the stock solution No. 2 is renewed about once in six months.—J. C. C.

PATENTS.

Liquids and gases chemically active upon each other: Apparatus and processes for simultaneously treating —. [Purification of water by ozone.] J. Steynis. New York. Eng. Pat. 16,128, July 29, 1908.

SEE Fr. Pat. 390,598 of 1907 and Addition thereto; this J., 1908, 1101, 1173.—T. F. B.

Water: Process and apparatus for purifying —. Oliver-Roche Co. Fr. Pat. 397,669, Dec. 19, 1908.

SEE Eng. Pat. 27,272 of 1908; this J., 1909, 539.—T. F. B.

(C).—DISINFECTANTS.

Disinfectants: Chemical control of —. M. W. Blyth. Seventh Int. Congr. Appl. Chem., London, 1909. (See also this J., 1905, 1183).

THE author shows that the Rideal-Walker test may give entirely different results when carried out by different observers; moreover, the action of disinfectants on organisms contained in faeces may be quite different from their action on naked organisms. Chemical examination of the disinfectant must therefore always be coupled with the bacteriological tests. Analysis is rendered difficult when emulsifying agents are present. The author recommends acetone as a de-emulsifying agent. For disinfectants containing soaps the procedure

is as follows: To 200 c.c. of disinfectant 200 c.c. of pure acetone and 200 c.c. of petroleum ether (boiling below 70° C.) are added; the mixture is extracted with 200 c.c. of water, and then with 200 c.c. at a time of a mixture of equal parts of acetone and water, until the aqueous extracts measure 800—900 c.c. The washings are then extracted with 100 c.c. of petroleum ether, which is added to the main petroleum ether solution. The aqueous extract is next made up to 1000 c.c., of which portions are taken for the determinations of emulsifying agent, i.e., free and combined alkali, resin, fatty acid, etc. A portion may be steam-distilled to see whether tar acids or hydrocarbons are still present; this should not be necessary, with the practically neutral disinfectants at present on the market. The petroleum ether solution is distilled from a large flask until the petroleum ether and water are volatilised. The residual oil in the flask is measured (allowing for that clinging to the flask) and represents total oil and free resin. The oil is then returned to the flask, distilled and again measured. The distillate is mixed with half its volume of petroleum ether, and extracted three times with sodium hydroxide solution (sp. gr. 1.2), the washings being extracted once with half their volume of petroleum ether. The two petroleum ether solutions are mixed, evaporated, and the residual hydrocarbons measured. The alkaline solution is acidified with sulphuric acid (1:3), extracted with petroleum ether, the latter well washed with distilled water and transferred to a distilling flask; the solvent and water are distilled off and the phenols remaining behind measured and fractionated as usual. Water in the disinfectant is taken by difference, but should be checked by distilling the sample and measuring the water. The result so obtained is always about 1 per cent. too low.

For disinfectants containing albumin, 200 c.c. of the sample are boiled under a reflux condenser with 200 c.c. of acetone until a homogeneous solution is obtained; 200 c.c. of petroleum ether are then added, and the analysis carried out as above.—A. G. L.

PATENT.

Antiseptics: Manufacture of new —. O. Inrray. London. From Farb- u. vorm. Meister, Lucius, und Brüning, Höchst a. M., Germany. Eng. Pat. 15,931, July 27, 1908.

MONO-HALOGEN derivatives of *m*-cresol of the type, CH_3 ; OH ; X :1:3:6, are heated with a neutral soap or a soap containing excess of fatty acid, or a sulphonated soap, producing products which are soluble in water and have antiseptic properties.—J. H. J.

XIX.—PAPER, PASTEBOARD, &c.

Metals: Action of paper on —. P. Klemm. Wochenbl. f. Papierfabr., 1909, 40, 1675—1681.

THE action of paper on metals under commercial conditions falls under two distinct heads: (1), corrosion and oxidation, such as occurs in the case of steel goods under the action of chemicals in the wrapping papers; (2), blackening, with formation of sulphides, such as may occur in the case of silver and copper articles, or in the case of decorative printing with metallic designs. The rusting of steel goods may occur not only with paper containing free acids and "chlorine," but also under the action of readily dissociable salts, particularly the aluminium sulphate used for sizing and the ferric or cupric salts sometimes employed in dyeing. The occurrence of free acid in papers is comparatively rare; it may exist in the form of free sulphuric acid, sometimes also as free hydrochloric or sulphurous acid. The presence of an injurious excess of aluminium sulphate is, however, very common, and may be regarded as the rule in the case of hard-sized papers. Its action may not be at first apparent, but under the influence of changes in the temperature and moisture of the atmosphere, rusting eventually takes place. Great caution must, however, be exercised in arriving at a conclusion in this case, since rusting may readily be induced, even when a perfectly indifferen-

aper, e.g., pure filter paper, is employed. When, for instance, a test is being made in an atmosphere containing moisture, great care must be taken to avoid changes in the temperature. If such occur, the metal, being the best conductor, becomes colder than the paper, and moisture condenses in drops upon its surface; these drops absorb carbon dioxide from the air and accumulate at the points of contact between the metal and paper, thus causing corrosion in exactly the same manner as if the paper were at fault. These conditions, of course, obtain very frequently in practice, and it may be said that no paper can really prevent rusting, unless it be gas-tight and the packet hermetically sealed. Having regard to the above circumstance, and always controlling the result by a blank test with pure filter paper, papers may be tested for their indifference to steel articles by a direct test. This is best performed under a bell jar, lined with moist paper, so as to preserve a humidity of about 95 per cent. of saturation. The jar should be protected from light, from changes of temperature, and from one-sided influences of all kinds, especially from draughts. The steel articles, consisting of a flat piece of watch spring and a piece of steel wire bent in the form of a U, should be carefully cleaned with emery paper and then handled lightly with the forceps. They are pinned twice through the paper, and the sides of the strip are then folded over them: several of such packets, together with the blank, may be clamped together. They are placed under the bell jar, in which is also placed an open dish containing caustic soda lye to absorb carbon dioxide. Good papers could remain for a week under these conditions without inducing rust. The blackening of metals under the influence of paper is more frequent now than formerly, owing to the fact that the majority of papers are prepared from some form of wood pulp which has been digested with sulphur compounds. Practically all unbleached wood pulps of the sulphite and sulphate classes contain residues of sulphur compounds which will blacken metals. Even bleached pulps are frequently contaminated. Unbleached wood pulps, straw and wood pulps prepared by caustic soda and mechanical pulps are generally free, but bleached pulps may contain residues from the "antiblocking." The active compounds include sulphites, sulphides, and free sulphur. Direct tests may be made with metallic iron on the same principle as that described above for steel. Sulphites are best detected by means of test papers impregnated with potassium iodate and starch, moistened with dilute hydrochloric acid. Sulphides and free sulphur are detected by making a decoction of the paper with 1 per cent. sodium hydroxide, acidifying the decoction by suspending a strip of lead paper in the atmosphere above the liquid. Free sulphur may be extracted by chloroform and recognised by its crystalline form on evaporation of the solvent.—J. F. B.

Canadian pulp and paper. Ch. of Comm. J., July, 1909. [T.R.]

STATISTICS issued by the Canadian Customs show that, during the year ended March 31st, 1909, the quantity of pulp exported was: To the United States, wood pulp, chemically prepared, 769,514 cwt. and mechanically ground, 3,033,885 cwt.; to Great Britain, chemically prepared, 13,660 cwt., and mechanically ground, 973,598 cwt. The export of paper during the same period was: To the United States, wall paper, rolls, 19,974, valued at \$440; felt paper rolls, 109,863, valued at \$101,835; wrapping paper, 594,695 lb., valued at \$24,264; printing paper, valued at \$791,533; paper of other kinds, valued at \$34,673. To Great Britain, wall paper, 512 rolls, valued at \$159; felt paper, 5,060 rolls, valued at \$21,896; printing paper to a value of \$922,278, and other paper a value of \$354,887. During the same period 901,861 cwt. of pulp wood were exported to the United States. The Department of Trade and Commerce has issued a statement showing a considerable decline in the importing of printing paper from the United States. For the nine months ended December 31st, 1908, the value was \$145,000; for the corresponding nine months of 1907, \$231,000; for the corresponding nine months of 1906, \$274,000. The imports of printing paper from Great Britain range from \$135,000

to \$165,000 for each nine months, and only a trifling amount was imported from any other country. The sales of wood for wood pulp to the United States have increased. In the last nine months of 1908 the value was a little over \$3,500,000, compared with a shade above \$2,000,000 for the corresponding term of 1906. No other country was a purchaser from Canada. In wood pulp the sales in the last nine months of 1908 were \$2,000,000, the same as in 1908, and \$750,000 less than in 1907.

Vegetable fibres; Chemistry of — C. G. Schwalbe. Seventh Int. Congr. Appl. Chem., London, 1909.

IN a short summary of recent studies on the effect of chemical reagents on cellulose, it appears necessary to repeat or extend former researches, such as, for instance, those of Tauss on the action of water and alkali under pressure, oxidation by alkalis, and the action of neutral salts. It is further very important to study the occurrence of the cellulose hydrates, for these correspond in properties to many varieties of cellulose. The greater or less capability of hydrolysis can be no longer considered as especially characteristic of the hemicelluloses, since it has been shown that mercerised celluloses, for instance, are very much more quickly hydrolysed than hydrocellulose or cellulose. The occurrence of cellulose hydrates in many natural celluloses has a strong influence on the results obtained by the usual methods of estimating cellulose. It has not been possible up to the present to distinguish with certainty between hydrocelluloses and oxycellulose. In the acetylation of cellulose, hydrocellulose appears to be formed as an intermediate product; when neutral salts are used in place of acids in the acetylation process, the decomposition of the salts by the cellulose is not improbable. The very necessary work from the standpoint of colloidal chemistry on cellulose problems has been hindered up to the present by lack of rational methods of investigation. (See also this J., 1909, 216).—H. P. P.

Action of oxalic acid on cellulose. Knecht. See V.

PATENTS.

Porous materials [cellulose]; Purification of — W. R. Whitney, Alplaus, N.Y., Assignor to General Electric Co., New York. U.S. Pats. 923,227 and 923,745, June 1, 1909.

THE porous material is washed with a solvent which is isotonic with respect to the impurity it is desired to remove and only contains a small quantity of it, while at the same time an electric current may be passed through the solvent, which may be a solution of an organic substance. The process is more particularly applied to the removal of zinc chloride from cellulose, by suspending the cellulose in a liquid which will dissolve the impurity and passing an electric current through the solution.—J. H. J.

Circulation of liquid especially in cellulose boilers. Ger. Pat. 209,443. See I.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Isoquinoline bases; Synthesis of — A. Pietet and E. W. Kay. Ber., 1909, 42, 1973—1979.

DERIVATIVES of isoquinoline can be prepared by the following reactions. Benzoylphenylethylamine dissolved in toluene or xylene is mixed with phosphorus pentoxide, and boiled in a reflux apparatus. Condensation takes place with the formation of a base, 1-phenyldihydroisoquinoline, $C_{15}H_{13}N$, which boils at $188^{\circ}C$ at 6 mm., and at $320^{\circ}C$ at 718 mm., and melts at 73° — $74^{\circ}C$ when crystallised from light petroleum. The hydrochloride melts at 222 — $223^{\circ}C$. If this base is oxidised in a warm acid solution with the requisite quantity of permanganate, 1-phenylisoquinoline, $C_{15}H_{11}N$, is produced. When crystallised from aqueous alcohol, it forms small needles, melting at 93° — $94^{\circ}C$. 1-Methyldihydroisoquinoline, $C_{16}H_{15}N$, was formed from acetylphenylethylamine in the

same way. It is a colourless oil, boiling at 236° C. at 735 mm. The hydrochloride melts at 160° C. Phenacetyl-phenylethylamine, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot NH \cdot CO \cdot CH_2 \cdot C_6H_5$, was made from phenylethylamine and phenacetyl chloride, and melts at 95° C. When treated with phosphorus pentoxide, 1-benzylidihydroisoquinoline, $C_{16}H_{15}N$, is produced. This substance is a basic oil, with a pleasant odour, and boils at 196° – 197° C. at 12 mm. The picrate melts at 174 – 175° C. When oxidised with permanganate, 1-benzylisoquinoline is produced, which crystallises from light petroleum and chloroform in colourless prisms, melting at 56° C. The picrate melts at 182° C.—F. SODX.

Essential oils; Constituents of —. Enol-isovaleraldehyde acetate. Enol-citronellal acetate and its conversion into an isopulegone derivative. F. W. Semmler. Ber., 1909, 42, 2014–2017.

ISOVALERALDEHYDE, was heated with acetic anhydride and sodium acetate to 200° C. under pressure. On making alkaline with sodium carbonate, extracting with ether and fractionating, enol-isovaleraldehyde acetate, $(CH_3)_2 \cdot CH \cdot CH \cdot CH_2 \cdot O \cdot CO \cdot CH_3$, was obtained. This boils at 127° – 133° C. at 760 mm., has the sp. gr. 0.8818 at 20° C., and $n_D^{20} = 1.41655$. Enol-citronellal acetate, $C_{12}H_{20}O_2$, produced in a similar way, boils at 110° – 115° C. at 10 mm., has the sp. gr. 0.902 at 20° C., $n_D^{20} = 1.45762$, and $[\alpha]_D^{20} = -1^{\circ}$. When this substance is boiled for 20 hours with acetic anhydride, and the product hydrolysed, isopulegol is obtained.—F. SODX.

Phenolphthalein in pharmaceutical preparations; Determination of —. K. Kollo. Pharm. Praxis, 1908, 7, 341–344. Chem. Zentr., 1909, 1, 1908.

THE author compared the following methods:—(1). The finely-divided dried sample was extracted with acetone, the solution evaporated, and the residue weighed. (2). The sample prepared as in (1), was extracted with 8 per cent. sodium hydroxide solution, the phenolphthalein precipitated from the solution by means of acetic acid, separated by filtration, dissolved in acetone, and then determined as in (1). (3). The sample (containing 0.4–0.6 gm. of phenolphthalein) was completely extracted with 10–15 c.c. of 8 per cent. sodium hydroxide solution; a solution containing 2 grms. of iodine and 3 grms. of potassium iodide in 20 c.c. of water was added gradually to the alkaline liquid, and the mixture acidified with concentrated hydrochloric acid. The tetraiodophenolphthalein was filtered off, washed with 90 per cent. alcohol and ether, which had both been previously saturated with the tetra-iodo-compound, dried at 100° C., and weighed. (4). The residue from the acetone extract, obtained as in (1), was boiled for half hour under a reflux condenser with about 2 grms. of acetic anhydride and sodium acetate, the reaction product washed with dilute sodium carbonate solution, saponified with alcoholic caustic soda, and the amount of alkali consumed determined; 1 c.c. of N/1 alkali = 0.318 gm. of phenolphthalein. It was found that methods (1) and (2) give results about 5 per cent. too low, but methods (3) and (4) yielded trustworthy figures.—A. S.

Lactic and glycollic acids; Very delicate reactions for [the detection of] —. G. Denigès. Bull. Soc. Chim., 1909, 5, 647–649.

LACTIC acid, even in traces, may be detected by decomposing it with sulphuric acid and causing the aldehyde produced to condense with guaiacol or codeine to give coloured products. 0.2 c.c. of the lactic acid solution (containing not more than 2 per cent. of this acid) is mixed with 2 c.c. of sulphuric acid (sp. gr. 1.84) and heated for 2 minutes on a boiling water bath; after cooling, one or two drops of a 5 per cent. solution of guaiacol or codeine in alcohol are added, and the mixture is shaken; with guaiacol a red tint can be detected with as little as 0.01 mgm. of lactic acid, and with codeine an orange or yellow colour is produced. Under the same conditions, but at a higher temperature, glycollic acid gives formaldehyde, and, for its detection, codeine, guaiacol, or *p*-cresol may be employed. 2–10 mgms. of the substance, 0.2 c.c. of water, and 2 c.c. of sulphuric acid (sp. gr. 1.84) are heated together, until small bubbles of gas are developed

rather rapidly, and, after cooling, a single drop of codeine solution is added and the mixture shaken; a yellow colour is produced, rapidly changing to deep violet. If the other reagents be employed, 1 or 2 drops of the alcoholic solution are added to the mixture before heating, together with 1 c.c. of glacial acetic acid; on heating, green colour is produced with *p*-cresol and violet with guaiacol.—F. SODX.

Methylglyoxal as a colour reagent [for phenols, alkaloids, etc.]. G. Denigès. Bull. Soc. Chim., 1909, 5, 649–651.

METHYLGLYOXAL gives characteristic colours with many cyclic compounds, particularly phenols and certain alkaloids of the morphine group. As a reagent it may be prepared as follows:—20 c.c. of water, containing 5 per cent. by weight of glycerin, are shaken with 100 c.c. of water and 0.6 c.c. of bromine, until the bromine is dissolved; the solution is then kept for 20 minutes on a boiling water bath and subsequently boiled for 5–6 minutes, so as to expel all free bromine and reduce the volume to about 100 c.c.; after cooling, 20 c.c. of pure sulphuric acid is added, and the liquid distilled, 50 c.c. of distillate being collected and constituting the reagent. The mode of using depends somewhat on the nature of the substance in question. In testing for certain phenols and alkaloids, a few mgms. or drops of the substance are added to 0.4 c.c. of the reagent and 2 c.c. of sulphuric acid (sp. gr. 1.84), and the mixture is shaken. Pyrogallol gives a deep brown colour; resorcinol, orange; pyrocatechol, red; α -naphthol, violet; β -naphthol, yellow, then green; apomorphine, violet-red, becoming deep violet on adding 2–4 c.c. of glacial acetic acid after 2 minutes' contact; oxymorphone, yellow-green on adding acetic acid; morphine, yellowish-brown; codeine, yellow, then greenish or bluish-green. In the last two cases boiling with 1 c.c. of pure acetic acid, after 1–2 minutes' contact, gives a violet colour with morphine and blue with codeine. Traces of the alkaloids in alkaloidal residues may be detected with a few drops of the mixture. In some cases (indole, scatole, and pyrrole, for example) a little of the substance is dissolved in 2 c.c. of glacial acetic acid, 1 c.c. of sulphuric acid and 1 c.c. of the reagent are added, and the mixture shaken. Indole gives a red colour; scatole, orange; and pyrrole, brown. In other cases 0.1 c.c. of a 4 per cent. solution of potassium bromide, 0.4 c.c. of the reagent, and 2 c.c. of sulphuric acid (sp. gr. 1.84) are shaken together and the mixture then again shaken with a little of the substance to be tested. Phenol gives thus a red colour, changing to orange; salicylic acid and salicylates, a violet colour; gallic acid, green; an guaiacol, blue, then violet. With some compounds only 0.2 c.c. of the reagent should be used in this last method. Homologues of benzene, under these conditions, give a red colour; naphthalene, a green colour on warming; santolin, violet on slight warming, then blue, and finally a rich green; thiophene, red, then violet and blue or green, a reaction which is very delicate and may serve for the detection of thiophene in benzene.—F. SODX.

Tartaric acid, citric acid, and cream of tartar; Impurities [lead and arsenic] in —. G. S. Buchanan. Extract from the Annual Report of the Medical Officer of the Local Government Board, 1907–8, 132.

THE amounts of lead and arsenic were determined in a large number of representative samples of tartaric acid, citric acids and cream of tartar. The results showed that much of the tartaric acid arriving in British markets has not been prepared with the care which its use as a food ingredient demanded. Limits of $\frac{1}{10}$ th of a grain of lead per lb., and $\frac{1}{100}$ th of a grain of arsenic, as arsenious oxide were therefore recommended. The former is based on a trade standard which has been in use for some time for cream of tartar, and the latter on the Final Report of the Royal Commission on Arsenic Poisoning (1903).—J. W. G.

Henbane and stramonium cultivated in Japan; Constituents of —. M. Watanabe. Seventh Int. Congress App. Chem., London, 1909.

THE dried leaves of cultivated *Hyoscyamus niger* were extracted with alcohol in three different ways, but i

case could more than a trace of the mydriatic alkaloids obtained. When, however, leaves and fruits were analysed in the same way, the alkaloids (0.021 per cent. calculated as hyoscyamine) consisting of scopolamine and a minute quantity of hyoscyamine, were isolated. In scopolamine appears to occur mainly in the fruits of the plant.

Some years ago, Shimoyama and Koshima isolated hyoscyamine, together with a small quantity of atropine, from the seeds of the plants found in the Chiba district, which are considered to be *Datura alba*. But such a result does not agree with results attained by other investigators. According to the statements by E. Schmidt, Kircher, J. Feldhaus and others, the chief alkaloid of *Datura alba* must be scopolamine. The author now repeats Shimoyama and Koshima's experiments, and obtained the same result, getting hyoscyamine (0.1 per cent.) as the main alkaloid. It is, therefore, probable that the plant is not *Datura alba*, but is, in reality, *Atropa stramonium*, the chief alkaloid of which is known to be hyoscyamine. This view was further confirmed by morphological examination.

Herba Scopolia japonica; Constituents of —. M. Watanabe. Seventh Int. Congr. Appl. Chem., London, 1909.

Dried leaves of *Herba Scopolia japonica* contain about 8 per cent. of total alkaloid, consisting of hyoscyamine, 5 per cent.; scopolamine, 5 per cent.; and a minute quantity of atropine.—F. SHOX.

Eupatorium rebaudianum (Paraguay sweet plant); Constituents of — and its pharmaceutical uses. K. Dieterich. Seventh Int. Congr. Appl. Chem., London, 1909.

The whole plant of *Eupatorium rebaudianum* was treated with water, the liquid evaporated and taken up in methyl alcohol. A dark, resinous, crude, sweet principle was obtained, which melted at 83° C. This contains two sweet principles, *eupatorin* and *rebaudin*, a bitter resin, a fatty oil, and a bitter principle. *Eupatorin* is soluble in absolute alcohol, and sinters at about 115° C. The methyl alcohol solution gives a yellow precipitate with the sodium salt with sodium hydroxide. When hydrolysed, the substance reduces Fehling's solution. It is about 150 times sweeter than sugar. *Rebaudin* is insoluble in absolute alcohol, and leaves 10–11 per cent. of ash on ignition. It is probably a glucoside; contains no nitrogen and melts at about 107° C. It is 10 times sweeter than sugar. At present the plant is difficult to procure, otherwise it would be of considerable practical use. The author suggests the use of the dried and powdered leaves as a sweetening agent.—F. SHOX.

Alkaloid extracts; Analysis and evaluation of — [for medicinal purposes]. M. Hamburg. Seventh Int. Congr. Appl. Chem., London, 1909.

The value of a malt extract for dietetic or medicinal purposes depends mainly on its enzymatic activity and its purity. The enzymatic activity should be determined from the quantity of maltose formed by the action of the extract on starch paste at the temperature of the body, the relation between extract and starch being chosen so as to give about a 1 per cent. solution of maltose. The detection of adulterants in malt extract is difficult, in the presence of glucose or starch syrup may be rendered evident by determining the non-reducing, nitrogen-free extract. This is given by the dry substance of the extract, less the sum of the reducing sugars calculated as maltose and the nitrogenous substances (nitrogen 6.25). The number thus obtained should lie between 2 and 20.74 per cent. of the dry substance. If the non-reducing, nitrogen-free extract is less than 8.2, adulteration with material containing monosaccharide is certain, whilst higher value than 20.74 indicates addition of cane or beet sugar molasses.—T. H. P.

Elaterin. A. Berg. Seventh Int. Congr. Appl. Chem., London, 1909.

The author considers that elaterin is not present in the free state in the fruit of *Echallium elaterium*, but is liberated by the action of an enzyme, *elaterase*, from an amorphous glucoside. The author still retains the formula, $C_{28}H_{38}O_7$. The molecule of elaterin contains two phenolic hydroxyls, an acetyl grouping, a keto grouping, and possibly a lactone ring. (See this J., 1907, 113.)—F. SHOX.

Asiphyl [mercuric *p*-aminophenylarsonate]. E. Mameli and G. Chiffo. Seventh Int. Congr. Appl. Chem., London, 1909.

The authors have prepared the mercuric salt of *p*-aminophenylarsonic acid, $[NH_2 \cdot C_6H_4 \cdot AsO(OH)O]_2Hg$, to which they have given the name, *asiphyl*. In this new compound the therapeutic action of atoxyl (sodium *p*-aminophenylarsonate) and of mercury are combined, and it is of value in the treatment of syphilis.—A. S.

Catalytic reactions at high temperatures and pressures. W. I. Ipatiew. Seventh Int. Congr. Appl. Chem., London, 1909. (See also Ber., 1909, 42, 2089–2097).

ETHYLENIC hydrocarbons and aliphatic acids containing a double linkage can readily be hydrogenised in a high-pressure apparatus in presence of copper oxide as a catalyst. Amylene and trimethylethylene yield isopentane; ethylene and propylene yield ethane and propane respectively; sodium oleate is reduced to sodium stearate. Aromatic acids can also be hydrogenised under high pressure; cinnamic acid yields cyclohexylbutyric acid with nickel oxide as catalyst, and hydrocinnamic acid when copper oxide is used; with reduced copper the hydrogenisation is not complete. β -Naphthoic acid yields first tetrahydronaphthoic acid and then decahydronaphthoic acid. α -Naphthoic acid yields tetrahydronaphthalene. Fluorene, acenaphthene, and retene, when hydrogenised in presence of nickel oxide as catalyst, yield perhydrofluorene ($C_{13}H_{22}$, b.p. 254–258° C.), perhydroacenaphthene ($C_{12}H_{20}$, b.p. 234–240° C.), and perhydroretene ($C_{17}H_{32}$, b.p. 300–310° C.) respectively. Perhydroretene is an isomeride of, but not identical with, the hydrocarbon fichtellite.—A. S.

Saccharin reaction. Wauters. See XVII.

PATENTS.

Camphene; Process of producing —. C. Glaser. Baltimore, Md. U.S. Pat. 923,967, June 8, 1909.

In the production of camphene from bornyl chloride, the latter is heated at 180°–210° C., under a reflux condenser, until the hydrochloric acid produced is completely expelled, and then the residual camphene is recovered by distillation.—A. S.

Bornylene; Process for preparing — from dextropinene. I. L. Kondakow. Fr. Pat. 397,161, Dec. 8, 1908. Under Int. Conv., June 20, 1908.

VOLATILE oils, e.g., oil of turpentine, containing dextropinene are treated with hydrochloric acid, and the pinene hydrochloride thus obtained is treated with caustic alkali and methyl or ethyl alcohol, or with alkali methylate or ethylate at 190°–200° C. in order to obtain bornylene. In some cases a mixture of bornylene and camphene is obtained, which is separated by fractional distillation, or the camphene is converted into an isobornyl ester, which is then separated by fractional distillation either before or after conversion into isoborneol.—A. S.

Camphor or camphor like material; Process for the production of —. G. Austerweil, Neuilly, France. Eng. Pat. 18,047, Aug. 27, 1908. Under Int. Conv., May 13, 1908.

SEE Fr. Pat. 392,011 of 1908; this J., 1908, 1222.—T. F. B.

Esters of bornols; Process for manufacturing —. J. Hertkorn, Berlin. Eng. Pat. 11,248, May 23, 1908.

SEE U.S. Pat. 901,293 of 1908; this J., 1908, 1131.—T. F. B.

Camphor; Process for manufacturing — J. Hertkorn. Berlin. Eng. Pat. 20,059, May 23, 1908.

SEE U.S. Pat. 901,708 of 1908; this J., 1908, 1176.—T. F. B.

Dichloroethylene; Process of making — P. Akenasy and M. Mugdan, Nuremberg, Germany. U.S. Pat. 924,304, June 8, 1909.

SEE Eng. Pat. 19,576 of 1907; this J., 1908, 37.—T. F. B.

Lactic acid; Process of preparing pure — H. Noerdlinger, A. Caroselli, and L. Berg, Assignors to Chem. Fabr. Flörsheim Dr. H. Noerdlinger, Flörsheim on Maine, Germany. U.S. Pat. 924,494, June 8, 1909.

SEE Eng. Pat. 26,415 of 1907; this J., 1908, 246.—T. F. B.

Disazo dyestuff. Eng. Pat. 7905. See IV.

Surrender of Letters Patent under the Patents and Designs Act, 1907. London Gazette, July 9, 1909.

ALBERT KNOLL, Max Daeger, and Hans Knoll have offered to surrender the Letters Patent No. 17,511 of 1905 (see this J., 1906, 233), granted for an invention for "Manufacture of santalol esters from sandal wood oil," of which they are the registered owners. Any person who desires to be heard with reference to such surrender should notify his desire to the Comptroller-General, at the Patent Office, 25, Southampton Buildings, London, W.C., on or before August 9, 1909.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Autochrome plates; Simplified treatment of —, and correction of errors of exposure during development. A. and L. Lumière and A. Seyewetz. Seventh Int. Cong. Appl. Chem., London, 1909.

AUTOCHROME plates which have been correctly exposed may be developed by using only three operations, *viz.*, a development with metoquinone and ammonia, reversal with an acid solution of permanganate, and a second development similar to the first. If there is doubt as to the correctness of the exposure, the plate is immersed in a diluted developer, and the time necessary for the appearance of the image noted; a further quantity of developer is then added, and development continued for a time which is found from a table.—T. F. B.

Photographic plates; Different effects of sensitisers on — according to the properties of the emulsified silver bromide. S. de Prokondine-Gorsky. Seventh Int. Cong. Appl. Chem., London, 1909.

THE silver bromide in each brand of photographic plate possesses special properties of its own as regards its sensitiveness to coloured light rays. Only those plates whose emulsions, without preliminary treatment, are distinctly sensitive to all parts of the spectrum, can be rendered panchromatic; in order to obtain a high degree of sensitiveness for a particular portion of the spectrum, plates should be used which, before treatment, are as sensitive as possible to that portion, even if the emulsion is not otherwise sufficiently sensitive.—T. F. B.

Eder's solution. [Detection of ferrous salts and of oxygen]. C. Winther. Seventh Int. Cong. Appl. Chem., London, 1909.

DECOMPOSITION of Eder's solution by light is accelerated by adding ferric chloride up to a certain point, when further addition decreases the sensitiveness; the presence of oxygen intensifies the action of the ferric chloride. This action is due to the formation of ferrous oxalate by the action of ferric chloride on ammonium oxalate in absence of light. Ferrous oxalate precipitates far more than its equivalent of mercurous chloride from Eder's solution, especially in absence of air. In presence of a ferric salt, this precipitation is slower, and increases when the amount of oxygen in the solution is decreased. The decomposition of Eder's solution in light is therefore due to the presence of traces of iron salts; when free from

iron salts it is insensitive to light. The precipitation of mercurous chloride by ferrous salts may be used as a delicate test for ferrous salts and for oxygen.—T. F. B.

PATENTS.

Films for photographic purposes; Manufacture of — J. H. Smith, Zurich, Switzerland. U.S. Pat. 923,569, June 1, 1909.

SEE Eng. Pat. 10,372 of 1905; this J., 1905, 1083.—T. F. B.

Sensitised surfaces or films for photography; Production of — W. H. Caldwell. Fr. Pat. 397,026, Dec. 2, 1908. Under Int. Conv., Jan. 24, 1908.

SEE Eng. Pat. 16,89 of 1908; this J., 1909, 259.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Nitration of cotton. C. Piest. Z. angew. Chem., 1909, 22, 1215—1224.

BEIL and Klays (this J., 1907, 1157) and Beil (Z. ges. Schiess- u. Sprengstoffw., 1909, 81) have studied the influence of the previous treatment of the cellulose on the properties of the resulting nitro-compounds, but their experiments were apparently under laboratory conditions. The author has, therefore, made similar experiments, but working with larger quantities according to the usual technical methods. The cotton was subjected to the following treatments:—(1), Bleaching for 48 hours in bleaching powder solution of 3.5° B.; (2) and (3) bleaching for 8 days in solutions prepared by mixing 2.5 and 5 kilos, respectively of bleaching powder with 5 litres of water; (4), mercerisation by treatment with 18.5 per cent. caustic soda lye for 20 minutes; (5), heating for 10 hours at 150° C. in a current of carbon dioxide (see Ger. Pat. 199,885; this J., 1908, 937). The results obtained showed that with a given nitrating acid and temperature of nitration, the nitrocellulose prepared from strongly bleached cotton has a somewhat lower nitrogen-content, and a considerably higher solubility in ether-alcohol, than that prepared from ordinary cotton. The solubility of the nitro-compound in absolute alcohol increases as the cotton is more strongly bleached. Nitrocellulose from strongly bleached cotton is more difficult to stabilise than that from ordinary cotton. The stabilised nitrocellulose is more soluble in ether-alcohol than the non-stabilised product. Nitrocellulose from mercerised cotton has a slightly lower nitrogen-content, a much higher solubility in ether-alcohol, about the same solubility in absolute alcohol, and is more difficult to stabilise than that from ordinary cotton. Nitrocellulose prepared from cotton which has been heated in a current of carbon dioxide has a slightly higher nitrogen-content, about the same solubility in absolute alcohol and in ether-alcohol, and is more difficult to stabilise than that from ordinary cotton.—A. S.

Trinitrotoluene factory; Explosion in the Schönbeck-on-Elbe — J. Rudeloff. Z. ges. Schiess- und Sprengstoffwesen, 1909, 4, 213—214.

THE explosion took place in that part of the factory where the impure trinitrotoluene was recrystallised from alcohol. Centrifugal machines, and an inclined drying cylinder, heated by a hot water jacket, were used for freeing the crystals from alcohol. It seems probable that a fire originated in one of the centrifugals and spread to the drying machine, where an explosion of alcoholic vapour and air resulted, the force of which was probably increased by the presence of trinitrotoluene dust in suspension in the explosive mixture. The fire in the centrifugal may have originated from an overheated bearing or a too severe use of the brake apparatus. On a former occasion a fire had originated in a similar manner owing to a workman using a large wooden paddle (intended for emptying the centrifugal) as a brake on the rim of the basket. The drying machine contained 400 kilos of trinitrotoluene, and this could not have exploded if the damage would have been more extensive. Th

flowing facts show that trinitrotoluene may be present in a very severe conflagration without exploding. There were 100 kilos. of trinitrotoluene in a sieve below the drying machine, 1000 kilos. in a packing house adjoining, and very considerable quantities in tinplate receptacles. In all cases the material burnt away without exploding even though in the last case the containing vessels were melted, and the walls of the building showed that there had been an extremely high temperature. Three very large vessels containing trinitrotoluene dissolved in alcohol continued to burn for about three days without exploding. Finally a trinitrotoluene explosive, "trinitrite," in cartridges and loose in large vessels, also burnt off quietly.—G. W. McD.

Explosion of detonators; Circumstances attending an explosion which occurred at the factory of The Cotton Powder Co., Ltd., at Uples Marshes, Faversham, Kent, on April 1, 1909. Major T. H. Crozier, H.M. Inspector of Explosives. [Cd. 4693.]

The operation in progress at the time of the explosion was the filling of copper detonator shells with fulminate composition which consists of a mixture of mercury fulminate, potassium chlorate and gun-cotton dust. A "jig" or holder for 100 detonator shells, each containing 1 gm. of composition was in use at the time of the explosion. I also used a vulcanite measuring plate, for the composition, which fitted on top of the jig. The object of the plate, constructed of brass and vulcanite, was to keep the detonator shells vertical during filling. A little over 1/2 gm. of composition, containing 2.85 per cent. of moisture, was in the compartment. The effects of the explosion, as always the case with a fulminate composition, were extremely local. Major Crozier concludes that there were two separate explosions—one on the work-table and the other on an adjacent shelf—and that the initial explosion occurred at the work-table. From the observed facts it was evident that the composition was already in the detonator shells and that the measuring plate had not been removed from the top, since it was also blown into fragments. It is possible that the workman having lifted the measuring plate a few inches, accidentally let it fall back on to the jig, and the impact caused the explosion of composition dust which would be the surface of the jig. On the other hand, the whole might have been lifted and tapped upon the india-rubber pad, for the purpose of shaking down the composition into the detonator shells, thereby jarring the plates together. The explosion could have been brought out by the impact of the plates in either manner suggested above, seeing that detonator composition is extremely sensitive to a blow or to friction. It is also considered that the slots in the jig plate, in which the plates of the measuring plate worked, are a source of danger, as any composition lodging in them would dry quickly and might receive a blow from one of the pins. It is worthy of note that this was the first recorded accident at the factory for some 30 years, during this particular operation in the manufacture of detonators. It is suggested that the apparatus should be arranged in such a manner that the operation of moving the measuring plate, tapping the jig and removing the measuring plate could be performed from behind an efficient screen.

—G. W. McD.

Cellulose; The theory of the nitration of cellulose. — M. A. Saposchnikow. Seventh Int. Congr. Appl. Chem., London, 1909.

The general scientific theory connecting the composition of the mixed acids and the degree of nitration of cellulose has been enunciated. The difficulties in the way of such generalisation are as follows: The molecular weights of cellulose and the cellulose nitrates are unknown. No direct cellulose nitrates corresponding to any particular formula are known, seeing that products of all intermediate degrees of nitration can be prepared. The system of acid nature and nitrocellulose is not homogeneous and cannot be treated from the point of view of the law of mass action. Considering the mixed acids with respect to the molecular proportions of sulphuric acid, nitric acid, and water, the

author has in previous work embodied his results in a series of curves, connecting the vapour tension of nitric acid in the mixed acids with the composition of the acid (see this J., 1907, 34). In a second series of experiments (*loc. cit.*) he has shown the relationship of the degree of nitration obtained with mixed acids, under similar conditions, i.e., the molecular proportions of the ingredients present in the mixed acid. In the present communication these two series of curves have been combined by employing the method of co-ordinate triangles, and in this way a clear idea is obtained of the conditions governing any desired degree of nitration. Actual results of nitration show a very close agreement with the results to be anticipated from the theoretical standpoint.—G. W. McD.

Explosives; Detection of mercury in explosives. — G. W. Patterson. Seventh Int. Congr. Appl. Chem., London, 1909.

SIMPLIFIED methods of preparation for spectroscopic tests are described. Two grm. samples are dissolved in organic solvents and electrolysed directly in the solvent, or, when only partly soluble, extracted by such solvents, and the residue treated with nitric acid to destroy all organic material, the residue being extracted with water and electrolysed. Metallic mercury is detected by the modified or second method. The method is also applicable for separation for quantitative determinations. The method is accurate to 0.000001 grm. of mercury, but fails with less than 0.0000001 grm. of mercury.

Smokeless powder; Stability tests of smokeless powder. — G. W. Patterson. Seventh Int. Congr. Appl. Chem., London, 1909.

As regards tests of single base powders, the author regards the German test at 135° C. as the most suitable high temperature test, and the surveillance test at 65.5° C. and Vieille test at 108.5° C. as the most suitable low temperature tests, the latter requiring more labour and care in operation.

Explosives; Method of investigating the sensitiveness of explosives to shock by a falling weight. H. Kast. Seventh Int. Congr. Appl. Chem., London, 1909.

For some years past, at the Military Research Laboratory in Berlin, an apparatus and method have been used with very satisfactory results for determining the sensitiveness to shock of explosives. The apparatus itself consists of two well-turned steel pistons, with heads, and a broad steel ring with a hole through the centre into which the pistons fit perfectly. The method of carrying out the experiment is as follows: The shorter of the two pistons is placed with its head upon an anvil and clamped in position. The steel ring is slipped over this piston and only passes so far that a cup is left. The explosive to be tested is placed in this cup and the other piston placed in position on top. The explosive is thus contained between two circular surfaces each of an area of 0.5 sq. cm. A known weight is then allowed to fall from varying heights upon the head of the upper piston, and the result is observed, from point of view of sensitiveness to shock. The advantages claimed for this apparatus are, that it works very well; that the various parts are easily made interchangeable, and that it can be very easily and rapidly cleaned from any residue of unexploded material. Owing to the form of the apparatus, the frictional play between the two surfaces is reduced to a minimum, and it is the sensitiveness to shock alone which is actually determined. As regards the apparatus itself, it is pointed out that the hole in the steel ring and the pistons themselves should be made with great exactitude, so as to fit perfectly without either loose play or too much friction. The pistons should be so tempered that they are neither distorted nor fractured by the blow. The surface of contact between the two pistons should be quite polished. In using the apparatus it is suggested that at least six determinations should be made and that three different sets of apparatus should be used so as to eliminate as much as possible any slight defects in a single apparatus. The temperature of experiment should be between 15° and 20° C., and should an apparatus become warm by use, it ought to be cooled down to this temperature before

being employed again. From experiments the author states that even with explosives which are fairly non-sensitive the following are the maximum heights which would be required to bring about explosion:—For 2 kilos., 60 cm.; 5 kilos., 30 cm.; 10 kilos., 24 cm.; 20 kilos., 20 cm. It is pointed out that the results of the experiments should be differentiated as follows:—(1). No explosion. (2). Feeble explosion; with appearance of smoke, a smell of burning, and no audible sound. (3). Feeble explosion. (4). Strong explosion. (5). Violent explosion. In the author's experience about 0.04 grm. is usually found to be sufficient for each experiment, and this amount can be easily measured out in a small cap.—G. W. McD.

Explosion of firedamp and coal dust: Experiments with explosives in regard to the —. Mente and W. Will. Seventh Int. Congr. Appl. Chem., London, 1909.

An account is given of the experimental methods adopted in various countries for the purpose of testing the suitability of explosives, from the point of view of safety, in coal mines where firedamp and coal dust may be present. All countries adopt some form of gallery containing an explosive mixture into which a shot is fired, with or without stemming. The United States employ a circular iron gallery, 1.93 m. diameter and 30.5 m. long. The shot is fired with or without stemming into an explosive mixture of pit gas or into coal dust. In France a gallery was first erected at Lens, but recently this work has been carried out at Liévin where an experimental gallery of 65 m. was erected, which was later increased to 500 m., with drives and other additions intended to represent as nearly as possible the actual conditions of mining. Arrangements are also made for experimenting with coal dust, and the use of ventilating plant brings experimental conditions closely in touch with actual work. The Belgian testing station at the Frameries has a gallery of elliptical section of 2 sq. m. area, and a length of 30 m. An explosive mixture containing 8 per cent. of pit gas mixed with air is used. Coal dust is also employed. Shots are fired without stemming, and a "charge limite" is determined which will not under these conditions ignite the explosive mixture. In England the testing station at Woolwich employs a gallery of circular section 0.7 m. in diameter and 9 m. in length. The explosive mixture consists of 15 per cent. of coal gas and 85 per cent. of air. Coal dust has not up to the present been officially used in the test, but the Royal Commission on Safety in Mines has the subject under review. The charge to be used was originally determined as that which gave in the Trauzl lead block the same expansion as 56 grms. of dynamite No. 1 (75 per cent. of nitroglycerin). In 1903 the ballistic pendulum test for determining the weight of charge supplanted the lead block test. Ten shots, using 30 cm. of special dry clay as stemming, and another 10 shots using only 23 cm. of stemming, have to be fired into the explosive mixture without either igniting it or leaving any perceptible amount of unconsumed explosive. A large testing station has recently been built in England, at Alchotts, of circular section, 2.3 m. in diameter and 213.5 m. in length. The question of the effect of coal dust and its influence in propagating explosions will be studied, and also questions of ventilation. In Austria-Hungary galleries were erected at Mährisch-Ostrau and Segen-Gottes in 1886. Shots were fired into a mixture of pit gas and air or into coal dust. The explosive was fired, not from a mortar, as is the general usage, but from a cartridge case which stood on a lead block in the gallery. The extent of the compression of the lead block gave an indication of the strength of the explosive. More recently at Rossitz a gallery 300 m. long has been in operation, where experiments on a practical scale are carried out. In Germany there are 5 official testing stations. The best known is at Gelsenkirchen where an elliptical gallery, 2 sq. m. in cross-section area and 35 m. in length, is used. Natural pit gas is employed and also coal-dust. It is now proposed to erect a large gallery in which experiments can be carried out [simulating actual] mining conditions. Every coal-getting country of any importance has, it will be noted, erected testing stations for the proof of the comparative safety of mining explosives in use. In

most cases galleries of considerable diameter but short lengths are employed, but a tendency towards proof in large galleries under working conditions is very evident. The authors draw attention to the many points awaiting definite solution, such as the effects of artificial and natural gas in the galleries, the presence of coal dust, the size of the cartridge and the bore hole, the atmospheric temperature and pressure, etc. Seeing the enormous importance of the subject of safety explosives, a plea is put forward for the international consideration of question of such vital interest.—G. W. McD.

Coaldust [explosions]. Galloway. See II.

Nitrosyl perchlorate. Hofmann and Zedtwitz. See VI.

PATENTS.

Explosive. E. A. Le Sueur, Ottawa, Canada. U.S. Pat. 923,435, June 1, 1909.

The explosive is prepared by mixing together saltpetre sulphur, and a substance containing hydrocarbons, and a wax, converting the mixture into grains, and coating the grains with powdered potassium chlorate.—J. H. J.

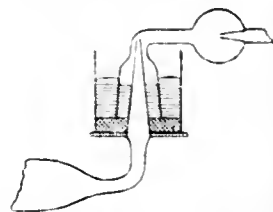
Dinitroglycerin obtained from glycerin and nitric acid
Process for the separation of —. Castropser Siebel'sche Sprengstoff-Akt.-Ges. Ger. Pat. 210,558, Jan. 24 1908.

AFTER nitration, the reaction product is neutralised with ammonium carbonate, and the dinitroglycerin while separates is removed. The aqueous solution is concentrated in order to recover the greater part of the ammonium nitrate by crystallisation, and the residual liquid is shaken with the dinitroglycerin separated in the first part of the process, this latter acting, it is stated, as a solvent for the mono- and di-nitroglycerin remaining dissolved in the solution after separation of the ammonium nitrate.—A. I.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Mercury joint instead of cork or rubber for connecting the combustion tube with the calcium chloride tube. J. Marek. J. prakt. Chem., 1909, 79, 510—512.



THE author has simplified the mercury joint previously described (this J., 1907, 992). The end of the combustion tube is bent upwards at right angles as shown in the figure and round this is fixed, by means of a cork protected underneath by an asbestos sheet, a short glass tube to contain the mercury. Over the end of the combustion tube is placed the conical end of the calcium chloride tube which is fitted with a ground-in hollow glass stopper (not shown in the figure). During the combustion a thermometer is placed in the mercury which should have a temperature of 60°—70° C. in order to prevent the condensation of water in the end of the combustion tube. During the combustion also, the whole mercury joint should be supported with an asbestos sheet so as not to bend the tube.—J. C. C.

PATENT.

Density: Apparatus for determining —. W. D. Mour. Assignor to The Mathieson Alkali Works, Saltville Va. U.S. Pat. 923,560, June 1, 1909.

The density of a powdered or granular material is determined by putting a weighed quantity into a vessel

linder and placing a closely fitting plunger above it. The cylinder is then tapped or jarred by a magnetic shaking apparatus and when the material has been shaken together so that it occupies the smallest space, the volume indicated by the distance between the bottom of the plunger and the bottom of the cylinder. This is read off on a graduated rod which extends upwards from the plunger.—W. H. C.

INORGANIC—QUALITATIVE.

For zinc salts; Colour reaction for —. A. del Campo Cerdan. Ann. Chim. analyt., 1909, 14, 205—206.

To a solution of a zinc salt sufficient ammonia be added to re-dissolve the precipitate at first formed, and then a c.c. of an alcoholic or ethereal solution of resorcinol. The blue colour is developed more or less rapidly according to the amount of zinc present. By this reaction 0.1 gm. of zinc may be detected in 1 litre of solution. For very small quantities of zinc, an ethereal solution of resorcinol is more sensitive than an alcoholic one. In ammonium, under like conditions, gives a green colour, which may mask the zinc reaction if only traces of the latter metal be present; and nickel, besides giving a blue colour with ammonia alone, gradually gives a tint to the resorcinol solution resembling that afforded by zinc. Cobalt gives the red colour distinctive of the cobalt-nickel. Copper, manganese, and certain oxidising substances, and reducing agents affect the reaction. These substances must therefore be removed before applying the test.—J. O. B.

For cobalt; New microchemical reaction for —. [Nickel and cobalt dimethylaminobenzene-azobenzene-sulphonates.] M. E. Pozzi-Escot. Ann. Chim. Analyt., 1909, 14, 207—208.

METHYLAMINOBENZENE-AZOBENZENESULPHONIC acid gives a number of sparingly soluble precipitates with metallic salts, the crystalline forms of which are very characteristic and distinctive. The nickel salt is a yellowish and amorphous precipitate in the cold; it re-dissolves on warming with a large volume of water, forming yellow, hexagonal tablets as the solution cools. Magnesium behaves similarly, but the precipitate assumes the crystalline form almost at once, in the cold, and moreover, the crystals are much smaller than those of the nickel compound. Cobalt gives a crystalline precipitate from both hot and cold solutions, composed of long slender white or blackish needles, often arranged in a stellate form. From rapid crystallisations, very minute needles appear in palse form, are obtained. This reaction is very distinctive and is not affected by the presence of nickel. Thallium, cerium, aluminium, manganese, sodium, chromium and silver, are also precipitated in somewhat similar manner; but the large size and distinctive colour of the cobalt crystals, enables them to be at once distinguished from these.—J. O. B.

For iron's solution. [Detection of ferrous salts and of oxygen.] Winther. See XXI.

INORGANIC—QUANTITATIVE.

For nickel; Determination of — in the presence of cobalt. J. A. Sanchez. Bull. Soc. Chim., 1909, 5, 641—647.

Potassium cyanide is added to a neutral solution containing nickel and cobalt, until the precipitate formed is redissolved, and the solution is evaporated to dryness in contact with air, the cobaltocyanide, $K_3Co(CN)_6$, is converted to cobaltic cyanide, $K_3Co_2(CN)_{12}$, whereas the nickel compound is unaffected, and, on addition of silver nitrate, insoluble silver cobaltic cyanide and cyanide are precipitated, and the nickel is left in solution as nitrate. This means very small amounts of nickel may be readily detected and estimated in the presence of large quantities of cobalt. For the determination of nickel, enough of a 10 per cent. solution of potassium cyanide is added from a burette to the neutral solution, containing only cobalt and nickel, to dissolve the precipitate first formed, the solution is evaporated to dryness on the water-bath, and the residue dissolved in 20 c.c. of hot

water; then excess of a 10 per cent. solution of silver nitrate is added (10 times the volume of the potassium cyanide used), and, after heating and stirring, the precipitate is washed by decantation with boiling water; the excess of silver is precipitated from the liquid and washings by adding a 14 per cent. solution of potassium bromide, and the filtrate from this is made up to 300 c.c. with hot water, being then rendered alkaline with caustic alkali, and the nickel hydroxide converted into hydrated sesquioxide by treatment with bromine water; after boiling for 10—15 minutes, the oxide is filtered off and washed with boiling water, and the determination then finished gravimetrically or better as follows:—The precipitate and filter are transferred to a flask with about 20 c.c. of water at 60°—70° C., and 5 c.c. of a 20 per cent. solution of potassium iodide and 5 c.c. of a 20 per cent. solution of sulphuric acid are added; then the liberated iodine is titrated with $N/100$ thiosulphate at the same temperature, every c.c. of thiosulphate being equivalent to 0.000586 gm. of nickel. If it be desired to determine both metals, they may be precipitated together as sesquioxides by means of caustic alkali and bromine water, and then, after weighing the oxides, they may be dissolved and the nickel determined as above.

—F. SODX.

Traces of silver; Determination of —, and the solubility of some "insoluble" silver salts. G. S. Whitby. Seventh Int. Congr. Appl. Chem., London, 1909.

WHILST investigating a method for preparing a colloidal solution of silver, it was found that solutions of silver salts when heated with a little sodium hydroxide and certain organic bodies develop a brown or yellow colour, even when the amount of silver present is very minute. 50 c.c. of a solution containing one part of silver in 25 million parts of solution gave a recognisable colour. It has also been found possible to apply this method to the quantitative determination of traces of silver. The organic substances which have hitherto been found capable of giving this colour when heated with silver solutions containing a little sodium hydroxide are dextrin, gum arabic, glycerol, cellulose (in the shape of filter paper), starch and sucrose, but the last of these is most suitable for the determination of small quantities of silver. To 50 c.c. of the silver solution, appropriately diluted, are added a few drops of a fairly concentrated solution of sucrose, and the beaker containing the liquid is immersed in a bath of boiling water for two minutes. About 6 drops of a $N/1$ solution of sodium hydroxide are added, and the heating is continued for not more than two minutes until the colour develops. The solution is cooled, transferred to a Nessler glass, and the colour compared with that of a standard. The standard colours are prepared from silver nitrate solutions of known strength, and are most conveniently of such strengths that 1 c.c. equals 0.000001 gm. of silver, and 1 c.c. equals 0.0000005 gm. of silver. The standard should not be prepared more than 12 hours before the actual experiment, since the colour deepens somewhat on standing. The colour produced by these minute amounts of silver is due to the presence of colloidal silver. The solutions give the Tyndall effect, and display the other characteristics of colloidal solutions of silver. The method is being applied to the determination of the solubility of sparingly soluble silver salts, particularly with reference to the conditions that arise in analytical work. Thus, at 21° C. the amount of freshly-prepared floccular silver chloride dissolved by a litre of water was found to be 1.55 mgrms.; a result which confirms the values obtained by Kohlrausch and Rose, and by Böttger.

Determining sulphurous acid in the gases of the lead chamber. Raschig. See VII.

Analysis of tungsten steel. Hinrichsen. See X.

Preparing pure tellurium. [Determination of tellurium in ores.] Schelle. See X.

Alkali, etc., works report. [Determining chlorides in presence of thiocyanate, e.g., in gas-liquor.] See VII.

Determining boric acid. Mandelbaum. See VII.

Electrolytic determination of manganese. Otin. See XI.A.

Influence of chlorides on the determination of nitrates in water. Perrier and Tarcy. See XVIII.B.

ORGANIC—QUALITATIVE.

Halphen's reaction. Garnier. See XII.

Detecting saccharin in beer. Jörgensen. See XVII.

Detecting saccharin in beer. Pawlowski. See XVII.

Reactions for lactic and glycollic acids. Denigès. See XX.

Methylglyoxal as a colour reagent. Denigès. See XX.

Examination of Chinese wood oil. Boughton. See XII.

Microchemical distinction between rye and wheat starches. Lenz. See XVI.

Saccharin [in beer, etc.]. Wauters. See XVII.

Detecting watering of milk. Cornalba. See XVIII.A.

Detecting mercury in explosives. Patterson. See XXII.

ORGANIC—QUANTITATIVE.

Boiling-point determinations under diminished pressure: A rarely observed source of error in —. C. von Reichenberg. J. prakt. Chem., 1909, 79, 475–491.

THE author points out that the usual arrangement of an apparatus for distilling under diminished pressure, in which the manometer is connected to the receiver, leads to erroneous figures as, owing to the distance of the manometer from the distilling flask and the throttling of the vapours in the narrow side-tube of the latter, the true pressure of the vapour, at the temperature given by the thermometer in the flask, is really several mm. higher than that recorded. This difference varies with the speed of distillation and the size of the side-tube of the distilling flask. In order to ascertain the true pressure under which the liquid distils, it is necessary to attach a manometer directly to the distilling flask by means of an extra side-tube. The author shows that many of the observations of pressure, made in the usual apparatus, cannot be regarded as correct.—J. C. C.

Sulphur; Determination of — by the catalytic method. G. Maderna. Seventh Int. Congr. Appl. Chem., London, 1909.

BRUCKER'S method (this J., 1905, 1086), which depends upon the catalytic action of cobalt oxide, can be applied successfully to the determination of sulphur in pyrites and in bitumens. Nickel oxide may be substituted for cobalt oxide and presents certain advantages over the latter. Of the methods hitherto proposed for the determination of sulphur in bitumens, only a modification of Eschka's method and Henriques' method have proved useful, and these are not always applicable. The catalytic method besides being more accurate, also occupies much less time than the two processes mentioned.—A. S.

Determining volatile matter in fuels. Constam. See II.

Determining crystallisable sugar in the beetroot. Pellet. See XVI.

Influence of concentration on determination of apparent degrees Brix of impure sugar house products. Pellet and Fribourg. See XVI.

Optically active non-sugar constituents of sugar beets. Strohmer and Fallada. See XVI.

Influence of pectic matters on polarisation of beetroots. Pellet. See XVI.

Determining dry substance in sugar products. Pellet. See XVI.

Ash in sugar and syrups. Main. See XVI.

Influence of clarification on valuation of raw sugars and molasses containing invert sugar. Prinsen Geerlig. See XVI.

Influence of clarification with basic lead acetate on valuation of sugar products. Eynon. See XVI.

Analysis of cane molasses. Ling and McLaren. See XV.

Analysis of bagasse. Davoll. See XVI.

Determining starch. Thorne and Jeffers. See XV.

Analysis of evaporated milk and milk products. Gudema. See XVIII.A.

Oxalic acid in cocoa and chocolate. Albahary. See XVIII.A.

Fuchsin S as standard for determining nitrites in water. Kastle and Elvove. See XVIII.B.

Chemical control of disinfectants. Blyth. See XVIII.

Analysis of malt extracts. Hamburg. See XX.

Indigo in dyed cotton fabrics. Knecht. See V.

Determining combined sulphur in vulcanised rubber. Budde. See XIII.C.

Tanning analysis. Paessler. See XIV.

Gelatin-hematin method of acid determination [in tanned liquors]. Alsop. See XIV.

Testing brewers' pitch. Brand. See XVII.

Creatinine determination [in meat extracts, etc.]. Cool. See XVIII.A.

Determining phenolphthalein in pharmaceutical preparations. Kollo. See XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES

Solubility of gases in water; Influence of colloids on colloid suspensions on the —. A. Findlay and H. J. M. Creighton. Seventh Int. Congr. Appl. Chem. London, 1909.

IS a preliminary note on the above subject, which is of essential importance in connection with the absorptive of gases by blood, it has been pointed out that absorption of carbon dioxide by water, under atmospheric pressure is increased, is unaffected, or is decreased by the presence of colloids and suspensions, according to the nature of the colloids present. This result pointed to the increase of absorption of carbon dioxide in presence of ferric hydroxide, gelatin, etc., as being due to chemical combination. As was pointed out in the preliminary note, however, the variation of absorption with pressure is of great importance for giving an insight into the influence of colloids than the change of absorption at any one pressure. Moreover, by studying the absorption of a neutral gas such as nitrous oxide, the effect due to chemical combination would be excluded. Experiments on these lines have been carried out during the past winter, the influence of ferric hydroxide, gelatin, arsenious sulphide, silicic acid, dextrin, starch, glycogen, egg albumin, and serum albumin, as well as suspensions of charcoal and silica on the absorption of carbon dioxide and of nitrous oxide having been investigated, at pressures varying from about 750 mm. to 1400 mm. of mercury. The chief factors which may be expected to influence the position and course of the absorption curves in presence of colloid relatively to the absorption curve in pure water (which is a horizontal line, according to Henry's law) are chemical combination, tending to raise the curve above that for water; presence of substance in true solution tending to lower the solubility; adsorption, accompanied or unaccompanied by solution of the gas in the colloid.

terial, tending to increase the solubility. Although we have not yet completely analysed the solubility curves which we have obtained, the following results may be given. Except in the case of suspensions of arsenious sulphide, the solubility curves obtained are, in general, similar in form. As the pressure is increased, the solubility increases but slightly, or may even slightly fall, but afterwards increases, although not proportionally with the pressure. This increase in solubility with pressure is more marked with nitrous oxide than with carbon dioxide, and from the data obtained, it has been concluded that an increase of solubility is due to adsorption. In the case of ferric hydroxide and gelatin, the solubility curve for carbon dioxide lies above that for the solubility in pure water, and this may be ascribed to chemical combination, and in the case of nitrous oxide, this increase in solubility is not observed. In other cases the solubility of the gases is diminished, a behaviour which at present can be most readily explained by the assumption of adsorption of the colloids.

Viscosity of solutions, and its bearing on the nature of solution. A. E. Dunstan. Seventh Int. Congr. Appl. Chem., London, 1909.

The author develops the following experimental laws:—
(1) When two monomolecular liquids are mixed, the viscosity of the mixtures only approximates to that demanded by the law of mixtures. The greater the divergence from this law, the greater is the mutual effect, η , of association, of the one on the other.

(2) In the case premised in (1) there exists a relationship between the angles made by tangents to the origins of the curves, and the respective molecular weights of the component liquids.

(3) When associated liquids are mixed, the viscosity of the mixture may attain a maximum value, which is held to indicate association, since it is well known that highly associated liquids are more viscous than simple liquids. These maxima invariably correspond with points of simple molecular concentration. (4) In the case premised in (1) the viscosity of the mixture may attain a minimum. On the same lines of reasoning, this implies a mutual association. (5) For pure substances the relationship $\eta = a + b \log M$, wt. is found to be universally applicable.

(6) For pure substances the relationship $\frac{\eta}{\text{Mol. Vol.}} \times 10^6$

is good for each chemical (homologues) series. The knowledge thus obtained has been applied to the following cases:—

- The condition of aqueous solution of sulphur trioxide.
- The existence of racemic compounds in solution.
- Various cases of isomeric change.
- The stability of hydrates in solution. Although little has been done at present from a technical point of view, yet the simplicity of the method and its remarkable sensitiveness render it most valuable in cases where knowledge of the condition of molecular aggregation is needed. To mention one example only, it has recently been applied to the determination of the "nerve" of India-rubber with good results.

Absorption ("Sorption") of hydrogen by carbon: Mechanism of the —. J. W. McBain. Seventh Int. Congr. Appl. Chem., London, 1909.

ABSORPTION is quite variously regarded by various authorities as one of the following:—(1.) True chemical combination. (2.) True solid solution. (3.) A modified solid solution in which practically only the outer layers become saturated owing to the difficulty of diffusion in solids. (4.) Condensation on the outside of the surface of the solid.

The first three are contrary to the requirements of thermodynamic theory, and the fundamental assumption of the third is disproved by experiments in which the time required for adsorption of hydrogen by carbon was independent of the pressure of hydrogen to be adsorbed. The fourth is found insufficient to explain the somewhat complex time relationships studied here, which, however, point strikingly to the conclusion that both true solid solution (true diffusion) and surface condensation occur.

They are independent of each other and their relative importance and magnitude depend upon the conditions of the experiment. The non-committal name "sorption" is coined to designate the sum total of the phenomena, while "adsorption" and "desorption" are restricted to the dissolved and superficially condensed matter respectively. It is found that the surface condensation requires only a few minutes for completion, whereas adsorption requires, in the case of hydrogen diffusing into carbon at the temperature of liquid air, a dozen hours for practical completion. Thus it was possible to isolate the two phenomena and to study them more or less independently of each other. For instance, by suitable manipulation a sample of carbon can be prepared highly charged with hydrogen in a state of solid solution but almost destitute of adsorbed hydrogen condensed on the surface. This is clearly attainable (if the hypothesis be correct) by suddenly exposing to a vacuum, carbon which has been previously saturated by long contact with hydrogen at a constant temperature. Such carbon, exposed to a low pressure of hydrogen and cut off from all external influences, took up hydrogen at first (surface condensation) although already supersaturated (*i.e.*, in respect to the solid solution), and then gave it off again in still greater quantity until final equilibrium was established. Thus the manometer first fell for a few minutes and then rose to a higher point than the initial value. In the converse case, where the interior was free from hydrogen but the surface had become supersaturated by a very short exposure to a high pressure of gas, hydrogen was first given off, and then taken up again by diffusion into carbon. Here the manometer automatically rose for a few minutes, then steadily fell for many hours to a lower value than previously obtained. The pressure changes observed, might at first seem unimportant, were it not for the one fact of great significance, *viz.*, that (taking the second case just outlined) the higher pressure at five minutes was even less than corresponded to the gas condensed on the surface of the carbon, and yet after a dozen hours had elapsed a much lower pressure was attained, a pressure which then actually did correspond to the condensed gas in equilibrium with it. Thus a considerable body of hydrogen had been transferred from this surface to the interior of the carbon. An approximate calculation of the extent of this transfer showed that the true solubility of hydrogen at the temperature of liquid air and under 2 cm. pressure was at least 4 c.c. (corr.) per gram of the coconut carbon employed. This absorption was roughly proportional to the square root of the pressure (whereas the total sorption varies as the cube root of the pressure). From this it appears that the dissolved hydrogen is split up into single atoms.

Trade Report.

Factories and Workshops: Annual Report for 1908. Home Office, 1909 [Cl. 4661]. Price 2s. 4d.

THE general report deals only with certain of the broader issues bearing upon the work of the Department: a summary of the sectional reports (including Industrial Poisoning and Dangerous Trades) and a general index are given at the end of it.

White phosphorus matches.—As the outcome of the Berne Conferences of 1905 and 1906, certain European countries decided to prohibit the use of white phosphorus, but the United Kingdom, Sweden, Norway, and Belgium did not see their way to similar action. Further regulations, proposed by the Home Office, were held by manufacturers to be oppressive; for three years no case of necrosis had appeared, save at one factory. Meanwhile, Departmental investigations, made in 1907, showed the need of more stringent dental examination and treatment, and the substitution of automatic machines for hand labour; and it was ascertained that "strike anywhere" matches could be made without white phosphorus, though patent rights, both in materials and machines, stood in the way of universal adoption. In 1908, match manufacturers

and the holders of patent rights in phosphorus substitutes agreed in favour of the prohibition of white phosphorus, provided that importation of white phosphorus matches were prohibited, and that the Home Office settled binding terms by which anyone might use the patented substitutes. This solution was accepted by the Home Office, and accordingly the White Phosphorus Matches Prohibition Act was passed, which comes into force on Jan. 1st, 1910 (this J., 1909, 43). Meanwhile all the match factories, save one, remained free from necrosis, but in this one a further case occurred in 1908, and two more cases in the first quarter of 1909. The disuse of white phosphorus renders the Special Rules of 1899 obsolete, but care will have to be taken in using phosphorus sesquisulphide, one of the substitutes, though it entails no risk like that attending the use of white phosphorus.

The following statistics of imports and exports of matches in 1907, distinguishing between "safety" matches (without white phosphorus), and "strike anywhere" matches (which as a rule contain it) are of interest. The unit is a gross of boxes.

Origin or destination.	"Safety" matches.	"Strike anywhere" matches.
Imported from—		
Sweden.....	3,640,775	2,863,586
Norway.....	818,737	157,320
Belgium.....	904,521	1,047,743
Holland.....	404,020	56,450
Other countries.....	369,790	121,718
	6,138,743	4,246,817
Re-exported to—		
India.....	1,068,270	1,291,330
Australia.....	36,050	17,736
Egypt.....	158,550	132,676
Other British Possessions ..	178,049	20,019
United States.....	395,011	92,040
Other countries.....	32,780	40,321
	1,868,710	1,595,022
Made in U.K. and exported to—		
Australia and New Zealand.	12,681	332,683
India.....	16,473	198
West Africa.....	72,520	11,500
Channel Islands.....	11,375	6,460
Other British Possessions ..	4,871	7,491
Germany.....	413	8,571
Belgium.....	795	1,214
United States.....	6,258	875
Other countries.....	5,015	4,607
	130,401	373,599

Regulations.—The Regulations for enamelling of metal and of glass, and for benzene derivatives were settled by discussion with the trade without recourse to public inquiry, and the latter came into force: the timing of metals with use of lead was certified to be a dangerous trade; seven codes of Special Rules are being superseded by Regulations of automatic application as the outcome of action now taken, and seven others have been so dealt with in earlier years. There remain nine codes of Special Rules to be converted into Regulations of automatic application: white lead, red and orange lead, yellow lead, lead smelting, hides and skins, bichromate, vulcanising of india rubber and carbon disulphide, chemical works, and bottling of aerated waters.

Potteries.—In a few potteries, out of 563 under Special Rules, there is a limitation of the use of lead in glaze, as a condition of the relaxation of certain rules, but only one case of lead poisoning, attributable to glaze, has been reported since 1905. The "leadless" (*i.e.*, 1 per cent.) Rule 22 has been in force since 1902 in 17 potteries and parts of 12 others, without any known instance of poisoning. Samples of glaze have been taken at intervals, and some excess has been found in four instances out of 124. There are two potteries in which a 2 per cent. limit is in force under Rule 24. In one of these, four cases of poisoning had occurred in 1906, and one in 1907. The 2 per cent. rule was established in Dec., 1907, and a glaze was adopted which a local analyst certified to be within the limit. Samples taken in 1908 yielded 4.7 and 6.6 per cent. of

soluble lead, whereupon the firm substituted a glaze with 1.9 per cent., as certified by the Government Laboratory with satisfactory results. In nine potteries the 5 per cent. limit is in force under Rule 23. There was one case of plumbism in 1908. Two out of 30 glaze samples yielded more than 5 per cent. of lead (but not at the factory where the case occurred), but later samples have been within the limit. There are 20 potteries working under the 5 per cent. limit as regards glaze (Rule 2). In the last three years three cases of plumbism have been reported, but not among the glaze workers. Out of 43 samples examined since 1902, nine exceeded the limit.

Colorimetric test for lead in glazes.—Mr. H. R. Rogers has devised a simple test for lead in the glaze of finished ware. The proportion of lead can be determined approximately so as to distinguish between 2 per cent. and 5 per cent. as follows: A standard solution of hydrofluoric acid is applied to the glaze, and, after 40 seconds' exposure, is absorbed by filter paper, which is then treated with sulphuric acid, washed to remove soluble sulphates, and treated with ammonium sulphide. The black stain on the paper is said to vary in depth of colour with the proportion of lead, and is compared with standard tint obtained in the same way from glazes of known lead contents. Cobalt, iron, manganese, or copper in the glaze do not affect the test.

China and earthenware.—In May a Departmental Committee was appointed to inquire into questions affecting the china and earthenware industry (see this J., 1908, 504).

Industrial diseases.—The Industrial Diseases Committee issued a second report, as the result of which the following were added to the third schedule of the Workmen's Compensation Act, 1906: Glassworkers' cataract (from the glare of molten glass); telegraphists' cramp; eczematous ulceration of the skin produced by dust or liquids; and ulceration of the mucous membrane produced by dust.

Humidity in weaving sheds.—The following conclusions are selected from the Report of the Humidity Committee published in March, 1909:—

1. As regards health and comfort of workers, the wet-bulb, rather than the dry-bulb, temperature is the essential point, and a limit (of wet-bulb reading) should be fixed beyond which no further humidification should be allowed.

2. Schedule IV., 1901, should be amended accordingly, omitting also all dry-bulb temperatures below 50° F., and requiring a minimum difference between the wet and dry-bulb readings.

3. The standard of carbon dioxide for humid sheds is 12 per 10,000 in daylight, and 20 during lighting by gas or oil; and 15 to 23 are suggested for dry sheds, to encourage disuse of humidification. Any excess of carbon dioxide in the open air, beyond the normal 4 parts, is to be taken into account.

5. Cold draughts must not impinge on the workers.

6. The water used for humidification should have a standard of purity.

7. Arrangements should be made for storing clothing.

8. The thermometers should be read by both employers and employed and the results registered, but the records need only be sent to the inspector when irregularities are found.

9. There should be power to prescribe details as to use of hygrometers.

10. Steam pipes should be small and covered with non-conducting material.

11. The floors and walls should be kept clean.

12. All roofs, including those of glass, even on the north side, should be whitewashed from June to September.

13. The present limit of 12 months, within which repetition of an offence renders the occupier liable to a penalty, should be made 24 months.

The expert evidence obtained by the Committee as to the injurious effect of high wet-bulb temperatures is conclusive.

The following data are furnished by Superintending Inspector Bellhouse:—*Method of ventilation:* Exhaust, 392; plenum, 369; both, 177; other, 20. *Method of humidification:* Steam jets alone, 519; Hart's, 134; Matthew and Yates', 39; Parsons', 54; Howarth's, 31;

all and Kay's, 57; Vortex, 29; Drosophore, 5; Pyc's, ; other, 1.

Construction: "Saw-tooth" roof, 896; flat, 2; saw-tooth and flat, 4; louvre, 1; under other rooms, 55.

Cloakrooms: Provided for 100 sheds out of 958.

The large amount of size used causes much dirt, and at this point frequent instructions are necessary.

Annealing of wire by lead.—Four cases of poisoning cured in a works where hot wire was passed through bath of molten lead. The lead oxide formed was carried off by the wire and given off into the air of the rooms it passed over the pulleys. The only method which was all successful was to cover the bath with charcoal, which reduced the lead oxide on the wire as it left the bath.

Aniline poisoning.—Two cases occurred, one in a calico printing works and the other in a dye works. The latter is caused by a quantity of aniline oil being splashed on to a workman's clothing, who, however, continued to work. By inhalation or absorption, or both, he was poisoned and died in a few hours.

Galvanising and ammonium chloride.—In two factories fumes of ammonium chloride given off are drawn off by exhaust fans, condensed in a stream of hydrochloric acid, and the salt recovered. The percentage of recovery so high that it is a commercial success, but, owing to the high initial cost, it is not being generally adopted.

Red lead manufacture.—An entirely new method of manufacture has been established in the Liverpool district, in which all handling of material is superseded by automatic appliances, and all risk of poisoning reduced to a minimum.

Books Received.

THE FUNDAMENTAL PRINCIPLES OF CHEMISTRY. An Introduction to all Text Books of Chemistry. By **WILHELM OSTWALD.** (Translation by H. W. MORSE.) Longmans, Green and Co., 39, Paternoster Row, London; also New York, Bombay, and Calcutta. Price 7s. 6d.

10 volume, containing 341 pages of subject matter, with 65 illustrations, and an alphabetical index. The subject matter receives the following sub-divisions:—
I. Bodies, substances, and properties. II. The three states. III. Mixtures, solutions, and pure substances. IV. Change of state and equilibrium. (The following equilibria are defined:—(i). Liquid-gas; (ii). Solid-liquid; (iii). That between the three states; (iv). Solid-liquid.) V. Solutions. VI. Elements and compounds. VII. Law of combining weights. VIII. Colligative properties. IX. Reaction velocity and equilibrium. X. Isomerism. XI. The ions.

EXERCISES IN PHYSICAL CHEMISTRY. By Dr. W. A. ROTH. Translated by A. T. CAMERON. Archibald Constable and Co., Ltd., 10, Orange Street, Leicester Square, London, W.C. 1909. Price 6s. net.

20 volume, containing 190 pages of subject matter, with 49 illustrations, and an alphabetical index. The subject matter is classified under the following heads:—
I. Introductory. II. Determination of density. III. Determination of molecular weights in solution. IV. Thermo-chemistry. V. Determination of optical constants. VI. The thermostat. VII. Chemical statics and dynamics. VIII. Electrochemistry. IX. Foundations. X. Electrical conductivity. XI. Faraday's law. Transport numbers. XII. Measurement of differences of potential. XIII. Electrostatics. Appendix.

SUGAR AND ITS MANUFACTURE. By H. C. PRINSEN GEERLIGS, Late Director of the West Java Sugar Experiment Station. Norman Rodger, Altrincham, Manchester. 1909. Price 12s. net.

LARGE 8vo volume, containing 350 pages of subject matter, and the alphabetical index. The subject in this work is divided into two parts: Part I., devoted to "THE RAW MATERIAL," and Part II., to "THE SUGAR MANUFACTURE." Under Part I., the subject is sub-

divided as follows:—(i). The constituents of cane sugar (ii). The proportion and distribution of the constituents of sugar cane. PART II.: (i). Extraction of the juice. (ii). Clarification. (a). Defecation. (b). Carbonatation. (iii). Lime and lime cream. (iv). Other clarifying and decolorising agents. (v). Filtration. (vi). Concentration of the juice. (vii). Curing. (viii). Exhausted molasses.

New Books.*

Arends, Apoth. G.: Neue Arzneimitteln u. pharmazeutische Spezialitäten einschliesslich der neuen Drogen, Organ- u. Serumpräparate, m. zahlreichen Vorschriften zu Ersatzmitteln u. e. Erklärung der gebräuchlichsten medizinischen Kunstausdrücke. 3. sehr verm. u. verb. Aufl. Berlin, J. Springer. 1909. (Geb. in Leinw. 6 M.)

Arnold, Carl: Repetitorium der Chemie. Mit besonderer Berücksichtigung der f. die Medizin wichtigen Verbindungen, sowie des "Arzneibuches f. das Deutsche Reich" u. anderer Pharmakopöen namentlich zum Gebrauche f. Mediziner u. Pharmazeuten bearb. Verb. u. ergänzte Aufl. L. Voss, Hamburg. 1909. Geb. in Leinw. M. 7.

Arrhenius, Svante: Theorien der Chemie. Nach Vorlesgn., geh. an der Universität v. Kalifornien zu Berkeley. Mit Unterstützung des Verf. aus dem engl. v. Alexis Finkelstein, 2. Neubearb. u. bedeutend verm. Aufl. Leipzig, Akadem. Verlagsgesellschaft. 1909. M. 7.50; geb. in Leinw. M. 8.50.

Ashcroft, E. A.: A Study of Electrothermal and Electrolytic Industries. Part I. Introductory. Cr. 8vo. Spon. London. Net, 8s. 6d.

Beck, R.: The Nature of Ore Deposits; tr. and rev. by Walter Harvey Weed. New York. Hill Publishing Co., 1909. 86. (Formerly published in 2 v. at 88.)

Carré, P.: Les Produits pharmaceutiques industriels. 2 vol. Doin, Paris. 10 fr.

Collins, Miles: Woollen and Worsted Spinning; a complete working guide to modern practice in the manufacture of woollen and worsted yarns and felt; including the sources, natural properties, grading, and cleansing of the raw material, and the machinery and processes of factory work. Chicago, American School of Correspondence, 1909. Illustrated. (American School of Correspondence pubs.) 83.

Conter, P.: Enciclopedia pratica per le industrie galvanoplastiche, elettrochimiche e fotomeccaniche (Acciaiatore, alluminio, amalgamazione, antimoniatura, argentatura, candeggio, catattipia, nozioni di chimica, cobaltatura, colori, concia elettrica delle pelli, coppellazione, damascatura, dinamo, doratura, nozioni di elettricità, fotoeromia, galvanoplastica, deposizione delle leghe, metalloeromia, motori, ossidatura, piombatura, platinatura, preparazione di prodotti, pulitura, ramatura, raccolta di ricette, saggi, smaltatura, soccorsi per infortuni, stereotipia, vernici, terminologia elettrica). Milano, Manuali Hoepli. 1909. 5.50 lire.

Douzal, E.: Production électrique de l'ozone et applications à l'industrie, l'hygiène, la thérapeutique. 52 fig. Béranger, Paris. 15 fr.

Erban, Fr.: Laboratoriumsbuch für Tinktorisch-Chemiker, Koloristen, Ingenieure und technische Reisende in Färbereien, Druckereien, Farben-, Lack- und Papierfabriken. 18, Abbildgn. im Text. W. Knapp, Halle. 1909. M. 5.20.

Fachini, S.: L'industria delle materie grasse. 1: I grassi e le cere. Parte generale e analitica. Milano, Man. Hoepli. 1909. 6.50 lire.

Felsen, Dr. F.: Der Indigo und seine Konkurrenten. Eine kritische Besprechung. 134 Muster, etc. Verlag für Textil-Industrie. Berlin S.W. 48. 1909. Geb. M. 10.

Freundlich, Priv.-Doz. Dr. Herb.: Kapillarchemie. Eine Darstellg. der Chemie der Kolloide u. verwandter Gebiete. Leipzig, Akadem. Verlagsgesellschaft. 1909. M. 16.30; geb. M. 17.50.

Fritsch, J.: Fabrication des engrais chimiques. 69 fig. et 4 pl. Desforges, Paris. 1909. 20 fr.

* Compiled by H. Grevel and Co., 33, King Street Covent Garden, London.

Guillet, Léon: Traitements thermiques des produits métallurgiques. 176 fig. et 37 pl. Dunot et Pinat, Paris, 1909. 27 fr. 50.

Hawk, P. B.: Practical Physiological Chemistry. 2nd ed. Roy. Soc. Churchill, London. 1909. 16s. net.

Kohert, Prof. Dr. R.: Ueber die Einwirkung v. Enzymen auf Alkaloide, Glykoside u. Ester. [Aus: "Sitzungsber. u. Abhandlgn. d. naturforsch. Gesellsch. zu Rostock."] Rostock, H. Warkentin, 1909. 80 pf.

Laubenheimer, Dr. Kurt: Phenol u. seine Derivate als Desinfektionsmittel. Habilitationsschrift. Wien, Urban & Schwarzenberg, 1909. M. 3.60; geb. M. 5.

Mayer, Prof. Dr. F.: Die Wärmetechnik des Siemens-Martinofens. (123 S. m. 29 Taf. u. 28 Tab.). W. Knapp, Halle, 1909. M. 5.40.

Mazzocchi, L.: Calci e cementi. 3^a ediz. aumentata e corretta, Mammì Hoepli, Milano. 2.50 lire.

Muehan, Magnus (Editor): Modern Electric Practice. New ed. 6 vols. 4to. Gresham Publishing Co., London, 1909.

Moore, E.: Crozier Sibbald. Sanitary engineering: a practical treatise on the collection, removal and final disposal of sewage and house refuse, and the design and construction of works of drainage and sewerage, with numerous tables, formulae and memoranda, including an extensive series of tables of velocity and discharge of pipes and sewers. 3rd ed., rev. and in part rewritten by E. J. Silcock. In 2 v. v. 1, Sewerage, hydraulics, sewer and drain ventilation, sanitary fittings and apparatus; v. 2, Land Drainage, sanitary notes, sewage disposal, refuse destructors, trade effluents and sewage fungus. Lippincott, Philadelphia, U.S.A. 1909. \$14 net.

Moss, Richard J.: The Toxine in Irish Yew. Scientific Proceedings of the Royal Dublin Society. Williams and Norgate, London. 1909. 6d.

Müller, G.: Die Chemische Industrie. (Unter Mitwirkg. von Phil. Fr. Bennigson.) B. G. Teubner, Leipzig und Berlin. 1909. (Geb. in Leinw. M. 12.

Münster, Dr. Hermann: Die Vernehrung der Kaliwerke u. der Kaliabsatz. Mit 7 grossen Kurventaf. W. Knapp, Halle, 1909. M. 3.60.

Nicou, P.: Les Gisements de minerai de fer de la Laponie suédoise. Dunot et Pinat. Paris. 1909. 4 fr. 50.

Nitzsche, H. dipl. Ing.: Materialbedarf u. Dichtigkeit sowie Kosten v. Betonmischungen unter Berücksicht. der Zusammenstampfbarkeit der Füllstoffe. Mit 3 graph. Taf. u. 1 Zahlentab. W. Engelmann, Leipzig. 1909. M. 4.20.

Oppenheimer, Prof. Dr. Carl: Grundriss der organischen Chemie. 6 Aufl. Leipzig, G. Thieme. 1909. M. 2.80.

Panayeff, Jos. V.: Verhail der wichtigsten seltenen Erden zu Reagentien. Zum Gebrauch im Laboratorium. W. Knapp, Halle, 1909. M. 3.60.

Pusqualis, L.: Trattato completo di bachicoltura teorico-pratica, con cenni sulla trattura dei bozzoli e sulla gelicoltura e un prontuario del bachicoltore. 3^a ediz. rifatta. Milano. 1909. 9 lire.

Pecchioni, Egidio: Coltivazione del frumento: studii, note, istruzioni praticate nelle agenzie Durazzo-Pallavicini. Parma. 1909. 4 lire.

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Richer, V. v.: Chemie der Kohlenstoff-Verbindungen od. organische Chemie. 11. Aufl. Neu bearb. v. R. Anschütz u. G. Schreeter. 1. Bd. Die Chemie der Fettkörper. Mit in den Text gedr. Holzschn. F. Cohen, Bonn. 1909. M. 18; in Halbfz. M. 20.40.

Smith, J. Walker: Dustless roads, tar, macadam: a practical treatise for engineers, surveyors, and others; with numerous ill. and tables. Lippincott, Philadelphia, U.S.A. 1909. \$3.50 net.

Stormer, R.: Die Oxydations- u. Reproduktionsmethoden der organischen Chemie. Ein Hilfsbuch f. die prakt. Arbeiten im Laboratorium. G. Thieme, Leipzig. 1909. M. 7.

Wamp, Chung Yu: Antimony: its history, chemistry, mineralogy, geology, metallurgy, uses, preparations, analysis, production, and valuation; with complete bibliographies, for students, manufacturers, and users of antimony; with numerous illustrations. Lippincott, Philadelphia, U.S.A. 1909. \$4 net.

Wallisch, E. M.: The Mobilities of the Ions produced by Röntgen Rays in Gases and Vapours. Dulau, London. 1909. 2s. net.

Waltercek, Herman C.: Production of Ammonia from Atmospheric Nitrogen. Scientific Proceedings of the Royal Dublin Society. Williams and Norgate, London. 1909. 6d.

Zsigmondy, R.: Colloids and the Ultramicroscope. Manual of Colloid Chemistry and Ultramicroscopy. Transl. by J. Alexander. John Wiley and Sons, New York. 1909. \$3.00. Chapman and Hall, London. 12s. 6d. net.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journal in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 14,024. Michaelis. Centrifugal separators.* June 15.
14,115. Keller. Conveying and compressing gases [Ger. Appl., March 6, 1909.]* June 16.
14,119. Mills (Arabul Manuf. Co.). See under XII.
14,514. Steger. Apparatus for separating particles of liquid gases and vapours.* June 21.

COMPLETE SPECIFICATIONS ACCEPTED.

- 13,632 (1908). Köhnke. Evaporator for sea-water. June 23.
14,155 (1908). Read and Campbell. Filters. June 23.
18,831 (1908). Peyton. Packing pieces for chemica absorption, condensing, and like towers. June 30.
25,643 (1908). Tiemann. Drying non-pulverulent materials. June 23.
2218 (1909). Read and Campbell. Capsules for holding compressed or liquefied gas. June 30.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 14,200. Hall. Process for purifying gas. [U.S. Appl. July 11, 1908.]* June 17.
14,508. Ewing. Gas retorts. June 21.
14,655. Wolfram Lampen A.-G. and Goll. Carbonising metallic glow-lamp filaments made with organic binding agents. [Ger. Appl., Feb. 15, 1909.]* June 22.
14,938. Jung. Manufacture of incandescent mantles for gas lighting. June 26.

COMPLETE SPECIFICATIONS ACCEPTED.

- 14,031 (1908). Johnson. Retort gas-making apparatus. June 23.
16,027 (1908). Rincker and Wolter. Production of gas from tar, oil, etc., in gas-producer plant. June 23.
19,363 (1908). Pettibone. Manufacture of producer gas or water gas. June 23.
1247 (1909). Zailer. Pent products for fuel purposes. June 23.
5163 (1909). Severin. Manufacture of incandescent mantles. June 30.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATION.

- 14,139. Hutchinson. Coal tar compounds. June 16.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

13,903. Aniline Colour and Extract Works. Manufacture of *p*-amino-*n*-oxvazo colouring matters. [Ger. Appl., March 29, 1909.]* June 14.

13,904. Aniline Colour and Extract Works. Manufacture of *o*-oxydisazo colouring matters. [Ger. Appl., March 29, 1909.]* June 14.

13,907. Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene colouring matters. June 14.

14,143. Ransford (Cassella and Co.). Manufacture of sulphide colours from carbazol derivatives. June 16.

14,311 and 14,312. Newton (Bayer und Co.). Manufacture of new dyestuffs. June 18.

14,314. Inray (Soc. Chem. Ind. in Basle). Manufacture of brown vat dyestuffs of the indigo series. June 18.

14,315. Inray (Soc. Chem. Ind. in Basle). Manufacture of substantive tetrazo dyestuffs.* June 18.

14,316. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of mono-azo dyestuffs suitable for use as lakes. June 18.

14,820. Newton (Bayer und Co.). Manufacture of acid wool dyestuffs. June 24.

14,940. Wetter (Chem. Fabr. Grünau, Landshoff, und Meyer). Manufacture of alizarin preparations suitable for dyeing and printing.* June 26.

COMPLETE SPECIFICATIONS ACCEPTED.

19,641 (1908). Newton (Bayer und Co.). Manufacture of alizarin. June 23.

24,604 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. June 30.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

14,092. Bleachers Assoc., Ltd., and Rusden. Treating woven piece goods. June 16.

14,112. Friedrich. Producing durable solutions for pinning, etc.* June 16.

14,477. Hart. Rendering fabrics waterproof and gas-tight, and waterproofing yarns, cords, &c. June 21.

14,760. Farjas and Jaboin. Radium-treated fibres. Fr. Appl., Dec. 4, 1908.]* June 23.

14,940. Wetter (Chem. Fabr. Grünau, Landshoff, und Meyer). *See under IV.*

14,959. Farjas and Jaboin. Fibres treated with radium. Fr. Appl., Feb. 16, 1909.]* June 26.

COMPLETE SPECIFICATION ACCEPTED.

13,226 (1908). Hanson. Dyeing machines and the like. June 23.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

14,300. Teisset and Prat. Impts. in Kessler's apparatus or concentrating sulphuric acid. [Fr. Appl., Dec. 31, 1908.]* June 18.

14,313. Newton (Bayer und Co.). Manufacture of a double compound of zinc hydrosulphite and sodium sulphite. June 18.

14,469. Rollason. Obtaining nitrates from atmospheric air. June 21.

14,725. Nanton, de Marsac, and Tesse. Alkaline solvents and the manufacture thereof.* June 23.

14,744. Evans and Macan. *See under X.*

COMPLETE SPECIFICATIONS ACCEPTED.

12,980 (1908). Eberhard. Increasing the mobility and activity of water-glass. June 23.

25,535 (1908). Blagburn. Obtaining nitrogen from the air. June 23.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATION.

14,761. Farjas. Permanently radio-active glass. [Fr. Appl., April 2, 1909.]* June 23.

COMPLETE SPECIFICATIONS ACCEPTED.

27,806 (1907). Roman Brick Co., and Schauer mann. *See under IX.*

7823 (1909). Sievert. Manufacture of glass plates. June 23.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

14,192. Govan. Making concrete. June 17.

14,281. Glover. Plant for crosscutting timber. June 18.

COMPLETE SPECIFICATIONS ACCEPTED.

27,806 (1907). Roman Brick Co., and Schauer mann. Manufacture of bricks, blocks, and pottery used in building. June 23.

22,126 (1908). Reich. Production of clay tiles resembling natural sandstone. June 30.

23,782 (1908). Isenschmid. Composition for making imitation marble. June 23.

X.—METALS AND METALLURGY.

APPLICATIONS.

13,869. Tucker. Treatment of iron and steel for prevention of rust. June 14.

14,129. Carson. Apparatus for treating ores or other materials containing volatile metals. June 16.

14,245. Angley. Open-hearth process for producing malleable and steel castings. June 17.

14,342. Frank. Treatment of zinc.* June 18.

14,351. Harrison (Resinelli). Furnaces for producing cast iron and steel.* June 18.

14,357. Hinchley. Plant for treating sheets by the process of sherardizing. June 19.

14,372. Parnell. Treatment of ores. June 19.

14,541. Hübner. Desulphurising ores.* June 21.

14,744. Evans and Macan. Treatment of calcined ores containing zinc or zinc and lead to produce zinc white or zinc sulphate. June 23.

14,812 and 14,813. Smallwood. Furnaces for roasting, calcining, and smelting ores, heating metals, &c. June 24.

14,945. Namaqua Copper Co., and James. Separation of metals from ores by flotation. June 26.

14,946. Soc. Electro-Métallurgique Française. Manufacture of pure nickel. [Fr. Appl., June 27, 1908.]* June 26.

COMPLETE SPECIFICATIONS ACCEPTED.

6148 (1908). Lockwood and Samuel. Treatment of ores. June 30.

12,534 (1908). Miller. Crucible furnaces for melting steel and other metals. June 23.

13,513 (1908). Armstrong. Furnaces for obtaining zinc and lead. June 30.

20,902 (1908). Williams. Extraction of metals from ores by solar heat. June 23.

23,497 (1908). Sulman. Separation of zinc from its ores or compounds. June 30.

24,503 (1908). Rogerson and Donaldson. Treatment of ores. June 30.

25,620 (1908). Tonceda. Alloys for bearing metals. June 23.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

14,288. Schott and Zeiss Stiftung. Electrolytic apparatus having a liquid anode. [Ger. Appl., June 26, 1908.]* June 18.

14,660. Thum. Electrolytic apparatus.* June 22.
 14,858. Bingham. Electric furnace electrodes. June 26.
 14,937. Grunwald. Electric induction furnaces. [Addition to No. 3599 of 1909. Ger. Appl., Oct. 2, 1908.]* June 26.

COMPLETE SPECIFICATIONS ACCEPTED.

1345 (1909). British Thomson-Houston Co. (General Electric Co.). Aluminium electrolytic cells. June 30.
 3599 (1909). Grunwald. Electric induction furnaces. June 23.
 7396 (1909). Grunwald. Electric induction furnaces. June 23.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

14,119. Mills (Arabol Manufacturing Co.). Emulsifier, emulsifying process, and emulsion.* June 16.
 14,750. Lever Bros., Ltd., and Edwards. Extraction of crude glycerin from the salt produced during concentration of soap or other lye. June 23.
 14,875. Fletcher, Mays, and Mays. Rapid tallow-melting process. June 26.

COMPLETE SPECIFICATION ACCEPTED.

14,623 (1908). Moore-Irvine. Apparatus for making soap, &c. June 23.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

APPLICATIONS.

14,744. Evans and Macan. *See under X.*
 14,835. Erbslow and Coudron. Manufacture of white lead.* June 24.

(C).—INDIA-RUBBER.

APPLICATION.

13,984. Robinson. Rubber substitute. June 15.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATION.

14,516. Redlich and Pollak. Treatment of quebracho extracts. June 21.

COMPLETE SPECIFICATIONS ACCEPTED.

13,768 (1908). Landenberger (Marwedel). Process of tanning. June 30.
 4130 (1909). Lake (Fiber Products Co.). Production of artificial leather. June 23.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATION.

14,266. Elmassian. Dry extraction of barley malt. June 17.

COMPLETE SPECIFICATION ACCEPTED.

16,987 (1908). Carroll. Distilling and treating spirits. June 30.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A).—FOODS.

APPLICATIONS.

14,491. Remfry. Manufacture of self-raising flour. June 21.
 14,931. Tildesley, Ritchie, and Watkins. Process for improving flour. June 26.

(B).—SANITATION; WATER PURIFICATION.
APPLICATION.

14,874. Coplans. Rapid preparation of potable water. June 26.

COMPLETE SPECIFICATIONS ACCEPTED.

13,632 (1908). Köhuke. *See under I.*
 6013 (1909). Felten und Guillaume Lahmeyerwerke. Apparatus for sterilising water with ozone. June 30.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

14,016. Wells, and British Xylonite Co., Ltd. Preparation of xylonite or celluloid. June 15.
 14,779. Stone. Production of a new paper product. June 24.

COMPLETE SPECIFICATION ACCEPTED.

6277 (1909). Turner and Maxwell. Treatment of bamboo pulp and similar materials. June 30.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

13,902. Skita. Manufacture of camphene. June 14.
 13,912. Zimmermann (Chem. Fabr. auf Actien vorm. E. Schering). Manufacture of cerium phenol compounds.* June 14.
 14,663. Wellcome and Pyman. Manufacture of therapeutic compounds. [Addition to No. 314 of 1909.] June 22.
 14,762. Farjas. Radioactive products possessing permanent activity. [Fr. Appl., Apr. 14, 1909.]* June 23.
 14,805. Wetter (Rütgerswerke). Meta-cresol-ortho-oxalic ester.* June 24.
 14,918. Wellcome and Pyman. Manufacture of therapeutic compounds. June 26.
 14,960. Farjas. Permanently radio-active products. [Fr. Appl., May 8, 1909.]* June 26.

COMPLETE SPECIFICATIONS ACCEPTED.

15,573 (1908). Newton (Bayer und Co.). Manufacture of purine derivatives. June 30.
 20,377 (1908). Imray (Meister, Lucius, and Brüning). Manufacture of 1-aryl-2,4-dialkyl-halogenmethylpyrazolones. June 23.
 22,085 (1908). Newton (Bayer und Co.). Manufacture of alkyl esters of methylsuccinic acid. June 30.
 27,096 (1908). Knoll und Co. Manufacture of condensation mixtures from phenols and aldehydes. June 30.
 28,011 (1908). Riechert. Production of hydrogen iodide and hydrogen bromide addition compounds of lecithin. June 30.
 2020 (1909). Fritzsche und Co. Manufacture of the *n*-propyl ester of *p*-nitro- and *p*-amino-benzoic acid. June 23.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

14,406. James (Cie. Gén. des Phonographes, Cinématographes, et Appar. de Précision). Process for obtaining photographs in colours.* June 19.
 14,502. Kogel. Preparation of photographic prints.* June 21.
 14,824. James (Cie. Gén. des Phonographes, Cinématographes, et Appar. de Précision). Colouring photographic prints by previously toning.* June 24.

XXII.—EXPLOSIVES, MATCHES, &c.

COMPLETE SPECIFICATION ACCEPTED.

15,916 (1908). Kilburn (Pieper). Explosives. June 23

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THE SPONTANEOUS HEATING OF COAL. PARTICULARLY DURING SHIPMENT.

BY RICHARD THRELFALL, F.R.S.

The literature of the subject of Spontaneous Heating of Coal is voluminous, and I do not expect to be able to do more than bring together some of the results obtained by the chief investigators of the matter. An index to the literature appears as an appendix to the Report of the N.S.W. Royal Commission, 1896, but what I shall have to say has already been more or less published in the reports of two Royal Commissions which sat at Sydney, N.S.W., from 1896 to 1900, with both of which I was connected, and in a Board of Trade (Marine Department) Paper No. 110 in the matter of the damage by fire sustained by the ship "Walter H. Wilson," the technical part of which paper was written by me. In these contributions a great many administrative matters are discussed, and a good deal of very human evidence is considered—so that the scientific side of the questions involved is not the most prominent. The problem of spontaneous heating is, however, in its general form merely a question of physics and chemistry, and it is possible to condense the treatment somewhat by regarding the matter purely from this standpoint.

Observations which have been made on the large scale of the firing of mines, of heaps of coal, and of coal-laden ships will then form an interesting commentary on the deductions which may be arrived at on purely scientific grounds. Coal may be considered from many points of view, but the most instructive way of looking at it for our present purpose is from the point of view of its origin in plant constituents. It thus appears substantially as a condensation product of bodies of the cellulose class mixed with impure clay and sand—and with secondary products such as pyrites or more usually marcasite. It is instructive to recall the fact that decacylene or trinaphthalenebenzene, $C_{36}H_{18}$, described by Rehlander (Ber., 1903, 36, 1553) Dziewonsky (Ber., 1903, 36, 962) contains only 4 per cent. of hydrogen, which is not more than is commonly present in coke and coal. It is tempting, therefore, to regard all cokes in the way suggested by Dziewonsky, viz.: as very advanced condensation compounds, and Dziewonsky's suggestion might probably be extended with some modification to coals themselves.

There is an almost or quite unbroken series of bodies starting from wood—passing through peat and lignite to gas coals, and finally to anthracite, with progressive condensation. The degree to which this condensation has been carried can be roughly tested by distillation up to a red heat, the carbon so removed being commonly referred to as "volatile carbon" in contradistinction to the so-called "fixed carbon" remaining in the coke. The further the process of coal formation has proceeded the larger is the proportion (roughly speaking) of "fixed carbon." I need hardly say that both these terms, though having a fairly well defined analytical meaning, only indicate in a rough way the degree to which condensation has attained. However it has been pointed out by Trémy and by Fayol (Bulletin de la Société de l'Industrie Minérale, 8 (1879)).—and is indeed common knowledge, that the stability of coal in presence of oxidising reagents (i.e., nitric acid and hypochlorites) increases as we pass from lignites towards anthracite. Fayol classifies coals in order of inflammability, and naturally places lignite at one end of the series and anthracite at the other, both from tests by direct ignition of samples by flame and also by noting the temperature at which the coal in powder ignited in a stream of air.

One of the most important investigations which have been made in the laboratory on the oxidation of coal by air, is due to Dr. E. Richters—chemist in the Mining School of Waldenburg, whose first paper was published in "Dingler's Polytechnisches Journal," 190, Dec., 1868, and continued in Vols. 193 and 195. Translations of these papers are published in extenso in The Report of the N.S.W. Commission on Coal Cargoes No. 1, 1897. Richters was not the earliest investigator—important experiments having been previously made by "Fleck, Stein, Grundmann, Varrentrapp, Sauerwein and others," to quote the beginning of his first paper.

The investigation which forms the subject-matter of the paper consists in heating powdered coal, of the coking variety, from a mine at Waldenburg, for some hours in a slow stream of dry air free from carbon dioxide. The temperature employed was about 200° C. The following is a typical analysis showing the effect of this treatment when the heating was continued for 10 hours at 190° C., and the coal increased in weight by 4.21 per cent.:

	Coal dried in the desiccator. Weight 2 grms.	Heated coal.	104.21 parts by weight of the heated coal, contained, consequently:
	per cent.	per cent.	parts.
Carbon	86.82	82.19	85.65
Hydrogen	4.26	3.38	3.52
Oxygen and nitrogen	6.40	11.96	12.47
Ash	2.52	2.47	2.57
			104.21

One hundred grms. of coal accordingly lost by heating 0.74 grm. of hydrogen and 1.17 grms. of carbon. On the other hand, it gained 6.07 grms. of oxygen. The water which made its appearance in the calcium chloride tube weighed 0.118 grms., corresponding to .66 per cent. of hydrogen. The increase in weight of the soda lime tube was 0.092 grms., corresponding to 1.25 per cent. of carbon. The result of this experiment is to show that by heating the coal in air there is complete oxidation of the hydrogen and carbon which it loses.

From this and six similar experiments Richters remarks, "If we heat at a temperature of from 180° to 200° C. coal in powder, which has been previously dried in a desiccator until its weight becomes constant, an increase in weight soon becomes apparent. For instance, according to the experiments which I have hitherto made, after heating for 12 hours the weight may increase by several per cent.; in 20 hours the increase of weight has reached its maximum, and any further heating then produces a diminution in weight. Coal which has gained in weight resembles unheated coal in little more than in appearance. The differences between heated and unheated coal are:—(1) The heated coal has a greater specific gravity than the unheated; (2) the chemical constitution is different; (3) when heated to a red heat, it behaves differently from ordinary coal; (4) coal, which has been heated, abstracts moisture from the atmosphere much more freely than the normal variety."

Richters' second paper (Dingler, 193, p. 51, July, 1869) contains an account of the absorption of oxygen by coal at temperatures between 15° and 21° C., each experiment lasting a week to ten days. The result is summed up by Richters in the words: "So much, however, follows from my observations with full certainty, namely, that perfectly dry coal, as well as air-dried coal, is able to absorb oxygen without exhaling carbon dioxide, both from dry air and from air saturated with water vapour. I shall show in another communication that in this behaviour of coal we have the key to the explanation of a whole series of phenomena, which without this key can hardly be explained. I must not omit to draw attention, however, to an objection which may be raised against the above conclusion, namely, that the oxygen is absorbed not by the coal itself, but by the pyrites which is present with it. If we calculate the total ash content in sulphur of the coal as if it were ferric sulphide, we find that the coal from the Carl seam contains .31 per cent., from the Robert seam

0.42 per cent., and from the Jacob seam .36 per cent. of pyrites. These coals, therefore, are extraordinarily poor in pyrites. Moreover, pyrites is quite unaltered in dry air. In moist air, however, it does absorb a certain quantity of oxygen, but in very small proportions, so that if we mix an indifferent substance—for instance, quartz sand—with the pyrites, so as to make a mixture having the same pyrites content as the above-mentioned coals, it appeared that, in the first case, no oxygen was absorbed and in the second only a very small quantity, even when the mixture was left for a very long time with a measured volume of air."

This memoir then deals with the action of oxidising agents upon coal and charcoal, with the result that charcoal is found to react very similarly to coal.

In the next paper (Dingler, 1870, 195, 315) Richters sums up the results of his investigations of the subject. His note on the absorption of oxygen and carbonic acid may be given verbatim, as its importance cannot be overstated: "Coal absorbs carbon dioxide with the greatest readiness. The volume of this gas, which is taken up in a given time, is often greater than three times the volume of oxygen which could be taken up. Samples of coal whose absorptive power for oxygen has almost vanished, so much so that 20 grms. will only take up about 1 cub. centimetre of oxygen, will absorb in a few hours at least their own volume of carbon dioxide. If a sample of coal saturated with carbon dioxide is brought into contact in a closed space with atmospheric air, we find at first an increment of volume as if the carbon dioxide was given off. Soon, however, the volume again begins to diminish. If, at the same time, a small bulb containing caustic potash is introduced in the absorption tube, or if the sides of the latter are moistened with a solution of caustic potash, the absorption of oxygen goes on very quickly, as does the separation of the carbon dioxide, which of course forms a compound with the caustic potash. If we leave samples of coal saturated with carbon dioxide for 36 hours under the receiver of an air pump exhausted to 2 ins. of mercury, the greater portion, but not all, of the absorbed carbon dioxide is given off. If a sample of coal which has been so treated is then saturated with moisture and again put into an absorption tube, it begins to take up oxygen with the same avidity as when it was freshly prepared, and this whether any potash is present or not. If potash is present, however, we soon discover that a certain quantity of carbon dioxide has been liberated, which shows that the absorption of oxygen is at first accompanied by a separation of carbon dioxide, and that this carbon dioxide will again be taken up by the coal in the absence of any other substance capable of absorbing it.

"If coal which has been saturated with carbon dioxide is boiled for half an hour in water and is then air-dried, so that it remains saturated with hygroscopic moisture, it is found to have recovered its original absorptive properties.

"Coal which has been exposed for a long time to the air, until it has lost its power of absorbing oxygen, behaves in a completely different manner when the foregoing experiments are performed upon it. For instance, when exposed under the receiver of an air-pump it does not by any means recover its original power of absorption, though this power is still partly restored by boiling out with water. Carbon dioxide is either not absorbed at all by such coal, or in only very small proportions."

The question as to the effect of keeping coal for a considerable time at a temperature of 70°–80° C. is then approached by heating samples of dried coal for 14 days at the temperature in question. The change occurring is exhibited by six analyses, of which the following are typical:—

	Before heating.	After heating.
	per cent.	per cent.
Carbon	81.99	81.07
Hydrogen	4.92	4.71
Oxygen and nitrogen	10.19	11.32
Ash	2.90	2.90
	100.00	100.00

It is not stated which of the numbers is estimated by difference.

The calorific value of the coal was reduced from 8084 to 7842 (calories per (German) pound). The coking power (scale not defined) was reduced from 2 to 1.6.

In regard to the weathering of coal as affected by moisture, reference is made to some experiments by Thompson, the results of which are not confirmed by Richters, but the effect of moisture on the weathering on the large scale is not investigated. The following remark is, however, of importance: "If we take two tubes, and into one of them introduce air-dried, and into the other moist coal, both being freshly won, the first absorbs oxygen much more rapidly than the second. If, in addition, small bulbs containing fused chloride of calcium are introduced alongside the dry sample of coal so that the coal gets gradually drier, the intensity of the absorption of oxygen becomes greater. The same is the case if the coal has been dried for a day over sulphuric acid, although during this process a very considerable quantity of oxygen must certainly have been taken up." This experiment is more decisive against the theory that the oxidation observed was due to pyrites and not to coal, than the one previously mentioned, as pyrites requires water for its oxidation. Richters does not appear to have tested the point by analysing the oxidised coal for sulphuric acid or sulphates.

The influence of pyrites on the absorption of oxygen at ordinary temperatures was next tested by Richters, both when the samples were wet and when they were dry—with the result that the coal containing 3.04 per cent. sulphur absorbed oxygen rather more quickly wet than dry—the reverse of the effect with coal containing less sulphur; the difference was, however, very small.

In Dingler's Polyt. J., 195, 449, Richters applies his results to a discussion of the spontaneous heating of coal. As the ground was traversed a little later by Fayol, who experimented on a much larger scale, we need not do more than note the main features of the paper. It was concluded that pyrites can have little or no effect on the spontaneous heating of the coal examined, because the 1.01 per cent. of pyrites could only heat the coal to 72° C. if no heat escaped, and if the heat of oxidation was equal to the sum of the heats of oxidation of the iron and sulphur regarded as free. On the other hand, the heat due to the oxidation of the coal by the oxygen absorbed in 12 days was shown to be much greater. This is, of course, clear from the figures given for the calorific power before and after heating to 70°–80° C., the effect of the higher temperature being merely to accelerate the rate of absorption of oxygen. The heat evolved during 12 days' oxidation at 70°–80° C. was calculated by Richters to be sufficient to raise the temperature of the coal to 1100° C.

The second classic on the subject of the spontaneous combustion of coal is entitled "Études sur l'altération et la combustion spontanée de la houille exposée à l'air," by Henri Fayol, Ingénieur, Directeur des Houillères de Commentry et de Montvicq. This was published originally in the "Bulletin de la Société de l'Industrie Minérale, Second Series, Vol. 8, 3rd part, 1879 (Dunod, Quai des Augustins 49, Paris). The separate copy of this paper kindly sent to me by M. Fayol in 1899 forms a volume of 260 pages, and is certainly the finest example of a published technical investigation I have ever seen or heard of. It should be read by every student in order that he may learn how worthy a subject technical research can be if approached in a critical and scientific spirit. The colliery of Commentry is situated in the North of France, near the Belgian frontier, and produces a bituminous coal burning with a long flame, much used for gas-making. The fracture is rhombohedral—the ash varies from 0.5 to 15 per cent., with an average of about 7 per cent.—even small samples contain very variable amounts of ash in different parts. The other impurities are clay, gypsum—pyrites spread through the mass in flakes—rarely in crystals. The average pyrites content is 1 per cent., but special samples may contain up to 5 per cent. The slack before washing contains 13 per cent. of ash, reduced by washing to 7 per cent.—and when coked in a Belgian oven gives 22 per cent. to 63 per cent. of hard bright coke, which is used in blast

urnaces. The installation of the coke ovens enabled Fayol to keep large quantities of coal at various specified temperatures for long periods of time. In addition to the coal of Commentry, 24 other kinds of coal were more or less investigated, ranging from anthracite to lignite, and from lignite to boghead coal from Scotland.

The first series of researches may be regarded as an extension of Richters' experiments, but the quantities of coal employed—necessitated by the condition of having enough to start with to give perhaps 50 samples, amounted to several kilogrammes. The phenomena investigated as functions of time, at each temperature, and in the presence of air were:—1. Weight. 2. Yield of coke. 3. Coking power, referred to an arbitrary scale in which 0 denotes a coal cohering to a hard solid ingot. 4. Yield of gas on subsequent distillation under fixed conditions, per 100 grms. of the exposed coal. 5. Illuminating power of gas produced.

FIG. 1.

Commentry coal in powder. Variation of weight.
Time of exposure to the air in days.

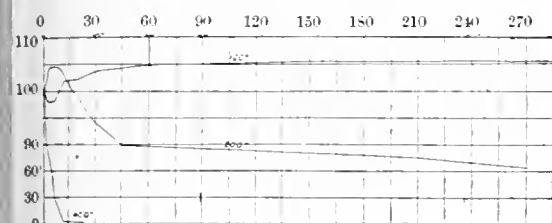
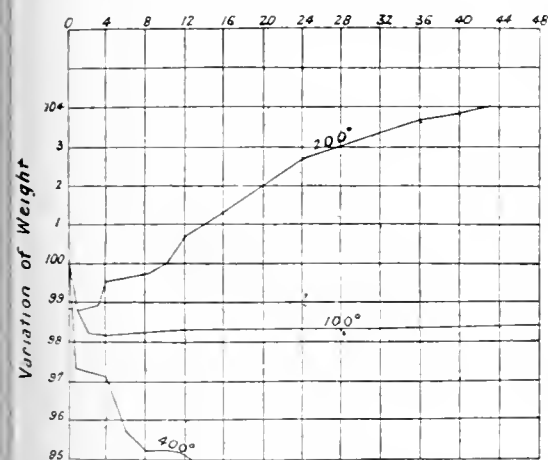


FIG. 2.

Commentry coal in powder. Variation of weight.
Time of exposure to the air in hours.

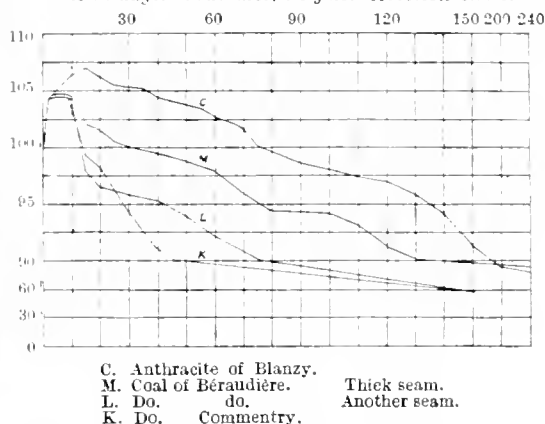


The general result as shown by the curves is that the weight increases or decreases at first according to the temperature, but after a long period, when the temperature is over 100° C., the weight tends to fall.

The yield of coke (which rises slightly at first) and the coking power tend to fall off after long periods of exposure; the yield of gas per 100 grms. of the material is not much affected after long periods, but the illuminating power falls off rapidly. There are considerable differences according to the kind of coal employed, but it is impossible to give an adequate idea of this investigation by a short abstract, as it comprised 23 kinds of fuel, each in at least two sizes, and the observations extended over three hundred days, the observations at first being at intervals of a few hours at most. The results are set out on 175 sets of curves showing the behaviour of the samples for each of the five properties enumerated and at six temperatures, viz., 25°, 50°, 75°, 100°, 150°, and 200°, and, while the

FIG. 3.

Various coals in powder exposed to the air at 200° C.
Time in days. Ordinates, weights. Abscissæ times.

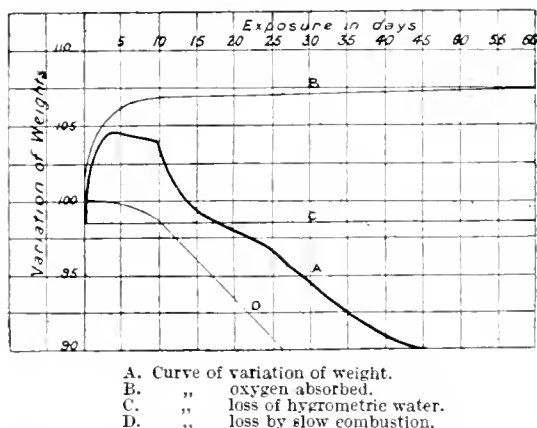


coal would stand it, at 400° C. The whole forms, to the best of my knowledge, the most complete set of data ever scientifically co-ordinated for the solution of a single technical problem.

An attempt was then made to analyse the curves of variation of weight with the following result:—

FIG. 4.

Commentry coal in powder exposed to air at 200°. Components of the curve of variation of weight.



and it was shown that the contents of iron, sulphur, phosphorus, &c., could not in any way account for the magnitude of the variations noted.

The inflammability of coal after exposure to various temperatures was tested by trying whether fragments could be lighted by a candle, and also by heating samples of various grades of division in the stoves till they took fire. Both sets of experiments led to the same result, viz., that the inflammability is highest with lignite, and passes through gas coal and coking coal to anthracite in the order named, but the differences between the gas and coking coals were not great. This is a point of some importance in connection with spontaneous fires, for there has, I believe, been a tendency to make too much of supposed great differences in the natural tendency of coals to inflame spontaneously.

Summing up, Fayol declares that the necessary and sufficient condition to preserve coal unaltered in storage is to keep it from the action of the air, and points out that this can be most thoroughly done by placing it in air tight bins, or immersing it in water. As either of these methods is practically impossible on account of the cost, the next best thing is to pile the slack (which is chiefly in question) in heaps as deep as possible, bearing the

liability to spontaneous fires in mind. At Commentry it is possible to keep the slack in heaps 2 m. deep without starting fires.

Having established the principles, Fayol then proceeded to consider the phenomenon of spontaneous fires in detail, both by investigating the conditions under which they occur in heaps of coal in the air and by experiments on considerable quantities of coal exposed to a series of graded temperatures.

The facts established with regard to heaps of coal in the air are summed up by Fayol as follows—at all events as regards the Commentry coal:—

1. Large pieces and smaller ones which will not pass a sieve of 20 mm. diameter do not get spontaneously hot. No appreciable heating has ever taken place in more than 200 heaps of such coal of from 3 to 6 m. in height.

2. The slack passing a sieve of 20 mm. diameter heats and fires spontaneously whenever it is in large enough heaps. The raw slack is rather more inflammable than it is after it has been washed.

3. The through coal as raised behaves like the slack.

4. The coal in fine powder coming from the slack washing is a little less inflammable than the screened slack. When this powder contains much clay it is less inflammable. This is also true if a large quantity of pyrites is present.

5. The carbonaceous schists, obtained by picking out, fire like slack.

6. The schists resulting from the washing contain much clay and are much less inflammable.

7. Heaps formed of inflammable coal or schist built up very slowly by successive layers of about 1 m. depth do not fire whatever the final volume may be.

There is a direct relation between the liability to spontaneous heating and the height and volume of the heap in which it occurs. If the heap is small the temperature rises to a certain point, after which it becomes stationary, and then falls again. There have been no cases of spontaneous fires in heaps of less than 2 m. height—on the other hand, when the height passes 4 m. spontaneous combustion always occurs.

The N.S.W. Commission came across and verified for themselves a similar piece of evidence in regard to the influence of the depth of the heap. The engineer of the Australian Gas Light Co., of Sydney, N.S.W., drew the attention of the Commission to a fact he had noticed in connection with the coal stores belonging to his company. In one of these stores the coal was never more than 14 ft. 6 in. deep, in the other it was 20 ft. deep. The coal stored at both stores was exactly the same. The heap 14 ft. 6 in. deep never fired, but the 20 ft. heap was always hot and generally on fire at one or more points.

Fayol has studied experimental heaps of Commentry slack in a most thorough manner. One experiment is so thorough and conclusive that we may profitably consider it in greater detail. A heap of newly-won slack was thrown up, having the following dimensions:—Length, 40 m. (131 ft.); height, tapering from 6 m. (20 ft. nearly) to nothing; breadth, at the top 1 m. (3 ft. 3½ in.), at the bottom depending on how the coal tailed out.

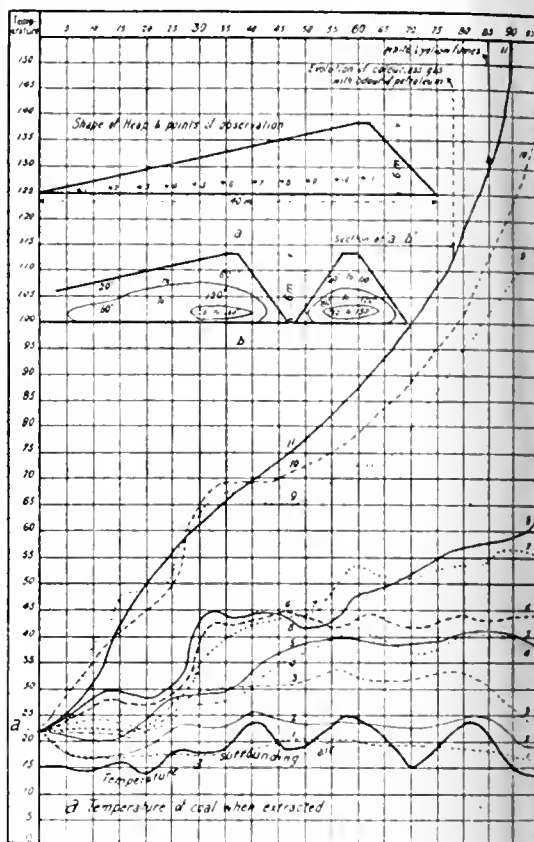
The temperature was tested at about ten separate points every day during ninety days, and the results are set forth in the diagram 4 (copied from Fayol's paper), and referring to Commentry slack. It was ascertained that the highest temperatures occurred in the median plane, parallel to the length of the heap; and the temperature was therefore tested in this plane.

Fayol's conclusions are as follows:—1. Where the layer of slack is thin there is no rise of temperature. 2. The temperature at any time increases with the height of the heap, i.e., as we pass along the heap from the lowest to the highest points there is a continuous rise of temperature in the coal. 3. At a height of about 3 to 4 m. (10–13 ft.) the temperature rises steadily at first, and finally falls without ever passing 60° to 70° C. (140° to 158° F.). 4. At or about a height of 4 m. (13 ft.) the temperature continues to rise. During the third month, or thereabout, steam begins to rise from that part of the heap whose height is greater than 4 m.; this is followed by the appearance of a colourless gas, smelling strongly

Diagram No. 5.

Rise of temperature in heat of Small Coal exposed to atmospheric influence.

Time of Exposure to the Air (in days).



Explanatory Note.

The sections show the temperature of the coal at various points in the heap after standing for 90 days in the air.

The curves illustrate the rise of temperature at the points indicated by the numbers, whose situation can be ascertained from the section.

of petroleum; and within a few days thereafter smoke is seen to issue from the sides of the heap. The point at which the smoke is first observed is generally half-way up the side of the heap, at the place where the heap is highest. At the moment when this appears, sections of the heap along the median line, and perpendicular to it at the highest point, disclose the existence of three zones:—Firstly—A lower central zone, where temperature lies between 120° and 150° C. (248° F. and 302° F.). Secondly—A zone surrounding the former, but at a considerably lower temperature. Thirdly—The exterior zone, which is approximately at the temperature of the air.

If the heap is cut across, so as to expose the core of the first zone, yellow and white fumes are rapidly given off; the temperature rises quickly to 200° C.—300° C. (392°—572° F.), and ignition takes place.

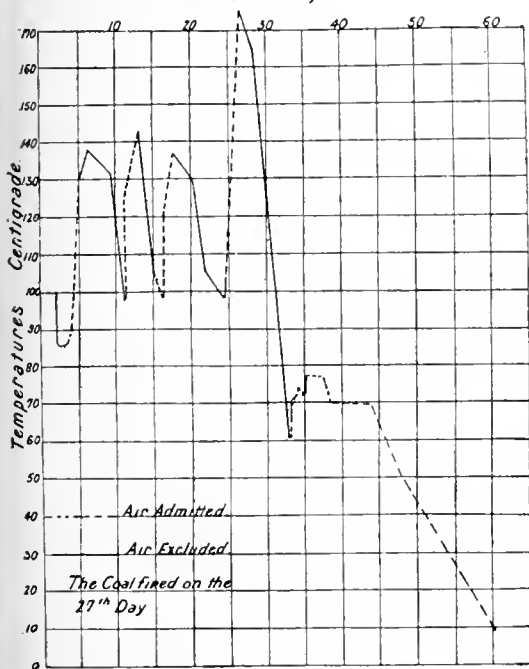
From whatever part of the mine the coal was taken, whatever was its ash content, and the nature of the ash, the coal heaped in the open air underwent the same thermal changes, which followed an approximately constant law. Atmospheric influences, hot and cold, drought and damp, had either no influence on the progress of events, or an influence too small to be observed; and the same remark applied to the impurities in the coal."

Another particularly instructive experiment by M. Fayol was the following:—A large bell jar (like a small gasometer) working into an annular water-pit was provided. The bell was 2.15 metres (6 ft. 7 in.) in diameter, and 1.2 metres (4 ft.) high. The coal was heaped up on the ground below the bell, and by raising the latter air was admitted, while by lowering it into the pit air was shut off. Air could also be let in, in any desired quantity, by opening air-holes near the bottom and top of the bell. In this manner the dependence of the temperature changes on the air supply was ascertained. In these tests five representative kinds of coal were employed, and each was tested under the bell after being initially heated to 75°, 100°, 150°, and 200° C. The general result of the experiments was as follows:—1. If the bell is closed the coal gradually cools to the air temperature. 2. If the air-holes are slightly opened the temperature rises, and spontaneous combustion occurs. 3. By alternately opening and shutting the air-holes the temperature can be caused to rise and fall.

FIG. 6.

Coal alternately exposed to and protected from the action of the air.

Time in days



By adjusting the air-holes properly it is very easy to get the coal to fire.

With regard to the effect of the size of the particles the result is so important that it had better appear in M. Fayol's own words:—"These experiments succeed easily with coal in grains deprived of dust, fairly easily with larger grains, and with greater difficulty with ordinary slack. In the last case the fine coal-powder which fills up the space between the fragments offers an obstacle to the penetration of the air." By regulating the air supply of the bell it is easy to cause coal to fire which would not do so if exposed at the same initial temperature to free air.

Finally, Fayol made similar experiments on a large number of coals, though on a smaller scale, by placing the coal in air at various temperatures. In general, three sizes of samples were tested:—1. 50 grms. in a crucible. 2. A sample in a brass box measuring 12 by 12 by 3 c.m. (4.7 in. by 4.7 in. by 1.2 in.). 3. A sample in a cubical brass box measuring 12 c.m. on the side. From these experiments Fayol gives the relative inflam-

mability of coals when exposed to hot air, i.e., at temperatures of 75°, 100°, 150°, and 200° C. (167°, 212°, 302°, 392°, and 752° F.):—Lignite (most inflammable), gas coal, coking coal, anthracite (least inflammable).

The general conclusions from the very large number of tests made are as follows:—These conclusions refer to samples of coal placed in hot air, in greater and smaller masses, and in various states of fineness of division:—1. Combustion takes place more rapidly the higher the temperature to which the coal is exposed. 2. At 400° C. (752° F.) all the samples fired—anthracite after some little time, lignite at once. 3. At 200° C. (392° F.) anthracite only fired when in grains, and bituminous coal only in the larger samples. 4. At 150° C. (302° F.) lignite in powder was the only one which took fire when exposed in the masses experimented upon.

The effect of the state of division of the coal was also tested in a similar manner with interesting results. In general, the finer the powder to which the coal was reduced the more rapidly did it take fire; and a single fragment of slack did not fire so readily as a number of fragments placed together. With regard to the temperature at which the coal took fire, the following approximate results were obtained, referring to coal in powder:—

	° C.	° F.
Lignite	150	= 302
Gas coal	200	= 392
Coking coal	250	= 482
Anthracite	above 300	= above 372

Too much stress must not be laid upon these exact values, because small differences in the conduct of the experiment lead to considerable variation in the results.

In order to study the progress of spontaneous heating in small samples of coal, the coal was raised to any desired temperature, and then exposed to the air in heaps 1.5 m. (say 4 feet) high, and containing 4 cubic metres (or 5.2 cubic yards). The conclusions from the tests were as follows:—1. If the heap was made in the open air with coal which had been previously heated to a little above 100° C. (212° F.) fire generally broke out in the course of a few days. 2. When the initial temperature lay between 60° and 100° C. (140° and 212° F.) there was sometimes a rise and sometimes a fall in temperature. 3. Below 60° C. (140° F.) the coal always cooled down to the air temperature.

A study of the circumstances leading to spontaneous combustion was then made by Fayol on the supposed influence of moisture in promoting spontaneous combustion. Fayol sums up his experience as follows:—"The influence of wet weather on heaps of coal has not been sufficiently marked to be observable."

On the other hand, there is no doubt a floating opinion among people accustomed to the handling of coal to the effect that moisture does increase the tendency to spontaneous combustion. In a letter to the English Commission in 1876, Mr. Poole, Inspector of Mines, Nova Scotia, makes the following remark:—"Heat has been observed in piles of slack coal that have been accumulated during the summer for the use of engines during the winter, when the season has been showery, but not when it has been dry." This evidence is very direct and absolutely opposed to Fayol's experience, and a good deal of similar evidence was tendered to the English Commission: for instance, out of 26 answers to questions as to the effect of moisture, every reply was to the effect that moisture was a source of danger. An examination of the reported evidence shows that in every case (with the above exception) this was a matter of impression merely. Cross-examination of a number of witnesses before the New South Wales Commission, who held this opinion, convinced me that it was in general held on very slender grounds; and two cases in which rain had apparently increased the tendency of the coal to heat were otherwise explained. Nevertheless, if the coal contains pyrites in any quantity this substance will be decomposed by air and moisture under circumstances under which it would not be decomposed by either agent separately. Since the products of decomposition of pyrites tend to crystallise and in general occupy a greater volume than the pyrites itself, it is clear that the "weathering" of pyrites may have an

indirect influence favouring spontaneous combustion, by causing the coal to break up into small fragments, which, as we have seen, heat more readily than larger ones.

Fayol made some experiments on the subject by building heaps of coal containing 2 to 12 cubic metres, placing them under cover, and watering some of them, while he kept the others dry. In no case did the rise of temperature exceed 60° C. These experiments leave much to be desired, (1) because they were only made on one class of coal low in pyrites; (2) since the temperature of the heaps never rose above 60° C., it is impossible to say how near they were to the critical condition above referred to; and (3) Fayol is careful to guard himself against any generalization of the result obtained.

The chief bugbear in connection with the spontaneous heating of coal has from the beginning been the question as to what part, if any, is taken by pyrites, and this must be considered as well as we can before a general theory of the phenomenon can be formulated. The stability of iron disulphide as it occurs in coal is probably a very variable quantity, and it would possibly be worth while to make a comparative study of the matter so as to obtain precise data which at present are lacking. We have already seen that neither Richters nor Fayol were able to detect any effect as regards the oxidation of their respective coals by their respective samples of pyrites, but it may be argued that, had they happened to use the coal brasses of South Staffordshire for instance, the results would have been different. One point to be noticed is that the quantity of water required for the decomposition of iron disulphide is not negligible. The equation, $2\text{FeS}_2 + 2\text{H}_2\text{O} + 7\text{O}_2 = 2\text{FeSO}_4 + 2\text{H}_2\text{SO}_4$, requires that water shall be present to the extent of 15 per cent. of the weight of the pyrites, and the sulphuric acid would also take up a considerable quantity. I have been informed by Mr. A. E. Savage, a well-known Australian metallurgist and a member of the Second N.S.W. Commission on the Spontaneous Combustion of Coal, that at the Mootooroo mine in South Australia there was a form of pyrites which rapidly decomposed, forming a pungent dust even in the exceptionally dry air of that district. It is difficult to understand how this could happen unless some other base was present to take up the excess of sulphuric acid. It is easy to see, however, on the other hand that if a trace of sulphuric acid once did get formed it would collect water to keep the reaction going out of even very dry air. No doubt the pyrites in question was a marcasite, and the same observer at the same time reminded me that the late Mr. Cosmo Newbery of Melbourne experimented on the large scale for years with the auriferous mundie (pyrite) of the Victorian quartz reefs in order to try to get it to weather so that the gold might be extracted—but never succeeded in making it break up. Of course, it is well known and stated in all the books that the cubical form of pyrites is much more stable than the rhombic—or marcasite—form; but even among marcasites themselves there are great differences in stability—the fibrous brasses, for instance, being possibly less stable than the lamellæ of pyrites found in most coals.

In regard to the heat of oxidation of pyrites the following calculation is of some interest for our purpose; it is applied to one of Richters' experiments the analytical data of which are available. Temperature of oxidation, 190° C.; time, 10 hours in a slow stream of air; loss of hydrogen, 0.66 per cent., and of carbon 1.25 per cent., on the weight of the coal. I calculate that per 100 grms. of coal this would mean at the very least the liberation of about 30 kilogram calories, or say 15–16 kilogram calories per 1 per cent. oxidation, and probably three or four times as much. If the coal contained 1 per cent. of pyrites, we should only obtain at the outside 2.7 kilogram calories from its oxidation if the sulphuric acid remained free. This might perhaps be increased to 3.5 kilogram calories if the acid combined with some base. If we take the specific heat of coal at 0.2, then the oxidation of 1 per cent. of its weight of pyrites might give enough heat to raise its temperature from 0° to 175°, while the oxidation of the carbon and hydrogen would give a temperature rise of 750° at least, and probably several times this amount; so that, weight for weight,

the oxidation of the coal is vastly more effective than the oxidation of the pyrites.

I have attempted to obtain some data for the effective specific heat of air dry coal, by crushing it till the largest remaining fragments measured about 2 mm. on the side and then heating it to about 80° C. in samples of from one to two pounds, and mixing it with about its own weight of water at a lower temperature. The specific heat appeared to vary from 0.35 to 0.45 according to the length of time occupied in heating the coal powder to the upper temperature. The experiment is not easy on account of the low heat conductivity of powdered coal; the powder must be kept well stirred if anything like a correct estimate of its temperature is to be obtained. The experiments were only rough, and I do not insist upon them, but I think they show that the effective specific heat of coal still containing moisture is near 0.4 than 0.2.

Given a mixture of coal and pyrites, both oxidisable in air and both reactions being accompanied by an evolution of heat, it is of course impossible to demonstrate that a spontaneous fire in such a mixture should not have been assisted by the presence of the pyrites. Some considerations appearing below show, however, that it is in general unlikely that the presence or absence of pyrites has any appreciable influence. The question of the action of pyrites in promoting spontaneous combustion can, however, be easily examined experimentally for any given coal and under any prescribed conditions. To do this it is only necessary to make a heap big enough to heat spontaneously and as the heating progresses to follow by analysis—conveniently by sulphuric acid estimations on properly chosen samples of the coal—the connection (if any) between the decomposition of the pyrites and the rise of temperature of the coal. If it is worth while the heap can be surrounded by walls of heat insulating material and the heat generated could possibly be estimated by making suitable allowances for the loss by conduction and by air currents, and this heat can be compared with the thermal change incident on the decomposition of the pyrites as revealed by analysis. In an enclosure, with air inlets and outlets which can be regulated, the variation of the percentage of carbonic acid gas in the air at the exit holes can also be followed—bearing in mind Richters' data on the subject.

If a trial cannot be made—and except in special circumstances it would rarely be worth while to make one—we have to fall back on general principles, and from these it appears that coal cargoes seldom or never fire through the action of pyrites, and for the following reasons:—
1. The cases of spontaneous firing under experimental conditions observed by Fayol were found to be independent of the quantity of pyrites present. 2. The laboratory experiments of Richters', so far as they go, lead to the same result—though an entirely different coal was used. 3. Experience shows that pyrites is generally stable in air, i.e., unless liquid water is present. But it will be shown that spontaneous fires have often, indeed generally, occurred in cargoes of dry warm coal. 4. No connection has ever been traced between the pyrites content of coal and the frequency of fires. The N.S.W. Commission No. 1 made every effort to bring such an effect to light assuming it to exist, and did not succeed in doing so—in fact, the data were such as to indicate that no relation existed. 5. In Commentry coal, proved by Fayol to fire as a result of direct oxidation, it was found that a mixture of fragments and dust was the most dangerous, i.e., would fire sooner under favourable conditions than any other screen gradings of the same coal. But such a mixture is formed in a coal cargo under the hatchways and nowhere else—and is produced by the breakage of the coal in loading where it is dropped down the hatchways under conditions which allow the large pieces to roll away and the dust and slack to form a heap. The N.S.W. Commission No. 1 obtained a considerable body of reliable evidence as to where fires originated in coal cargoes, and thus discovered that they invariably started under one of the hatchways. Similar evidence convinced the Royal Commission of 1876 of the same fact. The spontaneous heating of coal at sea therefore occurs under

actly the same physical conditions as determined flammation in Fayol's experiments—and in the latter influence of pyrites was inappreciable. It is difficult believe, therefore, that pyrites can have much effect one of these entirely parallel cases when its influence known to have been negligible in the other. 6. The ay in which the temperature rises, i.e., the temperature me curve of a spontaneous fire at sea has been often, ough roughly, ascertained by means of thermometers. ayol and the Second N.S.W. Commission, however, ve recorded the same phenomenon in the experiments i heaps, and the general progress of the heating is the me in both cases. It would be strange if one referred pyrites and the other to the direct oxidation of coal. Fayol states that "the influence of wet weather on eaps of coal has not been sufficiently marked to be ervable," but if pyrites of all ordinary varieties had me in question as a source of heating there is no doubt at wet weather would have helped the heating. The .S.W. Commission No. 2 definitely proved that wetting 50 tons of coal containing 0.5 per cent. sulphur, mainly pyrites, prevented it from rising above 40°–50° C., hile 250 tons of dry coal of exactly the same kind exposed nder exactly similar circumstances rose to 135° C. in out six weeks and was only kept from firing by digging at. 8. The spoil heaps in mines, often containing a eat deal of pyrites, in some cases nearly as much pyrites coal, so far as I am informed, generally fire where ey are dry, not where they are damp. This at least as been true of the limited number of cases which have me to my notice: cases of firing in pillars also occurs here the coal is dry. 9. It was suggested by Sir nderick Abel and Dr. Percy in the memorandum preared for the Royal Commission, 1876, that pyrites ight have some influence in promoting the disintegration of the coal if the cargo was wet, and thus in preparing e mechanically for spontaneous heating. This is true, ut as fires start under hatchways where the coal is roken by impact in any case to a far higher degree than could be broken by pyrites—it is clear that the above ggestion has no real application.

Perhaps we may sum up the matter with the remark that sufficiently formidable array of evidence can be collected i favour of Richters' view as to the origin of spontaneous es to justify us in neglecting the influence of pyrites i forming a general theory of spontaneous combustion. his we may now proceed to do on the basis of Fayol's nd Richters' proof that the bituminous constituents of al oxidise in air at all temperatures, but with enormous celeration as the temperature rises. The heat liberated uring this oxidation is high (see page 762), and coal is n extremely poor conductor of heat and has an effective ecific heat which we may perhaps put at about .35. he most important of these factors is possibly the low ermal conductivity of coal. The conductivity of coal i solid slabs is very low—of the same order as wood nd paper (Landolt and Bornstein Tabellen)—but, of ourse, the effective conductivity of a heap of slack is ery much less. A witness wrote to the 1876 Commission, mentioning that snow that had fallen while a heap of coal as being formed often lasted over the following summer— nd I have been informed by a gentleman who was resent when this paper was read, that a case has been nown of snow lasting under a heap of coal for two years— ut in neither case was the size of heap and depth of al stated. My own experience, moreover, has convinced e that a heap of slack has an extremely small thermal onductivity. If, therefore, a heap of coal be exposed o the air at any temperature it must oxidise, and heat ust be generated, and moreover this heat cannot escape o any extent by conduction through the coal. The emperature time curve of the hottest part of the heap ill depend on the relation between the heat generated nd the rate at which it can be dispersed by radiation, onduction, and air convection—the last of which may e expected to be by far the most important. Unless air an penetrate the heap fast enough to bring fresh oxygen o the centre as soon as the existing supply is used up idation will stop and the heat generated will diffuse utwards. If the temperature in the heap be above

that of the air outside the heap, air will tend to circulate through the coal. If the air current is large enough or increases fast enough with rise of temperature, heat will be abstracted from the heap nearly as fast as it is formed and the temperature can only rise slowly: meanwhile the more easily oxidisable constituents in the most favourably situated places will be getting used up, or, at all events, the activity of the coal in absorbing oxygen will, as Richters, has shown, diminish. It can be foreseen therefore that in this case the temperature of the heap will rise slowly to a maximum, and then fall away as weathering progresses.

On the other hand, if the heat insulation be sufficient, and if enough air be allowed to enter the heap to supply the necessary oxygen—but not enough to act as a cooling draught—the temperature of the heap will rise faster—the oxidation proceed more rapidly and the temperature will rise continuously till the firing point is reached. It is evident that for a spontaneous fire to originate, a good many conditions must be simultaneously satisfied—indeed, it would be a most risky proceeding to attempt to produce a spontaneous fire for the purposes of a lecture demonstration unless the exact conditions had been ascertained beforehand by careful preparation. If the experiment were to be made on a cargo of coal we should have to attend in minute detail to the air supply to the coal—to the initial temperature of the coal—to its volatile carbon content—to the moisture—to the mean temperature of the air and sea during the voyage—to the size of the cargo—to its depth—to the degree to which the favourable mixture of dust and smalls accumulated under the hatchway—and to the duration of the voyage. With so many variables it would hardly be possible to arrange for two cargoes to be shipped and carried under conditions exactly similar in all respects, and yet a slight variation anywhere might determine whether the temperature would rise to a maximum and then decline, or rise indefinitely. To a superficial analysis of the conditions attending the loading and carriage of coal it might appear that some cargoes fire and others do not, capriciously—and this, in fact, was the great difficulty at the commencement of the inquiry—there was at first no clue to the mystery of why certain cargoes fired while others "loaded and carried under identical conditions" escaped. Thanks to Fayol it becomes possible to understand how small a difference existing between reported "identical conditions" is sufficient to explain why some cargoes fire and others escape.

The second N.S.W. Commission has recorded very fully the progress of spontaneous heating in two heaps of coal contained in bins which were not air-tight. The experiment was made to ascertain the exact effect which thorough wetting has on the spontaneous heating of coal, and as temperature and other observations were very fully carried out, we may make use of this investigation in order to have the facts of a spontaneous fire fairly before us. The coal was slack from the main seam at Newcastle, N.S.W., and was chosen as representing the coal of the district. At the close of the experiment, when the bins were emptied proper samples were made and the following sieve tests made:—

	Dry bin.	Wet bin.
Remained on 2-mesh sieve	30.20	36.81
Passed through 2 and stood on 4-mesh	24.49	21.76
" " 4 " " 8 " "	24.08	23.43
" " 8 " " 10 " "	2.48	1.65
" " 10 " " 20 " "	5.60	6.10
" " 20 " " 30 " "	5.90	5.40
" " 30 " " 40 " "	3.34	2.11
" " 40 " " 50 " "	0.38	0.52
" " 50 " " 60 " "	0.44	0.26
" " 60 " " 80 " "	1.03	0.68
" " 80 " " 100 " "	1.43	0.67
" " 100 " " —	1.27	0.51
	99.80	99.90
Loss	0.20	0.10
	100.00	100.00

No. of sieve.	Diameter of square opening taken parallel to one side.	
	ins.	mm.
2	0.452	11.43
4	0.218	5.54
8	0.103	2.62
10	0.078	1.98
20	0.039	1.00
30	0.024	0.62
40	0.017	0.43
50	0.014	0.35
60	0.010	0.26
80	0.008	0.20
100	0.006	0.15

Proximate analysis of coal.	Dry bin (before heating).	Wet bin (at end of experiment).
Hygroscopic moisture	1.72	1.75
Volatile hydrocarbons	31.83	31.27
Fixed carbon	51.93	53.08
Ash	14.52 %	13.90 %
Specific gravity	100.00	100.00
Sulphur on coal, per cent. . .	1.387	1.387
	0.495	0.509
Coke	Well swollen, bright, firm.	Slightly swollen, dull, firm.
Ash	Reddish brown, flocculent.	Slight red brown, granular.

Ultimate analysis—samples as in proximate analysis.

	Dry bin.*	Wet bin.†
Carbon	68.512	69.252
Hydrogen	4.652	4.731
Oxygen and hydrogen, by difference ..	11.559	11.352
Sulphur	0.503	0.518
Ash	14.774	14.147
	100.000	100.000

* The coal as loaded into the bin contained 2.2 per cent. of moisture.

† Analysis after the coal had been dried at 100° C.

Coking tests on mixtures of coal dust and sand, graded in each case to pass 60 mesh and stand on 100 mesh sieve, were made by placing the mixture of coal and sand in a one-inch covered porcelain crucible and heating over a kerosene blast furnace for 1 hour—the bottom of the crucible being just red. The cone of coke was then placed on a table and pressed by a thin steel spatula as usual—with the result that mixtures containing over 80 per cent. of sand could not be regarded as coherent—the cones breaking down with a spatula deflection of about one-half inch.

Description of bins.

In view of the known importance of ventilation and removal of heat by atmospheric influence in connection with spontaneous heating of coal, it is necessary to describe the construction of the bins at some length.

Each bin was constructed so as to contain a cubical mass of coal, the length of each side being approximately 21 ft. The walls were constructed of old planks, averaging 6 in. wide by 1 in. thick, supported externally by a rough timber frame, well strutted to resist the outward pressure of the contained coal. The lining planks being of somewhat irregular shape, there were numerous spaces between them, which, though too small to allow coal to pass, permitted a certain amount of ventilation over the whole external vertical surface of the bins. To protect the coal from rain and sun, a flat galvanised iron roof was provided, supported on short uprights from the main frame of the bin at a height above the level top of the coal of from 4 ft. on the north-west side to 7½ ft. on the south-east side. The sides of the bins between the coal and the roof were closed with boards sufficiently to prevent the entrance of rain, but not too closely to prevent free ventilation.

The two bins were separated from one another by an air space of about 9 in. between the walls. This space was not open at the bottom or sides, and there was consequently no free circulation of air, but it was sufficient

to give good heat insulation between the two masses of coal. Two sides of the structure were entirely exposed to the weather, but on the south-east side (that on which the coolest winds prevail) it was protected by a railway embankment nearly as high as itself, and the space between it and the embankment was filled in with coke during the whole time the experiment was in progress. On the south-east side there was also a pile of coke almost as high as, and close to, the bins. It was on this side that the wet coal was situated.

The coal was filled from the railway trucks into wheelbarrows, and tipped from these directly into the bins at several points over the area of the floor. The height from which the coal fell was at first 17 ft., gradually lessening until the bins were full. The two bins were filled as nearly as possible at the same time, and as each barrowload of coal was dropped it was spread with shovels over the surface of the coal already tipped, thus avoiding, so far as possible, the separation of the fine from the coarse coal. If the coal had been tipped at one point only and not levelled, a conical heap would have been formed, down the sides of which the larger pieces of coal would have rolled fastest and accumulated at the bottom.

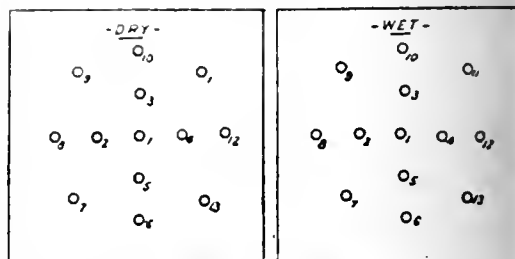
When loading the coal into the "wet" bin, a stream of fresh water from a hose was continuously played over it in such a way as to thoroughly saturate it. The quantity of water used was sufficient to cause a small stream to flow from the bottom of the bin, but not sufficient to wash out any considerable quantity of fine dust.

An experiment which I have recently made on fine slack shows that the maximum quantity of water which can be held for 12 hours by a bucket of coal—the bucket having a perforated bottom—is about 14.5 per cent. of the weight of the dry coal, or 12.7 per cent. on the mixture of coal and water. On the other hand, coal containing three-quarters of the above maximum would be described as thoroughly soaked; this would then contain about 11 per cent. of water removable by air drying at ordinary temperatures.

For the purpose of taking temperatures, 13 thin galvanised iron pipes of about 2 in. in diameter and 0.018 in. (0.457 mm.) wall thickness, were placed vertically in each bin prior to loading, and were situated as shown in the diagram.

Diagram No. 7.

Plan of Bins.



The numbers refer to the thermometer tubes.

The impact of the coal in loading slightly displaced these pipes, but not to any serious extent, except in the case of two of them—No. 3 in the dry bin and No. 5 in the wet bin—which became obstructed so as to prevent temperatures being taken below 16 and 8 ft. respectively from the surface.

It had been foreseen that this might happen, in spite of all precautions to the contrary, but we were afraid to use any but very thin pipes, since it was the object of the experiment to ascertain the distribution of temperature in a heap of coal under normal conditions, and it was therefore important that this distribution should not be affected by circumstances peculiar to the experiment. If the walls of the tubes had been thick, the vertical distribution of temperature in the tubes would have depended appreciably upon the conductivity of the tubes themselves, as well as upon the distribution natural to the coal, and the object of the experiment would not have been attained.

Methods and records of observations.

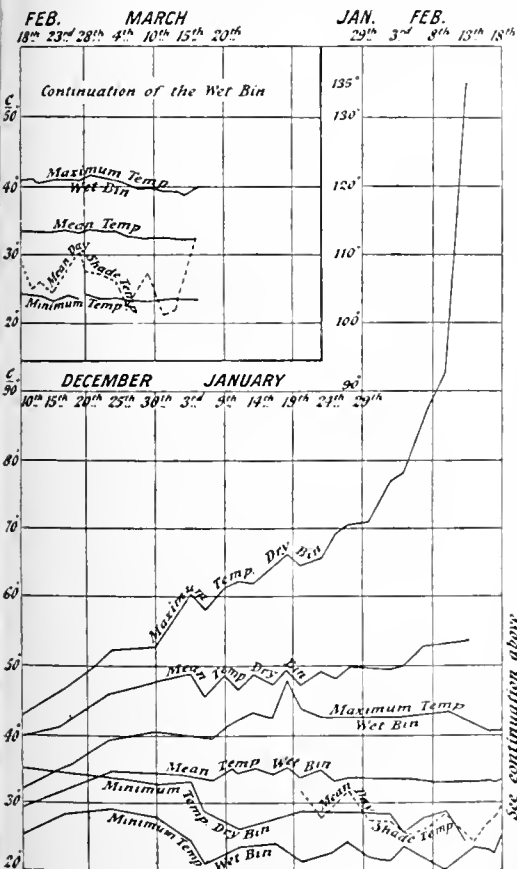
The bins being full on Dec. 2nd, 1908, the first temperature-reading was taken on Dec. 10th by centigrade thermometer. The subsequent readings were taken at intervals shown by the temperature records. The temperatures recorded are the mean of two and sometimes three readings at each point. The reason for taking more than one reading was not because there was any extensive variation, but more as a check on the accuracy of the observer. The observed readings were corrected to the true temperatures by a table of corrections supplied with the thermometers from the Physical Laboratory of the Sydney University. The corrections resulted from a comparison of the thermometers used with the standards, whose changes had been studied. The thermometers were enclosed in copper cases, both for the protection of the instruments and to provide a mass of metal to retard variation in temperature while the thermometer was being drawn to the top of the tubes for observation. Experiments were made to determine the fall of temperature in the time usually required in pulling the thermometer to the top of the tube, but this being found inappreciable, no correction was applied.

The temperatures were taken at two alternate sets of levels on alternate days, as is shown by the temperature records, until towards the close of the experiment, this being rendered necessary by the inability of the observer employed to take the temperatures at all the points of observation in any one day; as it was, each day's work consisted of 156 readings. The curves are, therefore, perhaps not quite as representative as they might have been had observations been more frequent. It would,

FIG. 8.

DRY AND WET BINS.

Maximum, minimum and mean temperatures, in degrees Centigrade.



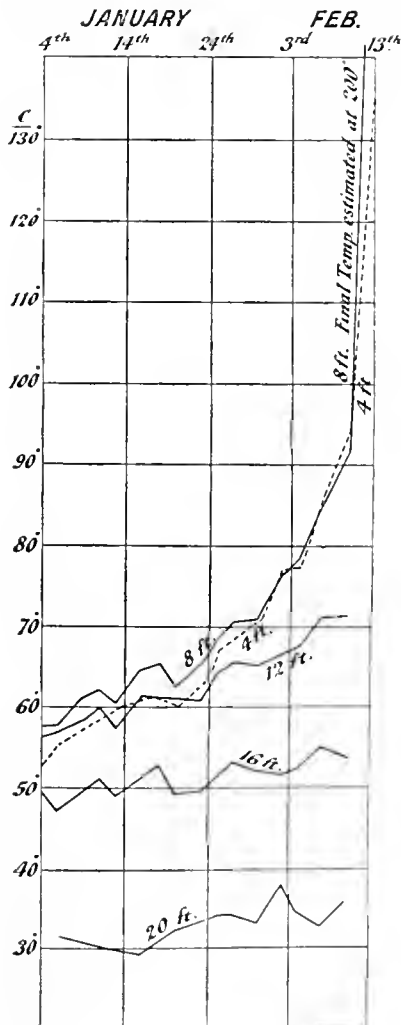
perhaps, have been appreciably better had there been daily readings in each pipe at each level, at any rate when the temperatures began to rise rapidly, but this was impracticable under the circumstances.

The first temperature readings taken on Dec. 10th showed a mean temperature of 39.8° C. in the dry and 28.9° C. in the wet bin, a difference of 10.9° C., due to cooling by the water and also to evaporation from the extensive surface of wetted small coal during the prolonged loading of the bins. That it was due to more rapid spontaneous heating of the dry bin seems improbable, in view of the slow speed of the rise of temperature recorded immediately subsequent to this date. With regard to the weather conditions, nothing abnormal was observed during this period.

When the temperature of the coal in the "dry" bin began to rise, it increased very rapidly (precisely as in the experiments of Fayol) until February 13th, when at 8 ft. from the surface in the centre tube the temperature was so high as to melt the solder connections of the thermometer and char the string that was used for raising and lowering it, thus causing the instrument to fall to the bottom of the tube. After the loss of the thermometer a cord was lowered into the tube and left for a short time, and on being drawn up was found to be charred at a point half-way through the coal, and indicated by its appearance that the temperature was highest at about 8 ft. from the surface.

DRY BIN.

Temperature of centre pipe at different levels.



In view of this decisive result and the inflammable nature of the bin and its surroundings, on Feb. 13th it was decided not to risk a fire by prolonging the experiment. The dry bin was therefore flooded with water and unloaded as far as was necessary to remove all the hot coal. Before unloading there was no visible smoke, though there was a distinct, but not strong, smell of the gaseous products of distillation of coal. On digging down, the heat seemed to be confined to a spot immediately in the vicinity of the centre pipe. No visible amount of coking had taken place, and the bulk of the coal was not to be distinguished by its appearance from fresh coal. After the heated part of the coal, and such as fell in from the sides during digging down, amounting altogether to about one-third of the whole, had been removed, the bin was left to itself, and showed no subsequent signs of heating.

The "wet" bin gave absolutely no indications of heating beyond the slight rises of temperature shown in the thermometer records, and from Jan. 27th there was a steady decline in the mean temperature. Minor variations of temperature at particular points in both bins probably correspond to variations in ventilation depending on changes of direction of the wind, &c.

Two of the most important results noticeable in these curves are the great cooling effect of the water on the coal and the relatively long period during which the temperature of the dry coal rises comparatively slowly. It might be supposed that the effect of wetting the coal was confined to reducing the initial temperature to such a point that heating was delayed till the weather cooled down. This, however, is not the case; for the wet coal did rise above the initial temperature of the dry coal, and the air temperature at the close of the experiment was practically the same as it had been throughout.

The importance of having the coal cool to begin with if a fire is to be avoided say for 90 days is rendered evident by the form of the curve of rise of temperature in the dry bin.

Applications to the phenomena of spontaneous combustion of cargoes of coal.

If the principles established above are correct, we should expect that liability to spontaneous fires would depend on the following conditions:—

1. *Size of cargo.*—The larger the cargo, the larger and deeper the ship; consequently, the percentage breakage on loading will increase with the size of the ship, and the size of the heap of dust under the hatchways will vary as the fourth power of the linear dimensions of similar ships. This is on the assumption that all large ships have the same number of hatchways and that the dust is substantially produced by the breakage in loading into the ship. The Commission of 1876 drew attention to the influence of size of cargo on percentage of casualties in the following words, alluding to the statistics collected: "Again this return shows, to a startling extent, that the proportion of casualties traceable to spontaneous combustion increases *pari passu* with the tonnage of the cargoes. This becomes still more apparent when the European trade is deducted. The return then shows that there were, in 1874:—2,109 shipments with cargoes under 500 tons, in which 5 casualties occurred,—or under $\frac{1}{4}$ per cent.; 1501 shipments with cargoes between 500 and 1000 tons, in which 17 casualties occurred, or over 1 per cent.; 490 shipments with cargoes between 1000 and 1500 tons, in which 17 casualties occurred, or $3\frac{1}{2}$ per cent.; 308 shipments with cargoes between 1500 and 2000 tons, in which 14 casualties occurred, or over $4\frac{1}{2}$ per cent.; and 77 shipments with cargoes over 2000 tons, in which 7 casualties occurred, or 9 per cent. The casualties in vessels bound to San Francisco were the most remarkable. Deducting vessels under 500 tons (in which no cases of spontaneous combustion were recorded), the return shows 9 casualties out of 54 shipments. These also increase in proportion to the tonnage of the cargoes, till we arrive at the alarming fact that out of the five ships with cargoes of over 2000 tons sent to San Francisco in 1874, two suffered."

The N.S.W. Commission found a similar relation as shown in the following diagram:—

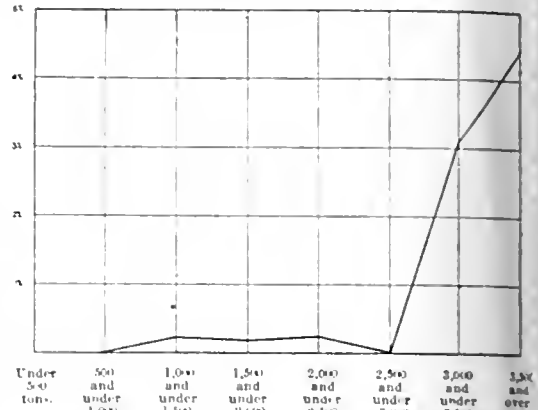
Diagram No. 9.

Illustrating Heating of Cargoes in (classified) ships which sailed to American Ports.

Years 1888—1896.

Orlinates: Percentage of Casualties.

Abscissa: Magnitude of Cargoes.



2. *The heap of dust under the hatchways should be the most dangerous place.*—Evidence of this was given to the 1876 Commission, and the N.S.W. Commission failed to find a single undoubted case of a spontaneous fire having occurred originally in any other place.

3. *Slight ventilation should be dangerous.*—It was formerly the practice to ventilate coal cargoes by means of air trunks running along the bottom of the ship below the coal. Air was supplied to this system by more or less elaborate vertical shafts, and escaped into the cargo by lateral openings so as to distribute itself through the coal. The Commission of 1876 proved that in this way the carriage of coal was made more dangerous. Their finding was as follows:—

"Of the 70 ships that suffered in 1874 none are reported as not having been ventilated, while 38 are distinctly stated to have been ventilated, 35 of them being vessels over 500 tons. But the most startling illustration is furnished by the cases of four vessels, the 'Euxine,' 'Oliver Cromwell,' 'Calcutta,' and 'Corah.' These ships, to which reference was made by several of the witnesses who appeared before us, were loaded under the tips at Newcastle, at the same time, with the same coal, and from the same seam, sometimes one ship being under the tip and sometimes another. They were each carrying from 1500 to 2000 tons of coal. The 'Euxine,' 'Oliver Cromwell,' and 'Calcutta' were bound for Aden; the 'Corah' for Bombay. The first three ships were thoroughly ventilated; the fourth was not ventilated at all. The 'Euxine,' 'Oliver Cromwell,' and 'Calcutta' were all totally lost from spontaneous combustion. The 'Corah' carried her cargo safely to Bombay." Nevertheless, if the ventilation had been thorough it would have kept the coal cool. An illustration of this is contained in a communication made to the Commission of 1876 by Captain Henry F. Scott, of Newcastle-on-Tyne. This communication gives such a good idea of what a spontaneous fire on board a sailing ship means, and is so evidently the narrative of a brave and resourceful man, that it is well worthy of quotation. It will also serve to give an idea of the subject to those who have not been fortunate enough to listen to many similar stories as they have been unfolded before Royal Commissions and Courts of Inquiry:—

"In 1852 I took a cargo of coal from Sunderland to Madras, without ventilators. After passing the Cape, not having been able to take off hatches for a considerable time owing to bad weather, I was alarmed at finding

oke issuing from the cargo, with a strong smell of
ipient gas. In this dilemma a panic came over my
w, and they insisted on getting the boats out and
paring to leave the ship. Now as danger and necessity
en sharpens the wits, after looking at things in all their
arings I determined to try and save ship and life
ewise. After a little trouble in getting my men to
ond me in my plans, we went to work. Happening to
ve on board some rod iron, I roughly pointed a few of
bars and drove them down into the cargo in different
ections. Allowing them to remain awhile, we drew them
t, feeling them all their length with the hand, marking
the hottest parts with chalk. By driving them down in
directions from the main hatchway, I found
at the heat was all in one place forming a nucleus
about 10 ft. in the lower hold and directly
der the hatchway, the bars driven diagonally through
a coal coming out quite cool. I then got four
adding-sail booms roughly squared, and knocking down
lkheads and part of bulwarks to procure boards, we
ade a trunk about 16 ft. long, 2½ ft. square at the upper
d and 3½ ft. at the lower, in form of a square cone.
e then dug down as far as we could, and placed the large
d of the cone in the hole, with a man inside, who dug
t the coal from under it, driving the cone down from
e top as the hot coals were sent up in buckets. After
tting down about 7 ft. we came upon the coal so hot
at the man at the bottom could only remain a short time,
ad had to be replaced at short intervals, owing to the
eat heat and smoke, and putting his feet into wooden
oxes which we made to save from burning them. We
ow found that as fast as the coal was cleared from the
ottom, the trunk crept down without forcing, owing to
s conical shape and the rolling of the vessel. In six
ours we had it down to the keelson, and by removing
ch alternate board from the side of the trunk at the
otest part, we grubbed out great part of the coal which
as smoking, and would not have been long before taking
re. I then rigged a topmast studding sail as a wind-sail,
ring the foot of it round the top of the cone, and thus
ring a strong current of air down to the bottom and
rough the sides where the boards were removed, and
about 24 hours, on going down our pit, we had the
expressible pleasure of finding the temperature little
ore than milk warm, and by continuing the use of the
indsail all heat and smoke disappeared, and ignition was
vented just in time. On two subsequent occasions I
ave repeated the process, and always found it successful.”
Captain Scott then goes on with the most absolute good
ith and assurance to recommend his system of thorough
entilation as a preventive of fires at sea. If the reader
mpares this very direct opinion, well supported by
vidence, with the equally direct and opposite evidence
dduced by the Royal Commission, and quoted above,
nd if he recollects that a large number of equally credible
itnesses, with equal assurance and with equal good faith,
ere present on both sides—ho will possibly realise the
ifficulty of trying to arrive at a conclusion without a
nowledge of the physics and chemistry involved. Indeed,
without the key supplied by Richters and Fayol, the
uestion might be fairly regarded as insoluble—and was

so regarded by many responsible but unscientific people
for many years after the work of these investigators
had been published.

4. *The risk of a spontaneous fire is much greater when the
cargo is loaded in summer than it is when the cargo is loaded
in winter.*—This was first established by the N.S.W. Com-
mission of 1896, whose attention was directed from the
first to an epidemic of casualties that had made its appear-
ance in the hot summer, 1895—1896. Analysis of the data
clearly showed that spontaneous fires were associated
with high maximum temperatures, and special experi-
ments on a large heap of slack showed that at a
depth of from 3—4 in. from the surface coal exposed to
the sun reached a temperature from 20° to 40° F. beyond
the recorded maximum shade temperature. From 1892
to 1896 inclusive, the lowest maximum shade temperature
recorded during the loading of a cargo which afterwards
fired was 63° F., and the highest 103° F., the average being
over 90° F. That such a seasonal variation in the number
of casualties should occur under the sunny sky of Newcastle,
N.S.W., will surprise no one—but I had not expected
that the same thing would have been noticeable under
the overcast climate of England. I was, however, anxious
to examine this point, and was fortunate enough to find,
in the report of the R.C., 1876, a most magnificent set of
data, prepared for the use of the Commission by Mr.
R. Cooper Rundell. These unrivalled data, referring to
no less than 4898 shipments and 102 casualties, are
tabulated below, and from them the curve of percentage
casualties which is treated as a seasonal phenomenon is
plotted against the mean temperature curve—not for the
particular years involved, but for the period 1841—1905,
as printed in Whitaker's Almanack. Mr. Rundell's data
refer to all fires in coal cargoes, and no doubt a few of
those were not strictly spontaneous. Consequently it did
not seem worth while to go beyond the long period tem-
perature curve—especially as the data refer to all United
Kingdom ports.

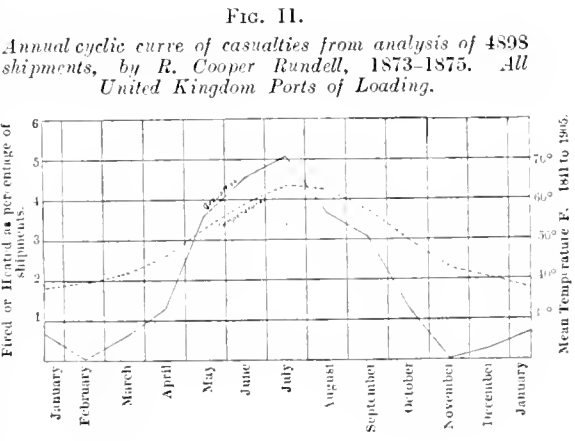


FIG. 10.

Casualties from Fire or Heating for all Ports of the United Kingdom, and for each month of the year, expressed as
percentages of shipments of 500 tons of coal and upwards on voyages across the equator and through the Suez
Canal, prepared from R. Cooper Rundell's data presented to the Royal Commission of 1876.

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total shipments.	Total casualties.
1873.....	1-941	0	0	0	2-00	4-39	2-04	4-545	3-23	0-684	0	0-86	1506	26
1874.....	0	0	0	3-09	4-69	7-76	10-56	5-23	2-84	1-95	0	0	1773	54
1875.....	0	0	1-72	1-06	9-43	2-45	2-45	1-27	3-30	1-02	0	0	1619	22
Total shipments ..	299	303	353	318	384	393	471	440	586	548	409	394	4898	102
Total casualties ..	2	0	2	4	10	18	24	16	18	7	0	1	102	—
Total percentage of casualties	0-67	0	0-57	1-26	3-60	4-58	5-09	3-64	3-07	1-28	0	0-254	100	2-08

Cases of spontaneous combustion of coal on board merchant vessels registered in the United Kingdom and British Possessions Abroad, reported to the Board of Trade from July 1st, 1884, to June 30th, 1907.

Merchant vessels registered in the United Kingdom.

	Sailing.			Steam.			Total.			Total
	Total losses.	Serious casualties.	Minor casualties.	Total losses.	Serious casualties.	Minor casualties.	Total losses.	Serious casualties.	Minor casualties.	
1884-5.....	7	4	5	16	—	1	2	5	6	18
1885-6.....	3	1	2	6	—	1	2	2	3	8
1886-7.....	4	—	3	7	—	1	1	—	4	8
1887-8.....	7	—	4	11	—	3	5	—	6	16
1888-9.....	—	2	3	5	—	—	4	—	7	9
1889-90.....	4	3	—	7	—	3	4	6	1	11
1890-91.....	—	3	—	3	—	1	8	4	7	11
1891-92.....	12	5	3	10	—	2	5	7	6	15
1892-93.....	12	—	5	7	—	1	5	1	9	12
1893-94.....	3	2	—	5	—	3	6	5	3	11
1894-95.....	—	3	—	3	—	1	7	4	6	10
1895-96.....	5	7	8	20	—	4	5	7	12	24
1896-97.....	1	3	8	12	—	3	9	1	14	21
1897-98.....	—	2	4	6	—	3	20	5	21	26
1898-99.....	—	3	4	7	—	3	17	6	18	24
1899-1900.....	1	3	1	5	—	1	19	4	19	24
1900-1.....	3	2	9	14	—	4	28	6	33	42
1901-2.....	4	3	9	16	—	3	36	6	42	52
1902-3.....	—	1	6	7	—	3	26	4	29	33
1903-4.....	—	—	1	1	—	7	33	7	27	34
1904-5.....	1	—	4	5	—	6	34	6	32	39
1905-6.....	—	1	—	1	—	7	40	8	33	41
1906-7.....	—	1	—	1	—	12	58	13	40	59
Total	47	49	79	175	—	68	373	117	384	548

Merchant vessels registered in British Possessions Abroad.

1884-5.....	3	—	—	3	—	—	—	—	—	3
1885-6.....	—	—	—	—	—	—	—	—	—	—
1886-7.....	—	—	—	—	—	—	—	—	—	—
1887-8.....	1	—	—	1	—	1	1	1	—	2
1888-9.....	1	—	—	1	—	1	1	1	—	2
1889-90.....	—	—	—	—	—	—	—	—	—	—
1890-91.....	—	—	—	—	—	—	—	—	—	—
1891-92.....	1	—	—	1	—	—	—	—	—	1
1892-93.....	—	—	—	—	—	—	—	—	—	—
1893-94.....	1	—	—	1	—	—	—	—	—	1
1894-95.....	—	—	—	—	—	—	—	—	—	—
1895-96.....	—	1	1	2	—	—	—	1	1	2
1896-97.....	1	—	—	1	—	—	—	1	—	1
1897-98.....	—	—	—	—	—	1	1	—	1	1
1898-99.....	—	—	—	—	—	—	—	—	—	—
1899-1900.....	—	—	1	1	—	—	—	—	1	1
1900-1.....	—	1	—	1	—	—	—	1	—	1
1901-2.....	—	—	—	—	—	1	—	1	—	1
1902-3.....	—	—	—	—	—	1	—	1	—	1
1903-4.....	—	—	—	—	—	—	—	—	—	—
1904-5.....	—	—	—	—	—	—	—	—	—	—
1905-6.....	—	—	—	—	—	—	—	—	—	—
1906-7.....	—	—	—	—	—	1	2	1	1	2
Total	8	2	2	12	—	5	7	7	4	19

Total merchant vessels registered in the United Kingdom and British Possessions Abroad.

1884-5.....	10	4	5	19	—	1	1	5	6	21
1885-6.....	3	1	2	6	—	1	2	2	3	8
1886-7.....	4	—	3	7	—	1	1	—	4	8
1887-8.....	8	—	4	12	—	4	6	—	6	18
1888-9.....	1	2	3	6	—	1	5	3	7	11
1889-90.....	4	3	—	7	—	3	4	6	1	11
1890-91.....	—	3	—	3	—	1	8	4	7	11
1891-92.....	3	5	3	11	—	2	5	7	6	16
1892-93.....	12	—	5	7	—	1	5	1	9	12
1893-94.....	4	2	—	6	—	3	6	5	3	12
1894-95.....	—	3	—	3	—	1	7	4	6	10
1895-96.....	5	8	9	22	—	4	5	8	13	26
1896-97.....	12	3	8	13	—	3	9	6	14	22
1897-98.....	—	2	4	6	—	3	21	5	22	27
1898-99.....	—	3	4	7	—	3	14	6	18	24
1899-1900.....	1	3	6	6	—	1	18	4	20	25
1900-1.....	3	3	9	15	—	4	24	7	33	43
1901-2.....	4	3	9	16	—	4	33	7	42	53
1902-3.....	—	1	6	7	—	4	23	5	29	34
1903-4.....	—	—	1	1	—	7	26	7	27	34
1904-5.....	1	—	4	5	—	6	34	6	32	39
1905-6.....	—	1	—	1	—	7	40	8	33	41
1906-7.....	—	1	—	1	—	13	60	14	47	61
Total	55	51	81	187	—	73	380	124	388	567

Coal-laden missing vessels reported to the Board of Trade from July 1st, 1884, to June 30th, 1907.

Year.	Merchant vessels registered in the United Kingdom.			Merchant vessels registered in British Possessions Abroad.			Total.		
	Sailing.	Steam.	Total.	Sailing.	Steam.	Total.	Sailing.	Steam.	Total.
1885	15	6	21	4	—	4	19	6	25
1886	12	4	16	5	—	5	17	4	21
1887	19	10	29	1	—	1	20	10	30
1888	13	6	19	4	—	4	17	6	23
1889	20	1	21	4	—	4	24	1	25
1890	9	4	13	6	—	6	15	4	19
1891	30	2	32	3	1	4	33	3	36
1892	18	3	21	2	—	2	20	3	23
1893	14	1	15	1	—	1	15	1	16
1894	13	7	20	2	—	2	15	7	22
1895	17	6	23	—	1	1	17	7	24
1896	10	2	12	1	—	1	11	2	13
1897	5	1	6	—	—	—	5	1	6
1898	4	1	5	2	—	2	6	2	8
1899	5	2	7	2	—	2	7	2	9
1900	17	3	20	2	1	3	19	4	23
1901	4	3	7	1	2	3	5	5	10
1902	5	5	10	1	—	1	6	5	11
1903	2	2	4	1	1	2	3	3	6
1904	3	2	5	1	1	2	4	3	7
1905	6	4	10	—	—	—	6	4	10
1906	6	3	9	—	1	1	6	4	10
1907	1	3	4	—	—	—	1	3	4
Total	248	82	330	43	8	51	291	90	381

It has been a great pleasure to me to discover this important relation from the study of data buried for over years, and to reflect that Mr. Cooper Rundell's laborious work has at last borne fruit. An important fact has thus been established, and the pyrites theory, also, is shown by the data alone to have no practical bearing on the spontaneous heating of coal on board ship.

5. Breackage of coal during shipment has long been recognised as a possible contributing factor to spontaneous combustion. No special comment need be made in view of the account given above of the theory of heating—except that the general opinion appears to be justified. The Commission of 1876 devoted much time and trouble to the examination of the system of loading in vogue in England at the time, but could only point out that all these systems, whether tips, cranes or spouts, gave rise to breackage. Since that time the Lewis and Hunter system of loading has been established at Cardiff, whereby an immense improvement in regard to prevention of breackage has been brought about. In other systems a coal is allowed to fall at least from the combings of the hatch, but in the Lewis and Hunter system the coal is first transferred from the truck to a loading box and this box is then lowered down the hatchway till it reaches the bottom of the ship, or top of the cargo, when the coal is put out practically without breackage. I examined this system in 1898, and in my ignorance had expected to find that it would have been used primarily in loading sailing vessels to diminish the risk of spontaneous heating by minimising the cause. It turned out, however, that the advantages of relatively unbroken coal had been so appreciated by the consignees that the Lewis and Hunter cranes were kept fully occupied in supplying the more important customers, *i.e.*, the steamship companies, who port coal largely for re-coaling purposes, and the unfortunate sailing ships were at that time (however it may be now) still loaded from old-fashioned appliances. The cost of installation of the Lewis and Hunter system is, however necessarily large, and I thought at one time that the same result might be achieved by ordinary cranes lifting railway trucks and lowering them through the hatchways before discharging. It appears, however, that large hatchways are not tolerated at Lloyd's on account of the structural weakening of the ship, which, in the absence of special precautions, would no doubt result. It should not be beyond the resources of engineering to get over this difficulty, however—the trouble would be in the interregnum while ships with small hatchways still had to be loaded, and the proposal must, I suppose, be regarded as an unpractical idea.

It is worth noting that the effect of breackage during

loading may be more serious with some coals than with others. Thus a witness before the 1876 Commission mentioned that some Welsh coals when broken by a fall fell into more or less cubical fragments, while other kinds of coal broke irregularly and made more dust. If these coals had the same inflammability to start with, the second kind would naturally be more dangerous than the first.

No account of spontaneous heating of coal on board ship would be complete without a reference to the subject of gas explosions. An explosion is often a consequence of spontaneous heating of a cargo of coal, and is sometimes the first indication a captain gets that his cargo has heated. The cause, of course, is the low temperature distillation going on, at, and around, the centre of heating, and the gas generated is usually almost or quite colourless. In a case of which I have had personal experience the scent of the gas was between that of benzene and paraffin oil—an odour which is easily recognisable once it has been smelt—it is not at all like that of town gas. As heating progresses the distillation products become visible, and in this case an actual outbreak of fire can only be a matter of a few hours. Carbon monoxide is probably always a constituent of the gas evolved from the hot coal and cases of poisoning have been reported, but none have come under my personal notice—at least in so far as coal cargoes are concerned. The gases coming from a spontaneous fire in a mine examined by me showed 0.2 per cent. CO—a quantity which could not be breathed with impunity for more than a short time, say, half an hour. The danger of explosion has in the past been aggravated by the habit of battening down when a smell of gas is first perceived, in the hope—I believe almost if not quite universally illusory—of cutting off all access of air to the cargo. Having in view the fact that the explosion of weak mixtures probably gives rise to pressures of less than 100 lb. sq. in. (Mond gas uncompresssed is said to have a maximum explosion pressure of 60–70 lb. per sq. in.), it is wonderful what destruction can be brought about on ship board by such explosions. On the whole, if the cargo heats, I think it is better to be sure that the surface ventilation is adequate by removing the hatches, than to try to keep all air from the coal, though, of course, if the latter could really be done the fire would eventually go out, as in Fayol's experiment with the bell.

In addition to explosions from gases due to heating of the cargo, coal shippers have had much trouble from explosions occurring within a few days of the loading of the cargo. In these cases the cause is to be found in the spontaneous evolution of Marsh gas by newly mined coal. Two such explosions in Sydney Harbour came under

my notice, and in one case I was able to visit the ship within a few hours of the disaster. The effects were exactly such as might have been expected, the deck had been burst upwards and the deck fittings destroyed—the ship was in fact completely disabled. An efficient system of ventilation of the space between the cargo and the deck, by windsails if necessary, will of course entirely get over the risk of explosion from newly-won coal.

Through the kindness of Mr. S. Bullock, Superintendent for Wrecks at the Board of Trade, I am able to bring the statistics of the subject of casualties through spontaneous heating up to date in the following tabular statement, which I owe entirely to Mr. Bullock. I should have been glad to have been able to sift the data so as to ascertain whether there has really been a diminution in the percentage number of spontaneous fires on sailing ships in recent years, or whether, as I suspect, the apparent reduction is largely an expression of the increased use of steamers as colliers. The steamer, of course, owes its comparative immunity to the fact that it generally completes its voyage within the incubation period of a spontaneous fire.

Prevention of spontaneous fires.

The Second New South Wales Commission made the following recommendation:—"Having in view the fact that cases of spontaneous heating invariably occur in the heap of small coal under the hatchways, and in the light of the foregoing conclusive result, we recommend that where large ships are being loaded during warm weather (say, when the temperature of the air is 90° F. or over) a hose should be played down the hatchway so as to wet, at all events, the coal which collects at that spot."

This recommendation was made with full knowledge of the theory of the matter and with the results of a large, costly and conclusive experiment before the Commissioners; and everything goes to show that a cargo thus treated would be absolutely safe, if not for ever, still for a much longer period than is occupied by any ordinary voyage. In the year 1900 I ascertained that at Cardiff it is not unusual to spray the coal during loading, in exceptionally dry weather, to lay the dust a little—a system good so far as it goes, but one which gives no security that the dangerous part of the cargo under the hatches is really wet enough. Mr. Bullock's figures clearly show that from one cause or another spontaneous fires on board ship are now much less frequent than they used to be, but I consider that with our present knowledge of the subject, there should be no spontaneous heating of cargoes at all. The means to be adopted are simple. In the first place if the weather is cold during the time the coal is in transit, and being loaded, no special precautions appear to be necessary except in regard to surface ventilation. If the weather is warm, and particularly if it is sunny, and if the coal has been lying in trucks exposed to the sun, the heap of small coal and dust under the hatchways should be attended to. One way would be to dig out the heap under the hatchways and distribute the coal over the rest of the cargo, replacing it by larger coal, as has occasionally been done. The objection to this would be the cost. From measurement of some drawings I estimate that about one-fifteenth of the cargo might have to be retrimmed. If we consider a cargo of 2000 tons, this means the restowing of about 130 tons. This could not cost more than about 6d. per ton for labour, or £3 5s., to which would be added possible charges for demurrage—which I am not in a position to estimate. Instead of delaying a ship under the cranes or tips (which would have the advantage that when the hatches were dug out the holes could be filled in direct from the loading appliances), it might be preferred to do the filling in from the rest of the cargo, though this could hardly be done conveniently if the ship was well loaded. In this case the labour charge would be higher, perhaps double the figure given above.

A more certain and less laborious precaution would be the adoption of the recommendation of the second N.S.W. Commission to wet the heap of fines under the hatchway. I have shown that such a mixture is thoroughly wetted

if it carries 10 per cent. of water. The coal probably would carry 2 or 3 per cent. of water on an average in any case, so we may reckon that about one-fifteenth of the cargo would have to carry 8 per cent. excess water. This is an increase of weight of about $\frac{1}{10}$ per cent. calculated on the whole cargo, and I believe the estimate to be above rather than under the mark. As to the means of carrying out the distribution of water, it would be a simple matter to arrange a Koerting's spray nozzle to play down the hatchway during the loading, and the delivery of water could be easily adjusted till the coal was observed to be thoroughly wetted where it needed to be wet. A still simpler plan would be to finish the trimming by leaving a depression in the surface of the cargo under the hatchway and pouring in water—salt or fresh—till the calculated amount, up to $\frac{1}{10}$ per cent. of the weight of the cargo but possibly only $\frac{1}{20}$ per cent., had been added and allowed to soak down.

I regret that I have only estimates to offer instead of actual measurements of the water required, but I have had no opportunity of late years of experimenting on whole cargoes. Anyone wishing to complete the subject and in a position to measure the water required would be doing a good service by publishing the result of a few experiments. I hope to live long enough to see the occurrence of a spontaneous fire at sea regarded rather as the result of culpable negligence than as the kind of misfortune defined in bills of lading as "The act of God."

DISCUSSION.

The CHAIRMAN said that the subject-matter of the paper was exceedingly important regarded from either the humanitarian, economical, or scientific points of view. The author's references to coal matters having relation to the shipping trade were most interesting, and one would like to know what were his experiences in coal mines. In the Chairman's opinion, sulphur did not have much to do with the spontaneous combustion of coal and coal which readily fired was thick coal which contained less sulphur. Spontaneous combustion was said to be more usual in mines in which the coal was ground exceedingly fine. On that account it was more readily oxidised, and spontaneous combustion soon occurred. He had seen it recorded that ferrous sulphate was calculated to produce combustion by catalytic action.

Mr. A. E. TUCKER pointed out that in some coal sulphur did not exist entirely as pyrites, and he had known a case of coal, which came from China, containing 6 per cent. of sulphur which was entirely in the uncombined form. Whether the question of the state of the combination of sulphur in coal affected the general point of spontaneity of combustion was a matter upon which he would like some expression. If, as was suggested, the liability to combustion was due to the high percentage of hydrogen present it occurred to him that the presence of sulphur existing in other forms of pyrites might bring about the same result. The matter of spontaneous combustion had been brought sadly home to them in the Birkenhead district in connection with the Hamstead Colliery, where, by reason of the peculiarly geological formation, the seams of coal were particularly liable to slip, with the accompanying generation of heat.

Dr. R. S. MORRELL said a question which was of interest to him was deterioration of coal when it was stored. What were the best conditions for the preservation of coal, in respect of the retention of its calorific value under varying conditions of temperature and moisture?

Mr. THRELFALL, in reply, said the best method was to keep the coal in such a condition that it would not heat, and that was achieved by keeping it at a minimum thickness which could be determined by trials. In Fayol's coal it was necessary to have it less than 4 in deep, while in Australia stacks twelve ft. high, of Newcastle coal, rarely heated; but stacks of 20 ft. always heated. So much depended, of course, upon the climate. With regard to the question of sulphur, that had been a bogey for many years, and he wanted to lay it that evening. If they would reflect on the fact that in ships no fire was ever started except under the hatchway, they would see that the presence of pyrites did not throw any light on

question of the cause of the fire. If the fire took place anywhere else in the ship there might be a question as to the possibility of sulphur becoming separated from the pyrites, the sulphur did separate, but not till the pyrites was heated to 400° C., under which temperature the coal yielded no assistance whatever. On the subject of the spontaneous heating of coal in mines, he would be glad to receive further information from anybody who had such knowledge at first hand. He had investigated several cases, but nothing compared with the number of fires in mines, and in those cases the fires in the mines had all taken place in dry places. He knew of no fires having started in a damp place in a mine. He should be glad to hear from you.

Mr. TUCKER asked whether the author had known of any cases of spontaneous combustion in ships arising from the use of patent fuel, and whether the conditions of manufacture of patent fuel prevented such combustion?

Mr. JOHNS said with regard to coal used in the manufacture of gas, his experience was that the value was increased if the coal was stored for any length of time. In gasworks it was necessary to store large quantities of coal in order to tide over periods of strikes or shortages of supply. He instanced a case in which a quantity of coal, having been stocked for 2 or 3 years, gave a return of 10,000 c. ft. per ton instead of 10,200 c. ft. The calorific value was also considerably reduced. Gas engineers held the view that the longer coal was stored the less quantity of gas was to be expected from it. The heating value of coal was similarly affected.

Mr. H. L. HEATHCOTE asked what bearing the temperature of the air at the time the coal was loaded had on the frequency of the fires. He would like to know whether humidity had any effect.

Mr. THREEFALL, further replying, said it made little difference to the coal whether it was stored 3 ft. deep in this country. But at 10 ft. it was rather a question. He felt that 10 ft. would be about the limit coal would be stored without deterioration. The varying experience may have been due to the circumstance that different sorts of coal were stored. There were many varieties of coal,

and the difference between some of them was very pronounced, so that without further explanation he saw no reason for thinking that the experiences mentioned were contradictory. He did not think he had ever come across an instance of the firing of a cargo of patent fuel. The spontaneous heating of patent fuel could not be a very common thing if it happened at all. He did not think that the percentage of water composition of the coal loaded into a ship would be materially affected by the humidity of the air at the time the coal was loaded. In dry weather it might be a little bit dryer, and in damp weather a little bit damper, but the main cause of difference in the quantity of water would depend upon the amount of water naturally existing in the coal in the mine and not in the air. The rainfall while the coal is in transit must also be considered. Moreover Richters had shown that it made no difference whether the air was dry or moist. Fayol had made the same experiment, and personally, in view of these experiments, he had not thought it worth while to consider the effect of humidity in producing spontaneous fire; nor did he think it had any kind of comparison with the effect—the greater effect—exercised by the water which was normally present in the coal as it was raised from the mine, and on the rain which fell upon it on its way to the ship.

London Section.

Meeting held at Burlington House on Monday, May 3rd, 1909.

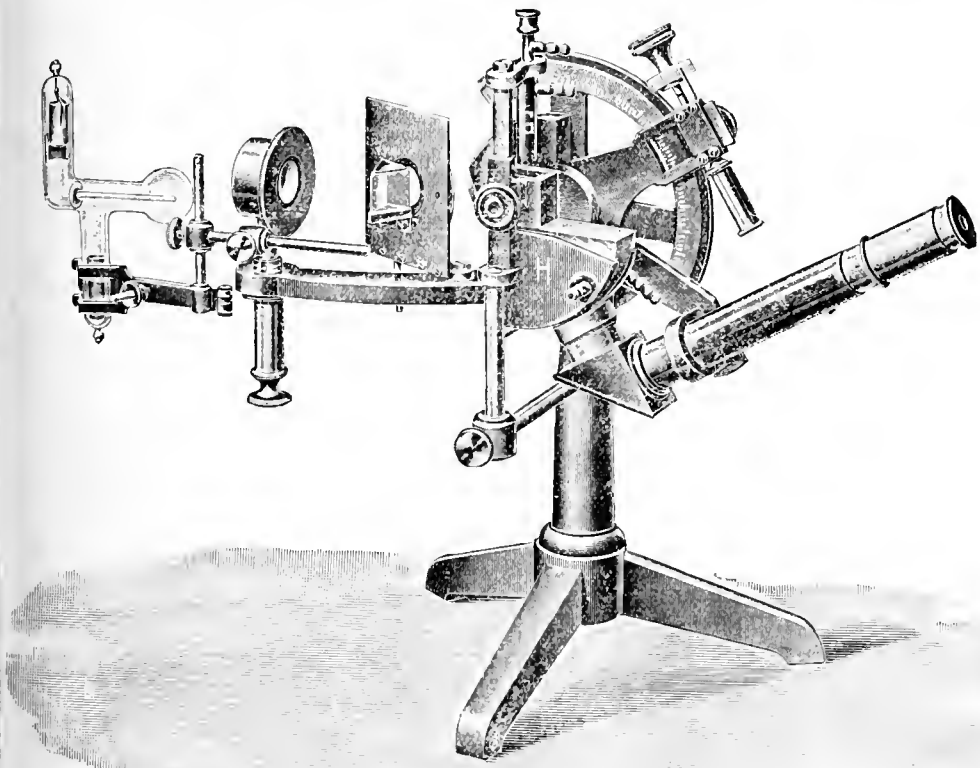
MR. E. GRANT HOOPER IN THE CHAIR.

A NEW REFRACTOMETER.

BY DR. J. LEWKOWITSCH.

The construction of the new refractometer (shown in Fig.) made by Hans Heele, Berlin,* is based on the

* The English representative is Mr. P. Heele, 34, Drayton Gardens, West Ealing, W.



Kohlransch-Abbe method of determining the angle at which the limiting ray, entering the object under observation at grazing incidence, emerges from a cylinder quadrant made of French flint glass of high refracting power. The detailed directions for the construction of the optical portions of the instrument were furnished by Professor Harland of Brussels. It will be noted that the refractometer resembles the Pulfrich refractometer (See Chemical Technology and Analysis of Oils, Fats and Waxes, 4th Ed., Vol. I., p. 253), but it differs from it in that essential point, that instead of the rectangular prism of the Pulfrich instrument, a cylinder quadrant is employed.

The object to be examined is placed on the polished horizontal surface of the quadrant. As will be seen from the illustration, the light falls into the substance under grazing incidence, and the limiting ray, after emerging from the cylinder quadrant, passes through a concave cylinder segment (made of the same highly refractive glass as the cylinder quadrant, and of the same radius) in the telescope and thence into the eye of the observer. The angle is read off an arc which is divided into one-quarter degrees (15 minutes); by using the "vernier," single minutes can be read off without any difficulty. In order to obtain still greater accuracy, a micrometer screw is provided, the drum of which is divided into 50 divisions. As one total revolution of the drum corresponds to 15' or 900", one division corresponds to 18"; this forms the limit of accuracy obtainable with this apparatus. From the observed angle, i , and the known refractive index, N , of the cylinder quadrant, the refractive index, n , of the substance under observation is found with the aid of the formula, $n = N \cdot \sin i$.

In order to obviate calculations, there is furnished together with the apparatus a table in which the refractive indices, n , are calculated out from 10 to 10 minutes for all the angles between 34° 44' 30" and 87°, for the sodium line D. For any other wave length the refractive index must be calculated; for this purpose the values of N for the rays A', C, D, F, G' are given in the table. Thus all refractive indices between 1 and 1.733 can be observed. (For higher refractions it would, of course, be necessary to use a cylinder quadrant, etc., of still higher refractive power). The instrument is so adjusted that the angle for air is 34° 44' 30". This is of great importance, inasmuch as it enables the operator to determine the zero point, as it were, of the instrument at any time.

To observe the refractive index, a sodium lamp or any other monochromatic light is thrown from a distance of 12 to 16 inches through the rectangular prism on to the object under observation. By turning the rectangular prism downwards and sparking the hydrogen tube provided (see Fig.), the refraction for the hydrogen line can be observed, and by thus changing the source of light the dispersion can be measured rapidly, as it is only necessary to turn the micrometer drum, until the dividing line between the dark and the illuminated fields passes again through the centre of the spider web in the telescope.

This dividing line is more sharply defined and is less curved than is the case in other instruments. Therefore the angle can be adjusted with greater accuracy than is the case in similar instruments. This, together with the wide range of angles than can be observed, and coupled with the fact, already mentioned above, that the zero can be checked without any difficulty in the shortest time, constitutes the chief features of the new instrument.

Inasmuch as the refractive indices of solid, liquid, and gaseous substances can be determined with this instrument it may be termed a universal refractometer.

In order to make observations at any desired temperature the quadrant is surrounded with a water jacket. Solid substances are examined by placing the instrument on the horizontal face of the cylinder quadrant. For the observation of liquid substances, at first an open trough (open both at top and bottom) was provided. This trough was to be fitted to the horizontal face of the cylinder of the quadrant by means of wool wax and the liquid was then poured into the trough. The liquid could be brought to the desired temperature by means of a heating apparatus, G, similar to the one supplied with the Pulfrich refractometer (cp. Chemical Technology and Analysis of Oils, Fats, and Waxes, 4th Ed., Vol. I., p. 253). The fixing of the trough, however, did not prove satisfactory in my own practice, and at my suggestion the construction of the trough has been altered in the following manner: The bottom edges of the four vertical side plates of the trough are bevelled, so that the loose bottom plate, which is also bevelled off at its edges, closes the trough tightly, especially if a slight pressure is applied by means of clips fixed on the jacket of the trough. It is, of course, necessary to place between the bottom of the trough and the horizontal face of the cylinder quadrant a liquid of a higher refracting power than that under observation. For liquids, a differential trough (suggested many years ago by Ostwald) may be used, so that two liquids can be observed simultaneously and the differences of the refractive and dispersive powers can be measured directly.

Of late years the butyro-refractometer has gained ground in chemical laboratories for the examination of oils and fats, and a comparison between the butyro-refractometer and the new refractometer will naturally suggest itself. When instituting such a comparison, must not be forgotten that the present instrument is a universal one, whereas the butyro-refractometer is specially constructed for the examination of butter fat. Hence in the latter case the critical line of total reflection is achromatised (cp. *Ibid.*, Vol. I., p. 250), and the line dividing the dark and illuminated fields appears colourless. If other fats or oils are observed in the butyro-refractometer, the dividing line is always coloured, whereby the exact reading becomes somewhat uncertain in so far that a lesser refraction than one "degree" can only be estimated. Even after applying the micrometer suggested by F. Löwe (*Ibid.*, p. 250) the accuracy cannot be extended to more than several tenths of a "degree". The following table will show that with the new refractometer

Substance.	New refractometer.		Butyro-refractometer.	
	Medium used.	For D line.	"Degrees."	Calculated.
Water*	Wintergreen oil 40°	34' = 1.33568	—	—
Tung oil*	" 50°	59' = 1.51943	—	—
Sofa oil	" 57°	31' = 1.48025	82°	1.4794
Malze oil	" 57°	15' = 1.47683	76°	1.47590
Cottonseed oil	" 57°	20' = 1.47721	76°	1.47590
Rape oil	" 57°	19' = 1.47695	76°	1.47590
Arachis oil	" 57°	4' = 1.47278	70°	1.4723
Olive oil	" 57°	4' = 1.47278	70°	1.4723
Castor oil	" 57°	38' = 1.48215	84°	1.4807
Neats foot oil	" 57°	1' = 1.47195	67°	1.4705
Cod liver oil	" 57°	38' = 1.48215	84°	1.4807
Whale oil	" 57°	23' = 1.47804	77°	1.4795
Thyme oil*	" 58°	45' = 1.50017	—	—
Wintergreen oil*	Carbon bisulphide 61°	15' = 1.53846	—	—
Rosin oil* (containing rosin acids)	" 61°	8' = 1.53675	—	—
Rosin oil* (free from rosin acids)	" 61°	50' = 1.54696	—	—

* In this case the butyro-refractometer is useless.

ter (which shares of course this advantage with other testing refractometers) differences are easily ascertained which would escape when using a butyro-refractometer of the old construction (without a micrometer), as was the case for the observations given below. It should further be pointed out that duplicate observations with the new refractometer agree down to a minute. Moreover, it should be borne in mind that even in fat and oil analysis the range of the butyro-refractometer is restricted, for in oil and tung oil fall outside its limits. Therefore, for refractometers must be used side by side with the butyro-refractometer, and for such purposes the present refractometer can be recommended.

The observations in the new instrument require, of course, more substance than with the butyro-refractometer and its congeners. As regards rapidity of work may, however, be stated that by using a number of enough the number of observations that can be made in a given time can also be very large. I append a list of comparative observations made.

The last two observations would suggest the application of the refractometer for the examination of the different commercial brands of rosin (colophony) in the solid state.

DISCUSSION.

The CHAIRMAN enquired the cost of this instrument, and appeared to have considerable resemblance to the Pulfrich refractometer, and he desired to ask what were the special advantages possessed by this instrument over the Pulfrich. Was there greater convenience of reading? Everyone who had experience of the ordinary butyro-refractometer would agree that when used for other substances than butter fat the readings are not quite sharp. The new instrument he gathered is of more general application, and gave closer readings. Mr. E. R. BOLTON thought that the butyro-refractometer had hardly had full justice done to it. The divisions of the scale were now divided into tenths by a micrometer screw. The line could be made clear and sharp using sodium light and also reducing the aperture of the bottom of the instrument by inserting a strip of card. Under those conditions there was no difficulty in obtaining any number of consecutive readings to e-tenth.

Dr. LEWKOWITSCH, in reply, said the disadvantage having to use a larger quantity of liquid than in the butyro-refractometer was obvious; but at a very little additional expense a number of the glass troughs might be obtained; in the Fery refractometer the quantity of liquid used was still greater, and the washing out of the trough caused much more inconvenience. He held brief for this instrument, but simply brought it forward as a new apparatus, offering certain advantages. The cost was about £30. The principal advantage over the Pulfrich instrument was that the dividing-line could be more easily fixed. With regard to the micrometer screw of the butyro-refractometer, he would defy anybody to read accurately tenths of degrees. Of course, the butyro-refractometer was a very excellent instrument for sorting commercial butters; in fact, it was used for that purpose by German police officers. And could be used with ordinary daylight, as well as with sodium light, but if it were used for any other oil or liquid they had to deal with a different dispersion, and the difficulty caused by a coloured line came in. This was the fault of the instrument, but the fault of the chemist who tried to get more out of it than it was designed to perform. By using a sodium light as Mr. Bolton did other complication was introduced. And if one went the trouble of using a sodium light one did away with the one great advantage of the butyro-refractometer when applied to oils and fats other than butter. He would like to repeat that the butyro-refractometer was not comparable with the new apparatus, which was a universal instrument applicable to solids, liquids, and gases.

A paper entitled "Vulcanisation Tests on Plantation Rubbers," by Messrs. Clayton Peadle and Henry P. Evans; M.A., Ph.D., was also read and discussed.

Scottish Section.

THE LIME IN BASIC SLAG.

BY JAMES HENDRICK, B.Sc., F.I.C.

Basic slag is now one of the most important of phosphatic manures, the annual consumption of which is measured in millions of tons. Its particular value as a manure is related to the fact that, although it contains a large proportion of lime and is alkaline in reaction, its phosphate is easily soluble in weak reagents and is therefore readily available to plants. Certain of the natural mineral phosphates, such as the largely used phosphates of Algiers and Tunis, also contain large proportions of lime, proportions far more than sufficient to fully combine with all the phosphate present, but their phosphate is not nearly so soluble in weak reagents and is not so available to plants. The chemical condition in which the phosphate and lime exist in basic slag is therefore a matter of great practical importance, and has received much attention from investigators.

It is commonly stated that basic slag contains a considerable proportion of "free lime." This statement is reproduced in well-known works on manures and on agriculture, and the "free" lime in slag is constantly referred to in writings on manures and manuring. For instance, the well-known manual on Manures and Manuring, by the late Dr. C. M. Aikman, states, p. 404, the free lime of average slag at 15 per cent.; and the latest edition of that standard work, "Stephen's Book of the Farm," states, Vol. I., p. 360 (1908), that one-third to one-half of the total lime in basic slag is in the caustic state, and again, at p. 500, that basic slag contains "a considerable quantity of caustic or free lime." A similar statement is contained in a recently issued leaflet of the Board of Agriculture and Fisheries, No. 170. The origin of these statements is to be found in the original papers of certain investigators who deal with the composition of slag and the state of the lime and phosphate in it. Thus, in a paper by Otto* the free lime (CaO) is stated as 11.0 per cent., and in a paper by Jensch† at 16.01 per cent. In both these cases the free lime was determined by means of a sugar solution.

G. Paturel‡ determined the free lime in a number of slags of French origin, and found from 2.55 to 21.43 per cent. In this case the determinations appear to have been made by means of a solution of ammonium chloride, which he says would not act on either calcium silicate or basic calcium phosphate. I have not been able to discover the record of any British determinations of the free lime in slag; though the presence of a considerable percentage of free lime is often assumed in British writings.§

Some time ago, I made some determinations of the free lime in slag by the method of solution with sugar, which I use for determining the free lime in burnt limes. In this method the lime, or substance containing lime, is shaken with a 10 per cent. sugar solution in a mechanical shaker for four hours, and an aliquot part of the solution titrated with standard hydrochloric acid.¶ To my surprise the amount of lime found was under 1 per cent. Similar amounts were found in several samples of slag. Thinking that possibly the free lime had been turned to carbonate by exposure, the carbon dioxide in some of the samples was determined, but the quantity found was so small as not to account for the absence of free lime in the samples, assuming they had originally contained 10 per cent. or over. The amount of carbon dioxide found in different samples varied from nothing to 1.5 per cent. The free lime was therefore determined directly in a large number of samples. Many of these were commercial samples of uncertain age, but a number were quite fresh samples specially obtained from the makers, and a number were samples of known origin

* Chem. Zeit., 1887, 255, and Zeits. f. Chem. Industrie, I., 257.

† Zeit. angew. Chem., 1889, Heft 11.

‡ Ann. Agronomiques, 1896, 22, 449.

§ Hughes (this J., 1901, 327) considers that basic slag does not contain more than 2 or 3 per cent. of caustic lime.

¶ Hendrick, Analyst, 1907, 32, p. 320.

and age. The average for ten commercial samples of unknown age was 0.99 per cent., and they varied from 0.57 to 1.57 per cent. All of these determinations were made by the sugar method. One sample which was known to be over two years old gave 1.12 per cent., another which was known to be only a few months old gave 0.84, and one which was known to have been ground a few weeks before being tested gave 1.26 per cent.

Several samples were tested for me by the sugar method, on the day they were ground by Mr. P. A. Keller, then chemist to Messrs. J. and J. Cunningham, Leith. These gave from 1.20 to 1.43 per cent. of free lime. All these were slags containing from 16 to 18 per cent. of phosphate estimated as tricalcium phosphate.

After these preliminary tests seven samples were obtained, and the free lime in them was determined in my laboratory by three different methods. The results are given in Table I. Samples Nos. 3 and 4 are Middlesburgh slags, and No. 5 is a South Bank slag. All these were obtained through the kindness of The Chemical Works, late H. and E. Albert, London. No. 1 was obtained from Messrs. J. and J. Cunningham, Ltd., Leith; and No. 2 is a Glangarnock slag obtained from Messrs. Alex. Cross and Sons, Ltd., Glasgow.

These five samples were all freshly ground. In the case of the samples from Middlesburgh, not only were the slags freshly ground, but they were ground from freshly made slag. The samples were preserved from free contact with the air in air-tight bottles until they were tested. Nos. 6 and 7 were commercial samples of unknown age.

The free lime was determined (a) by the sugar method already mentioned, (b) by extraction with distilled water, and (c) by extraction with ammonium chloride solution. The water extraction was conducted by shaking 5 grms. of slag with 500 c.c. of recently boiled and cooled distilled water for 4 hours in a mechanical shaker. An aliquot part of the solution was then titrated with decinormal hydrochloric acid. The amount of water used was sufficient to have dissolved all the free lime present even if it had amounted to over 10 per cent.

In the ammonium chloride method 4 grms. of slag were shaken with 200 c.c. of recently-boiled and cooled distilled water containing 1 gm. of ammonium chloride in solution. Each sample was thoroughly shaken at intervals for several hours. After the solutions had settled 50 c.c. was decanted off and titrated with decinormal hydrochloric acid.

TABLE I.
Free Lime.

No. of Sample.	Sugar Method.	Water Method.	Ammonium Chloride Method.
	per cent.	per cent.	per cent.
1.....	0.84	0.66	5.2
2.....	2.30	1.58	5.13
3.....	3.08	2.07	3.92
4.....	2.03	1.28	2.99
5.....	1.20	0.65	3.52
6.....	1.60	0.63	3.15
7.....	1.44	0.48	1.67

The table shows that extraction with water gives the lowest results, and the ammonium chloride extraction the highest results in every case. It is probable that the water extraction gives results which are below the truth, for when the shaking was continued for a longer period higher results were obtained, but in no case, even when the shaking was continued for two or three days, was the result by water extraction quite as high as that obtained by the sugar method.

As a sugar solution readily dissolves free lime, the results by this method are not below the truth. They may be a little above it, for certain compounds may break up and give up free lime on shaking with sugar.

On the other hand, the results with ammonium chloride are almost certainly above the truth. This question is discussed later.

The above results show that the percentages of free or caustic lime commonly stated to be present in basic slags are not found in the slags at present on the British market. As a rule, the amount of free lime present is under 2 per cent., and it is often under 1 per cent. It is probable the different results obtained by earlier investigators were due to a greater excess of lime being used formerly in the preparation of basic steel. There has been a considerable alteration, I understand, in the methods of preparing basic steel, and its by-product basic slag, during the past 20 years. These alterations are reflected in the composition of basic slag, though writers on manures do not appear to have taken note of them.

Lime available as a base in basic slag.—While the amount of free lime in basic slag is thus shown to be very small it will be obvious to anyone who has worked much with slag that the proportion of lime present in form in which it is available as a base, and can neutralise acid when brought in contact with them, must be considerable. Thus, if we mix slag and superphosphate together the amount of reversion of soluble phosphate to the insoluble state which takes place cannot be accounted for by the small amount of free lime present. It is also obvious that in fresh slag the lime cannot be present as carbonate, and as shown above, even in ordinary commercial slag which have been exposed to a considerable extent, the carbonate present is so small in amount as to be unimportant.

From an agricultural point of view it is the lime which is available as a base, and not merely the free or caustic lime, which is important. Lime which is so loosely combined as to be capable of neutralising acidity and acting as a base during nitrification is what is desired in the soil. Free alkali is not desired in the soil, but lime in the form of carbonate, in which it is not free and does not render the soil strongly alkaline, yet is available to neutralise acidity in the soil, is what is required. In basic slag there is a considerable percentage of lime in forms in which it is available as a base.

When ammonium sulphate in the soil undergoes nitrification, a base is required to neutralise the sulphuric and nitric acids formed. This suggested that the amount of lime available as a base for use in the soil might be estimated in the case of basic slag by distilling the slag with an excess of ammonium sulphate and measuring the ammonia liberated. Some preliminary experiments showed that the ammonia obtained in this way was equivalent to many times the amount of free lime found in the slag. It was also found that the result varied considerably with the conditions of the experiments. The seven slag already referred to were therefore tested under exactly similar conditions. Both ammonium sulphate and ammonium chloride were used.

A solution containing 1 gm. of ammonium sulphate or containing ammonium chloride equivalent in ammonia to 1 gm. of ammonium sulphate, 0.811 gm., was added to 1 gm. of slag, and slowly distilled into standard acid for 1½ hours. The bulk of the solution at the start was in every case 200 c.c. The amount of ammonia found was calculated into percentage of lime in the slag. 100 c.c. more water was then added to the solution at the distillation continued into a fresh portion of standard acid for another hour, and the equivalent in lime again determined. This was repeated three times more, till the total time of distillation was 5½ hours. In every case more ammonia was obtained, but the amount began gradually less, till at the 5th distillation it was very small.

In Table II. the analyses of the seven samples of slag are given. The citric soluble phosphate was determined by the British official method. [The Fertiliser and Feeding Stuffs (Methods of Analyses) Regulation 1908.]

The citric soluble lime was determined in the same solution as the citric soluble phosphate. The lime available as a base was determined by distillation with ammonium sulphate for 5½ hours. Table III. gives the determinations of the lime available as a base by distillation both for 1½ and for 5½ hours and with both ammonium sulphate and ammonium chloride.

TABLE II.
Table of Analysis.

	No. of Sample.						
	1	2	3	4	5	6	7
total phosphate ($\text{Ca}_3\text{P}_2\text{O}_8$)	per cent. 33.79	per cent. 31.50	per cent. 32.37	per cent. 32.73	per cent. 29.94	per cent. 27.70	per cent. 35.40
citric soluble phosphate ($\text{Ca}_3\text{P}_2\text{O}_8$)	15.50	30.60	30.04	25.34	27.50	21.40	33.60
total lime	48.60	45.30	43.60	41.24	45.10	35.30	39.70
citric soluble lime	31.10	34.50	31.90	27.80	40.00	29.00	34.80
free lime (Sugar method)	0.84	2.30	3.08	2.03	1.20	1.60	1.44
lime available as a base	28.30	24.40	19.31	15.23	24.05	22.30	13.60
calcia	17.56	13.30	12.65	15.40	16.90	30.80	16.00

Table II. shows that sample No. 1. was abnormal. It contained a very low percentage of citric soluble phosphate, although the total lime and the lime available as a base were higher than in any other sample. The table also shows that the slags varied greatly in the percentage of silica which they contained, and that there is no definite relation to the citric solubility of the phosphate. The free lime and the lime available as a base do not appear to bear any definite relation to one another or to the citric solubility.

that it readily acts as a base and liberates ammonia from its salts, and another considerable, though generally smaller, portion which is more slowly liberated, but which gradually becomes available as a base under the conditions of the experiment. Even after 5½ hours' distillation ammonia was still being slowly liberated in every case, so that the limit of the lime capable of liberating ammonia from ammonium sulphate or ammonium chloride had in no case been reached.

It is impossible to say how much of this lime would

TABLE III.
Lime available as a base.

	No. of Sample.						
	1	2	3	4	5	6	7
distillation with $(\text{NH}_4)_2\text{SO}_4$ 5½ hours	per cent. 28.30	per cent. 24.00	per cent. 19.31	per cent. 15.23	per cent. 24.05	per cent. 22.25	per cent. 13.60
distillation with NH_4Cl 5½ hours	26.47	23.49	—	14.37	22.71	21.13	11.50
distillation with $(\text{NH}_4)_2\text{SO}_4$ 1½ hours	21.28	16.58	12.93	8.45	16.40	15.65	9.60
distillation with NH_4Cl 1½ hours	19.90	15.96	—	8.90	16.60	14.40	7.00
with 2 per cent. citric acid in cold	35.00	30.50	27.50	25.50	33.00	30.50	29.00

Table III. shows that in practically every case more ammonia was obtained by distilling with ammonium sulphate than by distilling with ammonium chloride. This is probably because the lime is largely present as silicates, and sulphuric acid decomposes silicates more effectively than hydrochloric acid.

With the exception of Sample 4, from two-thirds to three-fourths of the ammonia was given off in the first distillation, the remainder was given off slowly in gradually increasing quantities. This is illustrated in Table IV., which shows the percentage of lime equivalent to the ammonia given off at each stage of the distillation with ammonium sulphate in the cases of Samples 1, 2, 4 and 6. Similar results were obtained in all the other cases both with ammonium sulphate and ammonium chloride.

TABLE IV.

Lime available as a base.

Lime equivalent of the ammonia liberated at different stages of the distillation with ammonium sulphate.

	No. of Sample.			
	1	2	4	6
1st Distillation, 1½ hours	per cent. 21.28	per cent. 16.58	per cent. 8.46	per cent. 15.66
2d " 1 hour	3.18	2.39	2.63	2.63
3d " 1 hour	2.14	1.93	1.66	1.66
4th " 1 hour	0.98	1.86	1.24	1.20
5th " 1 hour	0.76	1.24	1.24	1.10
Total " 5½ hours	28.34	24.00	15.23	22.25

Evidently, then, in addition to any free lime present, there is a large amount of lime which is so loosely combined

be capable of acting as a base under the very different conditions which prevail in the soil. Table I. shows how much was capable of liberating ammonia when merely shaken with a cold solution of ammonium chloride; and that this amount was generally considerably in excess of the free lime found by extraction with sugar solution.

It was also found that when the solution of ammonium chloride with which the lime was first shaken was removed and the residue of the slag washed by decantation, more ammonia was liberated in the cold when a new solution of ammonium chloride was added and the slag residue shaken with it. This was tried with the three samples, Nos. 4, 5 and 7. These after washing were again treated exactly as before with 200 c.c. of water containing 1 gm. of ammonium chloride. (See Table I.) On titration the solutions showed alkalinity corresponding to the following percentages of lime:—No. 4, 0.62 per cent., No. 5, 1.20 per cent., and No. 7, 0.81 per cent. In the case of No. 7, the alkalinity is about half that obtained in the first treatment (Table I.).

In all the above tables it has been assumed that lime is the only base present which liberates ammonia. It is probable that the liberation of ammonia is partly due to the action of other bases present in the slag. Basic slag contains a little magnesia and much ferrous and ferric iron, and these will not be without action.

The amount of available base in these slags was calculated in another way. The 2 per cent. citric acid solution which was used in the determination of the citric solubility of the slag was partly neutralised by the slag. The residual acidity was determined by titrating with standard soda, and the equivalent of the portion neutralised by the slag was calculated into percentage of lime. The figures obtained in this way have already been given in Table III. They are much greater than those obtained in any other way. This is probably due to the amount of citric acid which was neutralised by iron and bases other than lime.

Without entering into the long-continued controversy as to the forms of combination in which the citric soluble phosphate in slag exists, we may assume that part of it, at any rate, exists as the tetra-calcium phosphate, $\text{Ca}_4\text{P}_2\text{O}_8 \cdot \text{CaO}$. This salt is capable in presence of dilute acids of breaking up and liberating lime which acts as a base. There is reason for believing that each molecule of $\text{Ca}_4\text{P}_2\text{O}_8 \cdot \text{CaO}$ contains two molecules of lime in a lower state of combination than the others, hence when it breaks up with weak acids it forms di-calcium phosphate and liberates two molecules of lime.* Part of the lime capable of liberating ammonia from its salts is probably obtained in this way.

considerable proportion of it must be derived in most cases from other compounds. It is probable that this lime, most of which is comparatively slowly liberated, is contained in silicates. The exact proportion of the lime capable of acting as a base which is derived from silicates there is no ready means of estimating.

Table V. also shows (c) the citric soluble lime. This was the total lime dissolved on treating the slag sample with 2 per cent. citric acid by the official method for the estimation of phosphate. It was estimated by precipitation as oxalate. It will be seen that this citric soluble lime bears no relation even approximately to the lime

TABLE V.

	No. of Sample.						
	1	2	3	4	5	6	7
(a) Lime from tetra-calcium phosphate.....	per cent. 5.00	per cent. 11.04	per cent. 10.84	per cent. 9.14	per cent. 9.94	per cent. 7.60	per cent. 12.14
(b) Free lime (Sugar Method).....	0.84	2.30	3.08	2.03	1.20	1.60	1.44
(c) (a) + (b).....	6.44	13.34	13.92	11.17	11.14	9.20	13.58
(d) Lime available as base ($\text{NH}_4\text{H}_2\text{SO}_4$ Method) (5½ hrs.).....	28.30	24.00	19.31	15.23	24.05	22.25	13.60
(e) Citric soluble lime.....	31.10	34.50	31.90	27.80	40.00	29.00	34.80
(f) (e) - Lime in citric soluble phosphate.....	25.50	23.46	21.06	18.66	30.06	21.40	22.60

In Table V. (a) the percentage of lime which might be liberated from the slag samples in this way is calculated, assuming that all the citric soluble phosphate consists of tetra-calcium phosphate. The free lime found by the sugar method is given in line (b). Table V. Line (c) shows the sum of (a) and (b), and line (d) the lime available as a base as found by distilling with ammonium sulphate for 5½ hours (Table III.). It will be seen that except in the case of slag No. 7, where they are practically equal, the figure in (d) is much greater than that in (c) for the same sample. Nor do the figures bear any constant relation to one another. By comparing Table V. with Table III. it will be found that the percentage of lime found by distilling with ammonium sulphate for 1½ hours is in four cases Nos. 1, 2, 5 and 6, considerably greater than the sum of the percentages of free lime and basic lime derived from the maximum amount of tetra-calcium phosphate which could be present. [(c) Table V.] It is evident then that all the lime in basic slag that can act as a base and drive off ammonia from ammonium salt cannot in most cases be accounted for by adding the free lime to the maximum amount of lime which can be liberated from basic phosphate. A

available as a base estimated by any of the methods given in Table III. Part of the citric soluble lime, however, is lime firmly combined with phosphate. If we assume that each molecule of phosphoric anhydride requires two molecules of lime for such close combination, and subtract this amount of lime from (c), the figures in (f), Table V., are obtained. These again bear no approximately constant relation to the lime available as a base determined by other methods.

All these figures indicate that the basic lime in slag is not only a very variable quantity, but that it consists of lime in various forms of combination. A little of it is free caustic lime. The rest is in combinations, such as silicates and basic phosphates. A part of this combined lime is readily liberated, and will probably readily act in the soil as a base. Other portions are only liberated with greater difficulty and slowly. As the conditions are very complex, it is impossible to draw any line and state an exact percentage of basic lime in slag except in terms of a strictly defined method of determining it.

In addition to thanking those who supplied me with samples, I have to acknowledge my indebtedness to a number of my advanced students, who carried out for me most of the determinations recorded in this paper. In particular I have to thank Mr. R. Ferries, B.Sc., on whom the bulk of the analytical work fell.

* O. Förster. Zeit. f. angew. Chem., 1892, 13, 22; this J., 1892, 400.

THE BEHAVIOUR OF WHEATEN FLOUR TOWARDS BAKERS' AND BREWERS' YEAST.

BY JULIAN L. BAKER AND H. F. E. HULTON.

The difference between bakers' and brewers' yeasts in their respective fermentative powers in doughs has long been known. Brewers' yeast is still said to be used to a considerable extent in the production of "country bread" and bread made in private houses, and it is supposed to produce a sweeter flavoured and moister loaf than bakers' yeast. Since the public now demand that bread should have a white and even texture and be free from any bitter flavour, brewers' yeast is practically unused in the bread-making industry in this country.

C. J. Lintner (Woch. f. Brau., 1901, 18, 446; this J., 1901, 1128) was the first to point out that pressed bottom fermentation yeast was far less resistant to high temperatures than bakers' yeast; when it is used the dough rises rapidly to the proper height but falls down again during the baking, and the bread lacks the desired porosity. Solutions of cane sugar were fermented with different yeasts by this observer, and it was shown that low fermentation brewers' yeasts were weakened to a much greater degree by temperatures above 86° F. than distillery yeasts.

Lintner suggested that this might be the reason of their different behaviour during baking operations.

A number of processes have from time to time been described for converting brewers' into bakers' yeast. If it can be done by any simple process the proposition is an attractive one, for brewers' yeast has practically no market value, whilst pressed bakers' yeast is worth £30 or more per ton. The conversion is possible—in fact, in some distilleries where a proportion of brewers' yeast is used it is done. The question then presents itself, Why is brewers' yeast so much weaker in fermenting dough than bakers' yeast, since there is no evidence to the contrary that the two yeasts belong to the same species of *Saccharomyces cerevisia*?

In view of the results obtained in a series of interesting investigations conducted by H. Lange* and F. Hayduck

* With regard to the presence of toxic substances in flour, Jazo has recorded (Science and Art of Breadmaking, 1895, p. 223) experiments in which he shows that brewers' yeast, while quite as capable of fermenting sugar solution as distillery yeast, is relatively inactive towards a mixture of flour and water. When flour and sugar were mixed, even the gas yield from the sugar was inhibited. He states "that flour also exerted a retarding influence on the fermentation with distillers' yeast." Attempts were made to discover what part of the flour exerted this retarding action on brewers' yeast, and he decided that it was the gluten. It was also noticed that brewers' yeast destroyed the viscosity of the gluten more than did the distillers' yeast.

the presence of toxic substances in cereals, we have tried that some light might be thrown on the reason for the difference between the two yeasts by allowing them to ferment doughs under varying conditions of ironment.

F. Lange (Woch. f. Brau., 1907, 24, 417, 433, 445, 457, 489, 505, 521; this J., 1907, 1104) and F. Hayduck (Woch. f. Brau., 1907, 24, 673, 685, 706, 746; this J., 108, 85) have shown that many cereals exert a toxic effect on yeast which the presence of certain substances can overcome, and in the experiments that follow we hope to make it evident that the difference in the behaviour of brewers' and bakers' yeast in flour fermentation is due to the susceptibility of the former and the immunity of the latter to this poison. A partial acquired immunity can be conferred on brewers' yeast by the use of certain salts, thus enabling it to approach, though never to equal, the activity of distillers' yeast when allowed to ferment in dough under similar conditions.

Experimental.—A series of six wide-mouthed 250 c.c. bottles were fitted with rubber stoppers carrying outlet tubes. The carbon dioxide was led from each bottle to a small flask filled entirely with strong brine solution so that the least evolution of gas displaced a corresponding volume of solution of salt into a graduated vessel. The temperature was kept constant by immersing the bottles in a water bath. It is unnecessary to make correction for the solubility of carbon dioxide in the brine solution, as all readings are comparative, absolute volumes not being required. Unwashed pressed brewery ale yeast was used, varying in age from 50 to 70 hours. The bakers' yeast was an "Edinburgh whisky distillery yeast," and when used by us its age was also 50 to 70 hours.

The fermentations were carried out at 110° F., for, as shown by one of us (J. L. Baker, J. Fed. Inst. Brew., 1903, 489; this J., 1903, 1203), brewers' and bakers' yeasts do not greatly vary in their fermentative power towards sugar solutions at this temperature.

Throughout these experiments, unless stated to the contrary, the following conditions were kept constant:—50 grms. of flour (Hungarian) were stirred into an even paste with 50 c.c. of water, and 1 gm. of yeast was then thoroughly incorporated. The bottles and their contents were placed in a water bath maintained at a temperature of 110° F., and after standing for 5 minutes were connected with their respective flasks containing the saturated brine solution. Readings of the gas produced as indicated by the volume of the brine displaced were recorded at intervals of 2, 3, and 4 hours.

In the experiments about to be described it was obviously necessary to ascertain the volume of gas which had been derived from the soluble carbohydrates already existing in the flour used. The total sugar as "glucose" or inversion obtainable from 20 grms. of the flour by ether water extraction is 0.51 gm., which should yield on fermentation roughly 128 c.c. of carbon dioxide. Consequently if more than this volume of gas is obtained when carrying out a fermentation of flour-dough, there appears to be no escape from the inference that the maltose formed in the flour from the starch by the action of diastase is the source of the extra yield. More than this volume is obtained less than two hours when flour dough is fermented with brewers' yeast, the five hours' yield being 350 c.c. But with bakers' yeast, even with the protective help of potassium sulphate, the three hours' yield in our experiments never more than slightly exceeded the 130 c.c. derived from the ready formed sugar. This does not of course prove that no diastatic action occurred until after three hours, since fermentation of newly formed maltose and pre-existing sugar may have occurred simultaneously.

Essential differences between bakers' and brewers' yeast.

Fermentation of flour in distilled water.—When flour is mixed with distilled water and brewers' yeast there is practically no fermentation. Bakers' yeast, on the other hand, under similar conditions gives a considerable yield of gas. The following figures illustrate the point:—

Effect of distilled water.

Time in hours.	Carbon dioxide evolved.	
	Brewers' yeast.	Bakers' yeast.
	c.c.	c.c.
2	8	143
3	9	216
4	10	287

The total yield of carbon dioxide at the end of four hours being 10 c.c. in the one case, as against 287 c.c. in the other. In this connection it may be remembered that Lange, Henneberg, and others (Jahrbuch der Versuchs und Lehranstalt, 1904 and 1905) have shown that bottom fermentation yeast is susceptible to the action of toxic substances in cereals when the yeast and cereals are present together in saccharine solutions prepared with distilled water.

Effect of tap or supply water.

The laboratory supply water used in these experiments contained, in grains per gallon: Total solids, 21.42; solids after ignition, 19.74; SiO₂, 0.28; CaO, 7.6; MgO, 0.71; SO₃, 2.69; K₂O, 0.42; Na₂O, 1.26; Cl, 1.40; N₂O₅, 0.31.

When this water is substituted for distilled water there is a marked increase in the activity of brewers' yeast. The fermentative power of bakers' yeast is however, unaltered.

Time in hours.	Carbon dioxide evolved.	
	Brewers' yeast.	Bakers' yeast.
	c.c.	c.c.
2	23	158
3	30	224
4	35	287

Presence of inorganic salts in water.

These may be dissolved in distilled or tap water. The results show that a greater effect is produced on the fermentative activity of brewers' yeast towards flour by dissolving the salt or salts in tap water.

The following table shows the protective influence of different salts dissolved in tap water on brewers' yeast in the fermentation of flour. The "increased yield" is the number of c.c. of carbon dioxide more than the 33 c.c. yielded by the control. The weights of salt are expressed as a percentage on the weight of water (50 c.c.) used.

Salt.	Per cent.	Increased yield of carbon dioxide in 3 hours.
0.02 Potassium sulphate	0.02	6
0.2 "	0.2	52
0.6 "	0.6	102
1.2 "	1.2	122
2.0 "	2.0	135
0.02 Kainite	0.02	8
0.1 "	0.1	38
0.3 "	0.3	91
0.6 "	0.6	126
1.0 "	1.0	152
2.0 "	2.0	163
6.0 "	6.0	148
0.6 Potash alum	0.6	8
0.6 Rochelle salt	0.6	31
0.6 Potassium nitrate	0.6	80
0.6 Magnesium chloride	0.6	90
0.6 Potassium chloride	0.6	120
0.6 Potassium hydrogen phosphate	0.6	74
0.6 Potassium dihydrogen phosphate	0.6	25
0.6 Sodium chloride	0.6	105

Potassium sulphate, calcium chloride, sodium chloride, and many other salts all act as accelerants. For experimental purposes we have used potassium sulphate as this materially enhances the fermentative power of brewers' yeast. The following table shows the gas production of brewers' and bakers' yeast when the flour was doughed with an aqueous (tap or distilled) solution of potassium sulphate containing 0.6 grms. per 100 c.c.

Effect of potassium sulphate dissolved in distilled and tap water.

Yeast.	c.c. of carbon dioxide evolved in 3 hours.			
	0.6 per cent. potassium sulphate in			
	Distilled water.	Tap water.	Distilled water.	Tap water.
Brewers' yeast	9	29	47	133
Bakers' yeast	240	212	221	204

The accelerating effect of tap water on brewers' yeast is probably due to the presence of acid calcium carbonate, for we have found that a solution of this salt prepared in the laboratory, when diluted with distilled water so as to contain the same amount as is present in tap water, yielded the same volume of gas as flour, brewers' yeast, and tap water.

Ford and Guthrie (*J. Inst. Brewing*, 1908, 14, 61; this *J.*, 1908, 239) drew attention to the protective or stimulating action which some inorganic salts exert upon barley diastase. Experiments we have made on the activation of flour diastase by the use of potassium sulphate and sodium chloride show that the Lintner value can be raised from 29 to 42 by their use. But a distinction must be drawn between the two functions that such salts appear to possess, viz.: (1) that of diastatic activation and (2) that of toxin counteraction. That the increased yield of carbon dioxide obtained by the use of potassium sulphate in the foregoing experiments with brewers' yeast is due to the second of these two properties we think is emphasised by the three following considerations.

(1) The use of the salt does not result in an increased yield of carbon dioxide when bakers' yeast is employed to ferment flour.

(2) Without the use of some such salt only about one-tenth part of the gas due from the existing carbohydrates in the flour is obtainable on fermenting a flour dough with brewers' yeast and distilled water.

(3) The toxicity to brewers' yeast of cold water extract of flour is overcome by the use of potassium sulphate. Here there can be no possibility of an activated diastase producing more maltose and consequently an enhanced gas yield.

So far we have shown the marked differences in the behaviour of brewers' and bakers' yeast towards flour. Whilst the gas yielded from bakers' yeast is practically unaffected by the presence of certain salts, that from brewers' yeast is greatly augmented. We have thus a means of readily distinguishing between the two yeasts. This well-defined difference between the two yeasts suggests that they may be of a different race although this is not in harmony with the fact that distillers can ferment their worts with brewers' yeast and the crop off this is suited for baking purposes. It may be urged that in such a case only those cells which can reproduce readily in the presence of toxic substances in the distillers' wort survive and that what has really taken place is a fractionation of the brewers' yeast. The action of potassium sulphate and other salts in raising the gas yield of flour and brewers' yeast is thus one of "protection" of the yeast against the toxic substance in flour. Bakers' yeast having been grown in a medium containing a toxic substance of a nature similar to that in flour has no need of protection, and the gas yield is not augmented when such a yeast ferments flour. These considerations led us to make experiments to ascertain if it is possible thus to select out

from brewers' yeast a strain having the characteristics bakers' yeast.

Brewers' yeast was successively grown in distiller wort three times, the yeast crop from the first fermentation being used for the second fermentation, and so on. The gas yields below show that the resulting yeast no longer requires the "protective" influence of salts.

c.c. of carbon dioxide evolved in 3 hours.

	Brewers' yeast grown three times in distillers' wort.	Ordinary brewers' yeast.	Bakers' yeast.
Distilled water ...	188	7	240
Tap water	206	30	212
Tap water containing 0.6 per cent. of potassium sulphate	204	134	204

Having thus succeeded in obtaining a new strain bearing the characteristics of bakers' yeast, the next point was to ascertain if these characteristics are permanent. Some of the yeast was therefore grown three times in ordinary brewers' hopped wort and submitted to the test described above:—

c.c. of carbon dioxide evolved in 3 hours.

	Brewers' yeast grown three times in distillers' wort and three times in brewers' wort.	Ordinary brewers' yeast.	Bakers' yeast.
Distilled water ...	160	7	240
Tap water	172	30	212
Tap water containing 0.6 per cent. of potassium sulphate	160	134	204

Although the volumes of gas yielded by the yeast after being re-grown in brewers' wort are not so great as before, yet the characteristic of the yeast is maintained, that is to say, that potassium sulphate is unable to exert an accelerating influence.

As a result of the investigations described in this paper we believe we are justified in putting forward the following suggestion as to the reason of the difference between the two yeasts:—

In a distillery wash, before the yeast is introduced, there are present large quantities of raw cereals, such as barley and rye, containing toxins, and since the distiller pitches his yeast into unboiled wort and therefore one with the cereal poison still active, only those yeast cells which can survive and are immune to such toxic substances and can reproduce in this environment will carry on the race, giving rise to cells inheriting this advantageous variation. There will thus be obtained in a few generations by natural selection what is to all intents a new species bearing this character of immunity to cereal poison. When such yeast is used for bread making, where it is again exposed to the action of the toxic substance in wheaten flour, the high gas yield at once shows that it is now immune, while brewers' yeast which has always been grown in a boiled, and therefore non-poisonous wort, is readily susceptible. The accelerating influence of potassium sulphate, sodium chloride, etc., on the fermentation of flour with brewers' yeast is thus seen to be correlated with the protective function these salts exert on the yeast by negating the toxic effect of the flour, while distillery yeast which is already immune to these toxins from having been grown in their presence, needs no such protection, and is, in fact, not activated by these salts.

Conclusions.

1. The existence in flour of a substance toxic to brewers' top fermentation yeast is confirmed, the poisonous action

ing greatest in presence of distilled water, less in supply
ater, and largely counteracted by potassium sulphate
d some other salts.
2. Bakers' yeast is unaffected by the flour toxin, and
ments with equal readiness doughs prepared with
stilled, tap, or hardened water.
3. The increase in fermentative power shown by
ewers' yeast in presence of potassium sulphate is not
ie to the activation of the flours' diastase but to the
hibition of the cereal toxin.
4. Bakers' yeast is unable to ferment more than a
uall fraction of the existing carbohydrates in flour
hen the dough is made with distilled water.
5. Brewers' yeast, on being grown consecutively three
mcs in a whisky-mash wort was found to have the
operties of a bakers' yeast, such properties showing
it little deterioration when the yeast was grown suc-
essively three times in a brewers' hopped wort.
6. Bakers' yeast seems to owe its toxin immunity to
e fact that it has been produced in a wort made from
cereals, such as barley and rye, containing toxins, only
ose cells that can reproduce in such an environment
urviving and transmitting this selected immunity to the
op collected. Such yeast will exhibit a much greater
ermentative power in presence of flour toxins than a
ewers' yeast grown in a boiled and therefore non-
poisonous wort.

THE TOXICITY OF FLOURS TOWARDS SACCHARO-
MYCES CEREVISIÆ (TOP FERMENTATION
BREWERY YEAST).

BY JULIAN L. BAKER AND H. F. E. HULTON.
In the previous paper we have shown that the reason of
the difference in the fermentative power of bakers' and
ewers' yeast in a medium of flour and ordinary water
ould appear to be the susceptibility of the latter to
the toxic bodies which are present in the flour. Distillery
east which is used by bakers is the outcome of repro-
uction in a medium in which only those cells that are
immune to the toxicity of an unboiled cereal wort can
urvive and reproduce. Hence distillers' yeast has a
uch greater immunity to the toxic properties of flour
an brewers' yeast.
This paper is the outcome of a further investigation on
the effect of the toxic substances in wheat flour on
saccharomyces. Since the marked difference in ferment-
ative capacity in flour-dough of the two yeasts which we
ave already discussed does not extend to their action on
vert sugar, it was thought probable that by the investi-
ation of the behaviour of the two yeasts towards different
ermentable media we might find some common factor
hich could be regarded as assisting in an inhibiting action
a brewers' yeast.

Fermentations with brewers' and bakers' yeasts were
arried out with—1. Invert sugar. 2. Aqueous flour
tract. 3. Invert sugar and flour. 4. Aqueous flour
tract and flour. 5. Distillers' wort (malt maize and
ye). 6. Cold aqueous extract of distillers' malt. 7.
nboiled malt wort prepared from brewers' malt.
The apparatus used in these experiments was the same
as that described in the previous paper. 20 grms. of
our were stirred into an even paste with 50 c.c. of solution,
grm. of pressed yeast was then incorporated and the
ermentation carried out at a temperature of 110° F.
1. *Invert sugar*.—The following results show that
akers' and brewers' yeast behave alike to a solution
f invert sugar. 50 c.c. of a 2.0 per cent. solution of the
ugar in distilled water was fermented at 110° F. with
akers' and brewers' yeast.

Yeast.	2.0 per cent. invert sugar in distilled water (50 c.c.).	
	c.c. carbon dioxide evolved in	
	3 hours.	4 hours.
akers'	85	112
ewers'	91	113

In the presence of potassium sulphate the yield of gas
from brewers' yeast when fermenting invert sugar is
practically unaltered.
2. *Flour extract*.—It was thought that the substance
which is toxic to brewers' yeast might be partially soluble
in water. 20 grms. of flour were extracted with 100 c.c.
distilled water for four hours at the ordinary temperature
and filtered. 50 c.c. of this extract contains the soluble
matter in 10 grms. of flour.

Yeast.	c.c. of carbon dioxide evolved in 3 hours.	
	Flour extract alone. 50 c.c.	Flour extract. 50 c.c. with potassium sulphate.
Bakers'	70	67
Brewers'	42	68

Here from the extract of 10 grms. of flour fermented with
brewers' yeast 42 c.c. of carbon dioxide are obtained, but
when this yeast ferments a mixture of the same flour and
distilled water it only produces about 7 c.c. of carbon
dioxide. The fact that the fermentative power of the
brewers' yeast towards flour extract is raised by the
addition of an inorganic salt indicates that a toxic substance
is present. When flour is extracted with tap water the
extract shows no evidence of toxicity, the yield of gas with
brewers' and bakers' yeast being similar. This is no doubt
due to the protective influence of the dissolved salts.
3. Jago (Science and Art of Breadmaking, 1895) has
stated that the presence of flour will inhibit the fermenta-
tion of a solution of sugar. We thought it well to examine
this point somewhat more closely. A 2 per cent. solution
of invert sugar in distilled water was prepared, 50 c.c.
of which should yield about 170 c.c. of carbon dioxide.
Brewers' yeast was used.

c.c. of carbon dioxide yielded in 3 hours.					
Distilled water.			Distilled water containing 0.6 per cent. of potassium sulphate.		
50 c.c. of invert sugar solution.	50 c.c. of sugar solution + 20 grms. of flour.	20 grms. flour.	Sugar.	50 c.c. sugar solution + 20 grms. flour.	20 grms. flour.
94	13	9	96	61	50

The results clearly show that the fermentation of the
sugar is stopped by the flour and also that the protective
influence of potassium sulphate on the mixture of sugar
and flour is very great.
4. Flour will also inhibit the fermentation by brewers'
yeast of its own aqueous extract just in the same way that
it does invert sugar. The flour extract was prepared by
digesting 20 grms. of flour with 100 c.c. for several hours.
50 c.c. of the extract was used in the experiment.

c.c. Carbon dioxide evolved in 3 hours.	
Brewers' yeast.	
(a) Flour + tap water	29
(b) Flour extract (50 c.c.)	36
(c) Flour (20 grms.) + flour ex- tract (50 c.c.)	32

The gas yield from "c" should be the sum of "b"
and "a" (36+29), that is 65 c.c. Only half of this
volume being obtained shows that the flour has retarded
the fermentation of the flour extract.

A similar experiment carried out with bakers' yeast demonstrated that flour had no retarding effect on the fermentations of its own extract. The gas yield of the flour plus its own extract was equal to the sum of the yields of the flour itself and its extract.

5. Since brewers' hopped wort may be regarded as the natural medium for brewers' yeast, it appeared to us of interest to ascertain how brewers' yeast would ferment a distillers' wort which is unboiled. A wort was prepared by mashing a mixture of distillers' malt (diastatic power, 130° Lintner) 28 per cent., rye flour 36 per cent., and flaked maize 36 per cent., at 130° F. for an hour.

Yield of carbon dioxide (brewers' yeast).

Hours.	10 c.c. wort + 40 c.c. distilled water.	10 c.c. wort + 40 c.c. tap water.	10 c.c. wort + 40 c.c. tap water containing 0.6 per cent. potassium sulphate	10 c.c. wort + 40 c.c. tap water containing 0.6 per cent. sodium chloride.
3	33	71	80	84
5	39	99	113	118
17	39	145	143	148

The poisonous effect of the wort in presence of distilled water is marked, also the protective influence of the dissolved salts. The yeast in the latter case was vigorous and healthy and in contrast to that from the fermentation carried out in presence of distilled water. Lange has shown that rye is toxic to bottom fermentation yeast, and the last experiment shows that English top fermentation yeast is similarly affected.

6. So far there is ample evidence that certain cereals contain a substance which is toxic to brewers' top and bottom fermentation yeast. Lange has closely investigated the properties of this poisonous body, but up to the present there are no data which throw much light on its chemical or physical properties. The suggestion that it may be oxalic acid seems negated by the fact that so many neutral salts like potassium chloride, sodium chloride and potassium sulphate, can prevent the toxic effect on brewers' yeast. The fact that boiling destroys the toxicity of an extract suggested a protein carrier for the poison and it was thought that by digesting at 110° F. with its own active protease a wort which was poisonous to brewers' yeast the toxic substance, if present, might be broken down and its toxicity diminished or destroyed. Distillers' malt (diastatic power 120° Lintner) was extracted our hours with three times its weight of cold distilled water and filtered. A portion of the filtrate was digested at 110° F. for three hours, another portion was fermented at once, and a third portion was boiled before fermentation to destroy the diastase and toxic substance.

Yield of carbon dioxide (brewers' yeast).

Hours.	Undigested malt extract.			Malt extract previously digested for 3 hours.		
	Alone. 50 c.c.	Wort containing 0.6 per cent. potassium sulphate 50 c.c.	Boiled wort 50 c.c.	Alone. 50 c.c.	Wort containing 0.6 per cent. potassium sulphate 50 c.c.	Boiled wort 50 c.c.
3	44	74	92	59	90	96
4	51	90	114	72	112	116
10	53	127	142	77	155	140

The double effect of previous digestion and potassium sulphate protection brings up the gas yield to that of the boiled and therefore non-toxic solution.

Here, as in the fermentation of flour by brewers' yeast, the protective action of potassium sulphate is well shown. Fermentation of the digestion products of the malt extract

shows a somewhat increased yield of gas, but it is no possible to state with certainty if digestion has weakened the toxic substance by bringing about proteolysis, or if it is partially coagulated at the temperature of the experiment.

7. A pale English malt (diastatic power, 29° Lintner) was mashed at the rate of 10 grms. per 100 c.c. with (i.) distilled water; (ii.) tap water.

50 c.c. were fermented with brewers' and bakers' yeast alone and with the addition of potassium sulphate

c.c. Carbon dioxide evolved in 3 hours from 50 c.c. of wort.

Brewers' yeast.

Malt mashed in distilled water.	Malt mashed in tap water.	Malt mashed in tap water and 0.6 per cent. potassium sulphate added before fermentation.
168	191	176

Bakers' yeast.

Malt mashed in distilled water.	Malt mashed in tap water.	Malt mashed in tap water and 0.6 per cent. potassium sulphate added before fermentation.
187	192	193

It is evident that there may be a small amount of toxicity in the mash made with distilled water, since the yield of gas with brewers' yeast is smaller than when a mash made with tap water is fermented. Both yeasts behave alike when the wort made with tap water is fermented.

From an inspection of the foregoing experiments it would appear that it is not malting that restricts the toxicity of these cereals, but the heat to which they are subjected on the kiln after germination, as the distillers' malt wort which is air dried still retains much of the yeast poisoning qualities which have disappeared in the wort prepared from such lightly cured malt as that used in the last experiment.

The net result of these fermentations described above is to show that raw and even malted cereals contain a substance which is toxic to brewers' yeast, partially soluble in water, and in all cases capable of counteraction by salts. Our next experiments were accordingly conducted with the object of forming some idea as to the nature of the toxic substance present in flour. A summary of the work which had been done up to 1906 may be found in the Journ. Inst. Brew., 1906, 12, 666 (see this J., 1907, 61), in a paper by H. Lange, Henneberg, F. Hayduck and Wendel. With regard to the characterisation of the poisonous substance in cereals these authors state "that it can be destroyed in rye grits by heating for several hours at 100° C. The same effect is produced by boiling the poisonous extract, although in some cases the toxic action is only weakened. When a cereal is malted the toxic action is weakened, but it is yet undetermined whether it can be entirely destroyed. The toxic substance cannot be extracted by any of the customary chemical methods. This suggested that the toxic substance must be sought amongst the proteins, or it may be produced from the same by the activity of the yeast." We also find that after a flour is heated its toxic influence towards brewers' yeast is lessened. Flour was heated to 210° F. and kept in a moist atmosphere until the original moisture was absorbed again. The gas yielded by brewers' and bakers' yeast in the fermentation of the unheated and heated flour was then measured.

c.c. Carbon dioxide evolved in 3 hours.				
Yeast.	Distilled water.		Tap water containing 0.6 per cent. potassium sulphate.	
	Unheated flour.	Heated flour.	Unheated flour.	Heated flour.
Brewers' yeast.....	10.5	73	124	135
Bakers' yeast.....	200	152	237	157

The figures under the heading "Distilled water" show great improvement in the gas yield by brewers' yeast. There is no doubt to the destruction by heat of some of the diastatic material in the flour; but when bakers' yeast is employed, which is immune to this poison, heating the flour merely weakens the diastase, and so diminishes the amount of maltose formed from the starch without any compensating advantage, a considerably lower gas yielding the result. Turning now to the hardened waters, which benefit the brewers' yeast but not a bakers', it is evident that the protective action of the potassium sulphate is more than sufficient to mask the gain to the brewers' yeast due to heating the flour, but cannot compensate the bakers' yeast for the loss of diastase in the heated flour as is evidenced by its low gas production. It was thought that some indication of the nature of the toxic substance in flour might be gathered by fermenting the latter with brewers' yeast in presence of a general poison such as potassium cyanide and ascertaining under such conditions potassium sulphate still continues to exert a protective influence. A series of observations were made with brewers' yeast, the results of which are tabulated below:—

c.c. carbon dioxide evolved in 3 hours.					
20 grms. of flour + 50 c.c. of tap water.	20 grms. of flour + 50 c.c. tap water containing 0.01 gm. potassium cyanide.	20 grms. of flour + 50 c.c. tap water containing 0.3 gm. potassium sulphate.	20 grms. of flour + 50 c.c. water containing 0.01 gm. potassium cyanide and 0.3 gm. potassium sulphate.	20 grms. of flour + 50 c.c. tap water containing 0.05 gm. potassium cyanide.	20 grms. of flour + 50 c.c. tap water containing 0.05 gm. potassium cyanide and 0.3 gm. potassium sulphate.
34.5	39.5	130	112	15	18

It will be seen that when the amount of potassium cyanide used was insufficient to check the normal fermentation of flour by brewers' yeast as seen in columns 1 and 2, the addition of potassium sulphate only caused an increase in gas of 72.5 c.c. (112—39.5) in the presence of cyanide, instead of the increment of 95 c.c. (130—34.5) in its absence. Further, when, as in columns 5 and 6, an amount of potassium cyanide is used which seriously diminishes the gas yield, the addition of potassium sulphate exerts no protective action. As Lange and others working with him have stated that rye is very poisonous in its action towards yeast, it was thought it would be of interest to compare its effect in this respect with wheat flour.

Rye flour.			
Yield of carbon dioxide in one hour.			
Yeast.	Distilled water.	Tap water.	Tap water + 0.6 per cent. potassium sulphate.
Brewers' ..	c.c. 33	c.c. 48	c.c. 91
Bakers' ...	154	—	154

As the gas yield is very rapid when rye flour is fermented with bakers' yeast, it was not possible to record

the three hours' figure, but the figures are quite sufficient to show the immunity of the bakers' yeast and the great susceptibility of the brewers' yeast to the weakening effect of rye flour.

A cold water extract of rye in distilled water was prepared at the rate of 10 grms. per 100 c.c. This is very viscous and filters with difficulty. The following yield of carbon dioxide was obtained from 50 c.c. of the solution corresponding to 5 grms. of rye flour.

Bakers' yeast.			
50 c.c. + 0.6 per cent. potassium sulphate.		50 c.c. + 0.6 per cent. potassium sulphate.	
Hours.	50 c.c.	50 c.c.	50 c.c.
2	54	54	44
3	68	69	55
4	87	91	74

These results afford but slight evidence of a substance soluble in water which acts as a poison to brewers' yeast, in this respect differing considerably from wheat flour extract (*q.v.*).

The considerable extra yield of carbon dioxide obtained from wheat-flour dough and bakers' yeast when a trace of powdered malt (1 part in 400) is added was pointed out in our paper, "Considerations Affecting the Strength of Wheat Flours" (this J., 1908, 27, 368—376). We there attributed the extra yield to the starch liquefying enzyme of the malt. However this may be, no increase is obtained by the use of malt in the above proportions when brewers' yeast is substituted for bakers'.

It will be remembered that in all the experiments above described 20 grms. of flour are doughed with 50 c.c. of

water. The effect upon the gas yield of altering this ratio is very marked, as will be seen from the following figures. The weight of flour is 20 grms. in all cases:—

Yield of carbon dioxide in 3 hours.				
Yeast.	Distilled water.			Percentage decrease in gas yield.
	25 c.c.	50 c.c.	100 c.c.	
Brewers'	23	9	9	61
Bakers'	274	216	130	53

Yeast.	Tap water.			Percentage decrease in gas yield.
	25 c.c.	50 c.c.	100 c.c.	
Brewers'	72.5	40.5	21.5	66
Bakers'	270	224	182	33

Here the decrease in gas yield expressed as a percentage, is the fall when the 100 c.c. yield is compared with that from 25 c.c.

The following experiment was performed to see what was the relative efficiency as a protective agency of the

calcium carbonate in tap water as compared with the ash of the flour itself:—

Two portions of cold water extract from 20 grms. of flour were burnt and the ash (0.06 gm.) was added to a dough made with (1) distilled water; (2) tap water; fermentations being then carried out in the usual manner.

Yield of carbon dioxide in 3 hours. Brewers' yeast.			
1.	2.	3.	4.
Distilled water.	Tap water containing 0.008 gm. calcium carbonate.	Distilled water + 0.06 gm. flour ash.	Tap water + 0.06 gm. flour ash.
12	42	78	94

A calculation will show that in corresponding dilutions calcium carbonate is about 3.5 times as effective as the ash of flour in increasing the yield of gas in the presence of distilled water, or, in other words, in affording the yeast protection.

Conclusions.

1. Bakers' and brewers' yeasts behave alike to invert sugar, the yield of gas not being augmented by potassium sulphate.

2. Flour extracted with distilled water yields an extract toxic to brewers' yeast. This toxicity can be overcome by potassium sulphate.

3. Fermentation of a sugar solution by brewers' yeast is stopped by the addition of flour. In the presence of potassium sulphate the fermentation proceeds.

4. Fermentation by brewers' yeast of the aqueous extract of flour is retarded by the addition of flour. Flour or its extract is without influence on the fermentative energy of bakers' yeast.

5. A distillers' wort prepared from malt, rye flour and maize is toxic to brewers' yeast, the toxicity being destroyed by boiling. Whilst heating to high temperatures on the kiln effects the destruction of the toxicity of barley malt, the process of germination does not. When flour is heated to 100° C. for some hours the toxicity previously exhibited towards brewers' yeast is considerably reduced.

6. Flours were fermented with brewers' yeast in the presence of an amount of potassium cyanide which lowers the gas yield. The addition of potassium sulphate exerts no protective action.

7. Brewers' yeast is very susceptible to the weakening effect of rye flour. The toxins present, unlike those of wheat flour, are not soluble to any considerable extent in water.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Evaporating liquid from brine for the production of salt or for evaporating liquid from other solutions. J. Hodgkinson, Manchester. Eng. Pat. 5011, March 5, 1908.

In order to maintain a uniform temperature in the furnace below the closed brine-pan, the fuel is fed by an automatic coking stoker of the type known as the Hodgkinson stoker. The separated salt is removed from the pan by rotary rakes which deposit it in an external depression from which it is elevated and discharged. The foam is broken by a rotating film breaker partially immersed in the brine. Both the steam from the finishing pan and the waste gases from the furnace may be used in auxiliary pans through which the fresh brine flows and receives a preliminary heating and concentration before it reaches the finishing pan.—W. H. C.

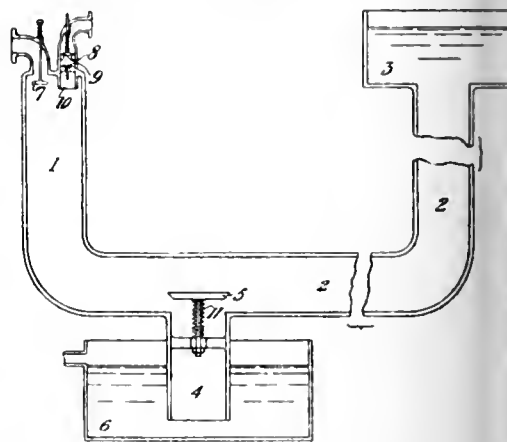
Coolers or condensers also applicable for use as heaters or evaporators. J. Grouvelle and H. Arquembourg, Paris. Eng. Pat. 13,776, June 29, 1908. Addition to Eng. Pat. 10,143 of 1902.

The claim is for the substitution of tubular for the solid partitions which bear against the wings or gills of the tubes.—W. H. C.

Washing, separating, or concentrating minerals or substances of different specific gravities [coal, &c.]. G. H. Tarver and M. Coulson and Co., Ltd., Spennymoor, Durham. Eng. Pat. 12,077, June 3, 1908.

The claim is for improvements in the rotary washer described in Eng. Pat. 2482 of 1896. A number of longitudinal fins or plates are attached to the interior of the rotary cylinder between the spiral conveyor rims. The material is lifted by the plates and then, as the cylinder rotates, is thrown across the cylinder.—W. H. C.

Compressing air or gases, and apparatus therefor. H. Humphrey, London. Eng. Pat. 12,565, June 11, 1908.



WATER flows from the overhead reservoir, 3, down the pipe, 2, and past the valve, 5, through the pipe, 4, into the lower reservoir, 6. As soon as the velocity of the water is sufficient to overcome the tension of the spring, the valve, 5, closes and the water fills the part of the tube marked 1, the air-inlet valve, 7, closes, and the water is compressed until the pressure is great enough to open the outlet valve, 8. The compressed air is then forced out of the valve, 8, until the water reaches the lower end of the pipe, 10, until the valve, 9, closes. The compressed air contained in that portion of the pipe, 1, which is above the bottom of the pipe, 10, then expands and forces the water backwards until the pressure due to the velocity has been overcome, when the valves, 5, and 7, open again, the water flows away through 5, and a fresh charge of air enters through the valve, 7.—W. H. C.

- Filtering apparatus.* A. J. Arbuckle, Johannesburg. U.S. Pat. 924,721, June 15, 1909.
- SLE Eng. Pat. 21,452 of 1908; this J., 1909, 195.—T. F. B.
- Concentrating solutions by freezing; Apparatus for —.* E. Monti, Turin, Italy. U.S. Pat. 925,820, June 22, 1909.
- SEE Fr. Pat. 390,085 of 1908; this J., 1908, 1008.—T. F. B.
- Refrigeration; Process of —.* W. W. Seay, San Francisco. U.S. Pat. 926,080, June 22, 1909.
- SEE Eng. Pat. 25,806 of 1907; this J., 1908, 740.—T. F. B.
- Distillation, condensation, and rectification of liquids; Apparatus for the fractional —.* V. Slavicek, Vienna. U.S. Pat. 926,216, June 29, 1909.
- SEE Eng. Pat. 27,063 of 1902; this J., 1903, 877.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

- Coal gas; Analysis of — and of similar gaseous mixtures, with special regard to the determination of nitrogen.* G. von Knorre. Chem.-Zeit., 1909, 33, 717–719.

A MODIFICATION of Jäger's method (J. Gasbel., 1898, 764) is described. After absorption of carbon dioxide, heavy hydrocarbons, oxygen, and carbon monoxide in the usual manner, the whole gaseous residue is passed over copper oxide in a quartz tube, heated to 250° C. The air in this tube is previously displaced by pure nitrogen which is led through by means of a capillary side-tube. At 250° C. the copper oxide oxidises the free hydrogen in the gas very rapidly to water; the gas is therefore passed to and fro through the heated tube until no further diminution in volume occurs. The total diminution in volume is equal to the volume of hydrogen originally present. The quartz tube containing copper oxide is then heated to bright redness and the gas passed to and fro until no further contraction occurs after contact with potassium hydroxide solution. The reduction in volume is equal to that of the carbon dioxide formed by the combustion of the methane in the residue, and therefore to the volume of $\frac{1}{2}$ methane itself. The residual gas represents the total nitrogen in the sample. Carbon monoxide is also oxidised to carbon dioxide by the action of copper oxide at 250° C. The copper oxide has to be occasionally regenerated by aspirating air through the heated tube for a few minutes. After a time, however, the regenerated copper oxide becomes inactive, and must be replaced. The quartz tube lasts for a long time. The results are said to be very accurate, as the total sample is used for all determinations and the quartz tube does not alter in volume by deformation on heating. For very accurate nitrogen determinations it is best to take a separate sample, pass it directly through the red hot copper oxide tube till no further contraction occurs and read off the volume of nitrogen which remains.—E. F.

- Oxyhydrogen flame; Temperature of the —.* E. Bauer. Compt. rend., 1909, 148, 1756–1757.

THE temperature of an almost homogeneous oxyhydrogen flame has been determined by two methods. (1). By measuring the emission and absorption of the flame for rays reflected from fluorspar, applying Planck's formula; this gives 2210° C. (2). By the method of the reversal of the D ray, by means of the electric arc and a system of absorbing prisms, which leads to values between 2260 and 2300° C., according to the proportion of oxygen.

—F. SODN.

- Illuminating efficiencies of carbon monoxide and hydrogen used in conjunction with incandescent mantles.* A. Forshaw. J. Gas. Lighting, 1909, 106, 865–871.

THE view widely held that the illuminating efficiency of a combustible gas used in conjunction with an incandescent mantle is proportional to its net calorific value appears to be based mainly on results obtained with more or less complex mixtures of gases (see this J., 1902, 1012, 1020; 1903, 1078, 1286). The author has compared the

illuminating efficiencies of hydrogen and carbon monoxide two gases not differing greatly in net calorific value, but exhibiting considerable differences in the character of their flames and their modes of combustion, the rate of combustion of hydrogen being very much higher than that of carbon monoxide, and the two rates being unequal accelerated by the influence of hot surfaces. It was found that in an ordinary atmospheric burner, it was not possible to burn a mixture of hydrogen with more than about one-fifth of the quantity of air necessary for complete combustion. Up to this point, namely a ratio of air to gas of 0.52, the duty (candles per cb. ft. of gas per hour) afforded steadily decreased with a rising rate of gas consumption. With this burner, carbon monoxide gave a very much higher duty than hydrogen, and the distribution of luminosity over the mantle was very different with the two gases. In order to be able to burn hydrogen in a well-aerated condition, a special burner was devised. The highest duty obtained therewith for hydrogen was 11.5 candles per cb. ft. with a ratio of air to hydrogen of 1.5; whilst the best result obtained with carbon monoxide (in the ordinary burner) was 17.3 candles per cb. ft. with a ratio of air to carbon monoxide of 1.9. The illuminating efficiency of carbon monoxide was thus 48 per cent. higher than that of hydrogen, whereas the calorific value under the experimental conditions, was only 13 per cent. higher. By using hollow cones of porous porcelain to confine the combustion as far as possible to a hollow she corresponding to the outline of the mantle, the combustion was accelerated and the illumination concentrated, but further experiments are needed to prove definitely whether the duty can be raised by this means.—A. S.

- Acetylene; Precautions in the preparation, storage, and use of — and storage of carbide.* Z. angew. Chem. 1909, 22, 1331–1332.

IN A decree issued by the Prussian Minister for Trade and Industry, it is stated that the exemption of small portable acetylene generators (charges of up to 2 kilos. of carbide) from the regulations in force with respect to the preparation and use of acetylene, has led to unforeseen results. Owing to the rapid development of autogenous welding in place of soldering, these acetylene generators are now used to considerable extent in closed workrooms and are frequently worked beyond their nominal capacity. The danger attending this state of things are referred to and a modification of the acetylene regulations is foreshadowed. In the meantime, exemption from the present regulation is to be limited to generators charged automatically with a definite quantity of carbide. Hand-worked generators which can be charged above their nominal capacity, and mechanically charged generators provide with means for feeding in several charges of 2 kilos. in succession are thus excluded, but permission for their use in closed workrooms may be granted in special cases. Where acetylene generators of any kind are used in workrooms, great care must be taken to avoid danger of injury to the workpeople, and special precautions must be taken when there is possibility of acetylene escaping into the room from the generator when it is in use.—A. S.

- Impurities in mine air due to the firing of dynamite.* Nauckhoff. See XXII.

PATENTS.

- Coal or coke dust or like fuel; Utilising — in furnaces fitted with mechanical stokers.* T. D. Stonehouse, S. Sampsons, Guernsey. Eng. Pat. 13,476, June 25, 1909.

LIQUID or solid hydrocarbons are fed in measured quantities into the hopper of a coking stoker, and are mixed with the fuel in the hopper. The finely divided fuel becomes agglomerated on the coking plate of the stoker and cokes into relatively large pieces which do not fall through the bars unburnt as would be the case with finely divided fuel if it were not agglomerated.—W. H. C.

- Peat products for fuel purposes, and process of manufacturing the same.* V. Zailer, Vienna. Eng. Pat. 1247, Jan. 18, 1909.

THE patent refers to a continuous process for the manufacture of enriched peat, in which the raw material is

orporated, in the cold, with mineral oil; tar and inferous oils are unsuitable. By incorporation with a thick peat pulp in a quick-running moulding machine the ordinary type, the oil becomes highly emulsified, and a homogeneous product is obtained in a single operation.—W. E. F. P.

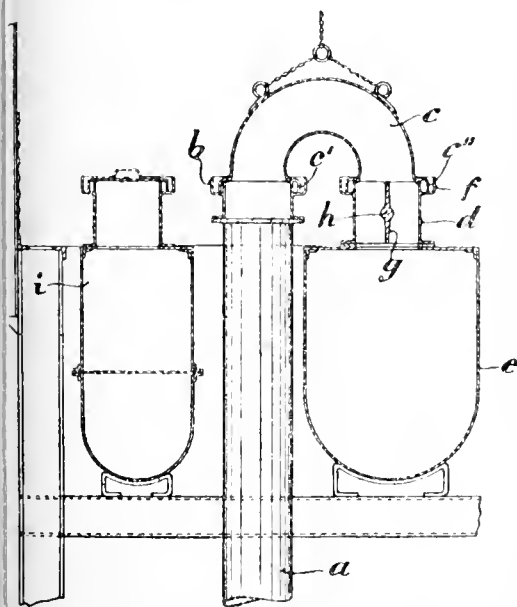
onising air [for internal combustion engines]. H. C. Williams and G. W. Glascock, London. Eng. Pat. 17,325, Aug. 18, 1908.

The apparatus is intended for the rapid automatic production of large volumes of ozonised air to be used in internal combustion engines. A number of glass tubes, each closed at one end and provided with a core of corrugated metal of high electrical conductivity, are exhausted of air, and fixed in a frame of insulating material, such as opiate, the latter being enclosed in an outer casing of material suitable for attachment to the carburettor or mixing chamber of an internal combustion engine. The tubes are arranged in two groups, and, by means of wires soldered in the glass of the tubes, the two sets of cores are connected to the opposite poles of an induction coil. It is stated that by the use of ozonised air the explosive force of the fuel used in the internal combustion engine increased by 15 per cent. or more.—B. N.

Explosive mixture for combustion-engines. P. Winand, Cologne, Germany. U.S. Pat. 914,624, Mar. 9, 1909.

The explosive mixture (for use in the combustion-engines of submarines, torpedoes, etc., where atmospheric air is not available) consists of two non-explosive, nitrated carbon-compounds, together with a convenient diluent. One of the compounds (such as nitrobenzene) must contain sufficient oxygen for the complete oxidation of its carbon and hydrogen, and the other (such as tetranitroethane) a considerable excess of oxygen. The diluent serves for maintaining the required limitation of temperature and could preferably be provided by the products of combustion.—W. E. F. P.

Gas and coke oven plant. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 982, Jan. 14, 1909.



The ascension pipe, *a*, has an annular channel, *b*, formed at its upper end and is connected to the hydraulic main, *c*, at the bend, *c*, provided with a flange, *c'*, which dips into water contained in the annular channel, *b*, and forms a siphon. The hydraulic main has a short neck, *d*, formed at its upper side provided with an annular channel, *f*, to which the flange, *c'*, at the other end of the bend, *c*, is connected. The neck, *d*, is provided with a transverse

swivel damper, *h*, *g*, which is closed before the ascension pipe is disconnected. After disconnection a loose cover is placed over *d*. While the retorts or ovens are being charged or discharged, the ascension pipe is connected in a similar manner to a waste gas main, *i*, which is connected to the chimney stack.—W. H. C.

Retorts for the destructive distillation of coal; Discharging retort.—T. Parker, Wednesfield, Staffs. Eng. Pat. 14,165, July 3, 1908.

The retorts are arranged in sets, each of which is closed at the bottom by a single cover-plate operated from without the furnace. By lowering or withdrawing the cover-plate, the contents of each set of retorts falls on to one or other of the inclined walls of a kind of hopper several feet below, the impact being sufficient to break up the charge, which then passes through to a conveyor beneath.—W. E. F. P.

Coking plant. W. R. Elliott, Denver, Colo. U.S. Pat. 925,428, June 15, 1909.

The patent relates to a plant, for continuous working, in which the charge is supported on a movable platform, acting in conjunction with suitable quenching apparatus, and receptacles. The platform is charged from the coal-receptacle, transferred to the oven, and removed at the conclusion of the coking operation. After quenching, the mass is forced from the platform into the coke-receptacle.—W. E. F. P.

Coke-ovens; Bunsen burner for —, with detachable tube of refractory material. R. Müller. Fr. Pat. 397,325, Dec. 11, 1908.

In coke-ovens utilising the gaseous products as a source of heat, the metal burners employed, which are of the Bunsen type, require frequent renewal in consequence of the high temperatures to which they are exposed. In the present invention, the tube, or the head, of the burner is constructed of refractory material, and is easily detachable from the metal base.—W. E. F. P.

Coke-oven with vertical flues for ascending and descending gases. Dr. C. Otto and Co. Fr. Pat. 397,380, Dec. 14, 1908. Under Int. Conv., Dec. 19, 1907.

The coke oven described, which is of the regenerative type heated by gas from below, consists essentially of a series of coking chambers, separated by vertical flues, in which the hot gases ascend and descend successively. Alternate flues are provided with burners, each of which serves a pair of adjoining coking chambers, the hot gases being drawn into, and down, the remaining flues. The downward flow of the gases is regulated by means of dampers, uniform heating of the coking chambers being thus obtained. The construction of the oven varies according to requirements, provision being made for heating by means of gas, waste heat, or by gas and waste heat combined.—W. E. F. P.

Gas generators. A. Jabs, Zurich, Switzerland. Eng. Pat. 12,446, June 9, 1908.

In a shaft generator, more heat is generated in the lowest zone by the complete combustion of the fuel, than is required for the purpose of distilling the fresh fuel; this causes the gases and by-products to be drawn off in a highly heated state, the latter being decomposed into less valuable products. To avoid this, the generator is constructed with one or more lateral openings near the upper limit of the lowest zone, and about half of the coke is withdrawn as it is produced, leaving only sufficient incandescent coke to convert the carbon dioxide into carbon monoxide. The square section of the furnace is increased at the distillation zone, causing the fuel adjacent to the walls to become more rapidly coked, and therefore able to be withdrawn without intermixture with the partly distilled fuel.—F. R.

Gas-producer. G. Akerlund, Wilkinsburg, Pa. U.S. Pat. 925,415, June 15, 1909.

The apparatus consists essentially of a cylindrical coal receiver, closed at the top, and provided with a horizontal

vaporiser surrounding the ash-pot. The vaporiser communicates with the upper portion of the coal receiver by means of pipes extending longitudinally through the refractory lining of the latter, or the pipes may be replaced by an annular chamber in the said lining; and suitable means are provided for the admission of air, so that the heated mixture of air and steam is drawn from the top to the bottom of the fuel column. The gaseous products pass through openings in the bottom of the ash-pot into a cylindrical chamber beneath, and thence to the outlet.

—W. E. F. P.

Gas-producer. L. F. Burger, Assignor to J. Thompson and Sons, Beloit, Wis. U.S. Pat. 925,621, June 22, 1909.

THE claim is for a charging hopper for a gas-producer, provided with a conical drop-valve opening into the generator chamber and attached to a vertical reciprocating rod by which the valve is operated and which extends through the hopper. The latter has a sliding cover, which on being opened, engages the rod supporting the cone and locks it, so that the cone can only be lowered when the sliding cover is closed.—W. H. C.

Combustible gas; Process and apparatus for production of homogeneous —, by carburisation of atmospheric air. J. M. Arnold. Fr. Pat. 397,081, Dec. 4, 1908.

CARBURETTED air gas is often extremely variable in composition, since, in many methods of working, the most volatile constituents of the carburizing liquid are carried off in the earlier stages of the process, the heavier hydrocarbons remaining until the end. In the present process it is claimed that gas of constant composition, calorific power, and specific gravity may be obtained by means of the apparatus described. The carburizing liquid is automatically fed (in the predetermined proportion for the quality of gas required) into the carburettor, consisting of a long cylindrical chamber enclosing a vertical spiral. The liquid enters the top of the cylinder by means of radial, perforated pipes, and, falling on to the upper edge of the spiral, flows down the vertical surfaces of the same, where it is quickly and completely evaporated by an upward current of air issuing from similar pipes at the bottom of the chamber. The process is carried on under the constant pressure obtained by the action of the bell of a gasometer, which also serves to regulate the supply of carburizing liquid.—W. E. F. P.

Gas producer. L. Bénier. Fr. Pat. 397,206, Dec. 9, 1908.

THE apparatus consists of a cylindrical combustion chamber, lined with refractory material, and surrounded by a sheet iron envelope, enclosing an annular space through which the mixture of air and steam passes before coming into contact with the fuel. The circular grate supporting the latter slopes down from the circumference towards the centre, and is formed about a small annular chamber containing water, which serves to cool the grate and to generate the necessary steam. The fire-bars are placed radially, the central space being left free, thus forming a vertical pipe which is prolonged nearly to the bottom of the chamber beneath. The latter, serving as an ash-pit, communicates with a rectangular chamber containing a small boiler. The mixture of air and steam enters at the bottom of the annular space surrounding the combustion chamber, and passes into the latter through horizontal openings at the upper end. The gaseous product issues from the bottom of the furnace, and, passing into the rectangular chamber, gives up part of its heat to the small boiler contained therein, the heated water being subsequently fed into the small annular chamber forming part of the grate. The gas is then brought into contact with a spray of water, in order to free it from dust, and is finally passed through sawdust to complete the purification.

—W. E. F. P.

Suction gas producer for bituminous fuel. K. Herold. Fr. Pat. 397,278, Dec. 9, 1908.

THE producer consists of a cylindrical outer casing, provided with a grate, and within which is a cylindrical charging hopper, the upper end of which is widened to

meet the outer casing near the top, while the lower end extends to within a short distance of the grate, the intervening space being occupied, under working conditions, by a layer of incandescent fuel. In the middle portion of the charging hopper is fixed a smaller cylinder, open at the bottom, and provided with a horizontal pipe at the top (by means of which connection is made with the chamber beneath the grate, or with the outside air, and so placed that its lower end is about as far above the bottom of the hopper as the latter is above the grate. The chamber beneath the grate also communicates, by means of an outside pipe, with the top of the producer, and the gaseous products are drawn off at the upper end of the annular space between the hopper and the outer casing. When in operation, sufficient fuel is present to form a fairly thick layer on the grate, and to fill the cylindrical portion of the hopper. By suitable regulation, the gaseous products are finally made to pass upwards through the incandescent layer before being drawn off, the function of the innermost cylinder being to prevent tarry fumes, etc., from passing directly from the hopper to the annular chamber. This is effected by maintaining the interior of the cylinder and the annular chamber at about the same reduced pressure.—W. E. F. P.

Combustible gas; Production and regeneration of —, for fuel or motive power. J. Taverne. Fr. Pat. 397,285, Feb. 18, 1908.

CARBON monoxide is mixed with the required proportion of air (obtained from liquid air) to form a combustible mixture. After combustion the products are passed through incandescent coke in order to regenerate carbon monoxide.—W. E. F. P.

Electric lamp filaments; Manufacture of —, and apparatus therefor. Soc. Française d'Incandescence par le Gaz (Système Auer), Paris, France. Eng. Pat. 12,720, June 13, 1908. Under Int. Conv., July 13, 1907.

THE unfinished filament, composed of a metallic oxide, is inserted from the bottom into a vertical tube furnace, which is traversed by a current of reducing gas. The upper part of the furnace is strongly heated by gas or electricity. When the filament becomes a conductor, by the reduction of the metallic oxide to metal, a current of electricity is passed through it, completing the formation of the filament.—F. R.

Coke oven. H. Koppers, Essen on Ruhr, Germany. U.S. Pat. 925,815, June 22, 1909.

SEE Fr. Pat. 382,066 of 1907; this J., 1908, 275.—T. F. B.

Gas-retort furnace. H. Ries, Munich, Germany. U.S. Pat. 926,135, June 29, 1909.

SEE Fr. Pat. 379,113 of 1907; this J., 1907, 1191.—T. F. B.

Gas from tar, oil, or the like; Method of producing — in gas producer plant. F. G. C. Rincker, Watergraafameer, and L. Wolter, Amsterdam. Eng. Pat. 16,027, July 28, 1908.

SEE Fr. Pat. 393,114 of 1908; this J., 1909, 16.—T. F. B.

Producer gas or water gas; Process of and apparatus for manufacturing —. H. Pettibone, New Rochelle, N.Y., U.S.A. Eng. Pat. 19,363, Sept. 15, 1908.

SEE U.S. Pats. 898,601 and 900,582 of 1908; this J., 1908, 1011, 1051.—T. F. B.

Mixing, measuring, and carburizing gaseous bodies; Apparatus for —. A. Bouvier, Lyon, France. U.S. Pat. 924,883, June 15, 1909.

SEE Eng. Pat. 21,022 of 1906; this J., 1907, 600.—T. F. B.

Gas producer. G. Hutton, Brierley Hill. U.S. Pat. 925,634, June 22, 1909.

SEE Eng. Pat. 18,214 of 1904; this J., 1905, 836.—T. F. B.

Gas purifier. C. Flössel, Munich, Germany. U.S. Pat. 926,647, June 29, 1909.

SEE Fr. Pat. 373,998 of 1906; this J., 1907, 754.—T. F. B.

Metallic filaments for electric incandescent lamps; Process of treating — W. Majert, Berlin. U.S. Pat. 926,069, June 22, 1909.

EE Fr. Pat. 392,524 of 1908; this J., 1908, 1198.—T. F. B.

Determining calorific power of combustible gases. Addition to Fr. Pat. 385,726. See XXI11.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Grossny petroleum; Optical and other properties of — M. Rakusin. Petroleum, 1909, 4, 921—924.

Crude oil.—On a former occasion the author determined the carbonisation constant (K) as 1/24 per cent. in benzene solution; and a recent examination of oil from a different depth gave the value, 3/32 per cent. *Laboratory fractions.*—The fractions up to 250° C. are colourless, free from dichroism, and give colour reactions with trichloroacetic acid, whilst the higher-boiling fractions show progressively deepening colour from straw yellow to blood red (the residue being black), and increasing dichroism. The oil behaves like other Caucasian oils on distillation, and contains 85 per cent. of recoverable fractions, 25.05 per cent. consisting of lubricating oil fractions. The heaviest of these fractions, coming over at 325°—340° C. (12 mm.), has the sp. gr. 0.9424 at 15° C., a viscosity equal to that of castor oil, and dextrorotatory power of about 80° in the saccharimeter. It is considered that the usual classification of petroleum residues according to their lubricating oil content, is based on the present defective method of practical distillation, and not on the nature of the crude oils. Specimens of lubricating oil, obtained by distilling about 8 cwt. of crude oil with superheated steam, would allow the rays of polarised light to pass only when examined in the form of solutions in benzene, of 6.25 and 3.12 per cent. concentration respectively; a result confirming the view that the practical distillation process requires modification, so that the distillates may be collected according to their boiling point limits and constants of rotation, thus enabling valuable technical products to be obtained with a minimum expense for fuel. *Residuum.*—The carbonisation constant (K) was only about four times as high as that of the crude oil, showing that no racemisation occurred in distillation. The optical examination of the residuum after refining with 30 per cent. of sulphuric acid, showed that the acid had greatly lowered the content of asphaltic constituents. *Behaviour of crude oil when centrifuged.*—This treatment reduced the specific gravity from 0.8791 to 0.8768, and raised the carbonisation constant from 3/32 per cent. to 1/8 per cent. These results are considered to throw light on the formation of asphaltum and similar products by the centrifugal force of the globe.—C. S.

Paraffin wax; Examination of — L. Singer. Petroleum, 1909, 4, 1038—1040.

PARAFFIN WAX of Austrian production is now so graded that it no longer consists of heterogeneous fractions, but of different grades, the melting and solidification points of which can be more or less sharply determined. For this purpose Shukoff's method is almost universally employed for commercial transactions (see this J., 1899, 406). For the determination of the proportion of oil in purified paraffin wax, Holde's modification is frequently used:—The weighed quantity (0.5 gm.) of the sample is dissolved in 30 c.c. of ether, and the solution mixed with 30 c.c. of 96 per cent. alcohol. The mixture is stirred and cooled to 20° C., and the insoluble portion separated and washed with 10 c.c. of a mixture in equal parts of alcohol and ether at 20° C. The residue on the filter is then washed with hot benzene or petroleum spirit into a weighed dish, the solvent evaporated, and the residue dried for 15 minutes at 105° C., and weighed. The filtrate and washings are also evaporated on the water-bath, and this residue washed with 6 c.c. of the mixture of alcohol and ether (this time cooled to —20° C.), and its weight added

to that of the previous residue. Finally the last filtrate and washings are evaporated, and the amount of residue obtained gives the proportion of "oil" in the paraffin wax. An addition of 1 per cent. must be made to the results thus obtained in the case of hard paraffins. The author has examined numerous samples of different grades of paraffin wax and has compared the results with the figures given by Shukoff's method. By dissolving the residues in 10 c.c. of petroleum spirit and treating the solution with alcohol and ether, as described by Holde, the proportions of "oil" are considerably lower. The following table gives typical results:—

Grade.	Solidification point.	Without petroleum spirit.		With petroleum spirit.	
		Paraffin.	Oil.	Paraffin.	Oil.
	° C.	per cent.	per cent.	per cent.	per cent.
White, soft (matsch)	44.9	90.02	9.98	91.90	8.10
50/51, opaque	50.3	98.10	1.90	99.80	0.20
50/51 transparent	50.6	98.93	1.07	99.78	0.22
60, transparent	58.6	99.55	0.45	100.00	0.00

From this it appears that the proportion of oil in a given grade of paraffin wax may be approximately the same in opaque and in transparent samples. In one case paraffin wax of undoubtedly transparent appearance contained as much as 3.6 per cent. of oil. This confutes the commonly accepted view that transparent paraffin wax must also be "free from oil," and that transparency may be accepted as the criterion of quality. Experiments made with Zoloziecki's method (which consists in dissolving the paraffin wax or paraffin oil in amyl alcohol and precipitating the paraffin with ethyl alcohol) gave analogous results. The author therefore concludes that all paraffins, including American and peat paraffins, have an "oil content" when examined by this method. Hence it would be advisable to adopt a commercially permissible limit for this proportion of "oil." This might well be fixed at 2 to 2½ per cent., and only in the case of soft paraffins for matches need an exception be made. A further difficulty in the examination of paraffin wax is that the methods of grading adopted in Germany, Scotland, and America do not agree, and a table is required showing the relationship between the Shukoff figures and those obtained by the Scotch and American methods of determination. The following table gives the present corresponding values, but in the author's experience these are not correct.

German method, ° C.	Scotch method, ° F.	American method, ° F.
38/39	98/102	101/105
45/46	110/112	113/115
48/49	115/	118/
50/51	118/120	121/123
51/52	118/120	121/123
53/54	125/127	128/130
56/57	130/	133/

—C. A. M.

PATENTS.

Tar; Device for preventing — from flowing with the ammoniacal liquor out of the tar well. R. Oetner. Ger. Pat. 210,590, May 26, 1908.

AN overflow pipe is provided through which the ammoniacal liquor floating on the tar in the tar well flows out into the liquor reservoir. At the bottom of the limb of the overflow pipe dipping into the liquor in the tar well is fixed a saucer with a hole in the centre and with several short inclined pipes projecting downwards between its centre and circumference. From the central hole a short conical pipe rises within the overflow pipe. As the ammoniacal liquor rises in the conical pipe and then in the overflow pipe, any entrained tar tends to settle and flow back down the outside of the conical pipe into the saucer, and thence through the short inclined pipes back into the tar well.—A. S.

Ammonium sulphat; *Saturator for the manufacture of* — H. Koppers. Ger. Pat. 210,902, April 3, 1908.

PERFORATED tubes are disposed within the gas space of the saturator and water is passed through these tubes in order to wet the walls of the vessel and so prevent the formation of crusts of salts thereon. Or, the gas space of the saturator may be surrounded by a cooling jacket, in which case water is condensed on the inner walls.—A. S.

Benzene hydrocarbons; *Process for purifying* — Badische Anilin und Soda Fabrik. Ger. Pat. 211,239, Sept. 5, 1907.

BENZENE hydrocarbons are purified from thiophen and its homologues by treatment with an aldehyde or an organic anhydride, in presence of a suitable condensing agent, and separating the purified hydrocarbon from the condensation product by distillation, etc. Formaldehyde, acetaldehyde, and phthalic anhydride are specially suitable for the process. The temperature and other conditions of the process should be so adjusted that the benzene does not enter into the reaction. 10,000 parts of benzene containing thiophen are agitated (for several hours) with a mixture of 1500 parts of 73 per cent. sulphuric acid and 45 parts of 30 per cent. formaldehyde, until a filtered sample does not react with a solution of isatin in sulphuric acid; the purified benzene may now be distilled with steam or by direct heat.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

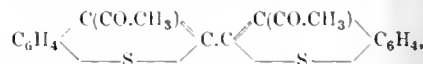
Reduction of triphenylmethane dyestuffs and azo-compounds with sodium hyposulphite [hydrosulphit]. O. Fischer, A. Fritzen and S. Eilles. J. prakt. Chem., 1909, 79, 562—568.

THE authors describe examples of the advantage of using sodium hyposulphite in the reduction of dyestuffs (compare Grandmougin, this J., 1906, 805, 1142; 1907, 959). In this operation it is of distinct advantage to add a small amount of zinc dust which acts as a catalyst. *Crystal Violet*:—A solution of 5 grms. in 100 c.c. of alcohol is treated at the boiling point with a concentrated aqueous solution of 10—15 grms. of sodium hyposulphite, and 0.5 gm. of zinc dust is also added. On diluting with hot water and ammonia, a quantitative yield of hexamethylparaleucaniline is obtained. *Pararosanine*:—This is reduced in an exactly similar way. From the leuco-compound the following derivatives were prepared. Tribenzylidene-*p*-leucaniline, $C_{40}H_{31}N_3 + C_6H_6$, m.pt. 79° C.; the benzene-free substance melts at 175° C. Tribenzyl-*p*-leucaniline, m.pt. 106°—107° C. This, on oxidation with lead peroxide in acetic acid solution or by chloranil in alcoholic solution, yields tribenzylrosaniline, which is a red violet dyestuff. Tri-*o*-hydroxybenzylidene-*p*-leucaniline forms yellow needles, m.pt. 121° C. Tri-*p*-anisylidene-*p*-leucaniline forms colourless rods or needles, m.pt. 79—80° C. Tri-*p*-dimethylaminobenzylidene-*p*-leucaniline crystallises in bright yellow prisms, m.pt. 240° C. *Benzeneazo-ββ*-dinaphthylamine:—10 grms. are dissolved in a hot mixture of 200 parts of pyridine and 150 parts of alcohol, and a concentrated solution of 20 grms. of sodium hyposulphite added gradually. The whole is kept boiling and 5 grms. of zinc dust are added in small portions at a time. Then 20—30 grms. of hyposulphite and 5 grms. of zinc dust are added, whereby the solution becomes colourless. The pyridine-alcohol mixture is poured off, and on adding water, fine yellow needles of α -amino- $\beta\beta$ -dinaphthylamine are obtained. When this or its acetyl derivative (m.pt. 214° C.) is boiled with acetic acid, β -naphthylmethylethyl-naphthiminazole is formed.—J. C. C.

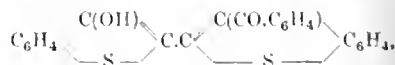
Thioindigo; *Some derivatives of* — Béchamp. Compt. rend., 1909, 148, 1677—1679.

THE author finds that, contrary to the experience of Sachs and Kantorowicz (this J., 1909, 594), the action of magnesium organic compounds on Thioindigo is simply

a reducing one: when decomposed by water the product of the interaction gives a white substance which rapidly oxidises to Thioindigo, and when treated with acetyl benzoyl chloride, the reaction product yields the acet derivative,



crystallising in fine white needles, m.pt. 218° C., or the benzoyl derivative,



which forms white felted needles, m.pt. 225° C. C saponification both compounds furnish leuco-Thioindigo —J. C. C.

Congo Red; *The osmotic pressure of* — and of some other dyes. W. M. Bayliss. Roy. Soc. Proc., 190 B, 81, 269—286.

It is found that Congo Red, although a colloid in the sense of not being diffusible through parchment-paper, has an osmotic pressure equal to that which would be given if it were present in true solution in single molecule. The theoretical osmotic pressure is only obtained in the absence of extraneous electrolytes. When these are present they cause aggregation of molecules to particles. The free acid of Congo Red forms a blue colloidal solution when dialysed: it gives an osmotic pressure of about 14 mm. of mercury for a 1 per cent. solution which, the kinetic theory be correct, means that the aggregate contains, on an average, 20 molecules.—J. C. C.

Indanthrene Blue and Indanthrene Violet as substitutes for ultramarine in sugar works. See XVI.

PATENTS.

Monoazo dyestuff; *Process for preparing a yellow* — Act. Ges. f. Anilinfabr. Ger. Pat. 210,598, April 1908.

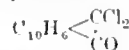
2,3-DICHLORO-4-AMINOAZOBENZENE is converted into disulphonic acid by treatment with sulphuric acid containing 60 per cent. of anhydride, at 55°—60° C. The product dyes wool yellow shades fast to acids, and fast to light than the shades given by the known yellow azo dyestuffs.—T. F. B.

[Azine] dyestuffs for wool; *Process for preparing red* — C. Jäger. Ger. Pat. 210,702, July 21, 1908.

p-AMINOPHENOL- α -DISULPHONIC acid (prepared from nitrosodimethylaniline) is oxidised together with *m*-diamine to an indophenol, which is then converted in the corresponding azine by boiling in presence of an oxidising agent.—T. F. B.

Vat dyestuff; *Process for preparing a red* — Ges. Chem. Industrie in Basel. Ger. Pat. 210,813, June 2, 1907. Addition to Ger. Pat. 205,377, Jan. 17, 1907.

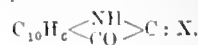
RED vat dyestuffs are obtained if, in the process described in the original patent (see Eng. Pat. 344 of 1908; this J., 1908, 399), the acenaphthenequinone is replaced by dichloroacenaphthenequinone,



and the oxythionaphthene by 3-oxy-(1)-thionaphthene-carboxylic acid.—T. F. B.

Vat dyestuffs; *Process for preparing green* — Ges. f. Chem. Industrie in Basel. Ger. Pat. 210,828, May 1, 1908.

DYESTUFFS which dye cotton fast, intense, green shades from the vat, are obtained by condensing inloxyl with derivatives of β -naphthhisatin of the formula,

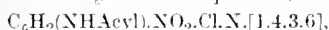


ch as β -naphthisatin-naphthalide, mono- or dibromo- β -phthisatinchloride, etc., and treating the resulting estuffs with halogenating agents.—T. F. B.

izarindisulphonic acids; Process for preparing 3.5- and 3.8- — R. Wedekind und Co. Ger. Pat. 210,863, June 2, 1908. Addition to Ger. Pat. 202,398, May 6, 1903.

IZARIN-3-MONOSULPHONIC acid is converted into a mixture of the 3.5- and 3.8-disulphonic acids by treatment with fuming sulphuric acid in presence of mercury. The 3-sulphonic acid need not be isolated; thus, 100 parts of izarin are heated at 110° C. for ten hours with 500 parts of sulphuric acid (20 per cent. anhydride); ten parts of mercury are then added, and the mixture heated for a further ten hours. The product is dissolved in water, and precipitated by potassium chloride. The salts of the 3.8-disulphonic acid are much more soluble than those of the 3.5-disulphonic acid. The sulpho-group in the 3-position is removed from both acids by treatment with sulphuric acid.—T. F. B.

Aromatic acyl-p-diamines; Process for preparing — Kalle und Co. Ger. Pat. 210,886, Sept. 3, 1907. COMPOUNDS of the general composition,



where X is a halogen, alkyl, or alkyloxy group, are treated with sodium polysulphide, thus replacing the chlorine by the disulphide group, which is then reduced to the SH group by treatment with iron in presence of an acid; this also reduces the nitro group to an amino group. The resulting derivative of *o*-amino-*m*-acylaminothiophenol is now etherified in the usual manner, when an acyl-*p*-amine containing a thioalkyl group in an *o*-position to the amino-group is formed. These compounds are of value in the preparation of disazo and other dyestuffs.

—T. F. B.

Dyestuffs of the anthracene series and intermediate products; Manufacture of — O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 15,355, July 20, 1908. SEE Ger. Pats. 205,149 and 209,321; this J., 1909, 134 and 650.—T. F. B.

Uizarin; Manufacture of — P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,641, Sept. 18, 1908.

SEE Fr. Pat. 395,137 of 1908; this J., 1909, 304.—T. F. B.

azo dyestuff. H. Jordan and W. Neelmeier, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 916,323, March 23, 1909.

SEE Fr. Pat. 397,613 of 1908; this J., 1909, 698.—T. F. B.

Anthracene series; Compound of the — and process of making same. F. Kacer, Mannheim. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 925,917, June 22, 1909.

SEE Eng. Pat. 9657 of 1907; this J., 1908, 556.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Bleaching powder solutions; Determination of the alkalinity of — K. J. P. Orton and W. J. Jones. Analyst, 1909, 34, 317—318.

A KNOWN volume of the bleaching powder solution (or a known weight of solid basic hypochlorite) is added to a measured volume of approximately N/10 hydrochloric acid contained in a Drechsel bubbler, shielded from light. A rapid current of air, freed from dust, is then drawn through the liquid for three-quarters of an hour, or until all free chlorine is expelled (the presence of the latter being indicated by its bleaching action upon a drop of 0.1 per cent. methyl orange solution), after which the excess of

acid is titrated with N/10 sodium carbonate. The titre of the bleaching powder solution with N/10 thiosulphate or arsenite gives directly the volume of N/10 acid reacting with the hypochlorite, the alkalinity of the solution being represented by the difference between this and the total volume of N/10 acid used up. The requirements for accuracy, all of which are fulfilled by the above method of procedure, are that the hypochlorous acid formed shall react completely with the hydrochloric acid; all the chlorine shall be evolved as gas, none being converted into hydrochloric acid; and the hydrochloric acid shall not react with chlorate at the dilutions used and at the ordinary temperature.—W. E. F. P.

PATENTS.

Artificial silk materials; Manufacture of — W. P. Dreaper, Felixstowe. Eng. Pat. 11,959, June 2, 1908.

IN composite artificial silk threads in fine counts where the thread is in a condition similar to that of "boiled-off" silk, difficulty is experienced in the weaving. To remedy this, the threads are dried at such a tension that in the final state of the yarn the filaments stick together as in "raw" silk. In order to improve the state of the thread, it may be dried out of a solution of soluble oil or other suitable colloid.—P. F. C.

Silk fibroin; Process for obtaining — C. R. Baumann and G. G. Diesser. First Addition, dated Dec. 2, 1908 (under Int. Conv., Sept. 15, 1908), to Fr. Pat. 396,305, Nov. 6, 1908 (this J., 1909, 597).

ALBUMINOID substances, in general, besides silk fibroin, are soluble in formic acid, and if the solutions be evaporated, pellicles are obtained which are quite insoluble in water. A better product is obtained if a small quantity of such substances as glycerin, gelatin, or tannin be added to the acid. This property of formic acid can be employed to manufacture artificial silk without using formaldehyde.

—P. F. C.

Amianthus [asbestos] fibres; Process of "hydrophilisation," steaming, and curling of — G. Capitain and N. Richard. Fr. Pat. 397,075, Dec. 3, 1908.

THE carded material is immersed in a boiling solution of sodium or potassium hydroxide (2—3 per cent.), then plunged into a 10 per cent. solution of bleaching powder for 30—40 minutes or exposed to ozone for 15 minutes. After a rinsing, firstly in dilute acid and afterwards in water, the material is dried in a stove at 120° C. and then carded again. In order to increase its absorptive power, the product is finally submitted to a succession of steamings, each steaming being followed by drying at 300° C.

—P. F. C.

Chrome colours; Dyeing with — R. B. Ransford, London. From L. Cassella und Co., Frankfurt-on-Maine, Germany. Eng. Pat. 22,097, Oct. 19, 1908.

IN dyeing wool with certain dyestuffs it is advantageous to add to the dye-bath a bichromate and an acid or an ammonium salt in place of the acid. It is found that an improved result may be obtained if the acid or ammonium salt be replaced by a salt of magnesium or of an alkaline-earth which will dissociate in the hot dye-bath into an acid and a base, the base forming a lake whilst the acid fixes the dyestuff. *Example.*—Charge the dye-bath with 2 per cent. of Anthracene Chromate Brown EB, 1 per cent. of sodium bichromate and 2.5 per cent. of magnesium sulphate on the weight of the goods. Enter the goods at 70°—80° C., raise in 15 minutes to the boil, boil for 1—1½ hours, then rinse and dry.—P. F. C.

Dyeing velvet or other pile fabrics; Process for — with powdered dyestuffs. J. M. Charcun. Fr. Pat. 396,996, Feb. 10, 1908.

THE fabric is passed with its face upwards underneath a shower of powdered dyestuff, the excess being kept back by a bar stretched across the material whilst the rest is distributed by means of moving and fixed brushes. The material is then led through another machine provided with beaters and brushes to ensure a perfectly even

distribution of the dyestuff, and is afterwards dyed by passing it over a moistening device consisting of a bar thickly wrapped round with flannel which dips into benzene. By capillarity, the benzene travels through the flannel on to the velvet, and there dissolves and fixes the dyestuff. The fabric is finally dried and finished.

—P. F. C.

Dyeing yarn in the hank; Process and apparatus for —.

E. Esser und Co., Textil-Maschinen- u. Tuchschneermesser-Fabr. Fr. Pat. 397,189, Dec. 8, 1908.

Each hank is hung over two rods which are arranged the one vertically above the other and are fixed in slots in a framework at such a distance apart, that the hanks are kept straight but are not stretched. When the framework, which is open at the top and the bottom, is quite full of yarn, it is lowered into a vat containing the dye-liquor. By means of a pump the dye-liquor is then circulated through the yarn along its length.—P. F. C.

Dyeing, bleaching and other similar treatments of textile substances; Apparatus having a circulating bath for —.

H. Schirp. Fr. Pat. 397,252, Nov. 30, 1908.

This apparatus consists of a rectangular vat divided by a partition into two compartments, one, which has an air-tight cover, being used as a dye-vat whilst the other is employed as a reservoir for the dye-liquor. The material to be treated is packed on a false floor, with which the dye-vat is provided, and pressed down by a perforated cover. By means of a circulating pump, and a delivery pipe which leads from the reservoir, and can be put in communication with either the upper or the lower part of the dye-vat, the dye-liquor can be pumped through the material in either direction by suitably adjusting the stop-cocks on the pipes which connect the two vats with one another and with the delivery pipe.—P. F. C.

Dyeing process. Farbenfabr. vorm. F. Bayer und Co.

Fr. Pat. 397,659, Dec. 19, 1908. Under Int. Conv., Jan. 7, 1908.

VEGETABLE fibres can be dyed in one bath by dyestuffs of the anthraquinone series in the following manner. For 50 kilos. of cotton, a bath containing 1200 litres of water, 5 kilos. of alizarine (20 per cent. paste), 30 grms. of common salt, 3 kilos. of aluminium sulphate and 4 litres of calcium acetate solution of 16° B. is prepared. The yarn, which has been oiled in the usual way, is entered into this bath, which is kept cold for 20 minutes and then heated in 45 minutes to the boil. After boiling for 30–60 minutes the yarn is withdrawn, washed, and finally soaped.—P. F. C.

Dyeing half-silk with sulphide dyestuffs in a single bath;

Process for —. Farbwerk Mühlheim vorm. A. Leonhardt und Co. Ger. Pat. 210,883, Aug. 26, 1908.

HALF-SILK fabrics can be evenly dyed with sulphide dyestuffs by adding "diastafor" to the bath and dyeing at a temperature of 50–90° C., according to the dyestuff used; black dyestuffs require a temperature of 80–90° C., others from 50–60° C. For example 10 grms. of "Pyrol Blue conc." 2 grms. of sodium carbonate, and 20 grms. of sodium sulphide are dissolved in each litre of water, 50 grms. of diastafor and finally 20 grms. of sodium sulphate are added, and the goods are dyed at 50–60° C. (Compare Eng. Pat. 13,948 of 1907; this J., 1908, 332.)

—T. F. B.

Dyeings on cotton; Production of fast yellowish-red to violet-red —. L. Cassella und Co. Ger. Pat. 211,029, March 12, 1908.

THE diazo dyestuffs obtained from *m*- or *p*-azoxyaniline (or a homologue) and 2,5-aminonaphthol-7-sulphonic acid, which may also be produced by alkaline reduction of the dyestuffs formed by combining *m*- or *p*-nitro-diazo compounds with the aminonaphtholsulphonic acid in acid solution, give orange to violet dyeings on unmordanted cotton, which are, however, of no value, owing to lack of fastness. If these dyeings are treated with diazocompounds, very fast yellow-red to violet-red dyeings are produced. The dyed fibre is treated with 0.5 to 3 per cent. of its weight

of the diazotised amine (according to the depth of shade), allowed to remain in the bath for $\frac{1}{2}$ hour, washed, and dried.—T. F. B.

Drying bobbins and cops; Process and apparatus for —.

H. L'Huillier. Fr. Pat. 397,108, Feb. 13, 1908.

THE bobbins are arranged inside a strongly built vat which is provided with an air-tight cover. The vat is then closed and air is forced into it under pressure, so that the wet bobbins become thoroughly impregnated with it. The air, impregnated with moisture, is then withdrawn by an aspirating device until a good vacuum is obtained. Warm air is next pumped into the vat and penetrates into the interior of the wet material and takes up the residual moisture so that on pumping out the hot moist air the bobbins are left quite dry.—P. F. C.

Fabrics; Method of treating — to render them adhesive.

F. J. Gleason, Assignor to Massachusetts Chemical Co., Walpole, Mass. U.S. Pat. 925,894, June 22, 1909.

ONE side of the fabric is treated with a composition containing gutta-percha and one or more substances (e.g., asphaltum and pontianac) capable of keeping the gutta-percha in a plastic state. The coating is then permitted to dry, and the plastic components removed by the action of a solvent (e.g., carbon tetrachloride).

—A. G. L.

Designs or ornamental and colour effects on textile materials;

Method of producing —. J. Rübner, Cheadle Hulme. Eng. Pat. 12,455, June 10, 1908.

SEE U.S. Pat. 917,298 of 1909; this J., 1909, 472.—T. F. B.

Fabrics; Process of treating — with fluids. E. Gminder,

Reutlingen, Germany. U.S. Pat. 924,979, June 15, 1909.

SEE Eng. Pat. 21,829 of 1908; this J., 1909, 519.—T. F. B.

Silk in hanks; Apparatus for treating —. F. Linder-

meyer, Assignor to tiebrüder Schmid, Basle, Switzerland. U.S. Pat. 926,429, June 29, 1909.

SEE Fr. Pat. 387,796 of 1908; this J., 1908, 854.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Bauxite production of the United States. U.S. Geol. Survey, 1909. [T.R.]

THE production of bauxite in the United States in 1908 amounted to 52,167 long tons, valued at \$263,968, a decrease of 45,609 tons and of \$216,362 compared with the production of 1907. The average price of the material at the mines was about \$5.06 per long ton, an advance of \$0.15 over the price in 1907.

The States producing bauxite on a commercial scale are Alabama, Arkansas, Georgia, and Tennessee. As in past years, Arkansas leads in production with an output of considerably more than 60 per cent. of the total. The actual production of this State, however, fell off about 43 per cent., and that of Georgia and Tennessee also decreased; the production of Alabama increased.

Sodium sulphite, and its equilibrium with water. H.

Hartley and W. H. Barrett. Chem. Soc. Trans., 1909, 95, 1178–1185.

THE authors describe the preparation and properties of pure anhydrous sodium sulphite, its solubility in water, and the spontaneous crystallisation of supersaturated solutions. They show that the salt exists in two stable forms, Na_2SO_3 and $\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$, the transition temperature being 22° C. The decahydrate could not be isolated. The anhydrous salt crystallises in the hexagonal system, and the hydrated salt in the monoclinic system. Solubility and freezing point curves are given for both forms. Supersolubility curves are given which show that the hydrated salt has a metastable range of about 30°. There was no indication of the formation of any other hydrate.—A. H. C.

odium metasilicate; Binary systems of — with the metasilicates of lithium, magnesium, calcium, strontium, and barium; of lithium metasilicate with those of potassium, magnesium, calcium, strontium, and barium; and the three-component system, $\text{Na}_2\text{O}-\text{Al}_2\text{O}_3-\text{SiO}_2$. R. C. Wallace. *Z. anorg. Chem.*, 1909, 63, 1—48.

The author has investigated the two-component systems of the alkali metasilicates with those of the alkaline-earth metals, and the three-component system, $\text{Na}_2\text{O}-\text{Al}_2\text{O}_3-\text{SiO}_2$, by the method of thermal analysis, combined with microscopic examination. The melting is effected in carbon tubes. There is a great tendency for these silicates to solidify as glasses on cooling, instead of crystallising, but lithium silicate, Li_2SiO_3 , crystallises readily in thin leaflets which are, unlike the sodium compound, not hygroscopic. Sodium silicate (m.p.t., 118°C .) forms continuous series of mixed crystals with the silicates of strontium (m.p.t., 1529°C .), barium (m.p.t., 1490°C .), and lithium (m.p.t., 1168°C .); with calcium silicate (m.p.t., 1502°C .) there is a gap in the series of mixed crystals at 70—80 per cent. of calcium silicate, and a eutectic point occurs at 1140°C . with 70 per cent. of this compound; with magnesium silicate (m.p.t., 549°C .) the melt solidifies to a glass, when 20—80 per cent. of the magnesium compound is present. Potassium silicate forms mixed crystals with lithium silicate, containing 60—100 per cent. of the latter. With lithium and calcium silicates there is a gap in the series of mixed crystals at 25—84 per cent. and a eutectic point at 979°C . with 50 per cent. of calcium silicate; lithium and magnesium silicates show a gap at 50—75 per cent. and a eutectic point at 876°C . with 55 per cent. of magnesium silicate; lithium and barium silicates show a gap at 35—92 per cent. and a eutectic point at 880°C . with 78 per cent. of barium silicate; and lithium and strontium silicates show a gap at 22—92 per cent. and a eutectic point at 900°C . with 60 per cent. of strontium silicate. Tamman's idea as to the concentration of saturated mixed crystals of two metals, that the saturated mixed crystal of the component with higher melting point always contains more of the easily melting component, than the mixed crystal of this component contains of that with the higher melting point, only applies to a limited extent to the silicates. The molecular volumes of the mixed crystals of lithium silicate with calcium and barium silicates are of linear functions of the concentration; this is only the case with conglomerates consisting of the two saturated mixed crystals. Corundum forms mixed crystals with sodium oxide, sillimanite with silica and with alumina, epheline with silica, sodium aluminate, and alumina, and sodium silicate with silica and probably also with alumina. The crystallisation of albite and nepheline glass, under the influence of sodium tungstate at 950°C ., takes place only at the surface between the glass and sodium mineraliser (sodium tungstate), the power of spontaneous crystallisation being greatly increased, but the rate of crystallisation little altered.—F. Soxh.

magnesium oxychlorides; Contribution to the knowledge of —. H. Hof. *Chem.-Zeit.*, 1909, 33, 693—694.

In an earlier paper (*Chem.-Zeit.*, 1908, 993), the author described a magnesium oxychloride of the type, $[\text{Cl}_2, 5\text{MgO}]$, obtained by electrolysis of concentrated solutions of magnesium chloride (the mother liquors from the manufacture of potassium chloride), as prepared by the extraction of bromine. The compound can be obtained in a pure state, by electrolysis of a concentrated solution of magnesium chloride (using a diaphragm in the cell), until magnesium hydroxide appears in the other compartment. The filtered solution on standing for 24 hours deposits the oxychloride, which is drained and washed free from adhering magnesium chloride with absolute alcohol. Water partially decomposes the oxychloride, and is thus not admissible for washing the latter. On drying, a fine granular powder is obtained, not attacked by dry carbon dioxide and having the composition, $[\text{Cl}_2, 5\text{MgO}, 14\text{H}_2\text{O}]$. Although cold water only partially decomposes the oxychloride, the latter is completely decomposed by prolonged boiling with water, magnesium hydroxide being precipitated and magnesium chloride

passing into solution. On adding an excess of water to a solution of the oxychloride in magnesium chloride, complete decomposition ensues, with separation of magnesium hydroxide. This reaction is noteworthy, inasmuch as the precipitated magnesium hydroxide absorbs free bromine present in the waste liquors, and renders the latter harmless to ironwork.

On prolonged exposure of the finely powdered oxychloride to a stream of carbon dioxide, it is partially decomposed, with formation of magnesium carbonate. The action is very slow, and proportionately slower with atmospheric carbon dioxide. This reaction also holds good when the finely powdered artificial stones (prepared by the action of strong magnesium chloride solutions on calcined magnesia) are similarly treated. The limited stability of such stones, and the loss of the polish of their surfaces, is due to this gradual action of atmospheric carbon dioxide. The presence of carbon dioxide does not, however, prevent the formation of the oxychloride, since if a current of carbon dioxide be passed through the cathode portion of the electrolyte above mentioned, from the commencement of the electrolysis, the separation of magnesium hydroxide takes place in the same way as before. Only after the prolonged passage of carbon dioxide, will the filtered electrolyte deposit magnesium carbonate; so that in this case also, the decomposition takes place with extreme slowness.

The author assigns to the chief compound concerned in the composition of the hard masses or stones, obtained by the interaction of magnesium chloride solutions and magnesia, the formula, $\text{MgCl}_2, 5\text{MgO}, 13\text{H}_2\text{O}$, and points out that the latter formula was also assigned by Davis (*Chem. News*, 1872, 25, 258) to an oxychloride deposit formed in ammoniacal solutions of magnesium chloride.

—E. C. V-E.

Copper carbonates, and cupricarbonates. S. U. Pickering. *Chem. Soc. Proc.*, 1909, 25, 188.

BESIDES the mineral azurite, $3\text{CuO}, 2\text{CO}_2$, and the ordinary carbonate of copper, malachite, $2\text{CuO}, \text{CO}_2, \text{H}_2\text{O}$, the following carbonates have been isolated. $5\text{CuO}, 2\text{CO}_2$: a blue, bulky precipitate, obtained by the precipitation of copper salts by sodium carbonate. $5\text{CuO}, 3\text{CO}_2$: a light blue, stable precipitate, obtained by precipitation with sodium hydrogen carbonate. $8\text{CuO}, 3\text{CO}_2, 6\text{H}_2\text{O}$: a rather dark blue substance, obtained by the action of water on the double carbonate of copper and sodium.

All the basic carbonates are insoluble in water and in sodium carbonate solution, but they dissolve slightly in aqueous carbonic acid and in acid carbonates, a normal copper carbonate, or a double carbonate of copper and the alkali metal, being formed. The latter is obtained as a molecular compound in rather light blue crystals from such solutions, although in the solutions it is present in another form, as sodio-cupric carbonate, of the constitution: $\text{NaO.CO.OCuO.CO.NaO}$. In this compound the copper is electro-positive, but has a colour 30 times more intense than the copper in copper sulphate. When excess of sodium carbonate is added to it, the copper becomes electro-negative, and has a colour 80 times more intense than that in copper sulphate. The substance then present is an *a*-cupricarbonate, consisting of $\text{Na}_2\text{Cu}(\text{CO}_3)_2$ united with Na_2CO_3 , but in which the copper is joined to the carbon atoms, and is in a quadrivalent condition. It oxidises dextrose, and the constitution suggested represents the presence of a loosely combined oxygen atom explaining such a reaction. Excess of sodium hydroxide decomposes it, but a greater excess dissolves the precipitated basic carbonate to form a deep violet-blue solution of the β -cupricarbonate, which consists of $\text{Na}_2\text{Cu}(\text{CO}_3)_2$, united with 1 or 2 NaOH . This, too, oxidises dextrose, and also combines with cellulose. It is stable in presence of excess of alkali, whereas the *a*-compound gradually decomposes, either into the crystalline double salt or into malachite. The sodio-cupric carbonate decomposes in a similar manner.

Determining alkalinity of bleaching powder solutions. Orton and Jones. See V.

Oxides of nitrogen and their compounds with metals, etc. Bonjean. See XVIII B.

Solid solution: contamination of barium sulphate precipitates with aluminium. Creighton. See XXIII.

PATENTS.

Nitric acid; Concentration of dilute — by distilling with sulphuric acid. C. Uebel. Ger. Pat. 210,803, June 12, 1904.

THE dilute nitric acid is first concentrated by distilling with sulphuric acid of medium strength, and the distillate is subsequently distilled with strong sulphuric acid at a lower temperature. The residual sulphuric acid from the second distillation is used over again in the first stage of the process. The nitric acid vapour from the second distillation may be passed through a dephlegmator kept at 85°–95° C. before being condensed. In this way nitric acid of high concentration (95 per cent. or more) is obtained, together with a certain quantity of dilute acid, which is treated again by distillation with sulphuric acid. The process may be applied to the spent mixed acid from nitration processes. The mixed acid is first distilled in a vessel connected with a dephlegmator and as much nitric acid as possible recovered in a highly concentrated form. The residue is then transferred to a second still and the remainder of the nitric acid distilled over into the first still, from which it is subsequently recovered, together with nitric acid from a further charge of the mixed acid, in a highly concentrated condition.—A. S.

Sodium cyanide; Manufacture of —. J. Tcherniac, Streatham Hill. Eng. Pat. 26,581, Dec. 8, 1908.

THE solutions of sodium cyanide, obtained by passing gases containing hydrocyanic acid into caustic soda solution, contain excess of caustic soda, sodium carbonate, and occasionally sodium sulphate. Hydrocyanic acid is first added to such solutions, in quantity sufficient to convert the hydroxide and carbonate into cyanide, and then sufficient lime is added to precipitate the carbonate; if sulphate be present, barium or strontium hydroxide may also be added. The solution is now filtered and evaporated at as low a temperature as possible (preferably *in vacuo*), filtered if necessary, and allowed to cool. The hydrated cyanide thus obtained is dehydrated over caustic soda *in vacuo*, or by passing air over it and then over the caustic soda, the concentrated solution of the latter formed being used for the first operation. The dry flakes of sodium cyanide are compressed, forming a tough, elastic mass. In order to avoid evaporation of the sodium cyanide solution, a concentrated (e.g., 30 per cent.) sodium hydroxide solution may be saturated with hydrocyanic acid, the solution being kept at a temperature of about 40° C.—T. F. B.

Carbon; Suspension of — in alkali metals, and process of making same. E. Weintraub. Assignor to General Electric Co., New York. U.S. Pat. 922,645, May 25, 1909.

POTASSIUM is capable of dissolving large quantities of carbon, and the solution is conveniently effected by means of the liquid alloy of potassium with about 5 per cent. of sodium, which quickly dissolves graphite at the ordinary temperature, the operation being carried out in a vacuum or in some inert gas. The suspension, which is claimed as new, may be put to a variety of uses and constitutes an intermediate product in a number of processes, e.g., the preparation of potassium cyanide by the absorption of nitrogen.—F. SOBX.

Sodium sulphide; [Manufacture of —.] E. H. Strickler, White Plains, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 915,633, Mar. 16, 1909.

SODIUM sulphide is made in the form of flakes or laminae by causing the molten sulphide, concentrated to 60 per cent. or over, to be picked up in a thin film by a rotating drum; this is cooled internally and skims the surface of the material, which is thus rapidly cooled and solidified and may be continuously removed by a scraper. A uniform brick-red colour generally characterises the product, and it is, moreover, readily soluble and very pure, since the impurities in the crude sulphide settle to the bottom of the tank.—F. SOBX.

Tungstic anhydride; Process of purifying —. E. I. Beckwith, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 926,084, June 2, 1909.

TUNGSTEN trioxide is treated with carbon tetrachloride vapour at a red heat. The resulting volatile chlorine compound is sublimed, condensed, and treated with *aqua regia* to produce tungstic acid, which is further purified by solution in ammonia and reprecipitation with dilute nitric acid.—A. G. L.

Nitrogen from the air; Process of, and apparatus for obtaining —. C. Blagburn, Antioch, Cal., U.S.A. Eng. Pat. 25,535, Nov. 26, 1908. Under Int. Conv. Nov. 27, 1907.

THE process consists in bringing a stream of air into contact with molten or burning sulphur, the amount of which is always in excess of that required to combine with all the oxygen in the air treated, conducting away the resulting gases, removing the excess of sulphur and the sulphur dioxide from them, and storing the residual nitrogen. The apparatus comprises a furnace of considerable area in proportion to its height, in which a large body of sulphur is exposed to oxidation by the whole of the air treated. Means are provided for supplying sulphur and air to the furnace, and the gases are drawn from it through a series of purifying chambers, in which first excess sulphur vapours are deposited, and then sulphur dioxide, ammonia, carbon dioxide, and moisture are successively removed. The current of air is maintained through the furnace and the purifying chambers, and the residual nitrogen forced into a storage vessel by a pump, placed at the end of the series of chambers. Piping and valves are provided so that the gases drawn from the furnace can be deprived of sulphur vapours and sulphur dioxide, and then discharged by the pump into the air, and not passed through the remaining purifying chambers and stored, until they are sufficiently free from oxygen. A heating chamber the bottom of which slopes from the inlet to the outlet of the furnace, is arranged across the entire width of the furnace, in order to preheat the air used in the process.—W. C. H.

Sulphur, etc., from furnace-gases; Process of obtaining —. F. R. Carpenter, Denver, Colo., Assignor to The American Iron and Steel Alloys Co., Colo. U.S. Pat. 925,751, June 22, 1909.

FURNACE gases are first freed from solid particles mechanically carried over, and are then passed through or over glowing carbon to reduce sulphur compounds, air being admitted from time to time to maintain the temperature of the carbon. The reduced gases are then further heated to decompose "subsidiary sulphides," and are then cooled so as to condense and separate the sulphur.—A. G. L.

Water-glass; Process for increasing the mobility and reactivity of —. P. Eberhard, Munich, Germany. Eng. Pat. 12,980, June 17, 1908. Under Int. Conv. June 17, 1907.

SEE Fr. Pat. 391,682 of 1908; this J., 1908, 1152.—T. F. B.

Evaporator for seawater. C. Köhnke, Stettin, Germany. Eng. Pat. 13,632, June 27, 1908.

SEE Fr. Pat. 386,073 of 1908; this J., 1908, 685.—T. F. B.

Ammonium sulphate; Manufacture of —. E. Erlénbach, Zabrze, Upper Silesia. Eng. Pat. 27,878, Dec. 22, 1908. Under Int. Conv., Jan. 10, 1908.

SEE Ger. Pat. 203,309 of 1908; this J., 1908, 1204.—T. F. B.

Ammonia and chlorine or hydrochloric acid; Process of making —. N. L. G. Whitehouse, Lewisham. U.S. Pat. 925,253, June 15, 1909.

SEE Eng. Pat. 15,140 of 1907; this J., 1908, 809.—T. F. B.

Evaporating liquid from brine. Eng. Pat. 5011. See I.

Saturator for manufacture of ammonium sulphate. Ger. Pat. 210,302. See III.

electrolysers for producing hydrogen and oxygen. Fr. Pat. 397,319. See XI.4.

VIII.—GLASS, POTTERY, AND ENAMELS.

nary systems of alkali metasilicates with alkaline-earth metasilicates, etc. Wallace. See VII.

PATENTS.

ass plates; Process and apparatus for manufacturing —. P. T. Sievert, Dresden, Germany. Eng. Pat. 7823, Nov. 20, 1908. Under Int. Conv., Nov. 28, 1907. Addition to Eng. Pat. 25,042 of 1908 (this J., 1909, 601).

To avoid any slip of the insulating or "ironing" surfaces of the surfaces of the glass plates, which might occur with the use of endless bands, the ends of the bands are cured to rolls, arranged in pairs, and the bands are alternately wound on or unwound from each roll. A uniform space is maintained between the bands by using them to pass over fixed guides, which are adapted to act as pressure surfaces.—W. C. H.

Sheet-glass; Continuous apparatus for the manufacture of —. E. Rowart. Fr. Pat. 397,505, Dec. 15, 1908. Under Int. Conv., Dec. 16, 1907, and Jan. 24, 1908.

MOLTEN glass flows from a tank-furnace into a channel adding to a "siphon" (or rather, a U-shaped channel) terminating in a narrow orifice at a slightly lower level than the surface of the glass in the tank; the width of the orifice corresponds with the thickness of the sheet to be made. The "siphon" is completely enclosed in a heated chamber except at the orifice, where the glass emerges into a delivery chamber, which is divided into two (or more) compartments, the one nearest the orifice being kept at a lower temperature than the other. This division may be effected by placing two square hollow cast-iron pipes just above the orifice; the glass emerges between these pipes, which are suitably heated. The second compartment may be formed by the walls of the heating chamber which surround the "siphon" being brought down in the form of a wedge to meet the cast-iron pipes. Above this delivery chamber is placed an annealing chamber, containing drawing and forming mechanism, consisting essentially of two vertical endless bands between which the sheet of glass moves upwards. This annealing chamber is kept at a suitable temperature by means of ports delivering air and gas.—A. G. L.

Tank-furnace for glass-making, metallurgy, etc. L. Rembaux. Fr. Pat. 397,548, Dec. 17, 1908.

MOLTEN glass from the furnace-tank proper overflows into a receptacle placed close to the tank. From the top of this receptacle an inclined plane leads to a second receptacle, close to the top of which is constructed a channel leading to a table provided with a roller for making plate-glass. The level of the molten glass in the tank is such that the first receptacle is normally full; from this receptacle the glass is forced to flow down the inclined plane by lowering a piston which nearly fills it into the first receptacle; the second receptacle is caused to overflow in a similar manner by lowering a second piston into it. The two receptacles may be heated by hot gases from the furnace; or they may be provided with separate heating devices.—A. G. L.

Quartz, etc.] Refractory ceramic materials; Process and apparatus for fusing and refining — by means of an electric resistance furnace. A. Voelcker. Fr. Pat. 397,140, Dec. 7, 1908.

THE apparatus consists essentially of a resistance composed of three carbon electrodes, one of which is fixed inside the furnace, whilst the other two are placed on opposite sides of the furnace in contact with the intermediate electrode, and are advanced further into the furnace as the quartz or other material in contact with the intermediate electrode melts; the resistance of the latter is thus diminished, and the temperature increased, so as to refine the material

under treatment. Or else, the quartz, etc., is placed inside a vertical tube of carbon, which forms one electrode; and is surrounded by crushed carbon, etc., forming the heating resistance material, and enclosed in a furnace lined with carbon blocks forming the second electrode. The carbon tube is closed at the bottom by a removable carbon plug, and at the top by a plunger, also of carbon, which can be lowered into the tube when the material is melted. If the diameter of the plunger is nearly as great as the bore of the tube, the molten material is forced in a very thin layer against the walls of the tube as the plunger descends, and is thus exposed to intense heating. The plunger may be made hollow, and compressed air, etc., admitted through it, if desired. The carbon tube may also be horizontal, in which case the plunger employed is also horizontal.—A. G. L.

Glass; Process and apparatus for drawing —. J. H. Lubbers, Assignor to Window Glass Machine Co., Pittsburg, Pa. U.S. Pat. 926,501, June 29, 1909.

SEE Eng. Pat. 23,968 of 1908; this J., 1909, 425.—T. F. B.

Metallisation of vitreous ceramic surfaces. Q. Marino, Assignor to E. J. Richardson, London. U.S. Pat. 925,365, June 15, 1909.

SEE Eng. Pat. 17,743 of 1907; this J., 1909, 22.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Wood; Preservation of —. F. Seidenschneur. Chem.-Zeit., 1909, 33, 701—702.

FROM his experiments the author concludes that it is not necessary that the tar-oils used for the preservation of wood (railway sleepers) should contain phenolic compounds. This is in agreement with work by Flüge and others, according to which phenol dissolved in alcohol or in oils has scarcely any antiseptic properties. Examination of sleepers which were in good condition after 16 years' service showed that only neutral heavy oils were left, although the oils used when the sleepers were put down must have contained a large proportion of phenols. About 0.8 kilo. of neutral oil per sleeper (2.7 m. long and 16—26 cm. thick) is shown to be necessary for preservation; the Prussian State railways require 7 kilos. per sleeper. Comparative experiments were also made with pure anthracene oil, ordinary commercial tar-oil, heavy Russian lubricating oil, and a mixture of 60 per cent. of a so-called "S-oil" with 40 per cent. of anthracene oil. This "S-oil" was obtained by heating (Russian) petroleum to 150° C., adding 2 per cent. of sulphur, and further heating to 280°, most of the sulphur added being evolved at 170°—210° C. as hydrogen sulphide; the distillate passing over at 210°—280° was returned to the residual oil. The "S-oil" is a clear liquid, completely soluble in chloroform, benzene and ether, but it cannot be emulsified alone with sodium resinate soap solution, although it readily forms an emulsion when mixed with anthracene oils. From the wood-preservation experiments made, it appears that pure neutral anthracene oil is a slightly better preservative than the commercial tar-oil which contains phenols, that the mixture of "S-oil" and anthracene oil is only 20 per cent. less efficient than the anthracene oil alone, and that the lubricating oil, like crude petroleum, has no preservative action whatever.—A. G. L.

Portland cement; the Le Chatelier test for soundness. A. C. Davis. Proc. Inst. Civil Eng., 1908—1909, 175. Part I, 12 pp.

THE author's experiments were made chiefly to test the statements that rotary kiln cements show an increased expansion when tested by the Le Chatelier method after aeration. He finds that this is not the case. Rotary kiln cements, tested when fresh, show a smaller expansion than fixed kiln cements, fresh; on aeration, the expansion of rotary kiln cements decreases slightly, or remains nearly constant, whilst that of fixed kiln cements usually decreases considerably. Occasionally, a cement is found in either

class, the expansion of which decreases at first on aëration, and then, on further aëration, rises again to the initial value, after which it falls again. In the author's opinion, the 5 mm. expansion allowed by the British Standard Specification is a much more stringent limit than the tensile tests imposed by the same Specification, and has the effect of excluding many sound fixed kiln cements which satisfy the tensile tests and are otherwise satisfactory.

A table showing the expansion of two cements, and also of their component parts, both fresh and after different periods of aëration, is given, from which the following figures are taken: *Rotary kiln cement*, fresh, 2.0 mm.; after 35 days, 2.0 mm.; residue on 180×180 mesh, 25.25 and 24.0; cement through 180×180 mesh, 4.5 and 3.0; grit from flourimeter, 38.75 and 36.0; flour, 2.25 and 2.0. *Fixed kiln cement*, 3.5 and 3.5; residue on 180×180 mesh, 23.75 and 23.0; cement through 180×180 mesh, 2.75 and 1.0; grit from flourimeter, 21.0 and 7.0; flour, 1.0 and 2.0.—A. G. L.

Lime in presence of silicic acid [in cements, mortars, etc.]; Volumetric determination of —. K. Balthasar. Chem.-Zeit., 1909, 33, 646—647.

0.7 GEM. of the substance (e.g., a cement) is decomposed by heating with concentrated hydrochloric acid in a small porcelain basin. The contents of the basin are then washed into a 350 c.c. Erlenmeyer flask with a narrow neck, at the lower end of which a mark has been made. The liquid (about 50—100 c.c.) is heated for about two minutes to drive off any dissolved carbon dioxide, and 50 c.c. of a mixture of strong ammonia, glacial acetic acid, and ammonium chloride, are added, and the liquid heated to boiling. [The ammoniacal solution is prepared by mixing 25 grms. of ammonium chloride and 100 c.c. of glacial acetic acid in a litre flask, and filling up to the mark with strong ammonia.] To the boiling liquid exactly 50 c.c. of $N/2$ oxalic acid are now added, and the flask is then cooled until it is just warm to the touch, and made up to the mark with distilled water. The contents of the flask are well stirred with a glass rod for about three minutes, and are then poured through a dry filter. The first few c.c. of the filtrate are usually cloudy and are set aside, the clear filtrate being collected separately. 50 c.c. of the clear filtrate are then titrated with $N/10$ permanganate, after the addition of about 5 c.c. of concentrated sulphuric acid and a few c.c. of manganous sulphate solution. The presence of the small amount of magnesia usually occurring in cements is without influence upon the accuracy of this process, since it is not sufficient to affect the solubility of the calcium oxalate, and is not itself precipitated as oxalate. The process is particularly suited to the needs of a cement works laboratory, where rapid estimations of lime are frequently very desirable.—E. W. L.

Magnesium oxychlorides. Hof. See VII.

PATENTS.

Tiles and the like; Machine for coating —. C. A. Allison, London. From The Ceramic Machinery Co., Hamilton, Ohio, U.S.A. Eng. Pat. 3139, Feb. 9, 1909.

THE tiles are fed by means of a travelling belt, on to a series of two or more coating rollers, rotating horizontally in a bath of coating material, maintained at constant level, then over a roller only thinly charged with the same material, for the purpose of producing a smooth surface, then over an air blast which partly dries the coating and blows off any superfluous material adhering to the rearward edge. If desired the rollers may be completely submerged so that the tiles are carried along with their under face in contact with the surface of the coating material. The tiles are then carried over two or more ever-changing mottling rolls, rotating in a bath of suitable material.—F. R.

Brick; Process of making —. O. S. Davis, Assignor to W. H. Spake and O. A. Lagman, Anaheim, Cal. U.S. Pat. 924,745, June 15, 1909.

BRICKS, blocks, etc., are formed and pressed, dried, without baking, to expel moisture, and immersed in a

bath of asphaltum heated to 212°—700° F. When the asphaltum has penetrated the articles to a depth of about $\frac{1}{2}$ in., the latter are removed and exposed to a gradually decreasing temperature, which at first is approximately the same as that of the bath, in order to cause the asphaltum to penetrate the articles still further.—A. G. L.

Wood for lumber; Art of treating —. W. A. Hall, New York, Assignor to American Mahogany Co., Maine. U.S. Pat. 924,770, June 15, 1909.

WOOD is impregnated with an alkaline solution of phlobaphenes, extracted from hemlock or other bark. The solution should contain an excess of alkali over that necessary to dissolve the phlobaphene extract.—A. G. L.

Drying process in tunnel dryers for plastic materials, wood, and other substances. H. Gahler. Ger. Pat. 210,636, June 21, 1908.

THE process is specially applicable to such materials as are liable to crack during drying. The air used as drying agent is divided into two currents, of which one moves in the opposite direction to the materials being dried in the first half of the dryer, whilst the other moves in the same direction as the materials in the second half. The currents of moist air are then united, passed through a condenser and a heater, and again divided and used as before.—A. S.

Stone [artificial] from ashes; Process for the manufacture of —. P. Ehestaedt. Ger. Pat. 210,540, Jan. 1, 1907.

THE ashes are moistened with a mixture of 1 part of sulphuric acid and 4 parts of water, pressed into bricks, tiles, etc., and dried.—A. S.

Concrete and lime-mortar; Process for the manufacture of waterproof —. P. Mecke. Ger. Pat. 210,541, Nov. 15, 1908. Addition to Ger. Pat. 200,968, Feb. 15, 1908.

THE basic calcium oleate prescribed in the main patent (this J., 1908, 1021) may be replaced by the corresponding barium or strontium compound, and the aluminium sulphate by magnesium sulphate.—A. S.

Wood; Process of impregnating —. J. Chateau and J. Merklen, Paris. U.S. Pat. 925,292, June 15, 1909.

SEE Addition of Oct. 29, 1907, to Fr. Pat. 375,859 of 1907; this J., 1908, 336.—T. F. B.

X.—METALS AND METALLURGY.

Graphite; Separation of — in white cast iron heated under pressure. G. Charpy. Compt. rend., 1909, 148, 1767—1769.

EXPERIMENTS are described in which alloys of iron and carbon, such as white cast iron and iron carbide, were heated under pressures reaching about 15,000 atmos. and at 600—1200° C. In all cases the free carbon, arising from decomposition of the carbide, was found to separate as graphite, the effect being most marked at high temperatures.—F. SODX.

Tungsten in tungsten steel; Determination of —. H. Bartsche. Oesterr. Chem.-Zeit., 1909, [2], 12, 114—115. Chem. Zentr., 1909, 1, 2017—2018.

FROM 1.5 to 2 grms. of the metal are dissolved by heating with a mixture of 40 c.c. of concentrated hydrochloric acid and 10 c.c. of concentrated nitric acid, the solution is concentrated to 10—15 c.c., then diluted with four to five times its bulk of water, cooled, and filtered. In the residue, which consists of tungstic acid and silica, the tungsten is determined either (1), gravimetrically, or (2), volumetrically. (1). The residue is washed with hot dilute hydrochloric acid until free from iron, and then treated on the filter with a hot solution of ammonium carbonate, which dissolves the tungstic acid. The ammoniacal solution is evaporated, and the residue ignited, finally over a blast-lamp, whereby tungstic acid

from iron and silica is obtained. (2). The residue of tungstic acid and silica is washed first with hot dilute hydrochloric acid, and then with hot water, to which 5 cent. of sodium nitrate has been added to prevent the formation of a colloidal solution of tungstic acid. It is then dissolved in a known quantity (about 30 c.c.) of 10 sodium hydroxide, and the filter washed with hot water. The tungstic acid readily dissolves, whereas the silica remains mostly on the filter. The excess of alkali in the solution is titrated with $N/10$ sulphuric acid. If nolphthalein be used as indicator, the end point is attained with the ratio, $2NaOH:WO_3$, whilst with methyl orange the ratio is $2NaOH:4WO_3$. The author's method gives higher, but it is claimed, more accurate results than other methods. In Lunge's method, for example, in which the metal is dissolved in dilute nitric acid, and the tungstic acid precipitated by heating with sulphuric acid, the author found that weighable quantities of tungstic acid remained in the acid solution. (See also this J. 1908, 230).—A. S.

d; Determination of — in tinned articles. F. Knöppfle. Z. Unters. Nahr.-und Genussm., 1909, 17, 70.

The determination of lead in tin alloys is generally effected by oxidising the metals with nitric acid and separating lead nitrate from the insoluble metastannic acid. If the alloy be rich in iron, the ferric nitrate causes some of the stannic acid to be dissolved, and this then contaminates the precipitate of lead sulphate obtained. The best method for the separation consists in treating 0.1 grm. of the alloy in a dish with nitric acid of sp. gr. 1.50—1.52, added slowly until about 1 c.c. of acid has been used for every 0.1 grm. of metal. The dish is then covered with a watch-glass and water is added drop by drop from a pipette until no more red fumes are evolved. When the reaction is finished, the excess of nitric acid is evaporated off on the water-bath to such a point that the residue still remains moist. A calculated quantity of a hot solution of disodium phosphate is then added, followed by 50 c.c. of hot water. The tin is thus separated as stannic phosphate and the lead is precipitated in the filtrate by the addition of sulphuric acid. Sometimes the iron separates during evaporation in the form of the oxide, which is not readily re-dissolved. In this case a few drops of nitric acid must be added to dissolve the ferric oxide; the same must also be done if the evaporation be carried too far.—J. F. B.

mercury; Determination of — in ores. E. Beyne. Bull. Soc. Chim. Belg., 1909, 23, 263.

The author finds that Eschka's method, depending on amalgamation with a gold crucible lid, affords results in excellent concordance with those obtained by weighing precipitated mercury sulphide on a tared filter.—J. F. B.

ides of nitrogen and their compounds with metals, etc. Bonjean. See XVIII.B.

Separation of nickel and cobalt. Pritze. See XXIII.

Test for mercury. Jones. See XXIII.

termining niobium in presence of tantalum. Taylor. See XXIII.

mining of metal articles; Draft regulations for the —. Report to the Home Secretary. [T.R.]

REPORT (Cd. 4740, price 2½d.) has been issued by E. T. Lawes on the objections made to the draft Regulations for the tinning of metal articles (see this J., 1908, 24). A new set of draft Regulations is appended to the report, embodying the recommendations made in the report.

etal production of Mexico. Mining World, Chicago, July 3, 1909. [T.R.]

URING the last 31 years (1877—1908), the total gold production of Mexico was 334,228,518 pesos, and that of silver was 1,649,528,978 pesos, a total gold and silver production of 1,984,757,496 pesos. The industry has

enjoyed substantial growth each year, with but few decreases.

The following table gives the production of metals in Mexico for the fiscal year 1907—1908.

	Kilograms.	Value, Pesos.
Gold	28,572	38,006,661
Silver	2,153,014	85,446,504
Copper, metal	38,912,109	18,437,165
Copper ore	80,556,418	6,396,096
Lead, metal	104,031,217	5,343,225
Lead ore	26,312	1,316
Zinc ore	43,339,938	888,474
Antimony, metal	4,405,847	81,672,847
Antimony ore	364,284	22,000
Mercury	No export	—
Tin	4,291	6,000
Iron	24,659	2,710
Iron ore	29,021	725

These figures are based on the exportation statistics and, with the exception of mercury, represent fairly completely the metal production, as the local consumption is almost entirely supplied from outside as manufactured products.

The value of the mineral exports of Mexico for the last two fiscal years (1906—07 and 1907—08) is given in the table following:—

	1907—8. Pesos.	1906—7. Pesos.
Gold	31,921,019	23,873,713
Silver	93,034,750	99,861,790
Antimony	1,691,187	1,427,423
Copper	24,834,068	28,792,778
Marble in bulk	36,063	81,724
Plumbago	64,376	134,365
Lead	5,344,561	3,644,738
Zinc	888,484	2,010,408
Other mineral products	616,115	419,064
Total value	158,430,625 (£15,843,062)	160,246,004 (£16,024,600)

Note: Peso = 2s.

The aluminium industry. Mining World, Chicago, June 26, 1909. [T.R.]

THOUGH there may be some recovery from the present price of £65 per ton, aluminium will not again be sold at £150 per ton. This will tend to eliminate all the weaker works.

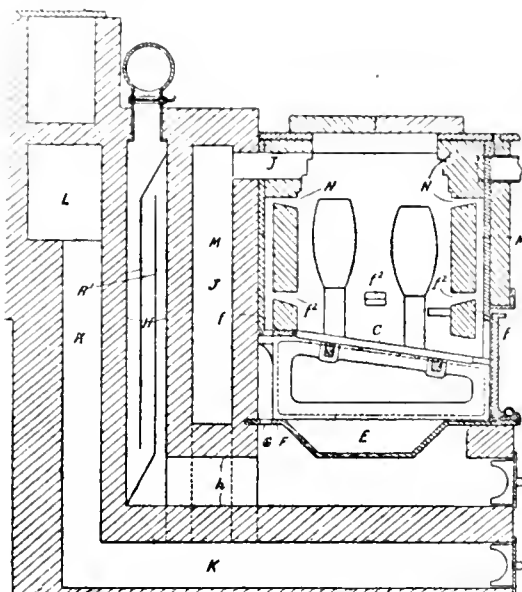
The French companies have the strongest position, while the Aluminium Co. of America also is believed to have accumulated large reserves. The large amount spent by the British Aluminium Company on new water power during the last three years has depleted its resources, and like the Neuhausen Co., it probably will have to turn to other manufactures in order to earn profits. None of the producing companies has published any official returns for the past year, and the heavy reduction in price has entirely stopped the three new works which were being erected by English companies, and has also curtailed the output at some of the older works. The output for the last 12 years, with the average price per ton, is given in the following table:—

	Estimated production.	Average price.
Year.	Tons.	£.
1897	3,327	155
1898	3,953	—
1899	5,459	148
1900	7,192	—
1901	7,420	—
1902	7,750	120
1903	8,102	120
1904	8,550	—
1905	9,000	150
1906	12,000	200
1907	19,000	167
1908	25,000	97

Unless some modification and cheapening of the method of production occur, aluminium cannot remain long at its present low value, for the bare cost of production is £61 per ton, while most works cannot produce it under £80, so that some recovery in value is probable. Any process which would enable bauxite or other unrefined aluminous earth to be used directly in the electrolytic bath would greatly reduce the cost.

PATENTS.

Furnaces; Crucible ——. for melting steel and other metals. W. Miller, Coventry, Eng. Pat. 12,531, June 11, 1908.



THE hot waste gases from the furnace escape through the flues J, K, and L, thus heating the air entering the regenerative flue, H, which may be provided with baffle-plates, R'. The heated air passes by means of *h* through perforations, G, in the flanges, F, of a water trough, E. The air then enters the furnace partly through the grate, C, and partly through *f* and M, and the ports, *f*² and N. The supplemental air supply, entering at N, serves to consume the combustible gases escaping from the furnace. —B. N.

Steels; Treatment of low-grade ——. The Pearlite Steel Co., Ltd., and A. C. J. Charlier, London. Eng. Pat. 13,120, June 19, 1908.

LOW-GRADE steel is heated in a closed furnace to above the recalescence point, and then plunged into a chilling bath supplied with hydrogen or which generates hydrogen when the hot metal is immersed. The hydrogen combines with the carbon and iron of the steel forming "hydro-carbide of iron." When all action has ceased, the steel is subjected to a soaking heat for some hours in order to drive off any excess of hydrogen.—F. R.

Steel from low-grade material; Process of producing high-grade ——. W. R. Palmer, Assignor to F. A. Wilmot, Bridgeport, Conn. U.S. Pats. 924,818 and 924,925, June 15, 1909.

OPEN-HEARTH steel is made by charging with low-grade material a primary furnace, which is worked at a temperature below ordinary steel-making temperatures. A second furnace, working at ordinary steel-making temperatures, is also charged with low grade material (scrap) and flux, and a portion of the charge from the primary furnace is transferred to the second furnace, in which the refining is completed. Sufficient of the charge is left in the primary furnace to form a molten bath for the reception

of fresh low grade material, to which is added slag from the second furnace; or else a portion of the charge the second furnace is returned to the primary furnace. The primary furnace may also be tapped into a ladle from which a portion of the charge is delivered to the secondary furnace, whilst the remainder is returned to the primary furnace.—A. G. L.

Iron ores; Process for briquetting finely divided spath or other ——. W. Schumacher. Fr. Pat. 397,31 Dec. 10, 1908.

FINELY divided iron carbonate in the form of spath iron ore or clay iron-stone, or manganese carbonate mixed with calcium hydroxide, and made into briquetts which are heated in the presence of water or water vapor in closed vessels or in the air. Other ores containing iron carbonate and blast-furnace dust may be mixed with finely powdered iron carbonate (spathic iron ore etc.), or manganese carbonate and calcium hydroxide and treated in a similar way.—O. F. H.

Zinc; Appliances to be used in the refining of ——. during extraction by distillation. The New Delaville Spoh Co., Ltd., Birmingham, and E. H. Shortman, Bloxwich. Eng. Pat. 16,956, July 29, 1908.

INSTEAD of the open ended cylinder containing coke or coal, which is placed at the junction of the retort at the condenser for the purpose of intercepting the low fumes (see Eng. Pat. 7223 of 1907; this J., 1908, 456) a special cylinder is used having the ends closed and having an opening on the upper side, close to each of the ends. The fumes from the retort are retarded by the tortuous passage and a more complete separation of the lead obtained.—F. R.

Fumes of spelter furnaces; Treating ——. H. E. Howland and G. Hadley, Birmingham, Eng. Pat. 19,384 Sept. 15, 1908.

IN place of the short plain tube employed for condensing the zinc fumes from furnaces of the Belgian type, a long cylinder is used, fitted with baffle-plates for retarding the fumes, and terminating in a cone having a small aperture. Practically all the zinc is condensed, rendering the issuing fumes innocuous. Self-closing vents are provided between the baffle-plates to minimise the effect of possible explosion.—F. R.

Complex sulphide and other ores; Reduction of ——. H. R. Angel, London. Eng. Pat. 19,882, Sept. 2 1908.

THE ore is roasted and mixed with 10–50 per cent of raw ore, such as plumbiferous concentrates. Carbonaceous matter equal to about 25 per cent. by weight of the mixture is added, together with 6 per cent. of zinc oxide. If iron is present, an equal weight of lime is substituted for the zinc oxide. The whole is well mixed in a granular condition, charged into an open hearth furnace and covered, to prevent loss of metal during reduction, with sodium sulphate equal to one-third the weight of the ore. After the charge has melted, it is well rabbled; the metals are reduced rapidly. Plumbiferous concentrates can be treated in this way without roasting or briquetting, if sodium carbonate and iron oxide are added to the charge. With some ores it is advantageous to add about 5 per cent. of sulphuric acid before charging into the furnace.—F. R.

Sulphide ores; Process of treating complex ——. G. Kingsley, Toronto, Canada, Assignor to A. E. Kingsley, Denver, Colo. U.S. Pat. 914,730, Mar. 9, 1909.

COMPLEX sulphide ores are treated with dilute nitric acid, containing 6½–7½ per cent. of nitric acid, at a temperature of 176° F. Lead sulphide is completely dissolved without the formation of any lead sulphate by acid of this strength at the temperature mentioned.—A. G. L.

Copper and silver; *Method of thionous precipitation of —*. G. C. Westby, Murray, Utah. U.S. Pat. 23,916, June 1, 1909.

SUBSTANCES containing iron in suitable form are treated with a solution of sulphur dioxide derived from smelter gases. A solution containing "thio salts of iron" is obtained, which is used to precipitate copper and silver from their solutions.—A. G. L.

Alloys; Process of manufacture of metallic —. D. Landenberger. Fr. Pat. 397,151, Dec. 7, 1908.

Metals of the iron group, such as chromium, iron, manganese, tungsten, vanadium, etc., are introduced into alloys, such as those of copper and zinc, by melting zinc with an equivalent quantity of the chloride of the metal to be added, and then adding the alloy so obtained to the molten copper. Or, the copper may be melted first, then the chloride added, and finally the zinc. Small quantities, say 2 per cent., of aluminium are added to assist in the reduction of the chloride.—O. F. H.

Cast or metallic alloys; Production of ingots of —. J. F. Monnot. Fr. Pat. 397,231, Oct. 31, 1908.

The metal is cast through a layer of flux, such as a mixture of borax, sodium-potassium silicate, and fluorspar in suitable proportions, with the object of giving a sound ingot free from flaws, blowholes, oxide, etc. Finely-divided aluminium may be mixed with the flux. It is claimed that the metals thus cast are free from gases and that the method is particularly suitable for the casting of composite ingots such as ingots of iron and copper.—O. F. H.

Alumina and corrosive gases; Process for the treatment of —. United States Smelting, Refining and Mining Co. Fr. Pat. 397,268, Dec. 9, 1908. Under Int. Conv., April 7, 1908.

The process is intended for the treatment of the fumes produced in the roasting, etc., of sulphide ores. Vapour of sulphuric or other corrosive acids, which would destroy the filtering medium in the condensing plant, is neutralised by introducing into the gas a substance, such as lime, zinc oxide, etc., which will neutralise the acid. The neutralising substances are introduced into the gas in a finely divided state, and all solid particles subsequently extracted the usual way.—O. F. H.

Aluminium; Process for the production of —. E. Viel. Fr. Pat. 397,399, Feb. 22, 1908.

Alumina is made for the use of an alkali or alkaline-earth metal in the nascent state as a reducing agent. A compound of aluminium, such as alumina, a double chloride of aluminium and sodium, or cryolite, is mixed with suitable quantities of an alkaline salt, such as sodium carbonate, charcoal, and treated in the electric furnace. Minerals, such as bauxite, may be treated with an alkaline salt in a reverberatory furnace for the production of an aluminate which is freed from impurities, and subsequently treated with charcoal in an electric furnace with the addition of cryolite or other flux.—O. F. H.

Alloys from their ores; Process for heating, melting and volatilising various materials, applied particularly to the extraction of —. W. G. Williams. Fr. Pat. 397,459, Nov. 14, 1908.

The ores are melted and their metallic contents volatilised by means of concentrated solar heat. In the apparatus described, the solar rays are collected by a number of parabolic mirrors, and concentrated in the interior of a crucible in which the ore is treated. Means are provided for the continuous charging of the crucible and for the condensation of the metallic vapours.—O. F. H.

Alloys and steel; Method of making —. A. J. Boulton, London. From J. T. Jones, Iron Mountain, Mich., U.S.A. Eng. Pat. 12,324, June 6, 1908.

U.S. Pats. 890,229, 891,704, and 899,405; this J., 1908, 814, 815, 1024.—T. F. B.

Iron oxides; Process of smelting —. H. W. Lash, Cleveland, Ohio. U.S. Pats. 924,676 and 924,677, June 15, 1909.

SEE Fr. Pat. 376,381 of 1907; this J., 1907, 1018.—T. F. B.

Steel; Refining of — in electric furnaces. O. Thallner, Assignor to Bismarckhütte, Bismarckhütte, Germany. U.S. Pat. 925,612, June 22, 1909.

SEE Addition of May 23, 1908, to Fr. Pat. 386,786 of 1908; this J., 1908, 1117.—T. F. B.

Alloy for armour-plates and other uses. E. Schneider, Le Creusot, France. U.S. Pat. 925,659, June 22, 1909.

SEE Fr. Pat. 379,188 of 1906; this J., 1907, 1202.—T. F. B.

Aluminium solder. W. H. Finrock, Chicago, U.S.A. Eng. Pat. 12,494, June 10, 1908.

SEE Fr. Pat. 391,161 of 1908; this J., 1908, 1117.—T. F. B.

Metals; Means for extracting — from their ores by solar heat, also applicable for heating, melting, or volatilising other substances or materials. W. G. Williams, Klipriviersberg, Transvaal. Eng. Pat. 20,902, Oct. 3, 1908.

SEE Fr. Pat. 397,459 of 1908; preceding.—T. F. B.

Alloys for bearing metals. E. A. Touceda, Albany, N.Y., U.S.A. Eng. Pat. 25,620, Nov. 27, 1908. Under Int. Conv., Nov. 27, 1907.

SEE U.S. Pat. 897,431 of 1908; this J., 1908, 985.—T. F. B.

Zinc-lead ores; Treatment of refractory —. P. C. C. Isherwood, Harrow. U.S. Pat. 925,190, June 15, 1909.

SEE Eng. Pat. 16,364 of 1906; this J., 1907, 1012.—T. F. B.

Metals of a highly refractory nature; Apparatus for producing homogeneous ductile bolies from —. W. von Bolton, Charlottenburg. Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 925,798, June 22, 1909.

SEE Fr. Pat. 337,607 of 1903; this J., 1904, 494.—T. F. B.

Tantalum; Process of hardening —. W. von Bolton, Charlottenburg. Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 925,988, June 22, 1909.

SEE Eng. Pat. 6051 of 1908; this J., 1908, 904.—T. F. B.

Sulphur, etc., from furnace gases. U.S. Pat. 925,751. See VII.

Bauxite production in the United States. [T.R.] See VII.

Tank-furnace for glass-making, metallurgy, etc. Fr. Pat. 397,548. See VIII.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

PATENTS.

Accumulator plates; New product and its process of preparation for the constitution of —. H. de Laminière and Soc. anon. des Accumulateurs de Laminière. Fr. Pat. 397,176, Dec. 8, 1908.

Oxides of lead, e.g., minium, litharge, or mixtures of these, are mixed with a solution in distilled water of sodium or potassium tartrate or the double sodium-potassium tartrate. The solvent is afterwards evaporated, and the resulting paste is used for the manufacture of plates, either with or without a support.—B. N.

Electrolysers for the production of pure hydrogen and oxygen. R. Eycken, C. Leroy, and R. Moritz. Fr. Pat. 397,319, Dec. 9, 1908.

The electrode plates are built up, with separating diaphragms of asbestos, in the form of a filter-press, suitable

openings, in the top of each plate, which communicate also with the electrolytic cells, fitting together to form two channels for the escape of the gases. All the joints are surrounded on the outside by the atmosphere, and as the gases are kept at a pressure above that of the atmosphere, it is impossible for them to become mixed. The electrodes and diaphragms are kept clean by making the first electrode hollow, and in the form of a large reservoir, in which the sediment accumulates and from which it may be removed from time to time. This reservoir is divided into two parts, into which the gases pass, through the electrolyte, the pressure being maintained constant, and the delivery of the gases regulated by two floats and balanced valves.—B. N.

Furnace; Electric —. J. Bouneau, Paris. U.S. Pat. 926,236, June 29, 1909.

SEE Fr. Pat. 377,119 of 1907; this J., 1907, 1055.—T. F. B.

Nitrogen; Process for oxidising atmospheric — by electricity. D. Helbig, Rome. U.S. Pat. 926,413, June 29, 1909.

SEE Fr. Pat. 385,193 of 1907; this J., 1908, 576.—T. F. B.

Electric lamp filaments. Eng. Pat. 12,720. See II.

Ozonising air [for internal combustion engines]. Eng. Pat. 17,325. See II.

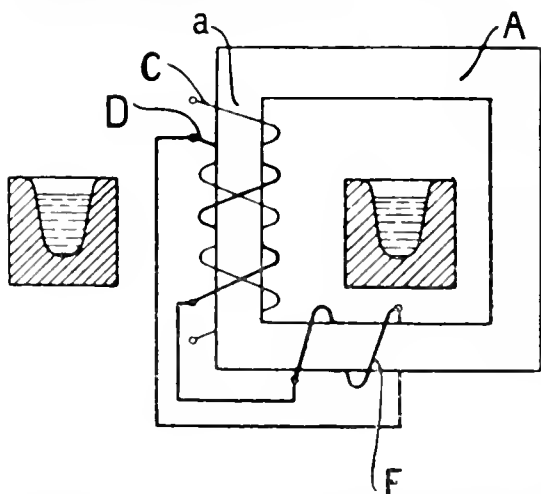
Fusing and refining refractory ceramic materials by means of an electric resistance furnace. Fr. Pat. 397,140. See VIII.

Glyoxylic acid, its esters and amide from oxalic acid by electrolytic reduction. Ger. Pat. 210,693. See XX.

(B.)—ELECTRO-METALLURGY.

PATENTS.

Furnaces; Electrical induction —. C. Grunwald, Bredene, Germany. Eng. Pat. 3599, Feb. 13, 1909. Under Int. Conv., May 7, 1908.



In electrical induction furnaces, owing to electro-dynamic effects which arise between the primary winding and the melting bath, the upper surface of the latter assumes an oblique position, resulting in oxidation of the metal and corrosion of the melting bath. The object of this invention is to obviate these disadvantages. Upon the part, *a*, of the transformer yoke, *A*, which is surrounded by the primary winding, *D*, there is arranged an auxiliary winding, *F*, the ends of which are connected to a second auxiliary winding, *F*, the number of turns in *F* being less than in *D*. The tension produced in *F* is in opposition to that in *D* and is less than this by an amount such that there is produced, in the auxiliary winding, *D*, a current strength sufficient to counter-balance the electro-dynamic effects

mentioned above, the winding, *F*, occupying such a position that it has no appreciable influence on the equilibrium of the melting bath.—B. N.

Furnaces; Electrical induction —. C. Grunwald, Bredene, Germany. Eng. Pat. 7396, March 27, 1909. Under Int. Conv., Aug. 15, 1908.

The central horizontal section of the fusion gutter, containing the metal forming the secondary of the inductive furnace, is in the form of a rhombus, and working openings are arranged at the corners of the fusion hearth forming the acute angles of the rhombus. By the aid of the openings, the entire upper surface of the fusion bath may be surveyed and manipulated.—B. N.

Furnace; Electric —. L. D. Farnsworth, Palo Alto and M. J. Bartell, San Francisco, Cal. U.S. Pat. 924,603, June 8, 1909.

THREE electrodes are arranged horizontally in the furnace overhanging and built permanently into the crucible the inner ends of the electrodes being wedge-shaped, so that the space between the ends is substantially Y-shaped. The electrodes and crucible are so constructed, that the current, in passing from one electrode to the other, will be distributed vertically through the slag, and horizontally through the molten metal in the crucible. A "supply chamber" is provided at one side of the crucible and in open connection with the latter, so that the molten metal will flow freely into it. Means are provided with the chamber for displacing the molten metal, thus raising the level of the metal in the crucible, and at the same time varying the depth of the slag between the electrode and the metal.—B. N.

Ores; Method of reducing —. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co. New York. U.S. Pat. 924,130, June 8, 1909.

ORES consisting of oxides of refractory metals are electrically smelted with boron, the latter being present in about the quantity necessary to combine with the oxygen of the ore, so as to give a product low in boron. A gas flux may be added to the charge. Ferro-boron may be used instead of boron, in which case an alloy of the refractory metal with iron is obtained.—A. G. L.

Metals from ores and other substances; Apparatus for recovering —. L. Dion, Assignor to The American Electro-Hermatic Co., New York. U.S. Pat. 925,621, June 22, 1909.

FUMES or gases from molten metals are passed through a chamber containing several groups of electrodes. Each group is composed of materials reacting with only one of the metals present in the gases; currents of electricity of different strength are supplied to the different groups of electrodes. The gases emerge into another chamber in which they are forced to pass through a filter.—A. G. L.

Tin; Method and apparatus for the recovery of pure — from tin-plate scrap and lead-tin alloy. A. Noda. Second Addition, dated Feb. 10, 1908, to Fr. Pat. 386,491, dated Feb. 10, 1908 (this J., 1908, 692 and 1212).

EACH tank is divided into compartments separated by porous walls, the same tanks being used for both solution and deposition of the tin. The scrap or alloy contained in baskets is cleaned and washed and then introduced into the outer compartments of the tanks which are filled with a dilute solution of sulphuric acid to which has been added a small amount of hydrochloric acid. On the passage of the current the tin is dissolved as chloride and at once converted into sulphate with regeneration of the hydrochloric acid which becomes available for the solution of more tin. When all the tin has been dissolved, the basket is removed, its place being taken by a fresh basket. A concentrated solution of tin sulphate is thus obtained which is then pumped into the central compartment where it is electrolysed, the tin being deposited on the cathodes from which it falls into a tray at the bottom of the central compartment.—O. F. H.

ring and cleaning of small [metal] objects; Process for the electrolytic —. A. Levy. First Addition, dated Oct. 19, 1908, to Fr. Pat. 394,120, Nov. 13, 1907 (this J., 1909, 249).

The application of the process is claimed to metallic objects of all kinds and sizes.—B. N.

Metals; Electrolytic process for the extraction of — from their ores, and the treatment of waste copper. Soc. Française Electrolytique. Fr. Pat. 397,482, Feb. 25, 1908.

Hydrogen peroxide is added, either in bulk at the commencement or in progressive portions during the operation, to the electrolytic bath, with the object of redissolving the copper in the electrolyte of sulphuric acid, whilst preventing the solution of foreign metals. Substances or mixtures of substances, which will produce hydrogen peroxide, may be employed, e.g., peroxides, carbonates or perborates of alkali or alkaline-earth metals in the presence of hydrochloric, hydrofluoric, sulphuric, phosphoric, carbonic, or other acids.—B. N.

Copper and analogous metals; Electrolytic process of extraction of — from their ores or alloys. Soc. Française Electrolytique. Fr. Pat. 397,483, Feb. 25, 1908.

Sulphuric, or monopersulphuric, acid is added to the electrolyte, either in bulk at the commencement or in progressive small portions, thus providing a permanent source of chemically active oxygen for the rapid solution of the copper, and at the same time maintaining the composition of the bath constant by regeneration of the electrolyte. The acid may be generated in the bath, by preliminary operations, e.g., by dissolving in water the product of the action of the electric discharge on a mixture of sulphur dioxide and oxygen; by the electrolysis of a solution of sulphuric acid; or by the solution of persulphate in cooled sulphuric acid.—B. N.

German silver and other copper-nickel alloys; Process for the preparation of — from mixtures of metals containing iron. Elektrostahl Ges.m.b.H. Ger. Pat. 10,550, Sept. 6, 1907.

The metal mixture containing iron is melted in an electric furnace of the Kjellin or Héroult type, or it is first melted and then run into the electric furnace. Compressed air or other oxidising gas is then blown into the bath, after addition of a flux if necessary. The iron or iron and salt pass into the slag, and after removing the latter, the necessary additions of metal are made to the residual copper-nickel alloy, according to the product desired.

—A. S.

German silver or other copper-nickel alloys; Process for the preparation of — from mixtures of metals containing iron. Elektrostahl Ges.m.b.H. Ger. Pat. 11,215, Sept. 6, 1907. Addition to Ger. Pat. 210,550, Sept. 6, 1907.

The oxidation of the iron is effected by means of oxides of nickel or copper, instead of by oxidising gases as in the main patent (see preceding abstract).—A. S.

Metals from their ores; Electric furnace for the continuous extraction of —. E. F. Côte and P. R. Pierron, Lyons, France. Eng. Pat. 18,653, Sept. 5, 1908. Under Int. Conv., Feb. 12, 1908. Addition to Eng. Pat. 5100, March 2, 1907.

Addition of Feb. 12, 1908, to Fr. Pat. 385,018 of 1907; this J., 1908, 864.—T. F. B.

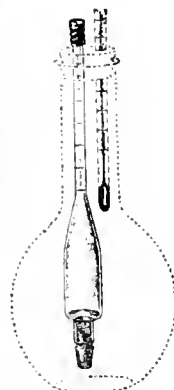
XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Cottonseed oil; Unsaponifiable constituents of —. H. Matthes and W. Heintz. Arch. Pharm., 1909, 247, 61—175.

The refined cottonseed oil examined by the authors yielded 0.71 per cent. of unsaponifiable matter with an

iodine value of 77. This did not give Beechi's reaction, and was quite free from sulphur. In the authors' opinion the 0.5 per cent. of sulphur found by Wagner and Clematis (this J., 1909, 372) in the unsaponifiable matter of cottonseed oil was derived from impurities. On distillation of the last portion of the ether and alcohol used in the separation of the unsaponifiable constituents, a characteristic aromatic odour recalling that of peppermint was observed. This was attributed to the formation of secondary products through the action of the alcoholic potassium hydroxide upon the phytosterol. A similar decomposition was effected by the long-continued action of alcoholic alkali solution upon purified phytosterol from Calabar beans. The unsaponifiable matter from cottonseed oil could be separated by treatment with chilled petroleum spirit into a solid and a liquid portion. The solid crystalline portion consisted of (a), a phytosterol (m. pt. 139° C.) which was levo-rotatory and contained one double linkage; (b), a saturated substance melting at 81° to 82° C.; and (c), a dextro-rotatory unsaturated substance containing oxygen (m. pt., not sharp, 172° C.). The liquid portion was separated by distillation under reduced pressure into several unsaturated substances. These were yellow or yellowish-brown oils containing oxygen. The authors' results confirm the experience of Windaus and Welsch (this J., 1909, 316) that many of the new phytosterols recently described are in reality mixtures of phytosterols already known.—C. A. M.

Fatty acids in soap; Determination of —. M. Dominikiewicz. Chem.-Zeit., 1909, 33, 728.



The apparatus (see Fig.) used in the author's method of determining the total fatty acids in soap is constructed on the principle of the butyrometer for the determination of fat in milk. It consists of a tube the wider end of which is closed by means of a rubber cork, whilst the narrower part, on which is the scale, is closed by means of a metal cap, which can be screwed down. Each division of the scale corresponds to 0.01 c.c. In making a determination, from 40 to 60 grms. of the soap are dissolved in water, and the solution diluted to 1 litre. Ten c.c. of hydrochloric acid and 10 c.c. of the soap solution are introduced into the tube, which is then lightly shaken, with the wider part downwards. It is next placed for 5 minutes in a flask of boiling water, after which it is whirled for 5 minutes in a centrifugal machine. By unscrewing the metal cap and pressing the rubber cork further into the other end, the separated layer of fat is brought within the limits of the scale. The apparatus is now replaced in the flask of boiling water, and the amount of fatty acids read upon the scale at 99° C. The sp. gr. of the fatty acids should be determined, and the necessary correction applied. The results obtained by this method are shown by test experiments to be in close agreement with those given by the usual gravimetric method.—C. A. M.

Stearolic and behenolic acids; Glycerides of —. H. Quensell. Ber., 1909, 42, 2440—2452.

SYNTHETICAL glycerides were prepared from stearolic and behenolic acids by various methods, including Scheij's modification of Berthelot's process (heating the equivalent proportions of acid and glycerol in a sealed tube containing carbon dioxide) and the methods of Guth (this J., 1903, 427) and of Kraft (Ber., 1903, 36, 4311), in which the sodium salts of the acids are heated with chloro- or bromohydrins. The resulting products were readily purified by crystallisation from alcohol. They absorbed one mol. of chlorine or bromine rapidly, but long continued action under the influence of light was required for the absorption of two mols. On the other hand, not more than one mol. of iodine or of iodine chloride (from Hübl's solution) could be made to combine with the

triple linkage in these acids or their glycerides. The following compounds were prepared:— α -monostearolin, $(\text{CH}_2\text{O.CO.C}_{17}\text{H}_{33})(\text{CH}_2\text{OH})(\text{CH}_2\text{OH})$, crystallising in white plates of m. pt. 40.5°C ; α -distearolin melting at 38.5°C ; β -distearolin (m. pt. 49°C); tristearolin (m. pt. 29°C); epistearolhydrin (m. pt. 36°C). The corresponding compounds of behenic acid were also prepared. They had higher m. pts. and crystallised better than the glycerides of stearic acid. Thus tribehenolin $(\text{CH}_2\text{O.CO.C}_{21}\text{H}_{41})(\text{CH}_2\text{OH})(\text{CH}_2\text{OH})$ (m. pt. 41°C) crystallised in brilliant white plates melting at 41°C . Various halogen compounds of the glycerides of stearic acid were prepared. Most of them were heavy oils which did not solidify even when cooled to a low temperature. —C. A. M.

Juniperic and sabinic acids. J. Bougault and L. Boudier. J. Pharm. Chim., 1909, 30, 10—16. (See also this J., 1909, 29.)

JUNIPERIC acid, $\text{C}_{16}\text{H}_{32}\text{O}_4$, was present in all the "waxes" from the *Coniferae* examined by the authors, but sabinic acid, $\text{C}_{12}\text{H}_{24}\text{O}_4$, was only found in the wax of *Juniperus sabina*. For the separation of both acids those portions of the wax of *J. sabina* melting at about 80°C . were mainly used. The mixed fatty acids from the wax were separated into two groups by treatment of their sodium salts with a 4 per cent. solution of sodium chloride. The insoluble salts consisted of those of juniperic acid and some other acids not yet obtained in a pure state, whilst the soluble portion consisted almost exclusively of the salt of sabinic acid. The juniperic acid was then isolated by recrystallising the liberated acids of the insoluble salts from a mixture of petroleum spirit and ether until a substance of constant m. pt. was obtained. *Juniperic acid*, as thus prepared, melted at 95°C , but after resolidification its m. pt. was lowered to 83°C . Its molecular weight, elementary composition and saponification value of its acetyl derivative agreed with the formula, $\text{C}_{16}\text{H}_{32}(\text{OH})\text{COOH}$, of a hydroxy-palmitic acid. It was slightly soluble in boiling water, fairly soluble in acetone (2 to 2.5 grms. per 100 c.c.), and in hot ether and petroleum spirit. All its salts, including the alkali salts, were insoluble in water, but the sodium, potassium, and ammonium salts could be crystallised from 90 per cent. alcohol. The acetyl derivative melted at 63°C . and was more soluble than the original acid in ether and petroleum spirit. It could be crystallised in fine spangles from 60 per cent. alcohol. *Sabinic acid* melted at 84°C . and from its analytical values it was concluded to have the composition of a hydroxylauric acid, $\text{C}_{11}\text{H}_{22}(\text{OH})\text{COOH}$. It was much more soluble in alcohol and acetone (10 grms. per 100 c.c. at 20°C .) than juniperic acid, but was only sparingly soluble in cold petroleum spirit, which was therefore used for its purification. A solution of its potassium salt yielded a crystalline precipitate on the addition of magnesium sulphate and a gelatinous precipitate with calcium sulphate. The silver, barium, and lead salts were white amorphous precipitates. The acetyl derivate melted at 43°C . and was very soluble in ether, petroleum spirit, and 60 per cent. or 90 per cent. alcohol. —C. A. M.

PATENTS.

Oils and all other similar products; Centrifugal filtering apparatus for the simultaneous extraction and filtration of —. H. Morel-Révoil. Fr. Pat. 397,203, Dec. 8, 1908.

The crushed olives or other material are placed in a rotatable inner vessel, the vertical wall of which is perforated and surrounded by the filtering material. The oil is thus driven through the filter into the external chamber. —C. A. M.

Soap and similar articles; Apparatus for the manufacture of —. G. M. L. Moore-Irvine. Newry, Ireland. Eng. Pat. 11,623, July 10, 1908.

The liquid soap or other material (jelly, butter, etc.), is introduced by means of gravitation, or otherwise, into a receiver, the bottom of which opens into a number of tubes surrounded by a refrigerating chamber, through the

lower end of which they project. A piston or plunger is driven into the receiver, and when driven by suitable mechanism, forces the soap into the tubes, where it is cooled and compressed into solid bars. The apparatus may also be used as a horizontal apparatus, and appliances may be fixed at the outlets of the tubes to cut the bars into suitable lengths. —C. A. M.

Soap frames. A. G. Bloxam, London. From the F. A. Jacobi, Darmstadt, Germany. Eng. Pat. 21,801, Oct. 15, 1908. Addition to Eng. Pat. 18,253 of 1907 (this J., 1908, 693).

A SPECIAL vent for the escape of the air is arranged on the edge of the side of the frame for the purpose claimed in Eng. Pat. 18,253 of 1907. This vent may be formed by fixing a grooved metal plate to the edge of the side, so that the concave surface of the groove is turned towards the cooling plate. —C. A. M.

Detergent compound. A. Kayser, Buffalo, N.Y., Assignor to The Electric Smelting and Aluminium Co., Lockport, N.Y. U.S. Pat. 923,850, June 8, 1909.

ALUMINA (one molecular proportion) is mixed with silicic acid (2 to 8 molecular proportions) and the oxide of an alkali metal, e.g. sodium oxide (4 to 6 molecular proportion) to form a hydrated detergent composition which is stated to contain the respective elements in the molecular proportions of Al_2 , Si_2 , Na_4 and O_{12} . —C. A. M.

Detergent. A. Kayser, Buffalo, Assignor to The Electric Smelting and Aluminium Co., Lockport, N.Y. U.S. Pat. 924,792, June 15, 1909.

CLAIM is made for a detergent, consisting of a soap, which are intermixed, one molecular proportion of alumina, 2—8 molecular proportions of silica, and 4 molecular proportions of sodium oxide or other alkali metal oxide. —F. SODS.

Detergents and other chemical products; Manufacture of —. N. Reif. Fr. Pat. 397,412, Dec. 14, 1908. Under Int. Conv., Dec. 14, 1907.

EQUIVALENT quantities of substances which intervene immediately to form solid products (e.g. sulphur chlorides and an oil, sodium carbonate and soap, etc.) are brought together in a continuous operation, mixed, and discharged from the apparatus by a rotary motion which leaves the final product in a fine granular or flocculent state. Or the pulverisation may be effected by means of a helicoidal device surrounded by a cover which may be turned so as to regulate the size of the outlet orifice. Other modifications of the apparatus are also claimed. —C. A. M.

Extracting grease and oil from garbage. U.S. Pats. 925,910 and 925,971. See XVIII. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(B).—RESINS, VARNISHES.

Acaroid resin; Red —. L. E. Andés, Chem. R. Fett-u. Harz-Ind., 1909, 16, 160—161.

OF the various species of *Xanthorrhoea*, the *X. Drummondii* (W. Australia) is reputed to afford most resin, a single tree yielding an average of 23 kilos. of a yellow resin. Attempts have been made to produce an illuminating gas from a mixture of equal parts of the resin and leaves of the plant. The gas has the sp. gr. 0.888, and possesses a greater illuminating power than coal gas; tar and coke are also produced. *X. totiana* (S. Australia and Kangaroo Island) furnishes a ligneous, vesiculated, readily friable and odourless resin. The mass is dark red; the powder is yellowish and imparts a blood red color to hot water. Petroleum ether extracts 1 per cent. of a colourless odourless resin; strong alcohol dissolves it entirely, forming a fiery red solution, which deposits crystals of benzoic acid on evaporation. *X. haasii* (N.S.W. and Queensland) produces a resin of sweet

our, resembling that of benzoin: it is readily friable, powder resembling gamboge and undergoing change colour when exposed to light. It melts in boiling water, during the latter turbid and yellow. Petroleum ether extracts 1 per cent. of a pleasant-smelling substance; alcohol dissolves 94 per cent., and the solution affords very crystals of benzoic acid on evaporation. The refined resin melts at 97.5° C. Another sample, showing lower melting point, yielded to petroleum ether, 2 per cent. of a faintly coloured viscous body, probably composed of essential oils and resin. *X. arborea* (N.S.W. and New Zealand) furnishes compact pieces mixed with leaves; colour of the product varies from purple brown to mine red. It forms a readily friable powder, of the colour of raw sienna, and tastes like benzoin. Petroleum ether extracts 8 per cent.; alcohol, 92 per cent. of this in; the alcoholic extract deposits crystals of benzoic acid, but in lesser quantity than the other *Xanthorrhoea* ins. *X. australis* (Tasmania and Victoria) affords regular shaped spheroidal masses of resin of a dark colour. The resin is readily friable. In the fused state, it resembles dragon's blood. Its alcoholic solutions are clearer than those of the other species of *Xanthorrhoea* ins. It occurs in all the species of *Eucalyptus*, with exception of *E. amygdalina*. It is only partially soluble in ether, and insoluble in oil of turpentine. Hesse recommended melting acroind resins to free them from woody fibre. The author has found, however, that on melting the resins, there is a troublesome frothing, and unpleasant smelling decomposition products are evolved. Moreover the properties of the resin are materially altered, and this treatment must be regarded unsuitable.—E. C. V-E.

PATENTS.

Terpentine oil substitutes; Preparation of — P. Pellaitz. Addition, dated Dec. 8, 1908, to Fr. Pat. 394,467, Sep. 19, 1908. (See Ger. Pat. 202,254; this J., 1908, 1212.)

The process may be carried out without the aid of pressure vaporising the mixture of terpenes and acetic acid "resin acid," and bringing it into direct contact with one or ozonised air.—C. A. M.

Enols and aldehydes; Process for hardening products of the condensation of — Knoll und Co. Fr. Pat. 397,051, Dec. 3, 1908. Under Int. Conv., July 3, and Oct. 20, 1908.

Acid, which may be diluted with a liquid other than water, is added to the products of the condensation of enols and aldehydes prior to their hardening, with the object of accelerating the process. Or the products may be treated with substances (such as esters of sulphuric acid, or chlorides of organic or inorganic acids) which readily yield a free acid, or with acid salts in solid form solution.—C. A. M.

(C.)—INDIA-RUBBER, &c.

Rubber; Determination of — in hot-vulcanised rubber goods. G. Hübener. Chem.-Zeit., 1909, 33, 648—649 and 662—663. (See also this J., 1909, 251, 720).

Axelrod's process (this J., 1907, 1058) the precipitate obtained by the action of bromine on a solution of vulcanised rubber in petroleum consists of a mixture of the monosulphide, $C_{16}H_{16}Br_2S$, and the tetrabromide, $C_{16}H_{16}Br_4$, of caoutchouc, any disulphide, $C_{16}H_{16}S_2$, present remaining in solution. Hence the same factor, 4, may not be applicable in all cases to the estimation of the rubber-content. The method now described is designed to overcome that difficulty. It seems almost possible to devise a single process that shall be suited to every case, on account of the very varied nature of rubber mixings, but the following can be employed in most instances for the direct estimation of rubber:—5 grms. of the finely rasped sample are extracted with acetone for from 4 to 6 hours: in cases where resins soluble in acetone are present, as in some ebonite mixings, this extraction must be followed by an extraction with dichlorhydrin. The extracted sample is dried at

60° C. and weighed, 0.2 grm. (or more in the case of mixings with low rubber content) of the dry, extracted sample, is placed in a flask in contact with 100 c.c. of distilled water and 5 to 10 c.c. of bromine, and the flask is warmed gently on a sand-bath until the reaction is complete and the greater part of the excess of bromine is volatilised. The excess of bromine is then completely driven off by heating more strongly. The precipitate is filtered off (Schleicher and Schüll's "White band" filter No. 590 is recommended for this purpose), and washed with hot water. The precipitate and filter are transferred to a 400 c.c. Erlenmeyer flask, excess of $N/10$ silver nitrate (about 20 c.c.) is added, together with about 20 c.c. of concentrated nitric acid and the liquid is heated until nitric acid fumes are given off and the liquid is reduced to about 15 c.c. in volume. The liquid is diluted with water and cooled, 5 c.c. of a cold saturated solution of iron alum are added, and the excess of silver nitrate titrated with $N/10$ ammonium thiocyanate. From the amount of silver used, the amount of rubber present in the precipitate, potentially as tetrabromide, is calculated. The remaining portion of the rubber is estimated from the combined sulphur, the latter being taken as the difference between the amounts of free sulphur and total sulphur; the calculation is based on the assumption that this portion of the rubber is potentially present as disulphide, $C_{16}H_{16}S_2$ (see this J., 1909, 252). Total sulphur is estimated in the manner previously described (loc. cit.). Free sulphur is estimated in 0.2 grm. (or more) of the original substance by oxidation with bromine water, filtration from the precipitate formed, acidification with hydrochloric acid and precipitation with barium chloride. If, in the ash, metals are found to be present which form sparingly soluble sulphates, they must be estimated, and the sulphur added to the free sulphur previously found. By making use of the fact that the tetrabromide, $C_{16}H_{16}Br_4$, is soluble in carbon bisulphide, it is possible to differentiate between "free rubber," $C_{16}H_{16}$, unsaturated sulphide, $C_{16}H_{16}S$; and saturated disulphide, $C_{16}H_{16}S_2$ present in the vulcanised rubber. Results obtained with a number of different soft and hard rubbers are given.—E. W. L.

Vermilion and "golden sulphide" [of antimony] in rubber goods; Determination of — J. Rothe. Chem.-Zeit., 1909, 33, 679. (See also this J., 1909, 614.)

The coarsely-divided sample is heated in a spacious round-bottomed flask with a mixture of 10 to 20 c.c. of nitric acid (sp. gr. 1.48) and 2 c.c. of concentrated sulphuric acid for every 1 grm. of the sample taken, for one to two hours, the temperature being regulated so as to ensure a regular and steady evolution of gases from the liquid. Finally, the temperature is raised until all the nitric acid is driven off, and sulphuric anhydride fumes are evolved. 5 to 10 c.c. of concentrated nitric acid are then added, and the liquid kept gently boiling until it becomes clear, after which the flask is heated until the sulphuric acid boils and fumes. Should the liquid darken in colour again, a further 5 c.c. of nitric acid must be added and the process repeated until the liquid remains clear. Traces of nitrogen oxides which remain in the liquid even after the sulphuric acid has been brought to the boiling point, may be removed by diluting the acid liquid with water, and boiling it for a short time. The estimations are from this stage carried out in the ordinary way, the organic matter having been completely destroyed without loss of volatile metals.—E. W. L.

PATENTS.

Hard rubber or ebonite; Manufacture of — T. Gare, New Brighton. Eng. Pat. 4484, Feb. 28, 1908.

CLAIM is made for a process based on the same principle as that of Eng. Pat. 12,354 of 1906 (this J., 1907, 339). Old or waste vulcanised rubber, preferably reduced to powder, is mixed with a suitable proportion of sulphur or other vulcanising agent (say 15 per cent.), and pressed to the desired density in a mould of the required shape, air being thereby expelled. The mould containing the compressed mixture is then locked and heated for a suitable length of time, and subsequently cooled.—C. A. M.

Caoutchouc, leather, and analogous products; Method and composition for joining, cementing and hardening — C. Coquerelle. Fr. Pat. 397,561, Feb. 27, 1908.

THE substance is treated in the cold with a composition containing several constituents, such as phosphorus and its derivatives, capable of adhering to caoutchouc or leather and of hardening under the influence of heat. A suitable preparation claimed consists of:—Phosphoric acid, 4.97; lime, 5.18; alumina, 61.90; iron oxide, 4.39; and lead oxide, 23.36 per cent.—C. A. M.

Gelatoid thermoplastic compound. B. B. Goldsmith, N. York. U.S. Pat. 925,328, June 15, 1909.

THE composition consists of an intimate mixture of β -naphthol with a gelatoid. The mixture, after thorough incorporating, is subjected to heat and pressure.

—G. W. McD

Joining, cementing, and hardening caoutchouc, leather, Fr. Pat. 397,561. See XIII C.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Hide powder; Rapid method of determining the acidity of — A. T. Hough. Collegium, 1909, 218—219.

THE method proposed by the author consists in weighing out the equivalent of 6.5 grms. of dry hide powder, adding about 100 c.c. of boiling distilled water, stirring for two or three minutes till the powder is thoroughly soaked and partly gelatinised, and then titrating while hot with N 10 sodium hydroxide solution, using a liberal amount of phenolphthalein (3—4 c.c.) as indicator. It is sometimes advantageous to boil the hide powder for a short time, as within limits, the more gelatinisation which takes place, the better the reaction. The reaction is fairly sharp, giving a permanent pink in two or three minutes, and it is said that results are obtained by the method, closely agreeing with those found by the official method of the Int. Assoc. Leather Trades Chemists.—S. H.

Ellagic acid; Artificial preparation and constitution of — P. Sisley. Bull. Soc. Chim., 1909, 5, 727—730.

PURE tannin prepared from Chinese extract of galls can be converted into ellagic acid by oxidation. 170 grms. of tannin are dissolved in 2½ litres of alcohol of 40°, and 150 c.c. of potassium hydroxide of 30° B. are then added. For each molecule of tannin there should be present two molecules of alkali. After exposure to the air for 5 days, there is an abundant separation of crystals of potassium ellagate. The ellagic acid obtained from this salt corresponds in its properties with the natural acid. The author considers that the production of ellagic acid by this reaction confirms the constitution of the acid as determined by Graebe (see Perkin and Nierenstein, this J., 1905, 1087). 45 grms. of tannin when hydrolysed by sodium hydroxide yielded 52 grms. of crystallised gallic acid, thus showing that tannin cannot be a glucoside.

—F. SUDN.

PATENTS.

Tanning extracts; Method of obtaining decolorised — E. W. Tillberg. Fr. Pat. 395,499, Oct. 20, 1908. Under Int. Conv., April 27, 1908.

MILK, preferably skimmed, or butter-milk, is added to the tanning extract and the mixture heated above 70° C. The albumin of the milk is thus coagulated, and in settling carries down the insoluble matter and part of the colouring matter of the extract. The clear liquor may be separated either by decantation or filtration.—S. H.

Tannage; Method of — of ungrained hides [sole leather]. Soc. Anon. des Mat. Tannantes et Colorantes. Fr. Pat. 396,025, Jan. 13, 1908.

THE raw hide is first swollen in a bath of formaldehyde and whilst still in a swollen state is given a first tannage in a drum with tanning extract. The hides are removed, dried completely, and then given a second tannage in the drum.—S. H.

Artificial leather; Production of — H. W. Lake, London. From Fiber Products Co., New York. Eng. Pat. 4130, Feb. 19, 1909.

THE trimmings or waste from "green" or untanned hides are mechanically cut into shreds and simultaneously tanned by a tanning agent placed in the shredding machine. The resulting fibrous mass is freed from moisture by pressure, and dried. If desired, the sheets of "artificial leather" thus obtained are calendered and again pressed.

—C. A. M.

XV.—MANURES, &c.

Double superphosphates; Analysis of — O. Foerst. Chem.-Zeit., 1909, 33, 685—686.

FOR the extraction of the water-soluble phosphoric acid in double superphosphates, it is not sufficient to shake 20 grms. of the substance with 1 litre of water for 0.5—2 hours as is prescribed for superphosphates. The duration of the extraction for the complete solution of the monocalcium phosphate should be 24 hours, and is not shorter by carrying out part of the extraction in a rotating shaker apparatus. The sample should be ground before extraction and the same results are obtained with 10 grms. as with 20 grms. per litre of water. Of the filtered extract 25 c.c., corresponding with 0.25 gm. of the superphosphate are boiled for 10 minutes with 10 c.c. of fuming nitric acid to destroy the pyrophosphoric acid. An indicator is added and the solution then neutralised as accurately as possible by means of ammonia solution of sp. gr. 0.9. When the liquid is cold, precipitation is effected with ammonium citrate and magnesia mixture in the ordinary way. The moisture in double superphosphates is estimated by drying 5 grms. of the sample in tared watch glass for 6 hours at 100° C.—T. H. P.

Nitrogen-fixing bacteria; Some effects of — on growth of non-leguminous plants. W. B. Bottomly. Roy. Soc. Proc., 1909, B, 81, 287—289.

THE author finds that *Pseudomonas radicola* and *Azobacter* together make a powerful combination for the fixation of free nitrogen. Pot experiments with plants watered with a mixed culture of the two bacteria, compared with plants watered with distilled water, show an increase in weight of 76 per cent. Field experiments on barley showed an increase of 76 per cent. Hyacinths gave an increase of 18.6 per cent., and parsnips an increase of 21.7 per cent. The presence of calcium carbonate in these experiments is necessary.—J. C. C.

Nitrogen; Assimilation of atmospheric — by microorganisms naturally occurring in the soil. F. Strain. Z. Zuckerind. Böhm., 1909, 33, 599—614. (See also this J., 1908, 1167.)

THE author concludes this paper with an account of practical experiments on the inoculation of soil with azotobacter. Direct inoculation of the soil was found to increase the yield of turnips to the extent of 10 per cent. of the roots and 35 per cent. of the leaves, that of oats to the extent of 13 per cent. of the corn and 16 per cent. of the straw, and that of potatoes to the extent of 31 per cent. of the tubers. Further experiments have shown that good results are to be obtained, not by direct inoculation of the soil with pure cultures, but partly by a gradually effected transfer of the culture from a medium of development (mannitol-nutrient solution) to a medium approximating in character to that of natural soil, and then to the soil itself, and partly by inoculation of crude cultures. The method of inoculation is as follows:—Soil, to which 5 per cent. of dextrose has been added, is inoculated with a pure or crude culture of azotobacter (500 c.c. of dextrose-nutrient solution, containing developed azotobacter cultures, were poured into 5 kilos. of soil to which 250 grms. of dextrose had been added); the mixture is kept for 3 months at 24°, whereby the organisms grow and probably become acclimatised to the chemical and biological conditions which obtain in soil under natural conditions. Experiments on a small scale, carried out under glass, and

with potassium chloride, monocalcium phosphate, calcium carbonate, and dextrose, were added to the soil, and that a pot which had not been inoculated with azotobacter, yielded 11.64 grms. of seeds and 19.22 grms. of straw, a pot which had been inoculated with a pure culture of azotobacter yielded 12.64 grms. of seeds and 10 grms. of straw, and a pot, to which had been added 500 grms., inoculated with azotobacter, yielded 29 grms. of seeds and 44.84 grms. of straw.—L. E.

Sugar beets; Sodium chloride (common salt) as a manure — H. Mette. Z. Zuckerind. Böhm., 1909, 3, 620—621.

COMPARATIVE experiments, dealing with the effect of addition of common salt to the soil on the growth of the sugar beet, were made in 1908 (a dry year). The soil, in which barley had previously been grown, was treated with stable manure and mineral fertilisers. On August 1, which date the beets already presented a shrivelled appearance owing to protracted dry weather, salt, in the proportion of 100 kilos. per $\frac{1}{2}$ hectare, was mingled with the soil. It was found that a plot of 100 sq. metres, treated with salt, yielded a crop of 295.4 kilos, as compared with a crop of 272.3 kilos, from a plot of the same size which had not been treated with salt, and, in the former case, the sugar-content of the roots was 21.48 per cent., as compared with 20.58 per cent. in the latter. The author considers that this striking result is to be traced, not to the direct manurial action of the sodium chloride, but to its hygroscopic power. The salt takes up, and retains moisture; the nutrient material is thus kept in the liquid state, and further development of the beet is insured. The author concludes that manuring with salt is practically valueless in the case of good soils in a temperate climate and with normal rainfall, but that excellent results can be obtained by such treatment (even though the salt is applied at a very late period, as in the case quoted above) in the case of light soils in a hot climate with a long period of dry weather.—L. E.

Fertilisers Act, 1909; Canadian — Board of Trade J., July 1, 1909. [T.R.]

The "Fertilisers Act, 1909" (No. 16 of 1909) which was enacted on May 19th last, repeals the Fertilisers Act of 1906 with effect from January 1st, 1910, and provides that every brand of fertiliser offered for sale in Canada shall bear a permanent registration number, which will be allotted by the Minister of Inland Revenue on application of the manufacturer of such brand of fertiliser, or his agent, on payment of a fee of two dollars. Every application for a registration number, which is to be affixed in plain and legible manner to every package of fertiliser offered for sale, must be accompanied by a statement giving—(a) Name of brand for which registration number is asked, and trade mark, if any. (b) Name and address of manufacturer. (c) Name and address of the person applying for registration. (d) Guaranteed analysis. Materials from which the fertiliser is made.

A licence—costing 5 dols.—is required for the sale of a fertiliser, and such licence shall be valid for the calendar year in which it is issued. The purchaser of any registered fertiliser may, under certain conditions, obtain an analysis thereof on payment of a fee of one dollar. The Act is not applicable to any fertiliser imported for the personal use of the importer and not for sale, nor to fertilisers which are manufactured to the order of the purchaser and are not intended for sale; but an analysis of such fertilisers may be obtained, under certain prescribed conditions, on payment of a fee of 5 dollars.

As provided in the Act that "fertiliser" shall mean any natural or artificial manure containing phosphoric acid or nitrogen or potash, except ordinary stable manure.

XVI.—SUGAR, STARCH, GUM, &c.

Asian corn [maize]; Use of — for the manufacture of starch, glucose, etc. L. E. von Cramm. Seventh Int. Congr. Appl. Chem., London, 1909.

Maize is cultivated in large districts in South Russia, as Bessarabia, Odessa, and that part of the Caucasus

controlled by the Vladikawkas Railway from Rostoff to Vladikawkas towards Batoum and Novorossisk. At present, nearly the whole of the maize is used for home consumption and is of poor quality, but if a better outlet could be obtained, the quality might be improved and cultivation extended. The price for maize f.o.b. Novorossisk is, on the average, £3 5s. per ton. It is suggested that in the districts of the Caucasus and in the valleys of Bessarabia which are too distant for remunerative export of the maize, the latter should be employed for the manufacture of starch, dextrin, glucose, etc., for export.—A. S.

Sugar cane in the Leeward Islands; Manurial experiments on — Dept. of Agric. for the West Indies, 1909. [T.R.]

NITROGENOUS fertilisers, such as ammonium sulphate and sodium nitrate, are necessary and remunerative for ratoon canes, while phosphates and potash do not appear to be advantageous.

Indanthrene Blue and Indanthrene Violet as substitutes for ultramarine in sugar works. Internat. Sugar J., 1909, 11, 320.

THE above dyestuffs possess advantages not present in the ultramarine at present used. Under the action of acids and bases there is no change in colour or intensity. This stability in colour is an important essential in beet sugar manufacture, for the juice always contains free bases. The dyestuffs are introduced into the pan in quantities depending upon the kind of sugar in view. Sugar from the centrifugals is of a superior whiteness, with a slightly blue hue very pleasing to the eye. In the refineries it is found that 45 grms. of Indanthrene make an excellent substitute for 75 grms. of ultramarine blue.

Molasses; Determination of sucrose in — A. C. Andersen. Compt. rend. Trav. lab. de Carlsberg, 1909, 7, 243—246.

THE author finds that mercuric nitrate is an excellent defecating agent for coloured sugar solutions. The reagent is prepared as follows:—220 grms. of red mercuric oxide are added carefully, and with thorough shaking, to 160 c.c. of nitric acid (sp. gr. 1.39); the whole is then shaken for some minutes, treated with 160 c.c. of water, and slowly heated to boiling. When solution is complete, the whole is cooled to the ordinary temperature, treated with 60 c.c. of 5 per cent. solution of sodium hydroxide in order to neutralise the bulk of the excess of nitric acid, made up to 1 litre, filtered, and preserved in a dark glass bottle. The author has determined the sucrose-content (by direct polarisation) of a sample of molasses, using solutions of various concentrations clarified with various quantities of the mercury solution. The procedure consisted in adding the mercury solution to 25 c.c. of the molasses solution, immediately neutralising with sodium hydroxide solution (the solution being kept cooled during neutralisation), making up to volume (100 c.c. plus 0.2 c.c. for each 10 c.c. of mercury solution), mixing, filtering, and polarising the filtrate. It was found that with increasing quantities of the mercury solution, the polarisation reading increased at first, and then remained constant. Experiments with pure sugar showed that with the above-described procedure, accurate results are obtained. The removal of colouring matters and of leucostatory substances (proteins, etc.) present in the molasses, requires a certain quantity of mercuric nitrate, but an excess of this reagent does not affect the determination of the sucrose by polarisation.—L. E.

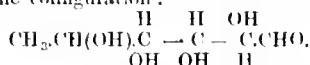
Honey; Artificial — A. Jägerschmid. Z. Unters. Nahr.-und Genussm., 1909, 17, 671—672.

ARTIFICIAL honey prepared from invert sugars show reactions due to the presence of furfural, methyl furfural, and hydroxymethylfurfural derived from the caramelisation of the sucrose during inversion. These furfural derivatives are volatile with steam and may be detected in the distillate by means of aniline acetate reagent. The distillate from genuine honey gives no red coloration with aniline acetate, but that from commercial invert syrup, even when mixed with 75 per cent. of genuine honey, gives a

marked coloration. The distillates from genuine honey possess a pleasant aroma which is absent from those of artificial honey. The coloration obtained on the addition of aniline acetate to the distillate from artificial honey sometimes requires a minute to develop; it frequently fades away in about 15 minutes, but re-appears more faintly on the addition of acetic acid. When examined spectroscopically, the red is seen to be more carmine in colour; there is next a yellow band and then a dark olive-green line; the blue disappears almost entirely and becomes bluish-black. If honeys containing invert sugar be extracted with acetone, and hydrochloric acid be added to the acetone extract, a red coloration is developed. In the spectroscope a broad black band follows the red, and the green and blue remain; on dilution with acetic acid, the broad black band becomes olive-green. The acetone extracts of pure honey, when treated with hydrochloric acid, do not change the spectrum except after long standing. The acetone used must be quite pure; when treated with hydrochloric acid it should develop only a slight yellow coloration.—J. F. B.

Fucose. B. Tollens and F. Rorive. Ber., 1909, 42, 2009—2012.

50 GRAMS of fucose were obtained from 6000 grms. of *Fucus* from Heligoland. Fucose does not form a crystalline hydrate; it exhibits mutarotation. When the solution is examined 10 minutes after preparation, the rotatory power is $[\alpha]_D = -124$, falling to $[\alpha]_D = -75.6^\circ$ in the course of $1\frac{1}{2}$ —2 hours; the calculated initial rotation is $[\alpha]_D = -150$. The constant rotation of the fucosehexonic acid prepared by the addition of hydrogen cyanide is $[\alpha]_D = +37.6$. The trihydroxyglutaric acid obtained by oxidation with nitric acid has $[\alpha]_D = +27.6^\circ$; two preparations of the potassium salt showed $[\alpha]_D = -8.2^\circ$ and -8.7 , whereas the corresponding acid from rhamnose has $[\alpha]_D = -24.9^\circ$ and its potassium salt $[\alpha]_D = +8.5$. The two acids are thus optical antipodes, and accordingly fucose has the configuration:



—E. F. A.

Starch granules; Microscopical study of changes occurring in — during germination of wheat. Effect of mineral acids, enzymes, and heat on granules of various starches. R. Whymper. Seventh Int. Congr. Appl. Chem., London, 1909.

SECTIONS of wheat grains cut longitudinally through the embryo or germ and transversely through the middle of the grain were studied microscopically over a period of growth of 14 days. When the grain had become thoroughly moist from standing on wet flannel for 36 hours, the larger starch granules nearest the germ began to show signs of surface pitting. After 3 days the grain had increased in size by about one-eighth, and the starch granules near the germ and in the centre of the flanks were considerably swollen, and in many cases pitted owing to enzyme action. Long oval starch granules, which showed no visible signs of attack, also began to make their appearance, and on the ninth day the majority of the starch granules were of the oval form. After this time the path of decomposition could be traced upwards and towards the centres of the flanks of the grain, the germ growing rapidly at the expense of the starch and protein matter, which, as they were removed, left a cavity up the outer side of the grain. The larger and more mature starch granules were the most readily assimilated as plant food; no markings could be observed on the smaller granules, even with the highest magnification, up to the sixth day.

There appears to be no general relation between the size of starch granules and the ease with which they are attacked by diastase, mineral acids, and wet and dry heat, although almost invariably the larger granules of any one starch succumb more quickly to attack than smaller granules of the same kind. The temperatures of gelatinisation of a large number of samples of barley, maize, rye, potato, rice, wheat, and tapioca starches were determined by exposing the starches to a gradually rising temperature and examining them microscopically. The

values obtained differed in some cases from those recorded previously, and also varied with the state of maturity of the starch granules.—A. S.

Starch; Determination of —. M. Buisson. Seventh Int. Congr. Appl. Chem., London, 1909.

BAUDRY'S method for the determination of starch (Bu Assoc. Chim., 1892, 9, 354), in which the starch is rendered soluble by heating with salicylic acid, presents certain disadvantages when applied to potatoes and flour. The author has obtained better results by using picric acid instead of salicylic acid. The normal weight (for 1) polarimeter employed) of the finely divided potato pulp is treated with 100 c.c. of water and 25 c.c. of an aqueous solution of picric acid saturated in the cold, and heated for 45 mins. at about 115°C . in a calcium chloride bath. 80 c.c. of cold water are then added, the whole cooled to 15°C ., made up to 200 c.c., and filtered through dry filter. The filtrate is then examined in the polarimeter in a 400 mm. tube. For commercial starches, 15 c.c. picric acid and 100 c.c. of water are used, and the duration of the boiling is 30 minutes; whilst for wheat flour 50 c.c. of picric acid are used, the other conditions being the same as for potato pulp. If the solution after filtering is opalescent, it is mixed with about 1 gm. of kieselsol and again filtered.—A. S.

Molecular and solution volumes of colloidal carbohydrates [starch and cellulose]. C. F. Cross and E. J. Beyer. Ber., 1909, 42, 2198—2204.

THE authors, in a preliminary note, draw attention to the application to such substances as starch and cellulose of the methods developed by Traube (Ber., 1895, 28, 41; Annalen, 1896, 290, 43), based on relations between the molecular and molecular solution volumes of compound and their molecular weights and constitutions. Tentative attempts in this direction have shown that the molecular and molecular solution volumes of starch and cellulose as calculated from available experimental data are much lower than the values calculated by Traube's method and it is suggested that this may possibly be due to the formation in the molecules of the substances mentioned.—A. S.

Sodium chloride as manure for sugar beets. Mett See XV.

PATENTS.

Beet juice; Defecation of crude — by the use of centrifugal separators. Aktiebolaget Separator. Fr. Pat. 397,383, Dec. 14, 1908.

THE crude juice, previously heated to about 85°C ., continuously mixed with the fluid saturation-mud separated in the centrifugals which clarify the juice after carbonatation and saturation. Together with this mud a small proportion of dry lime, amounting to 0.05—0.1 per cent., is added to the juice. In certain cases sodium carbonate may be used instead of lime. The juice clarified by decantation and the residual mud is separated in continuous centrifugal separators. The clear juice is then defecated with lime in the usual manner and saturated with carbon dioxide; the precipitate is separated in centrifugal separators and the saturation-mud so obtained is used for defecating a further quantity of crude juice.—J. F. B.

Sugar cane; Preliminary treatment of — for extraction of the juice. C. Steffen. Fr. Pat. 397,672, Dec. 1, 1908.

In order to open up the cells of the sugar cane which contain the juice and to destroy the coherence of the fibres, the sugar cane is cut or chopped into pieces from 60 to 150 mm. in length. These pieces are then beaten to a fibrous mass in a centrifugal mill or disintegrating machine and the juice thus liberated is extracted either by pressure or diffusion.—J. F. B.

Masseuite; Process for the dilution, heating, and refining of — W. Schäfer. Ger. Pat. 209,565, Sept. 26, 1908.

STEAM at a suitable pressure is introduced into the space above the surface of the masseuite contained in closed covered heaters. The steam gives up its heat not only to the surface of the masseuite, whence it is transmitted through the whole mass owing to the action of the stirrer mounted in the heater, but also to the walls of the heater. The condensed water deposits in minute drops, so that there is a gradual continuous dilution of the adherent juice without any solution of the crystals, and also there is no introduction of non-sugar materials.—A. S.

Sugar juice and other solutions; Apparatus for the evaporation of — W. Greiner. Ger. Pat. 210,337, April 29, 1908.

THE patent relates to a process in which the sugar juice passes in succession through a number of connected evaporators. The first evaporator is heated by exhaust steam, and the vapour generated therein is passed not to the next, but to a more distant evaporator and thence in succession through the following ones, whilst the second evaporator is heated by fresh steam, and the vapour generated therein passed to the following evaporators in the usual manner. It is stated that in this way a better utilisation of the steam heat is attained.—A. S.

Boiling of sugar juices and syrups; Apparatus for controlling the — F. Langen. Ger. Pat. 210,543, Oct. 22, 1908.

IN the boiling of sugar juices and syrups it is important that the water-content be kept at a definite figure during definite periods of the process. The water-content is not easily determined by measuring the difference between the b. pt. of the juice and the b. pt. of water at the same pressure. The apparatus described in the patent is claimed to possess advantages over the so-called "osmoscope" usually employed for this purpose. It consists of two or more thermo-elements, with one junction in the boiling juice or syrup and the other in saturated steam at the pressure under which the liquid is boiling, are combined with a galvanometer, which indicates the difference in temperature, or, by means of a suitable scale, the corresponding water-content of the boiling liquid. In order to avoid possible overheating of the junction of the thermo-element exposed to the steam, it is disposed in a closed chamber connected to the vapour-space of the juice-boiler, and steam is continuously led into this chamber, means being provided whereby before the steam enters the chamber, so much heat is withdrawn from it, that its total heat is the same as that of saturated steam at the pressure prevailing in the vapour-space of the juice-boiler.—A. S.

Using non-pulverulent materials [bagasse, etc.]. F. Tieann, Berlin. Eng. Pat. 25,643, Nov. 27, 1908. Under Int. Conv., March 4, 1908.

See Fr. Pat. 395,863 of 1908; this J., 1909, 486.—T. F. B.

VII.—BREWING, WINES, SPIRITS, &c.

Dead cells of yeast; Criticism of staining methods for determining the — E. Schlichting and H. Winther. Tenth Int. Congr. Appl. Chem., London, 1909.

ACCORDING to the authors the methods most generally followed in commercial laboratories for the determination of dead cells in samples of yeast are not sufficiently accurate for technical purposes. Definite conditions should be strictly adhered to, different concentrations of "stain" being liable to lead to erroneous results. The staining medium found most satisfactory was a solution of "sulpho-indigotate" at a dilution of 1:30, whilst the most appropriate dilution for the yeast was about 40 cells per cb. mm.—A. S.

PATENTS.

Malt for brewing; Mashing — B. W. Valentin, Llandely, Wales. Eng. Pat. 6087, Mar. 13, 1909.

IN the case of malts which in the ordinary way of mashing yield worts deficient in yeast foods, the proportion of the latter may be increased by mashing a fraction of the grist (10–15 per cent.) separately at a temperature which is below that which is unfavourable to the extraction of yeast foods. The most suitable temperature for this mash is 120° F., the goods being "stood" at this temperature for one or more hours, and then discharged through a mashing machine, together with the main bulk of the grist, to make up a mash at an initial temperature of 150°–155° F.—J. F. B.

Brewing; Art of — M. Henius, Chicago. U.S. Pat. 925,700, June 22, 1909.

MALT and a cereal product, such as prepared corn (maize), rice, or the like, are mashed separately, and a portion of the malt wort is then introduced into the cereal mash in order to partially invert the starch in the latter. The mixture is next boiled, and a further quantity of malt wort is added in order to complete the inversion. Finally, the whole mixture is boiled.—W. P. S.

Spirits; Process and apparatus for distillation and treatment of — J. E. Carroll. First Addition, dated Dec. 9, 1908, to Fr. Pat. 376,151, March 26, 1907 (this J., 1907, 985). Under Int. Conv., Aug. 12, 1908.

THE apparatus as now modified comprises a superheating arrangement, having its branch pipes connected with the pipe leading from the still to the condenser at points above the central axis of the latter pipe, so that none of the condensed liquid can pass into the superheater. The steam-jacketed apparatus composing the superheater is composed of several members, each containing a large number of small tubes surrounded by a closed steam jacket, the connection between the adjacent series of these tubes being effected by a union head at each extremity, so that the direct passage of the vapour from one end of the superheater to the other is impeded. The air which is delivered to the superheater undergoes a preliminary heating by means of a steam-jacketed coil before being injected into the vapour pipes of the superheater.—J. F. B.

Lactic acid bacteria; Process for the preparation of pure or mixed cultures of — in a dry condition. Löföf and Mayer. Ger. Pat. 210,988, Oct. 30, 1907.

THE product obtained by growing lactic acid bacteria (pure or mixed cultures) in skimmed milk is filtered or centrifuged, and the mixture of casein and bacteria thus obtained is washed with sterilised water to remove the milk serum, then compressed, and mixed with lactose, proteins, or other suitable substances so as to yield a dry powder.—A. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A).—FOODS.

Cutin of woody fibre [of cereals]; Nature of the — W. Sutthoff. Z. Unters. Nahr. und Genussm., 1909, 17, 662–663.

THE residue from the treatment of the woody fibre of cereals by hydrogen peroxide in ammoniacal solution, according to König's indications (this J., 1906, 1069), consists of cellulose and cutin. The latter may be separated from the cellulose by treatment with cuprammonium solution, in which it is insoluble. In this way the cutin of rye-bran was isolated, containing 15–34 per cent. of ash, consisting of almost pure silica. Combustions of this impure product, corrected for the ash, indicated 69–70 per cent. of carbon and 11–12 per cent. of hydrogen for the cutin. On boiling for 3 hours with a 20 per cent. solution of potassium hydroxide, the cutin is decomposed.

From the solution the author has extracted by means of light petroleum spirit, a small quantity of a greyish-white crystalline wax-alcohol, melting at 55°–56° C., and having a composition approximating to that of cetyl alcohol or octadecyl alcohol. On acidifying the residual liquid a flocculent precipitate was obtained, soluble in light petroleum spirit, and solidifying on freezing to a mass melting indefinitely at about 30° C., and corresponding in composition to nonyl or capric acid. This product, however, is doubtless a mixture of acids.—J. E. B.

Wheat; Influence of environment on the composition of —.
J. A. Le Clerc and S. Leavitt. Seventh Int. Congr. Appl. Chem., London, 1909.

Two samples of wheat, a spring variety and an autumn variety, were grown at three localities in the United States, differing widely in climatic conditions. The former, a durum wheat (Kubanka), was grown in S. Dakota, Kansas, and California; and the latter, a common wheat (Crimean), was grown in Texas, Kansas, and California. At each place three plots were employed for each of the two kinds; on one plot the home-grown seed was sown, and on the others, seed from the other two localities. It was found that all three plots in one locality gave seed identical in composition and in appearance, whilst the same seed grown at three different places varied to a very great extent. For example the Crimean wheat grown in Kansas, in California, and in Texas during 1907, gave the following results:—

	Kansas.	California.	Texas.
Protein, per cent.	22.3	11.0	17.6
Weight per 1000 corns ..	21.0	33.4	23.0
Weight per bushel	51.0	61.7	58.0

On the other hand, when seeds varying in chemical and physical characters, as shown by the results in the table, were grown side by side in Kansas, the three plots gave crops identical in composition and in appearance. They also yielded in Texas crops which were identical from the three plots, but which were quite different from those obtained in Kansas. The results show that climatic conditions have a much greater influence than the seed and soil on the character of the crop. If it be desired to improve a certain crop, the best method is by selection or otherwise in the locality in which it is to be grown, rather than by growing seed which has been bred in another locality. (See also this J., 1909, 336.)—A. S.

Flour; Changes suffered by — on keeping. F. Marion.
Seventh Int. Congr. Appl. Chem., London, 1909.

FIVE "Corbeil" flours of good quality, manufactured during March to May, were kept at the ordinary temperature for 2 years in small sacks; and each month, determinations of moisture, gluten, gliadin, fatty matter, and acidity were made, the results being referred to the dry substance of the flour. The amount of fatty matter diminished on keeping, and in some cases the flours acquired a rancid flavour. From the results for dry gluten, gliadin, and acidity, curves were plotted. The content of gluten was nearly constant during the first 5 months and showed only slight variations up to the nineteenth month, after which, however, it was found very difficult to wash the dough in a stream of water, and the decomposition of the gluten was very marked. The gliadin curve showed a maximum at 3 months, a minimum at 7 months, a second maximum at 15 months, and another minimum at 18 months. These results are in agreement with the practical observation that flour which has been kept for 3 months still retains its bread-making qualities, but is no longer suitable for the bakery after keeping for 6–7 months. The acidity increased during the first year, and then fell slowly and regularly, probably owing to ammonia, etc., being produced by the decomposition of the gluten.—A. S.

Wheat and flour; Mineral composition of —. L. J. Vuadart. Seventh Int. Congr. Appl. Chem., London, 1909.

The author determined the nitrogen, phosphoric acid and potash in different specimens of wheat, the result being shown in the following table. The first three samples were commercial seed wheats. The nine following were grown as spring wheats on the same field, Nos. 1 being supplied only with nitrogenous manure, Nos. I. with nitrogen and phosphoric acid, and Nos. III. with nitrogen, phosphoric acid, and potash. The heavy and light varieties of "Bon fermier" wheat were obtained by selection by means of sugar syrup. The last two specimens were Upper Egyptian wheats consisting of white wheat with elongated corns mixed with a little hard wheat.

Description of samples.	Nitrogen.	Phosphoric acid.	Potash.	Phosphoric acid per 100 of nitrogen.	Potash per 100 of nitrogen.
Square head	1.76	0.980	—	55.6	—
Japhet	1.63	0.903	—	59	—
Bon fermier	1.60	0.937	—	58.5	—
Saumur I.	1.82	0.919	0.487	50.4	26.7
" II.	1.80	0.988	0.527	54.8	29.2
" III.	1.77	0.975	0.566	55.1	31.9
Japhet I.	1.58	0.787	0.544	49.8	34.4
" II.	1.64	0.836	0.558	50.9	34
" III.	1.59	0.843	0.555	53	34.9
Bordeaux I.	1.52	0.855	0.538	56.2	35.3
" II.	1.54	0.845	0.578	54.8	37.5
" III.	1.58	0.868	0.557	54.9	35.2
Bon fermier, heavy	1.64	0.912	—	55.4	—
" light	1.48	0.889	—	59.8	—
Egyptian I.	1.44	0.759	0.531	52.7	36.6
" II.	1.44	0.772	0.530	53.6	36.6

It will be seen that the ratio of phosphoric acid to nitrogen, and, in a lesser degree, that of potash to nitrogen, is fairly constant. Analogous results were obtained with the flours prepared from the wheats (yield of flour, 70 p. cent.), as shown in the following table. In both cases (wheats and flours) the results are calculated with respect to material containing 15 per cent. of moisture.

Description of samples.	Nitrogen.	Phosphoric acid.	Potash.	Phosphoric acid per 100 of nitrogen.	Potash per 100 of nitrogen.
Square head	1.56	0.283	—	18.1	—
Japhet	1.49	0.213	—	14.3	—
Bon fermier	1.47	0.224	—	15.2	—
Saumur I.	1.61	0.229	0.168	14.2	10.4
" II.	1.56	0.230	0.209	14.7	13.3
" III.	1.56	0.251	0.198	16	12.6
Japhet I.	1.39	0.197	0.178	14.1	12.8
" II.	1.44	0.209	0.179	14.5	12.4
" III.	1.40	0.219	0.179	15.6	12.7
Bordeaux I.	1.40	0.219	0.199	15.6	14.2
" II.	1.41	0.240	0.197	17	13.9
" III.	1.38	0.209	0.198	15.1	14.3

The author also investigated the distribution of phosphoric acid in the flour (Saumur I. of the above table). It was found that of the total phosphoric acid, 66 per cent. was contained in the starch, 13.8 per cent. in the purified gluten, 2.4 per cent. in the ether-alcohol extract of the gluten, and 17.8 per cent. in the wash-waters.—A. S.

Wheat; Laboratory experiments on the determination of the milling and bread-making qualities of —.
Holdeffless and R. Wessling. Seventh Int. Congr. Appl. Chem., London, 1909.

TWO authors have made a series of experiments with the object of devising exact laboratory methods for ascertaining the milling and bread-making qualities of wheat. The results obtained were briefly as follows:—(1). With an experimental (Seck) mill it was found possible with 10 lb., or even with 5 or 4 lb. of wheat, to obtain a normal grinding, the results as to yield of flour being comparable with those obtained on the large scale. (2). With the mill, the variation of the grinding conditions according to the nature of the wheat could be studied, and also the effect of moistening the grain. (3). In baking tests

experimental oven, normal loaves were obtained both with 50 grms. and with 400 grms. of flour. (4). The quality of the bread could be judged most satisfactorily when the loaves were baked not, as usual, in moulds or shaped supports, but on large firebrick slabs. (5). The best material for raising the dough was found to be pressed yeast. In order that comparisons could be more easily made, a large proportion of yeast (2 grms. to 50 grms. of flour) was used; this had no injurious effect on the taste or quality of the bread. (6). Distinctions between different kinds of wheat could be more readily observed in milk loaves than in ordinary loaves; in the preparation the former, some sugar is added and hence the activity of the yeast is increased. (7). The loaves were compared with respect to volume (best determined by Reisch's method), appearance, shape, colour, and condition of the interior (crumb). The results obtained with a number of different wheats by the laboratory methods described are given in the following table:—

	Protein content of wheat dry substance, per cent.	Mealy corns, per cent.	Steady corns, per cent.	Weight of 100 corns in grms.	Yield of flour, per cent.		Bran, per cent.	Protein content of flour per cent.		Volume of loaves per 100 grms. of flour, in c.c.				Water-absorbing power of 10 grms. of flour.	
					White.	Dark.		White.	Dark.	Ordinary loaves.		Milk loaves.		Dark.	White.
										Dark flour.	White flour.	Dark flour.	White flour.		
Russian (moistened).....	17.93	14	54	2.37	442.5	21.0	76.8	13.37	16.44	403	498	438	524	65	62
" (not moistened).....	—	—	—	—	119.0	56.0	1.8	15.36	16.26	387	507	436	520	65	62
gentine (moistened).....	14.38	16	38	2.36	426.5	32.7	38.7	9.58	11.02	332	379	352	416	62	60
" (not moistened).....	—	—	—	—	113.5	52.3	31.5	11.29	12.11	397	481	471	488	62	60
alla Walla (not moistened)	12.06	48	16	3.01	400	20.0	36.8	9.22	10.48	401	495	466	489	56	55
tmärker (not moistened)...	10.24	34	8	4.88	404	32.8	22.2	8.13	8.67	370	456	449	495	63	62
ordeaux (not moistened)...	11.36	44	14	5.32	374	32.0	22.8	9.58	9.94	387	473	427	478	62	62
quare head (not moistened)...	12.25	36	22	4.44	485	24.0	24.2	9.03	9.77	385	479	421	478	62	60
vett's (bearded) (not moistened).....	9.76	80	6	4.90	36.0	34.5	25.7	7.05	8.13	330	369	370	389	60	60
vett's (bearded), later grinding	—	—	—	—	—	—	—	—	—	372	402	403	429	—	—
ample of baker's flour.....	—	—	—	—	—	—	—	—	—	463	469	472	467	55	55

NOTE.—With mixtures of flours the size of the loaf was the arithmetical mean of the sizes obtained with the component flours separately. For improving the appearance and taste of the bread, it was found most advantageous to use blends of more than two kinds of flour.

—A. S.

flour; Analysis of — with respect to its bread-making value. T. Kosutány. Seventh Int. Congr. Appl. Chem., London, 1909.

THE weight of the loaf which can be prepared from a given quantity of flour depends in the first place upon the quantity of water the flour is capable of absorbing in the preparation of the dough; this again depends upon the water content of the flour, which may vary from 9 to 16 per cent., so that the water-absorbing powers of two flours of exactly similar composition may show differences of as much as 7 per cent. Hence in buying flour the water-content should not be regarded. Besides moisture, the content of starch and of gluten must be taken into consideration. Starch is only capable of taking up 50–60 per cent. of water, and hence cannot be wholly responsible for the water-absorbing power of the flour, which is capable of absorbing up to 90 per cent. and still yield a dough of proper consistency. The controlling factor with respect to water absorption is the gluten, which can take up 300–350 per cent. of water. The character of the gluten is of importance in this respect, gliadin having a greater water-absorbing power than glutenin. If the flour be deficient in sugar or in enzymes capable of producing sugar during kneading, salt preparations or sugar should be added, in order that sufficient carbon dioxide be produced during the fermentation to produce loaves of the requisite size. The retention of the carbon dioxide is dependent upon the character of the gluten, the gliadin being the important constituent in this respect also. In order that the gas bubbles be small and of uniform size, it is essential that the yeast be evenly distributed throughout the dough and that yeast cells of approximately the same age and belonging to the same race be employed. From the above

considerations it will be seen that the quantity and character of the gluten are the most important factors governing the quality of a flour. The gluten is determined most readily by washing the dough. The gliadin is best determined by evaporating an extract of the flour prepared with 70 per cent. alcohol. The water-absorbing power may be ascertained by placing on the dough a ball of 3.5 cm. diam. loaded with shot so that it weighs 100 grms. In dough of the proper consistency this produces a depression of 30–32 mm. diam. in 12–15 secs. The consistency of the dough can be determined more accurately by means of the perforation apparatus of Rejtő.—A. S.

Mechanical kneaders [bread-making]; General results furnished by —. Arpin, Ringelmann, and Lindet. Seventh Int. Congr. Appl. Chem., London, 1909.

TESTS carried out with a number of mechanical kneading machines recently in Paris led to the following results. The different machines did not furnish doughs of the same

quality, but during the fermentation the gluten became hydrated, and the finished loaves were almost identical with respect to quality and yield. The loaves were of the same quality and size as those made by hand with similar amounts of flour, water, salt, and yeast, and baked in the same oven. The power required in the kneading rapidly rose to a maximum and then remained constant up to the end of the operation. The total mechanical work varied within wide limits with different machines, viz., during the 6–13 minutes occupied in the kneading and after deducting that performed by the machine *in vacuo*, "from 16–664 to 175–983 kilogram-metres" for 172 kilos. of dough, the maximum power varying from 0.41 to 5 h.p. per second. A workman kneading by hand furnished during the 30–35 mins. of the operation a force of 9.5–11.9 kilogram-metres per second.—A. S.

Parity fermentation; Researches on —. A. J. J. Vandevelde. Bull. Soc. Chim. Belg., 1909, 23, 267–283.

BESIDES the gluten, insoluble in water, cereal flours contain soluble proteins which are removed in the course of kneading, when this operation is adopted for the isolation of the insoluble proteins. This is why the proteins recovered by kneading do not correspond with the quantity calculated from the nitrogen of the flour. When the gliadin has previously been extracted by alcohol, the gluten cannot be separated in the usual manner. Gliadin, isolated and mixed with starch, will not form a dough, but when isolated gliadin is mixed with whole flour, it may be recovered quantitatively by kneading, together with the gluten of the flour. The author has made experiments in order to ascertain whether the gluten plays a definite part in parity fermentation, or whether

its action is merely the mechanical occlusion of the gases. For the determination of the results of panary fermentation, the author has modified Boutroux's method for measuring the rising of the dough. He employs cylindrical glass tubes of 2.7 cm. internal diameter and 25 cm. in length. Forty grms. of dough containing yeast are introduced into the tube, and the end at which it has been charged is closed with a cork. The dough is pressed down by means of a wooden piston from the other end, in order to expel all the air and make a solid mass against the cork. The tubes are then placed in a vertical position at a temperature of 20° C., and the increase in height of the dough is noted after 4 hours and after 24 hours. Further observations on panification have been made by determining the density of the loaves, by measuring their volume by the displacement of fine sand in which they are immersed in a suitable vessel. The fermentation experiments showed that the fermentative energy (expansion of the dough in a given time) is inversely proportional to the gluten-content of the flour. On the other hand the panification tests showed that the density of the loaves decreased as the proportion of gluten in the flour increased. Hence it is concluded that the action of the gluten is essentially mechanical. The elastic properties of the gluten cause the compression and retention of the gases in the dough during fermentation and permit of their expansion during baking, thereby increasing the volume of the loaves. When flour is heated, either dry or in presence of moisture, the elastic properties of the gluten are destroyed. After heating for 10 hours at 100° C., 6 hours at 120° C., 2 hours at 150° C. or 30 minutes at 175° C., the gluten of the flour is no longer elastic, and the proteins cannot be separated from the starch by the operation of kneading. The same action takes place still more rapidly if the flour is heated in a moist atmosphere, 30 minutes at 100° C. being sufficient to make it impossible to separate the gluten by kneading; a larger quantity of water is required to make a dough than with normal flour, and the dough disintegrates entirely when kneaded. It was thus possible, by various conditions of heating, to make a flour which contained any proportion of elastic gluten which might be desired. Fermentation experiments, made with a flour thus modified in different degrees, showed that the rising of the dough was greater, the lower the degree of modification produced. Moreover, panification tests confirmed this, and the modification of the gluten by heat gave loaves of correspondingly greater density. In order to ascertain whether the gluten undergoes any chemical change in the course of panary fermentation, the author prepared dough containing yeast and determined by the kneading process the yield of elastic gluten recoverable after 24 hours: the quantity recovered was only slightly lower than that yielded by the original flour. Thus gluten is the essential factor of the absorption of water in doughing and a mechanical agent, which although playing no appreciable part in the fermentation, is really the agent of panification, without which the production of loaves would be impossible.—J. F. B.

Artificial honey. Jägerschmid. See XVI.

Microscopical study of changes occurring in starch granules. Whympers. See XVI.

PATENTS.

Drying milk and the like; Process for — and apparatus therefor. J. M. Gabler-Saliter, Obergünzburg, Germany. Eng. Pat. 12,672, June 12, 1908.

SEE FR. Pat. 385,166 of 1907; this J., 1908, 587. After the preliminary heating under reduced pressure, the milk is cooled to 10° or 5° C. before being desiccated.—T. F. B.

Substances, organic and inorganic [foods, etc.]; Process of sterilising, disinfecting, decolorising, and oxidising —. C. M. de Kunwald. Fr. Pat. 397,603, Dec. 18, 1908. Under Int. Conv., Nov. 11, 1908.

The substance or liquid, such as solid foods, milk, cream, serums, etc., is immersed in, or mixed with, a solution of hydrogen peroxide which has been slightly acidified.

The substance or liquid thus treated is then submitted to the action of actinic rays produced by a mercury lamp burning magnesium, or other source of light.—W. P. S.

Albuminoids; Process of treating —. E. C. Ekström Boston, and M. Ekström, Quincy, Mass. U.S. Pat. 926,056, June 22, 1909.

SEE Eng. Pat. 28,619 of 1907; this J., 1908, 1159.—T. F.

Apparatus for manufacture of soap and similar articles [butter, etc.]. Eng. Pat. 14,623. See XII.

(B).—SANITATION; WATER PURIFICATION.

Cholera vibrio; Vitality of the — in artificially infected samples of raw Thames, Lee and New River water with special reference to the question of storage. A. Houston. Metr. Water Board. Fourth Report of Research Work, 1909.

It was found that cholera vibrios died very rapidly in raw river water after artificial infection, as the result of storage in the laboratory. At least 99.9 per cent perished in 1 week and all of them within 3 weeks. The isolation of the cholera vibrios in the raw river water after artificial infection, presented no difficulty even when the numbers added were very small; while microbially to be mistaken for true cholera vibrios were not found in any duplicate, but non-infected, samples of the same waters. The advantages of storing river water from the point of view of typhoid fever have been previously shown (see this J., 1908, 873), and the same conclusions apply to cholera; the time, also, required to ensure safety in the former case being more than sufficient in the latter. These conclusions emphasise the point that by adequately storing the raw river water prior to filtration, the safety of the metropolis as regards epidemic of water-borne disease is substantially assured.—J. H. J.

Oxides of nitrogen and their compounds with metals (iron and lead); Formation of — in the production of ozone for sterilising water. E. Bonjean. Compt. rend. 1909, 148, 1765—1766.

APPRECIABLE quantities of oxides of nitrogen are formed during the process of ozonising air for the sterilisation of water, and these, attacking any metals with which they may come in contact, such as iron or lead pipes, cause their rapid corrosion, leading even to the complete obstruction of the plant and serious contamination of the water to be treated. All metals, and particularly lead, should therefore be proscribed in the construction of parts of the apparatus which may be exposed to the ozonised air.—F. SOMM.

PATENTS.

Nightsoil; Apparatus for reducing — and recovering ammonia therefrom. K. E. Fryklind, Stockholm Sweden. U.S. Pat. 918,741, April 20, 1909.

THE apparatus is continuous and uniform in working and produces a dry nightsoil lime practically free from smell, and containing any desired percentage of lime. A large amount of ammonia is, at the same time, recovered. The nightsoil is subjected to a preliminary agitation by means (1), of a rotating stirrer, and (2), of a grating swinging up and down. It then passes to a closed holder which is always filled at a constant pressure. This closed holder is connected to a cylindrical vessel, which is, at the front end, provided with a feeding apparatus for quicklime, and has a rotating stirrer which mixes the nightsoil and lime and feeds the mixture towards the back end of the cylinder. The lime is slaked during its passage through the cylinder, and the larger part of the nitrogen present is driven off as ammonia and recovered by absorbing in sulphuric acid.—G. W. McD.

Garbage and rendering apparatus; also, process of extracting grease and oil from garbage. C. S. Wheelwright, Bristol, R.I. U.S. Pats. 925,970 and 925,971, June 22, 1909.

THE apparatus consists of a digester connected at its lower end with a chamber adapted to the further treat-

ent of material after it has been cooked in the digester. The ram, actuated from the outside, is provided in the digester for the purpose of forcing the material through the passage-way between the digester and the receiving chamber; the movement of the ram opens and shuts a live in the passage-way. The garbage is saturated with hot water, drained, and forced into the digester where it is heated with steam under pressure; water is added during the heating process, and the cooked material, together with the water and oil are then withdrawn from the vessel, the oil being separated subsequently from the water. These operations are carried out in a continuous manner. The water separated from the cooked material and oil is used for saturating and cooking a fresh supply of garbage.—W. P. S.

Wage treatment apparatus. K. Imhoff, Bresdeny, Germany. U.S. Pat. 924,664, June 15, 1909.

Eng. Pat. 10,984 of 1907; this J., 1907, 1291.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Paper pulp; Measuring absorption of dyestuffs by —. H. Wrede. Papier-fabrikant, 1909, 7 (Fest-und Auslandsheft), 43—46.

In the dyeing of paper pulp it is generally desirable to take the dyestuff by precipitation, in which case a colourless "backwater" is obtained, and the only loss of colouring matter is that which arises from the passage of particles of the precipitate through the felted mass of fibres on the wire. The economy of this method of operation depends very largely on the degree of mechanical separation of the pulp; a finely milled pulp "carries" the coloured precipitate more readily than a "free", beaten pulp. In certain cases, particularly with unsized papers, the dyestuff cannot be precipitated and the paper-maker has then to rely on specific affinity or absorption of dyestuff by the fibre. This specific affinity varies according to the chemical nature of the dyestuff and the chemical character of the fibre. Pulps which are only lightly boiled and bleached retain residual traces of incrusting matters which have a special affinity for basic dyestuffs, whilst fully purified cellulose pulps show a particularly strong affinity for substantive dyestuffs. A determination of this specific affinity between fibres and dyestuffs is therefore a valuable means for investigating the nature of either of the reacting substances. The author describes an empirical method for measuring this property:—25 grms. of dry pulp are moistened with water and beaten up to a uniform mass with a wooden stick. The fluid pulp is transferred to a litre measuring flask, 200 c.c. of a 1 per cent. solution of the dyestuff are added and the volume is made up to 1 litre. After standing for one hour, with occasional agitation, the coloured liquid is filtered off on a wire sieve and the pulp is pressed and dried for future reference. An aliquot portion of the clear filtrate is placed in a 1 litre cylinder, and its colour is matched exactly by adding a 1 per cent. solution of dyestuff from a burette to a litre of water in another cylinder. Thus the weight of dyestuff absorbed by the fibre may be calculated. As a type of basic dyestuffs, "methylene blue" may be used, and as a type of substantive dyestuffs, "dianil blue." The quantity of dyestuff absorbed increases with the time up to 5 hours; it increases with the temperature up to a certain point, but decreases again at high temperatures; it also increases with the concentration of the solution.—J. F. B.

"Kraft" (Strong) papers; German —. A. Klein. Papier-fabrikant, 1909, 7 (Fest-und Auslandsheft), 24—25.

The very strong, thin wrapping papers first made in Sweden under the name of "Kraft" papers, are now also largely manufactured in Germany. These papers are prepared from spruce or pine woods by the alkaline process of digestion. Generally speaking, young trees, felled in the winter give the strongest papers, but in selecting the wood, account must be taken of local conditions. Spruce wood, especially that grown at high altitudes, gives a more pliable, softer fibre than pine wood,

but many of the German "Kraft" papers are prepared from the latter. The digestion may be effected either with direct or indirect steam, generally in large vertical digesters. The digestion lye varies in density from 8° to 15° B. The weaker lye gives a higher yield, but requires a longer digestion than the more concentrated. The composition of the lye varies according to whether the whole of the alkali lost is replaced by sodium sulphate or whether a mixture of sulphate and carbonate is used. In the former case, the lye contains 20—25 per cent. of its alkali in the form of sulphide, the rest consisting of caustic soda and other sulphur compounds. In the mixed process, the alkali contains only 6—10 per cent. of sulphide and more caustic soda; frequently also the proportion of sulphite is higher. An important feature of the manufacture of kraft papers is the use, together with the fresh "white" lye, of 50—75 per cent. of a once used "brown" lye, which imparts the rich brown colour characteristic of these papers. The temperature of the digestion depends on the time allowed, the pressure employed ranging from 7 to 10 atmospheres and the time from 1 to 3 hours. The best results are obtained with pressures of 6—8 atmospheres, weak lyes and a digestion period of 1½ hours. In reducing the boiled mass to pulp the kollergang plays a very important part, since it is necessary that the fibres should be well milled without reducing their length. The mechanical preparation and the working on the paper machine require careful attention in order to develop the maximum strength, toughness and elasticity. The economy of the manufacture depends very closely on the efficiency of the means adopted for the recovery of the soda used for the digestion, the proportion recovered in a well appointed mill being 85—90 per cent.—J. F. B.

Molecular and solution volumes of colloidal carbohydrates [starch and cellulose]. Cross and Bevan. See XVI.

German paper industry in 1908. Board of Trade J., July 8, 1909. [T.R.]

WHEREAS in 1907 orders were plentiful and the paper factories in Germany were well occupied, although prices were low, in 1908 the customary exportation to the United States did not take place, and other countries were not such large buyers as formerly. On the other hand, American competition was less acute. In consequence of the high duties imposed by certain other States the exportation of paper to them from Germany is now only possible at a sacrifice. During the past year the German paper makers reduced their prices, while the consumers refrained as far as possible from buying. The position of the makers was rendered still more difficult by the fact that the cellulose factories have taken more than ever to manufacture papers of all kinds. With the exception of the cartell of the manufacturers of printing paper, and of a few local groups, there is free competition. Consequently the cheaper sorts of paper intended for the home and foreign markets are only manufactured in large quantities by the large factories provided with the latest machinery, while the smaller factories either confine their activity to limited areas, or produce specialities for which they have exceptional facilities. The cost of wood pulp and cellulose fell only slightly during 1908, and the price of coal did not fall until after the end of the year. Business in rags was more favourable, for American buyers were less active than in former years, but this class of raw material will probably become dearer again so soon as the paper industry in the United States regains its normal activity. The price of kaolin is maintained by a syndicate, which endeavours to make the terms of delivery more and more unfavourable to the buyer. It is estimated that the average profits of the German paper manufacturing companies during 1908 amounted to 3·87 per cent.

PATENTS.

Old papers; Process for converting — into pulp for re-manufacture. L. Heitz. Fr. Pat. 397,576, Nov. 19, 1908.

Old printed papers are introduced together with a bleaching solution into a vertical cylinder provided with a

knading mechanism. The papers are then reduced to a pulp and bleached simultaneously. The bleaching liquor is allowed to drain away through a wire sieve at the bottom and is replaced by a stream of water at the top, the stirring mechanism being kept in motion until the pulp is sufficiently washed. The latter is then either used directly for the manufacture of paper or is pressed as half-stuff.—J. F. B.

"Soluble cellulose": *Process for preparation of* —. P. Marino, London. Eng. Pat. 7430, Apr. 3, 1908.

ORDINARY pyroxylin is introduced into a mixture of alcoholic solutions containing about 10 per cent. (of the weight of the pyroxylin) of each of the following substances: manganese chloride, ferric sulphate, and sodium ethyl sulphate. The solution is diluted with ether or other solvent of pyroxylin, and the pyroxylin is dissolved. A saturated solution of freshly precipitated ammonium magnesium phosphate is separately prepared in a quantity of sulphuric, phosphoric, or other mineral acid equivalent to about 10 per cent. of that of the solvent used with the pyroxylin. The two solutions are mixed and heated at 25° C. for 12 hours. The "soluble cellulose," which separates on cooling, is drained, washed and dried. The mother liquors are collected separately, and after dilution with spirit and neutralisation of the mineral acid, they may be utilised for rendering wood or fabrics non-inflammable.—J. F. B.

Cellulose acetate; Manufacture of moulds and matrices from —. H. B. Manissadjian. Fr. Pat. 397,429, Dec. 15, 1908.

CELLULOSE acetate is converted into a plastic mass by means of a solvent, and the mass is incorporated with softening agents which, according to their proportions, modify the softening temperature of the product to any desired degree, according to whether it is intended to serve as a mould or a matrix. Mineral filling agents may also be added. The plastic mass is composed of 40 parts of cellulose acetate and 80—100 parts of a volatile solvent, such as ethyl acetate, chloroform, acetone or alcohol. The softening agents consist of 5—20 per cent. of castor oil, calculated on the weight of the solution, about an equal proportion of a sulphophenic derivative of a halogen and 10—15 parts of glycerol acetate.—J. F. B.

Plastic mass [from acetylcellulose]; Process for the preparation of a —. F. Bume. Ger. Pat. 210,519, Aug. 25, 1907.

ACETYLCELLULOSE is mixed with camphor or a camphor substitute, then with a solvent (chloroform, acetone, ethyl acetate) and next with a precipitant (water, benzene, alcohol, etc.) miscible with the solvent; or the solvent and precipitant may be added together. The semi-solid plastic mass thus obtained can be moulded in the cold or it may be rolled on to a suitable support. It is not adhesive, and rapidly hardens. A. S.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Alkaloid; New — from the bark of *Pseudocinchona Africana* (Rubiaceæ). E. Fournieu. Compt. rend., 1909, 148, 1770—1772. (See this J., 1909, 671.)

FROM the bark of *Pseudocinchona Africana*, a native of the Ivory Coast, the author has isolated an optically active crystalline alkaloid, $C_{21}H_{26}N_2O_3$, and another which is optically inactive and has not been crystallised, though its crystalline hydrochloride has been obtained pure. To prepare these, the powdered bark is extracted with very dilute cold sulphuric acid, and sodium carbonate is added to the extract; the precipitate, thus obtained, is dried and boiled with ethyl acetate, and the filtered solution is concentrated and precipitated with ether. The crystalline magma resulting being recrystallised several times from alcohol: the amorphous alkaloid is

contained in the ethereal mother liquor. The crystalline alkaloid separates from absolute alcohol in colourless anhydrous tablets which become coloured on exposure to light; it is alkaline to litmus and almost insoluble in water and ether, but soluble in boiling chloroform; its formula is identical with that of quabracine, which resembles in many respects, though, unlike this, it is levorotatory ($[\alpha]_D$ at 23° C. = -125°). It combines with one equivalent of acids to give well-defined salts which may be crystallised from alcohol; the hydrochloride, sulphate, tartrate, and methiodide are described. With strong sulphuric acid it gives a colourless solution becoming slightly brown, and a crystal of potassium bichromate leaves a deep blue streak in this solution. —F. SODS.

pseudo-Morphine. G. Bertrand and V. I. Moyer. Comp. rend., 1909, 148, 1681—1683.

EBULLIOSCOPIC or cryoscopic methods cannot be used to determine the molecular weight of ψ -morphine because the base forms molecular aggregates in solution. The solution of the hydrochloride in water, however, contains two molecules of the acid to one of the base, and an examination of the acetyl derivative confirms the conclusion drawn from this observation, namely, that ψ -morphine has the formula, $C_{21}H_{26}O_6N_2$, and is therefore to be regarded as being formed from two molecules of morphine, each of which loses one atom of hydrogen. As the two morphine residues retain their phenolic hydroxyl group it is probable that they are linked together by two carbon atoms.—J. C. C.

Cotarnine; Synthesis of substances allied to —. A. H. Salway. Chem. Soc. Trans., 1909, 95, 1204—1220.

THE author prepared myristicin aldehyde, by converting myristicin into isomyristicin, and oxidising the latter with permanganate. When the aldehyde is treated with sodium and ethyl acetate, and the product hydrolysed, 3-methoxy-4:5-methylenedioxyinnamic acid is produced. This acid crystallises from acetic acid and melts with decomposition at 228° C. β -3-Methoxy-4:5-methylenedioxypropionic acid was obtained by reducing the innamic acid derivative in alkaline solution with sodium amalgam; it crystallises from benzene and alcohol in hard colourless nodules melting at 124°—125° C. Treatment with phosphoric oxide converts this acid into methoxymethylenedioxy- α -hydrindone, which melts at 141°—142° C. after crystallising from alcohol. Myristicinylideneaminoacetal was prepared by the condensation of aminoacetal and myristicin aldehyde; it is a colourless oil boiling at 234° C. at 15 mm., and 244° C. at 25 mm. When this substance is reduced with aluminium amalgam, two compounds are produced, a solid basic substance, $C_{20}H_{41}O_{16}N_2$, melting at 128° C. and a colourless oil, myristicinylaminoacetal, $C_{15}H_{23}O_8N$, boiling at 247° C. at 27 mm. When methoxymethylenedioxyinnamic acid is treated with nitric acid, the carboxyl grouping is replaced by a nitro grouping, with the result that ω -2(6)-dinitro-3-methoxy-4:5-methylenedioxystyrene is produced, which melts at 148° C. 2(6)-Nitro-3-methoxy-4:5-methylenedioxyinnamic acid was prepared from nitromyristicin aldehyde by the action of acetic anhydride and sodium acetate. The free acid decomposes at 266° C., and the methyl ester melts at 192° C. and can be reduced by stannous chloride to the corresponding amino derivative, which forms yellow needles melting at 153° C. When this base is warmed with dilute acid, hydrolysis and condensation occur, with the formation of 2-keto-8(5)-methoxy-6:7-methylenedioxy-1:2-dihydroquinoline, melting at 181°—182° C. The O-methyl ether of this dihydroquinoline melts at 113° C., whilst the N-methyl ether melts at 179° C. When the latter substance is reduced with sodium amalgam, two atoms of hydrogen are introduced and there is produced oxyisocotarnine, or 2-keto-8(5)-methoxy-6:7-methylenedioxy-1-methyl-1:2:3:4-tetrahydroquinoline, $C_{12}H_{13}O_4N$, which is a feebly basic substance melting at 113° C. —F. SODS.

hydrastine, hydrastinine, and narcotine; New reactions or ——. A. Labat. Bull. Soc. Chim., 1909, 5, 742—743.

HYDRASTINE (1:300), and hydrastinine (1:100) are dissolved in alcohol; narcotine (1:100) is dissolved in pure sulphuric acid (1:10). One-tenth of a c.c. of the alkaloid solution is added to 2 c.c. of pure sulphuric acid (sp. gr. 1.84), followed by the addition of 0.1 c.c. of a solution of certain phenolic substances. On warming the mixture on a water-bath, intense colorations develop. With a solution of gallic acid (1:20) there is a strong emerald green coloration, passing into a blue. If a solution of guaiacol or catechol (1:20) is used, a red tint is produced, which on warming deepens and changes to violet. If a solution of morphine (1:50) is used, there is a violet tint.—F. SHDN.

Opianic acid; New reactions for —, and their use for detecting hydrastine and narcotine. A. Labat. Bull. Soc. Chim., 1909, 5, 743—745.

A 10 per cent solution of opianic acid in alcohol is prepared, and 0.1 c.c. is added to 2 c.c. of sulphuric acid (sp. gr. 1.84) followed by the addition of 0.1 c.c. of a solution of a phenolic substance. With gallic acid there is a blue colour, which fades, on warming, to a dull brown. With guaiacol, there is a red colour, changing to intense blue on heating. α -Naphthol gives gooseberry-red colour, whilst β -naphthol produces a wine-red. With codeine in alcohol (1:20) there is a light colour, slowly changing to blue on warming. Diethylnaphthol in alcohol (1:40) produces a strong light colour fading when warmed. If hydrastine or narcotine is oxidised in acid solution with permanganate, opianic acid is produced. When alcohol is added, the opianic acid in the solution can be detected by the above tests.—F. SHDN.

Essential oils; Constituents of —. Carlina oxide and some attempts at its synthesis. F. W. Semmler and E. Ascher. Ber., 1909, 42, 2355—2360.

The authors have prepared several compounds showing it in all probability carlina-oxide (this J., 1906, 281) is a 1-phenyl-3- α -furyl-allene. Furalacetophenone (phenyl-1- α -furyl-propene-2-one-1) was prepared by the condensation of acetophenone and furfural in the presence of sodium ethoxide. It boils at 181°—182° C. at 9 mm., and has the sp. gr. 1.15 at 17°/4° C. When reduced with sodium and alcohol, 1-phenyl-3- α -furyl-propane is formed which boils at 135° C. at 10 mm., and has the sp. gr. 1.007 at 20°/4° C., and n_D^{20} = 1.530. It is identical with the tetrahydrocarlina-oxide produced by the reduction of carlina-oxide. During the reduction of furalacetophenone as described above, phenyl-1- α -furyl-propanol, $C_{13}H_{14}O_2$, is produced in considerable quantity. This boils at 168°—170° C. at 12 mm., and has the sp. gr. 1.10 at 20°/4° C., and n_D^{20} = 1.553. When heated with phosphorus pentachloride, it forms a chloride, $H_2CHCl.CH_2.CH_2.C_6H_5O$, which boils at 154° C. at 11 mm., and has the sp. gr. 1.13 at 18°/4° C., and n_D^{18} = 1.552. When boiled with a solution of potassium dioxides in ethyl alcohol, the chlorine atom is replaced by an ethoxyl grouping. The compound, $C_{12}H_{18}O_2$, thus produced, boils at 145°—147° C. at 11 mm., and has the sp. gr. 1.055 at 20°/4° C., and n_D^{20} = 1.545. Hydrogen chloride can be removed by heating the above chloride at 170°—180° C. with sodium acetate and acetic acid in a sealed tube. In this way, phenyl-1- α -furyl-3-propene-1, dihydrocarlina-oxide, $C_9H_8.CH:CH.CH_2.C_6H_5O$ is produced. This substance boils at 146.5°—147° C. at 11 mm., and has the sp. gr. 1.029 at 20°/4° C., and n_D^{20} = 1.552. Benzoylfuroylmethane, $C_{15}H_{12}.CO.CH_2.CO.C_6H_5O$, is prepared by a method similar to that employed by Claisen in the preparation of benzoylacetophenone. The diketone obtained by the authors melted at 69° C., and boiled at 194°—196° C. at 11 mm. The monoxime melts at 137° C., and the dioxime at 168° C. When heated with sodium amalgam in dilute acetic acid, a acetate, $C_{12}H_{14}.O_3(CH_3.CO)_2$, is produced, which melts at 149° C.—F. SHDN.

Antipyrine and cryogenin; Vanillin as a reagent for —. Its application for the detection of antipyrine in pyramidone. C. Primot. Bull. des Sc. Pharmacolog., 1909, 270. Pharm. J., 1909, 83, 9.

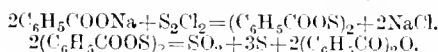
VANILLIN gives an extremely delicate reaction with antipyrine. The reagent is prepared thus:—Vanillin, 1 gm.; hydrochloric acid, diluted with an equal volume of water, 6 grms.; alcohol, 95 per cent., 100 grms. A very small crystal of antipyrine is placed in the bottom of a round-bottomed capsule, and about 2 c.c. of the reagent is poured on to it, and the whole evaporated on the water-bath. There is formed first a deep orange ring, and then a deposit of the same colour on the bottom of the capsule. As pyramidone does not react in this way, the reaction serves to show its adulteration with antipyrine. Cryogenin gives with the same reagent, a yellow-green tint under the same conditions, and the reaction is equally delicate.

Benzene sulphonic chloride; Preparation of —. R. Pummerer. Ber., 1909, 42, 2274—2275.

Using the process described in a previous paper (this J., 1909, 672), the author finds that a slightly higher temperature is favourable to the production of good yields of benzene sulphonic chloride. For instance, 100 grms. of benzene were allowed to drop during 1½—2 hours into 250 c.c. of chlorosulphonic acid, and the mixture allowed to stand for 20 hours at 15°—20° C. By distillation a yield of 159 grms. of benzene sulphonic chloride was obtained. Another mixture was allowed to stand for 3 hours at 25°—30° C., when 155 grms. of the sulphonic chloride were produced.—F. SHDN.

Organic acids; Action of sulphur monochloride on salts of —: a convenient method of preparing anhydrides. W. S. Denham. Chem. Soc. Trans., 1909, 95, 1235—1241.

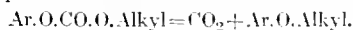
WHEN sulphur monochloride is brought into contact with the sodium or silver salts of many monobasic acids in the presence of solvents such as light petroleum, ether, or benzene, unstable derivatives of the acids are produced in which sulphur replaces the hydrogen of the hydroxyl group. These compounds readily decompose into sulphur dioxide, sulphur, and the acid anhydrides, according, in the case of sodium benzoate, to the following equations:



Benzoic, the isomeric toluic, acetic, phenylacetic and propionic acids all behave similarly. The silver salts of salicylic, ethylsalicylic and *o*-nitrobenzoic acids appear to behave in a more complex manner. The salts of succinic and the phthalic acids react readily yielding their anhydrides without the formation of intermediate compounds. The quantitative and simple nature of these reactions affords a rapid and convenient method of preparing the anhydrides of the acids.—A. H. C.

Phenols; New method for the alkylation of —. A. Einhorn. Ber., 1909, 42, 2237—2238.

MIXED carbonic acid esters of phenols, which contain an alkyl grouping, lose carbon dioxide on heating and form alkylated phenols:—



The diethylaminoethyl ester of guaiacolecarbonic acid when distilled in a vacuum yields diethylaminoethyl-guaiacol. Other esters, for instance, the methyl ester of guaiacolecarbonic acid, and the methyl ester of β -naphtholecarbonic acid, require many hours' boiling under atmospheric pressure to effect their decomposition. The same reaction takes place with mixed carbonic acid esters of the following substances, resorcinol, ethyl alcohol, thymol, eugenol, isoeugenol, salicylic acid, and *p*-hydroxybenzoic acid. When the ethyl ester of guaiacolecarbonic acid is heated for several days, the principal product of the reaction is ethylguaiacol with some guaiacol carbonate.—F. SHDN.

Methyl alcohol; Action of metallic oxides on —. P. Sabatier and A. Mailhe. *Compt. rend.*, 1909, 148, 1734—1736.

PREVIOUS work upon the action of metallic oxides on primary alcohols below 400 C. (this J., 1908, 767, 831) has been extended to methyl alcohol. The reduction of the various oxides was found to be analogous to that with other alcohols, but the catalytic decomposition of the alcohol differs, in that, the formation of an ethylenic hydrocarbon being impossible, only methyl ether is produced by dehydration, and the formaldehyde, resulting from dehydrogenation (catalytic or otherwise), commences to decompose at 280 C. into hydrogen and carbon monoxide, being almost completely destroyed at 350 C. With alumina, thoria, and titanium oxide, dehydration takes place, almost to the exclusion of aldehyde formation; chromic oxide and the blue oxide of tungsten give both methyl ether and formaldehyde and its decomposition products; and with most other non-reducible oxides, and some oxides which are slowly reduced, the predominating effect is that of reduction of the alcohol, much carbon monoxide and hydrogen being produced; stannous oxide is specially active. The efficiency of each oxide is largely dependent on its method of preparation.—F. SODN.

Alcohols; Catalytic action of metallic salts in the decomposition of —. Chavanne. *Bull. Soc. Chim. Belg.*, 1909, 23, 267.

THE sulphates of barium, magnesium, aluminium, chromium, manganese, nickel, cobalt and copper have a dehydrating action on alcohols at high temperatures and, with ethyl alcohol, yield ether and ethylene. Experiments made at temperatures of 250, 300 and 350° C. showed that the quantity of ethylene produced increases as the temperature is increased, whilst the quantity of ether increases with the temperature at first, but passes through a maximum point and decreases again when the temperature is further raised. The sulphates of zinc and cadmium have a dehydrogenising action; they yield aldehydes. The sulphates of the alkali metals have no action. The phosphates appear to behave similarly to the sulphates; ethyl ether is split up into ethylene and water under the action of the same catalysts.—J. F. B.

Dimercuricammonium bromide. H. Gauduchon. *Compt. rend.*, 1909, 148, 1763—1765.

WHEN a solution of mercuric bromide, at about 80° C., is added to an excess of a cold solution of ammonia, the resulting precipitate, when thoroughly washed, proves to be the compound, $\text{NH}_2\text{Br} \cdot \text{Hg}_2\text{Br}_2$, but when ammonia is added to the hot mercuric bromide solution and the precipitate obtained is washed free from bromide, it is found to have the formula, $(\text{NH}_2\text{Br})_2 \cdot \text{HgBr}_2$. On treating this latter compound with hot ammonia, until ammonium bromide no longer appears in the washings, dimercuricammonium bromide, $\text{NH}_2\text{Br} \cdot \text{Hg}_2\text{Br}_2$, is formed. This is a canary-yellow crystalline body, which explodes on sudden heating, but decomposes, when heated slowly to about 100° C., to give a mixture of mercurous bromide and mercury; it does not become hydrated in the presence of moisture. These compounds should be dried at a low temperature and in the dark.—F. SODN.

Determining volatile acids in tobacco. Kissling. *See XXIII.*

Test for mercury. Jones. *See XXIII.*

PATENTS.

Camphor; Manufacture of sticks, tablets and filaments of —. Chem. Fab. vorm. E. Schering, Berlin. Eng. Pat. 1532, Jan. 21, 1909. Under Int. Conv., Feb. 6, 1908.

CAMPOR is manufactured in the form of sticks or filaments by forcing it through dies of any desired cross-section. Transparent tablets can be made from these sticks by pressure.—J. F. B.

p-Nitro- and p-aminobenzoic acid; Manufacture of p-n-propyl esters of —. F. Fritzsche und Co., Hamburg, Germany. Eng. Pat. 2020, Jan. 27, 1909. Under Int. Conv., Mar. 24, 1908.

CLAIM is made for two new products, the *n*-propyl ester of *p*-nitro- and *p*-aminobenzoic acid, and also for process of manufacturing them. The latter compound is anæsthetic and is stated to have a stronger action than the corresponding ethyl ester (anæsthesin) and *m*-aminophydroxybenzoic acid methyl-ester (new orthoform). It is prepared, either from *p*-aminobenzoic acid as *n*-propyl alcohol, or by reducing the *n*-propyl ester of *p*-nitrobenzoic acid, which is obtained by boiling together *n*-propyl alcohol and *p*-nitrobenzoic acid, in the presence of a dehydrating agent. For example:—(1). 5 parts *n*-propyl alcohol are boiled with 1 part of *p*-nitrobenzoic acid and 1 part of sulphuric acid (66° B.), until esterification is complete; the excess of alcohol is distilled off the sulphuric acid neutralised, and the insoluble *p*-nitrobenzoic acid *n*-propyl ester crystallised from alcohol; it forms colourless rhombic prisms (m. pt., 35° C.) which are very soluble in hot alcohol and slightly soluble in other organic solvents. The ester is reduced by boiling with 3 parts of hydrochloric acid and 1 part of tin, after the mixture, made alkaline with soda, is extracted with ether or benzene, from which the *p*-aminobenzoic acid *n*-propyl ester crystallises in rhombic prisms (m. p. 73°—74° C.), readily soluble in organic solvents and slightly soluble in water. (2). 1 part of *p*-aminobenzoic acid is boiled with 5 parts of *n*-propyl alcohol in the presence of sulphuric acid or a current of dry hydrochloric acid until a large proportion has been esterified, when the sulphuric or hydrochloric acid is neutralised, the excess of alcohol removed by distillation, and any free *p*-aminobenzoic acid washed out by dilute caustic soda, the remaining ester being crystallised from benzene.—F. SODN.

o-Sulphamidobenzoic acid; Manufacture of —. List, and Saccharin Fabrik Akt.-Ges., vorm. Fahlberg List, und Co., Salbke-Westerhüsen a/E., German. Eng. Pat. 8421, April 7, 1909.

ALKALI derivatives of saccharin are converted into alkali salts of *o*-sulphaminobenzoic acid by heating the mixture obtained by oxidising *o*-toluenesulphamide with potassium permanganate, with a small amount of alkali, under pressure to a high temperature. A solution of 100 kilos. of *o*-toluenesulphamide in 1000 litres of water, to which 1 kilos. of caustic soda solution (40° B.) have been added, is oxidised by 190 kilos. of potassium permanganate at 50°—70° C. The product is heated in an autoclave provided with a stirrer, for 6—8 hours at 160° C., and filtered, and the solution treated in the usual manner to recover the *o*-sulphaminobenzoic acid.—T. F. B.

Medicament [Terpene peroxide]; Process of producing —. W. D. Neel, Chicago, Ill., Assignor to T. Oxoline Co., Jersey City, N.J., and The Neel-Armstrong Co., Maine. U.S. Pat. 925,599, June 22, 1909.

AN inhalable medicament (terpene peroxide) is produced by treating a hydrocarbon oil of the terpene group, for instance eucalyptus oil, in the absence of water, with gaseous oxidising agent (ozone or ozonised air) capable of oxidising the hydrocarbon and causing evolution of fumes of the terpene peroxide.—A. S.

Chloroform; Preparation of — in a solid condition. C. J. Schleieh, Berlin. U.S. Pat. 925,658, June 2, 1909.

A SOLID medical preparation is obtained by mixing peptone with excess of chloroform and then allowing the excess to evaporate.—A. S.

Tobacco; Process and apparatus for de-nicotinising —. Soc. des Tabacs Désintoxiqués, Fr. Pat. 397,02 Dec. 2, 1908. Under Int. Conv., Dec. 11, 1907.

THE tobacco is extracted with a solution previously saturated with the soluble constituents of tobacco free from nicotine. The solution containing the nicotine is then drawn off, rendered alkaline with ammonia, and

conveyed to a tank which is divided into two parts by means of a partition. The alkaline solution is filled into the compartment until it is about three-quarters full, whilst a similarly saturated solution, acidified with either sulphuric acid or oxalic acid, is placed in the other compartment. Petroleum spirit is then added to each compartment, an aperture at the top of the partition allowing the petroleum spirit to pass from one compartment to the other. A stirring device is provided in each compartment and the nicotine removed from the alkaline solution by the petroleum spirit is extracted from the latter by the acid solution. The alkaline solution may then be used for extracting further quantities of tobacco. If sulphuric acid be used to acidify the solution, portions must be withdrawn and fresh solution added as the solution becomes saturated with nicotine salts; but if oxalic acid is employed, it is sufficient to remove the crystals of nicotine oxalate from time to time.—W. P. S.

Monohalogen-acetic esters from dihalogen-vinylethers: Process for preparing —. G. Imbert, and Consortium f. Elektrochemische Industrie. Ger. Pat. 210,502, May 27, 1908. Addition to Ger. Pat. 209,268, Nov. 4, 1906.

In the preparation of monohalogen acetic esters by heating halogenvinyl ethers with water (see Fr. Pat. 375,167, 1907; this J., 1907, 839), the reaction is accelerated by the presence of hydrochloric acid. The best method of carrying out the process is to heat the ether with concentrated hydrochloric acid, the two substances having about the same specific gravities. The yields are said to be very good.—T. F. B.

Nitro-compounds of nitriles of aromatic carboxylic acids and oxalic acid; Process for preparing —. Kalle und Co., A.-G. Ger. Pat. 210,563, Dec. 5, 1907.

NITROPHENYLPIRUVIC acid is readily converted into nitrobenzonitrile and oxalic acid by heating it at 60°–70° C. with a molecular proportion of nitrous acid; the simonitrobenzoylgyoxylic acid, which is formed as an intermediate product, is decomposed at about 80° C. to oxalic acid and nitrobenzonitrile. Homologues of nitrobenzonitrile may be obtained by similarly treating homologues of *o*-nitrophenylpyruvic acid.—T. F. B.

Glyoxylic acid, its esters and anide, and phenylglycine and its derivatives; Process for preparing — from oxalic acid by electrolytic reduction. Kinzlerberger und Co. Ger. Pat. 210,693, Aug. 14, 1904. Addition to Ger. Pat. 163,842, Sept. 10, 1903 (this J., 1906, 492).

In place of using lead cathodes for the electrolytic reduction of oxalic acid, cathodes of other metals insoluble in sulphuric acid, especially mercury cathodes, are employed; the strength, pressure, and duration of current must be varied according to the metal used and the product to be obtained. For instance, for the preparation of glyoxylic acid, oxalic acid dissolved in a 2.5 to 5 per cent. solution of sulphuric acid, is electrolysed in presence of lead anodes and mercury cathodes, by a current of 6.5 amps. (current density 3 amps. per sq. dm.) at 7.5 volts, at a temperature of 5° C.; the yields are said to reach 89–85 per cent. of theory.—T. F. B.

Chlorides and anhydrides of organic acids; Process for preparing —. Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 210,805, Jan. 10, 1907.

In the action of sulphur dioxide, either in gaseous form or in solution, on the salts of organic acids, solid addition products are obtained; these are readily decomposed by chlorine, the chlorides and anhydrides of the acids being reduced, according to the amount of chlorine used. Thus, acetyl chloride is prepared by passing 7.1 parts of chlorine over 22–26 parts of the addition product of sodium acetate and sulphur dioxide, containing 6.4 parts of SO₂; the reaction is rendered smoother by diluting the solid with anhydrous salts of inorganic bases or with and.—T. F. B.

2,6-Dichloro- and 2,3,6-Trichlorotoluene-4-sulphonic chloride. Process for preparing a mixture of —. Anilinfarben- und Extract-Fabr. vorm. J. R. Geigy. Ger. Pat. 210,856, March 5, 1908.

p-TOLUENESULPHONIC chloride is treated with chlorine in presence of a suitable catalytic agent (e.g., antimony trichloride), at 70°–80° C., until the amount of chlorine absorbed corresponds to two atoms for each molecule of the sulphonic chloride. A mixture of 2,6-dichloro- and 2,3,6-trichloro-toluenesulphonic chlorides separates out on cooling, and can be converted into the corresponding sulphonic acids by saponification; the sulphonic acids can then be converted into the chlorinated hydrocarbons by heating with 80 per cent. sulphuric acid. On distilling the resulting mixture, the greater part passes over at 190°–200° C., and consists of 2,6-dichlorotoluene, whilst the 2,3,6-trichlorotoluene distils at 220°–230° C.

—T. F. B.

Magnesium phosphotartarate; Process for preparing —. K. Sorger. Ger. Pat. 210,857, June 23, 1908.

MAGNESIUM phosphotartarate is obtained by either of the following processes:—(1). Action of tartaric acid or magnesium hydrogen tartrate on magnesium phosphate; (2). action of phosphoric acid or magnesium hydrogen phosphate on magnesium tartrate; (3). decomposition of sodium phosphotartarate with magnesium oxide. The new salt is a white powder, sparingly soluble in water and dilute acids, and is said to be tasteless.—T. F. B.

Allophanic acid ester of castor oil; Process for preparing the —. Verein. Chindfabr. Zimmer und Co. Ger. Pat. 211,197, Dec. 28, 1907.

AN allophanic ester of castor oil, of the composition, C₅₇H₁₁₃O₁₀(CO.C₁₇H₃₃O.C₂O₂N₂H₃)₃, is obtained by treating castor oil with urea chloride, or by any other method for preparing allophanates. It is a white, tasteless, odourless powder, of m. pt. 61°–62° C., insoluble in water, sparingly soluble in cold alcohol, but readily soluble in hot alcohol.

—T. F. B.

Tetranitromethane from acetic anhydride and nitric anhydride; Process for preparing —. R. Schenck. Ger. Pats. 211,198, Jan. 28, 1908, and 211,199, June 23, 1908.

(1). ACETIC anhydride is added, in small quantities at a time, to nitric anhydride, at temperatures below 40° C., preferably in presence of a diluent. Concentrated nitric acid may be utilised as the source of the nitric anhydride, decomposition being effected by phosphoric anhydride or other suitable agent. After all the acetic anhydride has been added, the mixture is allowed to stand for some time at a temperature below 40° C., and the tetranitromethane recovered by fractional distillation. (2). Nitrogen tetroxide, N₂O₄, is employed as diluent for the nitric anhydride. 120 grms. of acetic anhydride are gradually added to a mixture of 155 grms. of nitric anhydride and 75 grms. of nitrogen tetroxide, the temperature being maintained at 30° C.; the tetranitromethane can then be recovered by distillation or addition of water.—T. F. B.

Lacilin, free from bitter alkaloids, from the seeds of lupines and other podded plants; Process for obtaining —. H. C. Buer, Cologne-Marienburg, Germany. Eng. Pat. 12,405, June 9, 1908.

SEE Ger. Pat. 200,253 of 1907; this J., 1908, 1131.—T. F. B.

1-Aryl-2,4-dialkylhalogenmethylpyrazolones; Manufacture of —. O. Murray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst or Mainz, Germany. Eng. Pat. 20,377, Sept. 28, 1908.

SEE Ger. Pats. 206,637 and 208,593; this J., 1909, 328, 491.—T. F. B.

Polychlorandine derivative. C. Schrambe and E. Laudien. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 926,023, June 22, 1909.

SEE Eng. Pat. 8077 of 1906; this J., 1906, 608.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic prints; Preparation of — by means of basic dyestuffs. R. Namias. Seventh Int. Congr. Appl. Chem., London, 1909.

SILVER prints are bleached by immersion in a solution of lead ferriocyanide, whereby the image is converted into one of ferrocyanides of lead and silver; the silver ferrocyanide is dissolved out by means of a dilute solution of sodium thiosulphate, and the lead ferrocyanide is converted by means of sodium sulphate into lead sulphate, which is used as a mordant for basic dyestuffs, such as Auramine. The lead sulphate may finally be removed by means of concentrated sodium thiosulphate solution, when an image composed of the dyestuff alone remains.—T. F. B.

PATENT.

Photographic paper [prints]; Method of treating —. E. A. Cunningham. Ambridge, Pa. U.S. Pat. 917,418, April 6, 1909.

PHOTOGRAPHIC prints, such as those on ferroprussiate paper, which have been treated according to U.S. Pat. 895,970 of 1908 (this J., 1908, 959), are first subjected to the action of an alkali, such as ammonia, and then treated with a solution of potassium ferrocyanide and hydrochloric acid, whereby Prussian blue is formed; they are finally treated with an oxidising agent, such as potassium bichromate, washed, and dried.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Mine air; Impurities in — due to the firing of dynamite, and their effect upon health. S. Nauckhoff. Z. ges. Schiess- und Sprengstoffw., 1909, 4, 241–244.

THE author has investigated the question of the percentage of carbon monoxide present in the atmosphere of mines, after firing varying weights of charges of dynamite of different composition. For estimating the percentage of carbon monoxide, which is always small, he employed a 0.4 per cent. solution of palladium chloride. The yellow colour of this solution is discharged by carbon monoxide, and the method was standardised by employing volumes of air of from 250 c.c. to 1 litre, containing known quantities of carbon monoxide. The following gives some of the results obtained during standardising the method in this manner. Using 1 litre of air and 5 c.c. of palladium chloride solution, 0.01 per cent. of carbon monoxide produced only partial decolorisation after 4 to 5 hours. Carbon monoxide to the extent of 0.04 per cent. completely decolorised the solution after $\frac{1}{2}$ to 1 hour, whilst 0.1 per cent. brought about complete decolorisation at the expiration of 5 minutes. The explosives were fired in the drives in the mines at Grönge-berg, and samples of the mine air were collected in flasks varying from 250 c.c. to 1 litre in capacity. In each case, after passing the gas through sulphuric acid and caustic potash, its content of carbon monoxide was determined. The results obtained are shown in the following table, together with the calculated quantities of carbon monoxide, supposing complete combustion of the explosive to have taken place.

Express dynamite and weight used.	Carbon monoxide.	
	Found.	Calculated.
	Per cent.	Per cent.
No. 1 15.0 kilos.	0.025	0.015
No. 1 4.5 kilos.	0.01	0.008
No. 1 9.2 kilos.	0.02	0.009
No. 1 13.2 kilos.	0.02	0.013
No. 2 10.0 kilos.	trace	Nil
No. 2 12.5 kilos.	Nil	Nil
No. 3 7.7 kilos.	0.035	0.09
No. 3 16.0 kilos.	0.09	0.16
No. 2 4.0 kilos.		

In the case last recorded the miners found that they suffered from headache after several hours' working. Lange states that breathing air containing 0.2 to 0.3 per cent. of carbon monoxide produces serious symptoms in from $\frac{1}{2}$ to 1 hour. Air containing 0.05 to 0.10 per cent. produces little ill effect during the same period, whilst air containing 0.02 per cent. of carbon monoxide can be breathed for several hours with hardly any perceptible effect. Air which contains 4 per cent. of carbon dioxide produces difficulty in breathing. If the carbon dioxide content rises to about 10 per cent., serious trouble is experienced, although the after-effects are not necessarily dangerous. But in the experiments mentioned above the amount of carbon dioxide present in the mine air would be only about 0.5 per cent., which, allowing also for the nitrogen evolved from the explosive, would only mean a reduction of oxygen of about 1 per cent. The author points out that where, as in Sweden, it is customary to add from 5 to 10 per cent. of nitrobenzol for the purpose of lowering the freezing point of explosives intended for use in winter, a considerable amount of carbon monoxide would be produced. In view of the author's experiments and bearing in mind that a considerable number of cases of gas poisoning occur yearly in mines, the author suggests that the following possible conditions of work may be productive of an excess of carbon monoxide. The use of frozen explosives which do not fit the bore-hole, and consequently, produce a low charge density; the use of No. 4 detonators, which may not be sufficiently strong for the work; the presence of the paper wrapping on the cartridges, which would give rise to carbon monoxide, and the possibility of the reduction at high temperatures of carbon dioxide by coal dust in the mines.—G. W. McD.

PATENTS.

[Blasting] explosives. B. E. D. Kilburn. London. From C. Pieper, Berlin. Eng. Pat. 15,916, July 27, 1908.

THE patent relates to a new blasting explosive, composed of ammonium perchlorate, an alkali nitrate, and two hydrocarbons, of which one is a solid or liquid product of natural petroleum, substantially non-volatile at ordinary temperatures, while the other is a nitrated coal tar product. A suitable binding medium may be added, the explosive being used in the form of powder or otherwise. The perchlorate and nitrate are present in molecular proportion and the relative quantities of carbon and oxygen may be such that, as far as possible, complete combustion takes place. An example is given of a mixture containing paraffin wax 13 per cent., trinitrotoluene 14, ammonium perchlorate 42, and sodium nitrate 31 per cent. No residue is said to be left from these explosives, and, further, a low flame temperature is combined with considerable explosive power.—F. SOPS.

Gelatin dynamite; Machine for packing explosive —

W. J. Donaldson, Paulsboro, N.J., Assignor to T. E. L. Du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 914,396, March 9, 1909.

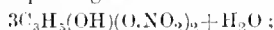
A GELATINOUS explosive is fed from a cylindrical hopper by means of a screw through openings, arranged with nozzles, into cartridge cases held by a carrier. The nozzles project into the cases during the process of filling. On top of the cylinder is a conical hopper slightly contracted at the mouth. Blades, set at an angle, are fixed to the shaft where it passes through the conical hopper, so as to feed the explosive into the cylinder, from which it is forced by means of the screw through the nozzles into the cartridge cases. The feed of the cylinder is thus constant, and regulated by the screw in the cylinder itself. The holder for the cases is supported on a piston in an air cylinder which descends during the filling of the cases. When the holder descends to a point corresponding to the filled cartridge case, an indicating device, such as a whistle, is brought into play so that the time at which the case is filled is accurately determined. The feed screw is then stopped. This automatically results in the removal of the case holder, containing the filled cartridges, which is replaced by another holder of empty cases.—G. W. McD.

Donating compounds for cartridges; Use of manganese dioxide in —. Soc. Française des Munitions de Chasse, de Tir et de Guerre. Fr. Pat. 397,253, Nov. 30, 1908.

The use of manganese dioxide in detonating compounds claimed in order to produce an explosive which is not liable to premature explosion or miss-firing.—W. P. S.

nitroglycerin; Process for purifying —. C. Claessen. Ger. Pat. 210,990, July 30, 1907.

NITROGLYCERIN is kept for two hours in an atmosphere containing 75–80 per cent. of moisture, or is mixed with 50 per cent. of water; the mixture is absorbed by selguhr, and kept cool for some time, when a hydrate formed, corresponding to the formula,



can be obtained pure by recrystallisation from ether, when its melting point is 25° C. By dehydrating a desiccator or by a short heating at 40 C., it loses water and pure liquid dinitroglycerin is obtained.

—T. F. B.

Explosive compounds and manufacture of the same. G. Lezinsky, New York. Eng. Pat. 22,555, Oct. 23, 1908. Under Int. Conv., Nov. 1, 1907.

U.S. Pat. 909,915 of 1909; this J., 1909, 384.—T. F. B.

Explosive nitro-substances; Process of increasing the density of fusible —. C. E. Bichel, Hamburg. Assignor to E. I. Du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 925,419, June 15, 1909.

Fr. Pat. 369,371 of 1906; this J., 1907, 115.—T. F. B.

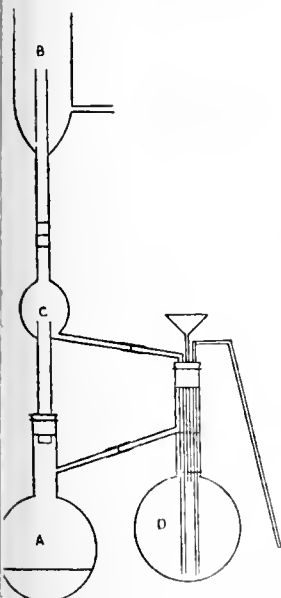
Explosion-gases; Composition for oxidising and purifying —. H. Walker, Knights, Transvaal. U.S. Pat. 925,670, June 22, 1909.

Eng. Pat. 24,002 of 1905; this J., 1906, 609.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Extraction of liquids with ether; Apparatus for —. A. H. Fiske, Amer. Chem. J., 1909, 41, 510–515.



The apparatus shown in the diagram is claimed to be of simpler construction and more efficient than any previously described. It consists of a flask, A, which is heated below a reflux condenser, B, to the lower part of which is attached, by means of rubber tubing, a trap, C, consisting of a small bulb with a side tube. The liquid to be extracted is placed in the flask, D, which has a capacity of about 500 c.c., and the condensed solvent passes from the trap, C, to the bottom of this flask. Thence it rises through the liquid, and runs back through the side tube of D, into the distilling flask, A, to be distilled again. The extraction flask is also fitted with

a siphon tube and a funnel so that its contents can be withdrawn or renewed without taking the apparatus to pieces. Comparative experiments showed that the extraction of succinic acid from large quantities of water

by means of ether in this apparatus was four times as rapid as in van Rijn's apparatus, this being due to the smaller capacity of the latter.—C. A. M.

PATENT.

Combustible gases; Method and apparatus for determining the calorific power of —. P. Lemoult et Soc. Anon. les Etablissements Poulsen Frères. First Addition, dated Dec. 1, 1908, to Fr. Pat. 385,726, Dec. 3, 1907.

THE Addition refers to modifications in the apparatus only, the method of working already described (this J., 1908, 27, 646) being unchanged. In the modified apparatus, the combustion or explosion is performed in a separate vessel, and a special glass sampling tube has also been added.—W. E. F. P.

INORGANIC—QUALITATIVE.

Mercury; New test for —. P. W. Jones. Proc. Roy. Soc. Queensland, 21, 49.

WHEN mercury is rubbed on aluminium in the presence of a little caustic alkali, an amalgam is formed, the bright surface of which in a moist atmosphere soon becomes covered with concretions of alumina. For a toxicological test, the sample is boiled with copper and platinum as in Reinsch's method, and the copper after washing and drying, is heated to dull redness for a few minutes and then let cool, in a tube closed with an aluminium plate. The latter is then rubbed with a wash leather moistened with a drop of caustic alkali, and allowed to stand for a few minutes in a moist atmosphere, when characteristic growths of alumina will be seen if mercury be present. 0.002 grain can be detected in viscera. In assaying, 0.5–1 gm. of the finely ground ore is mixed with an equal bulk of lime and a little reduced iron, and heated to dull redness in a small tube closed by a piece of aluminium. The latter is kept cool by means of a few drops of water.

INORGANIC—QUANTITATIVE.

Iron alum as a standard in volumetric analysis. De Koninck. Bull. Soc. Chim. Belg., 1909, 23, 261–262.

IRON ammonia alum is purified by crystallisation, the crystals are drained, sifted, spread for half an hour on filter paper and bottled whilst still slightly moist. Under these conditions the crystals may be preserved indefinitely. On exposure to air iron alum loses three-fourths of its water of crystallisation, and after several weeks it is converted into a white pulverulent substance having a composition corresponding to the formula, $(NH_4)_2Fe_2(SO_4)_3 \cdot 6H_2O$. This product is stable, very sparingly soluble in cold water, but soluble in hot water with reproduction of the alum. The efflorescence of iron alum is slow; crystals may be left for 45 minutes on the pan of the open balance without losing weight. In order to obtain a known weight of the normal alum, a portion of the moist crystals is tared on the balance, the front of the case being left open. After a short time the crystals will cease to lose weight, and the weight will remain constant for 15–20 minutes; at this stage the required weight of the alum may be adjusted with certainty.—J. F. B.

Solid solution; contamination of barium sulphate precipitates with aluminium. H. J. M. Creighton. Z. anorg. Chem., 1909, 63, 53–58.

WHEN a solution of ammonium sulphate, containing a little hydrochloric acid and a fixed amount of aluminium chloride, is precipitated with a slight excess of barium chloride and the mixture is heated for some hours, the weight of aluminium contaminating the precipitated barium sulphate is found to be proportional to the weight of ammonium sulphate present. If, however, this weight be kept constant and that of the aluminium chloride allowed to vary, the weight of co-precipitated aluminium increases with that of the aluminium present, up to a maximum, and then becomes constant. The author interprets these facts to mean that a solid solution of the

aluminium salt in barium sulphate is formed, which, in the second group of experiments, becomes saturated at a certain concentration.—F. SODX.

Iron: Determination of — by permanganate in the presence of hydrogen chloride. J. A. N. Friend. *Chem. Soc. Trans.*, 1909, **95**, 1228—1235.

Ferrous sulphate dissolved in water with just sufficient sulphuric acid to prevent the precipitation of basic salt, was titrated with $N/10$ solution of permanganate in the presence of varying quantities of hydrogen chloride and a little manganous sulphate. The author finds that accurate estimations of ferrous iron, in the presence of hydrogen chloride, can be made, provided that the volume titrated does not exceed 200 c.c. and the manganous sulphate present is not less than 2 grms in this volume. (1), if the titration is performed slowly with constant shaking; (2), if the concentration of the hydrogen chloride does not exceed $N/4$.—A. H. C.

Iron: Determination of — by permanganate, in the presence of hydrochloric acid. G. C. Jones and J. H. Jeffery. *Analyst*, 1909, **34**, 306—316.

The authors recommend a modified Zimmermann-Reinhardt process of titration in which the following reagents are employed:—*Manganese solution*: prepared, according to Reinhardt's formula, by dissolving 200 grms. of crystallised manganese sulphate in 1000 c.c. of water, and adding to this a cooled mixture of 400 c.c. of concentrated sulphuric acid, 600 c.c. of water, and 1000 c.c. of phosphoric acid of sp. gr. 1.3. *Stannous chloride*: 50 grms. of the crystallised salt and 100 c.c. of concentrated hydrochloric acid made up to 1000 c.c. with water. *Mercuric chloride*: a cold, saturated solution. *Hydrochloric acid*: acid of sp. gr. 1.1, or about the strength which exhibits a constant boiling point. The slight oxidising power sometimes possessed by the manganese solution, when freshly prepared, may be easily determined and allowed for if necessary; but it has been found that this oxidising effect is unmeasurable when the solution is a week old. In the presence of hydrochloric acid, permanganate titrations give results which are a little too high, even when the manganese solution is employed; the authors find that the small error so introduced is a constant one, independent of the amount of iron present, and therefore easily allowed for. The titration is carried out as follows:—The iron solution (in hydrochloric acid of 1.1 sp. gr.) is reduced with the smallest possible excess of stannous chloride, and 10 c.c. of mercuric chloride are added to the cold solution, the mixture being then allowed to stand for ten minutes to ensure the complete conversion of the stannous salt to the stannic condition, no appreciable oxidation of the reduced iron occurring in the meantime. A quantity of tap-water, which may vary between 400 and 1000 c.c. without appreciable effect on the titration, is then mixed, in a capacious bowl, with a volume of the manganese solution equal to that of the hydrochloric acid present in the assay, and the mixture tinted with permanganate, of which one drop should suffice. The ferrous solution is then transferred to the bowl, together with the rinsings of its containing vessel, and the permanganate added, drop by drop, with constant stirring, until the end point is reached. 0.1 c.c. is then deducted from the burette reading, and the amount of iron present is calculated by reference to the known titre of the permanganate, as determined by titration against a ferrous solution free from hydrochloric acid.—W. E. F. P.

Nickel and cobalt: Quantitative separation of — by the Rosenheim-Huldschinsky method. M. Pritze. *Chem. Zeit.*, 1909, **33**, 694.

The Rosenheim-Huldschinsky method (this J., 1901, 840) is based on the fact that cobalt-ammonium thiocyanate is soluble in a mixture of amyl alcohol and ether, whereas the corresponding nickel salt is insoluble. The metals can thus be separated by shaking an aqueous solution containing the two double salts with the organic solvent. The author has applied the method to alloys containing from 98—99 per cent. of nickel and 1—2 per cent. of cobalt,

but finds that varying small quantities of the nickel salt are always dissolved along with the cobalt salt. For the separation of these small quantities of nickel, precipitation with dimethylglyoxime (this J., 1907, 643, 121) proved more satisfactory than a second treatment with the organic solvent.—A. S.

Niobium in presence of tantalum: Volumetric method for the determination of —, and its application to the analysis of niobium minerals. C. E. Taylor. Dissertation, Columbia University, U.S.A.

The method proposed is based on the facts that if succinic acid be added to a solution of niobium and tantalum in strong sulphuric acid, the solution can then be largely diluted without the formation of any precipitate, and in the diluted solution the niobium can be determined by reduction with zinc and titration with permanganate without interference from the tantalum. From 0.2 to 1 gm. of the mineral is fused with 5—10 grms. of potassium bisulphate, the cooled melt is boiled with water and filtered through a rubber funnel. The insoluble matter is washed well with hot water, then with several portions (15 or 20 c.c.) of hot yellow ammonium sulphide, and afterward in succession with hot water, dilute sulphuric acid, and hot water. The white residue of silica and niobian and tantalic acids is dissolved off the filter by means of warm dilute hydrofluoric acid and the solution is mixed with 19 c.c. of concentrated sulphuric acid and evaporated until white fumes are copiously evolved, when a few c.c. more of sulphuric acid are added and the evaporation repeated. The solution is then allowed to cool, poured into cold water, and the whole diluted to about 500 c.c. boiled for a few minutes, and filtered. The insoluble matter is washed with boiling water, dried, ignited with a strong blast flame for 10 minutes and weighed. This gives the weight of the combined oxides of niobium and tantalum. The oxides are now fused with 5 grms. of potassium bisulphate, the melt is heated with 10 c.c. of concentrated sulphuric acid, and the clear solution transferred to a beaker, the crucible being rinsed out with 30 c.c. of concentrated sulphuric acid. The acid solution is allowed to cool, and 2 grms. of succinic acid added, followed by 20 c.c. of a saturated aqueous solution of succinic acid in a fine stream from a wash-bottle, the mixture being kept agitated. The solution is next diluted gradually to 200 c.c., being kept constantly agitated meanwhile, then heated to 75° C., and passed through a "reductor," 19 in. long by $\frac{3}{4}$ in. diam., filled with amalgamated zinc, prepared by shaking 600 grms. of 20—30 mesh C.P. zinc with an acid mercury solution (0.5 gm. of mercury dissolved in 25 c.c. of concentrated nitric acid and diluted to 250 c.c.), washing with water, then shaking with dilute sulphuric acid, and keeping under water until required for use. The reductor filled with zinc is prepared for use by passing through it 200 c.c. of 5 per cent. sulphuric acid heated to 75° C., and then filling it with 20 per cent. sulphuric acid also at 75° C. After passing the niobium solution through, 50 c.c. of 20 per cent. and 200 c.c. of 5 per cent. sulphuric acid are passed through. The reduced solution is then titrated with permanganate (1 c.c. of $N/10$ permanganate = 0.007052 gm. of niobium pentoxide). The reduction and titration are carried out in an atmosphere of carbon dioxide. The method is much more rapid and accurate than that of fractional crystallisation of the double fluorides of niobium and tantalum with potassium.—A. S.

Determining alkalinity of bleaching powder solutions. Orton and Jones. See V.

Determining lime in presence of silicic acid [in cements, mortars, etc.]. Balthasar. See IX.

Determining tungsten in tungsten steel. Bartonee. See X.

Determining lead in tinned goods. Knüpfle. See X.

Determining mercury in ores. Beyne. See X.

Analysis of double superphosphates. Foerster. See XV.

Mine air: Impurities in — due to the firing of dynamite, and their effect upon health. S. Nauckhoff. See XXII.

ORGANIC—QUALITATIVE.

Reactions for hydrastine, hydrastinine, and narcotine. Reactions for opianic acid, and detection of hydrastine and arcotine. A. Labat. See XX.

Willian as reagent for antipyrine and eryogenin; Detection of antipyrine in pyrimidin. Primot. See XX.

ORGANIC—QUANTITATIVE.

Tobacco; Determination of volatile organic acids in — and the behaviour of oxalic acid. R. Kissling. Chem.-Zeit., 1909, 33, 719—720.

The author criticises statements made by Tóth in the description of a method for determining the volatile acids in tobacco (this J., 1908, 367). Malic, citric, and oxalic acids are not decomposed by a current of steam in presence of sulphuric or tartaric acid with formation of an acid salt, as stated by Tóth. Also, oxalic acid does not decompose on evaporation of its aqueous solutions on the water-bath, as stated by Tóth, but on evaporation to dryness, and further heating of the dry residue on the water-bath, it slowly sublimes. Tóth is also wrong in stating that it is necessary, in determining the amount of volatile acids by his method, to deduct the quantity of oxalic acid determined directly. The author is of opinion that a fully accurate knowledge of the various groups of acids in tobacco samples is obtained by his own method of determining the malic, citric, and oxalic acids, and then determining the volatile acids by the loss in weight of total acids, as indicated by Tóth's or any other method, evaporating once to dryness on the water-bath and stopping the evaporation as soon as no more water-vapour evolved. The loss of oxalic acid is then, according to the author, only very small, and he considers the results to be accurate enough for all practical purposes.—E. F.

Analysis of coal gas. Von Kuorrie. See II.

Examination of paraffin wax. Singer. See III.

Determining fatty acids in soap. Dominikiewicz. See XII.

Determining rubber in hot-vulcanised rubber goods. Hübener. See XIII.

Determining vermillion and "golden sulphide" [of antimony] in rubber goods. Rothe. See XIII.

Determining acidity of hide powder. Hough. See XIV.

Determining sucrose in molasses. Andersen. See XVI.

Determining starch. Buisson. See XVI.

Determining dead cells of yeast. Schlichting and Winther. See XVII.

Determining milling and bread-making qualities of wheat. Holdcliffe and Wessling. See XVIII.

Analysis of flour. Kosztány. See XVIII.

Books Received.

BOARD OF AGRICULTURE AND FISHERIES. ANNUAL REPORT OF THE INTELLIGENCE DIVISION. PART I. PROCEEDINGS UNDER THE SALE OF FOOD AND DRUGS ACTS, 1875 TO 1907, THE MERCHANDISE MARKS ACTS, 1887 TO 1894, THE FERTILISERS AND FEEDING STUFFS ACT, 1906, AND THE BOARD OF AGRICULTURE ACT, 1889 SECTION 2, SUB-SECTION 3), FOR THE YEAR 1908. (Cd. 4688.) Wyman and Sons, Fetter Lane, E.C. Price 5½d.

It is a report describing the work accomplished by the Commercial Control Branch of the Intelligence Division of the Board of Agriculture, which was established early in 1908, and undertakes inquiries and correspondence as to the administration of the Sale of Food and Drugs Acts,

1875 to 1907; complaints relating to adulteration of articles of food affecting the interests of agriculture; the administration of the Fertilisers and Feeding Stuffs Act, 1906; prosecutions under the Merchandise Marks (Prosecutions) Act, 1894; and complaints as to rates and facilities for the carriage of agricultural produce by rail.

LABORATORY METHODS OF INORGANIC CHEMISTRY. By HEINRICH BILTZ and WILHELM BILTZ. Translated by WILLIAM T. HALL and ARTHUR A. BLANCHARD. John Wiley and Sons, New York, 1909. Price 12s. 6d. net. Chapman and Hall, Limited, London.

8vo volume, containing 244 pages of subject matter, with 27 illustrations, and an alphabetical index. The subject matter is arranged and classified in the following manner:—I. THE ELEMENTS. II. CHANGES OF CONDITION. III. SIMPLE COMPOUNDS. (i), Oxides. (ii), Hydrides. (iii), Acids, bases, and salts. IV. COMPOUNDS CONTAINING A COMPLEX NEGATIVE COMPONENT. (i), Compounds with homogenous complexes. (ii), Oxyacids and their salts. (iii), Thioacids and their salts. (iv), Complex halogen acids and their salts. Complex cyanogen compounds. (v), Nitrito acids and their salts. (vi), Condensed acids and their salts. (vii), Organo-complex compounds. V. COMPOUNDS CONTAINING A COMPLEX POSITIVE COMPONENT. (i), Ammonium compounds and substituted ammonium compounds. (ii), Metal-ammonia compounds. (iii), Hydrates. VI. COMPLEX NON-ELECTROLYTES. (i), Acid chlorides. (ii), Esters. (iii), Metal-organic compounds. VII. PREPARATION OF COMPOUNDS OF THE RARE ELEMENTS FROM THEIR MINERALS.

VERHALTEN DER WICHTIGSTEN SELTENEN ERDEN ZU REAGENTIEN. ZUM GEBRAUCH IM LABORATORIUM. Von Dr. Jos. v. PANAYEFF. Wilhelm Knapp's Verlag. Halle a. S. 1909. Price M. 3.60.

8vo volume, containing a preface and 83 pages of subject matter. The subject matter receives the following classification:—I. Introduction. Periodic system of the elements. II. Zirconium. III. Thorium. IV. Cerium. V. Didymium (Praseodymium and Neodymium). VI. Lanthanum. VII. Yttrium. VIII. Erbium. In the case of each of the metals named, the reactions according to the wet and dry methods respectively, are described. In the case of cerium, the reactions both of the cerous and ceric salts, are given.

JAHRBERICHT ÜBER DIE LEISTUNGEN DER CHEMISCHEN TECHNOLOGIE, MIT BESONDERER BERÜCKSICHTIGUNG DER ELEKTROCHEMIE UND GEWERBESTATISTIK FÜR DAS JAHR 1908. LIV. Jahrgang, oder Neue Folge, XXXIX. Jahrgang. Bearbeitet von Dr. FERDINAND FISCHER. (Jahrgang I. bis XXV. von R. v. WAGNER.) 2^{te}. Abteilung: Organische Teil. Otto Wigand's Verlagsbuchhandlung und Buchdruckerei m.b.H. Leipzig. 1909.

8vo volume, containing 576 pages of subject matter, notices of new books, alphabetical indexes of names of authors and patentees, and of subjects, and an index of German patents, in all filling 619 pages. I. MANUFACTURING CHEMICAL INDUSTRY. (a), Alcohol preparations, and organic acids. (b), Cyanogen compounds. (c), Aromatic compounds. (d), Newly patented dentists' remedies. (e), Etheral oils and odorants. (f), Indigo. (g), Dye-stuffs of the Benzene series. (h), Naphthalene- and anthracene dyestuffs. (i), Sulphur dyestuffs. (j), Azo-dyestuffs. (k), Other dyestuffs, and lakes, &c. II. CARBOHYDRATES, FOODSTUFFS. (a), Starches. Saccharification. (b), Beet sugar. (c), Cane sugar. (d), Flour and bread. (e), Milk, butter, cheese, &c. (f), Meat. (g), Other foodstuffs, &c. (h), Fodders. III. FERMENTATION INDUSTRY. (a), Yeast and fermentation. (b), Wine. (c), Beer. (d), Spirits. IV. TEXTILE FIBRES. DYEING. (a), Animal fibres. (b), Artificial silk, &c. (c), Vegetable textile fibres. (d), Bleaching, dyeing, printing, &c. (e), Paper. V. FURTHER ORGANIC CHEMICAL INDUSTRIES. (a) Fats, oils, and lubricants. (b), Fatty acids, soaps, glycerin. (c), Varnishes, paints, resins. (d), Caoutchouc. (e), Celluloid, &c. (f), Tanning industries. Gums, &c. (g), Wood preservation.

ANNUAL STATEMENT OF THE TRADE OF THE UNITED KINGDOM WITH FOREIGN COUNTRIES AND BRITISH POSSESSIONS, 1908. Volume I. [Cd. 4687.] Price 6s. Wyman and Sons, Fetter Lane, E.C.

THIS is the first volume of the statement of the overseas trade of the United Kingdom for the year 1908, and contains abstract tables showing the total imports and exports of every article which is separately enumerated in the official classification, as well as detailed tables showing the quantity and value of the imports and exports of each article from and to each country, figures being given in each case not only for the year 1908, but for each of the four preceding years. Statistics of the imports and exports of coin and bullion from and to each country are given in separate tables at the end of the volume.

Several alterations have been made in the classification of imports and exports. As regards imports, the headings for china and earthenware, dyestuffs and tanning substances, machinery, steel, &c., have been subdivided in greater detail than formerly. The statements of the domestic exports of chemicals, china, and earthenware, machinery, metals, and paper are, amongst others, shown in greater detail.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

15,062. Parouty-Dupont and Muneret. Distilling apparatus. June 28.

15,304. Humphrey. Raising liquids by compressed gases. June 30.

15,506. James. Means for generating and collecting gases. July 3.

15,829. Bost. Manufacture of heat insulating material. July 7.

15,931. Mechan. Discharge aperture fittings of cyanide and other tanks. July 8.

COMPLETE SPECIFICATIONS ACCEPTED.

14,014 (1908). Thomlinson-Haas (F. Haas Ges.). Apparatus for treating materials with air or other gases or vapours for drying, bleaching, &c. July 7.

23,720 (1908). Resines. Process and apparatus for filtering liquids. July 14.

26,843 (1908). Lake (Reif). Manufacture of chemical products in granulated, powdered, flaked, or similar condition. July 7.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

15,078. Jones. Coke ovens.* June 28.

15,192 and 15,193. Soc. Franç. d'Incandescence par le Gaz. Manufacture of filaments for incandescent electric lamps. [Fr. Appl., July 18, 1908.]* June 29.

15,196. Epstein. Fuel for internal-combustion motors. June 29.

15,206. Weidl. Horizontal coke oven.* June 29.

15,280. Epstein. Fuel for internal-combustion motors. June 30.

15,496. Jahoda. Manufacture of metallic filaments for electric incandescent lamps. [Austrian Appl., May 10, 1909.]* July 2.

15,569. Cone. Manufacture of gas. [U.S. Appl., July 3, 1908.]* July 3.

15,643. Richards and Pringle. Apparatus for distilling coal and recovering the products. July 5.

15,647. Lessing. Manufacture of electric carbon. July 5.

15,661. Thomas. Gas producer.* July 5.

15,704. Craig. Manufacture of coke in closed oven. July 6.

15,867. Bourdos. Manufacture of filaments for electric lamps. July 7.

15,911. Palmer. Suction gas producers for bituminous fuel. July 7.

16,110. Barton and Renison. Manufacture of artificial fuel. July 10.

COMPLETE SPECIFICATIONS ACCEPTED.

14,169 (1908). Parker. Retorts for the destructive distillation of coal or other carbonaceous substance. July 14.

14,405 (1908). Berry. Suction gas producers. July 14.

14,483 (1908). Marietti. Soldering metallic filaments of electric lamps to their electrodes. July 14.

14,558 (1908). Justice (Coal Treating Co.). Facilitation or controlling combustion of fuel and preventing smoke. July 14.

23,726 (1908). British Thomson-Houston Co., and Newham. Manufacture of filaments for incandescent electric lamps. July 7.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

15,071. Lessing. Decomposing hydrocarbons. June 28.

15,497. Boyer, Cavaillon, and Barishac. Preparation of lubricating oils having a basis of castor oil and mineral oils. [Fr. Appl., July 3, 1908.]* July 2.

COMPLETE SPECIFICATION ACCEPTED.

14,169 (1908). Parker. See under II.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

15,088. Kalle und Co. Manufacture of tetrabrom indigo. [Ger. Appl., Aug. 1, 1908.]* June 28.

15,089. Inray (Meister, Lucius, und Brüning). Manufacture of a black monoazo dyestuff. June 28.

15,142. Wyler, and Levinstein, Ltd. Dyestuffs of the indigo series and the production thereof. June 29.

15,403. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of substantive disazo dyestuffs. July 1.

15,625. Newton (Bayer und Co.). Manufacture of black sulphur colouring matter. July 5.

15,846 and 15,848. Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. July 7.

15,847. Newton (Bayer und Co.). Manufacture of azo dyestuffs. July 7.

COMPLETE SPECIFICATIONS ACCEPTED.

16,743 (1908). Ransford (Cassella und Co.). Manufacture of azo dyestuffs. July 7.

23,190 (1908). Merz. See under XIII A.

24,601 (1908). Newton (Bayer und Co.). Production of flavopurpurine. July 14.

3758 (1909). Meister, Lucius, und Brüning. Manufacture of dyestuffs. July 14.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS AND FIBRES.

APPLICATIONS.

15,306. Lilienfeld. See under XIX.

15,341. Bright and Bros., Ltd., and Oldroyd. Colouring yarn for making carpets and other fabrics.* July 1.

- 15,658. Stine. Treatment of silk.* July 5.
 15,674. Marshall. Apparatus for dyeing and similarly treating textile material on bobbins or the like. July 5.
 15,828. Schneider. Preparing wool or other animal fibre for mordanting, dyeing, or printing. [Addition to No. 6152 of 1907.] July 7.

COMPLETE SPECIFICATIONS ACCEPTED.

- 14,014 (1908). Thomlinson-Haas (F. Haas Ges.). *See under I.*
 14,143 and 28,149 (1908). Lecoq. Manufacture of threads and filaments of cellulose. July 7.
 19,157 and 19,158 (1908). Tetley and Clayton. Apparatus for making artificial silk and like filaments or threads. July 7.
 23,972 (1908). Newton (Bayer and Co.). Process of printing. July 14.
 25,097 (1908). Courtauld and Co., and Clayton. Apparatus for spinning threads of artificial silk. July 14.
 3196 (1909). Bouchat. Apparatus for removing the grease from and bleaching wool. July 14.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

- 15,423. Eckford. *See under XIII A.*
 15,611. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds containing nitrogen. July 5.
 15,823. Hill. Production of soda crystals. July 7.
 15,931. Mehan. *See under I.*
 15,995. Serpek. Production of compounds of aluminium and nitrogen. [Addition to No. 13,579 of 1906. Ger. Appl., Sept. 22, 1908.]* July 8.
 15,996. Serpek. Production of aluminium nitride. *See under I.*
 15,997. Serpek. Production of ammonia from aluminium nitride. [Ger. Appl., July 15, 1908.]* July 8.
 16,053. De Bechi and Blythe. *See under X.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 13,792 (1908). Eberhard. Increasing the mobility and reactivity of water-glass. July 7.
 15,239 and 17,976 (1908). Poehin and Richardson. Manufacture of ferrie sulphate and cakes or slabs containing ferrie sulphate. July 14.
 24,345 (1908). Langlet. Production of phosphoric acid or substances containing phosphoric acid soluble in water or citrates, from phosphatic raw materials. July 7.
 612 (1909). Leese. Manufacture of magnesite in the form of impalpable paste and of calcined magnesite therefrom. July 7.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATION.

- 15,924. Carter. Muffle kilns for firing tiles, earthenware, &c. July 8.

COMPLETE SPECIFICATIONS ACCEPTED.

- 21,260 (1908). Salamon, Grace, and Exploration Co. Preparation of china clay. July 14.
 2490 (1909). Bloxam (Hoorickx and Hendel). Manufacture of silvered glass mirrors. July 7.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

- 15,161. Metzger. Manufacture of cement from blast furnace slag.* June 29.
 15,165. Metzger. Machines for treating blast furnace slag in making cement.* June 29.
 15,649. Backus. Manufacture of artificial stone.* July 5.
 16,132. Christie. Manufacture of clay.* July 10.

COMPLETE SPECIFICATIONS ACCEPTED.

- 14,336 (1908). Kelly. Manufacture of cement. July 7.
 15,100 (1908). Kathe. Rendering artificial stone, mortar, plaster, &c., waterproof, non-conducting, and sound proof. July 14.

X.—METALS AND METALLURGY.

APPLICATIONS.

- 15,105. Nielsen. Soldering aluminium. June 28.
 15,164 and 15,165. Metzger. *See under IX.*
 15,172. Lavington (McMiken). Metallurgical furnace for use with oil, gas, &c. June 29.
 15,183. Custer. Producing from foundry iron a metal having properties of high grade tool and high speed steel.* June 29.
 15,189. Durant and Sulman. Separation of zinc from its ores or compounds. June 29.
 15,215. Johnson. Extraction of gold and other metals from ores. June 29.
 15,384. Mackintosh. Alloys. July 1.
 15,469. Wolf. Separation of metalliferous material from ores or other matter. July 2.
 15,764. Simpson and Oviatt. Manufacture of iron and steel directly from iron ores. July 6.
 15,913. Wasserfuhr. Protection of iron and similar substances against atmospheric influences.* July 7.
 15,987. Reynolds. Manufacture or forging of steel. July 8.
 15,988. Reynolds. Manufacture of steel. July 8.
 15,989. Reynolds. Manufacture of crucible steel. July 8.
 16,051. Cowper-Coles. Rendering iron surfaces non-corrosive. July 9.
 16,053. De Bechi and Blythe. Dissolving impure tin or tin alloys to obtain tin or tin compounds. July 9.

COMPLETE SPECIFICATIONS ACCEPTED.

- 12,317 (1908). Levy-Mond. Recovery of products from lead fumes or waste metallic solutions or suspensions. July 14.
 13,715 (1908). Mason. *See under XI.*
 13,964 (1908). Witter. Recovery of zinc oxide from molten slags of lead and copper smelters. July 7.
 14,399 (1908). Schumacher. Manufacture of briquettes from blast furnace slag. July 14.
 1786 (1909). Boulton (Kroeschell Bros. Co.). Crucible furnaces. July 14.
 6276 (1909). Norddeutsche Affinerie A.-G. Refining gold or gold alloys. July 7.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATION.

- 15,960. Flood. Electrolytic cell. July 8.

COMPLETE SPECIFICATIONS ACCEPTED.

- 13,715 (1908). Mason. Preventing oxidisable metals from rusting after they are electroplated. July 7.
 13,734 (1908). Cornaro. Electrodes and resistances for electric furnaces, radiators, lamps, &c. July 7.
 15,792 (1908). British Thomson-Houston Co. (General Electric Co.). Electrolytes for electrolytic cells. July 7.
 18,246 (1908). Hutton and Hutton. Electroplating and like processes. July 7.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS

APPLICATIONS.

- 15,246. Savril, Ltd., Irving, and Wilson. Washing compound or soap.* June 29.
 15,497. Boyer, Cavaillon, and Barishac. *See under III.*
 15,748. De Hempinne. Transforming oils into viscous products and manufacture of lubricating oils.* July 6.

- 15,900. Hewitt. Manufacture of soap. July 7.
 16,058. Markel, and Crosfield and Sons, Ltd. Conversion of unsaturated fatty acids or their glycerides into saturated compounds. [Addition to No. 1515 of 1903.] July 9.
 16,148. Wynberg. Recovery of waxes, fats, and oils.* July 10.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

- 15,423. Eckford. Manufacture of red lead. July 1.
 COMPLETE SPECIFICATION ACCEPTED.
 23,190 (1908). Merz. Preparation of azo pigments insoluble in oil. July 7.

(B.)—RESINS, VARNISHES.

COMPLETE SPECIFICATION ACCEPTED.

- 5709 (1909). Yaryan. Purification of rosin. July 7.

(C.)—INDIA-RUBBER.

APPLICATIONS.

- 15,299. Wallace and Morton. Artificial production of india-rubber or caoutchouc. June 30.
 15,419. Walter. Quantitative recovery of rubber solvents used in manufacture. July 1.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

- 15,028. Browning and Golder. *See under XVIII.A.*
 15,933. Mansfield Shoe Co., and Royce. Leather substitute. June 28.
 15,284. Silberrad. Dressing hides or leather. June 30.
 16,087. Lauro. Tanning apparatus.* July 9.

XV.—MANURES, &c.

APPLICATIONS.

- 15,093. Thompson (Van der Kolk.) *See under XVI.*
 15,594. Hughes. Manufacture of soluble or precipitated phosphatic manures. July 5.

COMPLETE SPECIFICATION ACCEPTED.

- 24,345 (1908). Langlet. *See under VII.*

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATIONS.

- 15,092. Thompson (Van der Kolk). Furnaces for disposing of bagasse and molasses. June 28.
 15,093. Thompson (Van der Kolk). Utilisation of waste substances in cane plantations and manufacture of manure therefrom.* June 28.

COMPLETE SPECIFICATION ACCEPTED.

- 17,961 (1908). Ephraim. Gum and process of extracting same. July 7.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

- 15,278. Porteus. Treatment of malt for mashing purposes. June 30.
 15,407. Moritz. Brewing. July 1.
 15,499. Hewitt. Aleoholic fermentation. July 2.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

- 14,998. Kunick. Reconstitution of dried milk or cream to the liquid state. June 28.
 15,028. Browning and Golder. Machinery for the manufacture of casein. June 28.
 16,133. Loring. Treatment of flour. [Addition to No. 12,780 of 1908.] July 10.

COMPLETE SPECIFICATIONS ACCEPTED.

- 14,249 (1908). Slavoff. Preparation of coagulate milk. July 14.
 15,474 (1908). Quine. Cereal products. July 14.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

- 15,079. Hogermann and Wellensiek. Clarifying and utilising municipal and industrial water, particularly waste water. June 28.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

- 15,190. Brandenberger. Manufacture of cellulose films.* June 29.
 15,281. Brandenberger. Manufacture of cellulose films.* June 30.
 15,306. Lilienfeld. Process for coating or printing with viscose. June 30.
 15,555. Meister, Lucius, und Brüning. Manufacture of the paper machine of paper having relief-like effect [Addition to No. 10,529 of 1908. Ger. Appl., July 2 1908.]* July 3.
 15,855. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of celluloid-like products.* July 7.

COMPLETE SPECIFICATIONS ACCEPTED.

- 13,994 (1908). Franz. Treatment of peat fibre and its manufacture into paper and cardboard. July 14.
 14,143 (1908). Lecoenr. *See under V.*

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

- 15,303. Cross. Manufacture of chloramine derivative. June 30.
 15,525. Wellcome and Barger. Manufacture of therapeutic compound. July 3.
 15,526. Wellcome and Barger. Manufacture of physiologically active base. July 3.
 15,552. Rose and Siddall. Rotary machine for extracting essential oils from limes, lemons, bergamots, & July 3.

COMPLETE SPECIFICATIONS ACCEPTED.

- 24,742 (1908). Gloystein. Manufacture of concentrated tobacco extract. July 14.
 27,038 (1908). Knoll und Co. Pharmaceutical preparations. July 14.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

- 15,363. Quick. Smokeless propellants for guns large calibre. July 1.

COMPLETE SPECIFICATION ACCEPTED.

- 12,506 (1909). Kilburn (Pieper). Explosives. July 1

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Official Notice.

INTERNATIONAL EXHIBITION, BRUSSELS, 1910. CHEMICAL TRADES EXHIBIT.

The system devised for exhibiting chemical products at St. Louis in 1904, will be followed at Brussels: it enables every exhibitor to see in his own country, beforehand, how the goods will be shown; it supplies him with evidence that they are so shown; and will relieve him of all responsibility for their transport, installation, and presentation to the jury of awards. This will be the case for a comparatively small addition *pro rata* to the general charge for space (see this J., July 15, 1909, p. 684). The method of installation at St. Louis was as follows:—In each case a model was made of the showcase, with the ground plan of its shelves; and the specimens to be shown were arranged in this model showcase in London to the exhibitor's satisfaction. A photograph of the exhibit was taken; the specimens, the bottles they were to be shown in, and the ground plan were numbered correspondingly; and, the exhibit being then dismantled, could be set up again in the same way. At the Exhibition, there was a skilled man to receive the goods, to transfer them from the strong vessels in which they had travelled, and to install them in accordance with the numbered ground-plan. A photograph of the exhibit *in situ* was then taken. Showcases will shortly be on view at the Exhibitions Branch of the Board of Trade, Queen Anne's Chambers, Westminster, and the same system will be followed for the Chemical Section at Brussels. The section will be in charge of a competent technical assistant, able to explain the merits of the various exhibits.

London Section.

THE ACTION OF SULPHURIC AND NITRIC ACIDS IN THE NITRATION OF CELLULOSE.

BY C. NAPIER HAKE AND MARCUS BELL.

(See this J., May 15, 1909, pp. 457-464.)

Messrs. HAKE and BELL write as follows in reply to the points raised during the discussion:—"The term 'pioneering action,' used in reference to the function of sulphuric acid in nitration with mixed acids, implies that the formation of a compound of cellulose and sulphuric acid is a necessary stage in the normal process of nitration; that the whole of the cellulose nitrate produced must be freed by the replacement of sulphuric by nitric acid. The results given in our contribution are opposed to this view. In Table I., Section B, the results indicate that when a proportion of sulphuric acid in the mixture is high, a comparatively large proportion of sulphuric acid is combined, but that as the time of contact is extended, the nitrogen content of the product becomes higher, the sulphuric acid combined at the same time diminishing. It is this alteration in the product is due to replacement. It is how far to solution of the sulphuric acid compound, is not clear. By varying the method of preparation, products may be obtained which have the same composition as regards nitrogen and sulphuric acid combined (see Table V.), but our later work indicates that their properties do not carry this similarity further.

"The fundamental change which is readily brought about by the action of sulphuric acid on cellulose would suggest that a nitrate formed by substitution of nitric acid radicals on sulphuric would be a body totally distinct from a nitrate formed by direct nitration, and our experiments have confirmed this.

"So far, then, is a pioneering action of sulphuric acid from being a necessary factor in the production of cellulose nitrate, that any action of this nature tends to form a different compound, of inferior stability, and, moreover, lowers the yield obtained.

"In reply to Dr. Robertson's remarks as to the relative rates of esterification of nitric acid and sulphuric acids, we would point out that, as shown in Table I., a very small proportion of nitric acid in the nitrating mixture is sufficient to retard and largely to prevent esterification by sulphuric acid, so that even when the proportion of sulphuric acid is 10 parts to 1 part nitric (making the active mass of sulphuric acid relatively very high), the action of nitration still predominates."

New York Section.

Meeting held at the Chemists' Club on Friday, May 21, 1909.

DR. CHARLES F. MCKENNA IN THE CHAIR.

DETECTION OF METHYL ALCOHOL IN ETHYL ALCOHOL.

BY ANTON VORISEK, PHARM.D.

That the detection of methyl alcohol in the presence of ethyl alcohol is not a very simple matter, would appear from the number and variety of methods devised for that purpose. Even the methods now accepted as standard present some difficulties when the task is to detect small amounts, say two per cent. or less. When the quantity of the sample available happens to be limited the detection of small amounts is almost impossible.

Before the methods of purification of wood spirit were perfected, the detection of acetone, which always accompanied methyl alcohol, was practised and regarded as sufficient evidence of the presence of methyl alcohol. Other methods for the detection of methyl alcohol since devised may be, for convenience, divided into three groups.

1. *Physical methods.*—In a method originated by Duclaux, the surface tension of the liquid is measured, and from the value obtained, the calculation of the proportion of the two alcohols made. Leach and Lythgoe (1) employed an immersion refractometer, there being an observed difference of 83.4° between the two alcohols of 91 per cent. strength. A. Lam (2) bases his method on the difference in specific gravities of methyl and ethyl iodides. Separation of a compound of methyl alcohol with calcium chloride has also been practised.

2. *Esterification.*—The production of methyl salicylate, which has a characteristic odour, is well-known, but unsuitable for small amounts. Conversion into methyl oxalate and separation of this compound was devised by Hager. Here may be also included the method of Richter and Bardy (3), in which methyl iodide, dimethylaniline and methyl violet are successively formed.

3. *Oxidation methods.*—These are the more numerous. Commonly, the products of oxidation, giving characteristic reactions, are tested, though the amount of carbon dioxide produced has served to indicate the presence or absence of methyl alcohol.

As oxidising agents, the peroxides, permanganates, chlorates with hydrochloric acid, bichromate-sulphuric acid mixture, chlorine, bromine, hypochlorites, mercuric oxide, hot copper oxide, and others have been used. Out of these, the bichromate-sulphuric acid mixture, permanganate, and hot copper oxide (on copper spiral or gauze) are chiefly employed.

(a.) *Hot copper oxide* was first used for this purpose by Mulliken and Scudder (4) who state that 1 in 5 and even 10 parts of methyl in ethyl alcohol may be thus detected, but that methyl esters, if present, give a reaction for formaldehyde. They modified and improved their method (5) in respect to testing for formaldehyde with resorcinol. This method, modified by S. P. Sadtler (6) was adopted by the U.S. Pharmacopœia, VIII. D.R. Acetic aldehyde is boiled off and the liquid tested for formaldehyde with a weak solution of resorcinol and strong sulphuric acid. Upwards of 2 per cent. may be detected. The observations of others that ethyl alcohol will, by oxidation with hot copper wire, yield some formaldehyde, especially when volatile impurities are present, have been confirmed in experiments with this method. After oxidation with hot copper oxide A. B. Prescott (7) destroyed the acetic aldehyde with hydrogen peroxide, and tested for formaldehyde with an alkaline solution of phloroglucin, as devised by Vanino (8). In the copper spiral method of L. D. Haigh (9), the liquid after oxidation is filtered, acetic aldehyde removed by boiling, and test made with phloroglucinol in a white porcelain dish. The same colour was produced even with pure ethyl alcohol.

The copper spiral method was criticised by E. Jandrier (10), who found that acrolein reacts with resorcinol like formaldehyde, and that traces of furfural will effectively cover relatively large amounts of formaldehyde. Scudder and Riggs (11) showed that many organic compounds give formaldehyde on oxidation with copper spiral, pronouncing the method unreliable.

(b.) *The potassium permanganate* method of P. Cazeneuve was modified by Habermann and Oesterreicher (12), the oxidation with $N/10$ permanganate being carried out in an alkaline solution. Limit, 5 per cent. Sanglé-Ferrière and Cuniasse (13) oxidised in sulphuric acid solution with a saturated solution of permanganate, neutralised the liquid and tested with phloroglucinol. Fendler and Mannich (14) selected and elaborated the permanganate method. They oxidise in sulphuric acid solution, in the cold, with the powdered salt, and test with morphine-sulphuric acid. The method did not give satisfaction with distillates from spirits, tinctures, or other aromatic preparations.

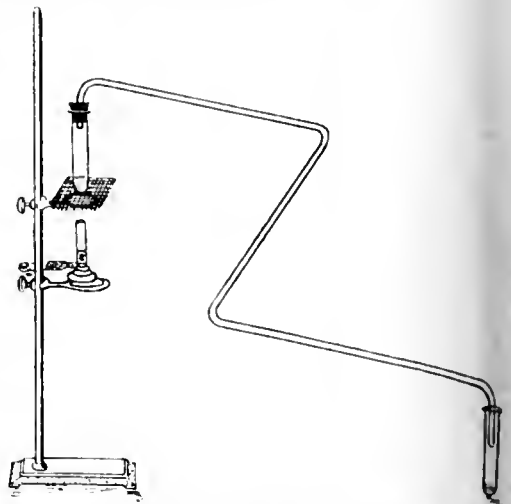
(c.) *The oxidation with the bichromate-sulphuric acid mixture* originated with J. F. Miller (15). Depending on the concentration of the reagents, temperature, and the duration of treatment, methyl alcohol will be converted into methylal, formaldehyde, or, according to Thorpe and Holmes (16), completely into carbon dioxide and water. A. Trillat (17) says that 0.5 per cent. of methyl alcohol may be detected in absolute alcohol by his rather elaborate method, in which five-hour digestion, two distillations, removal of diphenylamine with steam, and a treatment with suspended lead peroxide in acetic acid solution must be made. He modified his method for the treatment of spirits and the method was further modified by J. Wolff (18). The time of digestion was then shortened to 1 hour in the method of E. Voisenet (19), in which the two final fifths of the slowly distilled liquid are tested with albumin, hydrochloric acid, and nitrous acid. Other aldehydes react, but their colour is readily discharged by traces of hydrogen sulphide or sulphur dioxide. L. E. Hinkel (20) called attention to a rather peculiar phenomenon, namely, that if the bichromate mixture be dilute and heat applied, the amount of formaldehyde formed is exceedingly small. He adds that less than 5 per cent. of methyl alcohol cannot be detected with certainty. In his method the last three-fifths of the distillate are tested with a solution of morphine hydrochloride and strong sulphuric acid.

It was while trying the three most commonly used oxidising agents that difficulties were encountered. A reaction for formaldehyde was often obtained with ethyl alcohol alone or with distillates containing no methyl alcohol. It was not possible to detect small amounts with certainty. The "bichromate" methods were found to be the most reliable, under certain conditions, though, at best, they are neither simple nor rapid.

Since the bichromate-sulphuric acid mixture will not only produce methylal and formaldehyde, but will oxidise methyl alcohol completely (16) to carbon dioxide and water, the

use of a weak solution of chromic acid suggested itself. Trials were made with its solutions of varying concentration and without the customary sulphuric acid. The results were encouraging. Digestion at 60° C. was at first practised, but was later found unnecessary.

The method.—In the method finally devised, oxidation is made with a weak solution of chromic acid, free from sulphuric acid. The acid is mixed with a small volume of the sample and the liquid at once distilled. The distillate is tested for formaldehyde.



An air condenser. The nearly horizontal sections are 16 ins. to 18 ins. long; the middle, 14 ins.; tubing, 2 in.

It was thought that an air condenser which could be readily detached for cleaning could be employed. The kind, represented in the figure, has served this purpose admirably. In distillation it is held in position by means of a wooden test tube holder secured in a small metal clamp.

Of the numerous tests for formaldehyde, the modified Helmer's test was selected, and when used as here directed gave complete satisfaction. Liquids containing other substances should, of course, be distilled direct or after dilution with water. By using another air condenser this distillation is performed with expedition, only 5 to 15 drops of the distillate being required.

Reagents needed.—*Chromic acid solution*, in distilled water, containing 0.8 per cent. of CrO_3 , free from sulphuric acid. *Albumin solution*.—The white of one fresh egg is mixed with 50 c.c. of distilled water, filtered, and preserved with a few drops of chloroform. Less sensitive on long keeping. *Aldehyde-free milk* answers nearly as well. *Ferric chloride solution*, containing 0.4 per cent. of ferric chloride corresponding to 0.25 per cent. of iron. *Sulphuric acid*, pure, concentrated, and specially free from nitric and nitrous acids. *Pumice*, in small pieces.

Procedure.—0.5 to 1.0 c.c. of the sample of alcohol or of an alcoholic distillate is placed in a 6 inch test tube 1 c.c. of the chromic acid solution added, and the liquid diluted with water to 4 to 5 c.c. Two or three small pieces of the pumice are dropped in, the test tube connected with the condenser (see figure) and the liquid distilled into another test tube by boiling briskly over small flame. When 3 to 4 c.c. of the liquid have passed over or when only about 0.5 c.c. remains behind in the first test tube, the condenser is detached and rinsed with about 2 c.c. of distilled water, into the receiving test tube. To the distillate are added: 1 drop of ferric chloride solution, 2 drops of albumin solution, and after mixing, 4 to 5 c.c. of the pure sulphuric acid are poured in, slowly and carefully as a layer, generation of much heat being avoided. The zone of contact is then observed without disturbing the liquids, against a white background. A sharply defined, violet zone appears almost

once if the proportion of methyl alcohol is above 5 per cent. With smaller amounts but more than 1 per cent., colour shows within one minute; several minutes will be required for the colour to appear with less than 1 per cent. of methyl alcohol. Pure ethyl alcohol, treated in this manner, gives no colour. When organic impurities (other than methyl alcohol) are present which cannot be removed, a yellow to reddish colour is often obtained, but not violet. The violet colour is intensified on standing, warning, so that the entire liquid becomes coloured violet to lavender if the test tube be placed in boiling water for some time. Dilution with water will diminish the intensity of the colour, which is not affected by cerin or 50 per cent. sulphuric acid.

Albumin in strong solutions gives with concentrated sulphuric acid a variety of colour reactions. It must be used in excess, and only traces of ferric chloride could be added to obtain perfect blank tests. Various ferric salts have been recommended, but trials have shown the chloride to be the best suited. This is in agreement with the conclusions of Shrewsbury (21). 5 to 5 drops will be found a sufficient quantity of milk for the test. Commercial sulphuric acid, as used bychner (22) was found unsuitable; the acid which appeared to be tried gave no reaction with a weak maldehyde solution, with which a pure acid reacted. Investigation showed that traces of nitric or nitrous acid will affect the reaction to a marked degree and that in larger amounts the acids will prevent the reaction entirely. The other impurities of commercial sulphuric acid, arsenic, selenium, lead, and sulphur dioxide showed marked influence on the reaction.

Under the conditions here described, it was possible to detect as little as 0.001 gm. of methyl alcohol in 1 c.c. of the ethyl compound. Experiments were made with alcoholic solutions of chloroform, chloral hydrate, acetone, sulphur, phenol, resorcinol, methyl salicylate; tinctures of camellia, ginger, benzoin; soap and chloroform liniments, with negative results. A good reaction was obtained in each case when 1 drop of a 10 per cent. alcoholic solution of methyl alcohol was added. A notably different behaviour was observed with benzaldehyde, which, when treated, gave a green-blue zone; on warming, the entire liquid acquired an indigo-blue colour.

Conclusion.—If the described method has any merit and advantages they would seem to consist of the following:—

1. The use of a small quantity of the sample (0.1 c.c. of 1 per cent. methyl alcohol gave a good reaction), other than requiring 10 to 50 c.c.
2. Simplicity and ease of execution. No special apparatus is required.
3. Rapidity; 10 to 15 min. in all being consumed. Much time is thus saved when a number of tests is made.
4. Detection of small quantities, 0.001 gm., and even less.

It is hoped that the method will be found useful and that it may be modified to become of value for quantitative determination of methyl alcohol.

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- 3) Comptes. Rend., 80, 1076.
- 4) Amer. Chem. J., 1899, 21, 266 (this J., 1899, 492).
- 5) Amer. Chem. J., 1900, 24, 444 (this J., 1901, 71).
- 6) Amer. J. Pharm., 1905, 77, 106 (this J., 1905, 1128).
- 7) Pharm. Arch., 1901, 4, 86 (this J., 1901, 1030).
- 8) Pharm. Centralt., 1899, 40, 101 (this J., 1899, 403).
- 9) Pharm. Rev., 1903, 21, 404 (this J., 1903, 1370).
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- 12) Zeits. anal. Chem., 1901, 40, 721 (this J., 1902, 192).
- 13) Ana. Chim. anal. appl., 8, 82 (this J., 1903, 653).
- 14) Arbeiten a. d. Pharm. Inst. d. Univ. Berlin, 1906, III., 3 (see this J., 1905, 1128).
- 15) Allen's Organic Analysis, 3rd ed., 1, 81.
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- 20) Analyst, 1908, 33, 417 (this J., 1908, 1175).
- 21) Analyst, 1907, 32, 5.
- 22) Leach, Food Analysis, Vol. I., 140.

THE CHEMICAL SCHEDULE AND THE TARIFF.

BY R. W. MOORE.

Owing to the somewhat superficial comments often appearing in public print regarding the manner in which tariffs are framed, the idea prevails in some quarters that the tariff law is the result of incomplete consideration of the needs of the country and scanty information regarding the merchandise on which duty is levied or which is free of duty. Nothing could be further from the truth; and it is only just to our representatives in Congress and in the Senate to point not only to the immense volume of facts which they have at their command, but the masterly manner in which conflicting statements are weighed and sound and logical conclusions arrived at.

The present revision of the Dingley tariff was undertaken by the Ways and Means Committee of the House early in the summer of 1908. Under the supervision of the Clerk, Mr. Wm. K. Payne, a most thorough and painstaking quarto volume of nearly 1000 pages was prepared, with the modest title "Notes on Tariff Revision," in which each paragraph of the tariff of 1897 was separately considered, and in a parallel column such changes in the wording of the law were given in italics as were deemed necessary for its proper enforcement. No rates of duty were given, this being very properly left for Congress to determine. A skeleton tariff was then prepared, in which the weak points of the present law were noted and suggestions made to remedy the defects. In addition to this, under each paragraph a brief description of the goods was given with statements showing the amount imported per annum, the amount of duty paid, and decisions and interpretations given to the particular paragraph of the law by the Board of General Appraisers and the United States courts. To prepare this volume almost every department of the Government was consulted, while in the chemical schedule use was made of such authorities as the U.S. Dispensatory and Pharmacopœia, Watts, Allen, Thorpe, Lange, Redwood, Rensen, and many others. The amount of information thus obtained was certainly great, and derived an added value from its orderly arrangement and availability.

With this work as a basis, the Committee on Ways and Means held extended hearings on the chemical schedule and reviewed numerous briefs, most of which were published in a large volume. Anyone who has attempted to digest this book will at once see the great labour involved in reconciling the statements of so many conflicting interests, but it must be remembered that the members of the Committee are active and practical men of affairs and capable of weighing evidence. As to how many times the chemical schedule of the tariff bill was taken up and considered only the members of the Committee know. In my official capacity, I was present at three separate considerations by the Ways and Means Committee of the chemical schedule, where each item was minutely explained, the volume of imports under the present law noted, and statements regarding the effect of raising or lowering the rates of the Dingley law discussed. There was no haste, but the greatest deliberation, and when facts were wanting, time was taken to secure them. The discussions were pointed, intelligent, and indicated, especially on the part of the Chairman of the Committee, an astonishing grasp of the infinite detail of a tariff bill.

When the Committee on Ways and Means reported to the House, their work came under fire, as was to be expected. Many amendments were adopted, but in the main the chemical schedule remained as reported. Little or no change was here made in the wording, which had been particularly considered by the Committee with the view of making each paragraph clear and distinct in meaning. It is not too much to say that the chemical schedule in this respect compares very favourably with the other schedules. Loose designations and descriptions have been avoided and clear and definite terms employed. Assistance to attain this end was given by both chemists and lawyers. It is not realised as fully as it should be that the definite quality of a tariff schedule is of immense importance, both to the importer paying duty and to the manufacturer seeking protection. An indefinite low rate plus a lawsuit will often make the goods cost more to land

than a higher definite rate, while a loosely drawn provision will allow the admission at a low rate of goods similar in character to others bearing a higher rate. Thus zinc in pigs, under the Dingley tariff, pays 1½ c. per lb., but zinc dust is allowed to enter free of duty as a crude substance used in dyeing. Oxide of cobalt pays 25 c. per lb. duty, but a cobalt ceramic colour, worth about the same price, it containing lead, is entered at but 5 c. per lb. duty, under a too general paragraph designed to cover lead vermilions. The latter case is still, however, before the United States courts, and may result in establishing the higher and more uniform rate.

The treatment of the chemical schedule in the Senate was naturally very similar to that of the House, though even more attention was given to the administrative feature of the bill. Particular inquiry was directed to the exact meaning of the chemical terms used. Public hearings were not held by the Senate Finance Committee, chiefly on account of the amount of time consumed by those representing various interests when addressing the Committee, but various representative men were consulted, among them several members of the Board of General Appraisers for the administrative features, Treasury officials, and many examiners from the New York Appraisers' Office, who are personally familiar with the great variety of goods imported at this port. Further, several representative chemical manufacturers had an opportunity to be heard, and a large number of written statements from chemical manufacturers and importers were received and considered. Practically a new bill was drawn by the Senate Finance Committee, using the House bill as a basis, as the House Bill had used the Dingley Tariff Act. On its presentation to the Senate it was subjected to severe attack, though little of this was specially directed against the chemical schedule. It was claimed by its opponents that the bill contained many "jokers" or obscure provisions by which rates were raised though apparently lowered. No "jokers" were found in the chemical schedule, which passed through the contest in practically the form reported by the Committee.

An ideal tariff from an administrative standpoint is one that is framed in such a manner as to be clear and easy of interpretation. Litigation is expensive and interferes with commerce. A clear and definite rate is satisfactory to all. A careful perusal of both the House and Senate bills will show that much has been accomplished in this direction. The searching criticism of the Senate bill, which is now under way, will doubtless result in further improvement of the measure, and it is well that it should be searching, for whatever weak points are discovered and remedied will add to the real strength of the law when further tested in the courts.

The rates of duty of the House and Senate bills are still under consideration, and any attempt to consider their bearings on chemical industry would have but a temporary value. In general there was a substantial reduction in the House bill and a tendency towards partially restoring the Dingley rates in the Senate bill. The final results promise to be close to a middle course with a leaning towards the lower rates. The enormous difficulty of enacting a tariff bill must be noted. When it is considered that everything that is capable of importation must be provided for, and in such a manner as to bear a proper relation to everything else, that arguments *pro* and *con* are submitted in countless number, and that the revenue-producing feature must be kept continually in mind, the magnitude of the task can be seen. Courts listen to arguments respecting one kind of merchandise at a time, but the Committees of Congress consider whole schedules of the tariff in a day. The statements of attorneys must be presented to the court in proper form; the Committee hear and read statements of all kinds and practically at all times. To bring an orderly law from this chaos requires great clearness of mind and grasp of detail. Not even a perfect law would escape violent criticism, and satisfactory though it might be in principle, it would be years before its character could be fully appreciated. It is highly probable that the manner of framing the tariff law, though subject to the most hostile criticism, is as good as is provided for under our laws, and that the compromises which are so unfavourably regarded have as

much wisdom in them as many of the court decisions which are received with universal respect. A body of lawyers would probably draw a bill that no body of officials could administer without calling in one or more lawyers at every step and causing a vast amount of uncertainty and litigation. A body of Government officials would probably draw a bill that would win every case that the Government had ever lost. A body of specialists would draw a law in which the lawyers would find more loopholes than law. A body of manufacturers would probably draw a bill that would finish for all time the ultimate consume while the bill drawn by a body of chemists and exper would probably not be written in the English language and would be somewhat greater in volume than Webster Unabridged Dictionary; but mix all the foregoing together and something of value would result. Repeat this process several times and a workable tariff would be obtained but at an expenditure of time which would be beyond forecast.

The often suggested remedy, that of a tariff commission may or may not be the solution. The success of commissions is not on the whole flattering. Any tariff bill must represent a consensus of opinion, the wider the better. A commission can hardly do this. It is prone to proceed in its own way, which may be laborious and scientific and yet fail of its end. The complex nature of the problem is the chief difficulty. The lawyer, expert, Customs official, chemist, and economist should all be felt in the tariff. Information is not lacking. The Government possesses to-day in the Treasury, State, Agriculture and Commerce and Labour Departments a colossal mass of facts on almost every item of the tariff. What is needed in my opinion, is the proper and orderly arrangement of these facts by a body of men whose conclusions would amount to demonstrations in order that Congress, when exercising its legal functions in enacting a tariff, should be able to obtain the whole truth on each and every item.

UTILISATION OF MAGNESIA IN THE PREPARATION OF OILS IN POWDER FORM.

BY OTTO B. MAY.

In magnesia has been found a substance with which castor oil may be mixed, without in the least affecting its properties. The castor oil magnesia powder contains 50 per cent. of the oil, and is stable, tasteless, odourless, readily taken, and well borne. Its therapeutical efficacy is as great as the same dose of pure castor oil, and the magnesia contributes its own properties to the powder.

The use of magnesia as an excipient to convert liquid into dry or semi-dry substances is not new. The U.S. Pharmacopoeia of 1890 contains a preparation—the *massa copaiba*—which was prepared by heating magnesia water, and copaiba balsam until a plastic mass was obtained. On using more magnesia than the formula asks for a copaiba powder would result. It is further more known that with glycerin, sugar, and stearol magnesia forms solid masses, which can be reduced to powder. In all these cases, however, the magnesia combines chemically with the substances with which it is mixed. In the castor oil powder the oil is in no way changed, that is to say, castor oil powder is not magnesia soap of castor oil. No glycerin or free fatty acids (except those present in the original oil) can be found, as would be the case if saponification had taken place. On extracting the castor oil powder with ether in the Soxhlet apparatus from 96 to 98 per cent. of the entire fat content may be recovered. The fact that not all of the oil is thus extracted at first gave rise to the thought that at least a part of the oil was saponified. To settle this question the powder was rubbed up with water and enough hydrochloric acid added to decompose the magnesia. The resultant liquid was then shaken out with ether. In this way all the oil incorporated was recovered. The examination of the oil extracted in the Soxhlet apparatus or extracted after decomposition of the powder with acid differed only in the one point, that the acid value of the former was zero; all other constants were the same as those of the

ginal oil. On mixing the castor oil with magnesia, the free fatty acids present in the oil are neutralised, forming minute quantities of magnesia soap, which acts as a kind of catalytic agent, emulsifying the balance of the oil and distributing it very thoroughly. On drying the paste formed by mixing castor oil, magnesia, and water, the oil globules do not unite again, but remain the state of the original fine subdivision. On examining the powder under the microscope with a magnification of 450, very few fat globules can be observed, almost the entire amount of oil having been absorbed so firmly that no oil separates out when the powder is mixed with hot or cold water and allowed to stand.

Mr. D. T. ATKINS (of Messrs. Eimer and Amend), described the working of the new Emerson bomb calorimeter, giving figures showing its efficiency as compared with the standard Mahler bomb calorimeter. He also explained the working of the Barnes telephone pyrometer, with the galvanometer and telephone receiver, indicating its advantages over some similar pyrometers. The Wanner pyrometer was also shown. A further exhibit consisted of a collection of fused silica ware, including dishes, muffles, tubing, and other laboratory appliances, and also a variety of fused alumina ware, such as muffles, crucibles, combustion bulbs, tiles, bings, &c., which are recommended for metallurgical and other high temperature experiments. Other exhibits were a Williams modified Westphal specific gravity balance for liquids and solids, and a new graphite rotating cathode for the rapid electrolytic termination of metals.

Sydney Section.

Meeting held at Sydney on Wednesday, May 12, 1909.

PROFESSOR SCHOFIELD IN THE CHAIR.

A RAPID AND ACCURATE METHOD OF ESTIMATING IRON IN IRON ORES.

BY J. S. MACLAURIN, D.S.C., AND W. DONOVAN, M.S.C.

Anyone who has had experience in the estimation of iron in magnetites and hematites must have frequently experienced difficulty in getting the iron into solution within a reasonable time. Such difficulties led one of us to subject the ore to a preliminary heating in hydrogen gas. The iron could then be readily dissolved in hydrochloric acid, reduced by stannous chloride, and estimated volumetrically. In these estimations, however, potassium permanganate could not be used if really accurate results were required, owing to the disturbing effect of hydrochloric acid, and consequently it was necessary to employ the bichromate method, which has the serious defect of requiring an external indicator. These defects have been entirely removed by modifying the process, which is now carried out in the following manner.

A weighed quantity of finely ground ore is introduced into a hard glass bulb tube by means of a small copper spoon (made of thick copper foil bent into the desired shape and soldered to a stout piece of copper wire). The bulbs, carrying narrow glass tubes, are then fitted into the ends of the tube. Should the ore contain organic matter, air is drawn through the tube by means of a rubber pump or aspirator, and the bulb heated to redness for a few minutes, being gently rotated backwards and forwards during the heating. It is then allowed to cool, the air current stopped, and a stream of hydrogen or carbon gas substituted. This is lighted at the exit end of the small glass tube. Should hydrogen be used, the bulb may be prevented from closing up by the use of a platinum tip, made by rolling a small strip of platinum round the end of the tube. After heating for from 15 to 30 minutes, according to the nature of the ore; the

tube is allowed to cool, the stream of hydrogen or carbon gas shut off, and the reduced ore shaken into a flask containing one or two grams of sodium bicarbonate and a little water. Any ore remaining in the tube is washed into the flask with dilute sulphuric acid. By this means sufficient carbon dioxide is evolved to fill the flask, and so prevent oxidation of the iron. In order to still further guard against oxidation, the flask is closed by a rubber cork carrying a short exit tube and an inlet tube which dips beneath the surface of the solution in the flask, through which a steady stream of carbon dioxide is allowed to flow from a Kipp apparatus. The flask is then heated, and the solution boiled for from 5 to 20 minutes, according to the ease with which the iron dissolves. This operation requires little or no attention, and can be carried out while another sample is being heated in the bulb tube. When all the iron is dissolved, the solution is allowed to cool in the air, or more rapidly by closing the exit tube with the finger and allowing water to flow over the outside of the flask, the carbon dioxide apparatus being still, of course, attached. It only remains to shut off the carbon dioxide, remove the cork from the flask, wash the tubes with a little water, and titrate the solution with potassium permanganate.

This process gives very constant results, duplicate determinations agreeing excellently. Thus, in estimating the iron in 55 samples of limonite, the greatest difference in the duplicate determinations, which were made quite independently of one another, was 0.22 per cent. of iron, and the average difference only 0.09 per cent. In many of these determinations, after titrating with permanganate, the solution was reduced with sulphuretted hydrogen, the excess of this gas being removed by passing carbon dioxide through the boiling solution (Hillebrand's method). The iron so reduced was then estimated by titration with permanganate, and in every case the result so found agreed closely with that previously found by our method. This agreement shows that the whole of the iron dissolved out of the reduced ore goes into solution as a ferrous salt, and is therefore estimated in the subsequent titration. Moreover, the residues contained no iron. This was proved by fusing with sodium and potassium carbonates, and testing for iron.

We had thus conclusive proof of the accuracy of our results, but for the sake of comparison with other methods, the following determinations on five limonites were made. The results given under A are by our method. Those under B were determined by dissolving in hydrochloric acid and stannous chloride, adding mercuric chloride to remove the excess of stannous chloride, phosphoric acid and manganese sulphate to improve the conditions for titration, and finally titrating with permanganate. In column C of the table, the results were obtained by dissolving in hydrochloric acid, reducing with lead and copper sulphate, and titrating with potassium bichromate.

The results are percentages of iron.

A.	B.	Difference from A.	C.	Difference from A.
44.03	43.13	-0.90	43.42	-0.61
49.21	49.06	-0.15	49.29	+0.08
36.57	36.99	+0.42	36.66	+0.09
26.73	26.46	-0.27	26.78	+0.05
35.52	35.97	+0.45	36.02	+0.50

Mean diff. from A. -0.09 Mean diff. from A. +0.02

The titration in the case of B is not nearly so satisfactory as in A, owing to the presence of a large amount of precipitate, which somewhat masks the ending. Duplicates by this method differ to a much greater extent than do those by the A method. In making determinations by method C the solution of the ore is very slow—sometimes taking hours to accomplish, and, owing to the necessity for an external indicator, the titration is not nearly so simple and satisfactory as in the A method.

Our method is thus shown to be well adapted for the estimation of iron in limonites. It may also be used with advantage for the much less soluble magnetites, ilmenites, hematites, &c. In this case the ore requires fine grinding

and half an hour's reduction in hydrogen; coal gas cannot be used, as it does not give complete reduction. If the hydrogen be made from commercial zinc, it should be purified from antimony and arsenic, which interfere with the subsequent titration. The purification is most simply effected by passing through a hard glass tube wrapped in thin sheet asbestos, and heated to redness by a long flat burner. The tube should be from 15–18 ins. long, and about $\frac{1}{2}$ in. in diameter, reduced to $\frac{1}{4}$ in. or less for 4 or 5 ins., to allow of the ready deposition of antimony and arsenic. It is interposed between the source of hydrogen and the hard glass bulb tube in which reduction of the ore takes place. This treatment removes all but minute traces of arsenic and antimony, and these may be got rid of by passing the hydrogen through one or two wash bottles containing glass wool saturated with chromic acid.

Using this method we got the results given in column A of the following table. Those shown under B were obtained from the same solution in the following manner. After titrating with permanganate (for A determinations) the solutions were reduced by hydrogen sulphide (Hillebrand's method), the excess removed by carbon dioxide, and again titrated with permanganate. The results so obtained are shown in column B. As a further check on these figures, the ore was fused with sodium and potassium carbonates, dissolved in sulphuric acid, reduced by means of sulphuretted hydrogen, &c., as before, and titrated with potassium permanganate, the percentages of iron so found being shown in column C. Or it was fused as before, dissolved in hydrochloric acid reduced by stannous chloride, and titrated with bichromate, the results being shown in column D.

	A.	B.	C.	D.
Magnetite, Taranaki, N.Z.	59.62	59.90	60.02	59.75
" " "	57.75	—	57.72	—
" " Quebec, Canada	64.34	—	—	64.12
" " France, . . .	67.17	67.24	—	67.34
Ilmenite, Norway . . .	43.48	—	43.53	—
Micaceous iron ore	57.39	—	—	57.50
Hematite, Ohio, U.S.A.	61.18	61.24	—	—

These figures are sufficient to show that our method gives very satisfactory results for such refractory ores as magnetites and ilmenites. For these ores it has the further merit of making the estimation of titanium quite a simple matter. This is done by adding hydrogen peroxide to the solution after the permanganate titration, and estimating the percentage of titanium by comparison with a standard solution of that substance. By this means, 9.12 per cent. of titanium dioxide was found in the Taranaki magnetite, as against 9.27 per cent. obtained by fusion. Moreover, it was found that none of the insoluble residues contained more than minute traces of titanium.

To recapitulate very briefly, the process consists of the following steps:—(1.) Roasting the finely ground ore. (2.) Reduction of the roasted ore by heating in coal-gas or hydrogen. (3.) Solution of the reduced ore in dilute sulphuric acid in an atmosphere of carbon dioxide. (4.) Titration of the resulting solution by potassium permanganate. The advantages of the process over those commonly employed are the removal of any organic matter which might interfere with the subsequent titration, the ease and completeness with which the ores are dissolved, the accuracy of the titrations, and the possibility of estimating titanium in the same solution.

NOTE.—Since writing this paper our attention has been drawn to the fact that a somewhat similar method is described in Crookes's Select Methods in Chemical Analysis, 3rd Edition. That method we find involves the use of a porcelain tube and platinum boats. It requires from four to six hours for four determinations, and it admittedly fails to extract the whole of the iron when dealing with magnetites, this being due no doubt to incomplete reduction.

In our method, on the other hand, much simpler apparatus is used, complete reduction is easily and quickly obtained in the rotating bulb tube, the whole of the iron goes into solution, and the determination is made accurate and reliable by purifying the hydrogen. This was found to be a very important step in the process, because when using unpurified hydrogen, results differing from the true value by several per cent. were sometimes obtained.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Treating materials with air or other gases or vapours for drying, bleaching and other purposes. Toulinson-Haas, Ltd., Manchester. From F. Haas, Ges.m.b.H., Lennep, Germany. Eng. Pat. 14,914, July 2, 1908.

THE claim is for improvements in the apparatus described in Eng. Pat. 15,108 of 1903 and consists in providing valves by means of which any one or more of a series of drying chambers can be cut out of the drying system, and atmospheric air, which may be first moistened if desired, can then be drawn through the chambers so cut out of the series. Further, a portion of the air drawn through the apparatus may be circulated through certain of the chambers to admit of its being used continuously.

—W. H. C.

Packing pieces for chemical absorption, condensing and like towers. E. P. Peyton, Birmingham. Eng. Pat. 18,831, Sept. 8, 1908.

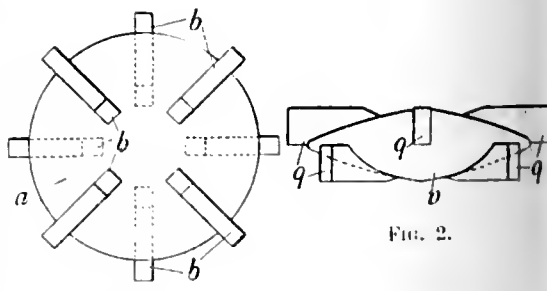


FIG. 1.

FIG. 2.

THE packing pieces have the form shown in plan in Fig. 1, and in cross-section in Fig. 2. They consist of a circular or polygonal central portion, *a*, having curved surfaces provided both above and below with projecting radial ribs or bearers, *b*.—W. H. C.

Apparatus and tools; Manufacture of —. Siemens und Halske A.-G., Berlin. Eng. Pat. 19,564, Sept. 17, 1908. Under Int. Conv., Sept. 26, 1907.

THE alloys of tungsten and nickel, containing more than 60 per cent. of tungsten and more than 1 per cent. of nickel (see Fr. Pat. 393,595 of 1908; this J., 1909, 149), are employed for making apparatus, tools, &c., which are exposed to chemical attack.—T. F. B.

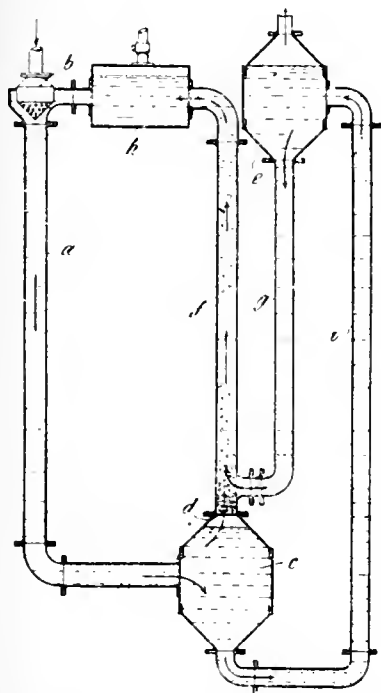
Fire extinguishing compounds. E. M. Davidson, New York. Eng. Pat. 3704, Feb. 15, 1909.

THE claim is for a fire-extinguishing compound consisting of a solution of hydrochloric acid, sulphur dioxide and carbon dioxide in carbon tetrachloride.—W. H. C.

Centrifugal separator. T. S. Patterson, Rosemont, Pa., Assignor to The Oil and Waste Saving Machine Co., Philadelphia, Pa. U.S. Pat. 926,596, June 29, 1909.

THE claim is for a perforated cage or frame which fits into the drum or bowl of the machine and can be withdrawn and opened out for the purpose of removing the materials treated.—W. H. C.

Separation of gases by absorption by a circulating liquid; Apparatus for the —. M. Honigmann, Ger. Pat. 211,065, Nov. 29, 1907.



THE apparatus is shown in the figure. The absorbing liquid flows down the pipe, *a*, sucking in the gas through the rose, *b*, and then flows in succession, with the entrained gas, through the receptacle, *c*, the pipe, *i*, the receptacle, *e*, the pipes, *g* and *f*, and the receptacle *h*. The unabsorbed gas flows upwards through the screen, *d*, and the pipe, *f*, and assists the circulation of the liquid; it may be withdrawn from the receptacle, *h*. The absorbed gas passes with the liquid into the receptacle, *e*, to which may be connected any suitable means for removing it.—A. S.

II.—FUEL, GAS, AND LIGHT.

Vertical retorts; The Glover and West — at St. Helens. H. G. Colman. J. Gas Lighting, 1909, 106, 632-637; 107, 166.

THE retorts are 20 ft. high and oval in cross-section, 24 ins. by 12 ins. at the top increasing to 30 ins. by 16 ins. at the bottom. Each retort is capable of carbonising

2½ tons of coal per 24 hours and they are worked continuously, the coal being fed into the upper end by gravity from a charging hopper which is refilled at intervals, and the coke being continuously removed from a horizontal plate, which is fixed just below the lower opening, by a rotating blade or "wiper" into a receiving hopper from which the coke is withdrawn at intervals. The retorts are set in a furnace and heated by gas from an external producer. In order to obtain regular and uniform heating, the furnace is divided into a number of sections by horizontal partitions, the supply of air and gas to each section being controlled separately. The lower 3 feet of the retort are not heated but serve as a cooling chamber for the coke, the secondary air being conducted through flues arranged around this portion so that it becomes heated. Very little heat remains in the coke when discharged, so that only a small amount of water is required for quenching. The gas leaves the retort by a horizontal pipe situated near the top. The results of two trial runs with different qualities of coal, carried out under the supervision of the author, are given below in tabular form.

	I.	II.
Kind of coal	Orrell nts.	Thornley coal.
Locality	Lancashire.	Durham.
Percentage of ash in coal	6.94	3.24
Percentage of moisture in coal	3.95	1.08
Yield of gas in cub. ft. per ton ..	11,448	13,102
Average illuminating power, in candles	16.28	15.56
Calorific power in B.Th.U. gross ..	588.8	573.6
Do. do. net	529.6	514.5
Average composition of the gas—		
Carbon dioxide	1.97	1.00
Unsaturated hydrocarbons ..	2.70	2.85
Oxygen	nil	0.05
Carbon monoxide	9.90	8.70
Methane	31.97	29.05
Hydrogen	50.67	54.70
Nitrogen	2.73	3.20
Yield of coke in cwts. per ton, moist ..	14.8	15.6
Do. do. dry	14.2	14.2
Percentage of ash in coke	10.8	4.8
Do. moisture do.	4.0	9.5
Fuel used in gas generator, as percentage of dry coke	12.06	12.3
Yield of tar in gallons per ton ..	17.2	12.3
Sp. gr. of tar	1.076	1.119
Quality of tar	thin	rather thicker
Water in tar, per cent.	5.0	—
Composition of tar freed from liquor—		
Percentage by weight of light oils distilling up to 170° C.	3.0	3.7
Percentage of middle oils distilling from 170°–270° C.	27.0	20.2
Percentage of heavy oils distilling from 270°–350° C.	23.8	23.1
Percentage of pitch remaining at 350° C.	15.9	52.6
Percentage of naphthalene	4.5	4.8
Percentage of free carbon	2.5	4.2
Yield of ammonia equal to lb. ammonium sulphate per ton ..	33.4	26.7
Yield of cyanogen as Na ₄ Fe(CN) ₆ ·10H ₂ O, lb. per ton ..	5.5	5.3
Total sulphur in gas after purification with oxide only, grains per 100 cub. ft.	37.5	20.8
Naphthalene in purified gas, grains per 100 cub. ft.	—	2.7

The advantages of the vertical retort are summed up as follows:—increased yield of gas, tar and ammonia per ton of coal carbonised; coke of better quality obtained; no trouble with stopped ascension pipes; increased yield of gas per retort and on same ground space; improved labour conditions and considerably reduced cost of labour; great economy and saving in first cost of land and buildings, and lastly, reduced wear and tear in retorts.—W. H. C.

Carbon bisulphide; Removal of — [from coal gas]. J. Matwin. J. für Gasbeleucht., 1909, 52, 602–604.

GAS free from sulphuretted hydrogen and containing 98 to 122 grms. of sulphur per 100 cub. m. was passed through wood charcoal in a tube 80 cm. long and 13 cm. in diameter. The quantity of sulphur in 10 cub. m. of the gas was reduced by passing it through 1 kilo. of

charcoal, to 29.2 grms. per 100 cub. m. The calorific value of the gas was not affected, but the candle-power was reduced from 13 to 12 Hefner units. The charcoal can be regenerated by soaking it in water and afterwards drying it at 50° C. The action of various solvents on the crude gas was as follows:—

Solvent.	Quantity of sulphur in 100 cub. m. of the washed gas.
	grms.
Anthracene oil mixed with 10 per cent. of fish oil	58.8
Anthracene oil mixed with 10 per cent. of turpentine oil	61
Anthracene oil mixed with 10 per cent. of amyl alcohol	59
Anthracene oil mixed with 10 per cent. of acetone	53.6
5 grms. of colophony dissolved in 15 grms. of linseed oil and mixed with 80 grms. of anthracene oil	60.0
Colophony dissolved in alcohol and mixed with anthracene oil	53.8
Concentrated solution of colophony in benzene and anthracene oil	56.6
10 grms. of colophony dissolved in 90 grms. of anthracene oil	64.3
Colophony dissolved in 4 parts of linseed oil	26.5
Rape oil	34.1

Linseed oil and rape oil absorb the heavy hydrocarbons as well as the carbon bisulphide.—A. T. L.

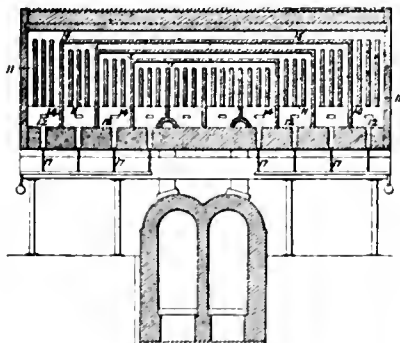
PATENTS.

Anthracite dust; Agglomeration of — by the products of distillation of coal. J. Dybowski. Fr. Pat. 398,232, Dec. 31, 1908.

ANTHRACITE dust is ground and mixed with tar, and the mass is heated in a retort until the retort is brought to a red heat and no more gases are evolved. After cooling, the product is broken into pieces of convenient size.

—A. T. L.

Coke-oven. W. M. Person, Sparrows Point, Md. U.S. Pat. 926,285, June 29, 1909.



THE vertical heating flues, 11, are divided into groups by the vertical walls, 14; opposite pairs of groups are connected by horizontal flues, 15; and each group has a separate combustion chamber, 12, to which gas is supplied by the pipes, 17.—W. H. C.

Creosote or similar substance; Use of — for internal-combustion engines. C. Rodriguez. Fr. Pat. 397,847, Dec. 24, 1908.

THE patent is for the use of crude creosote or similar substances in engines of the Diesel type, in place of petroleum where this is difficult to obtain.—A. T. L.

Fuel for use in place of petrol for motor-car and similar engines. G. Thuillier. Fr. Pat. 398,239, Mar. 18, 1908.

THE patent is for the use of wood-charcoal in a suitable gas-producer so as to obtain a continuous supply of clean producer gas. The apparatus required is light, since a shallow fuel bed is sufficient and no purifying apparatus is necessary.—A. T. L.

Producer gas; Process for enriching — in carbon monoxide by introducing carbon dioxide into the producer. H. Trachsler and F. Ernst. Ger. Pat. 211,575, May 15, 1908.

LIMESTONE or other carbonate is mixed with the fuel supplied to the producer.—A. S.

Tar; Process for the separation of — from gases obtained from combustible materials. C. Otto und Co., Ges.m.b.H. Ger. Pat. 211,577, Oct. 8, 1908.

IN the production of gas from combustible materials, such as coal, the portion of gas obtained in the last stage of the operation is almost or entirely free from tar. According to the present patent, this portion of the gas is led off separately from the major portion evolved earlier, which latter is freed from tar by one of the known methods, and then mixed with the smaller portion of the gas collected separately.—A. S.

Carbon bisulphide; Method of removing — from gases. M. Mayer, Karlsruhe, Germany and A. Fehmann, Basel, Switzerland. U.S. Pat. 926,273, June 29, 1909.

THE gas is treated with a mixture of aniline or other suitable liquid amine and a metal oxide, or compound, in order to absorb carbon bisulphide. The spent mixture is then treated with a further proportion of the amine to cause the liberation of hydrogen sulphide.—W. H. C.

Purifying coal-gas and collecting by-products. T. Mc Watters, Hawkins, Station, Pa. U.S. Pat. 926,352, June 29, 1909.

THE gas at a temperature of about 300° F. is passed through a washer, whereby the temperature is reduced to from 90° to 70° F. and thick tar is condensed and collected separately. The gas is then passed through a condenser and the temperature further reduced to from 60° to 50° F. and strong ammoniacal liquor separated and collected. Any light tar or ammonia still remaining may be recovered from the gas by still further reducing its temperature.—W. H. C.

Phosphoretted hydrogen [in acetylene gas, etc.]; Process of rendering certain oxides and chlorides capable of absorbing —. Soc. Commerciale du Carburé de Calcium. First Addition, dated July 28, 1908, to Fr. Pat. 397,787, Mar. 6, 1908 (see Eng. Pat. 14,824, of 1908; this J. 1909, 237).

THE patent is for the use of a product containing cupric chloride or sulphate in place of a part of the mercuric chloride used according to the principal patent. As an example, the product may consist of 0.5 part of mercuric chloride, 4.5 parts of cupric chloride, 600 parts of ferric chloride solution of 45° B., 250 parts of ferric oxide, and 145 parts of dry infusorial earth.—A. T. L.

Acetylene; Purification of —. A. J. B. Jouve. Fr. Pat. 398,551, Jan. 15, 1909.

THE patent is for the use of persulphates for the purification of acetylene. These salts oxidise the impurities and are without action on acetylene itself.—A. T. L.

Automatic ignition of lighting gas; Process and apparatus for the preparation of a compound for —. C. Lubeck and M. Payet. Fr. Pat. 397,746, Mar. 5, 1908.

NATIVE hydrated cobalt oxide is mixed with cuprous chloride and heated *in vacuo* to 450° C., and a current of hydrogen or of lighting gas, previously heated to 120° C., is then passed over the mixture. The mixture is treated with hydrochloric acid so as to dissolve the cuprous chloride and to precipitate a double chloride of cobalt,

and copper, or a mixture of hydrated cobalt chloride and copper chlorides according to the conditions of the heating in hydrogen. The precipitate is allowed to settle on pieces of pumice stone which are afterwards dried. The solution is used for coating a part of the incandescent mantle, and the prepared pumice stone is made into pellets which are fixed near the burner.—A. T. L.

Incandescent electric lamps; Filaments for —. The British Thomson-Houston Co., Ltd., London, and H. H. Needham, Rugby. Eng. Pat. 23,726, Nov. 5, 1908.

THE claim is for the use of an alloy consisting of approximately 40 per cent. of cadmium, 40 per cent. of mercury and 20 per cent. of bismuth as a binder to mix with tungsten or other suitable refractory metal to form a "squirting mixture" from which the lamp filaments are pressed.

—W. H. C.

Filaments for electric and other incandescent lamps; Manufacture of — from tungsten and other refractory metals. O. E. Picquet. Fr. Pat. 398,010, March 12, 1908.

THREADS or fabrics of cotton or other fibre are impregnated with insoluble compounds of tungsten or other refractory metal, and the treated threads or fabrics are dried and heated in an atmosphere of hydrogen. The process of impregnation is carried out, in the case of tungsten, for example, by passing the threads alternately through a solution of a soluble tungstate and through an acid bath.

—A. T. L.

Incandescent lamps; Manufacture of flat metallic filaments for —. Deutsche Gasglühlicht Akt.-Ges. (Auerger.). Fr. Pat. 398,247, Jan. 2, 1909. Under Int. Conv., Jan. 2, 1908.

THE filaments are formed in the usual manner by squirting through circular orifices, and are then flattened by passing them between rollers. The flattened filaments are carbonised and finished in the ordinary way.—A. T. L.

Fuel for heating; Manufacture of —. T. Parker. Fr. Pat. 397,867, Aug. 5, 1908.

SEE Eng. Pat. 15,872 of 1907; this J., 1908, 930.—T. F. B.

Smoke; Apparatus for washing — and for inducing draught. J. Black, A. H. and H. Lennox. Fr. Pat. 398,394, Dec. 17, 1908.

SEE Eng. Pat. 14,693 of 1908; this J., 1909, 510.—T. F. B.

Producer-gas; Manufacture of —. W. J. Crossley, Openshaw, and T. Rigby, Fairfield, Manchester. U.S. Pat. 926,729, July 6, 1909.

SEE Eng. Pat. 28,181 of 1906; this J., 1908, 67.—T. F. B.

Gas from wood; Process of manufacturing —. B. Loomis, Hartford, Conn., and H. Pettibone, New Rochelle, N.Y., Assignors to Power and Mining Machinery Co. U.S. Pat. 927,418, July 6, 1909.

SEE Eng. Pat. 6302 of 1904; this J., 1904, 602.—T. F. B.

Gas producers; Generator for use with suction —, for use with bituminous or other coal. R. V. Farham. Fr. Pat. 397,985, Dec. 29, 1908.

SEE Eng. Pat. 5793 of 1907; this J., 1908, 326.—T. F. B.

Incandescence mantles; Refractory, indestructible filament for —. R. Laigle. Addition, dated March 19, 1908, to Fr. Pat. 382,749, Oct. 11, 1907.

SEE Eng. Pat. 9622 of 1908; this J., 1908, 620.—T. F. B.

Disposal of house refuse. Eng. Pat. 23,765. See XVIII B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Crude petroleum; Changes in — effected by diffusion through clay. D. T. Day and J. E. Gilpin. J. Ind. and Eng. Chem., 1909, 1, 449—455. (See this J., 1900, 890, 1005; 1908, 1105).

IN addition to unsaturated hydrocarbons, the asphaltic and sulphur compounds present in Texas petroleum are retained with great readiness when the oil is allowed to diffuse through clay (fuller's earth). Semi-solid paraffin hydrocarbons, on the other hand, are found in oils which have diffused so far through the clay as to become appreciably lower in specific gravity. It is suggested that the substances in colloidal suspension are retained by the clay more readily than those in true solution in the oil. This view is to some extent confirmed by partially successful attempts to precipitate asphaltum from its suspension in petroleum by addition of an electrolyte.—A. S.

Asphaltum in dark mineral oils; Use of "standard benzine" for the determination of —. Holde. Mitt. kgl. Materialprüfungsamt Gross-Lichterfelde West, 1909, 27, 143—148.

ASPHALTUM in dark mineral lubricating oils is determined by dissolving the oil in 40 times its volume of light petroleum, and separating the insoluble residue. The light petroleum to be used for this purpose is supplied by Kahlbaum, of Berlin, to a specification of a Committee of the German Union for Testing Technical Materials. This "standard benzine" is to be uniform as far as possible, free from unsaturated and aromatic hydrocarbons, with the sp. gr. 0.695—0.705 at 15° C.; at least 95 per cent. must boil between 65° and 95° C. Some analyses of the benzine supplied during the last few years are given in the paper; unsaturated and aromatic hydrocarbons are determined by shaking the benzine with fuming sulphuric acid, when the loss should not exceed 2 per cent. In testing successive batches on the same mineral lubricating oil, it was found that the asphaltum present in the latter increases slightly on keeping.

—A. G. L.

Gooch crucibles for asphalt analysis. Mears. See XXIII.

PATENT.

Use of creosote in internal combustion engines. Fr. Pat. 397,847. See 11.

IV.—COLOURING MATTERS AND DYESTUFFS.

iso-Indogenides. A. Wahl and P. Bagard. Compt. rend., 1909, 149, 132—134.

THE authors have prepared further examples of *iso-indogenides* (this J., 1909, 420*) by condensing oxindole with aromatic aldehydes in alcoholic solution in the presence of a trace of piperidine. *iso-Indogenides* from the following aldehydes are described: benzaldehyde, sulphur yellow needles, m. pt. 175—176° C.; anisaldehyde, yellow needles, m. pt. 157° C.; *m*-nitrobenzaldehyde, orange leaflets, m. pt. 255°—257° C.; *p*-dimethylaminobenzaldehyde orange yellow needles, m. pt. 194°—195° C.; this dyes wool in orange yellow shades; salicylaldehyde, yellow needles, m. pt. 195° C.; *m*-hydroxybenzaldehyde, yellow needles, m. pt. 280° C.; *p*-hydroxybenzaldehyde, small yellow crystals, above 300° C.; resorcyllaldehyde, small yellow needles, m. pt. above 300° C.; protocatechualdehyde, small compact crystals, m. pt. 246° C.; this dyestuff gives yellow shades on an aluminium mordant, a greenish-brown on iron, yellowish-brown on chromium, thallium, zirconium, and yttrium, and orange on titanium.

—J. C. C.

* In the above as in its original, for "Bayard" read "Bagard."

Tannic and gallic acids; Application of methods for the determination of — to extracts of various tanning materials. [Manufacture of inks]. F. W. Hürichsen and E. Kedesdy. Collegium, 1909, 233—237, 242—248.

IT has been previously shown that the content of tannic and gallic acids in iron-gall inks can be ascertained by acidifying the sample with hydrochloric acid, extracting with ethyl acetate, evaporating the extract *in vacuo*, and

weighing the residue. If necessary, the actual amount of tannic and gallic acids in the residue can be determined by titration with iodine solution or with copper sulphate solution, or colorimetrically by means of ammonium molybdate. Comparative experiments with extracts of gall nuts, myrobalauns, divi-divi, pine, oak, and mimosa, showed that with gall nuts, the evaporation residue of the ethyl acetate extract consisted wholly, and in the case of myrobalauns and divi-divi, mainly (from % - 1), of tannic and gallic acids. It extracts from which the portion insoluble in ethyl acetate had been removed, were used in the manufacture of inks, it would not be possible to detect, by chemical analysis, the substitution for gall nuts of other tanning extracts capable of giving a blue coloration with iron compounds. The German Official Regulation (Aug. 1, 1888), according to which, inks belonging to Class I, must be prepared from gall nuts, is thus valueless. Moreover Schluttig and Neumann have shown that inks prepared from extracts of myrobalauns, valonia, and sumac, and from hæmatoxylin are not inferior to those prepared with pure tannic acid with respect to intensity of colour and permanence of tint.

—A. S.

PATENTS.

Soluble blue for laundry and other purposes; Preparation of —. H. B. Binko and N. Mayer, London. Eng. Pat. 14,126, July 3, 1908.

ONE part by weight of indigo is treated with 4 parts of sulphuric acid and the solution is diluted with 16 parts of water. It is then filtered, and to the filtrate are added 4 parts of common salt and 2 parts of farina, dextrin, or gum. After standing for 3 days, the surplus water is drained off, leaving 16 parts of "soluble blue" paste. The paste, in addition to its use as a laundry blue, can be employed as printing ink for producing blue designs on cloth, metal, &c.—F. M.

Dyestuffs of the galloxyanin series; Manufacture of new blue to violet —. Chem. Fabr. vorm. Sandoz, Basle, Switzerland. Eng. Pat. 6272, Mar. 16, 1909. Under Int. Conv., Oct. 31, 1908. Addition to Eng. Pat. 6270 of 1909.

THE process described in the main patent for producing new dyestuffs by the action of resorcinol upon an alkaline solution of galloxyanin, may with advantage be carried out in the absence of air and taking one molecular proportion of resorcinol to two molecular proportions of galloxyanin. The product then consists of one molecule of the new condensation product and one molecule of leuco-galloxyanin; the latter can be recovered in a very pure condition.—P. F. C.

Tetrazo-dyestuffs; Production of new substantives —. Soc. pour l'Ind. Chim. à Bâle. Second Addition, dated Mar. 11, 1908, to Fr. Pat. 337,449, Dec. 5, 1903.

CLAIM is made for tetrazo-dyestuffs obtained from the tetrazo-compounds of diamines of the general formula,



O, S, --NH.CO. , $\text{--NH.CH}_2.$, $\text{--CH}_2.$, --O.CO.O. , --NH.CO.NH. , or --NHCS.NH. -groups and R and R' are identical or different radicals such as



The dyestuff prepared from the tetrazo-derivative of *pp*-diaminodiphenyl ether, $\text{NH}_2\text{C}_6\text{H}_4\text{O.C}_6\text{H}_4\text{NH}_2$, and 2:5-aminonaphthol-7-sulphonic acid in alkaline solution dyes cotton in bluish-red shades which become deep violet-blue when diazotised and developed on the fibre with β -naphthol. When *m*-aminobenzoyl-2:5-aminonaphthol-7-sulphonic acid is used, the resulting dyestuff gives blue-red shades on cotton which on further treatment as above turn to a bright scarlet. The tetrazo derivative of thioaniline gives, with 2:5-aminonaphthol-7-sulphonic acid, a dyestuff dyeing cotton in blue-red shades which become violet on diazotisation and development with β -naphthol on the fibre. *m*-Aminobenzoyl-*m*-phenylenediamine (prepared by condensing *m*-nitraniline with *m*-nitrobenzoyl chloride and reducing the product) gives, when tetrazotised and combined with 2:5-amino-

naphthol-1:7-disulphonic acid in alkaline solution, dyestuff producing orange shades on cotton, and on diazotising and developing on the fibre with β -naphthol a pure blue-red is obtained. The same tetrazo-compound when combined with *m*-aminobenzoyl-2:5-aminonaphthol-7-sulphonic acid gives a dyestuff producing red shade on cotton passing into red-orange on further treatment on the fibre. The mixed disazo-dyestuff, obtained from the same tetrazo-compound and one molecular proportion of 2:5-aminonaphthol-7-sulphonic acid and one *m*-aminobenzoyl-2:5-aminonaphthol-7-sulphonic acid dye cotton in red shades passing into a brownish Bordeaux on further treatment on the fibre.—J. C. C.

Fat dyestuff; Process for preparing a red — either as such or on the fibre or on another substratum. Gea. 1 Chem. Industrie in Basel. Ger. Pat. 211,696, Nov. 5, 1907. Addition to Ger. Pat. 205,377, Jan. 17, 1907.

THE process is similar to those described in the original patent (see Eng. Pat. 344 of 1908; this J., 1908, 399) and in Ger. Pat. 210,813 (this J., 1909, 790), except that acenaphthenequinone is applied in the form of its bisulphite compound, and is heated with 3-oxy-(1)-thio naphthene or its 2-carboxylic acid, in aqueous solution or suspension, with addition of alkali, either alone or in presence of fibres or fabrics or substrata suitable for lake-formation. T. F. B.

Chlorotoluidinesulphonic acid; A new —, and process of preparing dyestuffs therefrom. Badische Anilin und Soda Fabrik. Fr. Pat. 398,602, Jan. 18, 1909. Under Int. Conv., Nov. 26, 1908.

2-ACETYLAMINO-1-METHYLBENZENE-5-SULPHONIC acid is mixed with water and chlorine passed in at 0° C. Hydrochloric acid is then added and the whole boiled in order to remove the acetyl group. 3-Chloro-2-amino-1-methylbenzene-5-sulphonic acid separates as a pale red crystalline precipitate. When this new acid is diazotised and combined with β -naphthol, an orange dyestuff is obtained which gives a yellowish-orange lake with barium chloride. On condensing sodium dioxycarbonate with 3-chloro-2-hydrazino-1-methylbenzene-5-sulphonic acid in aqueous solution, the resulting dyestuff as well as the lakes prepared from it furnish very pure citron yellow shades. When 3-chloro-2-amino-1-methylbenzene-5-sulphonic acid is diazotised and combined with 1-*p*-sulphophenyl-5-pyrazolone-3-carboxylic acid in alkaline solution, a dye stuff is produced which dyes wool in pure yellow shades.—J. C. C.

Fat dyestuff of the anthracene series; Process for preparing a red —. Badische Anilin und Soda Fabrik. Ger. Pat. 211,383, July 21, 1908.

BY treating the sulphonic acid of 2-aminoanthraquinone (obtained by sulphonation with fuming sulphuric acid with acid oxidising agents, a dyestuff soluble in water which dyes red shades from the vat, is produced. It is quite different from the green dyestuff obtained by sulphonating the oxidation products of 2-aminoanthraquinone.—T. F. B.

Colouring matters of the anthracene series; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine Germany. Eng. Pat. 24,604, Nov. 16, 1908.

SEE Fr. Pat. 396,583 of 1908; this J., 1909, 596.—T. F. B.

Monazo dyestuff; Production of an insoluble —. Badische Anilin und Soda Fabrik. Fr. Pat. 398,378, Jan. 9, 1909. Under Int. Conv., Aug. 10, 1908.

SEE Eng. Pat. 28,272 of 1908; this J., 1909, 304.—T. F. B.

β -Naphthylindigo; Process for preparing bromine substitution products of —. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 397,751, March 5, 1908.

SEE Eng. Pat. 5299 of 1908; this J., 1908, 1147.—T. F. B.

Vat [thioindigo] dyestuffs; Process of making red —. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 397,796, March 7, 1908.

SEE U.S. Pat. 892,897 of 1908; this J., 1908, 804.—T. F. B.

Dyestuffs of the anthracene series and intermediate products therefor; Production of new —. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 398,015, March 12, 1908.

SEE Eng. Pats. 7583 and 13,057 of 1908; this J., 1908, 1015, and 1909, 85.—T. F. B.

Anthracene dyestuffs; Production of new — and of new primary compounds suitable for their manufacture. Soc. pour l'Ind. Chim. à Bâle. First Addition, dated Mar. 18, 1908, to Fr. Pat. 398,015, Mar. 12, 1908.

SEE Eng. Pat. 7583 of 1908; this J., 1908, 1015.—J. C. C.

Sulphide dyestuffs; Process of producing compounds soluble in water, containing —. Act.-Ges. f. Anilinfabr. Fr. Pat. 398,685, Jan. 21, 1909.

SEE Ger. Pat. 209,850 of 1908; this J., 1909, 650.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

Silk; The world's trade in —. Zeits. Seide, 14, 324; Z. angew. Chem., 1909, 22, 1474.

THE total consumption of silk is estimated at 25 million kilos. Ten years ago the consumption was 15 million kilos, nearly all in Europe, since at that time America imported very little raw silk, but acquired the manufactured material from Europe. The production has increased only slightly in Europe, but to a greater extent in China and Japan, the latter country producing about half as much again as 10 years ago. The most important increase has however taken place in Asia Minor, which supplies now practically the whole of the European imports, whilst the Japanese exports go almost exclusively to America, which country now no longer supplies its market with European silk, but buys as much raw silk as did the whole of the world together 15 years ago.—A. S.

PATENTS.

Dyeing machines and the like. J. T. Hanson, Huddersfield. Eng. Pat. 13,226, June 22, 1908.

IN dyeing machines of the "Rhodes" type in which wool, yarn, or other fibrous material is supported during treatment upon canvas or wire gauze, the canvas or gauze is kept clean only with difficulty. It is therefore proposed to construct the false bottom in the form of a grating, of parallel iron bars, the bars being wider at the top than at the bottom.—F. M.

Dyeings on furs, hairs, feathers, etc.; Process for producing dark brownish-red —. Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 211,567, July 20, 1907.

FURS, hairs, feathers, and similar articles, mordanted or not, are treated with a solution of nitro-*p*-phenylene-amine in presence of an oxidising agent, such as hydrogen peroxide. Without mordants, Bordeaux-red shades are produced, whilst with mordants various shades of brownish to black-brown are produced.—T. F. B.

Reserves under Thioindigo Red, indigo, and sulphide dyestuffs; Process for producing —. Kalle und Co., A.-G. Ger. Pat. 210,682, May 23, 1906.

WHITE or coloured reserves under thioindigo, indigo, or sulphide dyestuffs are obtained by printing the material with a thickened aromatic nitro-compound, which is efficiently soluble in water or the thickening mixture, drying, and then padding or printing with an alkaline mixture containing Thioindigo Red, indigo, or a sulphide dyestuff, and finally steaming and washing. As an example of a white reserve under Thioindigo Red, the following mixture is given:—100 grms. of sodium *o*-nitrotoluenesulphonate, 800 grms. of gum solution (1:1), and 100 grms. of water.—T. F. B.

Canned fabric with finish coating and process of making same; Artificial —. E. Weinheim, New York. U.S. Pats. 926,525, 926,526, and 926,527, June 29, 1909.

A SOFT fluffy pad of vegetable fibres is impregnated with a solution of potassium bichromate and dried. A "leather-

fyng" composition, containing viscous animal matter, vegetable oil, animal fat, a hydrocarbon, a metallic oxide, and a saponifying agent, is then forced into it under continued pressure and heat. The composition coagulates and the fibres are thus covered with an insoluble coating. The fabric is next dried and a layer of the composition suitably coloured, is applied to its surface and subjected to heat and pressure to render it insoluble. The material thus obtained may be finally varnished and calendered.

—P. F. C.

Bleaching; Process of —. F. Fuhrmann, Assignor to L. F. Neirath, Berlin. U.S. Pat. 927,457, July 6, 1909.

SEE Eng. Pat. 15,137 of 1907; this J., 1908, 682.—T. F. B.

Sodium peroxide for washing and bleaching; Process of making —. F. Gruner. Fr. Pat. 398,293, Jan. 5, 1909. Under Int. Conv., Feb. 29, 1908.

SEE Eng. Pat. 1150 of 1909; this J., 1909, 663.—T. F. B.

Dyeing half-wool fabrics; Process for —. L. Cassella und Co. Fr. Pat. 397,919, Dec. 24, 1908. Under Int. Conv., Jan. 6, 1908.

SEE Eng. Pat. 270 of 1909; this J., 1909, 471.—T. F. B.

Reducing agents; Process for producing new — for use in printing and dyeing textile fibres and fabrics. A. Ashworth. Fr. Pat. 398,189, Dec. 24, 1908.

SEE Eng. Pat. 17,734 of 1908; this J., 1909, 88.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Sodium 4/3-carbonate. J. Habermann and A. Kurtenacker. Z. anorg. Chem., 1909, 63, 65—68.

BESIDES the normal carbonate and bicarbonate, two other carbonates of sodium have been described in the literature, namely the sesquicarbonate, $\text{Na}_2\text{CO}_3 \cdot 2\text{NaHCO}_3 \cdot x\text{H}_2\text{O}$, and the 4/3-carbonate, $\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$. Natural soda was formerly supposed to consist of the sesquicarbonate, but Chatard (Amer. J. Sci., [3], 38, 59) found that American trona had a composition corresponding to the 4/3 carbonate, and stated also that the methods prescribed for the preparation of the sesquicarbonate always gave the 4/3 carbonate together with some bicarbonate. In the authors' experiments, a solution of sodium bicarbonate, saturated in the cold, was boiled in a flask through which a strong current of air was passed, until crystals began to separate. The residue was dissolved in a small quantity of water, and hot 96 per cent. alcohol added until a turbidity was produced. On cooling, leaflets of normal sodium carbonate separated. The mother liquor, when again treated in a similar manner with alcohol, yielded needle-shaped crystals of the 4/3-carbonate. The same product was also obtained by leading carbon dioxide into a boiling solution of normal sodium carbonate until crystals began to separate, and then treating with alcohol as before. The authors therefore conclude that the 4/3-carbonate is the only one intermediate between the normal carbonate and the bicarbonate, which is capable of existence or at all events which can be isolated. A carbonate of potassium corresponding to sodium 4/3-carbonate is not produced under analogous conditions.

—A. S.

[But, according to Deville and Divers, J. Chem. Soc., 1870, 23, 190, the corresponding ammonium salt can be obtained in this way.]

Potash Syndicate; Renewal of German —. Oil, Paint, and Drug Rep., Aug 2, 1909. [T.R.]

THE German potash syndicate has been provisionally renewed until Dec. 31st, 1910. The acquisition of the Solldstedt and Aschersleben mines by the International Agricultural Corporation of America created some difficulty, and the Syndicate opened negotiations for taking over the contracts, at the same time letting it be known that, if the Syndicate were not renewed, the German Government would levy an export duty on potash equivalent

to about £4 a ton on concentrated salts. This apparently had the desired effect, but the position is one of great uncertainty.

Potassium carbonate; Hydration of —. De Forcrand. *Compt. rend.*, 1909, **148**, 1731—1734.

AFTER referring to the uncertainty existing with respect to the different hydrates of potassium carbonate, and hence the lack of precision in the use of this salt as a dehydrating agent, the author shows that from saturated solutions the hydrate with 1.5 mols. of water separates at all temperatures between 10 and 75° C., and also from the solution saturated at 130° C., when cooled to 75° C. The crystals when apparently dry contain 1.62–1.99 per cent. of water, but they yield a moist powder, which after being dried in a current of inert gas at 30° C., contains 1.5 mols. of water. The saturated solution of the hydrate at 15° C. has the composition, $K_2CO_3 \cdot 7.2H_2O$, and the sp. gr. 1.57. When heated in a current of inert gas at 100° C., the hydrate gradually loses the whole of its water, without any indication of the formation of a hydrate with 1 or 0.5 mol. of water. The heats of solution (at 15° C.) of anhydrous potassium carbonate, of the hydrate, $K_2CO_3 \cdot 1.5H_2O$, and of the saturated solution, $K_2CO_3 \cdot 7.2H_2O$, are +6.382, –0.654, and –0.020 cal., respectively, so that on passing from the anhydrous salt or the hydrate to the saturated solution, the thermal effect is +6.402 cal. in the first case, and –0.634 cal. in the second. Hence, the hydrate is of no use as a dehydrating agent, and in order to obtain the greatest effect with the anhydrous salt, such a quantity should be used as will yield the hydrate with 1.5 mols. of water.—A. S.

Nitrates; Detection of small quantities of — in presence of bromides. Villedieu. *J. Pharm. Chim.*, 1909, **30**, 66—67.

FROM a mixed solution of nitrates and bromides, the latter are precipitated almost completely as lead bromide by means of excess of solution of basic lead acetate. After filtering, the excess of lead is removed by means of sodium sulphate. After again filtering, the filtrate is treated with an equal volume of sulphuric acid. This acid liquid affords the usual reaction for nitrates with ferrous sulphate and sulphuric acid, and other reactions for nitrates which are obscured by the presence of bromine.—J. O. B.

Perchlorates; Reduction of — by titanium sesquisulphate. A. Stähler. *Chem.-Zeit.*, 1909, **33**, 759.

ACCORDING to the author, perchlorates cannot be determined satisfactorily by boiling in sulphuric acid solution with titanium sesquisulphate solution, and titrating the excess of trivalent titanium left, as, even when the whole operation is carried out in an atmosphere of carbon dioxide, appreciably more titanium is oxidised than corresponds with the perchlorate. Good results are obtained, however, if the chloride formed is determined. The author deems it incorrect to apply the term "titanous salts" to salts of trivalent titanium. Titanous salts are salts of bivalent titanium, which have recently been prepared in aqueous solution by the author and H. Georges.—A. G. L.

Lead phosphates; Contribution to the knowledge of —. H. Alders and A. Stähler. *Ber.*, 1909, **42**, 2261—2270.

STÄHLER and SCHARFENBERG (Ber., 1905, **38**, 3869), asserted that the precipitate caused by solutions of sodium phosphate in aqueous solutions of lead salts at ordinary temperatures, consists of mixed crystals, and that the mixture becomes homogeneous when boiled with water, tribasic lead phosphate being formed. The authors have now prepared three distinct phosphates of lead, and establish the fact that it is impossible to prepare pure lead phosphate by precipitating a solution of a lead salt with excess of alkali phosphate at ordinary temperatures, since under these conditions the precipitate always includes a considerable quantity of alkaline salt not removed by boiling with water. *Tribasic lead phosphate*, $Pb_3(PO_4)_2$, is prepared either by precipitating an excess of lead acetate with a small quantity of sodium phosphate at 100° C., or by boiling the dibasic salt in water for 5–6 hours. The compound obtained in either case, forms an amorphous white powder. *Dibasic lead phosphate*, $PbHPO_4$, is

readily prepared by precipitating a somewhat dilute solution of lead nitrate with hot dilute phosphoric acid (about 25 per cent. H_3PO_4), at 100° C. The compound separates as a fine crystalline powder. The dibasic salt entirely converted into the tribasic compound by prolonged boiling with water, the crystals of the former suffering disruption. *Monobasic lead phosphate*, $Pb(H_2PO_4)_2$, prepared in the pure state by dissolving the dibasic salt in concentrated phosphoric acid (90 per cent. H_3PO_4), with the aid of heat, and allowing the solution to crystallise. A recrystallisation from phosphoric acid frees the compound from traces of the dibasic salt. The salt forms fine needles, stable in air. It is decomposed by cold, very readily by boiling water, forming first the dibasic, and finally the tribasic salt. The tribasic salt is only stable at a very low concentration of phosphoric acid, the dibasic salt already beginning to form in the presence of 0.046 per cent. of phosphoric acid. The dibasic salt possesses the greatest stability in the presence of free phosphoric acid. The monobasic salt is only stable in the presence of highly concentrated acid, slight alterations in the degree of concentration sufficing to determine its conversion into the dibasic salt.—E. C. V. E.

Bismuth bromide; Hydrolysis of —. R. Dubriay. *Compt. rend.*, 1909, **149**, 122—124.

PURE bismuth bromide was prepared by igniting crystallised bismuth nitrate, and dissolving the resulting oxide in hydrobromic acid free from bromine. This liquid was treated with water under various conditions, and the various phases were determined by precipitating the bismuth as sulphide, and titrating the free hydrobromic acid with alkali, using methyl orange as indicator. The author found: (1), that increase of temperature had no appreciable effect on the hydrolytic dissociation of bismuth bromide; (2), representing graphically the contents of bismuth and of hydrobromic acid under different conditions of hydrolysis, a continuous curve was obtained, from which the phase rule indicated that only one bismuth oxybromide had been precipitated in the course of the experiments.—O. R.

Chromic oxide; Red colloidal solution of —. H. W. Wondstra. *Z. Chem. Ind. Kolloide*, 1909, **5**, 33.

CHROMIC hydroxide was dissolved in acetic acid, the solution evaporated to dryness at 40° C. *in vacuo*, the residue dissolved in water and the solution dialysed. The liquid finally obtained appeared clear and brown-red in transmitted light, and dirty-green in reflected light. On passing an electric current through the liquid, it was shown to be electropositive. The red colour disappeared from the vicinity of the positive electrode, a lilac tint taking its place. A second solution of chromic hydroxide was obtained by dissolving this substance in acetic acid and steam-distilling the solution until a green precipitate was produced. The liquid was then diluted with cold water and filtered after some time. The filtrate showed properties similar to those of the first solution, but was coagulated by an electric current, green flocks being produced. Neither solution was coagulated by adding electrolytes. Acids merely produced green solutions of chromium salts.—A. G. L.

Iodine; Determination of — gravimetrically by the action of metallic silver. F. A. Gooch and C. C. Perkins. *Amer. J. Sci.*, 1909, **28**, 33—39.

IODINE may be determined gravimetrically, either in a neutral solution or in a solution made alkaline with a bicarbonate, by shaking the solution with metallic silver, in the presence of potassium iodide, in a closed flask filled with hydrogen, and determining the increase in weight of the silver. The best form of silver, and the one most easily prepared in the pure state, is that deposited electrolytically, upon a small oscillating cathode of platinum, from a solution of silver nitrate, the platinum anode being enclosed in a porous cell. The flask containing a weighed quantity of silver is shaken, so as to give the liquid a rotary motion, until the colour due to iodine vanishes (15–25 mins. for 0.65 grm. of iodine in 50 c.c. of liquid); the liquid is then diluted and filtered

rough a Gooch crucible, and the residue of silver and
 Iver iodide washed, dried at 130°—140° C., and weighed.
 —F. SODX.

PATENTS.

caustic alkali; *Process for the electrolytic manufacture
 of — with simultaneous obtaining of bromine.* H.
 Kossuth. Ger. Pat. 211,068, Jan. 23, 1908.

THE process consists in using an alkali chloride solution
 of catholyte and a solution containing both chlorides and
 bromides, e.g., the final liquors from the manufacture
 of potassium chloride, as anolyte. By suitably regulating
 the flow of the anolyte in accordance with its content of
 bromides, no chlorine, but only bromine is produced at
 the anode.—A. S.

Lapiesite in the form of an impalpable paste or powder;
*Manufacture of —, and of calcined magnesite there-
 from.* J. Leese, Manchester. Eng. Pat. 612, Jan. 11,
 1909.

THE process is based on the discovery that "amorphous"
 distinguished from "crystalline" magnesite is com-
 pletely disintegrated by treatment with a comparatively
 small quantity of acid diluted sufficiently to wet the whole
 of the rock. The proper quantity of acid to be used
 must in each case be determined by preliminary experi-
 ment, but at least 1 fluid oz. of liquid must be present
 for every 4 oz. of magnesite. The magnesite is used in
 the form of lumps. When all the acid added has been
 neutralised, water is added to the mass, and the magnesite
 is run out in the form of a "milk" from the decomposition
 vessel, in which any grit remains behind, this "milk"
 is run on to filters, washed and dried at a temperature
 not exceeding 150° C. Or else, it is ignited to form
 magnesia. Hydrochloric, nitric, or sulphuric acid may
 be used for the decomposition; hydrofluoric acid or a
 soluble fluoride may be added in cases in which it is
 desired to remove silica.—A. G. L.

Hydrated magnesia; *Process of preparing concentrated*
 —. W. S. Morrison, Oakland, Cal. U.S. Pat.
 926,280, June 29, 1909.

THE claim is for the process of preparing a concentrated
 magma of magnesium hydroxide which has been thoroughly
 freed from the precipitating reagent and consists in mixing
 the magma with water, boiling, agitating, settling and
 draining off the water each day for several successive
 days. Finally the strained mass is concentrated by
 heating with constant agitation. The product should
 be an unctuous, moist and plastic mass, free from grit-
 tiness, having a specific gravity of about 1.13 and the
 individual particles forming the magma should measure
 from 1/5000 to 1/10,000 of an inch in diameter.—W. H. C.

Chlorine; *Method of causing — to act on liquids or
 suspensions which are to be chlorinated or oxidised.*
 E. A. F. Düring. Ger. Pat. 211,066, July 29, 1908.

THE direct use of liquefied chlorine in the preparation of
 hypochlorites, etc., has been accompanied with great
 difficulties. These are claimed to be overcome by the
 process described. The liquid or suspension to be treated
 is kept in vigorous motion in a closed vessel, and the
 liquefied chlorine is introduced in the form of a fine rain
 through jets which do not come in contact with the liquid.
 The way of carrying out the process is to circulate the
 liquid to be treated continuously through a closed tower,
 provided with plates, balls, or the like to assist the distri-
 bution, and introduce the liquefied chlorine through fine
 jets projecting laterally into the tower.—A. S.

Water-glass; *Process of increasing the mobility and
 reactivity of — by means of chemical admixtures.*
 R. Elberhard, Munich, Germany. Eng. Pat. 13,792,
 June 29, 1908. Addition to Eng. Pat. 12,980, June 17,
 1908.

SEE Eng. Pat. 391,682 of 1908; this J., 1908, 1152.—T. F. B.

Sulphur; *Process of recovering —.* W. Feld, Zehlend-
 dorf, and A. Jahl, Hönningen on Rhine, Germany.
 U.S. Pat. 927,342, July 6, 1909.

SEE Fr. Pat. 387,438 of 1908; this J., 1908, 810.—T. F. B.

Hydrogen phosphide; *Process for rendering certain oxides
 and chlorides capable of fixing —.* Soc. Commerciale
 du Carbone de Calcium. Fr. Pat. 397,787, March 6,
 1908.

SEE Eng. Pat. 14,824 of 1908; this J., 1909, 237.—T. F. B.

Gases of different densities; *Separation of —, especially
 for increasing the proportion of oxygen in the air.* A.
 Tavernier and C. E. George. Fr. Pat. 398,712, Jan. 22,
 1909.

SEE Eng. Pat. 2029 of 1908; this J., 1909, 365.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Clay; *Liquefaction of — by alkalis, and use of fluid clay
 casting in the ceramic industry.* E. Weber. Trans.
 Eng. Ceram. Soc., 1908-9, 8, 1—22.

THE plasticity of clay is probably due to colloidal
 substances, organic as well as inorganic. These colloids,
 such as aluminium hydroxide, iron oxide, silicic acid,
 and humic compounds, can exist in solution as well as in
 a gelatinous condition, so that the plasticity of clay may
 be destroyed by dissolving the colloids. This can be
 effected by adding small quantities of alkali, but the process
 is retarded by the quantities of salts, especially sulphates,
 which a clay can absorb, and which precipitate the colloids.
 When this difficulty is overcome, it is possible to cast
 sanitary and fireclay goods of great size and thickness,
 despite the coarsely powdered and specifically heavy
 substances such as grog, shale, quartz, corundum, which
 are added to fireclay. To obtain the requisite fluidity,
 each clay must be treated on its own merits. The appli-
 cation of heat may be serviceable in some cases, whilst
 with other clays, which contain much colloidal silicic acid,
 the colloids are gelatinised on heating. Casting is very diffi-
 cult with some clays because they gelatinise immediately
 they are at rest in the mould, so that the superfluous
 material cannot be removed without damage to the slip
 or to the mould. Where this gelatinisation cannot be
 rectified chemically, it is necessary to increase the propor-
 tion of water, whereas a good casting slip should contain
 very little more water than is needed for pressing or
 throwing; that is, about 15 to 20 per cent. The plaster
 mould absorbs the greater part of the alkalis used for
 liquefaction, hence the influence of alkalis on the refractory
 qualities of the ware need not be feared. The water and
 alkalis may be removed from the slips quickly by electro-
 osmosis. The bottom is connected with the negative
 pole, and the top with the positive pole of a source of
 current, and a very small current is sufficient to cause the
 water and alkali to collect at the bottom. In this way
 clay slips can be very quickly dried. Liquefaction is best
 effected by means of sodium and potassium hydroxides,
 ammonia, and the sodium, potassium, and ammonium
 salts of weak acids, such as carbonic, phosphoric, oxalic,
 and boric acids. The salts of the stronger acids (sulphuric,
 nitric, hydrochloric, and acetic acids, etc.) retard lique-
 faction. Of the divalent bases, those soluble in water,
 e.g., barium and calcium hydroxides, precipitate colloids,
 though under certain conditions they may influence
 liquefaction favourably. Vigorous stirring is essential in
 all cases. This new method of casting has been in use for
 four years. It can be used for the manufacture of blocks
 for glass and gas furnaces, locomotive boxes, retorts and
 zinc muffles. Attempts are now being made to cast the
 large crucibles used in the manufacture of steel, which hold
 twenty tons of molten metal, in one piece.—H. H. S.

Enamels; *The function of fluorine compounds in —.*
 M. Mayer and R. Hays. Chem. Zeit., 1909, 33, 758.

THE authors criticise Bock's work (this J., 1908, 900).
 Comparison of the analyses of finished enamels with the
 composition calculated from the ingredients used, shows
 that a large part of the fluorine added remains in the
 enamel. Thus, for two enamels, one containing 51, the
 other 65 per cent. of silica, to which 6.8 and 4.8 per cent.
 of calcium fluoride were added, the losses of fluorine after
 melting amounted to only 20.2 and 23.8 per cent.

respectively. In another case, in which cryolite as well as fluor spar was added, only 11.85 per cent. of the total fluorine was volatilised. Cryolite possesses the power of clouing enamels, and can replace tin oxide to a large extent for this purpose. The authors confirm Ruff and Plato's experiments, according to which the melting-point of fluor spar is above 1400° C., and not, as recently stated by Vogt, about 900° C.—A. G. L.

PATENT.

Silvered glass mirrors. Eng. Pat. 2490. See XIX.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Fireclay goods; Glazing of porous — A. B. Searle. Trans. Eng. Ceram. Soc., 1908 9, 8, 31—45.

Bricks and tiles are the simplest forms of glazed fireclay articles; more complicated is a lavatory basin with a back of more than four inches, while a bath is the most difficult of all. When separate pieces have to be fitted together, it is important, for uniformity in colour, to have them as large as possible, so that the number of separate pieces is reduced to a minimum. It is less easy to glaze a brick made of compressed dust than one made of the same clay by the plastic process. Re-pressing of "finished" goods before glazing is not necessary, though in the case of bricks it is the simplest method of giving them a good shape and surface. The pressures used are often excessive. The best size of grain of the body depends chiefly on the nature of the firing. Sometimes it is advantageous to use a larger proportion of grog ground up a little more finely. The clays of the Southern Midlands do not take the glaze in the green state (without previous biscuiting) so well as the northern clays. The latter, if biscuiting before glazing, give a very rough surface. The glazed bricks and wall-facings of the future will probably be composed of a more or less vitrified body, but goods of this class cannot be regarded as fireclay, and are not porous. At present, most manufacturers favour a porosity as high as 15 per cent. With regard to the glaze, it is more important in building ware that it should not craze than that it should be free from lead. Seger's formula for white-ware glazes is, $RO, 0.1-0.4Al_2O_3, 2.5-1.5SiO_2$, and for porcelain glazes, $RO, 0.5-1.25Al_2O_3, 5-12SiO_2$. For leadless glazes on bricks and sanitary ware fired at 1300° C., the author suggests the formula, $RO, 0.9-1.1Al_2O_3, 5-7SiO_2$. These glazes are not simple silicates, but the replacement of part of the lime by barium sulphate enabled a firm to use a glaze which had a rational formula with whole numbers instead of fractions. Such glazes, however, cause devitrification, though they are useful when crystalline effects are wanted. The engobe, the slip placed between the body and the glaze, is generally most satisfactory when its composition is the arithmetical mean of the compositions of body and glaze. The excessive grinding of glazes has a detrimental effect on their adhesive power in the kiln, causing "curling." Colouring oxides cannot be too finely ground, but for most purposes the glaze need only be fine enough to pass through a No. 200 sieve.—H. H. S.

Heat-insulating materials; Efficiency of — C. R. Durling. Engineering, 1909, 88, 37—38.

A NUMBER of commercial laggings have been tested with the apparatus previously described (this J., 1907, 1297), and curves are given showing the relation between the amount of heat escaping per sq. ft. per hour and the internal temperature of the apparatus. With material intended for steam-pipe or boiler coverings, the outer surfaces were exposed to convection and radiation, in order to imitate practical conditions, it being pointed out that conductivity tests, in which the material is placed between two surfaces, give results which apply only to enclosed laggings, as used in cold stores, etc., the loss of heat through a lagging with exposed surface being

upwards of 10 per cent. greater. A comparison of the results with different thicknesses of the same lagging shows, that at low temperatures the saving effected by the use of a thicker lagging is much less marked than at high temperatures; also, at a given temperature, the additional saving effected by successive increments of thickness is a diminishing quantity, the economic limit under given conditions, being readily ascertained by comparing the extra saving, as shown by the curve and the cost for successive thicknesses. The insulating power of some materials, such as magnesite and blue asbestos fibre, is found to improve as the temperature is increased, and it is quite possible for a material at low temperatures to give results inferior to those obtained with another material and yet to be superior to the other at high temperatures, a point of importance in selecting a lagging for pipes conveying highly superheated steam. A curve is also given for a slag-wool lagging, illustrating the fact that a porous solid is a better insulator than an air-space or the same material in a non-porous form, and it is recommended that in all cases the most suitable density should be determined experimentally.—F. SODS

Hydraulic cements; The setting of calcareous — W. Michaelis, sen. Z. Chem. Ind. Kolloide, 1909, 5, 9—22.

THE hardening of hydraulic cements is, according to the author, due entirely to the formation of colloidal compounds practically insoluble in water. Of these compounds calcium silicate is by far the most important, calcium aluminates and ferrites playing similar but very subsidiary rôles. On gauging Portland cement with water, a saturated solution of calcium hydroxide, aluminate, ferrite and sulphate is obtained almost at once, from which needle-shaped crystals are soon deposited, as the water necessary for solution is taken up by adjacent particles of the cement. So far the process is analogous to the setting of plaster of Paris, and, if the hardening of cement consisted solely in this, the resulting mass of crystals consisting of the compounds mentioned above, to which calcium carbonate and calcium sulphoaluminate are added later, would be as little resistant to the prolonged action of water as plaster is. The cement particles, however, which have become deprived of lime, and made richer in acid substances by this process, soon begin to take up lime and water again from the strong solution of calcium hydroxide surrounding them, with formation of hydrated colloidal calcium silicate, aluminate and ferrite. The water is given up again by these hydrated colloids to fresh particles of cement; the lime remains adsorbed. As more lime is taken up, whilst water is lost, the hydrated colloids set to firm and hard colloids and this process constitutes the true hardening of hydraulic cements. The whole process can be watched under the microscope, as described by Le Chatelier, Ambronn, and others.

A number of direct experiments are adduced in support of the above theory. Thus, Portland cement treated with a large quantity of water and prevented from setting by shaking, loses lime until approximately monocalcium compounds of silica, etc., are left. If this leached cement is then shaken with a saturated solution of lime-water, a small quantity of lime is taken up, and the particles swell enormously in size. If, on the other hand, the leached cement is cautiously covered with the saturated lime-water, so as not to disturb the particles, lime is also taken up, a marked change in colour from brown to white takes place, but instead of swelling, the particles become firm and set together.

Magnesia is a practically inert substance in cement, since its solubility in water (1 in 55,000 parts) is too small to allow of the formation of a solution sufficiently basic to enable the silica to withdraw it from solution and so to form colloidal magnesium silicate. The presence of alkalis in general delays the setting of cement, as they tend to form soluble silicates. Alkali carbonates also delay the setting by precipitating inert calcium carbonate as fast as the lime goes into solution, and thus delaying the formation of the strong solution of calcium hydroxide necessary. The action of other substances is explained on the same lines.—A. G. L.

silicofluorides and Portland cement. M. Merkulow. Ingenieur, 1909, 28, 114; Tonind.-Zeit., 1909, 33, 871—872.

CUBES (7×7×7 cm.) of normal Portland cement mixed in different proportions of sand were allowed to harden for 2—3 days, and then repeatedly immersed for 2—5 hours in a solution of zinc silicofluoride (zinc "fluoride"), after drying for at least 24 hours, the treated cubes were kept in air or water for different periods, or repeatedly frozen, and the compression tests obtained compared with those furnished by similar cubes not treated with the silicofluoride solution. The results obtained are summarised in the following table, the results being stated in per cent.

Treatment.	Mixture 1:1.		Mixture 1:2.		Mixture 1:3.		Mixture 1:4.	
	Treated.	Untreated.	Treated.	Untreated.	Treated.	Untreated.	Treated.	Untreated.
days in air.....	147	132	133	114	103	59	54	25
" " ".....	151	139	135	120	121	61	55	31
" " ".....	151	142	134	122	130	65	56	34
days in water.....	232	173	171	134	125	81	78	48
" " ".....	237	173	175	136	120	85	80	49
" " ".....	236	172	169	139	120	87	81	50
frozen 23 times.....	204	136	166	121	94	67	43	22

[Note:—1 kilo per sq. cm. = 14.2 lb. per sq. in.]

Treated and untreated cubes of the 1:3 mixture were so allowed to harden for 14 days in air, and then tested by Bauschinger's abrasion method, the disc making 200 revolutions. Three treated cubes, with an initial weight of 768—777 grms. lost 27—42 grms. by this treatment; three similar untreated cubes, weighing initially 740—743 grms., lost 318—321 grms. It is evident that the treatment increases the resistance to compression, and the hardness, of the cubes considerably.—A. G. L.

Portland cement; Decomposition of —. W. Muth. Tonind.-Zeit., 1909, 33, 841—842.

CEMENT was treated with varying proportions (from 2½ to 800 times by weight) of water, and prevented from setting by shaking continually at first. The phenomena which occurred are described in detail and practically confirm Imbronn's observations (this J., 1909, 366). When a large excess of water is used, needle-shaped crystals are reduced first, accompanied by a large increase in the volume occupied by the cement; later on a small quantity of a colloid is also formed. As the quantity of water used is decreased, the quantity of these crystals produced diminishes, as does also the increase in volume, whilst at the same time the quantity of colloid formed increases. The author concludes that only the colloid plays a part in the setting of cement, and that the formation of crystals of calcium hydroxide and of the needle-shaped crystals observed can be of importance only as regards the final hardening of the cement.—A. G. L.

Cement; CO₃'-ions; Retardation of reactivity of adsorbed —. P. Rohland. Z. Chem. Ind. Kolloide, 1909, 5, 33—35.

HEX Portland cement is digested for some time with a solution of an alkali carbonate or bicarbonate, the cement being prevented from setting by shaking or stirring, it absorbs the CO₃'- or HCO₃'- ions completely. On removing the alkali solution, and treating the cement with dilute hydrochloric acid, it is found that no evolution of carbon dioxide occurs until the concentration of the acid is increased so much that the cement dissolves as a whole. The acid ions taken up from ammonium carbonate solutions are held less firmly, and can be detected by treatment with 2N-hydrochloric acid. Cement also takes up the acid ions from solutions of borax. The author believes that these phenomena are connected with the tenacity with which sodium sulphate is retained by glass or by medium-hard-burnt bricks, long-continued extraction of the finely powdered material with water being necessary in these cases to remove the sodium sulphate.—A. G. L.

Graphite crucibles for asphalt analysis. Mears. See XXIII.

PATENTS.

Resinous cement; Process for the production of moulded masses [artificial stones, ore briquettes, etc.] by binding and hardening filling materials by —. A. Hol, Witten-Ruhr, and A. Pieper, Schmalleberg, Germany. Eng. Pat. 14,954, July 14, 1908.

IN the production of artificial paving stones, ore briquettes and the like, the filling material, for example, stones, blast-furnace slag, ore-dust, etc., is heated to remove all the moisture, and whilst still hot is mixed with a hydrocarbon solvent for the resinous binding material, such as asphaltum, which is then added and thoroughly mixed with the impregnated filling material. When thoroughly mixed, the mass is heated for some time to bring about polymeri-

sation of the solvent, so that it acquires properties similar to the resinous binding material, and no longer exists as a separate solvent body. The claims also include the moulded mass obtained from filling materials, resinous cements and hydrocarbon solvents, which solvents are finally polymerised, and objects manufactured from the mass. —W. C. H.

Cement; Manufacture of [white] —. T. D. Kelly. Forest Gate. Eng. Pat. 14,336, July 6, 1908.

FLINTS are heated to redness, and plunged into cold water. One part of the powdered silica so obtained is mixed with 2—4 parts of chalk or lime and 10—15 per cent. of common salt, and the whole calcined, a white clinker being obtained if contact with the fuel is prevented. Alternatively, clay is treated first with hydrochloric acid and then washed with water. One part of the leached clay is mixed with 2—4 parts of chalk or lime and about 10 per cent. of salt, and the whole burnt to cement. Instead of washing the clay with hydrochloric acid, this operation may be omitted, and then a larger proportion of salt (10—15 per cent. in excess of the quantity of ferric oxide present) must be used in order that the iron may be volatilised during the burning.—A. G. L.

Disposal of house refuse. Eng. Pat. 23,765. See XVIII B.

X.—METALS AND METALLURGY.

Iron and steel; Transformations of —. Grenet. Bull. Soc. Chim., 1909, 5, 758—764.

THE author combats the view that the transformation of pure iron is a phenomenon to be considered apart from the mutual solution of iron and carbon. He extends the idea of solid solution to pure bodies and considers the transformation of pure iron as a limiting case, the passing of pure iron into solid solution, just as the fusion of a pure body may be regarded as the limit of its liquid solution in other constituents, when the proportion of these approaches zero. Steels are looked upon as containing only the three constituents, ferrite, cementite, and solid solution, and the phenomena relating to them as falling in with the general case of alloys, of which the constituents can form solid solutions at certain temperatures. The law relating to the phenomena of quenching and annealing becomes general, therefore, and may be stated: an alloy, formed of several constituents, is softer, as the maximum temperature attained since the transformation which has given rise to these constituents becomes higher and

longer maintained. The quenching (rapid cooling) of an alloy, heated to a sufficiently high temperature for its constituents to form a solid solution, may lower the temperature at which the solid solution decomposes into its constituents, in which case quenching will cause hardening, or it may suppress the transformation on cooling, when the effect of quenching cannot be foreseen.

—F. SODN.

Cementation of iron by carbon in vacuo. L. Guillet and C. Griffiths. *Compt. rend.*, 1909, **149**, 125–127.

SUGAR charcoal, which had previously been heated in chlorine to 1000° C., and soft iron wire heated together in a glazed porcelain tube, which was connected with a manometer at one end, and with means for producing a vacuum at the other. It was found that if all gases were first removed from both the ingredients, cementation did not take place unless the iron and the charcoal were in intimate contact. If the ingredients were subjected to mechanical pressure, the amount of cementation increased. The action was, however, so slow that the author concluded that carbon, as such, played but a very small part in the industrial processes of cementation.

—O. R.

White scale on steel; Formation of — and the surface decarbonisation of pipe-annealed steel. C. M. Johnson. *J. Ind. and Eng. Chem.*, 1909, **1**, 459–462.

THE author describes experiments made in an attempt to discover the cause of the coarsely crystalline, white, aluminium-like scale (much lower in carbon content than the remainder of the metal), which is frequently observed on bars of steel which have been annealed in steel pipes, with charcoal, with a view of producing a frosted metallic finish free from scale. Steel having a coating of this white scale does not become hardened file-proof on the outside. Experiments in which pieces of steel were heated in presence of carbon dioxide, hydrogen, charcoal, carbon monoxide, and natural gas in a porcelain tube, and also in the tube containing only air and sealed so that air could be expelled, but no fresh air drawn in, indicated that the most active agent in producing the "bark" (surface decarbonisation) was the rust or black scale adhering to the steel, this being reduced to metal by the carbon of the steel. In a further experiment, a piece of high-carbon steel was heated at 850°–900° C. in the porcelain tube, in which was also placed a porcelain boat containing some hard semi-fused iron oxide. After 18 hours it was found that the hard mass of oxide had been converted into a loose friable substance, whilst the steel showed great surface decarbonisation. After a second heating with a fresh piece of steel, the friable substance in the boat had become light grey in colour and fibrous and was found to contain 98 per cent. of metallic iron. It is suggested that pure metallic iron could be prepared in this way from pure iron oxide by heating it in a closed tube with a sealed vent, in presence of a piece of high-carbon tool steel low in sulphur. The white aluminium-like scale on steel is produced more rapidly at temperatures above 750° C. At a temperature of about 700° C., the surface decarbonisation of steel annealed in a closed tube with a sealed vent is confined to a very thin skin, below which the steel is hardened file-proof. If the steel be polished free from rust and scale, and then annealed in a tube from which all oxygen has been expelled by carbon monoxide, no surface decarbonisation is produced and the steel is hardened file-proof.—A. S.

Iron; Passivity of —. P. Krassa. *Z. Elektrochem.*, 1909, **15**, 490–500.

AN investigation of the potential of iron in strong alkali solutions shows that with 8N–12N solution, maximum activity is reached below the boiling point or after short boiling; with 4N–8N solution longer boiling is necessary, and with still weaker solutions activity is not induced by boiling, though the iron, if once rendered active, remains so in the boiling solution, if stronger than N/1. Iron is best rendered active by boiling in strong alkali solution or by cathodic polarisation. With solutions

weaker than N/1, active iron soon loses its activity. When active iron is anodically polarised, with a weak current, in a solution of alkali at its boiling point, it remains active for a time, but the potential sooner or later begins to change, at first slowly and then rapidly, until finally the value is reached at which oxygen evolved, the iron gradually becoming passive. At the same time, before passivity sets in, the solution becomes coloured bluish-green, owing to the solution of iron and the electrode is coated with a velvety black film of oxide, part of which settles to the bottom of the containing vessel. With a very strong current, even in concentrated solution, evolution of oxygen begins at once without any visible change of the electrode. The author regards passivity as due to the formation of this oxide film, which, under proper conditions, may reach a considerable thickness, though with high current density low alkali concentration, and a low temperature, the thickness is reduced, so that the film may even become invisible. Solution of the film renders the iron active again; strong solutions and a high temperature, therefore, which increase the solubility of the oxide, tend toward activity. It is found that weak solutions, in which iron does not become active at the boiling point, are decomposed by iron at higher temperatures, with the liberation of hydrogen, thus pointing to the activity of the metal. Only ferrous iron is found in the anodic solution, but the film contains also iron in a higher state of oxidation. After cathodic reduction, this film, owing to its extremely fine state of division, is quite active, even in solution, in which massive iron is passive, and, moreover, the capacity of a plate which has been treated in this way is very marked. Potential measurements lead to the view that the active mass of the iron plate in the iron-nickel accumulator is in this form.—F. SODN.

Silver coinage alloys; Changes of structure of — during thermal and mechanical treatment. E. Pannain. *Atti R. Accad. dei Lincei, Roma*, 1909 [5], **18**, **1**, 523–525. *Chem. Zentr.*, 1909, **2**, 239–240.

THE preliminary treatment of the alloy for silver coinage differs from that of the alloy for bronze coins (see this J., 1909, 246) chiefly in that the former, before and after the first series of rollings, is allowed to cool slowly in the air instead of being quenched in water. The alloy contains, on the average, 83.29 per cent. of silver and 16.53 of copper. When the polished pieces of metal are etched with concentrated nitric acid, the structural components, namely large white crystals of a solid solution of copper in silver, surrounded by a dark eutectic, show up distinctly. During the working of the alloy, the structure becomes finer and more uniform. The crystals are deformed by rolling and broken by stamping, whilst heating renders the structure more uniform.—A. S.

Zinc-smelting; Contribution to the chemistry of —. V. Lepiarczyk. *Metallurgie*, 1909, **6**, 409–419.

EXPERIMENTS are described in which pure zinc sulphide was roasted alone, with ferric oxide, with calcium carbonate, and with a mixture of iron sulphide and calcium carbonate in porcelain crucibles of 10 c.c. capacity, by the flame of a Tech burner at a temperature of 850°–950° C. The residue was analysed and the loss in weight determined, the results being tabulated after calculation in percentages of the original amount of substance used. The results show that:—(1). Pure zinc sulphide can be roasted completely to the oxide if the conditions are such that the zinc sulphate produced is again decomposed. (2). Incomplete removal of sulphur is due to incomplete decomposition of the sulphate. Iron oxide influences this by reacting with the zinc sulphide forming ferrous sulphide. Calcium carbonate does not prevent the complete roasting of the zinc sulphide, but forms calcium sulphate. Experiments on reduction, with distillation, were carried out in covered graphite crucibles in a muffle heated to 1300°–1400° C. for fourteen hours, when the crucible was allowed to cool in the closed muffle, and its loss in weight determined, the results being calculated and tabulated as before. It is shown that calcium sulphate and carbon do not quantitatively react according

to the equation, $\text{CaSO}_4 + 4\text{C} = \text{CaS} + 4\text{CO}$. Part of the calcium sulphide produced appears to react with the sulphate according to the equation, $3\text{CaSO}_4 + \text{CaS} = 4\text{CaO} + 4\text{SO}_2$. Zinc sulphide appears to be volatile, since zinc and sulphur are lost in atomic proportions. Iron sulphide is more readily reduced by carbon than zinc sulphide. Ferric oxide, zinc sulphide and carbon yield carbon monoxide and bisulphide, iron sulphide, and the metals iron and zinc, with some reproduced zinc sulphide. In the technical roasting of zinc sulphide ores it is concluded that the iron present in the blende is to a slight extent harmful during the roasting because it prevents the complete oxidation of the zinc sulphide. In the distillation process iron is useful if present as ferric oxide, (1), because during the roasting it converts zinc sulphide into zinc oxide which is then available for reduction; (2), because if calcium sulphate be present, ferric oxide retains the sulphur as iron sulphide, and prevents the zinc forming zinc sulphide. In preparing the mixture for the retort in case the blende contains much calcium, it is advisable to add ferric oxide in order to obtain a better yield of zinc. Of course it is advisable to remove the calcium salts before roasting, preferably by washing; if this were done, the roasted blende would be as easily distilled as a calciferous calamine, since in the absence of calcium sulphate the small amount of ferric oxide usually present in the mineral would be sufficient to convert unroasted zinc sulphide into zinc oxide.—A. H. C.

Lead in solder and in the tin coating of cans for preserved foods; Determination of —. v. Della Croce. Ann. chim. anal., 1909, 14, 245—248.

Solder.—0.5 grm. of the sample is dried in the oven, weighed again, heated with 1.5 c.c. of nitric acid (sp. gr. 1.30) and the mixture evaporated to dryness in a flask. The residue is treated with 2—3 drops of nitric acid and 10 c.c. of water, heated in order to dissolve lead nitrate, and transferred to a 100-c.c. flask. The metastannic acid adhering to the evaporating flask is removed by heating and shaking with about 5 grms. of washed sand and water, the liquid and wash waters being decanted into the graduated flask. The flask is cooled to 15° C., and the contents are made up to 100 c.c., mixed and filtered. Fifty c.c. of the filtrate are transferred to a 100-c.c. flask, and the lead is precipitated with a potassium bichromate solution (of which 1 c.c. precipitates 0.01 grm. of lead), added in portions of 5 c.c. at a time until excess is present. The contents of the flask are made up to 100 c.c., and filtered, 50 c.c. of the filtrate being titrated with a solution of a ferrous salt to determine the excess of bichromate. The lead determination may thus be effected in, at most, an hour and a half. If the solder contains iron, the sample is heated gently (not to boiling) under a reflux tube with 5 c.c. of hydrochloric acid (sp. gr. 1.19) and 3—4 c.c. of water. The solution thus obtained is treated with 100 c.c. of water, and enough ammonia to produce a slight turbidity, and then acidified with hydrochloric acid. The warm solution is precipitated with sulphuretted hydrogen, the precipitate is washed with sulphuretted hydrogen water by decantation, collected and washed. The filter and precipitate are heated and stirred with 5 c.c. of yellow ammonium sulphide, and 10 c.c. of water are then added. The liquid is decanted through a filter, the residue being washed with sulphuretted hydrogen water by decantation and collected. The filter and precipitate are gently heated with 10 c.c. of nitric acid (1:3) until the black precipitate has disappeared, 20 c.c. of water are added, the liquid is decanted through a filter into a 100-c.c. flask, and the residue is washed with warm water until the filtrate is no longer acid. After cooling and making up to volume, 50 c.c. of the filtrate are transferred to a 100-c.c. flask, treated with enough ammonia to produce a faint turbidity, and cleared with a little acetic acid. Precipitation with potassium bichromate is then effected as above described. By deducting the weight of iron (determined in the filtrate from the sulphides) from that of the weight of sample, the weight of solder is found, the lead-content being calculated in the latter (provided that no arsenic, antimony, copper, etc., are present). *Tin coating.*—At least 1 grm. of the coating is removed from the interior of the clean, dry can;

care must be taken not to remove any solder, which often penetrates to the interior of the can; it is impossible to avoid contaminating the sample with iron. The weighed sample is treated with hydrochloric acid as described for solder containing iron, and if the lead-content is high, the further treatment is also the same. Otherwise the hydrochloric acid solution is neutralised with ammonia, and made up to 25 c.c., the lead in solution being determined as sulphate. The filtrate from the lead sulphate is neutralised with ammonia, freed from alcohol by evaporation, made up to 50 c.c., acidified with hydrochloric acid, precipitated with sulphuretted hydrogen, and filtered. The filtrate is used for determining the iron, the weight of the latter being deducted from that of the sample.

—L. E.

Chromium ores; Production of — in the United States. U.S. Geol. Survey, 1908. [T.R.]

THE production of chromic ore in 1908, though showing an increase over any year in the past decade, indicates that American consumers are still very largely dependent upon imported ore, the greater portion of which comes from New Caledonia, Greece, and Canada.

The total production of chromite or chromic ore in the United States in 1908 was 359 long tons, valued at \$5,640. Most of the ore was produced in Shasta County, Cal., but a small quantity came from Converse County, Wyo. Very little domestic ore has yet been used in the manufacture of chromium alloys, potassium bichromate, chrome paints, or other chemical materials.

The imports of 1908 included 27,876 long tons of chrome ore, valued at \$345,960; 216,081 pounds of chromate and bichromate of potash and 3,805 pounds of chromic acid. The total value of all products of chrome ore was \$362,121.

Aluminium; Action of hydrochloric acid gas on —, and quantitative analysis of metallic aluminium. E. Kohn-Abrest. Bull. Soc. Chim., 1909, 5, 768—775.

PURE dry hydrochloric acid has no appreciable action on aluminium in the cold, but at 250°—300° C. the metal is attacked very readily. Any silicon present is completely volatilised at 300° C., and iron is converted into ferric chloride; aluminium oxide, existing in the metal used, remains in the residue unchanged. When a mixture of iron and aluminium, in atomic proportions, is used, the aluminium is first converted into chloride, which is obtained almost pure, and then the iron is attacked, but this is volatilised only in small quantities, ferrous chloride being chiefly produced. The percentage of metallic aluminium present in samples of the metal may be determined by heating about 0.3 grm. to 300° C., first, for about 19 mins., in a current of dry hydrogen, free from oxygen, and then for 25 mins. in a current of dry hydrochloric acid; after cooling in the presence of hydrogen, the residue is weighed, and the chloride in this residue determined volumetrically, so as to obtain the proportion of hydrated oxide in the sample.—F. SODN.

Colloidal silver solution. Traube-Mengarini and Seala. See XX.

PATENTS.

[*Refractory*] *ores; Treatment of —.* A. A. Lockwood, and M. R. A. Samuel, London. Eng. Pat. 6148, March 19, 1908.

COMPLEX lead-zinc ores and the like, which resist separation by mechanical concentrators, are agitated with a solution of sodium or potassium silicate or caustic alkali or both, until the material binding the metallic constituents together is sufficiently acted upon to liberate the particles, after which they are separated by means of mechanical classifiers or the like.—F. R.

Furnaces for obtaining zinc and lead. J. Armstrong, London. Eng. Pat. 13,513, June 25, 1908. Addition to Eng. Pat. 20,543 of 1904.

IN the reduction furnace described in the chief patent (this J., 1905, 1113), the zinc is distilled by heating the ore, mixed with carbonaceous matter, in long narrow

chambers by means of gas-fired flues, which form the walls of the chambers. The present improvement consists essentially in substituting a series of superimposed horizontal heating flues, fired independently, in place of vertical flues, so that the temperature throughout the chamber may be adjusted as required.—F. R.

Zinc: Separation of — from its ores or compounds. H. L. Sulman, London. Eng. Pat. 23,497, June 24, 1908. Addition to Eng. Pat. 701 of 1908 (this J., 1909, 206).

In the process in which zinc is leached out of ores, in the form of zinc bisulphite and precipitated as mono-sulphite, a vacuum or partial vacuum is produced in the furnace in which the mono-sulphite is calcined, in order to accelerate the removal of the sulphur dioxide and water vapour. The furnace may consist of a revolving air-tight cylinder, containing iron balls to break up the charge, and connected with a suitable exhaust pump.—F. R.

Ores: Treatment of —. T. B. Rogerson and P. Donaldson, Glasgow. Eng. Pat. 24,503, Nov. 14, 1908.

Finely divided ores, "purple ore," "blue billy" or the like, are agglomerated into lumps suitable for smelting, by treatment in an inclined furnace, heated by means of one or more tuyères or burners directed into the lower end of the furnace, and supplied with a mixture of blast-furnace gas and the heated air from the hot-blast pipe of a blast-furnace.—F. R.

Desulphurising and agglomerating ores: Process for —. C. Robinson, Mount Vernon, N.Y. U.S. Pat. 926,289, June 29, 1909.

The ore is mixed with fuel and continuously fed, by means of a hopper into a tall narrow chamber. The successive layers of ore pass through a zone of heat which is maintained, without the aid of extraneous heat, by adjusting the supply of air to the narrow chamber.—F. R.

Metals: Extraction of — from ores. W. T. Smith, Los Angeles, Cal. U.S. Pat. 926,718, June 29, 1909.

PULP, consisting of finely divided ore and cyanide solution, is charged into a cylindrical tank, with a conical bottom, having a discharge pipe leading externally from the bottom and discharging into the top of the tank. Superheated steam is injected into the pipe, thereby heating the pulp and causing it to circulate.—F. R.

Basic Bessemer process: Addition of substances containing iron oxide and of lime in the — in order to shorten the after-blow. Eisenhiitten-Akt.-Ver. Düdelingen. Ger. Pat. 210,809, Oct. 8, 1907. Addition to Ger. Pat. 197,591, July 15, 1906.

A PORTION of the material containing iron oxide used in the process described in the main patent (see this J., 1908, 689) is replaced by substances containing manganese oxide. A small portion of the manganese oxide is reduced, but the greater part passes into the slag, rendering the latter more fluid and thus accelerating dephosphorisation of the iron.—A. S.

Slags of lead and copper smelters: Process of recovering oxide of zinc from molten liquid —. W. Witter, Hamburg, Germany. Eng. Pat. 13,964, July 1, 1908. Under Int. Conv., July 2, 1907.

SEE Fr. Pat. 392,422 of 1908; this J., 1908, 1210.—T. F. B.

Gold or gold alloys: Refining —. Norddeutsche Affinerie Akt.-Ges., Hamburg, Germany. Eng. Pat. 6276, March 16, 1909. Under Int. Conv., Sept. 21, 1908.

SEE Ger. Pat. 207,555 of 1908; this J., 1909, 482.—T. F. B.

Gold and other metal in sheets: Process and apparatus for making —. L. Kürz. Fr. Pat. 398,028, Dec. 30, 1908.

SEE Eng. Pat. 28,081 of 1908; this J., 1909, 608.—T. F. B.

Metals: Method of uniting or welding —. W. & Simpson, London. Assignor to United States Carbo Welding Co., Delaware. U.S. Pat. 927,292, July 6, 1909.

SEE Fr. Pat. 376,868 of 1907; this J., 1907, 1053.—T. F. B.

Ores: Method of treating —. The Murex Syndicate Ltd. Fr. Pat. 398,059, Jan. 20, 1909. Under Int. Conv., March 19, 1908.

SEE Eng. Pat. 6148 of 1908; preceding.—T. F. B.

Apparatus and tools. Eng. Pat. 19,564. See I.

Producing moulded masses [artificial stones, ore briquettes, etc.] by binding and hardening filling materials by resinous cement. Eng. Pat. 14,954. See IX.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Passivity of iron. Krassa. See X.

Electric conductivity of waters. Pleissner. See XVIII B.

PATENTS.

Electrolytes for electrolytic cells. The British Thomson-Houston Co., Ltd., London. From General Electric Co. Schenectady, N.Y., U.S.A. Eng. Pat. 15,792, July 24, 1908.

THE electrolyte consists of a solution of ammonium tetraborate and an organic substance, such as glycerin for use with electrodes one or both of which may consist of aluminium. The cell will thus act as a current valve, or rectifier, or as a static electrical condenser at relatively high voltages, with only a moderate rise of temperature.—B. N.

Electrolytic cells; Aluminium —. The British Thomson-Houston Co., London. From the General Electric Co. Schenectady, New York. Eng. Pat. 1345 of 1909; date of application, Sept. 4, 1908.

In aluminium electrolytic cells, an acid solution of ammonium tartrate is used as the electrolyte, to prevent deterioration of the electrodes when the cells are not in use.—W. C. H.

Electrodes of magnetic oxide of iron: Process for the production of —. Consortium für Elektrochem. Ind., Ges.m.b.H. Ger. Pat. 211,300, Nov. 22, 1907.

METALLIC iron or mixtures of iron and its oxides are burnt in oxygen or in gases rich in oxygen, and the magnetic oxide thus produced is allowed to solidify in moulds of the desired shape. *Example:* A cylindrical hole is bored in a block of magnesite, and one end is closed by a plug of iron or ferrosilicon. A rod of iron heated to incandescence at the lower end is then placed in the hole, and oxygen is blown in through perforations in the walls surrounding the hole. The iron burns, and the molten magnetic oxide produced fills the hole.—A. S.

Electrodes and resistances for electric furnaces, radiators, lamps, and the like. G. Cornaro, Turin, Italy. Eng. Pat. 13,734, June 29, 1908. Under Int. Conv., June 27, 1907.

SEE Fr. Pat. 393,311 of 1908; this J., 1909, 148.—T. F. B.

Wood used for electric cells and electrolytic vats: Treatment of —. The Chloride Electrical Storage Co., Ltd., and B. Heap. Fr. Pat. 398,362, Jan. 8, 1909. Under Int. Conv., Jan. 21, 1908.

SEE Eng. Pat. 1420 of 1908; this J., 1908, 1070.—T. F. B.

Incandescent lamp filaments. Eng. Pat. 23,726. See II.

Incandescent lamp filaments. Fr. Pat. 398,247. See II.

electrolytic manufacture of caustic alkali and bromine. Ger. Pat. 211,068. See VII.
erilising water with ozone. Eng. Pat. 6013. See XVIII.B.
reating bamboo pulp, etc. Eng. Pat. 6277. See XIX.

(B.)—ELECTRO-METALLURGY.

PATENTS.

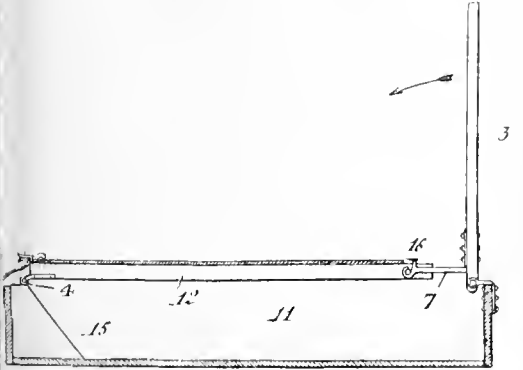
idisable metals and the like ; Process of and means for preventing — from rusting, after they are electroplated. C. Mason, Kingston-upon-Hull. Eng. Pat. 13,715, June 29, 1908.

IE articles of oxidisable metal, after being suitably epared, are placed in a solution containing copper, tin, zinc, or the latter may be deposited upon them "in a stable state," for the purpose of imparting a preliminary ating. In the case of a zinc coating produced from ie vapour, the deposit is thickened by any suitable lution of tin, zinc, or copper, preferably by a solution of e sulphate and ammonium tartrate in water, the articles ing then dipped in hot water and dried quickly. They e then subjected in an oven or chamber to sufficient heat just melt the metal forming the initial deposit or coat, that "the atoms which form such metal coalesce and ereby render the deposit or coat non-porous." The ticles, after cooling, are prepared to receive a coating of ekel, the latter being deposited from a solution composed nickel sulphate, ammonium tartrate, and water, with without the addition of a small quantity of an organic id, preferably tannic acid.—B. N.

electroplating and like processes. H. and R. S. Hutton, Sheffield. Eng. Pat. 18,246, Aug. 31, 1908.

order to cover those parts most exposed to wear with a icker coating than the remainder, the article to be plated first subjected "to a differential plating by arranging eens or their equivalent (which produce a vignetting ect of the plated material upon said article) between e anode and cathode, and then to an equal or uniform ating." The screens are made of insulating material, th suitable openings opposite or adjacent to the portions the cathode which are to be plated more thickly. The eens may be secured to the cathode, and motion imrted to the same, in order to facilitate the deposition of al.—B. N.

vered glass mirrors [electrolytically] ; Manufacture of —. A. G. Bloxam, London. From E. Hoorickx and A. Hindel, Brussels. Eng. Pat. 2490, Feb. 2, 1909.



E improvements relate to the operation of coating the vered surface of a mirror with a protective layer of per or other suitable metal. A frame, 12, carries the ror, one end of the frame being attached to rollers, 4, apted to roll on an inclined surface, 15, the other end ng supported in hooks, 16, attached to a bar, 7, idly fixed to the frame, 3, carrying the anode. The vement of the frame, 3, in the direction of the arrow,

causes the mirror to descend horizontally in an oblique direction into the electrolyte in the bath, 11, thus avoiding disturbance of the liquid, whilst the complete immersion of the mirror, before the anode enters the liquid, prevents localisation of the current on a small portion of the silvering of the mirror. The current is conducted to the silvered surface by spring clamps, connected with each other and with the negative pole of an electric generator by an insulated flexible conductor. Each clamp consists of two parts hinged together, the lower one having an abutment and an extension adapted to be applied to the edge and underside of the mirror, whilst the upper part has a contact finger adapted to rest on the silvered surface. The flexible conductor consists of a series of short rigid bars forming the current terminals, electrically connected together by lengths of thin flexible conductors, the latter and the ends of each bar being covered with rubber tubing, thus leaving exposed just sufficient of the length of each bar to ensure contact with its corresponding clamp. The two parts of the latter are preferably adapted to turn around the rigid bars, and are pressed against the mirror by an elastic band or spring. A modification of the contact fingers is described, in which the finger makes contact by virtue of its weight, the tip of the finger being rounded for resting upon the frame, in order that the contact portion may adapt itself to the silvered surface. Where the frame, carrying the mirror, forms the cathode, the finger may be made with two conducting surfaces, one making contact with the mirror, and the other resting upon the cathode frame.—B. N.

Ore-reducing apparatus. W. V. Jean, Minneapolis, Minn. U.S. Pat. 926,492, June 29, 1909.

THE apparatus consists of a tank divided concentrically by means of a screen. Anodes and cathodes are suspended respectively in the inner and outer compartments. Agitation is effected by means of a hollow shaft having hollow and perforated radial arms at its lower extremity, which rotates within the inner compartment, air being simultaneously forced into the solution through the perforations in the arms.—F. R.

Ore separating machine ; [Magnetic —]. W. V. Jean, Minneapolis, Minn. U.S. Pat. 926,493, June 29, 1909.

FINELY divided ore and solution are charged into a tank and agitated by means of a hollow rotating shaft having hollow perforated radial arms at its lower extremity, through which air is forced. A magnetic separating element is caused to rotate partly submerged in the solution, and separated by a space from the rotating arms.—F. R.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Cacao butter ; Analysis of —. G. Halphen. Ann. chim. anal., 1909, 14, 254—256.

THE author uses a method for detecting certain vegetable fats and, in particular, "green butter" (*beurre vert*) in cacao butter, depending on the different solubilities of the bromine derivatives. If a solution of "green butter" in twice its volume of carbon tetrachloride is treated with excess of a very concentrated solution of bromine in the same solvent, and, after filtration of the liquid through a mixture of equal parts of sand and starch, 4—5 volumes of petroleum ether are added, it will be found that, on cooling in water at 15° C. for 2 hours, an abundant precipitate is formed. Cacao butter yields no precipitate, and the presence of 10 per cent. of "green butter" in cacao butter is sufficient to produce a precipitate. If only 2—3 volumes of petroleum ether are added to the brominated mixture, 5 per cent. of "green butter" in cacao butter may be detected. To detect "green butter" in chocolates, the fatty matter, extracted in the usual way and freed from solvent, is dissolved in carbon tetrachloride (2 c.c. for each grm. of substance), the solution is heated under a reflux condenser with a little charcoal, cooled and filtered. One c.c. of the clear, colourless filtrate is treated with a solution of bromine (prepared by adding to carbon tetrachloride sufficient

bromine to double its volume), added drop by drop until the red colour persists. The mixture is allowed to react for 1–2 minutes, treated with 3 c.c. of petroleum ether, the tube is hermetically stoppered, and allowed to stand till the next day. Pure cacao butter gives no precipitate, whilst with only 5 per cent. of "green butter," a slight solid deposit is formed. The amount of precipitate increases with the proportion of "green butter" in the mixture.—L. E.

Poppy seed oils ("Huile d'ailette" and "Huile de pavot"). L. Vuathart. *Annales des Falsifications*, 1909, 2, 276–278.

ALTHOUGH poppy seed oil ("huile d'ailette") was defined at the Geneva Congress as "the oil extracted from black poppy seed," the definition is not sufficiently precise. Two kinds of poppy-seed oil are known in commerce, "huile d'ailette" furnished by grey or blue European poppy seeds; and the oil from white or brown, or even blue or black seeds of foreign origin, known as "huile de pavot." "Huile d'ailette" is much more esteemed for culinary purposes and is commercially of greater value than "huile de pavot." Physico-chemical tests do not serve to differentiate the two oils; but the flavour of "ailette oil" is nutty and more fatty than that of "pavot" oil, the latter being somewhat acid. "Ailette" oil, when shaken, shows a persistent froth; "pavot" oil does not. "Huile d'ailette" is of a fine golden yellow colour; "pavot" oil is much paler. The taste and frothing tests are the best to distinguish these two oils.—J. O. B.

*Fish liver oils from *Myliobatis aquila* and *Centrina saliviana**. J. Huwart. *Chem. Rev. Fett.- und Harz-Ind.*, 1908, 200.

*Oil of *Myliobatis aquila* (cagle-ray) liver*.—Sp. gr., 0.9214 at 15° C.; n_D^{20} = 1.4760; acid value, 1.84; ester value, 189.96; Helmer value, 93.6; iodine value, 115.3; acetyl value, 1.4. The separated fatty acids had the m. pt., 34.2° C.; solidifying point, 28.8° C.; acid value, 198.5; saponification value, 203.6; lactones, 5.1 per cent. *Oil of *Centrina saliviana* liver*.—Sp. gr., 0.9058 at 15° C.; n_D^{20} = 1.4751; acid value, 0.5; ester value, 136.3; Helmer value, 99.6; iodine value, 97.7; acetyl value, 13. The fatty acids had the m. pt., 31.2° C.; solidifying point, 24.5; acid value, 131.3; saponification value, 134; lactones, 2.7 per cent.

With strong sulphuric acid *Myliobatis* oil gives first a purple-red, then a reddish-brown and finally a dark brown coloration; *Centrina* oil becomes at first brown, then black. With fuming nitric acid *Myliobatis* oil gives a bright red colour, turning reddish-brown, then somewhat paler; *Centrina* oil shows at first a reddish colour then light yellow and finally light brown. With Beechi's reagent neither oil gives a black precipitate. With Cailliet's reagent applied to the oil in petroleum benzene solution, *Myliobatis* oil gives a bright red to brownish red and, finally, dark brown reaction; *Centrina* oil gives pink, red, reddish brown then dark brown shades.—J. O. B.

Oil and fat analysis; Provisional methods of the American Leather Chemists' Association for —. J. Amer. Leather Chem. Assoc., 1909, 4, 130–138.

DETAILS for the determination of the saponification, acid, and iodine values, unsaponifiable matter, Maumené test, specific gravity, titer-test, melting point, cold test (Millwood), and the cloud-test (Manns), are given as the official methods for the present year.—H. Br.

Detecting benzoic acid in meat and fats. Fischer and Gruenert. See XVIII.

Paper pulp from castor oil plant. Wille. See XIX.

PATENTS.

Castor oil; Method of treating —. L. E. Common, and Hull Oil Manufacturing Co., Ltd. Fr. Pat. 397,739, Dec. 21, 1908.

SEE Eng. Pats. 15,466 and 19,140 of 1908; this J., 1909, 532.—T. F. B.

Chemical products [soaps, etc.] in granulated, powdered, flaked, or similar condition; Process and apparatus for the manufacture of —. W. E. Lake, London. From N. Reit, Hanover, Germany. Eng. Pat. 26,847, Dec. 10, 1908.

SEE Fr. Pat. 397,412 of 1908; this J., 1909, 802.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

PATENTS.

Artists' colours; Medium for —. K. Lupus. Ger. Pat. 241,674, Aug. 12, 1908. Addition to Ger. Pat. 187,211 March 29, 1906.

Egg albumin is employed in place of egg yolk for preparing the medium. 100 grms. of clarified white of egg and 40 grms. of poppy-seed oil are thoroughly mixed and heated to about 90° C., with agitation, until the weight of the mixture is about 55 grms. The residue, when mixed with a solution of mastic in turpentine oil, is suitable for use as a medium for artists' colours or as a varnish.—T. F. B.

Azo pigments insoluble in oil; Process for the preparation of —. K. Merz, Frankfurt on Maine, Germany. Eng. Pat. 23,190, Oct. 30, 1908. Addition to Eng. Pat. 20,990 of 1907, Sept. 24, 1906.

SEE Fr. Pat. 382,191 of 1907; this J., 1908, 219.—T. F. B.

(B).—RESINS, VARNISHES.

Copaifera paupera; Oleoresin of —. [A new Bolivian *copaiba* "balsam."]. C. Hartwich and A. Jamar. Schweiz. Wech. Chem. Pharm., 1909, 47, 373–380.

THE oleoresin of *Copaifera paupera* is remarkable among the South American *copaiba* "balsams" as being the only kind known to be dextro-rotatory; in this and certain other characters it resembles African *Illurina* *copaiba* "balsam." The oleoresin is light yellowish-brown in colour, and resembles Maracibo balsam in consistence; sp. gr., 0.998 at 15° C.; $[\alpha]_D^{20}$ = +36° in a 100 mm. tube; n_D^{20} = 1.522; direct acid value, 89.7; cold saponification value, 97.25; hot saponification value, 101.5. It gives a positive reaction with the sulphuric and nitric acid test, as if it contained gurjun balsam. It does not contain the crystalline illurinic acid found in African balsam; only a small growth of microscopic hexagonal leaflets could be obtained from the alcoholic solution of the resin acid after 2 months' standing. The bulk of the resin acid is an amorphous, brittle, pale-yellow substance; acid value, 151.06; saponification value, 153.31. Illurinic acid, according to Keto, has the acid value, 177.9; and saponification value, 0. The rotatory power of illurinic acid is $[\alpha]_D^{20}$ = –51.89°; that of the *Copaifera paupera* acid $[\alpha]_D^{20}$ = +41.48°. *Copaifera paupera* "balsam" yielded 22 per cent. of essential oil; sp. gr., 0.916 at 15° C.; n_D^{20} = +18° in 100 mm. tube; n_D^{20} = 1.5048; direct acid value, 1.07; cold saponification value, 1.60. The bulk of the oil distils between 250° and 270° C. at ordinary atmospheric pressure. All its fractions are dextro-rotatory.—J. O. B.

PATENTS.

Gum [resin] and process for extracting same. F. Ephraïm, Santa Barbara, California. Eng. Pat. 17,961, Aug. 26, 1908. Under Int. Conv., Aug. 28, 1907.

THE crushed, dried octilla plant (*Fouquieria*) is suspended in a solvent such as ordinary, or absolute alcohol (either of these alcohols being preferably heated), ordinary alcohol mixed with sodium hydroxide solution, alcohol of almost any kind mixed with ammonia, or acetylene tetrachloride mixed with ammonia. The solution of gum thus obtained, is strained to remove fibre, and may then be used, either

lone or mixed with other ingredients, as a varnish, or it may be evaporated to dryness, a shellac-like gum has been obtained.—L. E.

rosin oil; Process for the preparation of a — from rosin, consisting of a single substance. E. von Boyen. Ger. Pat. 210,830, Jan. 8, 1908.

ORDINARY rosin oil prepared by distillation is a mixture of different substances. It is claimed that by the action of pyrophosphoric acid on rosin at 260°C ., a rosin oil consisting of an individual substance is obtained. The product has a constant boiling point of 350°C ., a high viscosity, and a low acid value. The phosphoric acid can be used over again several times in succession.—A. S.

lastic sealing wax; Process for the preparation of —. H. Bergmeister and F. Schaar. Ger. Pat. 210,965, May 26, 1908.

HELLAC (12.5 parts) is intimately mixed with gutta-percha (100 parts) and a solution of rubber in benzene (25 parts) at 100°C .—A. S.

Chinese wood oil; Process for the conversion of — into a product which gives a smooth, hard, lac-like coating. Chem.-Techn. Laboratorium Meffert. Ger. Pat. 211,405, Sept. 8, 1908.

It is found that Chinese wood oil can be heated above its temperature of polymerisation without solidifying, if care be taken to keep the oil in motion. The product is of the same colour as the original oil; it may be thickened in the same way as linseed oil, and when diluted with turpentine oil or the like, is said to yield varnishes possessing properties similar to those of the best copal varnishes.—A. S.

dipping-varnishes possessing covering power; Process for the preparation of —. H. Zwick. Ger. Pat. 211,520, Feb. 10, 1907.

By adding water and fats or oils to solutions of nitrated cellulose in a mixture of solvents of different volatility and solvent power, or to solutions of mixtures of nitrocellulose with other colloids (resins, balsams), insoluble in water, in one solvent or a mixture of solvents, varnishes are obtained, which possess such good covering power, that satisfactory coatings are obtained by dipping articles in them. Suitable preparations are:—(1). Collodion, 10; ether, 1000; 96 per cent. alcohol, 200; acetone, 10; linseed oil, 40; and water, 75 grms. (2). Collodion, 10; 96 per cent. alcohol, 900; ethyl acetate, 300; cellac, 25; castor oil, 40; and water, 75 grms. (3). Collodion, 100; ethyl acetate, 1000; sandarac resin, 10; and water, 75 grms.—A. S.

ketols and aldehydes; Manufacture of condensation mixtures from —. Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 27,096, Dec. 14, 1908. Under Int. Conv., July 3, 1908.

See Fr. Pat. 397,051 of 1908; this J., 1909, 803.—T. F. B.

rosin; Process for the purification of —. H. T. Yaryan, Toledo, Ohio, U.S.A. Eng. Pat. 5709, March 9, 1909.

See U.S. Pats. 915,401 and 915,402 of 1909; this J., 1909, 431.—T. F. B.

turpentine oil from sulphate-cellulose manufacture. Ger. Pat. 210,829. See XIX.

(C).—INDIA-RUBBER, &c.

caoutchouc; Notes on the chemistry of —. F. W. Hinrichsen, W. Manasse, K. Meisenburg, and E. Stern. Chem.-Zeit., 1909, 33, 735—736, 756—757.

EDDE'S tetrabromide method (this J., 1907, 1057) gives useful results for the actual caoutchouc present raw or in cold-vulcanised rubber. The method cannot be used if lead or antimony sulphide is present. The milar method of Axelrod (this J., 1907, 1058) for caoutchouc in hot-vulcanised rubber suffers from several defects, the most important being that the mineral filling matter present is weighed as such together with

the tetrabromide, whilst only the weight of its ash is afterwards deducted. This may lead to very serious errors.

To determine mineral filling matters, the authors recommend extraction of the rubber with paraffin oil (b. pt. 230° — 260°C .) or camphor oil (b. pt. 175°C .). One gram of the finely divided sample is heated with 25 c.c. of the solvent in a tared 100 c.c. flask for $\frac{1}{2}$ —2 hours under an air condenser. When the caoutchouc is completely dissolved, the flask is allowed to cool, filled with benzene, and allowed to stand overnight. The solution is then decanted through a Gooch crucible, and the residue repeatedly washed with hot benzene, petroleum ether, alcohol and ether, and weighed. The use of a centrifuge shortens the operation considerably. The values so obtained are within about 2 per cent. of the calculated values. If the sample contains free sulphur it should first be extracted with acetone.

For total sulphur, oxidation by Gasparini's method (this J., 1904, 952; 1908, 340) is recommended. Nitric acid (concentrated or fuming) is electrolysed in a tall 100—150 c.c. beaker between platinum electrodes, the sample being placed in a basket of platinum gauze which forms the anode. With a current of 6—8 volts the oxidation of the sample is complete in $\frac{1}{2}$ —1 hour. If lead compounds and barium sulphate are absent, the solution obtained is evaporated to dryness after adding sodium chloride, the residue is dissolved in dilute hydrochloric acid, and sulphate precipitated as usual. If lead or barium compounds are present, barium nitrate is added before oxidising; the liquid obtained is concentrated, diluted and filtered, the insoluble sulphate being fused as usual.

A number of experiments were made to determine whether a definite amount of sulphur is taken up by caoutchouc, when vulcanised cold with an excess of sulphur chloride. Apparently this is not the case, the combined sulphur in the treated samples varying from 15.5 to 26.15 per cent. Experiments on hot-vulcanising were made by dissolving caoutchouc and sulphur in molten naphthalene and heating in an atmosphere of carbon dioxide. It was found that, when the time of heating was kept constant, the percentage of sulphur taken up varied as the proportion present, and that with the same proportion of sulphur, the percentage taken up varied as the time of heating, at least up to 10 per cent. of sulphur.—A. G. L.

Vulcanised rubber goods; Analysis of —. Frank and Marckwald. Chem.-Zeit., 1909, 33, 812—813.

ACCORDING to Hinrichsen (see preceding abstract) the chief defect of Axelrod's tetrabromide method for the determination of caoutchouc, is that its accuracy is affected by the presence of mineral filling materials. The authors point out that minimum, one of the mineral substances mentioned, is never used in the preparation of good rubber mixings. Moreover, the error due to the presence of mineral filling materials is small compared with that caused by the solubility of the caoutchouc tetrabromide in the solvents employed, a point which appears to have been overlooked hitherto. For the determination of the mineral filling materials, Hinrichsen's proposal to dissolve the rubber in petroleum oil (b. pt. 230° — 260°C .) at the ordinary pressure, is considered to be less satisfactory than the use of xylol under increased pressure (this J., 1908, 989), and Hinrichsen's objections to the use of the autoclave are stated to be quite unfounded.—A. S.

Caoutchouc solutions; Viscosity and coagulation of —. H. W. Woudstra. Z. Chem. Ind. Kolloide, 1909, 5, 31—32.

CAOUTCHOUC, when "dissolved" in toluene or carbon bisulphide, does not pass through parchment paper to the pure solvent on the other side. Solutions of 1 gram in 200 c.c. of toluene, carbon bisulphide, xylene, and carbon tetrachloride filtered through glass-wool or, preferably, paper, become opalescent and finally deposit flocks when kept for some time at 25°C .; at 36°C the clouding is much more rapid, especially in the xylene solution. These reactions agree with the assumption

that caoutchouc is a true colloid. Viscosity determinations on the xylene and toluene solutions showed that the viscosity slowly decreases on keeping the solutions.

—A. G. L.

The guayule rubber industry. J. E. Kirkwood. *Scient. Amer.*, July 10, 1909. [T.R.]

THE guayule (*Parthenium argentatum*) thrives in the dry regions of Northern Mexico and Texas. The plant produces no latex, and the rubber occurs as minute granules distributed throughout the tissues.

R. Endlich (*Tropenpflanzer* IX., 1905) describes several processes for its extraction (see also this J., 1908, 1123). The process of extraction involves the destruction of the plant, and must in time ensure the death of the industry. In 1905 the value of the export from Durango was \$125,478. In 1906, rubber was shipped from Torreon to the value of \$917,571. During the year ending June, 1908, the value exported from the Durango district alone was \$2,250,000.00. Attempts made to cultivate the plant have so far proved a commercial failure. Only about 1 per cent. of the seeds sown reach maturity under the most favourable circumstances. Cuttings fail to grow except from parts of the root, and then only under irrigation, without which subsequent growth is very slow. Unfortunately, plants rapidly grown under irrigation yield no rubber. Without irrigation, it takes twenty years to mature a crop. (See also this J., 1909, 483.)

PATENTS.

Caoutchouc and cellulose: Manufacture of a new product from —. Soc. Française de la Viscose, Paris. Eng. Pat. 7302, March 26, 1909. Under Int. Conv., March 28, 1908.

ALTHOUGH a basic solution of cellulose, e.g., in the form of viscose or a solution in cuprammonium, will not mix with the ordinary solutions of caoutchouc, it has been found that such derivatives of cellulose readily amalgamate with the crude rubber latex to give a sufficiently stable and homogeneous mixture for industrial purposes. The two components of the mixture may then be coagulated or precipitated together in intimate association by any of the known means for coagulating and fixing cellulose from its solutions.—J. F. B.

Cellulose [and rubber]: New product derived from —. Soc. Franç. de la Viscose. Fr. Pat. 398,628, March 28, 1908.

SEE Eng. Pat. 7302 of 1909; preceding.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

"Tannin"; Suggested terminology for the substances known generally under the name —. E. Perrot and A. Goris. *Bull. Sciences Pharmacol.*, 1909, 16, 189—191. *Chem. Zentr.*, 1909, I, 1998—1999.

For the complex compounds present in the fresh plants, the name "tannoids" is proposed. These tannoids on hydrolysis yield among other products, "tannides" or "tannosides." The tannides possess the properties of the substances usually known as tannins, whilst the tannosides are compounds of the tannides with a carbohydrate. The tannides and tannosides always contain at least one phenolic group; they may yield also a glucoside or alkaloid on hydrolysis. The tannoids may be represented by the general formula $(A-[C_6H_4(O_2)_n-B])$, in which A and B represent chemical compounds combined with the carbohydrate residue. The tannoid of the chestnut tree yields on hydrolysis, the tannide, aesculitannic acid, and dextrose and aesculetin, the products of hydrolysis of the glucoside, aesculin, which is combined with aesculitannic acid in the tannoid. The tannoid of coffee yields caffeine and the tannoside, caffeetannic acid, which in turn can be hydrolysed to caffeic acid and dextrose or mannose. In the tannoid of galls, the compounds, A and B, are identical, the products of hydrolysis being gallic acid and dextrose. The tannoids are easily soluble in water, alcohol, and acetone; slightly soluble or insoluble in ether, petroleum

ether, and chloroform. The enzymes present in the plants decompose them, with production of tannides or tannosic, and may also oxidise the latter to "phlobaphene red" such as "kola red," "cinchona red," etc.—A. S.

Aspergillus niger in tanneries. Bolland and Dr. J. Pharm. Chim., 1909, 29, 573—575.

EXPERIMENTS are recorded on the growth of *Aspergillus niger* in tannery liquors. They were based on Raulin's statement that silver retards or even prevents the growth of this mould. A silver wire network of known weight was fastened to a wooden frame and placed in a vat the surface of a tan liquor of known volume and strength. After a month the *Aspergillus* was present as abundantly in this vat as in neighbouring ones containing the same liquor but no silver. The metal suffered no loss of weight. Raulin's artificial nutrient medium was put into dishes and chestnut extract added to one dish. A known weight of silver wire was added to each dish and the contents were then sown with spores of *Aspergillus*. A fine growth was observed in the dish containing chestnut extract but none on the other dish. Silver wire left for a year in various extracts was not attacked. When experiments were conducted in closed vessels, no *Aspergillus* appeared but in open vessels it grew abundantly. Silver in chestnut extract was not attacked even in presence of nitric acid. Under the same conditions copper and brass were also not attacked, but zinc, iron and mercury were acted upon by the acid. Light rays of different colours did not seem to affect the growth of *Aspergillus*. Liquors protected from the air by oil or petrol were free from attacks of the mould.—H. G. B.

Gelatin-hematin acid method [for tanning liquors]. W. Alsop. *J. Amer. Leather Chem. Assoc.*, 1909, 4, 194—207.

THE gelatin-hematin method (see this J., 1908, 116—1909, 721) of estimating acid in tanning liquors has recently been tested by members of the American Leather Chemists Association and the author gives a report of the work carried out. Several collaborators expressed opinions on the method and these along with tables of results are published in the report. The author considers the agreement between results obtained by different operators and the correctness of the acidity found, to be quite good as would probably be obtained by any of the other methods. He makes no recommendation for or against the adoption of the method, but states that he knows of no other method that would apply equally well to all classes of liquors. It is suggested, however, that a better indicator than hematin is required.—S. H.

Tannin analysis; Official method of the American Leather Chemists Association for —. *J. Amer. Leather Chem. Assoc.*, 1909, 4, 118—124.

THE official method for the analysis of tanning materials for the present year, is given, together with methods of sampling. No alterations are made from that of last year.—H. B.

Leather analysis; Provisional method of the American Leather Chemists Association for —. *J. Amer. Leather Chem. Assoc.*, 1909, 4, 124—130.

A DETAILED account of the official method for the analysis of leather for the present year is given, including determinations of moisture, fat, ash, water-soluble matter and glucose (dextrose).—H. B.

Application of methods for determination of tannic and gallic acids to extracts of various tanning material [Manufacture of inks]. Hinrichsen and Kedes. See IV.

Oil and fat analysis. See XII.

PATENTS.

Tanning; Process of —. C. M. Landenberger, London. From J. E. Marwedel, Waywood, N.J., U.S.A. Eng. Pat. 13,768, June 29, 1908.

THE use of tea leaves, tea waste, tea refuse, or an extract of tea is suggested for the tanning of hides. If the tea

reated with lime and then with chloroform or benzene, the former absorbs the aroma and the latter dissolves the caffeine, which two products can be removed by filtration. The dissolved lime can be removed by the addition of a little sulphuric acid which precipitates it as calcium sulphate. The tea material may be used in conjunction with any other tanning material.—H. BR.

Leather substitute; Process for the production of a —. R. Weeber, Vienna. U.S. Pat. 927,198, July 6, 1909.

SEE Eng. Pat. 15,253 of 1907; this J., 1908, 581.—T. F. B.

Leather, artificial; Process for making —. Oesterreichische Pluviusin-A.-G. Fr. Pat. 397,747, March 5, 1908.

SEE Eng. Pat. 4536 of 1908; this J., 1909, 102.—T. F. B.

Tanned fabric. U.S. Pats. 926,525 *et seq.* See V.

XV.—MANURES, &c.

Soil samples; Preparation of — for chemical analysis. G. M. MacNider. J. Ind. and Eng. Chem., 1909, 1, 447—449.

THE author gives the results of the analysis of a number of soils of which samples were prepared by passing through sieves of 2 mm. and 0.5 mm. diam. respectively. The results show that in many cases the greater portion of the fertilising constituents is found in the soil particles of less than 0.5 mm. diam., the particles between 0.5 and 1 mm. being composed chiefly of quartz. In other cases the coarser particles contain considerable quantities of elspar, and the analytical results furnished by the two samples of different degrees of fineness differ only slightly. As the author believes, particles of soil of less than 1 mm. diam. fairly represent the soil from which the plant derives nutriment, then analytical results obtained with a sample prepared by passing through a sieve having perforations of less than 2 mm., *e.g.* 0.5 mm., as in the official method of the Assoc. of Official Agric. Chemists (U.S.A.), will be too high and will not fairly represent the composition of the soil. The author recommends passage through a sieve with circular perforations of 1 mm. diam., the portion passing through being termed "fine earth" or "soil," and used for analysis, whilst the residue is classed as "coarse gravel."—A. S.

Chemical nature of dicyandiamide. Caro and Grossman. See XX.

PATENTS.

Manure; Process for the preparation of a —. A. Lang. Ger. Pat. 211,420, Aug. 14, 1907.

THE bones in the horns of horned cattle are freed from fat by steaming or boiling and converted into bone meal in the usual manner. It is claimed that the product possesses a much higher manurial value than ordinary bone meal.—A. S.

Carbide [for the manufacture of calcium cyanamide]; Method of grinding —. Cyanid-Ges.m.b.H. Ger. Pat. 211,706, Nov. 25, 1908.

IN the grinding of carbide preparatory to the manufacture of calcium cyanamide therefrom, explosions are liable to occur owing to the formation of an explosive mixture of air and carbide dust. Besides air, carbon dioxide and carbon monoxide also decompose carbide. According to the present patent, the grinding is performed in an enclosed space which is filled with dry nitrogen. In this way not only is all danger of explosions avoided, but any sparks are produced during the grinding, owing to the presence of hard metallic inclusions in the carbide, these only result in the formation of calcium cyanamide from the interaction of the carbide and the nitrogen.—A. S.

Phosphoric acid or substances containing phosphoric acid soluble in water, or in citrates, respectively, from phosphatic raw materials. N. A. Langlet, Gottenburg, Sweden. Eng. Pat. 24,345, Nov. 12, 1908.

SEE Fr. Pat. 396,195 of 1908; this J., 1909, 485.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Java [Sugar industry]. Internat. Sugar J., 1909, 11, 357—358. [Consular report.]

THE following figures show the production for the past three years:—

—	1906.	1907.	1908.
Planted area acres	260,810	281,750	284,600
Total production tons	1,046,691	1,144,383	1,217,390
Production per acre	4.01	4.06	4.28
Mills working	176	176	177

During the past season, prices and profits have been high. The area planted for the 1909 crop is estimated at 2.8 per cent. more than for 1908. The exports of sugar for the past three years have been as follows:—

Country.	1906.	1907.	1908.
United States	Tons. 192,178	Tons. 309,449	Tons. 456,435
China	127,495	151,187	149,324
Japan	160,709	191,928	135,100
British India	111,527	315,569	303,465
United Kingdom	4,123	12,261	3,453
British Columbia	17,413	12,089	11,558
Australia	39,495	5,726	17,588
Continent of Europe	5,881	20,376	4,557
Other countries	60,906	44,083	24,815
Total	719,727	1,058,668	1,105,095

—L. E.

Sugars; Bacterial flora of Hawaiian —. L. Lewton-Brain and N. Deer. Report of Work of Experiment Station of Hawaiian Sugar Planters' Assoc., Div. Pathol. and Physiol., April 1909, Bull. No. 9, 1—35.

THE authors give detailed descriptions of five organisms isolated from a number of Hawaiian sugars, and describe their action on sugar in liquid cultures and on commercial raw sugars. *Bacillus A.*—Grown on sugar-nutrient agar, the cells average 2 μ in length, whilst on carrots, and in glucose bouillon, the average length is 1.6 μ . The organism does not sporulate, but is very resistant to desiccation, and, hence, is capable of living for an indefinite period in the sugar factory. *Diplobacillus B.*—The cells average about 3 μ in length and 1.7 μ in breadth; the spores are usually terminal, but often central. The organism is very resistant to desiccation. *Bacillus C.*—The cells are about 4 μ long and 1.2 μ broad; the spores are usually central but occasionally terminal. *Bacillus D.*—The cells developed in sugar-nutrient agar are about 3.7 μ long and 1.2 μ broad; the spores are usually central. *Bacillus E.*—The cells average about 3.5 μ in length and 1 μ in breadth, and form spores. Since none of these organisms has flagella, they would be placed in Migula's genus *Bacterium* rather than *Bacillus*. On cultivating the organisms in sucrose-nutrient solutions, it was found that invert sugar is formed more or less rapidly, and that a faculty of rapidly hydrolysing sugar is associated in liquid cultures with the formation of gums; *bacilli A* and *D* form other substances besides invert sugar and gums in sucrose-nutrient solutions. The gum formed by *bacilli A* and *C* was found to have properties identical with those of Greig Smith's levan [levan] (see this J., 1902, 1381), the gum formed by *B. levaniformans*, and the two are probably identical, so that the production of a gum with the properties of levan cannot be held as characteristic of one particular bacterium. With regard to the action on commercial sugars, it was found that *bacilli A* and *C* cause rapid deterioration, whilst *B. D.* and *E.* are less injurious. Deterioration is favoured by high temperature, and by a high moisture-content of the sugar. In conclusion, the authors discuss the precautions to be taken against deterioration of sugar during storage and shipment. The Keen ventilator, whereby a current of air is maintained round the hold of the ship,

but not in it, has been recommended, and in so far as it tends to keep the hold cool, and to prevent the temperature from rising to a point favourable to bacterial action, it should be of great service. The authors suggest that it might be applied to storage warehouses, the latter being built with double walls; the best safeguard against deterioration, however, is the maintenance of the factory in an aseptic condition as possible.—L. E.

Sucroclastic enzymes in Beta vulgaris: Polarimetric study of the —. R. A. Robertson, J. C. Irvine and M. E. Dobson. *Biochem. J.*, 1909, 4, 258—273.

THE most probable explanation of sucrose-formation in the sugar beet appears to be that dextrose and levulose are formed in the leaf region, and are there transformed into sucrose, the latter passing, by means of the leaf meristem, to the root. Assuming that the condensation of dextrose and levulose is an enzymic process, this may be effected by a special enzyme termed the associating enzyme, or it may be due to a reversed invertase action. The authors have investigated the problem of sucrose-formation in the sugar-beet, and to this end, the topography and nature of the enzymes in the plant were first studied. Enzyme preparations were obtained by filtering the aqueous extracts from the leaves, stems, and roots, through several folds of fine muslin, (with more careful filtration, less active preparations are obtained), precipitating the turbid filtrates with alcohol, washing the sludges thus obtained with absolute alcohol, filtering, and washing with dilute alcohol until the washings were optically inactive and ceased to reduce Fehling's solution; the preparations were then examined for the presence of various enzymes. In the case of the roots and stems, the residues left on the muslin filters were also examined. The results of these experiments are given in the following table:—

	Leaf.	Stem.	Root.
Invertase	+	+	0
Diastase	+	+	+
Maltase	+	0	+
Inulase	0	+	+
Emulsin	0	+	+

In the above Table: + = present, and 0 = absent.

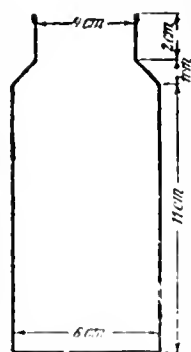
Kastle and Clark found that invertase is present in larger quantity than inulase or diastase in inulin- and starch-producing plants such as the artichoke and potato, even in the tubers, when the inulin and starch are being stored (see this J., 1903, 1372). The enzyme, invertase, appropriate for the formation of sucrose, is absent from the beet-root when the sugar is being stored. Since inulin and starch are formed *in loco* in the artichoke and potato respectively, the analogous conclusion in regard to the beet, seems to favour the view that sucrose is not formed *in loco* in the root, but is stored there after translocation as sucrose from the other organs. Various experiments were made with a view to synthesising sucrose from invert sugar by means of reversible zymolysis. Experiments with pure enzyme extracts of beet leaves gave no positive results, but these extracts were found to be free from invertase. With sludge from the stems and from young plants, however, which contained invertase, it was found that a decrease in the levo-rotation of the invert sugar solution occurred, and on subsequent hydrolysis with hydrochloric acid, an increase in the levo-rotation was observed. With the stem sludge the figures obtained indicated that about 4 per cent. of sucrose was formed. With the sludge from the whole of a young plant, the figures indicated that about 6 per cent. of sucrose was formed, thus indicating the greater activity of the plant at the beginning than at the end of the storage period. With regard to the small proportion of disaccharides formed experimentally *in vitro*, the authors point out that the equilibrium stage attained is permanent under these conditions, whilst in the plant the equilibrium phase is only momentary owing to the continual removal of the products as they are formed.

—L. E.

Sugar estates: Statistics of the factory results on a number of Java —. H. C. Prinsen-Geerligs. *Internat. Sugar J.*, 1909, 11, 324—333.

THE author discusses the statistics for the past 10 years of a large number of sugar estates in Java. The attention given to selection and cultivation has caused a considerable increase in the yield of canes, but has had no appreciable effect on the sucrose-content of the cane. This sucrose-content is chiefly determined by climate and soil conditions; a regular and decided increase in the sucrose-content of the cane, in the districts where it is already high, is now improbable. The Black Java or Cheribon cane has been gradually supplanted by the descendants of seedling canes during the last 10 years; two of the most popular varieties of seedling canes happen to possess a high fibre-content, and consequently, the average fibre-content of the cane crushed in Java, and the fuel supply from this source, have risen by about 10 per cent.; many of the newer cane varieties yield bagasse of relatively low juice-content, and this partly compensates for loss of juice due to increased amount of bagasse. The milling work has considerably improved, since in spite of the increase in bagasse, the loss of sucrose in bagasse per 100 parts of canes decreased from 1.36 in 1899 to 1.11 in 1908. Prior to 1903, Java sugar was chiefly delivered as refining crystals, and 5 per cent. of the whole amount as black stroop (obtained by shovelling the last after-product massecuites into mat bags, and allowing the molasses to drain off). Since 1903, the manufacture of white first and second sugars has increased considerably, and in 1908, the sum of these two amounted to 40 per cent. of the total production. The percentage of black stroop has latterly decreased and now amounts to about 3 per cent. Though a much larger amount for loss of sucrose in molasses is recorded when making white sugar than when making refining crystals, the total loss of sugar in molasses and unaccounted for has diminished.—L. E.

Sugar in the beetroot: Determination of —. A. Herzfeld. *Z. Ver. deut. Zuckerind.*, 1909, 627—639.



SOME experiments on the analytical control of the work of a sugar factory, showed that in Steffen's steeping process, the total yield of sugar was apparently about 0.4 per cent. greater than that contained in the raw material. The author has therefore investigated the various methods usually employed in controlling sugar house work, and in the present paper, he describes a modification of the Sachs-Le-Docte method for determining sugar in the beetroot, whereby certain sources of error, inherent in the old method, are avoided. A series of nickel-plated iron beakers (distinguished by consecutive numbers) of the shape and dimensions shown in the figure, and an equal number of weighing dishes, which are unnumbered and all of the same weight, are employed. The beakers are stoppered with corks coated with tinfoil. Twenty-six grams of the sample of pulp are weighed in a dish and transferred to a beaker with exactly 177 c.c. of a mixture of basic lead acetate and water in the proportion of 5 parts of basic lead acetate solution (Ger. Pharmacopoeia) to 100 parts of water; the measured volume of liquid is run in from a special burette. The beaker is now stoppered and thoroughly shaken. If the pulp is very finely divided, the mixture may be filtered at once and polarised. If, however, the pulp is coarse, or if, for any other reason, hot digestion is preferred, the beakers are placed in water heated to 75°—80° C., for 30 minutes, and then cooled; the contents are then filtered and polarised. Sachs has shown that the error introduced by adding 177 c.c. of liquid as above described is practically negligible (see this J., 1906, 1010). The author quotes the results of comparative determinations of sucrose in beetroot pulp by (1), the original Sachs-Le-Docte method of

cold digestion; (2), his own modification of this method, by hot aqueous digestion. In most cases, the results agree, but in a few instances, the modified method gives higher results; the differences are, no doubt, due to incomplete exhaustion of the pulp by the cold method, and the modified method must be considered the more accurate. Results obtained by the modified method were found to agree with those obtained by alcoholic extraction. The author has also modified the extraction method with the view of shortening the time required for its execution. A flask of about 100 c.c. capacity, is filled to one-half with 26 grms. of pulp, alcohol of not more than 90 per cent. strength, and 3—5 c.c. of basic lead acetate solution. The flask is heated under a reflux tube for 10—15 minutes in a water-bath, and the contents of the flask are then introduced into the extraction apparatus. A uniform distribution of the pulp in the extraction apparatus is thus insured. If extraction proceeds too slowly, as sometimes occurs with very fine pulp, an aspirator is provided by means of which the apparatus may be partially evacuated. By means of this modified extraction method, an analysis may be completed in 2—3 hours. This method is particularly suitable for the analysis of exhausted, dried slices and of the so-called "Zuckerschneitzeln" obtained by Steffen's steeping process. Half the normal weight of the finely-ground dry slices are digested in a 100 c.c. flask with 60 per cent. alcohol and 3—5 c.c. of basic lead acetate, until the slices settle to the bottom of the flask; this takes about 20—30 minutes. The flask-contents are then rinsed into the extraction apparatus, the further treatment being as above described. The whole analysis requires, at most, 5—6 hours, whilst with the old method, the sugar is often not completely extracted in several days.

—L. E.

Reducing sugars; Simple method for determination of —. J. Dusehsky. *Dents. Zuckerind.*, 1909, 34, 521—522.

For rapid and convenient use in the refinery, the author has tested several methods for the volumetric determination of the cuprous oxide obtained from reducing sugars. He finds the method of Müller, depending on the oxidation of the cuprous oxide by ferric sulphate, to be as accurate as any other, and to possess the advantage of simplicity.

—J. F. B.

Starch paste; Catalytic changes in —. A. Fernbach and J. Wolff. *Seventh Int. Congr. Appl. Chem.*, London, 1909.

WHEN 5 per cent. starch paste is treated with a few drops of neutral hydrogen peroxide and ammonia and kept at a temperature of 70° to 75° C., rapid liquefaction is observed, the liquid attaining the viscosity of water in about a quarter of an hour. The requisite proportions of the reagents are a quantity of hydrogen peroxide corresponding to 5 mgrms. of oxygen, and about 4 mgrms. of ammonia, per 50 c.c. of paste. The ammonia may be replaced by other alkalis, such as soda, lithia, lime and baryta; but whilst with these, a certain optimum quantity is necessary or the reaction to proceed satisfactorily, an excess of ammonia over the requisite minimum quantity has no retarding influence on the reaction. The optimum quantity in question, under the conditions set forth above, is equivalent to 8 mgrms. of sodium hydroxide. In examining the nature of the alteration produced by ammonia and hydrogen peroxide, the authors have found that the ammonia is partially neutralised, the quantity of substance effecting this result corresponding to 1.6 mgrms. of ammonia per grm. of starch. Similar results were obtained in the case of lime.

The liquefactive action of other substances was also investigated, among them being the sulphates of iron and copper. Numerous experiments were conducted with ferrous sulphate and hydrogen peroxide in different proportions, selected with a view to obtaining complete liquefaction in about 20 minutes. It was found that the weak acidity, due to the ferrous sulphate, was sufficient to retard liquefaction considerably. In one series, in which 2 mgrms. of ferrous sulphate and 10 drops of hydrogen peroxide, containing 7.7 mgrms. of oxygen, were used in 50 c.c. of 5 per cent. starch paste, at a temperature of 70° C., varying quantities of sodium hydroxide were

added; the best result was obtained with 0.8 mgrm., the liquid being very faintly alkaline toward methyl orange, and the viscosity at the end of 15 minutes being 1' 25", as compared with 6' 10" without alkali. On the other hand, the adverse influence of even small quantities of acid was demonstrated by the fact that with 1 mgrm. of sulphuric acid, the viscosity test gave the value 27' 30", whilst even as little as 0.05 mgrm. of acid produced appreciable retardation. Organic acids, especially lactic and succinic acids, were also used. Their effect was only about one-third that of an equimolecular quantity of sulphuric acid; and similarly, ferric sulphate, in presence of the optimum quantity of sodium hydroxide, was only about one-third as active as ferrous sulphate. Copper sulphate, on the other hand, was about twice as effective as the ferrous salt; it was less sensitive to the presence of acids and quite insensitive to the presence of alkali.

Liquefaction was effected by even smaller quantities of hydrogen peroxide, down to a minimum of 2 mgrms. of oxygen, longer time being, however, required.

When ferrous sulphate was used in the reaction with starch under the above conditions, but with an increased proportion of hydrogen peroxide, the transformation produced was not confined to simple liquefaction. It has already been stated that the liquefaction of starch by ammonia is accompanied by the formation of a compound which partially neutralises the ammonia, but which represents only a very small fraction of the starch. With a relatively large proportion of hydrogen peroxide, acting on a small amount of starch, the whole of the starch could be transformed. At the end of two hours at 75°—75° C. the starch ceased to give a colour reaction with iodine, and the liquid had acquired a high reducing power and an acid reaction. Thus, on treating 25 c.c. of starch paste (containing 0.5 mgrm. of starch) with 1 mgrm. of ferrous sulphate, 42 mgrms. of oxygen (as hydrogen peroxide) and 0.6 mgrm. of sodium hydroxide, the quantity of reducing substance, at the moment when a coloration was no longer furnished with iodine, amounted to 0.288 grm. Under the same conditions, hydrogen peroxide alone gave the value 0.071 grm., and a large quantity of starch remained untransformed. The product formed did not appear to be a sugar, since it did not furnish an osazone on treatment with phenylhydrazine acetate.

With regard to the formation of acids, 150 c.c. of 3 per cent. starch paste were treated with 12 mgrms. of ferrous sulphate in presence of hydrogen peroxide corresponding to 190 mgrms. of oxygen. After four hours at 75° C., the acidity corresponded to 40 c.c. of $N/10$ soda, about one-quarter consisting of formic acid. The authors are convinced that the acidity of the liquid is not the cause of the transformation of starch into reducing substance. This latter is nearly insoluble in alcohol, and differs essentially from dextrin by its property of being precipitated, from a concentrated solution, by copper sulphate, like the gums.

Soluble starch. C. Tanret. *Compt. rend.*, 1909, 148, 1775—1776.

THE author prepared soluble starch by a slight modification of Fernbach's method (*Compt. rend.*, 140, 1403), by treating starch for half an hour with cold dilute hydrochloric acid (1:1000), washing well with water, drying at 30° C. until the product contained only 17 per cent. of water, and then heating for 1 hour in a closed vessel at 100°—110° C. The soluble starch thus obtained was extracted with 50 times its weight of boiling dilute alcohol (25°), and the solution filtered whilst hot; the filtrate became turbid on cooling. Half of the starch remained undissolved; on drying and treating with boiling water, about one-fourth of the residue dissolved, the soluble portion having the rotatory power, $[\alpha]_D^{20} = +188.6^\circ$. On treating the weak alcoholic solution with about half its volume of alcohol of 95°, a precipitate was produced which agglomerated on vigorous agitation. This was filtered off, washed with absolute alcohol, and dried first over sulphuric acid, and then at 100° C. The product was only slightly soluble in boiling water; the soluble portion had the rotatory power, $[\alpha]_D^{20} = 208^\circ$ —210°. The

insoluble portion gave an insoluble blue iodine compound, and when dissolved in potassium hydroxide gave a solution which did not gelatinise. It closely resembled the granular amylose of Maquenne and Roux (this J., 1906, 192, 601; 1908, 291, 415). The residue obtained on evaporating the alcoholic solution was dissolved in water, and the solution treated with two successive portions of strong alcohol. The two products thus precipitated had the rotatory powers, $[\alpha]_D^{20}$ 180.5° and 173° and their solutions gave reddish-violet and red colorations respectively with iodine. The residue left on evaporating the filtrate had the rotatory power, $[\alpha]_D^{20}$ 154.5°, gave a red coloration with iodine, and possessed a cupric-reducing power equal to one-third of that of dextrose; this mixture of erythro-dextrins constituted about 8 per cent. of the matter soluble in the boiling dilute alcohol. Soluble starches prepared with hydrochloric acid at a concentration of 4:1000 and varied after-treatments gave similar results, the products being mixtures of substances differing in their rotatory powers, their reducing action on Fehling's solution, the colorations produced by them with iodine, and their solubility in alcohol of various concentrations. The author suggests the name "solubilised starch" for such products.—A. S.

PATENT.

Gum tragacanth: Manufacture of —, C. V. Greenwood.
Fr. Pat. 398,922, Dec. 30, 1908.

SEE Eng. Pat. 569 of 1908; this J., 1909, 153.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Yeast: Nuclein ferments of —, M. N. Straughn and W. Jones. J. Biol. Chem., 1909, 6, 245—255.

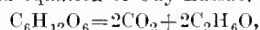
THE authors show that yeast does not contain xanthoxydase—a ferment which converts hypoxanthine into xanthine and the latter into uric acid—in the following way:—Compressed yeast (300 grms.), distilled water (1 litre), and chloroform (6 c.c.) were kept in a closed vessel for 15 hours at the room-temperature, with frequent and violent agitation, the insoluble matter then being removed by centrifuging. A quantity of the extract (750 c.c.) was treated with hypoxanthine (400 mgrms.) dissolved by suspending in warm water and adding just enough sodium hydroxide to effect solution. The whole was kept at 38° C. for 4 days, a slow stream of air from a wash-bottle containing chloroform being passed through the liquid for about half the time. A drop of acetic acid was then added, and the liquid was heated to boiling and filtered. The filtrate was treated with 19 c.c. of dilute sulphuric acid, evaporated to about 150 c.c., boiled for half an hour to decompose any trace of protein, and examined for xanthine bases. Small quantities of xanthine and adenine (evidently from the nucleic acid of the yeast extract), but no guanine nor uric acid were found; a quantity of hypoxanthine was recovered equivalent to 90 per cent. of that added. These results show that the yeast does not contain xanthoxydase. The function of guanase is to convert guanine into xanthine; the authors show that yeast (extract) is capable of transforming relatively large quantities of guanine into xanthine, i.e., that yeast contains guanase. They also show that the yeast contains no adenase—a ferment which converts adenine into hypoxanthine—since the extract does not attack the small amount of adenine formed from its own nucleic acid. In their experiments on yeast digestions, the authors have repeatedly observed the occurrence of hypoxanthine in very small quantities, and are convinced that its presence is due neither to adenase nor to decomposition of adenine by the methods of isolation employed.—L. E.

Fermentation: Formation of succinic acid in alcoholic —, F. Ehrlich. Z. Ver. deutsch. Zuckerind., 1909, 645—672.

THE author has previously shown that the higher alcohols which occur in fusel oil, are formed by the fermentation of amino-acids by the yeast (see this J., 1905, 683; 1907, 28, 480). Various observations appear to show that suc-

cinic acid is formed in an analogous way. In view of the similarity of constitution, it seemed probable that aspartic acid is the material from which succinic acid is formed, but neither this view, nor the author's previous suggestion, that aspartic and glutaminic acids yield ethyl and propyl alcohols respectively, proves to be correct. Further experiments showed, that whilst addition of aspartic acid to a fermenting sugar solution causes a decrease instead of an increase in the yield of succinic acid, addition of glutaminic acid causes a large increase in the yield. Hence the succinic acid formed during fermentation with yeast is derived from glutaminic acid. The author now shows that the formation of succinic acid is quite analogous to that of fusel oil. In a series of fermentation experiments, in which pure sugar solutions were fermented with various quantities of pure yeast cultures (different races of yeast, different samples of the same race, and samples of the same race identical except in respect of age were used), amounts of succinic acid, ranging from 0.24 to 0.60 grm. per 100 grms. of sugar fermented, were obtained. The formation of succinic acid under these conditions is easily explained; owing to want of the most essential nutriment, part of the yeast dies. The contents of the dead cells pass into the solution and nourish the still living cells. In this process, autolysis of yeast protein must occur, and glutaminic acid is one of the amino-acids formed in this autolysis (compare Schenck, this J., 1905, 555). The still living yeast decomposes these amino-acids and utilises the ammonia set free for protein-synthesis; the residual complex, after further alteration (oxidation or reduction) leaves the yeast cell as a product of metabolism. In this way succinic acid is formed during the fermentation of pure sugar with a pure yeast culture. That the amount of succinic acid obtained in the above-mentioned experiments, varied considerably, is to be ascribed to the use of yeasts of different compositions; in three experiments, in which samples of yeast identical in every respect, were used, the yields of succinic acid were nearly equal. That the yield of succinic acid is proportional to the alcoholic fermentation of the sugar, accords with the author's theory, since protein-decomposition of the yeast only proceeds normally in presence of sugar; moreover, with complete fermentation of equal weights of sugar by different quantities of the same yeast, the amounts of succinic acid formed are nearly equal. Besides aspartic acid, addition of other amino-acids, and of ammonium salts, to fermenting sugar solutions, causes a decrease in the yield of succinic acid, from which it must be concluded that the nitrogenous nutriment protects the yeast protein from decomposition. If a comparatively small quantity of glutaminic acid is added to a fermenting sugar solution, the yield of succinic acid is greater than that theoretically obtainable from the added glutaminic acid; it appears that the yeast first decomposes the added acid, and is then driven by nitrogen-hunger to attack its own protein. The author has also found that presence of sugar is necessary to the formation of succinic acid. He concludes from this, and other results, that the carbon complexes required in synthesising yeast protein, are derived from the fermenting sugar and that perhaps the only purpose of alcoholic fermentation in general, is to supply the energy and carbon material for synthesising the yeast protein. Further experiments showed that acetone permanent yeast cannot convert glutaminic into succinic acid. The author has previously suggested that the mechanism of the formation of amyl alcohol from leucine may comprise conversion of the leucine into leucic acid, which then decomposes into valeric aldehyde and formic acid, the bulk of the valeric aldehyde being converted by reducing enzymes to amyl alcohol, whilst a small part is oxidised by oxydases to valeric acid. He now suggests that glutaminic acid may be decomposed in an analogous way: according to this scheme, the first decomposition-product is hydroxyglutaric acid which decomposes into formic acid and the half-aldehyde of succinic acid, the latter being quantitatively converted into succinic acid by the action of yeast oxydases and atmospheric oxygen. Since fusel oil and succinic acid are not decomposition-products of sugar fermentation itself, and since it is doubtful if the formation of lactic acid and volatile acids in fermentation, is traceable to the sugar (compare Sator,

this J., 1907, 217), only glycerol, besides carbon dioxide and alcohol, is left for consideration as a fermentation product of sugar. Though Buchner and Meisenheimer have shown that glycerol is formed in fermentation with cell-juice (see this J., 1906, 998), the author considers it possible that this compound is derived, not from the sugar, but perhaps from yeast nucleic substances which are present in yeast juice in appreciable amount. If such is the case, the old equation of Gay-Lussac,



would be rehabilitated.—L. E.

Specific heat of mixtures of ethyl alcohol and water. Doroshewski and Rakowski. See XX.

Electric conductivity of mixtures of ethyl alcohol and water. Doroshewski and Roshdestwenski. See XX.

Indices of refraction of mixtures of alcohols and water. Doroshewski and Dworzanczyk. See XX.

PATENTS.

Spirits; Distilling of — J. E. Carroll, London. Eng. Pat. 19,348, Sept. 15, 1908.

ACCORDING to this specification the rectifier of a "patent" still is divided into two parts by a plate or diaphragm, and the alcoholic vapours are passed from one side to the other of the diaphragm through an apparatus in which they are mixed with air and superheated, whereby the product is artificially matured. The vapours, for this purpose, are mixed with heated air and passed through nests of pipes of small diameter enclosed in steam jackets, the ends of successive nests being coupled together by uptakes or headers. The vapours are led into the aëerator and superheater through a branch pipe situated below the diaphragm in the rectifier, and pass back again into the latter through a branch pipe above the diaphragm.

—J. F. B.

Spirits; The distilling and treating of — J. E. Carroll, London. Eng. Pat. 16,987, Aug. 12, 1908.

SEE Addition of Dec. 9, 1908, to Fr. Pat. 376,151 of 1907; this J., 1909, 807.—T. F. B.

XXVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Benzoic acid; Detection of — in meat and fats. K. Fischer and O. Gruenert. Z. Untersuch. Nahr. Genussm., 1909, 17, 721—734.

THE following method of extracting benzoic acid from flesh products was found the most suitable:—50 grms. of the finely divided material are mixed with 100 c.c. of 50 per cent. alcohol, and the mixture acidified with dilute sulphuric acid and allowed to stand for 30 minutes, with frequent stirring. It is next pressed in muslin, and the expressed liquid rendered alkaline and heated on the water-bath until all alcohol has been expelled. When the volume has been reduced to about 50 c.c. the liquid is mixed with 5 grms. of sodium chloride, acidified with dilute sulphuric acid, and heated to the boiling point. It is then cooled and filtered, the filtrate shaken out with ether, and the ethereal extract washed with water and evaporated at a low temperature. About 50 to 60 per cent. of the benzoic acid present was thus extracted, whereas the yields were considerably less by the other methods commonly employed. This residue was used in comparative tests for the detection of benzoic acid by different methods. For the iron chloride test it was dissolved in water containing ammonia, and the solution evaporated to 1 c.c. and treated with one drop of a 1 per cent. solution of ferric chloride. The presence of 0.02 per cent. of benzoic acid could thus be detected both in fresh and smoked flesh. In the case of fats, as little as 0.01 per cent. of benzoic acid could be detected. Brevan's test (formation of "aniline blue"

on adding to benzoic acid a solution of rosaniline hydrochloride in aniline) failed completely in the case of meats and fats. Röhrig's reaction (conversion of benzoic acid into its ethyl ester, recognisable by its odour) was capable of detecting 0.02 per cent. of benzoic acid in fresh meat, and 0.01 per cent. in fats, but failed when applied to smoked flesh. The similar test depending on the conversion of the benzoic acid into benzaldehyde enabled 0.04 per cent. of benzoic acid to be detected in fresh meat, but failed with smoked flesh. In the case of lard, 0.01 per cent. could thus be detected, but 0.05 per cent. could only occasionally be found in margarine and never in butter. The salicylic acid test was most sensitive when carried out as follows:—The residue was dissolved in a few drops of sodium hydroxide solution and about 1 c.c. of water, and evaporated to dryness in a silver crucible on the water-bath, and the residue fused with about 2 grms. of coarsely powdered potassium hydroxide. After 2 minutes the mass was dissolved in water, and the solution acidified with sulphuric acid, and extracted with ether. The ethereal extract was washed three times with water, and the ether evaporated (after the addition of 1 c.c. of water) at a low temperature. The aqueous residue, filtered if necessary, was then tested with a few drops of a freshly prepared 0.05 per cent. solution of ferric chloride. In this way 0.01 per cent. of benzoic acid could be detected in fresh flesh, 0.02 per cent. in smoked flesh, and 0.005 to 0.01 per cent. in lard, margarine and butter.—C. A. M.

Extract of meat; Constituents of — R. Engeland. Ber., 1909, 42, 2457—2462.

THE author prepared a quantity of carnine from extract of meat, and purified it by means of the double gold chloride of the base. The chloride of carnine was dissolved in ethyl alcohol containing hydrogen chloride. After heating and evaporating, the residue was treated with platinum chloride, when the platinum chloride compound of carnine ethyl ester was produced. This substance has the same properties and composition as the platinum chloride compound of novaine ethyl ester, and the author considers it highly probable that these two substances are identical. The platinum compound of carnine ethyl ester was treated with acetyl chloride, when acetyl-carnine was produced. The platinum compound of this substance, $(C_8H_{14}O_4N)_2PtCl_6$, melts at 199° C., and decomposes at 201° C. When carnine chloride is oxidised with calcium permanganate, β -homobetaine is produced. The author considers that carnine can be regarded as α -hydroxy- γ -trimethylaminobutyric acid.—F. SUDN.

Lead in solder and in the tin coating of cans for preserved foods. v. Della Croce. See X.

Analysis of cacao butter. Halphen. See XII.

Nuclein ferments of yeast. Straughn and Jones. See XVII.

PATENT.

Tanning [with tea waste, etc.]. Eng. Pat. 13,768. See XIV.

(B.)—SANITATION; WATER PURIFICATION.

Nitrates [in water]; Determination of small quantities of — L. Farcy. Bull. Soc. Chim., 1909, 5, 775—779.

A COMPARISON of the method of Granval and Lajoux for the determination of nitrates in water (this J., 1909, 740) with those of MacGowan (J. Chem. Soc., Trans. 1891, 59, 530) and Frerich (this J. 1903, 1209) shows that the first, as modified by the author (*loc. cit.*), is to be preferred in the presence of chlorides and ammonium salts the latter causing quite erroneous results to be obtained by the other methods.—F. SEDN.

Waters; New method for the hygienic control of — Spitta and Pleissner. Arch. Kais. Gesundh.-Amt., 1909, 30, 463—482. Chem. Zentr., 1909, 2, 61—62.

AN apparatus (see following abstract), which registers continuously and automatically variations of electrical

conductivity, has been constructed, and used for controlling a river water receiving waste liquors from the manufacture of potassium chloride. The record thus obtained gives indication of undue contamination of the water, extent of such contamination, and the time at which the contamination occurred. The method was found capable of detecting the addition of 1 part of the waste liquor to 200 parts of Spree water, and has the advantage that it allows of the detection of sudden transient alterations of the character of the water, which would probably not be discovered by the ordinary methods of chemical and bacteriological control. It would prove especially serviceable for indicating when a chemical examination of the water was desirable. Further in places where water purification by means of ozone is carried on, it would afford useful information with respect to the amount of ozone needed at different periods.—A. S.

Electrical conductivity of waters; Measurement and registration of the —, using a direct current. M. Pleissner. *Arch. Kais. Gesundheits-Amt.*, 1909, 30, 483–522. *Chem. Zentr.*, 1909, 2, 62–63.

AN apparatus is described which allows of the automatic and continuous registration of variations of the electrical conductivity of a water. A current of known and approximately constant voltage from a battery of six lead accumulators (average total E.M.F. 12.5 volts; capacity 27 ampere-hours), is sent alternately through a wire resistance of 200 ohms, and through the water by means of two graphite electrodes suspended from a float of paraffined cork. The direction of the current is reversed every two minutes. The current strength in the two different circuits is measured by means of a modified recording milliamperè-meter for direct current. The results are recorded in the form of two curves of which one represents the strength of the current passing through the water, whilst by the other the E.M.F. of the battery can be controlled. The specific conductivity is calculated by

means of the equation: $x = \frac{iC}{k - p - i}$; where i is the current strength recorded, k is the E.M.F. of the battery, p is the polarisation, and C the resistance-capacity of the pair of electrodes. The polarisation for a given current-strength can be obtained from a curve derived empirically; in the case of most natural waters, the values correspond for the most part with those found for magnesium chloride solution. It is stated that even in the most unfavourable cases the specific conductivity of natural waters can be determined with an error of less than 5 per cent. The values for the specific conductivity are calculated for a normal temperature of 18° C.: for the waters of the Rivers Rhine, Spree, Mosel, Unstrut, and Oder, the temperature-coefficients of conductivity were all approximately 0.023.—A. S.

Determining nitrate- and nitrite-nitrogen. Zeller. See XXIII.

PATENTS.

Refuse; Disposal of house — [as fuel, paving slabs, etc.]. A. D. Furse, London. Eng. Pat. 23,765, Nov. 6, 1908.

UNSORTED house refuse is ground to a uniform powder in a suitable disintegrator, and then mixed, in a dry state, with a certain proportion of binding material, such as solidified pitch, preferably possessing deodorising, disinfecting, and calorific properties. The mixture is agglomerated by means of heat, and then, by pressing into moulds of various sizes, it is converted into fuel briquettes or "nuts," or into paving blocks or slabs. In making paving blocks or slabs, hardening materials such as a silicate, pulverised flint, or granite, cement, slag, etc., may be added.—L. E.

Ozone; Apparatus for sterilising water with —. Felten und Guillaume-Lahmeyerwerke Act.-Ges., Frankfurt on Maine, Germany. Eng. Pat. 6013, Mar. 12, 1909. Under Int. Conv., Aug. 31, 1908.

IN a system for sterilising domestic water by means of ozone, the ozone generator is automatically switched in

whenever the water tap is opened, and ozonised air is drawn from the generator by the action of the waste itself. According to this invention a single generator is caused to serve several taps by carrying narrow supply pipes for ozonised air from a central generator separately to each of the taps. Each tap is provided with a suction and mixing nozzle, by means of which the escaping water is efficiently sterilised by the ozone drawn through. In order to prevent the access of atmospheric air through the taps, when water is drawn from one tap, each tap is provided with a check-valve so that only ozonised air can be drawn in.—J. F. B.

Filtering apparatus [for water purification]. H. Leister. Ger. Pat. 211,064, Jan. 23, 1908.

THE apparatus is of the type in which several filtering layers are arranged one above the other, with intervening spaces, in a casing, each filtering layer being connected to special inlet and outlet compartments, which communicate with common outflow and wash-water supply pipes respectively. It is intended specially for the purification of water by means of permutites or artificial zeolites (see this J., 1907, 711, 1251; also Ger. Pat. 197,111, this J., 1908, 587). One of the filtering layers is of the usual kind for the removal of mechanical impurities, whilst the others are composed of permutite. The wash-water supply pipe which is common to the mechanical and chemical (permutite) filtering layers, is provided with a branch pipe, through which a regenerating liquid is supplied to the permutite layers, suitable cocks being provided so that this liquid does not pass through the mechanical filter. Thus, when the filter needs renewing, first the regenerating liquid is passed through the permutite filters, and then wash-water is passed through both mechanical and chemical filters, in both cases in the opposite direction to that followed by the water under treatment.—A. S.

Waters; Process and apparatus for softening and purifying natural or polluted — principally for feeding steam-boilers and for industrial purposes. J. H. Dales. Fr. Pat. 397,774, Dec. 22, 1908. Under Int. Conv., Dec. 23, 1907.

SEE Eng. Pat. 28,221 of 1907; this J., 1908, 1173.—T. F. B.

Water filter. Oliver-Roche Co. Fr. Pat. 398,100, Dec. 19, 1908.

SEE Eng. Pat. 27,272 of 1908; this J., 1909, 539.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Castor oil plant; Paper pulp from the —. Walle. Papier Markt; through Paper Making, 1909, 28, 279.

THE writer has succeeded in establishing a large variety of the castor oil plant named *Ricinus giganteus*. The plant grows in Italy to the height of 20 ft. in a single year, its circumference at the base being 12–14 ins. The stem thickens considerably in subsequent years, and may measure 30 ins. round by the end of the third year. This stem yields 50 per cent. of papermaking cellulose fibres of a quality similar to that of poplar, but finer and more easily bleached. A *Ricinus* is said to yield after 2 years' growth as much cellulose as a poplar of 8–10 years' growth, and to require a lower proportion of chemicals for its isolation. The *Ricinus* requires a warm and moist climate, free from frost, and 2-year old plants might be grown in Southern Italy. 1-year old plants might be cultivated further north. The plants would be grown primarily for seed, and the stem would then be cut into lengths, barked and digested in the same way as poplar wood. To supply 20 tons of cellulose daily, it would be necessary to plant 250 acres with 2,000,000 plants, each yielding 13–22 lb. of wood. The value of the wood at the pulp mill is estimated at 1s. 6d. per cwt., and its cost of cultivation, with a biennial harvest, at 8s. 9d. per ton.—J. F. B.

Chromates as colouring matters for paper. E. W. L. Skark. Papierfabrikant., 1909, 7, 647–654.

LEAD chromate is frequently employed as a yellow or

orange colouring matter for paper pulp, being generally precipitated *in situ* by double decomposition between lead acetate or nitrate and potassium bichromate. If lead nitrate be used, the nitric acid produced by the action of the bichromate tends to dissolve some of the lead chromate; the bichromate should therefore be converted into the normal chromate by the addition of alkali before use. This complication does not arise when lead acetate is employed. The shade of the precipitate is very variable and depends not only on the composition of the product, but also on the temperature at which it is formed. The fine precipitate of lead chromate coagulates on heating, and this shrinkage in volume causes a darkening of its shade. For chrome yellow shades, 2.5 parts of lead acetate require 1 part of potassium bichromate. An excess of lead salt gives a precipitate with a fiery, dark lemon yellow shade. If, on the other hand, pale lemon to sulphur yellow shades be desired, a portion of the lead must be precipitated in the form of sulphate, by substituting for some of the bichromate an equivalent quantity of sulphuric acid, or preferably sodium sulphate. The composition of the water has an important influence on the shade, chalky waters tending to produce basic lead acetate and an orange tone. Alum only changes the shade of chrome yellow when it is added before the reaction is complete, or when an excess of lead salt over bichromate is present. If normal lead chromate be treated with sodium hydroxide or hot milk of lime, it is converted into chrome red, a basic lead chromate of variable composition, but generally approximating to Pb_2CrO_4 . The maximum red coloration is obtained by the interaction of 1 mol. of lead acetate, 1 mol. of potassium bichromate, and 4 mols. of sodium hydroxide. If the mixture be heated, the same colour may be obtained with only half the quantity of alkali, but the precipitate shrinks considerably in volume. Since chrome red always contains free lead oxide, it is not stable in presence of alum and cannot be used for colouring sized papers. Chrome orange is a mixture of chrome yellow and chrome red obtained by limiting the proportion of alkali. In colouring with chrome yellow, the lead salt is added first; it is better to under-dye than to colour too heavily in the beater. Since the reaction takes place instantaneously, any deficiency of colour may be made up in the stuff-chest; but if too much colour be added it cannot be conveniently reduced by the subsequent admixture of white pulp, because the paper will not be uniformly coloured. The lead chromate shows a tendency to become basic, not only by heating, but also on long standing in the chest; constancy of shade is, therefore, only obtained by steady working. A good test for the presence of chromates in paper consists in moistening the paper with a drop of sodium hydroxide and applying a drop of an acid solution of silver nitrate to the edge of the spot. A red streak of silver chromate will be formed at the junction of the two liquids. The analysis of the colouring matter in the paper consists of determinations of the chromium, lead and lead sulphate, which may be effected either on the ash or on the paper by decoction. Lead sulphate is extracted by boiling with sodium thiosulphate; chromates may be determined volumetrically with standard arsenite in a decoction made with sodium hydroxide.—J. F. B.

Paper; Penetration of gum solution in gumming — W. Herzberg. Mitt. kgl. Materialprüfungsamt Gross-Lichterfelde West, 1909, 27, 133—135.

It has been found that if certain kinds of paper are first ruled on one side, and then gummed on the other, the gum solution will penetrate through the paper, and cause unsightly blotches on the printed side, especially in the vicinity of the printing. The cause of this appears to be injury to or removal of the size of the paper by some constituent of the printing ink used. As a remedy it is suggested that the paper be first gummed, and then ruled; this may not always be feasible, but is even now done occasionally. Further that more strongly sized paper be used, and if the gum penetrates the paper even then, that a stronger solution of gum be employed.

—A. G. L.

PATENTS.

Bamboo pulp and other similar materials; Treatment of — J. S. Turner and A. W. Maxwell, London. Eng. Pat. 6277, March 20, 1908.

THE pulp prepared by the digestion of matured bamboo has a brown colour not readily removed by the ordinary bleaching agents. Bamboo half-stuff is treated with electrolytic "chlorine," that is, electrolysed brine and acid. Chlorinated products are removed by digestion with alkali, and the final cellulose bleach is effected by usual methods.—J. F. B.

Turpentine oil recovered in the manufacture of sulphate-cellulose; Process for improving the odour of the — C. G. Schwalbe. Ger Pat. 210,829, April 25, 1908.

A CURRENT of oxides of nitrogen is led through the crude oil in order to oxidise the mercaptans, etc., and the oil is then further purified with sulphuric acid and caustic soda in the usual way. (Compare this J., 1909, 37.)—A. S.

Cellulosic films; Treatment and application of — J. E. Brandenberger, Thion-les-Vosges, France. Eng. Pat. 24,809, Nov. 18, 1908.

FILMS of cellulose, obtained preferably from the xanthogenate, are embossed or decorated in various ways. The films themselves, in the course of their formation, may be made transparent, opaque, coloured, metallised, etc. The finished films may be printed or embossed in decorative designs, and the embossed reliefs may be padded with appropriate composition (mastic), with or without an external support. Or the supports themselves may be decorated, and the dry or moist films attached by means of adhesives, and the product embossed, its hollows being filled with a plastic or rigid material to which a second support is then applied. Suitable supports are paper, cardboard, textiles, leather, wood, foliated metals, etc.

—J. F. B.

Cinnouche and cellulose product. Eng. Pat. 7302. See XIII. C.

Nitration of cellulose. Fr. Pat. 397,707. See XXII.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Conium alkaloids; Isolation of the — from animal tissues and the action of living cells and decomposing organs on these alkaloids. W. J. Dilling. Biochem. J., 1909, 4, 286—299.

THE author has investigated various methods for the isolation of coniine, conhydrine, and pseudo-conhydrine from urine, blood, and various animal tissues previously treated with small quantities of these alkaloids, and has also studied the action of living and of decomposing tissues on the alkaloids. The best method for isolating coniine from animal tissues is that of distillation (with sodium carbonate). Of 10 mgrms. of coniine salt added to 200 c.c. of urine or to 100 grms. of horse's liver or spleen, from 41.6 to 83 per cent. was recovered by this method. This alkaloid appears to be decomposed both by living cells and by decomposing tissues. Conhydrine and pseudo-conhydrine can be isolated from animal tissues in appreciable amount by extraction with alcohol and ether and by precipitation with phosphotungstic acid, but the results are not sufficiently constant to allow of any definite conclusions as to the action of living cells or decomposing tissues on these poisons.—L. E.

Lead number of vanilla extracts. H. L. Jackson and W. T. McGeorge. J. Ind. and Eng. Chem., 1909, 1, 478—479.

EXTRACTS were prepared in the laboratory from different varieties of vanilla beans by a method of very slow percolation with alcohol of different strengths. It was found that for extracts prepared from equal weights of a given kind of beans, the lead number (see Winton, this J., 1906, 957) was practically constant, regardless of the concen-

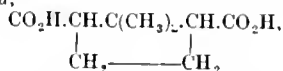
tration (between 20 and 65 per cent.) of the alcohol used in the percolation. Tests with three extracts, of which 100 c.c. corresponded to 5, 10, and 15 grms. respectively of vanilla beans, indicated that the lead number of the extract is a measure of the quantity of beans used, when this does not exceed 10 grms. per 100 c.c.—A. S.

Curcuma (turmeric) oil. H. Rupe, E. Luksch, and A. Steinbach. Ber., 1909, 42, 2515–2520. (See this J., 1908, 90).

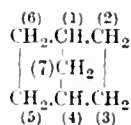
The oil examined had the sp. gr. 0.9388 at 20° C., and $[\alpha]_D^{20} = -24.76^\circ$ at 20° C. On distilling 100 grms. at 10–5 mm., 1.6 grms. boiled between 80° and 117° C., and was found to contain *n*, (*a*), phellandrene. The principal fraction (82 grms.) boiled between 146° and 160° C. at 10 mm. On further fractionation this portion boiled at 155° to 158° C. at 11 mm. and was found to be identical with the turmerol of Jackson and Menke (Amer. Chem. J., 1882, 4, 77, 368). It yielded no crystalline derivatives. When curcuma oil is boiled with alcoholic potassium hydroxide, a ketone, *curcumanone*, $C_{15}H_{14}O$, is produced. When pure, curcumanone boils at 122° C. at 11 mm. It is a colourless mobile oil, with a sharp ginger-like smell. The sp. gr. is 0.9566 at 20° C., and it has $[\alpha]_D^{20} = -80.55^\circ$ at 20° C. The semicarbazone melts at 120°–121° C. It condenses with benzaldehyde to form benzylidene-curcumanone, $C_{15}H_{14}O : CH.C_6H_5$, melting at 106° C. The piperonal compound, $C_{15}H_{14}O_3$, melts at 86° C., and the anisaldehyde compound at 77°–78° C.—F. SUDN.

Iso-pinene: Constitution of —. O. Aschan. Översigt af Finska Vetenskaps-Soc. Förhandlingar, 1908, 51, 1–17. Mfd. A. No. 9. Chem. Zentr., 1909, 2, 26–27.

The author has previously shown (this J., 1907, 776) that the liquid "first runnings" from the crude camphene formed by the action of bases on crude pinene hydrochloride contains a hydrocarbon, pinolene ($C_{10}H_{16}$), boiling at 145°–146° C. This yields with hydrochloric acid an addition-compound, which when treated with aniline gives the isomeric hydrocarbon, isopinene, boiling at about 10° higher than pinolene. Isopinene hydrochloride, m. pt. 36°–37° C., is identical with the addition compound of pinolene and hydrochloric acid. It has now been found that pinolene consists of a mixture of two hydrocarbons, α - and β -pinolene, which can be separated by means of permanganate solution at 60°–80° C., the former being oxidised to *r*-camphoric acid, whilst the latter remains unattacked. Pure β -pinolene boils at 142°–144° C., has $[\alpha]_D^{20} = +0.28^\circ$, sp. gr. 0.8588 at 20° C., and $n_D^{20} = 1.44769$; its molecular refraction, 42.37, indicates that it is a triyclic compound containing a trimethylene ring. When its ethereal solution is saturated with dry hydrogen chloride at 15° C., it yields a volatile hydrochloride, m. pt. 25°–26° C., which when treated with aniline yields pure isopinene. The latter hydrocarbon boils at 154.5°–155.5° C., and has the sp. gr. 0.8658 at 20°/4° C., $n_D^{20} = +2.61^\circ$, $n_D^{20} = 1.470253$; its molecular refraction indicates that it is a bicyclic compound with one ethylenic linkage. By oxidation with permanganate two acids were obtained from isopinene: one which the author names *fenchonic acid*, $C_{10}H_{16}O_3$, m. pt. 126°–128° C., was a ketone acid and yielded apocamphoric acid on treatment with bromine and alkali; the other was *cis-apocamphoric acid*,



m. pt. 200° C. The author concludes that isopinene has the constitution ascribed by Wallach to fenchene. In view of the conflicting views as to the constitution of fenchene, the author considers that more rational names are needed for the hydrocarbons *d*-l-fenchene and isopinene, and he proposes a nomenclature based on the formula,



for norcamphane. According to this plan, *d*-l-fenchene would be metho-2-dimethyl-7,7-norcamphane, and isopinene, trimethyl-2,7,7-norcamphene-2.—A. S.

Neuralteine, pyramidon, and antipyrine: Reactions for distinguishing —. A. Monferrino. Giorn. Farm. Chim., 1909, 58, 145–151. Chem. Zentr., 1909, 1, 2029.

Neuralteine (sodium salt of sulphomethylphenetidine).—If a few drops of a solution of neuralteine, which has been coloured violet by addition of ferric chloride, be added to concentrated sulphuric acid, a green coloration is formed which changes to blue on adding a larger quantity of the solution. Addition of ferric chloride to an alcoholic solution of the substance produces a reddish colour, changing to chestnut-brown and green; the colour becomes brighter on addition of sulphuric acid. A 1 per cent. aqueous solution is coloured reddish-yellow by addition of concentrated sulphuric acid and nitric acid. Stannous chloride produces a white precipitate in the aqueous solution. A solution of 1 part of neuralteine in 100,000 is coloured reddish-yellow by addition of 1 drop of potassium nitrite solution (1:20) and 1 drop of concentrated sulphuric acid or glacial acetic acid.

Pyramidon (dimethylaminoantipyrine).—A few drops of the solution coloured violet by ferric chloride produce a faint blue coloration when added to concentrated sulphuric acid. The sensitiveness of the reaction with potassium nitrite is 1:1000 in presence of sulphuric acid and 1:10,000 in presence of glacial acetic acid. *Antipyrine (phenyldimethylpyrazolone).*—The solution coloured red by ferric chloride gives a chrome-yellow coloration when added to concentrated sulphuric acid. The reaction with potassium nitrite does not take place in presence of glacial acetic acid, and in presence of sulphuric acid, the sensitiveness is 1:10,000. For the examination of neuralteine for the detection of adulterants, the following reactions are recommended. (1). 1 part of the substance should be soluble in 10 parts of water. (2). The solution coloured violet with ferric chloride should become blue and then green when added to sulphuric acid, but the lower layer of sulphuric acid should not be coloured yellow and should give no flocculent precipitate (presence of sodium salicylate). (3). The aqueous solution should give a precipitate composed of glistening scales on addition of sulphuric acid, and on further addition of a solution of nitrite, this should dissolve, with formation of a red coloration. (4). The aqueous solution when treated with glacial acetic acid should not give a precipitate either immediately or after standing for several hours.—A. S.

Abrastol (asaprol, calcium β -naphthol- α -sulphonate); A reaction of —. O. Carletti. Boll. Chim. Farm., 1909, 48, 223–224. Chem. Zentr., 1909, 2, 72.

A SOLUTION of abrastol in concentrated sulphuric acid gives an emerald-green coloration when treated with a few drops of a 10 per cent. alcoholic or aqueous solution of tartaric acid and then gently warmed. 0.00005 gm. of abrastol can be detected by means of this reaction, which has the advantage over the ferric chloride test of not being affected by the presence of organic acids.—A. S.

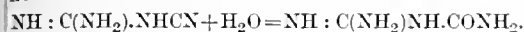
Pyrrole; Preparation of —. E. Khotinsky. Ber., 1909, 42, 2506–2507.

AN improved yield of pyrrole can be obtained by distilling ammonium mucate with glycerol instead of heating it alone. 50 grms. of mucic acid in the form of the ammonium salt were heated under the following circumstances. When heated alone, 2 grms. of pyrrole were produced. By adding 200 c.c. of glycerol, the yield was increased to 4.5–4.7 grms.; with 150 c.c. of glycerol saturated with ammonia gas, 6.5 grms. were obtained; whilst with 200 grms. of glycerol and distilling in a current of ammonia gas, there was a yield of 6.7 grms. of pyrrole.—F. SUDN.

Dicyandiamide; The chemical nature of —. N. Caro and H. Grossmann. Chem. Zeit., 1909, 33, 734–735.

IN contradiction to the conclusions of Radlberger as to the basic character of dicyandiamide, it is shown that

icyandiamide is not capable of forming salts directly, but that on bringing it in contact with acids, the molecule is completely changed, one molecule of water being taken up with the formation of diacyandiamidine which immediately combines with the acid present to form a salt. The reaction is:



Experiments with a 2 per cent. solution of diacyandiamide with different indicators showed that the presence of this compound had little influence upon the neutral reaction of the water. Measurements of the conductivity of a 0.3 per cent. solution showed only a slight increase over the conductivity of the water. Experiments upon the specific rotation of tartaric acid solutions showed that the addition of diacyandiamide had no influence; hence diacyandiamide has no basic properties. Thus it appears that diacyandiamide is a perfectly neutral compound, and this property explains why it so easily combines with other molecules to form complex salts.

—J. H. J.

tribromophenol; Behaviour of — to benzene in the presence of aluminium chloride. M. Kohn and N. L. Müller. *Monatsh. Chem.*, 1909, 30, 407—409.

When a mixture of tribromophenol (35 grms.), benzene (10 grms.) and aluminium chloride (35 grms.) is heated in the boiling water bath for 3 hours, bromobenzene (0.24 grms.) and phenol (2—5 grms.) are formed together with bromophenols. In a similar experiment carried out with trichlorophenol, interaction did not occur, but in the case of *p*-bromophenol a small amount of bromobenzene was detected.—J. C. C.

aldehydes; Oxidation of — by silver oxide. M. Delépine and P. Bonnet. *Compt. rend.*, 1909, 149, 39—41.

The presence of nitrates in no way affects the oxidation of aldehydes by silver oxide; accordingly, there is no need to prepare freshly precipitated and washed silver oxide as a preliminary, but silver nitrate may be added to the alcoholic solution of the aldehyde, and be then decomposed by addition of an equivalent quantity or slight excess of sodium or barium hydroxide. The action proceeds best if the silver salt be added in excess to the extent of from one-twentieth to one-half of the quantity theoretically required. The authors have readily obtained excellent results by this method with cinnamaldehyde, pyromucic aldehyde, citral, and other aldehydes.—J. T. D.

ethyl alcohol and its mixtures with water; Specific heat of —. A. Doroshewski and A. Rakowski. *J. Russ. Phys.-Chem. Ges.*, 1908, 40, 860—886. *Chem. Zentr.*, 1908, 2, 1568.

The absolute alcohol prepared by the authors had the sp. gr. at 15°/15°, 0.79426, and specific electric conductivity, $\kappa = 0.097 \times 10^{-8}$. The specific heat was determined by Schukarew's method (*Ann. der Physik*, [3], 59, 229), which is based on the fact that when different substances are introduced into an atmosphere of steam, the quantities of water condensed upon the surfaces of the substances are proportional to the specific heats of the latter. For absolute alcohol at 20° C. the value found was $c_{20} = 0.518$. For mixtures of alcohol and water the following results were obtained, the figures representing respectively, the percentage of alcohol by weight and the specific heat of the mixture over the interval, 22°—99° C.:—0, 0.6597; 94.43, 0.7089; 90.02, 0.7390; 85.05, 0.7732; 80.030, 0.8030; 74.99, 0.8309; 69.96, 0.8603; 64.96, 0.8859; 59.95, 0.9079; 54.93, 0.9296; 50, 0.9489; 44.95, 0.9702; 39.93, 0.9924; 34.98, 1.0116; 29.94, 1.0277; 24.97, 1.0411; 20.09, 1.0440; 15, 1.0422; 10.04, 1.0300; 0, 1.0169; 0, 1.0067.—A. S.

ethyl alcohol and water; Electric conductivity of mixtures of —. A. Doroshewski and M. Roshdestwenski. *J. Russ. Phys.-Chem. Ges.*, 1908, 40, 887—908. *Chem. Zentr.*, 1908, 2, 1568—1569.

In their experiments the authors purified the water by repeated distillation over barium hydroxide, potassium

permanganate, and phosphoric acid, and the alcohol by repeated distillation over quicklime. The results obtained at 15° C. were as follows, the figures representing the percentage of alcohol by weight and the electric conductivity ($\lambda \times 10^6$) respectively:—0, 1.097; 2.6, 0.949; 13.6, 0.540; 20.1, 0.414; 28.2, 0.313; 37.4, 0.256; 44.2, 0.237; 50.4, 0.234; 56, 0.219; 60.4, 0.223; 71.4, 0.235; 74.6, 0.238; 80.6, 0.248; 86.3, 0.235; 91.1, 0.215; 94.9, 0.196; 98.5, 0.133; 100, 0.097. The relation between the specific electric conductivity (λ) and the concentration (C) of alcohol in the mixture can be represented by the equation, $\lambda \cdot C^2 = a$ constant, which varies with the temperature and the degree of purity of the alcohol and water. The relation between the viscosity (η), the conductivity (λ), and the dielectric constant (D) of mixtures containing from 10 to 50 per cent. of alcohol, can be represented by the equation, $\frac{\eta \lambda}{D} = a$ constant.—A. S.

Alcohols and water; Indices of refraction of mixtures of —. A. Doroshewski and S. Dworzanczyk. *J. Russ. Phys.-Chem. Ges.*, 1908, 40, 908—931. *Chem. Zentr.*, 1908, 2, 1569—1571.

The authors have determined the indices of refraction of mixtures of ethyl alcohol and water for thallium and lithium rays at 15° C. and for sodium rays over the interval, 15°—55° C., also the indices of refraction for sodium rays of mixtures of water with propyl, isopropyl, butyl, and isobutyl alcohols respectively at 15° and 20° C. For the determinations at 15° C. the Pulfrich apparatus was used, whilst for higher temperatures the Zeiss immersion refractometer was employed. The more important results for mixtures of ethyl alcohol and water are given in the following table:—

Percentage of alcohol by weight.	$n_{15^\circ}^D$	$n_{30^\circ}^D$	$n_{40^\circ}^D$	$n_{50^\circ}^D$	$n_{55^\circ}^D$
0	1.33345	1.3318	1.3306	1.3290	1.3281
10	1.34020	1.3384	1.3368	1.3349	1.3339
20	1.34778	1.3450	1.3429	1.3406	1.3393
30	1.35470	1.3510	1.3481	1.3452	1.3435
40	1.35948	1.3550	1.3518	1.3484	1.3468
50	1.36290	1.3578	1.3543	1.3506	1.3488
60	1.36505	1.3597	1.3560	1.3522	1.3501
70	1.36645	1.3608	1.3570	1.3528	1.3505
80	1.36690	1.3611	1.3569	1.3525	1.3502
90	1.36626	1.3603	1.3561	1.3515	1.3491
100	1.36332	1.3573	1.3531	1.3487	1.3465

From the general results of the experiments it is concluded that:—(1). The maximum in the curve representing the indices of refraction of aqueous solutions of alcohols is more pronounced in the case of the iso than of the normal alcohol, and is also better defined the smaller the molecular weight of the alcohol. (2). The greater the molecular weight of the alcohol, the higher is the concentration of alcohol in the mixture showing the maximum refractive power. (3). Gladstone's formula, $\frac{n-1}{d}$, is the most suitable one for expressing the specific refractive power. (4). The influence of temperature upon the index of refraction of the mixtures can be represented by the equation, $n_t = \frac{n_n}{1+kt}$ (See also this J., 1908, 416.)—A. S.

Hydrolysis of bismuth bromide. Dubrisay. *See VII.*

Iodine determination. Gooch and Perkins. *See VII.*

Copaifera paupera oleoresin. Hartwich and Jama. *See XIII.*

Ether purification and extraction apparatus. Fritsch. *See XXIII.*

PATENTS.

Lecithin; Process for obtaining hydrogen iodide and hydrogen bromide addition compounds of —. G. Richter, Budapest. Eng. Pat. 28,011, Dec. 23, 1908.

ADDITION compounds of lecithin with the halogen

hydracids are prepared by dissolving 1 kilo. of lecithin in 5 kilos. of carbon tetrachloride and saturating the solution with gaseous hydrogen iodide or bromide, while cooling with ice. The nitrogen of the choline residue combines with an excess of halogen, which is eliminated by stirring the solution with 50—100 gms. of calcined sodium carbonate; the product is finally filtered and evaporated *in vacuo*. The products are yellowish-brown, wax-like masses, containing 32 per cent. of iodine or 21 per cent. of bromine; they may be purified by dissolving in hot alcohol or acetone from which they separate on cooling. If the treatment with sodium carbonate be omitted, products containing still higher proportions of halogen are obtained.—J. F. B.

1. *p*-Dialkylamino-aryl-2:4-dialkyl-3-oxymethyl-5-pyrazolones; *Manufacture of* —. O. Imray, London. From Farbwerke vorm. Meister, Lucius, and Brüning, Höchst am Main, Germany. Eng. Pat. 4128, Feb. 19, 1909.

COMPOUNDS which are claimed to possess antipyretic qualities, are prepared by the action of alkylating agents on the *p*-aminoaryl-2:4-dialkyl-3-oxymethyl-5-pyrazolones. The starting point for the preparation of these bodies is the condensation of *p*-nitrophenylhydrazine with α -methylacetoacetic ester, whereby 1-*p*-nitrophenyl-3:4-dimethyl-5-pyrazolone is produced. This is converted into the trimethyl compound by treatment with dimethyl sulphate. By the action of bromine, this is converted into the 2:4-dimethyl-3-bromomethyl derivative, and the bromine is displaced by hydroxyl by the action of an alkali acetate and subsequent hydrolysis. Finally the nitro group is reduced by tin and hydrochloric acid.—J. F. B.

Camphor from borneols; Process for making —. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 398,361, Jan. 8, 1909. Under Int. Conv., Jan. 11, 1908.

BORNEOL and isoborneol are converted into camphor by heating, with or without a solvent, in presence of metals or their oxides, which possess the property of liberating hydrogen from the borneol; nickel and cobalt are especially suitable, and also cupric oxide, which is employed in insufficient quantity to oxidise the borneol. The metal is preferably added in several portions, as the action proceeds more regularly than when it is all added at once. For example, 10 parts of borneol, 30 parts of paraffin, and one part of petroleum are heated to 240° C. in an open vessel, and one part of nickel powder is added; when evolution of hydrogen has nearly ceased, four further additions, each of about 0.75 part of nickel, are made; the yield of camphor is said to reach 94 per cent.—T. F. B.

Therapeutic agent from myrrh; Process for obtaining a —. W. von Bolton. Ger. Pat. 211,212, May 17, 1907.

THE myrrh is extracted with water, the solution is evaporated, the residue is extracted with alcohol, and the alcoholic liquid evaporated. Or, the extraction with alcohol may be performed first, and the evaporation residue of the alcoholic solution extracted with water. In either case the product is a brown substance soluble in ether, melting at about 78° C., and possessing a very bitter taste. Its therapeutic action can be increased by boiling it with a solution of hydrogen peroxide, and then evaporating to dryness, preferably at 30—40° C. under diminished pressure, in order to avoid danger of explosion.—A. S.

Alkylthiosalicylic acids and their alkyl esters; Process for preparing —. Farbwerke vorm. Meister, Lucius, and Brüning. Ger. Pat. 211,679, Aug. 28, 1906. Addition to Ger. Pat. 203,882, Aug. 23, 1906 (see this J., 1908, 1223).

o-Diazobenzoic acid or one of its alkyl esters is treated with an alkali xanthate in presence of alkali; the resulting *o*-carboxylic acid or ester of "xanthogen phenyl ester," which need not be isolated, is readily converted into an alkylthiosalicylic acid or its ester by heating with an alkyl halide or an alkyl sulphuric ester in presence of alkali.—T. F. B.

Salts of arabic acid with bases possessing anæsthetic properties; Process for preparing —. E. Erhardt. Ger. Pat. 211,800, May 22, 1908.

ARABIC acid salts of cocaine, tropacocaine, stovaine, novocaine, and analogous bases, are prepared by the action of pure arabic acid on the base. They are intended to replace the hydrochlorides of the bases as anæsthetics.—T. F. B.

p-Aminobenzoic acid isopropyl ester; *Process for preparing* —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 211,801, Feb. 13, 1908.

THE isopropyl ester of *p*-aminobenzoic acid possesses more powerful anæsthetic properties than the other known esters, but is less soluble. It is obtained by esterifying the acid or its salts with isopropyl alcohol or an isopropyl halide, or by the reduction of *p*-nitrobenzoic acid isopropyl ester or of a corresponding azo compound.—T. F. B.

Parine derivatives; Manufacture of new — and of intermediate compounds for use therein. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 15,573, July 22, 1908.

SEE FR. Pat. 393,564 of 1908; this J., 1909, 160.—T. F. B.

Methylene citric acid; Manufacture of alkyl esters of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 22,085, Oct. 19, 1908.

SEE FR. Pat. 395,447 of 1908; this J., 1909, 490.—T. F. B.

Iron in a masked condition; Process for preparing a solution containing —. A. Ascoli. Fr. Pat. 398,035, Dec. 30, 1908.

SEE GER. Pat. 194,950 of 1906; this J., 1908, 644.—T. F. B.

p-Aminobenzoic acid; *Process for producing the *n*-propyl ester of* —. F. Fritzsche und Co. Fr. Pat. 398,259, Jan. 4, 1909.

SEE ENG. Pat. 2020 of 1909; this J., 1909, 814.—T. F. B.

Dibromobenzene acid; Process for the production of salts of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 398,683, Jan. 21, 1909. Under Int. Conv., July 21, 24, and 28, 1908.

SEE ENG. Pat. 17,132 of 1908; this J., 1909, 673.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENT.

Photographic negatives or positives on any sensitive surface; Process for developing and fixing in daylight —. F. Jeannot and M. Brenner. First addition, dated March 25, 1908, to Fr. Pat. 390,265, July 23, 1907 (see this J., 1908, 1046).

IN place of the pierate employed in the process described in the original patent, the reddish liquid obtained by boiling and expressing beetroots, is used.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Transportation of explosives. Eng. and Min. J., July 17, 1909. [T.F.B.]

THE lines comprising the American Railway Association, working 246,172 miles of line in the United States, Canada, and Mexico, have, beginning July 1, 1909, put into effect revised rules for the transportation of inflammable articles and acids. These are supplementary to the rules of the Interstate Commerce Commission, effective April 13, 1909, for the transportation of explosives. These regulations for the transportation of dangerous articles have been formulated by Col. B. W. Dunn,

U.S. Army, chief inspector of the Bureau for the Safe Transportation of Explosives for the American Railway Association, and are based upon an Act of Congress approved May 30, 1908.

The particular purpose is that the shipper shall know the true characteristics of his shipment and familiarise himself with the requirements of the regulations in order that he may inform the carrier by use of prescribed certificates and labels. Special supervision is given not only to the transportation of powder, dynamite and other heavy explosives, but it is now provided that special care shall be pursued in the handling of any material that gives off inflammable vapour at or below a temperature of 80° F.; materials subject to spontaneous combustion; materials other than acids, which are liable to cause accidents by friction, concussion, absorption of moisture, contact with organic matter and otherwise. Special rules so govern the handling of compressed gases as well as a list of eight of the more virulent acids and corrosive compounds. Illustrative of the detailed care with which the various rules have been formulated to govern the packing of different articles, are the following regulations:—

"Nitro-cellulose wet with solvent must contain not less than 30 per cent. of a solvent whose flash point is not less than 40° F.; and must be packed in strong lined or galvanised iron vessels, of the milk-can type, with a satisfactory means for keeping them securely closed.

"Metallic sodium or potassium, in quantity not greater than 1 lb., must be placed in neutral oil, and this in a well stoppered bottle protected by a tin box, or these substances may be packed in a hermetically sealed tin cylinder."

It is stipulated that every article of a hazardous character, when offered for shipment, must bear a prescribed red label to indicate to the railroad employees the method of handling (see also this J., 1908; 713, 834, 18).

Explosives; Report of the Chief Inspector of — for Western Australia, 1908.

The quantity and value of explosives imported into Western Australia for 1908 were as follows:—

Explosive.	Quantity.	Value.
		£
Gelignite	3,251,928 lb.	94,586
Dynamite	12,000 "	330
Blasting gelatin	438,500 "	17,712
Latex dynamite	339,852 "	11,726
Detonators	3,000,000 (number)	3,341
Fuse	547,872 (coils)	11,265
Blasting powder	116,500 lb.	2,896
Sorting powder	1,150 "	133
Other explosives	—	15,125
Reworks	—	312

A comparison is given of the importations of the different States of the Commonwealth for 1908:—

State.	Nitro-glycerin compound.	Blasting powder.	Sporting powder.	Totals.
	lb.	lb.	lb.	lb.
Western Australia	4,052,280	116,560	1,150	4,169,990
Victoria	1,457,200	195,390	42,070	1,694,660
Queensland	1,819,113	385,315	1,000	2,205,428
New South Wales	1,981,000	1,783,850	31,407	3,796,257
South Australia	772,000	123,300	8,985	904,285
Tasmania	564,100	69,480	10,859	644,439

Western Australia takes 31·08 per cent. of the total Commonwealth importations of explosives. No less than 12 tests for explosives were carried out during the year, and of this number 1445 were for gelignite alone, and 922 tests were made in connection with the special precautions which were taken to bring about a greater regularity and uniformity in the safety fuse used for blasting. There are 10 magazines (including Government buildings), in 43

explosives reserves, of an area of 3195 acres. The total capacity is 11,180 tons. Outside the reserves there are 36 magazines licensed, with a total capacity of 30 tons. The condition of the explosives imported into the State was, on the whole, very good. Some 260 cases of gelignite, 40 cases of gelatin dynamite, and 20 cases of blasting gelatin were destroyed owing to not passing the official test; 50 cases of gelatin dynamite were destroyed owing to chemical deterioration on storage; whilst some 600 coils of fuse were condemned owing to the fact that they hung fire, and did not comply with the regulations with respect to rate of burning.—G. W. McD.

PATENTS.

Nitration of cellulose; Method and apparatus for the — in the manufacture of powder, celluloid, and other materials: C. Crépelle-Fontaine. Fr. Pat. 397,707, Dec. 8, 1908.

The nitrating vessel is cylindrical in form, and is provided with an air-tight cover. Two acid reservoirs which can be either evacuated or placed under pressure are connected with the nitrating vessel. The pipe from one enters at the bottom of the nitrating vessel, and passes up the centre, delivering its acid at the top close to the cover. The other delivers its acid at the bottom of the vessel just beneath a perforated false bottom. The cellulose having been placed in the nitrating vessel, the air is withdrawn from it by evacuating one of the acid reservoirs. The cock communicating with the other reservoir is then opened, and the acid flows into the evacuated nitrating vessel. When this has been filled with acid, the cock is turned off and the acid which has been in contact with the cellulose is sucked off into the other reservoir. This process is repeated alternately and the advantages claimed are that a very much more uniform nitration of the cellulose is thus obtained.—G. W. McD.

Explosives containing hypophosphites; Preparation and use of —. E. Serrant and A. Boilleau. Fr. Pat. 397,792, March 7, 1908.

The hypophosphites of sodium, potassium, ammonium and calcium are claimed as explosives either alone or, preferably, in admixture with oxidising agents (10 to 50 per cent.). The advantages claimed are that they are stable, and have greater power than explosives generally employed, and produce no deleterious products on explosion.—G. W. McD.

Blasting powder; Wrappers for —. F. E. Thomas. Fr. Pat. 398,033, Dec. 30, 1908.

In place of the paraffined or parchment wrapper usually employed, it is proposed to utilise aluminium foil, or paper faced with aluminium powder. The advantages claimed are that in the case of explosives containing an excess of oxygen, the oxidation of the aluminium wrapper increases the strength of the explosive. The air space in the bore-hole between the cartridges is also reduced. The wrapper should weigh 4 to 12 per cent. of the weight of the cartridge itself.—G. W. McD.

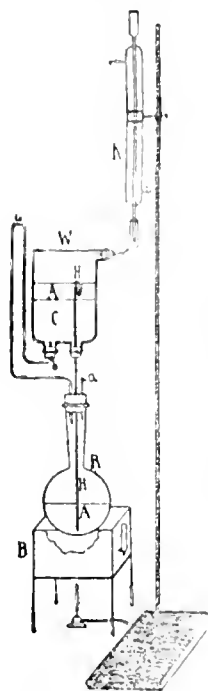
XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Gooch crucibles for asphalt analysis; Preparation of —. B. Mears. J. Ind. and Eng. Chem., 1909, 1, 477.

The filtration of tarry or asphaltic precipitates suspended in organic solvents by means of the Gooch crucible, can be effected much more satisfactorily, it is stated, if a thimble of platinum gauze be inverted on the bottom of the crucible, and the fibrous asbestos disposed over the surface of the thimble. If the precipitate is not to be ignited, a copper gauze thimble may be used.—A. S.

Ether; Purification of and extraction apparatus.
R. Fritsch. Chem. Zeit., 1909, 33, 759-760.



back into R, and the latter is cooled at once by means of cold water. The ether so obtained is freed from water as usual with sodium and distilled.—A. G. L.



PATENT.

Vapours or gases of all kinds; Tube for the introduction of — into liquids. H. Stoltzenberg. Ger. Pat. 211,528, Feb. 21, 1908.

THE tube is intended specially for use in distilling with-steam. It is closed at the lower end and near this end is provided with a number of curved branch tubes (see Fig.) having fine perforations, through which the steam issues in a tangential direction.—A. S.

INORGANIC—QUALITATIVE.

Detecting nitrates in presence of bromides. Villedieu. See VII.

INORGANIC—QUANTITATIVE.

Nitrate- and nitrite-nitrogen; Determination of — in mixtures and in presence of organic matter. T. Zeller. Landw. Vers.-Stat., 1909, 70, 145-154. Chem. Zentr., 1909, 2, 148-149.

THE method is a modification of that of Gailhat (J. Pharm. Chim., 1900, [6], 12, 9). A suitable quantity of the liquid to be tested is boiled with a known quantity of ammonium chloride solution in a 100 c.c. flask until the volume is reduced to about 2 c.c. The residue is diluted to 100 c.c., and 40 c.c. are distilled with magnesia to determine the amount of undecomposed ammonium chloride. Another 40 c.c. are reduced with sulphuric acid and iron, and thus the nitrate- and ammonia-nitrogen present are determined. If the original solution contains ammonium compounds,

the ammonia is determined in a separate portion by distillation with magnesia. The method is inapplicable in presence of ferrous salts and carbonates; the latter may be removed by means of barium chloride before the treatment with ammonium chloride. The method is suitable for the examination of bacterin-cultures.—A. S.

Reduction of perchlorates by titanium sesquisulphate. Stähler. See VII.

Iodine determination. Gooch and Perkins. See VII.

Lead in solder and in the tin coating of cans for preserved foods. v. Della Croce. See X.

Action of hydrochloric acid gas on, and analysis of metallic aluminium. Kohn-Abrest. See X.

Preparing soil samples for analysis. MacNider. See XV.

Determining nitrates [in water]. Farey. See XVIII B.

ORGANIC—QUALITATIVE.

Analysis of cacao butter. Halphen. See XII.

Detecting benzoic acid in meat and fats. Fischer and Gruenert. See XVIII A.

Distinguishing neurathine, pyramidone, and antipyrine. Monferrino. See XX.

Abrastol reaction. Carletti. See XX.

ORGANIC—QUANTITATIVE.

Asphaltum in dark mineral oils. Holde. See III.

Oil and fat analysis. See XII.

Tannin and leather analysis. See XIV.

Chemistry of caoutchouc. Hinrichsen and others. See XIII C.

Gelatin-hematin acid method [for tanning liquors]. Alsop. See XIV.

Determining sugar in the beetroot. Herzfeld. See XVI.

Determining reducing sugars. Duschsky. See XVI.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Mixed solvents containing glycerol; Conductivity and viscosity of —. M. R. Schmidt and H. C. Jones. Amer. Chem. J., 1909, 42, 37-95.

GLYCEROL with water, or with methyl or ethyl alcohol, forms binary mixtures the properties of which are not additive.

In these mixtures, the conductivity curves of three electrolytes in no case obey the law of averages. The same is also true of the fluidity curves. The temperature coefficients of conductivity of solutions in pure glycerol are very large, and nearly identical with the temperature coefficients of fluidity. Glycerol, as a dissociating liquid, resembles water more closely than it does the alcohols. It is further found that conductivity increases with fluidity, but instead of increasing at the same rate, it varies as some fractional power of the fluidity.

Rare earths from mariupolite; Separation of —. J. Morozewicz. Anz. Akad. Wiss. Krakau, 1909, 207-213. Chem. Zentr., 1909, 1, 1965-1967.

THE minerals in which the rare earths occur, and which

are associated with the mariupolite (see Anz. Akad. Wiss. Krakau, 1904, 485), are beckelite and pyrochlore; the former contains metals of the cerium group and forms about 0.3 per cent. of the whole mineral, whilst the latter contains metals of the tantalum group, and is present to the extent of about 0.2 per cent. For the separation of the rare earths from the strongly preponderating oxides of iron, aluminium, and titanium, the following method was found satisfactory. By treatment with dilute hydrochloric acid, in which nepheline and beckelite are readily soluble, a separation was effected into a soluble portion containing the cerite earths, and an insoluble portion containing metals of the tantalum group, and also zirconium and titanium. (1). *Separation of cerium, lanthanum, didymium, yttrium, and cerium.*—The hydrochloric acid solution was evaporated, the silica separated, and then the solution again evaporated. The residual chlorides were converted into sulphates and heated until sulphur trioxide fumes were evolved, whereupon the residue was dissolved in cold water, and sufficient solid sodium hydroxide added to redissolve any precipitated aluminium hydroxide. The precipitate thus obtained consisted of hydroxides of the cerium metals contaminated with ferrie hydroxide. It was dissolved in hydrochloric acid, the solution diluted, and the hydroxides re-precipitated with ammonia. The precipitate was dissolved in nitric acid, the excess of acid expelled, and the faintly acid solution diluted with water to 50 c.c., warmed, and added drop by drop to a large excess of a hot concentrated solution of oxalic acid, in order to precipitate the oxalates of the cerite earths. In this way 0.21 per cent. and 0.06—0.07 per cent. of oxides of the cerium metals were obtained from two specimens of mariupolite respectively rich and poor in beckelite. (2). *Separation of niobic and tantalic acids.*—10 grms. of the portion of the mineral insoluble in dilute hydrochloric acid were heated in a platinum dish, on the water-bath, with 200 c.c. of water and 10 c.c. of sulphuric acid of sp. gr. 1.845, and hydrofluoric acid was added in small portions, until the whole of the mineral appeared to have dissolved with the exception of the zircon; this took from 10—12 hours to 2—3 days. The excess of hydrofluoric and sulphuric acids was then expelled, and the residue warmed with 200 c.c. of water; only the zircon and niobic and tantalic acids remained undissolved. The zircon was separated from the two acids by adding a few drops of concentrated sulphuric and hydrofluoric acids and filtering by means of a platinum funnel. From the filtrate the niobic and tantalic acids were precipitated by expelling the hydrofluoric acid, diluting with water, and boiling vigorously. A small part of the niobic acid sometimes remained in solution; hence, after filtering, the solution was treated with solid potassium hydroxide, the precipitate of ferrie hydroxide, together with hydroxides of any rare earths present, was separated, ignited, fused with potassium pyrosulphate, and the product extracted with cold water; on heating the solution for half an hour on the water-bath, any niobic acid present was precipitated. From 0.15 to 0.16 per cent. of niobic acid was obtained in this way from mariupolite. (3). *Separation of zirconia.*—The insoluble zircon, ZrSiO_4 , obtained in the separation of niobic and tantalic acids, was fused with sodium carbonate, whereby it was converted into zirconia and sodium orthosilicate: $\text{ZrSiO}_4 + 2\text{Na}_2\text{CO}_3 = \text{ZrO}_2 + \text{Na}_4\text{SiO}_4 + 2\text{CO}_2$. The sodium silicate was removed by extraction with water.—A. S.

Perbia; New method of isolating — G. Urbain.
Compt. rend., 1909, 149, 37—39.

With certain exceptions, the order of solubility of the salts of the rare earth metals is independent of the nature of the salts, the least soluble in any series being the salt of lanthanum, followed by the salts of cerium, praseodymium, neodymium, samarium, europium, gadolinium, terbium, dysprosium, holmium, yttrium, erbium, thulium, neoytterbium and lutecium. The nitrates with 5 molecules of water form one of the exceptions, that of gadolinium being the least soluble, those of neodymium and erbium next one another, and those of cerium and lanthanum being with those of neoytterbium and lutecium amongst

the most soluble. The author finds that the isomorphous bismuth nitrate is more soluble in nitric acid than gadolinium nitrate, less soluble than dysprosium nitrate, and very slightly less soluble than terbium nitrate. Accordingly, by adding to a mixture of gadolinium and terbium nitrates a very large amount of bismuth nitrate, and submitting to fractional crystallisation over a sufficiently long time, a perfect separation of gadolinium from terbium can be effected. The terbium compound obtained by the new method is equally pure with that formerly obtained by the author by fractional precipitation with dilute ammonia, and though the new method requires at least as much time as the old, the amount of labour involved is very much less.—J. T. D.

Colloidal silver solution obtained by the action of pure distilled water on metallic silver. M. Traube-Mengarini and A. Scala. Atti R. Accad. dei Lincei, Roma, 1909, [5], 18, I., 542—545. Chem. Zentr., 1909, 2, 179.

If pure water be boiled for a long time in a silver vessel containing some cuttings of silver, a colloidal silver solution is produced, which gives the characteristic appearance with the ultramicroscope. If the solution, whilst hot, be poured into a glass vessel, it becomes slightly turbid and acquires a faint reddish-violet colour, but if allowed to cool in the silver vessel, it remains perfectly clear. On addition of salts or acids to the solution, a white flocculent precipitate of metallic silver separates. Hydrogen sulphide produces a dark coloration. Copper is more easily attacked than silver by distilled water. Fresh-water fish when placed in pure distilled water which has been boiled in contact with cuttings of pure copper, die after a few hours.—A. S.

Uranium X; Separation and relative activity of —. B. Szilard. Compt. rend., 1909, 149, 113—115.

To a solution of 50 grms. of uranyl acetate in 1 litre of distilled water is added a solution of ferrie acetate in ammonium acetate and acetic acid. The mixture is heated, boiled for a few minutes, and rapidly filtered whilst still hot. The precipitate, which contains the greater part of the uranium X, is carefully washed, first with hot water and then with ammonium carbonate solution. The uranium X may be concentrated by dissolving the precipitate in acetic acid and repeating the above operation, but a better method is as follows: The precipitate is dissolved in hydrochloric acid and the solution is extracted with a large quantity of ether free from alcohol, which dissolves the greater part of the iron, and leaves uranium X in the aqueous solution. With either method of concentration, it is easy to obtain per gramme of uranium a product which gives an ionising current equivalent to that obtained from 0.03 gm. of uranium in radioactive equilibrium. The author concludes that the radioactivity of pure uranium X is equal to 10^9 times that of uranium in radioactive equilibrium.—O. R.

Trade Report.

The new American Tariff. Times Supplement, July 20, 1909. [T.R.]

THE American Tariff Bill has passed both Houses of Congress, and has been signed by President Taft.

SECTION I.

The following figures show the percentage of increase or decrease which has been made on the existing duties so far as they relate to chemical products, etc., e.g., an alteration in an *ad valorem* duty of 20 per cent. to 15 per cent. would be recorded as a reduction of 25 per cent.; an alteration from 5 cents to 2 cents per lb. would be recorded as a reduction of 60 per cent.

	Increase.	Decrease.
	Per cent.	Per cent.
Acid—		
Benzoic	25	—
Boric	—	40
Chromic	—	33
Gallie	—	20
Oxalic (from free list), 2c. lb.	38	—
Tannic or tannin	—	30
Tartaric	—	28
Alcoholic compounds	—	20
Arsenic (from free list), 11c. lb.	—	—
Oils—		
Nut oil or oil of nuts	19	—
Crude mineral	—	Free
Refined mineral	—	Free
Paraffin	—	Free
Grease	25	—
Ammonia, sulphate of	—	Free
Argols—		
Crude tartar (not more than 40 per cent. bitartrate of potash)	—	85
Do. (more than 40 per cent. bitartrate of potash)	—	65
Do., partly refined (not more than 90 per cent. bitartrate of soda)	—	25
Do. (more than 90 per cent.)	—	20
Soda, tartrate of	—	25
Tartar, cream of	—	16
Bleaching powder, or chloride of lime .	150	—
Borax	—	60
Borates of lime or soda	—	30
Chloroform	—	50
Collodion	—	20
" rolled in sheets	—	25
Copper	—	50
Copperas	—	Free
Ethers, sulphuric	—	80
"	—	50
Glue size	25	—
Iodoform	—	25
Lead—		
White	—	41
Acetate, nitrate, &c.	—	5
Oil—		
Cottonseed	123	—
Croton	—	22
Linseed	—	25
Orange (from free list), 50 per cent. <i>ad val.</i>	—	—
Poppyseed	—	25
Peppermint	—	50
Morphia	50	—
Ochre, sienna, umber, ground in oil or water	—	33
Ultramarine	—	20
Varnishes, spirit	—	66
Putty	—	25
Paris green	—	Free
London purple	—	Free
Potash—		
Bichromate, and chromate	—	25
Chlorate	—	20
Nitrate	—	Free
Soap—		
Medicinal	33	—
Fancy, perfumed—new duty of 50 cent. added	—	—
Soda, various preparations of	—	Ranging from 12½ to 33.
Strychnine	—	50
Sulphur	—	50
Vanillin	—	68
Starch, other than potato	—	33
Dextrine, burnt starch, or British gum ..	—	25
Cascia	25	—
Saccharine	—	50
Fireworks	275	—
Gunpowder, and explosives for mining, blasting, artillery, or sporting purposes—		
Valued 20 cents or less	—	50
" over 20 cents	—	33
Matches	—	25
Blasting caps	6	—
Cartridges	—	14

THE MAXIMUM TARIFF.

SECTION 2.

The following is a summary of the text of Section 2 of the proposed Tariff Law.

Sec. 2. That from and after the thirty-first day of March, nineteen hundred and ten, except as otherwise specially provided for in this section, there shall be levied, collected, and paid on all articles when imported from

any foreign country into the United States, or into any of its possessions (except the Philippine Islands), the rates of duty prescribed by the schedules and paragraphs thereto twenty-five per centum *ad valorem*; which rates shall constitute the maximum tariff of the United States [This is followed by granting power to the President to decide all cases where such rates are to be enforced, and to issue a proclamation accordingly. Provision is also made for the employment by the President of expert advisers.]

Although nearly all the changes made in the Chemical Schedule of the American tariff are in favour of the importer, every care has been taken to safeguard the interests of the home producers in continuation of the policy which matured in the McKinley tariff. The reductions in the tariff which have been made are merely indicative that the same high duties which may be required to build up an industry are not necessary to maintain it, and the circumstance that in some cases the duties have been reduced does not of necessity mean that better opportunities are offered to foreign competitors. Even the reduced rates are quite sufficient to give the home producer an important advantage, notwithstanding the higher cost of labour. The importer in America, and consequently the manufacturer in the United Kingdom, will be placed at some disadvantage by reason of the new method of valuation which requires the wholesale price in the United States to be taken as the basis for the assessment of duty, for this means that the duties on all those products assessed on an *ad valorem* basis, which have been left undisturbed in the schedule, have in effect, been raised. By taking the actual existing wholesale value of goods in the United States, instead of the selling price of the manufacturer in the exporting country, duty will be levied on freight and charges, as also on the profit of the dealer on the other side. In the case of heavy chemicals, however, this point is of no importance, as specific duties are charged.

The reduction of the duty on borax to 2 cents per pound is apparently an important one; but it was acquiesced in, and, in fact, recommended by American producers, who admitted that the old duty of 5 cents was much higher than was necessary for their protection. In practically every case in which a reduction has been made the same reason underlies it, and the concessions, if such they may be termed, are concessions to the American public, and not to the foreign manufacturer.

One of the important articles of export from Great Britain is ammonium sulphate, of which, according to American returns, America bought in 1907, 27,910 tons, on which the rate of duty was 0.3 cent per pound. At the tariff hearings the directors of the various agricultural experiment stations throughout the United States urged upon the committee the desirability of placing all plant foods containing nitrogen on the free list, on the ground that the duty on ammonium sulphate, which was equivalent to 1½ cents per pound of nitrogen in it, was enough to prevent its general use, and that it was not produced in the United States in such quantities as to meet the requirements of agriculture. These arguments carried weight with the committee, and in the House Bill the article was placed on the free list. On the other hand, the coke and gas companies made out a good case for retaining the duty. They showed that during 1907 the production of ammonia in various forms, all calculated as ammonium sulphate, was only about 100,000 tons, whereas they could produce 600,000 tons. They produced figures to show that the English market price for 1907 was, on an average, \$56.56; the freight, insurance, and brokerage was estimated at \$7, which made the cost of English sulphate, at New York, \$63.56. During the year 1907 the average price of English sulphate, at New York, was only \$61.93, however, hence the gas companies argued that English producers, in order to get rid of surplus products in the United States, sold at a sacrifice to the detriment of the American companies, and they argued that the removal of duty would encourage the erection of by-product coke ovens in England and retard it in America. These arguments prevailed with the Senate, and in the Senate Bill ammonium sulphate was

restored to the dutiable list at the decreased rate of wo-tenths of 1 per cent per pound. Subsequently, however, as a result of influential representations on behalf of the agricultural interests, at a late stage of the proceedings in the Senate, this product was placed on the free list, and thus restored to the position which it occupied in the House Bill. The reductions in duties on some of the alkalis and other heavy chemicals are also favourable to British producers, but it is questionable whether the difference between the old and new rates is sufficiently pronounced to make any appreciable difference in the volume of trade. The agitation for a lower tariff on chromates and bichromates of potassium and sodium was favoured on account of the position which these salts now occupy as the raw materials for the preparation of rust-inhibitive pigments for the protection of steel structures and fences. Ten thousand dollars were appropriated by the last Congress to cover the expenses of an investigation into this subject, and the discovery of the inhibitive properties of the chrome products is the result of the researches of the assistant director of the Office of Public Roads. The petition for a reduction of the duties was opposed by American manufacturers, and the Committee on Ways and Means, after considering the interests of both sides, recommended the slight reductions mentioned.

Taking as a whole the other articles on which the duties have been reduced, there are few instances where the alterations will have any noticeable effect on British industries. In fact, the position was well defined by Representative Harrison in the debate on the House Bill, when, affecting a thorough acquaintance with the chemical industries, he said:—"In almost all those instances (of reduced duties) the rates are still as prohibitive as ever."

Books Received.

GEWINNUNG UND REINIGUNG DES KOCHSALZES. Von Dr. CARL RIEMANN. Wilhelm Knapp's Verlag. Halle a. S. 1909. Price M. 3.20.

Svo volume containing 84 pages of subject matter with 20 illustrations. It forms one of Knapp's series of "*Monographien über chemisch-technische Fabrikations-Methoden*," Bd. XVIIII. The entire subject is sub-divided under the following heads:—I. Origin of the salt deposits. II. General remarks on the winning of salt. III. The search for, and exploiting of salt deposits. IV. Development by the sinking of shafts. V. Development by mining methods, &c. VI. The explosives used. VII. Conveyance of the rock salt, &c. VIII. Influx of water; mine waters, &c. IX. Ventilation, &c. X. Preparation of the crude salt. XI. Recovery from aqueous solution, &c. XII. Brine from various sources, and its treatment. XIII. Determining the salt in brines. XIV. Preparation of pure commercial salt from brines.

JAHRBUCH DER ELEKTROCHEMIE UND ANGEWANDTEN PHYSIKALISCHEN CHEMIE. Begründet und bis 1901 herausgegeben von Profn. Dr. W. NERNST und Dr. W. BÖRCHERS. BERICHTE ÜBER DIE FORTSCHRITTE DES JAHRES 1905. Herausgegeben von Dr. HEINRICH DANNEEL. Unter Mitwirkung der Herren Dtn. P. ASKENASY, P. BERL, K. ELBS, F. HARMIS, J. HESS, H. LEY, J. MEYER, M. ROLOFF und O. SACKUR. XII. Jahrgang. Wilhelm Knapp's Verlag, Halle a. S. 1909. Price M. 30.00.

LARGE Svo. volume, containing 968 pages of subject matter with 114 illustrations, and a bibliographic list of works on the following subjects:—I. Mathematics and Physics. II. Chemistry, chemical physics, and analytical chemistry. III. Biography, &c. IV. General, and Monographs. V. Periodical works. The work closes with alphabetical indexes of authors' and patentees' names, and subjects. With special regard to the subject matter, this is sub-divided and classified as follows:—I. PURELY

SCIENTIFIC SECTION. II. SECTION OF APPLIED ELECTRO-CHEMISTRY. I. THE PURE SCIENCE. (i), General. (ii), Books, &c. (iii), Apparatus. (iv), The periodic system, and the doctrine of valency. (v), Phase rule. (vi), Laws of velocity of reaction, and mass action. (vii), Catalysis. (viii), Thermochemistry. (ix), Theories of ions and electrons. (x), Osmotic pressure. (xi), Colloids. (xii), Solution phenomena. (xiii), Chemical and electrical energy, &c. (xiv), Theory of accumulators. (xv), Polarisation and electrolysis. (xvi), Electrical phenomena in gases, and Radioactivity. II. APPLIED ELECTROCHEMISTRY. (i), Production of current. (ii), Inorganic electrochemical processes and products. (iii), Carbides. (iv), Silicon and silicides, also borides. (v), Contact chemistry, and technical applications of the law of mass action. (vi), Metals. [Copper. Nickel. Zinc. Lead. Iron. Manganese. Ferro-alloys. Chromium. Tungsten. Vanadium. Titanium. Tantalum. Niobium. Cerium metals. Antimony. Arsenic. Tin. Platinum group. Gold. Silver.] (vii), Organic compounds. (viii), Alkali chloride electrolysis, and production of bleaching products and compounds. (ix), Apparatus for electrochemical technology. (x), Electric furnaces. (xi), Electro-treatment of ores. (xii), Galvano technology and allied branches.

THE HARMFUL EFFECTS OF ACETANILIDE, ANTIPYRIN, AND PHENACETIN. L. F. Kebler. U.S. Dept. of Agric., Bureau of Chemistry. Bulletin No. 126. Washington, 1909.

This Bulletin contains the results of an inquiry made by the Department of Agriculture to furnish information to the public to show them that acetanilide, antipyrine, and phenacetin should be employed with caution in the absence of medical advice. A summary of cases in which deleterious or fatal effects on health have been produced, shows that 1084 were due to acetanilide, 615 to antipyrine, and 193 to phenacetin.

MINES AND QUARRIES: GENERAL REPORT AND STATISTICS FOR 1908. PART I. DISTRICT STATISTICS. [Cd. 4751.] Wyman and Sons, Fetter Lane, E.C. Price 6½d.

This return, which forms the first part of the General Report on Mines and Quarries for 1908, contains statistics of the number of persons employed, the output of minerals, and accidents at mines and quarries in the United Kingdom arranged according to the inspection districts. The total output of the under-mentioned minerals in the United Kingdom in 1908, as compared with 1907, was as follows:—

	1907.	1908.
	Tons.	Tons.
Coal	267,830,962	261,528,795
Iron ore	15,731,604	15,031,025
Clays and shale	14,827,895	14,407,470
Limestone (other than chalk) ..	12,509,142	11,610,656
Igneous rocks	5,674,470	6,113,735
Sandstone	5,012,053	5,024,832
Chalk	4,779,387	4,261,585

MINES AND QUARRIES: GENERAL REPORT AND STATISTICS FOR 1907. PART IV. COLONIAL AND FOREIGN STATISTICS. [Cd. 4739.] Price 1s. 8d.

This part of the report includes statistics relating to persons employed, output, and accidents at mines and quarries in the British Colonies and in foreign countries during 1907.

New Books.

Abderhalden, Prof. Dr. Emil: Handbuch der Bio-chemischen Arbeitsmethoden. Bd. I. Allgem. Teil. Erste Hälfte. Mit 527 Textabbildgn. Verlag von Urban u. Schwarzenberg in Berlin und Wien. 1909. Preis M.18. (Das Handbuch soll 3 Bände umfassen. Der erste allgem. Teil wird in diesem Sommer vollst. vorliegen. Bd. II. u. III. erscheinen bis Herbst.)

Albrecht, Max, u. Albrecht, Ernst: Das Erdöl u. seine Produkte, Lagerung u. Transport von der Quelle bis zum Verbraucher. [Aus: "Das Erdöl."] (VIII, 151 S. m. 75 Abbildgn. u. 13 Taf.) Lex. Svo. S. Hirzel, Leipzig, 1909. M.7.50; geb. M.8.50.

Barber, Edwin Atlee: The pottery and porcelain of the United States; an historical review of American ceramic art from the earliest times to the present day; to which is appended a chapter on the pottery of Mexico. 3d. ed., rev. and enl., with 335 illustrations. Putnam, New York, 1909. c. 1893-1909. Price \$5 net.

Berkeley (Earl of), Hartley (E. G. J.) and Stephenson (J.): On the Osmotic Pressures of Calcium Ferrocyanide Solution. Part 2. Weak Solutions. 4to, sd. Dulau, London. Net. 1s.

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Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 16,198. Kyll. Rectifying column.* July 12.
16,500. Allgem. Briketierungsges. Briquetting and pressing material. [Ger. Appl., Aug. 26, 1908.]* July 15
16,523. Manlove, Elliott, and Co., and Liversedge. Apparatus for evaporating, drying, distilling, or crystallising. July 15.
16,546. Landau (Landau). *See under X.*
16,615. Irwin, and Johnson and Co. Hydraulic opening gear for filter presses.* July 16.
16,821. Neubäcker. Evaporating drum.* July 19.
17,088. Johnston. Filtering apparatus.* July 22.
17,192. Bonnel. Rectifier for distilling.* July 23.
17,220. Bennett. Distilling apparatus. July 24.
17,246. Boulton (Blair Engineering Co.). Regenerative furnaces.* July 24.
17,340. Anderson. App. for mixing or measuring liquid or other substances in definite proportions. July 26.
17,380. Müller and Bomhard. Process and apparatus for purifying gases.* July 26.
17,459. Lake (Freed, Krupp A.G. Grusonwerk). Separation of substances by the wet magnetic process.* July 27.
17,640. Harbord. *See under X.*
17,710. Ihner. Drying of materials or mixtures containing water. July 30.

COMPLETE SPECIFICATIONS ACCEPTED.

- 13,139 (1908). Rigby. Drying cylinders. July 21.
15,000 (1908). Ridley. Obtaining gases from solids. July 21.
18,129 (1908). Kirkham, Hulett, and Chandler, Ltd., and others. Apparatus for effecting intimate contact of liquids and gases. July 21.
18,990 (1908). Williams, Snell, and Green. Rotary radiator for the cooling of liquids and gases. Aug. 5.
19,960 (1908). Knowles and Malone. Apparatus for the manufacture of crystals. Aug. 5.
20,381 (1908). Hewitt. Cooling or refrigeration of liquids or fluids. July 28.
24,859 (1908). Segalevie. Centrifugal separators. July 21.
25,829 (1908). Marks (U.S. Liquid Air and Oxygen Co.). *See under VII.*
37,57 (1909). Tebbutt. Treatment of materials by disintegration or pulverisation. July 28.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 16,217. Reynolds. Gas producers. July 12.
16,232 and 16,233. McMullen. Power gas producers. July 12.
16,239. Langhaus. Mantles for incandescent burners. July 12.

16,243. Kölmische Maschinenbau, A.-G., and Wegenscheidt. Gas purifiers.* July 12.

16,328. Weber. Manufacture of incandescence lamp filaments.* July 13.

16,355. Wilton. Treatment of gas obtained in distillation of carbonaceous materials. July 13.

16,356. Wilton. Gas generator plant. July 13.

16,357 and 16,358. Wilton. Carbonisation or distillation of coal or other carbonaceous materials. July 13.

16,925. Gibbons and Masters. Vertical gas retorts. July 20.

17,074. Lynn. Production of gas and ammonia from peat and like fuels. July 22.

17,112. Gibbons and Masters. Vertical gas retorts. July 22.

17,139. Roux. Converting peat into charcoal. [Fr. Appl., July 22, 1908.]* July 22.

17,348. Westgate. Retorts for gas making purposes. July 26.

17,420. Hiby. Treatment of gases produced by the destructive distillation of coal. July 27.

17,570. Crombie. Distillation of coal, peat, and wood. July 28.

17,572. Ward. Oil furnaces. July 28.

17,574. Pace. Manufacture of gaseous mixtures, more particularly air gas. July 28.

17,591. Lane. Construction and method of operation of hydrogen gas producing apparatus. July 29.

17,771. Laigle. Manufacture of filaments for incandescent gas mantles. [Fr. Appl., Aug. 1, 1908.]* July 30.

17,852. Durant. Method and apparatus for complete combustion of solid fuel. July 31.

COMPLETE SPECIFICATIONS ACCEPTED.

14,852 (1908). Trenzen and Pope. Manufacture of bodies of titanium, especially for electric incandescent filaments. July 21.

14,853 (1908). Trenzen and Pope. Manufacture of metallic filaments for electric incandescent lamps. July 21.

14,971 (1908). Sabatier. Manufacture of methane or of mixtures of methane and hydrogen. July 21.

22,033 (1908.) Zindler. Utilising bituminous brown coal and peat in making fuel briquettes. July 21.

24,893 (1908). Smith. Apparatus for producing water-gas. July 21.

26,121 (1908). Ely and Rollason. Treatment of coke. July 21.

27,045 (1908). Sabatier. Apparatus for making methane or mixtures of methane and hydrogen. July 21.

4860 (1909). Layton-Fisk. Incandescent gas mantles. Aug. 5.

5260 (1909). Fellner (Oberfeldt und Co.). Incandescent gas mantles. July 28.

5572 (1909). Ruddiman. Gas cleaners. July 28.

7780 (1909). Duff and Gas-Power and By-products Co. Gas producers. Aug. 5.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

16,357 and 16,358. Wilton. *See under H.*

16,464. Köhn. Vaporisation, distillation, and combustion of heavy hydrocarbon liquids. [Ger. Appl., July 15, 1908.]* July 14.

16,908. Davies and Richards. Treatment of liquid hydrocarbons. July 20.

17,030. De Fazi. Treatment of crude petroleum shale oil, and the like. July 21.

17,139. Roux. *See under H.*

17,209. Leaver. Apparatus for solidifying tar. July 23.

IV.—COLOURING MATTERS AND DYESTUFFS APPLICATIONS.

16,312. Wetter (Chem. Fabr. Grünau, Landshoff, und Meyer). *See under XX.*

16,377. Johnson (Badische Anilin und Soda Fabrik). Manufacture of derivatives of indigo colouring matter July 13.

16,799. Newton (Bayer und Co.). Manufacture of disazo dyestuffs. July 19.

16,996. Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. [Ger. Appl., July 22, 1908.]* July 21.

17,265. Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. [Ger. Appl., July 27, 1908.]* July 24.

17,546. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matter suitable for use as a pigment or lake. [Patent of Addition to No. 26,714, 1908.]* July 28.

17,818. Wyler and Levinstein, Ltd. New dyestuff derived from indigo and the production thereof. July 31.

COMPLETE SPECIFICATIONS ACCEPTED.

16,092 (1908). Newton (Bayer und Co.). Manufacture of disazo dyestuffs for cotton. July 28.

18,729 (1908). Newton (Bayer und Co.). Manufacture of dyestuffs of the azine series. July 21.

20,367 (1908). Newton (Bayer und Co.). Manufacture of basic dyestuffs. July 28.

21,911 (1908). Newton (Bayer und Co.). Manufacture of basic dyestuffs. July 21.

23,349 (1908). Newton (Bayer und Co.). Manufacture of azo dyestuffs. July 28.

24,605 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture and use of pastes of leuco compounds of indigo colouring matters. July 28.

4859 (1909). Wülling, Dahl, und Co. Azo dyes. July 28.

5792 (1909). Soc. pour l'Ind. Chim. a Bile. Manufacture of substantive azo dyestuffs. July 21.

6270 (1909). Chem. Fabr. vorm. Sandoz. Manufacture of blue to violet dyestuffs of the gallocyanine series July 21.

8154 (1909). Cassella and Co. Manufacture of rechromable dyestuffs. Aug. 5.

12415 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture and production of azo colouring matters and intermediate products. Aug. 5.

15,088 (1909). Kalle and Co. A.-G. Manufacture of tetrabromindigo. Aug. 5.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS AND FIBRES.

APPLICATIONS.

16,285. Brierley and Melling. Dye-jigs, tanks, vats &c., used by dyers, bleachers, calico-printers, &c. July 14.

17,125. Mayo. Extraction of grease, &c., from an treating wool, skins, textiles, &c. July 22.

17,170. Walter. Recovery of benzine or other spirit used in making soft goods and in cleaning processes July 23.

COMPLETE SPECIFICATIONS ACCEPTED.

15,997 (1908). Gillies. Dyeing machines. July 28.

16,329 (1908). Kershaw and Cole. Apparatus for dyeing yarn and other fibrous material. Aug. 5.

16,689 (1908). Thomlinson-Haas, Ltd., and Standeven. Apparatus for drying or otherwise treating textile fibres, brics, &c. July 28.

19,276 (1908). Chandelon. Apparatus for the manufacture of glossy artificial threads. Aug. 5.

22,690 (1908). Newton (Bayer and Co.). Dyeing half-ool. July 21.

23,721 (1908). Turlur. Apparatus for drying yarns, etc. uly 28.

24,605 (1908). Johnson (Badische Anilin und Sodaabrik). *See under IV.*

25,312 (1908). Johnson (Badische Anilin und Sodaabrik). Production of resist effects and resist pastes for t dyeing. July 28.

26,616 (1908). Boulton (Edw. Esser et Cie.). Process and apparatus for dyeing yarn in hanks. Aug. 5.

27,742 (1908). Newton (F. Bayer and Co.). Printing th brominated indigo. Aug. 5.

4104 (1909). Friedrich. Production of ammoniacal pper oxide solutions for spinning artificial threads, etc. uly 28.

I.—COLOURING WOOD, PAPER, LEATHER, &c.

APPLICATION.

17,018. Faller. Process of dyeing wood and stone. wiss Appl., July 25, 1908.]* July 21.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

16,224. Bunet and Badin. *See under XI.*

17,074. Lynn. *See under II.*

17,216. Soc. l'Air Liquide. Liquefaction of air and separation into its constituents. [Fr. Appl., ly, 24, 1908.]* July 23.

17,318. Owens. Removal of carbonic acid gas from nes. July 26.

17,611. Serpek. Method of producing pure alumina. er. Appl., April 10, 1909.]* July 29.

17,642. Johnson (Badische Anilin und Soda Fabrik.) nufacture of ammonia. July 29.

17,690. Coulter. Process of manufacturing alkaline th sulphhydrates.* July 30.

COMPLETE SPECIFICATIONS ACCEPTED.

3426 (1908). Allgem. Elektrizitäts-Ges. Concentration ntric oxide. July 21.

13,458 (1908). Manufacture of lead oxide. Aug. 5.

16,963 (1908). Frank and Caro. Process for the nufacture of pure nitrogen from combustion gases. g. 5.

15,391 (1908). Dyes (Lehmann). Manufacture of rates. July 28.

17,246 (1908). Guttensohn. Production of briquettes of anganese ore. July 21.

19,738 (1908). Loesekann. Manufacture of artificial olite from fluorspar. July 28.

20,406 (1908). Johnson (Badische Anilin und Soda brik). Manufacture of compounds containing nitrogen l oxygen. July 28.

26,726 (1908). Caro and Scheele. Manufacture of amonium phosphate. July 21.

25,829 (1908). Marks (U.S. Liquid Air and Oxygen Co.). cess and apparatus for the liquefaction of gases moro ecially applicable to the liquefaction of air and its ration into oxygen and nitrogen. Aug. 5.

711 (1909). Herrmann und Co. Packing peroxides of alis for household use. July 28.

3189 (1909). Peniakoff. Manufacture of sodium sul- phate or other alkali sulphate. July 21.

6415 (1909). Mackenzie. Concentration of sulphuric acid and apparatus therefor. July 28.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

16,935. Martin. Treating clays for the manufacture of pottery and other articles. July 20.

17,264. Ingrams. Manufacture of refractory materials. July 24.

COMPLETE SPECIFICATIONS ACCEPTED.

12,974 (1908). British Thomson-Houston Co. (General Electric Co.). Machines for forming porcelain ware. July 28.

3546 (1909). Brightmore. Abrasive material and its manufacture. July 28.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

16,466. Soufflet. Artificial stone. [Fr. Appl., July 15, 1908.]* July 14.

16,588. Smith and Edwards. Method and apparatus for testing cements, &c. July 16.

16,602. Accettola. Manufacture of artificial marble. July 16.

17,002. Boucherie. Process for injecting wood.* July 21.

17,018. Faller. *See under VI.*

17,381. Lake (Pine Street Patents Co.). Process and app. for making cement.* July 26.

17,629. Seidner. Manufacture of artificial marble. July 29.

COMPLETE SPECIFICATIONS ACCEPTED.

24,718 (1908). Kayser. Method of making an acid proof cement. Aug. 5.

27,902 (1908). Von Medveesky. Process of producing a fireproof concrete compound. Aug. 5.

X.—METALLURGY.

APPLICATIONS.

16,210. Kunheim und Co. Metallic alloys Ger. Appl., Sept. 23, 1908.]* July 12.

16,211. Kunheim und Co. Pyrophoric metallic substances. [Ger. Appl., Jan. 25, 1909.]* July 12.

16,229. Loekwood and Samuel. Treatment of ores and the like. [Addition to No. 12,962 of 1908. Ger. Appl., Jan. 7, 1909.]* July 12.

16,300. Bullock and Calcott. Treatment of iron or steel to prevent rusting. July 13.

16,546. Landau (Landau). Apparatus for dissolving metals and other substances. July 15.

16,936. Holman, Holman, and Coad. Apparatus for treating metalliferous slime. July 20.

16,940. Heskett. Manufacture of steel.* July 20.

16,956. Büchel. Making slag easy to dissolve in the aluminogenetic extraction of metals. July 20.

17,102. Sulman and Durant. Recovery of zinc from its ores. July 22.

17,103. Dor-Delattre. Charging the retorts of zinc and analogous furnaces. [Addition to No. 13,822 of 1908.]* July 22.

17,105. Diehl. Refining metals, particularly iron and steel. July 22.

17,339. Beauchamp. Process for extraction of zinc. July 26.

17,345. Stephens. Process and apparatus for elimination of chlorine and zinc and recovery of tin and lead from tin residues.* July 26.

17,382. Keller. Carburisation of steel.* July 26.

17,474. Bailey. Recovery of tin from tin scruff. July 27.

17,640. Harbord. Means for dehydrating air for metallurgical furnaces. July 29.

17,718. Stoker. Treatment of metals and their alloys. July 30.

17,748. Jouve. New metal alloy and process of manufacturing same. [Fr. Appl., Aug. 1, 1908.]* July 30.

COMPLETE SPECIFICATIONS ACCEPTED.

14,852 (1908). Trenzen and Pope. *See under 11.*

15,038 (1908). Johnson (Chem. Fabr. Griesheim Elektron). Melting and casting aluminium and its alloys. July 28.

15,628 (1908). Coslett Anti-rust Syndicate. Treatment of iron or steel for preventing oxidation. Aug. 5.

16,895 (1908). Brandenburg. Apparatus for extracting tin from tin-plate waste. Aug. 5.

16,972 (1908). Marks (Soc. Anon. Ind. G. A. Armstrong and Co.). Manufacture of armour plates, etc. July 28.

21,921 (1908). Junquera. Extraction of metals from minerals. July 21.

5821 (1909). British Thomson-Houston Co. (General Electric Co.). Process for reducing oxides. Aug. 5.

6088 (1909). Aktiebolaget Elektrometall. *See under XI.*

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

16,224. Bunet and Badin. Production of compounds of oxygen and nitrogen by electrical means. [Fr. Appl., Aug. 17, 1908.]* July 12.

16,225. Bunet and Badin. Production of electric arcs for forming compounds of oxygen and nitrogen. [Fr. Appl., Nov. 30, 1908.]* July 12.

16,931. Mills (Van Winkle). Electroplating baths.* July 20.

17,342. Aktiebolaget Elektrometall. Electric furnaces. [Swedish Appl., Aug. 1, 1908.]* July 26.

COMPLETE SPECIFICATIONS ACCEPTED.

15,645 (1908). Kilburn (Oesterle). Electric furnace for treating ores and the like. July 28.

16,737 (1908). Diesser. *See under XIII.*

21,004 (1908). Haddan (Nya Akkumulator Aktiebolaget Jungner). Electrodes for accumulators. July 28.

6014 (1909). Felten und Guillaume Lahmeyerwerke. Ozone apparatus. July 21.

6088 (1909). Aktiebolaget Elektrometall. Electric production of iron, steel, and other metals, and furnaces therefor. July 28.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS

APPLICATIONS.

16,260. Johnson (Badische Anilin und Soda Fabrik.). Purification and decolorisation of glycerin. July 12.

16,524. Manlove, Alliott, and Co., and Liversedge. Manufacture or recovery of glycerin. July 15.

16,665. Genthe. Thickening linseed and other oils. [Ger. Appl., Jan. 29, 1909.]* July 16.

17,181. Murray. Concentrating saponaceous and cleansing compounds. July 23.

17,228. Walker, Ltd., and Freestone. Washing compound.* July 24.

17,271. Fillbert. Cottonseed oil and food compounds of which it is an ingredient.* July 24.

17,655. Laroche and Juillard. Treatment of fatty matters and essential oils and products obtained therefrom. July 29.

17,868. Brunet. Treatment of substances analogous to soap and apparatus therefor. July 31.

COMPLETE SPECIFICATIONS ACCEPTED.

717 (1909). Hollingworth. Soap or soap compound. Aug. 5.

2890 (1909). Manley. Cleansing cream or white soft soap. July 21.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

16,291. Hoechstetter. Inks.* July 13.

17,277. Bellet. Manufacture of ultramarine blues.* July 24.

17,697. Schott. Waterproofing and preservative paints.* July 30.

17,815. Earle and Fencelon. Primings or paints. July 31.

(B.)—RESINS, VARNISHES.

APPLICATIONS.

17,320. Bateman and Aitcheson. Liquid composition for polishing and preserving. July 26.

COMPLETE SPECIFICATIONS ACCEPTED.

16,737 (1908). Diesser. Substances to be used as varnishes and for impregnation and insulation. July 21.

27,024 (1908). Pellnitz. Process for the manufacture from terpenes of a resinous distillation product similar to turpentine oil. Aug. 5.

11,166 (1909). Diesser. Substances to be used as varnishes and for impregnation and insulation, and method for their production. Aug. 5.

(C.)—INDIA-RUBBER.

APPLICATIONS.

16,316. Elias. Coagulating rubber latex and producing practically pure rubber. July 13.

16,540 and 16,663. Poizat. Manufacture of spongy rubber. [Fr. Appl., July 17, 1908, and Feb. 12, 1909.]* July 15 and 16.

16,938. Puntchart. Manufacture of elastic materials.* July 20.

17,327. Gardner. Machine for reducing rubber to powder. July 26.

COMPLETE SPECIFICATIONS ACCEPTED.

22,893 (1908). Gare. Machines for reducing vulcanised rubber to powder.

25,726 (1908). Lengfellner. Elastic composition for making tyres and foot coverings. Aug. 5.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

- 16,440. Nitritfabrik. Manufacture of tannin extracts. *er. Appl.*, July 20, 1908.* July 14.
17,125. Mayo. *See under V.*

COMPLETE SPECIFICATION ACCEPTED.

- 28,219 (1908). Bullum and Carter. Manufacture of terproof leather board. July 21.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATIONS.

- 16,824. Soc. Anon. Raffinerie Moderne Proc. Natta. Apparatus for concentrating the juices of refinery syrups. *r. Appl.*, July 22, 1908.* July 19.
16,834. Soc. Anon. Raffinerie Moderne Proc. Natta. Manufacture of refined syrups. [*Fr. Appl.*, July 22, 08.]* July 19.
16,845. Soc. Anon. Raffinerie Moderne Proc. Natta. Apparatus for concentrating and boiling green syrups. *r. Appl.*, July 22, 1908.* July 19.
17,637. Steel. Manufacture of invert sugar and glucose transportable form.* July 29.

COMPLETE SPECIFICATION ACCEPTED.

- 9370 (1909). Paira, and Administration der Minen von schweiler. Production of soluble starch. July 28.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

- 16,318. Cooper. Making hop extract. July 13.
17,113. Faulkner, Collett, and Collett. Manufacture of uted materials. July 22.
17,206. Dymond (Topf und Soehne.) Apparatus for eeping, germinating, and kiln drying malt, &c.* July 23.

COMPLETE SPECIFICATIONS ACCEPTED.

- 20,086 (1908). Rogerson. Treatment of beer for sterili- tion and precipitation of the albumen. July 28.
5571 (1909). Ascoli. *See under XX.*

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

- 16,279. Epstein. Treatment of cocoa and chocolate. ly 13.
16,375. Ekenberg. Disiccation of milk and milk eparation. July 13.
16,757. Roffason. Conditioning or improving flour. ly 19.
17,003. Charronat. Food products formed from the ms of wheat and the like.* July 31.
17,271. Filbert. *See under XII.*
17,800. Woosnam (Wm. E. Whetham). Manufacture foodstuffs. July 31.

COMPLETE SPECIFICATIONS ACCEPTED.

- 15,552 (1908). Lloyd. Manufacture of aerated or carna- ted beverages at low temperatures. July 28.
24,425 (1908). Waldmeyer. Treatment of flour or und cereals. July 21.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

- 17,001. Dixon and Wilberforce. Methods and means for deodorising. July 21.
17,279. Thomson. Treatment of waste liquors. July 24.
17,649. Dodd and others. Production of inoculating substances. July 29.

COMPLETE SPECIFICATIONS ACCEPTED.

- 15,854 (1908). Cie. Française de l'Ozone. Purification of liquids by ozone. Aug. 5.
18,355 (1908). Reiser. Removing iron from water by means of air. July 28.

(C.)—DISINFECTANTS.

COMPLETE SPECIFICATION ACCEPTED.

- 16,982 (1908). Little and Morris. Manufacture of cleansing fluids for use as sheep-dips, for disinfecting, &c. July 21.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

- 16,220. Marx. Apparatus for saving pulp in making paper, also for concentrating pulp. July 12.
17,036. Von Kapff, and Nitritfabrik A.-G. Production of cellulose formate. July 21.
17,451. Reeser. Celluloid and articles made therefrom. July 27.
17,452. Reeser. Method for producing transparencies. July 28.
17,708. Summer and Hammond. Manufacture of wood-wool. July 30.
17,855. Egoroff and Remmer. Process for manufacture of all kinds of paper from sphagnum.* July 31.

COMPLETE SPECIFICATIONS ACCEPTED.

- 16,104 (1908). Sparre. Apparatus for treating fibres in the manufacture of paper. July 28.
17,967 (1908). Friedrich. Manufacture of cellulose structures. July 21.
19,276 (1908). Chandon. *See under V.*

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

- 16,312. Wetter (Chem. Fabr. Grünau, Landschoff, und Meyer). Manufacture of nitro-compounds and oxidation products of cyclic hydrocarbons and their substitution products.* July 13.
16,429. Newton (Bayer und Co.). Manufacture of new pyrimidines. July 14.
16,721. Zimmermann. Manufacture of acetyl deriva- tives of alkylated iminopyrimidines and of the alkyl- barbituric acids derived therefrom. July 17.
17,017. Bedford and Williams. Catalytic synthesis or deduction of organic substances. July 21.
17,171. Wellcome and Barger. Preparation of a physiologically active base. July 23.
17,655. Laroche and Juillard. *See under XII.*
17,830. Knoll and Co. Manufacture of purified extracts from aperient drugs. [*Ger. Appl.*, Aug. 24, 1908.]* July 31.

17,834. Gerber. Manufacture of alkyl ethers of phenols and other aromatic hydroxylic derivatives. [Ger. Appl. July 31, 1908.]* July 31.

COMPLETE SPECIFICATIONS ACCEPTED.

14,752 (1908). Lütkehermölle. Manufacture of isobornyl esters from pinene hydrochloride. July 21.

15,306 (1908). Kerfoot. Production of sterilised crystals of laxative salts. July 21.

18,049 (1908). Austerweil. Making borneol and borneol esters from pinene. July 28.

24,428 (1908). Newton (Bayer und Co.). Manufacture of a pharmaceutical compound. July 28.

314 (1909). Wellcome and Pyman. Manufacture of a therapeutic compound. July 21.

1560 (1909). Wellcome and Barger. Manufacture of a physiologically active base. July 21.

5571 (1909). Ascoli. Medical preparation from yeast. July 21.

9112 (1908). Bedford and Williams. Reduction of organic substances. Aug. 5.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

16,313. Palmer. Photographic screen plates for natural colour photography. July 13.

17,009. Newton (Bayer und Co.). Apparatus for the manufacture of photographic films. July 21.

17,324. Hollingsworth. Manufacture of sensitised albumenised paper. July 26.

COMPLETE SPECIFICATIONS ACCEPTED.

15,050 (1908). Caille. Photographic reproduction of colours. July 21.

27,686 (1908). Soc. Anon la Photographie des Couleurs, Sury and Bastyns. Preparing solutions used in the gum bichromate process of photographic printing. July 28.

7000 (1909). Triepel. Production of pigment prints. July 28.

XXII.—EXPLOSIVES, MATCHES, &c.

COMPLETE SPECIFICATION ACCEPTED.

27,341 (1908). Lesmüller. Process for the manufacture of pyrophorus substances for ignition and illumination. Aug. 5.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATIONS.

16,536. Hillmer. Apparatus for determining the specific gravity of liquids. [Addition to No. 2812 of 1909.]* July 15.

16,647. Beasley, Beasley, and Bradbury. Recording gas colorimeter, especially for examining the products of combustion. July 16.

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Birmingham Section.

Meeting held at Wolverhampton on Thursday, April 29th, 1909.

MR. HARRY SILVESTER, B.Sc., F.I.C., IN THE CHAIR.

MANUFACTURE OF IRON AND STEEL IN RELATION TO OTHER INDUSTRIES.

BY F. W. HARBORD.

In the industrial developments which the last 100 years have witnessed, I think we may claim that the great industry of iron and steel stands among the first. In 1806, just over a hundred years ago, the total production of the world did not exceed 800,000 tons of pig iron per annum, while in 1907 the annual production had reached the total of 58,973,000 tons of which 50,517,000 tons were converted into steel, a product unknown in the modern sense at the commencement of the nineteenth century. This enormous output of pig iron required approximately 129,000,000 tons of iron ore and probably not less than 95,000,000 tons of coal, apart from that used subsequently during its manufacture into wrought iron and steel.

I propose to consider the various causes which have assisted in these vast developments; how on the one hand the engineer and the chemist have made this progress possible, and how on the other the metallurgist, responding to the call of the varied modern requirements, has supplied the materials without which modern engineering developments would have been impossible.

It is clear that for the economic production of pig iron the essentials are cheap iron ores, cheap fuel, and suitable labour, and consequently the iron manufacturer is largely dependent upon the progress of mining engineering and cheap methods of transport for these materials. In 1806 a coal shaft 100 ft. deep was an object of wonder, whereas to-day, in a modern pit, 2000 tons of coal are raised per day and through one shaft from a depth of 1300 to 1400 ft., and in some instances mines are working at a depth of 4000 ft. The developments both in size and efficiency of modern pumping plants now render it possible for the mining engineer to face almost any volume of underground water at these great depths, while the winding engines, with which he is supplied, deal easily with the immense quantities of mineral at a maximum of speed and a minimum of cost. Rapid underground and surface traction and loading has reduced the cost of transport, and dressing has improved the value of the product, while the chemist with his modern explosives has enabled the miner to break ground in such quantities that his roads and hauling appliances can always be fully employed.

For raw material our modern iron and steel industries have been largely dependent upon the geologist and the prospector for the discovery of new deposits, and upon the mining and mechanical engineer for developing the ever extending areas of suitable ore and fuel for their consumption. Admitting, however, how much we owe to the mining and mechanical engineers, on the other hand, without the materials supplied by the iron and steel metallurgists, cheap mining would have been impossible; the demand of the engineer for materials suitable for his boilers and his steam-engines has been met by the metallurgist supplying him with a soft ductile plate for boilers, forgings of any strength required for engines, wire ropes of such a strength that deep haulage has been made possible, and steel castings of almost any shape and quality. Through the whole history of the industry it has been by mutual services rendered that progress on the one side has led to further progress on the other, so that while the engineer is ever, by improvement in design, obtaining greater

efficiency and thus reducing costs, the steel maker is ever supplying him with a material suitable for his requirements.

The products of iron manufacture are pig iron, wrought iron, and steel. The first, the product of the blast furnace, supplies the raw material for the other two, and they may be regarded simply as purified pig iron.

The blast furnace has been in use in England for the manufacture of pig iron from very early times in Sussex, Gloucestershire, and South Wales, in close proximity to the large forests then existing, whence charcoal was readily obtainable, but the modern blast furnace may be said to date from about 1735, when Abraham Darby of Coalbrookdale first successfully used coke as the fuel; an improvement which was rapidly taken up by iron manufacturers in the various iron districts near the coal measures. Since Darby's time the invention which has had the most far-reaching result has been the use of the hot blast introduced by Neilson in 1828, which has enormously increased the output and efficiency of the blast furnace, and coupled with this is the utilisation of the waste gases of the blast furnace, first for heating the blast for raising steam, and in comparatively recent times in internal combustion engines.

The reverberatory furnace for puddling iron was introduced by Cort in 1774, revolutionising the manufacture of wrought iron and practically superseding all others, while his invention of the grooved rolls in 1783 marked a mechanical advance which, when considered in the light of the present day steel works experience, has been even more far-reaching in its results.

At the commencement of the 18th century, the only processes of making steel were the crucible, invented by Huntsman in 1740, and the fusion of pig iron with its partial decarburization, by the joint action of blast and slag in an open fire on a hearth lined with charcoal. It is, however, the inventions of the Bessemer and Siemens-Martin open-hearth steel processes, which, coupled with the introduction of the basic lining by Thomas and Gilchrist, are the great landmarks in the development of steel manufacture during the past century, and will ever make it memorable in the annals of industrial progress.

In 1828, when Neilson first introduced hot blast, the average output of an ordinary furnace did not exceed 25 to 30 tons per week, and the coke consumption was not less than 45 to 50 cwt. per ton, and it is only by gradual steps that our present large production and low fuel consumption has been attained. This has been made largely possible by the engineering skill which has designed blowing engines enabling high pressure blast to be used, and by means of improved hoists, automatic charging appliances, and a hundred and one details, has so increased the output and reduced the labour costs, that probably the blast furnace to-day, in proportion to the weight of material it produces, is the cheapest industrial machine in the world.

The application of the Siemens regenerative principle to the heating of the blast as introduced by Cowper and Whitwell, and the complete utilisation of waste gases, has led to a great economy in blast furnace practice. As the result of very costly experiments, the best size of the blast furnace for the different classes of ore in different districts has been determined gradually, and a height of about 85 ft. and 20 ft. diameter at bosh has been found to be about the maximum limit for economic production. Above this size no increased output or economy in fuel is obtained, and the difficulty of getting coke sufficiently strong to stand the weight of the burden without crushing, and consequently the increased pressure of blast necessary to penetrate the burden, induces a tendency in the furnace to channel, and causes irregular working. Thus, those furnaces which were built 100 ft. and higher, have been discarded in favour of the smaller furnace.

The high pressure and high temperature of blast used in modern practice is very severe on the furnace lining, and the wear in the neighbourhood of the boshes was soon

found to be most serious. This was met by the device of water cooled blocks inserted in the brickwork of the furnace, by which means the life of furnace linings has been greatly increased. It is not too much to say that without the system of water cooling now generally employed, the rapid driving and large production of the American blast furnace plants would have been an impossibility.

Great improvements have been made in recent years in the delivery of the raw materials into the blast furnace. In place of hand filled barrows carried to the top of the furnace by inclined plane or vertical lift, and which then had to be hand tipped again on to the bell top of the furnace, the ore, flux, and fuel are now delivered from the chutes of bins into wagons on scales, and the weighed material is delivered automatically into the hoist skip, which travels up the inclined plane and automatically discharges the materials into the receiving hopper at the top of the furnace.

The economy of working is largely due to the great attention to detail, such as careful mixing of ores to insure a regular product, careful control of the temperature of the blast by means of pyrometers, and the most economic utilisation of the waste gases. Although the waste gases have for many years been utilised for steam raising and similar purposes, it is only during the last few years that they have been successfully employed in internal combustion engines. This problem presented considerable difficulties owing to the fine dust in suspension, but gradually, as the result of the labours of various inventors, methods of purification have been evolved, and in a number of works in this and other countries gas engines from 500 up to 2000 horse power are successfully employed and giving satisfactory results. In some iron and steel works where formerly the blast furnace gases did little more than raise the steam necessary to supply the power for the blowing engine, sufficient power is now generated to largely supply all that is required for the rolling mill and other plant of the steel works. In some cases the gas engine is utilised to generate electricity at a central power station in the works, which is then distributed to the various shops as required, whereas in others the gas engine may be employed as the motive power direct, as in the case of the blowing engine for a Bessemer or blast furnace plant. The economy thus effected by using the gases direct is most important and, in the case of those blast furnaces that have steel works attached, offers the possibility of making them nearly independent of outside supplies of fuel for power purposes. To those that have not facilities for utilising their surplus power in this way, especially if there are several blast furnace plants within a small area, the possibility of generating and distributing electric power to outsiders, for use either for lighting or power purposes, does not seem by any means an improbable development, when there is such a growing demand for cheap electric power in almost all industrial centres.

As a rival to the internal combustion gas engine, we now have the reciprocating steam engine in combination with the steam turbine, which, in the opinion of many competent judges, is likely to prove more efficient than even the gas engine. Some blast furnace plants are already equipped with steam turbines driven by steam raised by the waste gases, and possibly at no distant date, instead of having to use steam in our turbines, we may be able to employ the waste gases direct. The difficulties to be overcome are very considerable, but in view of the past engineering achievements, there seems nothing improbable in assuming that this will ultimately be accomplished.

Another question which is now receiving considerable attention is the dehydrating of the blast by cooling it to a temperature below zero before it enters the furnace. Furnaces for several years have been at work in America with the Gayley plant, and for over a year a plant has been in operation at Messrs. Guest, Keen, and Nettlefold's works at Cardiff with marked success. Opinions may differ as to the extent of the economy, but it is now generally admitted that the advantages direct and indirect of dry blast are very considerable, and had it not been for the costly nature of the plant many more furnaces would have been equipped with air drying plants before this. The

first cost is undoubtedly a very serious consideration, but from a recent visit to the Cardiff plant, and from the latest information obtainable, the advantages in lower fuel consumption, greater regularity of working of the furnace, and greater control over the production of iron of any required grade, seem to justify the expenditure, and it is probable that other plants will soon be installed in this country. As a minor matter, although one of no small importance in view of the large amount of room required for tipping, the utilisation of slag may be mentioned, and numerous attempts have been made to find some purpose for which it could be employed. To a small extent it has been used for cement manufacture and some excellent slag cement has been made, but this industry has not developed sufficiently to deal with any large proportion of the slag produced. It is used to some extent for ballast for railways and sidings, and the recent demand for waterproof roads has led to the introduction of Tarmac, which in the future will enable a considerable amount to be usefully employed. Broadly, however, no satisfactory method of dealing with anything like the large amount of slag produced has been suggested, and for the man who succeeds in relieving the ironmaster from the cost of tipping room, apart from actually paying him for his slag, a fortune is waiting.

In the preliminary treatment of ores in recent years there have been considerable improvements effected. In some works gas calcining kilns have been introduced with success, and considerable progress has been made in briquetting fine ores both in Sweden and this country. Briquettes can now be produced which are not only strong enough to bear carriage, but can withstand, without disintegration, the combined action of temperature and pressure to which they are subjected in a modern blast furnace.

The large production of the modern blast furnace in America has stimulated the English ironmasters to emulate the example, but so far not with complete success. In some cases the failure has been due to the different classes of ore used, but more frequently to trying to adapt our English plants to American conditions of working, when to obtain success a new plant especially designed with the accessories all duly proportioned would have been necessary. There seems no reason why a specially designed furnace working on 50 per cent. ores and high-class coke such as we have in this country, should not be able to turn out its 300 to 350 tons per 24 hours, but to do this, not only the furnaces, but the blowing engines, hot blast stoves, blast mains, charging appliances, and all other accessories must be duly proportioned, and unless one can start with a clear field it is not generally easy to arrange all these matters. The saving effected by ore bins with automatic charging appliances in which labour is reduced to a minimum may appear very inviting, but the expenditure necessary is so great that it is only justified by results when the capacity of the furnace, the blowing engine plant, and all accessories are such that the charging apparatus can be kept working to its full capacity.

Mistakes are sometimes made in this country by not fully realising that the economy in working, and the large production of certain plants, is due to the whole plant having been so designed that each part is in proportion, and that to increase the pressure or volume of blast is useless without a proportionate increase in hot blast stove capacity, facilities for charging, &c. The old question whether large outputs of American furnaces are not more than counterbalanced by the short life of the furnace, and whether our own practice of slower driving and longer life is not in the end more economical has been often discussed, but is really not a question which is worth serious discussion, except when a particular case can be considered. Generally speaking, American conditions of working are not possible in this country with our existing plants, and to attempt them is to court disaster; on the other hand, much progress has been made and is being made in our practice by modifying some of the American methods to suit our special requirements. Notwithstanding our many shortcomings it is no small satisfaction to know that in certain districts in England, working with extremely poor ores, we are producing pig

probably as cheaply as anywhere in the world. Closely connected with the economics in blast furnace practice are the great improvements that have been made in the manufacture of coke. The modern retort oven of the Otto-Hoffmann type produces a higher yield of coke than the old beehive oven at a greatly reduced labour cost, and the evolved gas is sufficient not only to coke the coal, but to leave a very considerable surplus for power purposes, which can be either used direct in internal combustion engines, or for steam raising, or for other purposes. The Siemens principle of regeneration is utilised in most of these ovens, so that the sensible heat in the waste gases is recovered, and heated air is supplied for the combustion of the gas round the retorts. In some plants the gas which comes off during the first stages of coking is taken off through what is known as the rich gas main, and used for illuminating purposes, and the gas which comes off later is taken through a separate main and used for heating the ovens. In the earlier forms of these ovens the coking of a charge took 26 to 30 hours, but by detailed improvements this has gradually been reduced to 20 hours, and in some ovens it is claimed that the average time does not exceed 18 hours. Great, however, as is the saving by the complete utilisation of the gases, to this has to be added the recovery of the by-products, tar, ammonia, and benzol. The ammonia may be recovered and sold as concentrated ammonia liquor, or it may be converted into sulphate. The tar may be sold as crude tar, or may be distilled for the recovery of the various tar oils where there is no local sale for the tar, but usually this treatment is better done at chemical works.

A plant of 100 coke ovens yields per year about 4,000 tons of tar, and nearly 3000 tons of sulphate of ammonia, and in 1907 over 95,000 tons of sulphate of ammonia were produced in England from blast furnaces, coke ovens, and producer plants, and very large quantities of tar. The value of sulphate of ammonia may be taken as £12 per ton, so that the recovery of this by-product alone represented a saving of nearly £1,140,000 to the community.

No reference has been made so far to the facility of transport, and yet nothing probably during the last 50 years has had more vital influence on our great industries. By means of our modern steam boats and mechanical means for charging and discharging cargoes, distances have been almost annihilated, and in our own country iron districts which otherwise must have ceased to exist have been maintained in a state of prosperity by the importation of ores from Spain and other countries many hundreds of miles away, at a cost little, if anything, exceeding that at which local ores were formerly raised in the spot. In America ores are brought from the Lake Superior district 800 miles by land and water to the coalfields of Pennsylvania, at a cost which enables this district to hold its own against the whole of the States. In no less a degree has cheap transport made it possible to distribute our finished products all over the world, thus greatly increasing the demand and making possible those great developments in railways and other large engineering undertakings, which are such a feature of the last 50 years.

The manufacture of wrought iron in the puddling furnace was carried on exactly as first proposed by Cort in a sand bottom, until the year 1818, when Samuel Falwin Rogers introduced the iron bottom to replace the sand, so that the iron could be worked in a bath of cinder or rich oxide of iron practically free from silica. This proposal was at first received with great indifference or considered impracticable, and it was only after much trouble and expense that it was given a fair trial, and the inventor never received the recognition which he deserved. Previous to this date the average production of the puddling furnace was about 8 tons per week, and by his device not only was the quality greatly improved, but the production of the furnace was very greatly increased. With this exception no important modification has been made in the puddling process, and it is carried on to-day as it was 90 years ago. Many attempts have been made to facilitate the operation by mechanical means, and much money and time have been spent in this direction, but none have been so successful

as to be generally adopted. The use of gaseous fuel in the puddling furnace also has never been a success, and the old coal-fired reverberatory still holds its own. In some other directions, more especially in the mechanical treatment, by the introduction of the direct acting steam hammer and sectional rolling mills, great advances were made and economies effected in the production of finished iron during the first half of the last century. In 1820 the first rail mill was introduced, previous to which time wooden or cast iron rails had been used. As railways gradually developed these gave a great impetus to the production of wrought iron for rails and other purposes.

In the manufacture of crucible steel little advance was made between its introduction by Huntsman and Robert Heath's process of reducing manganese oxide with carbon in the crucible during melting in 1839. In 1856 Vickers introduced the manufacture of steel castings, the far-reaching effects of which are hardly realised even to-day. Every year the methods of casting and quality of the castings are being so improved, that results are obtained equal in many cases to forged material, and finished products of such intricate shapes are produced that it would be impossible to make them in any other way.

The old coke-hole, practically the same as 100 years ago, is still largely used, although, comparatively recently, gas-fired furnaces on the regenerative principle have been introduced; and now electric furnaces are being employed on the Continent, and have in one or two cases been tried in this country.

The modern two regenerator gas-fired Siemens furnace or the Robinson-Pope furnace, capable of holding 10 to 12 crucibles, has been successfully used by various makers; the saving in fuel costs by their use is said to be nearly £2 per ton, but notwithstanding this saving they have not been generally adopted. The gas furnace is more costly to erect per ton of steel melted, but the chief objection seems to be that the same uniform heat cannot be obtained, and consequently all the pots are not ready to "teem" at the same time, and the quality of the steel varies; further, it is said that there is a greater absorption of sulphur from the gases than when steel is melted in coke furnaces, although from theoretical considerations this hardly seems possible. In my opinion it is only a question of time for the electric furnace to be largely adopted for the manufacture of what is now known as crucible steel, especially when charges of one ton and upwards can be conveniently dealt with, although for small quantities of 1 cwt. or less of special steels, the crucible will probably always hold its own. So far as the metallurgy of the crucible steel process is concerned, little change has been made, the highest classes of steel being still made from best cemented bars remelted in the crucible, or from mixtures of best Swedish iron recarburised in the pot. The demand for a cheaper quality of steel has led to cheaper materials being used for the second class qualities, and to-day large quantities of crucible steel are made from selected steel scrap, by melting this with Swedish pig iron or other recarburising material in pots. Special alloy steels, known as air-hardening steels, which are revolutionising our machine shops, are largely, although not exclusively, made in the crucible by melting suitable mixtures.

The vast developments, however, which have characterised the steel industry during the last 60 years are due almost entirely to the Bessemer, open-hearth and Siemens processes. These processes are worked to-day practically as when they were first introduced by their inventors, and, since Mushet showed the necessity of using ferro-manganese, there has been no metallurgical discovery of paramount importance to record with the exception of the basic process. Apart from this and some comparatively minor metallurgical improvements, the development of both processes has been entirely in the direction of increased size of converters, furnaces, and appliances. The discovery of the basic process, by which burnt dolomite replaced silica as a lining, marked a new era in the steel industry of the world, and made available for steel manufacture enormous deposits of phosphoric ores which were before unworkable. It also enriched the world by the recovery of the phosphoric acid, which these ores contained, in such a form that it could be largely

used for agricultural purposes. In the early days of the basic process it was generally considered that the phosphoric slag would have to be chemically treated to remove the iron and render the phosphoric acid soluble before it could be used as a manure; but experiments soon demonstrated that fine grinding was all that was necessary to render the phosphoric acid easily soluble in the soil, and that the iron and other constituents present had no deleterious effects. To-day the value of the slag is such that certain basic Bessemer works depend very largely for their profits on the sale of their phosphoric slag.

The effect of the basic process on the development of new districts is most marked in the case of Germany. Previous to 1880 the total production of pig in Germany did not exceed 2,500,000 tons, whereas in 1906 it had reached 12,293,825 tons, of which over 8,000,000 tons was basic pig iron made from local ores. With this exception, the development of the steel industry, like that of the blast furnace, is due far more to improvement in mechanical appliances and details of practice, than to new processes.

Our Bessemer converters have increased in size from 2 to 5 ton converter to 16 to 20 tons, and our open-hearth furnaces from 5 to 250 tons. In the early days of Bessemer practice the advantage of taking metal direct from the blast furnace and saving the cost of remelting in the cupola was recognised, but owing to the difficulties of obtaining metal of regular composition, and also of tapping the blast furnace at very frequent intervals, it was not generally used until the metal mixer or receiver was introduced. This is simply a large reservoir, sometimes gas-fired and sometimes not, in which metal from a number of blast furnaces is stored and is poured off as required into ladles and taken to the converters. These mixers, originally about 100 tons capacity, have been increased in size to hold 300 and 400 tons, and in one case in England 750 tons of molten metal. By mixing the products of several blast furnaces metal of very fair regularity is obtained, and to some extent a certain elimination of impurities effected; thus, the silicon is appreciably oxidised, and if manganiferous metal is mixed with metal high in sulphur, the sulphur can be considerably reduced.

The modern type of mixer is usually gas-fired, the air, if not the gas, being regenerated, and is similar in general construction to a large tilting open-hearth furnace; and it is becoming more and more the general practice to use this as a preliminary refining furnace by the addition of suitable fluxes. Many of these mixers are now basic lined, and, by the formation of suitable slags, not only can the metal be desilicified but largely desulphurised, matters of the greatest importance if the metal is afterwards to be treated by the basic process either in the converter or the open-hearth furnaces. For many years various attempts were made to use molten iron from the blast furnace or cupola in the open-hearth acid and basic furnaces, but without success, owing chiefly to the excessive wear and tear on the bottom. This was due largely to the irregular composition of the metal, and also to the method employed in the early days of making the hearths of basic furnaces, which were either rammed or bricked. Now the basic material is glazed on layer by layer, with the result that the very hard bottom, all fritted together, is well able to resist the cutting action of the molten metal. So far as the acid open-hearth process is concerned, there is probably little advantage in using molten metal, as it is not possible to add oxides of iron on the silica hearth of the furnace to effect rapid oxidation of the impurities, and it has not been generally adopted; in the basic open-hearth, provided a partially refined metal of regular composition from a mixer can be obtained, very rapid oxidation of impurities can be effected by oxidising slags, and considerable saving in time in the working of the charge is effected. Comparatively few early basic open-hearth plants had blast furnaces attached from which molten metal could be obtained, or probably its use would be more common to-day. Where there were blast furnaces there were no facilities for charging the open-hearth furnaces with the molten metal, and to provide these would have

necessitated in many cases the practical rebuilding of the melting shop, as the building would not have been strong enough to carry overhead cranes, or the open-hearth platform, to carry the ladle full of molten metal.

In modern Bessemer works, whether acid or basic, the practice is to take the metal from blast furnaces to a mixer and thence to the converter. The mixer is not expensive to work, as it requires little attention and the repairs are few.

In the open-hearth acid plants, when cold materials are charged, the increase in the size of the furnaces has necessitated mechanical charging, and this has been met by the Wellman charger and similar machines by which the materials are charged about 1 ton at a time from boxes. This has reduced the hard manual labour, and effected a great saving in the time of charging, thus considerably increasing the output and decreasing the fuel consumption.

In basic open-hearth works the best practice is to take molten metal, previously subjected to a preliminary refining in a mixer, direct to the open-hearth furnace, some of the ore and lime having been previously charged into the furnace by a Wellman charger, but in works where molten metal is not available cold materials must be charged as in the acid process. Attempts have been made many times to use an acid Bessemer converter in combination with basic open-hearth furnaces, and in some works the results appear to be satisfactory. The molten metal, either direct from the blast furnace or after passing through a mixer, is desilicified and partially decarburised and then transferred to a basic open-hearth furnace to be converted into finished steel. Provided the Bessemerising is stopped before any large percentage of the carbon has been removed, and that the metal is comparatively low in phosphorus, so that when the metal is transferred to the open-hearth furnace the proportion of carbon to phosphorus is relatively high, good results may be obtained, but in the case of high phosphoric metal the removal of carbon to any appreciable extent before transferring the metal to the open-hearth would, one anticipates, greatly increase the difficulty of obtaining regularly low phosphoric steel, as there would be considerable risk of the carbon being oxidised before the phosphorus. Within the last few years several important modifications of the basic open-hearth process have been introduced, but the only two of any practical importance are the Bertrand-Thiel and the Talbot continuous process. In the Bertrand-Thiel, either cold metal or molten metal from a mixer is largely dephosphorised and partially decarburised in what is known as a primary furnace, and when the carbon is reduced to about 1.5 to 2.0 per cent. and the phosphorus to about 0.2 per cent., it is transferred to a finishing furnace, in which scrap, oxide, and some lime have been previously heated, care being taken to prevent any of the phosphoric slag formed in the primary furnace passing into the finished furnace. This process was at work for some time on the Continent and in America, and later in this country at the Round Oak and Brynbo Steel Works, and no doubt excellent steel of very regular quality can be produced, but it has not so far been adopted at other works. One difficulty in adopting this process to an ordinary open-hearth plant is the transferring of the metal, as unless furnaces can be arranged one below the other, the molten metal would have to be raised to be poured into the finishing furnace, which in many cases might be difficult unless the plant were specially designed with a suitable overhead crane.

The Talbot continuous process involves the use of large tilting-furnaces, and molten metal from a mixer is charged and converted into steel in the usual way; instead, however, of pouring the whole charge, only a portion equal to about one-third of the contents of the furnace is tumbled, and then a ladle of mixer metal equal in weight to that removed is poured into the bath of finished steel remaining in the furnace. Oxides and lime additions are made in the usual way with a Wellman charger, and when the metal is dephosphorised and decarburised to the required extent, another third is cast into ingots and more mixer metal charged into the furnace. In this way the furnace is worked continuously, being, even

after the pouring of a charge of finished steel, always two-thirds full of molten steel, and it is only emptied at the week end. There are a number of furnaces at work or building, in England, on the Continent, and in America, and Mr. Talbot informs me that these furnaces when in full work will be capable of producing over 1,000,000 tons per year. There is no doubt that the quality of the steel is excellent, and the large outputs obtainable and small labour charges make it a very serious competitor with the ordinary open-hearth. The tendency seems to be to make the furnaces larger and larger, and a 250 ton furnace is now being erected in the North of England. These large furnaces, with necessary foundations and varied appliances for dealing with such large quantities of material, are necessarily very costly, and this is probably the principal reason why they have not been more generally adopted, as frequently it necessitates the entire reconstruction of the open-hearth shop.

In Bessemer practice the addition of oxides of iron in the basic converter by increasing the fluidity of the slag and decreasing the waste, although only a detail, is of some importance, and was first used in this country some years ago, although quite recently it has been described as a new modification in the technical Press. The more general use of mixer metal has considerably increased the yield, and also reduced the cost of repairs, but in other respects both acid and basic Bessemer processes are carried on as they were 20 years ago.

With the increased size of converters and furnaces, mechanical means have been devised for handling the large quantities of metal, and overhead cranes to carry ladles which hold 50 tons of metal are now common in large works. To deal with this large quantity of metal before setting has necessitated the casting of large ingots and all the mechanical appliances for dealing with these. Instead of 18 cwt. to 25 cwt. ingots, as was customary some years ago, 2 to 5 tons, and frequently larger ingots are now regularly cast, and the ingot moulds, instead of being placed in sunk pits, are frequently carried on cars on the floor level of the shop, and directly the entire heat is teemed, are drawn away by a locomotive to the stripper, where the ingot moulds are removed, and the ingots immediately taken away to the soaking pits or gas-fired reheating furnaces. This increase in the size of ingots has necessitated again larger reheating furnaces, and especially larger and more powerful rolling mills for cogging down and finishing, and more powerful engines for driving the mills. With the assistance of our engineers all these requirements have been met, and to-day rails 180 feet long are rolled in some of our large rail mills, and plates over 12 ft. wide in our plate mills. Not only, however, has progress been marked by an increase in size, but at every point mechanical devices have been introduced to save labour, increase the speed of working, and to reduce the cost of manufacture.

Previous to 1870, all rails were rolled in pull-over mills, and the maximum output was 100 per shift and rarely exceeded 50 tons. To-day a reversing rail mill with cogging, roughing, and finishing mill will turn out 250 tons per shift, and one works in England has rolled 1000 tons in a week, and another works, not in this country, but with which I am acquainted, has turned out 6000 tons. But it is not only in the special mechanical appliances connected with our industry that we have to thank our engineering friends, but also for providing us with engines capable of running at almost any speed, for our small mills, and reversing engines capable of withstanding the great and sudden stresses to which they are subjected, which are under absolute control, are steady in running, and easily handled and rapidly reversed.

To the engineers, also, we owe the great economies in fuel which have resulted from the use of high pressure steam—expansion, condensing, and compounding—economies which have been of the greatest importance to our industry in view of the large amount of power used in our works. As, however, the steam engine has displaced the water wheel, so now in its turn it appears to be in danger of being ousted by the dynamo and electric motor. We have already seen that it is no longer a question of steam engine *versus* gas engine for blowing our blast

furnaces, but the contest is between the gas engine and the steam engine combined with the turbine; and now we have electric driving for mills claiming the most serious attention of all practical steel works men. For many years we have been using electric motors for driving our cranes and for a number of subsidiary purposes, and now electrically driven mills are an accomplished fact. Both reversing and continuous mills are being electrically driven, and I believe I am correct in saying that in this district Sir Alfred Hickman has just completed the equipment for driving his rolling mills electrically. Now that the initial difficulties in the design of the electrical plant necessary to meet the special conditions have been overcome, there seems every probability that electrical driving will gradually but surely replace steam driving.

Again, if we consider the forging of large masses of steel which are necessary to meet the modern requirements of our latest battleships, we have to thank our engineers for the modern forging press, which has so largely replaced the steam hammer for the forging of our large guns and armour plates. Presses are now in use capable of giving pressure from 14,000 to 20,000 tons, and the work done by these is so much better than the hammer that the latter is gradually being superseded for heavy high class work, and even for small work the modern rapid forging press is gradually being adopted.

While, however, the engineer has, by his designs of improved machinery, made modern progress in iron and steel possible, it has only been so by the metallurgist supplying him with a material suitable for his machines, at a cost undreamt of a few years ago. Each year he is demanding a material of greater strength combined with greater ductility and making his specifications more rigid as regards the purity of the materials he uses and the mechanical tests it has to withstand. Thus, in railway materials we have to supply rails capable of resisting greater crushing load and resistance to wear, due to the greater weight of rolling stock and higher speed, axles and tyres which shall combine strength and rigidity with an absence of all tendency to brittleness, and steel for bridges and similar structures combining lightness, rigidity, and strength. For the moving parts of high speed engines, he demands material which is capable of withstanding reversal stress under all variations of speed without risk of failure.

We have only to consider some of our modern engineering structures, such as the Forth Bridge, or a modern Atlantic liner, to see how far the iron and steel makers have done their part during the last 30 years. Not only must the steel be as free as possible from impurities, but it must also be manufactured under such conditions that it is not over-oxidised, and further, that it is free from all mechanical defects. To fulfil these requirements there are two ways open to the steel makers—one to start with high price pig iron of exceptional purity, and the other to use cheaper material and purify during the manufacture. If the acid process is used, either Bessemer or open-hearth, it is well known that there is no dephosphorisation or desulphurisation during the operation, and to obtain a high class product, the manufacturer is compelled to use very specially selected irons, which are costly. On the other hand, if the basic open-hearth is used to obtain the same result, he has a much wider choice as regards his pig iron and scrap, and the problem that faces us to-day is the manufacture of steel, regular in composition and free from impurities, at a minimum cost. The most promising solution in my opinion is the use of the basic open-hearth for low phosphoric or what are commonly known as hematite irons. This has frequently been suggested, and is already being done at several works in this country, and various works in America and on the Continent, with excellent results, and there seems no reason why practically all our open-hearth furnaces should not be basic lined, irrespective of the pig iron used. I have long advocated this, and the only reason why it has not been more generally adopted, so far as I have been able to judge, is that most low phosphoric or hematite pig irons are usually somewhat high in silicon, and consequently are destructive to the basic hearth. There should, however, be no great difficulty in making pig iron of this class low in silicon and sulphur,

and at one of the works referred to, iron is being made of such regularity in these respects, that it is taken direct to the Talbot furnace without being passed through a mixer. This would at once give ironmasters a far greater range in the selection of their ores, as it would no longer be necessary to confine their purchases to ores with less than 0.035 per cent. of phosphorus, but anything up to 0.1 per cent. could be used. In those districts where phosphoric ores are obtainable, a certain proportion of these could be used with higher class ores, as absolutely reliable results in regard to the elimination of phosphorus could probably be obtained with pig irons containing up to 0.3 per cent. I am not suggesting that basic pig containing from 1 to 1.5 per cent. of phosphorus should not be used, but simply that, where hematite ore or other non-phosphoric ore is at present used, these should be treated in basic-lined instead of acid-lined furnaces. Working under such conditions, either with molten metal from a mixer or with cold pig iron and scrap, the quality of the whole of our steel at present produced in acid furnaces would be improved at practically no additional, but probably at a reduced cost, when the lower price of pig iron and the less risk of rejections are taken into consideration.

The Bessemer process, both acid and basic, has done such good service in the past that one feels loth to say anything which may seem to discredit a process which has served us so well, but at the same time we must face the fact that slowly yet surely both acid and basic Bessemer converters are being replaced by open-hearth furnaces. For boiler plates and many other purposes some engineers decline to have any Bessemer steel, and even for rails, open-hearth steel is now becoming a serious competitor with the Bessemer converter, and although the present Bessemer works may continue for many years to come, it is very unlikely that any other Bessemer plants will ever be erected in this country. More especially is this the case since the recent economies effected in the working of the open-hearth practice has reduced the margin between the cost of production, and to a very great extent left little advantage with the Bessemer process in this respect.

With regard to the Bessemer basic process, this, apart from any other consideration, is restricted by the phosphoric ores available. To work this process economically it is necessary to have a pig iron containing at least 2.25 per cent. of phosphorus and preferably 3 per cent., and the supply of ores to produce such a pig iron is limited to one or two districts in Great Britain.

The necessity of obtaining steel of exceptional purity for some purposes has led to interesting developments in refining in the electric furnace, and on the Continent this is being carried out at several works with marked success. Molten finished steel from either a Bessemer or open-hearth furnace is transferred to an electric furnace, where, by the addition of suitable fluxes, it is almost completely dephosphorised and desulphurised in about three hours. The furnaces are basic lined, and the refining is effected with very basic slags, the final desulphurising slag being practically free from iron. At two of the works I visited recently, one working with the Héroult and the other with the Röchling-Rodenhauser induction furnace, the phosphorus was reduced from 0.07 per cent. to 0.013 per cent., and the sulphur from 0.05 per cent. to 0.001 per cent. in three hours, with a consumption of about 300 kilowatts per ton of steel; an 8 ton furnace was refining about 50 tons in the 24 hours. Taking electric energy at the price it can be obtained in this country, the cost is by no means a prohibitive one. If the refining is not carried so far, less electric energy is required, and a considerably greater output is obtained. The possibilities of utilising electric furnaces in conjunction either with Bessemer or open-hearth furnaces for the production of steel for special purposes seems to offer considerable possibilities, as not only is the steel of exceptional purity, but with careful work it can be practically deoxidised. In steel castings, too, remarkably good work is being done in the electric furnace: castings of all sizes from a little over 1 lb. in weight and less than $\frac{1}{2}$ inch in thickness are being regularly made, equal in soundness and quality to anything produced from the crucible, and at a considerably less cost. All grades of steels can be made equal to high-class crucible steel, and

such steel is now being largely produced and competing with crucible steel. The increased size of our ingots with the accompanying segregation troubles, makes it doubly important that we should be able to produce the purest material, and so far, the best preventive for segregation is to have few impurities to segregate.

During recent years great advances have been made in the economy of fuel in our steel works for reheating and other purposes. The adoption of the Siemens regenerative system in many gas-fired furnaces, together with the use of vertical furnaces, sunk beneath the floor level, by which radiation losses are reduced to a minimum, has been attended with great economy in fuel, reducing the losses by oxidation and the labour of charging and withdrawing. In modern practice the sensible heat of the ingot as removed from the mould is practically sufficient, if allowed time to distribute itself equally through the mass, for clogging down, and in some cases for rolling the finished product, and in gas fired soaking pits very little gas is required for actual heating of the steel.

In numberless types of reheating furnaces great attention has been paid to details of furnace construction, both with a view to fuel economy and convenience for handling the materials, and the results have been most satisfactory.

Furnaces are now at work in which such a reducing atmosphere can be maintained that steel articles can be annealed at a red heat without appreciable surface oxidation, quite equal to anything obtained a few years ago by close annealing.

In the gas-producers, modifications in details of design by which the proportions of air and steam are made better control, have led to more perfect combustion and considerable increase in efficiency. The producer plant in a works has been in the past and even now is not infrequently neglected, and yet its systematic control is of the greatest importance. Not only should there be daily analyses of the gases produced, but a systematic record of the temperature of the gas as it leaves the producer, and an estimation of the percentage of carbon in the ashes, so that any losses may at once be detected and rectified.

We have now mechanical producers in which by stirrer and various other devices, the fuel is equally distributed and efficient combustion maintained, and others in which by-products are very largely recovered. The Mond producer is specially designed for by-product recovery, and the results obtained in this direction have been most satisfactory, the only drawback being the greater cost of the plant compared with an ordinary producer plant.

So far I have not referred to the question of alloy steels, and yet perhaps it is in this branch of steel manufacture that the greatest progress has been made from a metallurgical standpoint. From the discovery of manganese steel by Hadfield, to the recent developments in connection with high speed steels, there has been a record of steady progress. Our weapons of offence and defence depend entirely upon these special steels, and their special heat treatment by the metallurgist. To-day a Krupp cemented 6-inch armour plate affords resistance equal to more than 18 inches of wrought iron. There is ever the fight between the projectile and the armour, and some idea as to the shock these latter are required to resist may be gathered from the fact that the striking energy of a projectile from a 12 inch breech-loading gun is in some cases over 42,000 foot-tons, and if unencased is capable of penetrating 19 inches of Krupp cemented armour, and if capped 23 inches. The extraordinary properties of the projectiles now made, may be gathered from the fact that a 12 inch Krupp cemented plate has been pierced by a 12 inch armour piercing shell, and the projectile, after passing through the plate, has been found in the rear in a condition for bursting.

Our heavy guns are also made largely of special alloy steels, heat-treated to give them that combination of toughness and strength combined with ductility sufficient to avoid any risk of bursting.

For purposes too numerous to mention, nickel steels, chrome vanadium steels, molybdenum and other alloy steels, are used, and much of the success of our motor industry is due to the use of these special alloy steels.

for parts subject to vibratory and other stresses. The recent developments in high speed tool steel are so well known that they hardly need mentioning, but we have now alloy steels which are capable of cutting in a lathe at a rate of 500 feet per minute, and are revolutionising the machine shops of the world, thus enabling the metallurgist to make some repayment to the engineer for the many services which he has rendered to metallurgy.

The progress in the manufacture of steel alloys and the heat-treatment which is essential to their successful application is largely due to a number of workers on the theoretical side; without their labours the progress made would have been impossible. Amongst these may be mentioned Roberts-Austen, Osmond, Stead, Hadfield, Arnold, Le Chatelier, Guillet, and many others, who by their systematic researches on the constitution of steel and alloys have stirred the imagination and started

practical men thinking on these complex problems; and it is no exaggeration to say that their work is revolutionising various branches of our industry. The relation between the critical points and heat-treatment, instead of being a matter for academic discussion, is now made the basis of heat-treatment in actual practice, and I could mention works where the heat-treatment absolutely depends on previous accurate determination of critical points, and the results are largely controlled by the microscope.

It is by the intelligent application and adaptation to practice of the results of our scientific men that the future of the industry must largely depend, and provided our theoretical and practical men work hand in hand, each doing his part, there is every reason to believe that future developments will in every way equal those of the past, and that the present century will show a record of progress of which we may all be proud.

Journal and Patent Literature.

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[I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Filtering media and the like; Cleansing — J. Wilson, London. Eng. Pat. 15,019, July 15, 1908.

THE claim is for a method of cleansing the filtering medium of a filter, in which the filtration takes place by an upward flow of the liquid through such filtering medium. To effect the cleansing, the supply of liquid to be filtered is shut off and water is caused to flow downwards through the medium from above and at the same time air is forced through the perforated pipe by which the liquid to be filtered enters in the ordinary course. The air agitates the cleansing water and enables it to wash away the deposit.—W. H. C.

Mixing and filtering machines. W. S. Kern. Fr. Pat. 397,762, Dec. 19, 1908.

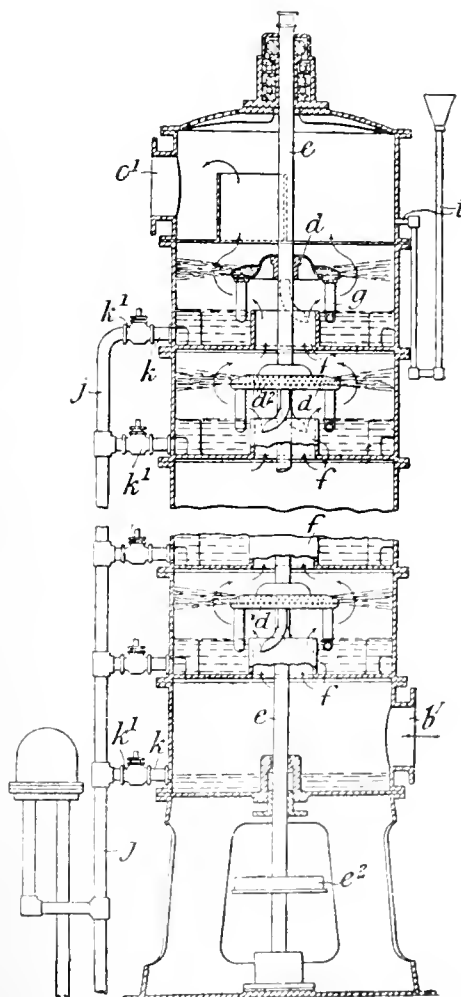
A HORIZONTAL perforated truncated cone is mounted upon a stand and has each end closed by metal plates, that at the larger end being easily removable. The material to be treated is fed through an opening in the smaller end of the cone and is mixed and agitated by brushes carried by arms fixed to a central shaft, which passes through the ends of the cone and is rotated by a pulley from without. The finer particles are brushed through the perforations, leaving the coarser ones on the interior surface. The latter are scraped off by blades fastened to the arms carrying the brushes, and are discharged through an opening in the plate closing the larger end of the truncated cone.—W. H. C.

Filter-press plates; Method of making thin — for oil, sugar, and chemical works. B. Degremont and A. Devaux. Fr. Pat. 398,065, Dec. 8, 1908.

THE plates are formed of a narrow iron frame with grooves on its inner edges. A thin corrugated metal sheet is held between two perforated plates which fit into the grooves, and a central aperture, strengthened by a metal ring on each side, is pierced through the plates for the admission of the liquid to be filtered and to afford support to the filter-cloth.—W. H. C.

Liquids and gases; Apparatus for effecting intimate contact of — Kirkham Hulett and Chandler, Ltd., and S. Hersey, London, and E. W. Blake, South Croydon. Eng. Pat. 18,129, Aug. 28, 1908.

THE gas enters through the opening, b^1 , and passes upwards through the central openings, f , from chamber to chamber, finally escaping from the top chamber through



the opening, c^1 . The liquid enters through the siphon, i , and flows down from chamber to chamber over the upper

edge of the upstanding pipes, *f*, finally escaping through the seal, *j*. The latter is also connected to each chamber by pipes, *k*, and taps, *k*¹, for the purpose of emptying the apparatus of liquid. In each chamber there is a domed disc, *d*, having its outer edge, *d*², turned upwards and perforated. The discs are mounted on the shaft, *c*, driven by the pulley, *e*², and each disc has several curved pipes, *g*, depending from it, so that when the discs are rotated, the liquid is scooped up by the pipes and is thrown off as spray through the perforations. The gas as it passes upwards is thus obliged to pass through the spray.

—W. H. C.

Introducing air or other gases into liquids. M. Schönmann. Fr. Pat. 398,060, Nov. 21, 1908.

The liquid is placed in a tank the bottom of which is covered by a plate having, on its upper surface, rows of gutters which cross one another at right angles. A round block formed of porous wood free from sap and hollowed out below, is placed over each intersection of the gutters, and the whole is covered by a plate having circular openings corresponding to the blocks. The edges of the openings are bent downwards and fit into grooves formed round the upper edges of the blocks. All the joints are made tight with asphaltum or pitch. Air, under pressure, is introduced by a pipe into the gutters and rises through the porous blocks in a finely divided condition into the liquid.—W. H. C.

Centrifugal separators. I. Segalevic, Budapest, Austria. Eng. Pat. 24,859, Nov. 18, 1908.

The claim is for a centrifugal machine which can be automatically emptied without stopping its rotation. A bell provided with external radial arms or blades at different heights, is fitted over the spindle within the drum. During the filling of the machine, the bell is coupled to the spindle so that bell, blades and drum rotate together. When the drum is full, the bell is disconnected from the spindle by means of a lever and ratchet, and is brought to a standstill by a brake. The drum continues to rotate and the blades on the bell detach the contents of the drum and discharge them through openings in the bottom of the drum.—W. H. C.

Drying air; Method of and apparatus for —. D. Baker, Philadelphia, Pa. U.S. Pat. 926,972, July 6, 1909.

The air is first compressed and then cooled to remove the heat due to compression. It is next further cooled whilst maintaining the compression, and the deposited water is mechanically removed. The temperature and pressure being still maintained constant, the air is passed through a measuring apparatus and delivered to the place where it is to be used.—W. H. C.

Furnace. T. S. Blair, jun., Elmhurst, Ill. U.S. Pat. 927,098, July 6, 1909.

A REVERBERATORY regenerative furnace is provided with a gas-port covered by a hollow metal hood projecting into the furnace from the end-wall and provided with an outlet in its rear-end portion. The hood is composed of united sections, insulated material on the upper side of the hood covering a joint. Water pipes placed outside the hood and connected with it, cause a flow of water through the inner end of the hood.—A. G. L.

Evaporating apparatus. W. and A. Ganlin, St. Cesaire, Canada. U.S. Pat. 927,520, July 13, 1909.

The liquid to be evaporated, is contained in pans supported on a frame over the flues of a furnace. By means of a device, controlled by a weight, the pans are progressively raised above the frame as the liquid in them evaporates, and at the same time dampers in the flues are lowered in order to regulate the evaporation.

—W. H. C.

Crystallisation; Disturbed —. H. Flamisset. Fr. Pat. 397,877, Nov. 27, 1908.

The solution to be crystallised is atomised by a current of air produced by a fan, and allowed to fall in the con-

dition of a fine spray into the crystallising vessel. The liquid is cooled by the air, and crystallisation takes place while the spray is falling.—W. H. C.

Agglomeration; Process of —. E. A. L. Rouxville. Fr. Pat. 398,083, March 13, 1908.

CLAIM is made for the use of hydrocarbons of the terpene series described in Fr. Pat. 356,716 of 1905 (this J., 1906, 83) and 378,251 of 1906 (this J., 1907, 1153) either in their natural condition or after vulcanisation, as an agglomerant.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Coal in Mull (Scotland). Times Eng. Suppl., Aug. 4, 1909. [T.R.]

LARGE seams of coal have been discovered in the island of Mull on the estates of the Duke of Argyll and of Mr. Clark, of Ulva. Mining rights have been granted to a syndicate, and operations have been begun near Bunessan by blasting an extensive seam quite close to the seaboard. This is the first effort that has been made in Mull to develop the coal resources commercially.

Coal-dust explosions. Times Eng. Suppl., Aug. 11, 1909.

DEMONSTRATIONS (in the presence of Lord Monkswell, chairman, and other members of the Royal Commission on Mines) of the explosive force of a mixture of coal-dust and air were carried out at the experimental gallery at Messrs. Pope and Pearson's Altofts Colliery, near Normanston, and were intended to show (1) whether an explosion can be confined to a coal-dust area by sandwiching it between two lengths distributed with stone-dust, and (2) to demonstrate the effect of an explosion of coal-dust without the mitigating influence of stone-dust. The series of experiments carried out at Altofts last year were mainly intended to convince mining engineers generally of the fact that finely divided coal-dust and air, without the presence of firedamp, constitute an explosive mixture of enormous power, and with that end in view they were undoubtedly successful. So far, however, they could only be considered as empirical, and the serious scientific investigation of the many ramifications of the problems involved had not been entered upon. Obviously the next step was to establish, if possible, the actual maximum force and the rate of development of an explosive mixture consisting of a finely divided solid and air, to be followed by the calibration of the effect of means of starving this force by depriving it of food and heat by the use of stone-dust zones and similar devices.

From November, 1908, to June 1, this year the work with the experimental gallery was suspended on account of atmospheric conditions. The interval was employed in designing and perfecting instruments for recording (1) the pressure produced by the explosion, (2) the velocity with which this pressure is developed, (3) the composition of the resultant gases, and (4) the temperature of the flame. When the experiments with the gallery were resumed in June, the committee had the assistance in their investigations, of several new instruments—(1) a pressure recorder, (2) a time recorder, (3) a measuring apparatus, and (4) separate forms of velocity recorders. The pressure recorder, or manometer, is so designed as to absorb any vibration arising from the experimental gallery without transmitting it to the recording mechanism. It consists essentially of a strong, triangular-shaped flat spring, against which there presses lightly a movable piston. This piston takes the form of a hollow cylinder and rests in a box containing oil. The pressure of the explosive blast acts upon the surface of this oil, and drives the piston against the spring. The end of the spring carries a hard steel point which marks its movement on a ruled surface revolving at a known speed. By this means a continuous record of the pressure is obtained from the first moment of its development. The speed of revolution of the drums carrying the ruled surface is obtained from a specially designed time marking recording tenths of a second. The time intervals of

one-tenth of a second are recorded simultaneously on the pressure charts by means of a delicate Deprez indicator, as two breaks in electric contact. The amount of displacement of the spring due to 200 lb. pressure is only half an inch, so that the records need to be read by means of a microscope and scale, so arranged as to enable pressures as low as 1 lb. per square inch and as high as 250 lb., to be easily measured. The rate of development and length of duration of pressure can also be determined by means of this instrument. The principle adopted for the velocity recorders is that of registering the time at which electrical contacts, placed at known distances inside the experimental gallery, are broken by the force of the explosion. These instruments give the speed of travel of the pressure. The average speed as shown by the experiments from the time of ignition to a point 275 ft. distant appears to have been 1400 ft. per second.

The evidence supplied by the several instruments described, appears to have confirmed what might logically have been deduced from previous experiments rather than to have afforded new information. This is illustrated by two experiments made on July 2 and 8 last. In each of these experiments a length of 275 ft. of the gallery was spread with coal-dust. In one case the succeeding length of 150 ft. to the open ("down cast") end of the gallery was spread with stone-dust, but in the other it was left undressed, constituting a so-called "dustless zone." A pressure recorder (X) was in each case placed at the end of the coal-dust zone 275 ft. from the point of ignition, and a second pressure recorder (Y) was placed 100 ft. in advance, or 375 ft. from the point of ignition and 50 ft. from the open ("down cast") end of the gallery. The coal-dust was raised and exploded in the usual manner by firing two cannon, as described in this J. 1908, 971. See also *ibid.*, 888. In the "dustless zone" experiment the pressure recorder (X) registered a rapid rise to a maximum of 45 lb. per square inch, and then fell—the rise and fall occupying about equal periods of time. The pressure recorder (Y), however, immediately upon being reached by the explosion wave, rose to a maximum of 113 lb. per square inch. In the "stone-dust zone" experiment the pressure curve registered by the pressure recorder (X) was practically identical with that of the previous experiment, but the pressure recorder (Y) on this occasion rose to only about 30 lb. per square inch, which gradually died away.

The explanation given for these divergent phenomena is that in the first experiment the coal-dust was driven in front of the explosion wave, so that the pressure recorder (Y) actually registered the pressure developed at the end of a coal-dust length of $275 + 100 = 375$ ft. In the second experiment the explosion was quenched by the stone-dust. In the former case the flame from the explosion shot out beyond the open ("down cast") end of the gallery to a distance of 16 ft., as shown by a specially constructed cinematograph. In the second case the flame penetrated the stone-dust zone for a distance of only 55 ft., as shown by tufts of gun-cotton suspended in the gallery. These experiments appear to prove conclusively that the stone-dust has a definite restraining action beyond the negative one of not supplying food for the explosion.

The Altofts investigation gives promise of supplying information which will be invaluable in the endeavour to prevent or minimize the effect of explosions in coal-mines, the success of which attempt must depend upon the thoroughness with which the phenomena attendant upon such explosions are understood.

A satisfactory instrument for determining the temperature of the flame of an explosion still remains to be devised, and in spite of the serious difficulties which the problem involves it is believed that success will be achieved. The information which such an instrument would supply is of very great importance and would lead to rapid progress.

Gas producer; Influence of steam and of loss of heat from the gas-producing zone on the efficiency of a —. J. Voigt. Z. angew. Chem., 1909, 22, 1539—1548.

The author takes the experimental results of Wendt (Mitt. über Forschungsarbeiten, herausgeg. v. V.d.I. II-ft

31), and bases upon them, calculations of the effect of the quantity of steam introduced, and of the loss of heat by radiation and conduction on the efficiency of a gas producer. He concludes that in order to attain the highest efficiency of the gas-producing zone and the highest temperature of combustion of the gas mixture produced, the total heat liberated by the combustion of the carbon by air, with formation of a mixture of carbon monoxide and nitrogen, must be utilised for the decomposition of steam by carbon, with formation of hydrogen and carbon monoxide. In practice the amount of steam introduced should be such that the proportion of carbon monoxide in the gas is a maximum. The loss of heat from the gas-producing zone by radiation has an important influence on the results obtained, but if this loss be kept low, the maximum efficiency is attained in most cases by using about 300 grms. of steam per kilo. of solid carbon, or 80 grms. of steam per cb. m. of air.—A. S.

Vertical retorts; Distillation in —. J. Bueb. J. Gasbeleucht., 1909, 52, 685—687.

In order to determine whether the gas evolved in vertical retorts ascends through the interior of the fuel column, or whether it passes through the coke in the neighbourhood of the walls, lighting gas was passed through a column of coke 6 cm. long in a porcelain tube heated to various temperatures. It was found that at temperatures from 500° to 900° C. the resistance to the flow of gas was increased; the heavy hydrocarbons in the gas were wholly or partly destroyed; the illuminating power of the gas was diminished, being entirely destroyed after passing through coke at 900° C.; and the calorific value was considerably reduced. The quantity of naphthalene in the gas was increased. Soot was deposited on the coke near the gas inlet, and this soot was only partly removed by the passage of a current of lighting gas mixed with steam. These experiments show that the gas does not pass through the incandescent coke in vertical retorts, or ascend in the neighbourhood of the walls, excepting immediately after charging, when the gas liberated near the walls is decomposed with formation of graphite. The gas may, however, pass up through the coke in the later stages of the distillation, when the heavy hydrocarbons have been liberated.—A. T. L.

Naphthalene in [lighting] gas; Determination of —, and its removal by cooling. J. Rutten. J. Gasbeleucht., 1909, 52, 694—696.

NAPHTHALENE in lighting gas may be determined by a modification of Colman and Smith's method, in which the solution of picric acid used, is saturated and contains crystals of the acid. When lighting gas is passed through this solution, the formation of the insoluble naphthalene picrate is quantitative, without further treatment, and after diluting the solution and re-dissolving the picric acid, the solution may be titrated immediately. The removal of naphthalene from lighting gas by washing the gas with tar is more effective the lower the temperatures of the gas and tar, since the vapour pressure of naphthalene decreases with temperature more rapidly than its solubility in tar. In the author's tests the gas was cooled by means of cooling chambers separated from the retorts by about 220 metres of piping. With the inlet and outlet temperatures of one of the coolers varying from 51° C. and 22° C. respectively, to 63° C. and 41° C., the quantity of naphthalene in the gas entering and leaving the cooler, varied from 1.142 and 0.504 gm. to 1.950 and 1.44 gm. per cub. m. It was also found that 50 per cent. of the tar and 70 per cent. of the naphthalene were removed in the cooling chambers.—A. T. L.

Peat for generating electricity in Germany. Bd. of Tr. J., Aug. 5, 1909, [T.R.]

THE following information is from the report by the British Vice-Consul at Emden:

An undertaking has been initiated near Aurich with Government assistance. Works are being erected with a view to utilising peat, of which a vast supply is available, for the generation of electricity. The Government will, it is reported, require a supply of some 2,000,000 kilowatts yearly in connection with the harbour at Emden.

PATENTS.

Cokes; Treatment of — B. Ely and A. Rollason. Pye Bridge. Eng. Pat. 26,121, Dec. 3, 1908.

COKE as they are withdrawn from the ovens are covered with a layer of coke breeze "of sufficient thickness to exclude air and moisture," whilst they are cooling down. It is stated that the coke when so treated becomes softened, and when employed as fuel in an open grate or a furnace, will ignite and burn with a steady flame. The softened cokes, so produced, can be ground and used in the manufacture of electric carbons or for other purposes.—E. F.

Combustion of fuel; Process for facilitating or controlling the — and for preventing smoke. P. M. Justice, London. From The Coal Treating Co., Boston, Mass., U.S.A. Eng. Pat. 14,558, July 9, 1908.

THE coal is coated with a very thin film of a salt which will not volatilise at 1000° F. but will, at that temperature or above, exert a catalytic action and accelerate the combustion of the carbon. The salts preferred, are calcium chloride or sodium nitrate, but salts of other alkali or alkaline-earth metals, or of copper, iron, manganese, aluminium, chromium, nickel, cobalt, tin, gold, and platinum have been used with similar results. A highly graphitic coal burning under ordinary conditions with flames not longer than 4 ins., when dipped in a weak solution of sodium nitrate or calcium chloride and dried, burned with flames 35 or 40 ins. long after the volatile matter was expelled and until the coal was practically consumed. The long flames do not appear until the temperature reaches 1000° F. It is essential that weak solutions of the salts should be employed; for example, solutions containing the salts in proportions varying from 1 in 600 to 1 in 10, according to the salt used. (Reference is directed to Eng. Pat. 1154 of 1907; this J., 1907, 752.)—A. T. L.

Suction gas producers. H. Berry, Clementston, Australia. Eng. Pat. 14,465, July 7, 1908.

To facilitate the removal of clinker and ashes while the producer is in operation, wells are provided at each side of the grate, into which the clinker and ashes are discharged by means of a rake passing through an air-tight gland in the outer wall of one of the wells. The wells are provided with suitable doors, and the gland for carrying the rake may be mounted on a universal joint. Instead of these wells, there may be openings controlled by sliding doors on each side of the grate and level with it, for discharging the clinker and ashes directly into the ash-pit.—A. T. L.

Methane, or mixtures of methane and hydrogen; Manufacture of — P. Sabatier, Toulouse, France. Eng. Pat. 14,971, July 14, 1908. (See Eng. Pat. 27,045, following.)

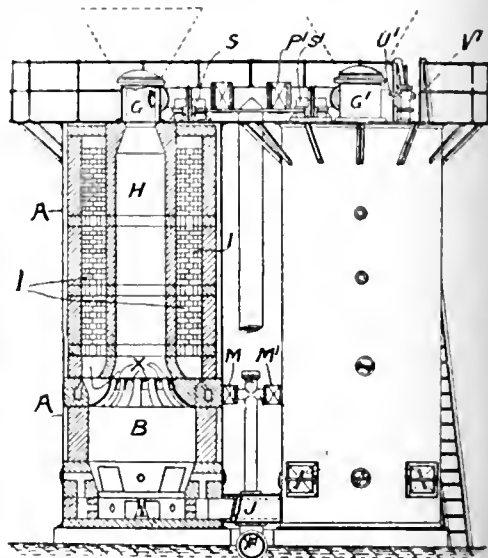
METHANE, alone or mixed with hydrogen, is prepared by passing water-gas over heated nickel. The use of moist water-gas as obtained by washing the crude gas with alkali hydroxide solution, is claimed, this condition rendering it unnecessary to specially introduce water vapour before passing over the heated nickel. The use of ordinary gas retorts, before the withdrawal of the incandescent coke, for the production of water-gas for making methane, is also claimed. It is stated that a water-gas containing 20 per cent. of carbon dioxide, obtained from light coke at 970° C., is just in condition for producing pure methane. The copper for freeing the water-gas from sulphur compounds should be kept at 500 to 600° C. After long use the copper becomes partly converted into sulphide and must be renewed; it may be roasted to oxide and then reconverted into metallic copper by heating in the gas to be purified. The temperature of the nickel used for effecting the reduction should preferably be 350, but may vary between 350 and 450° C.—E. F.

Methane, or mixtures of methane and hydrogen; Manufacture of — P. Sabatier, Toulouse, France. Eng. Pat. 27,045, July 14, 1908.

STEAM is passed over coke, anthracite or wood-charcoal kept at a constant temperature in tubes heated in a

furnace. In this way water-gas of constant composition is obtained. This is freed from carbon dioxide by washing first with sodium carbonate solution and finally with sodium hydroxide solution. It is then freed from sulphur compounds by passing it through tubes containing copper, heated in the same furnace as those in which the water-gas is produced, and is finally passed through flattened metal tubes containing side plates holding nickel, which are kept at a constant temperature in the same furnace as is used for the other reactions; in these, the conversion into methane takes place. The gas is then scrubbed and stored. The sodium bicarbonate solution produced from the sodium carbonate used for washing the water-gas, is reconverted into sodium carbonate by boiling on the top of the furnace, and then used again.—E. F.

Water-gas; Apparatus for the production of — with improved method of carburization by means of oil or other heavy hydrocarbons. H. E. Smith, London. Eng. Pat. 24,893, Nov. 19, 1908.



THE apparatus consists of two similar units which are worked together in an alternating manner. Each contains a water-gas generator, B, surmounted by a fireclay-lined channel, H, leading up to the charging hopper, G, G'. The channel, H, is surrounded by the system of checker brickwork, 1, which fills in the annular space between it and the outer lining, A, of the shell. Fuel is fed in from the hoppers, G, G', to the full height of the cylinders and raised to incandescence up to the level of the openings, X, by blowing in air from below; the escaping gases pass into the baffle-chambers, 1, together with excess of air coming from the secondary air-valves, MM', and raise the checker brickwork to a suitable temperature, escaping finally through the valves, SS'. The steam and air are now shut off, one of the gas valves, e.g., P', is opened, steam admitted to the baffle-chamber, 1, through the valve, T, in the other cylinder and the carburetting material through valve, U', to the baffle-chamber, 1, in the first cylinder together with a stream of water-gas introduced through pipe, V'. The steam is superheated in the chamber, 1, converting any carbon which may have been deposited in the chamber by the previous reverse operation into water-gas, passes through the fire in the generator, B, through the fireclay connecting pipe, J, into the adjoining generator, up which it passes, the long travel being conducive to a minimum of carbon dioxide in the resulting water-gas; this meets the mixture of gas and of carburetting material gasified in the baffle-chamber of this generator, and is thus carburetted, passing out through the fireclay-lined channel, and the usual condenser and scrubber. When the test flame shows that temperatures are getting low, the oil gas and steam valves are closed and the fires again raised to

suitable incandescence by the air blast just as at first; the air blast is then shut off, steam passed through the after-chamber in the second generator and through the two generators, and out by way of H. meeting carburetted gas produced in chamber. I. Operations are continued indefinitely in the same manner. The advantages of the apparatus are said to be that any carbon deposited in the carburetted gas is oxidised by the steam, which also cleans the injection and connecting pipes, that a shallow bed of fuel is used for the blow and deep one for the run, and that the heat contained in the gases produced during the blow is economically utilised.—E. F.

as-generator. R. N. McDonough and J. M. Conway, Fossil, Ala. U.S. Pat. 926,889, July 6, 1909.

HE claim is for a horizontal cylindrical retort set in a furnace and provided with a horizontal agitator. The retort is also provided with a valved feeding hopper at one end and with a valved discharge chamber at the other end. An auxiliary valved feed hopper formed by an extension of the cylinder is provided near the discharge hopper.—W. H. C.

as; Process of manufacturing —. B. Brazelle, Kirkwood, Mo., Assignor to H. Leschen, St. Louis, Mo. U.S. Pat. 928,103, July 13, 1909.

HE supply of air to a bed of hot coal is alternately opened and closed and the gases, consisting of the products of combustion when the air is admitted, are passed successively through a mass of mineral carbonates, a second mass of coal, and a mass of refractory material, and the resulting fuel gas is collected. When the air supply is cut off, the gases distilling from the coal are used through the same train of apparatus, a volatile hydrocarbon being injected into the gases before they enter the refractory material. The illuminating gas is collected separately. In some cases steam is injected to the glowing coal along with the air.—W. H. C.

as; Apparatus for generating hot compressed —. H. Neumann, Berg Gladbach, Germany. U.S. Pat. 928,324, July 20, 1909.

HE exhaust gases of an internal-combustion engine are delivered under pressure into a reservoir, and the compressed gases remaining in the clearance space of the engine cylinder are allowed to escape at a lower pressure for the next charge is admitted. The reservoir is fitted with a pressure-regulating valve controlled by the engine governor so that the pressure in the reservoir increases with the speed of the engine.—A. T. L.

liquid [liquefied] gas suitable for illuminating and heating purposes, and method of making said gas. L. Wolf, Boston, Mass. U.S. Pat. 928,729, July 20, 1909.

HE liquefied gas is obtained by cooling distillation gases — 25° C. under atmospheric pressure, in order to separate the constituents which are liquefied under those conditions, and then forcing the remaining constituents to a chamber filled with gasoline at a pressure of 1500 lb. per sq. in.—A. T. L.

producer gas; Method of generating —. H. F. Smith, Lexington, Ohio. U.S. Pat. 928,808, July 20, 1909.

HE gas obtained by passing air and steam upwards through a producer, is first cooled, and then passed through a separator to remove tar and water. The tar is discharged into the producer and converted into gas, and the water is allowed to run off.—A. T. L.

as producers; Grate for —, and means for removing ashes therefrom. H. F. Smith, Lexington, Ohio. U.S. Pat. 928,809, July 20, 1909.

A gas producer having a water-sealed ash-pit, the grate rests upon a ring which is suspended from the shell of the producer. The ring extends downwards into the water-stand and the space, thus enclosed beneath the grate, is provided with a blast-pipe, or with a gas-outlet pipe. A movable shoot, within which works a conveyor for

withdrawing the ashes, projects downwards through the shell of the producer and terminates below the water-level in the ash-pit.—A. T. L.

Incandescent mantles; Process of manufacturing —. A. Müller, Fürstenwalde-on-the-Spree, Assignor to G. P. Drossbach und Co., Freiburg, Germany. U.S. Pat. 927,374, July 6, 1909.

THE fabric of the mantle is impregnated with a colloidal solution of an "oxide-hydrate" of a rare earth.—W. H. C.

Incandescent mantles; Process for producing —. G. Buhlmann, Gross-Lichterfelde, Germany. U.S. Pat. 928,580, July 20, 1909.

A FABRIC of artificial silk is impregnated with a basic solution of a salt of a rare earth metal, prepared by adding small quantities of ammonia to the aqueous solution and shaking to re-dissolve the precipitate, these processes being repeated until the precipitate is no longer re-dissolved.—A. T. L.

Electric lamps; Soldering of the metallic filaments of —, to their electrodes. S. Marietti, Alpignano, Italy. Eng. Pat. 14,483, July 8, 1908. Under Int. Conv., July 8, 1907.

THE soldering of the filaments to their electrodes by means of the voltaic arc has hitherto been performed in an inert atmosphere, to avoid oxidation of the filaments. According to the present invention, oxidation is prevented by means of a current of air passing in a direction opposite to that of the filament, the process being conducted under ordinary conditions.—W. E. F. P.

Electric incandescent lamps; Manufacture of bodies of metallic titanium, particularly for filaments of —. C. Trenzen, Cologne, Germany, and F. R. Pope, Willesden. Eng. Pat. 14,852, July 13, 1908.

FILAMENTS consisting of practically pure titanium are obtained as follows: Titanic anhydride is saturated with ammonia in the cold and the product is heated in a vacuum to about 1200° C. The resulting mass is mixed with an organic binding medium such as a solution of casein in ammonia; the mixture is formed into threads and these are heated in electric furnaces up to 1200° C. The titanium nitride is thereby converted into cyanide and in the final treatment of the filaments in a vacuum by the passage of a high tension electric current, a filament of metallic titanium having a high melting point and high resistance is produced.—J. C. C.

Electric incandescent lamps; Manufacture of metal [tungsten] filaments for —. C. Trenzen, Cologne, Germany, and F. R. Pope, Willesden. Eng. Pat. 14,853, July 13, 1908.

RAW filaments are manufactured by allowing an aqueous solution or suspension of a tungsten-ammonium salt to flow through a narrow opening into a gel-forming medium, such as 99.8 per cent. alcohol, in which the hardening of the filament takes place uniformly. The form to be given to the filament is determined by suitable movement of the container holding the gel-forming medium or of the opening through which the solution flows. The filaments are heated in the usual way to about 450° C. in a vacuum and then electrically in an inert atmosphere or in a vacuum and so converted into metallic filaments.—J. C. C.

Measuring and recording device apparatus for gas analysis. Ger. Pat. 211,739. See XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Coal tar; Some constituents of —: *Alkylbenzene.* G. Schmitz and A. Sander. Ber., 1909, 42, 2633–2636.

THE authors have obtained a number of derivatives of ethylbenzene, extracted from coal tar. Dinitroethylbenzene, b. pt. 167.8° C. at 13 mm., was reduced by means

of ammonium sulphide to 2,4-nitroamino-1-ethylbenzene, which is very soluble in alcohol and when recrystallised from ligroin forms orange prisms of m. pt. 43°—44° C. Its acetyl compound melts at 100°—101° C. Trinitroethylbenzene was obtained by adding 10 grms. of ethyl-

(bomb calorimeter) 18,474 B.T.U.; it contained 0.62 per cent. of sulphur. The refining was effected by two slightly different methods, details of which are given. The yield of the different products from 100 galls. of crude oil are given in the following table:—

Product.	Quantity in gallons.		Sp. gr. at 60° F.		Setting point, in °F.		Melting point, in °F.	
	A	B	A	B	A	B	A	B
Heavy naphtha.....	1.62	1.45	0.7670	0.7670	—	—	—	—
Burning oil.....	10.04	11.50	0.7954	0.7955	—	—	—	—
Gas oil.....	14.87	13.04	0.8431	0.8450	25	25	—	—
Cleaning oil.....	2.83	1.56	0.8113	0.8705	26	26	—	—
Lubricating oil.....	9.58	11.03	0.8957	0.8935	30	30	—	—
Crude wax.....	2.26	2.21	—	—	—	—	112-26	111-34
Do.....	0.93	0.60	—	—	—	—	101	104
Do.....	—	0.16	—	—	—	—	—	84
Residuum from blue oil (refined).....	0.28	0.57	—	—	—	—	—	—
Residuum from treated crude distillate (refined).....	1.27	1.95	—	—	—	—	—	—

Method A.—Yield of refined wax of m. pt. 108.89° F., 2.907 galls.; sulphuric acid (sp. gr. 1.84) used in refining, 4.705 galls.

Method B.—Yield of refined wax of m. pt. 108.38° F., 2.707 galls.; sulphuric acid used, 4.68 galls.; burning oil, flashing point (Abel close test) 117° F.; lubricating oil, viscosity 200 secs. at 70° F. (Redwood).

benzene drop by drop to a cooled mixture of 40 grms. of nitric acid (sp. gr. 1.52) and 105 c.c. of sulphuric acid containing 25 per cent. of anhydride. The product crystallises in nearly colourless needles of m. pt. 37° C. When reduced with ammonium sulphide it forms *sym.* dinitroaminoethylbenzene, melting at 110° C. Additive compounds have been obtained of trinitroethylbenzene with *p*-toluidine, *o*-toluidine, monomethylaniline, *m*-xylylene (1,3,4.), benzidine, *o*-tolidine, β -naphthylamine, β -naphthylamine and naphthalene.—R. L.

American [Canadian] oil shales; Economic possibilities of —. C. Baskerville. Eng. and Min. J., 1909, 88, 149—154, 195—199.

AFTER a brief account of the shale oil industry in Scotland and elsewhere, the author refers to the large deposits of bituminous shales in New Brunswick, Canada. A description is given of the results obtained with 50 tons of low-grade run-of-mine oil shale from Westmorland County, New Brunswick, when tested in the experimental plant of the Pumpherson Oil Co., Scotland (see this J., 1897, 990). The retort was cleaned by distilling about 4½ tons of the New Brunswick shale therein, and then 36 tons 15 cwt. of the shale were retorted in 17 days. The results are shown in the following table:—

Date, 1908.	Weight of shale used.		Crude oil.		Yield per ton.	
	Tons.	Cwt.	Gallons.	Sp. gr.	Crude oil, gallons.	Ammonium sulphate, lb.
July 25a	2	4	95.85	0.885	43.57	58.55
" 26a	2	6	99.45	0.907	43.24	60.51
" 27	2	0	74.44	0.920	37.22	75.38
" 28	2	5	86.13	0.917	38.28	70.62
" 29	2	7	90.37	0.911	38.88	70.01
" 30	2	3	81.60	0.920	38.04	83.18
" 31	2	5	81.63	0.916	37.61	67.46
Aug. 1	2	3	96.87	0.918	45.06	82.93
" 2	2	3	84.32	0.921	39.22	79.58
" 3	2	4	80.42	0.927	40.64	81.88
" 4	2	4	70.56	0.918	34.59	49.27
" 5	2	3	86.75	0.910	40.35	55.47b
" 6	2	5	88.70	0.922	39.42	82.81
" 7	2	3	87.38	0.918	40.64	100.69c
" 8	2	4	88.43	0.921	40.19	62.45
" 9	2	3	95.72	0.918	44.52	79.63
" 10	2	3	91.28	0.911	42.46	81.31
" 11	2	0	79.90	0.925	39.95	71.14
" 12	2	0	87.58	0.925	43.79	85.03
	36	15	1473.28	—	40.99	76.94

a. Not included in average, as shale in previous test was not all out of retort until July 26th.

b. Condenser chest choked.

c. Condenser cleared.

The crude oil had the sp. gr. 0.92, flashing point 194° F. (90° C.), and setting pt., 54° F. (12.2° C.), calorific value

These results show that it is quite possible to utilise economically the New Brunswick shales, for the value of the by-product, ammonium sulphate, would more than cover the expense of mining and treatment. There are also deposits of shales in the United States, which might prove valuable under proper treatment. (See also this J., 1891, 136; 1893, 919; 1897, 876, 981.)—A. S.

Montanin and montana (montan) waxes. H. Ryan and T. Dillon. Proc. Roy. Dublin Soc., 1909, 12, 202—209.

THE commercial wax sold in Ireland as "montana wax" is said to be derived from peat, but differs widely in composition from the "peat wax" described by Zalosiedl and Hausmann (this J., 1907, 830); for the authors found it to contain a "free" acid melting at 83° C., and a unsaponifiable portion of m. pt. 58°—59° C. It also differed in composition from the wax extracted from peat by Krämer and Spilker (this J., 1902, 540), but was apparently identical with the montan wax prepared by von Boyen from Saxo-Thuringian lignite (this J., 1900, 728; 1901, 1221). The crude acid (*montanin acid*) in montan wax was found by Marcusson (this J. 1908, 850) to have an acid value of 143 and to be composed of insoluble hydroxy-acids melting above 100° C., and wax-like acid melting below 100° C. The montan wax examined by the authors was a yellowish, crystalline, wax-like solid (m. pt., 76° C.), which was readily soluble in hot alcohol, ether, chloroform, and petroleum spirit but was nearly insoluble in the cold solvents. It had a faint odour of petroleum. It had an acid value of 73.3 saponification value, 73.9; and iodine value (Hüf. Waller), 16.0. It was free from resin, and did not give the characteristic colour reactions of cholesterol. It yielded 47 per cent. of unsaponifiable matter, and 53 per cent. of crude montanin acid. The latter had an acid value of 138.3 and consisted, in the main, of an acid (C₂₄H₅₆O₂), with a molecular weight of 424, and a small quantity of an acid with lower molecular weight. The unsaponifiable matter crystallised from hot benzene in fine needles melting at 58°—59° C., and having a sp. g. of 0.92 and an iodine value of 31.13. Its elemental composition indicated that it was not a pure hydrocarbon but as it did not form an acetyl derivative on treatment with acetic anhydride it could not have contained appreciable quantities of primary or secondary alcohol. Montanin wax is a similar product, but differs greatly from montana wax in its physical properties. The sample examined was a white, hard friable wax with the following characteristics:—m. pt., 95°—97° C.; sp. gr. at 15° C. 0.980; acid value, 56.9; saponification value, 57.6 and iodine value, 10.5. It contained 34.8 per cent. of unsaponifiable matter, which was found to be identical with the unsaponifiable matter in montana wax. The other constituents were sodium montanate, 23.87; acetic montanin acid, 41.33 per cent. In the author's opinion montanin wax is prepared from montana wax by neutralisation.

ing part of the free acid with sodium hydroxide. *Irish lignite wax*.—A specimen of dried lignite yielded, on extraction with petroleum spirit, 0.24 per cent. of a rosinish wax, which had the following characteristics:—*n*. pt., 72° C.; *sp. gr.*, 0.989; acid value, 70.28; *m. pt.* of free acid, 80° C.; and *m. pt.* of unsaponifiable matter, 8°–59° C. All these values agree closely with the corresponding figures for montana wax.—C. A. M.

Detecting paraffin wax in lard. Shrewsbury. See XVIII.4.

Oxidation of phenol. Gibbs. See XX.

Shale deposits of New Brunswick. Ch. of Comm. J., Aug., 1909. [T.R.]

It is reported that Dr. Ells, of the Geographical Survey, recently stated to the Senate Committee on Mines, at Ottawa, that the shale deposits of New Brunswick were richer than those of Scotland, from which the Standard Oil Company annually purchases 62,000,000 gallons of oil and 50,000 tons of sulphate of ammonia. The Scotch shale produces 30 to 40 gallons of oil per ton, and the New Brunswick, according to Dr. Ells, would produce from 50 to 110 gallons per ton.

PATENTS.

Detectors for the destructive distillation of coal or other carbonaceous substance. T. Parker, Wednesfield. Eng. Pat. 14,169, July 3, 1908.

A BUNCH or battery of vertical tubes is cast in one piece with common top and bottom flanges. Each battery of tubes is mounted as described in Eng. Pat. 4266 of 1908 (this J., 1909, 515), so as to have a single charging chamber and a single discharging chamber common to all the tubes.—A. T. L.

Acetate of lime: Process of making —. R. W. Erwin. St. Louis, Mo. U.S. Pat. 927,335, July 6, 1909.

A SOLUTION of calcium acetate is evaporated in a vacuum in a series of three vessels. It is concentrated in the first to a *sp. gr.* of 1.08, in the second to 1.12, and in the third to 1.16, or to the point of crystallisation, the crystals being subsequently dried in a vacuum.—F. R.

Extraction, purification and rectification of the volatile products of tar: Process for the continuous —. E. A. Barbet. Fr. Pat. 398,625, March 28, 1908.

THE crude tar is fed from an overhead store-tank into a tubular heater where it serves to cool the naphtha vapours and then passes down a column into a boiler where it is heated by high-pressure steam. The vapours pass into a rectifying column from which at different points very pure benzol, toluol, and xylol are separately withdrawn, condensed and cooled. The tar passes from the first boiler into a second similar one also steam heated, where the heavier naphthas are driven off and are condensed in the tubular heater mentioned above. The tar then passes through a series of stills, provided with agitators, set in brickwork. The last still of the series is heated by direct fire, the waste gases serving to heat the other stills. Carbolic oil, creosote and heavy oil are driven off, cooled in air condensers and collected, and soft pitch flows away continuously from the last still. The heavy oil may if desired be passed through a "cracking" still heated in a water bath in order to dissociate it into lighter products. The carbolic oil is passed continuously through a series of conical vessels packed with materials presenting a large surface and a stream of caustic soda solution is passed through the series in the opposite direction. Washed creosote issues from one end of the series and is, after treatment with sulphuric acid, fractionated in a continuous column still. The sodium phenate which issues from the other end of the series of washers is passed continuously through a decomposer where it is treated with acid or acid sodium sulphate and the separated crude tar acids flow away continuously into a store-tank. They are then passed down a continuous column still and fractionated.—W. H. C.

Bitumen and similar bodies; Purification of —. A. Mitchell. Fr. Pat. 398,159, July 7, 1908.

CRUDE bitumen containing a large proportion of mineral matter is heated along with water in a tank or boiler and bubbles are formed in the mass either by the action of the heat on the more volatile constituents of the bitumen, or by the addition of a small quantity of an acid which decomposes any mineral carbonates present, with the evolution of carbon dioxide. The bubbles of vapour or gas attach themselves to the particles of bitumen and float them up to the surface, forming a scum of bitumen and water free, or nearly free, from mineral matter. The scum is removed to another tank where it is heated to drive off the water.—W. H. C.

Purifying oils that have been used for lubrication. Fr. Pat. 398,411. See XII.

IV.—COLOURING MATTERS AND DYESTUFFS.

PATENTS.

Azo dyestuffs; Manufacture of new —. R. B. Ransford. London. From L. Cassella and Co., Frankfurt-on-Maine, Germany. Eng. Pat. 16,743, Aug. 8, 1908.

THE monoazo dyestuffs from 1,2,4-diazonaphtholsulphonic acid and α -naphthol can be transformed into new dyestuffs by the action of aromatic nitroso compounds. By using nitroso derivatives of the naphthalene series, dyestuffs are obtained which yield on wool by after-treatment with chrome, shades ranging from bluish to greenish blacks of good fastness; from the nitroso compounds of the benzene series, products giving reddish-black shades result. Example:—39.4 kilos. of the dyestuff obtained from 1,2-diazonaphthol-4-sulphonic acid and α -naphthol are heated to the boil with 800 litres of water, and after adding 10 kilos. of sulphuric acid (66° B.), a paste containing 17.3 kilos. of nitroso- β -naphthol is gradually introduced. After heating for about half an hour, the nitroso compound disappears. The new dyestuff is then salted out.—P. F. C.

Dyestuffs of the Gallocyanine series; Manufacture of new blue to violet —. Chem. Fab. vorm. Sandoz, Basle, Switzerland. Eng. Pat. 6270, Mar. 16, 1909. Under Int. Conv., Sept. 24, 1908.

CLAIM is made for new dyestuffs of the Gallocyanine series by condensing the Gallocyanine obtained from nitroso-dimethylaniline and gallic acid with resorcinol in alkaline solution in the presence of an oxidising agent. Example I:—34 parts of the above Gallocyanine hydrochloride are dissolved in 500 parts of water and two molecular proportions of sodium hydroxide; 25 to 34 parts of resorcinol are then added, and the whole is stirred for about three days at the ordinary temperature, in the presence of a current of air. The mass is finally heated to 90° C. and is filtered and washed. The dried product is a crystalline powder with a bronze lustre. In a second example (in which 20–30 parts of resorcinol are used, the quantities of the other ingredients being the same), the mixture is heated at 60–70° C. for two to three hours in a current of air. The product forms small green leaves with a metallic lustre. The sulphonated dyestuff of Example I. dyes chromed wool blue, and that of Example II. produces a violet shade. The leuco-compound of the colour-base of Example I. gives blue shades on cotton mordanted with chromium, whilst that of Example II. gives violet shades. (See also Eng. Pat. 6272 of 1909; this J., 1909, 832.)

—J. C. C.

Ink. R. W. Hochstetter, Assignor to the Ault and Wiborg Co., Cincinnati, Ohio. U.S. Pat. 928,450, July 20, 1909.

AN ink that can be used with wax stencil sheets, is prepared by grinding an organic pigment with glycerin or a mixture of glycerin and a sulphonated oil, such as Turkey-red oil. The pigment, which should not be soluble in, or chemically react with glycerin, may be prepared with a base of barium sulphate.—C. A. M.

Ink. R. Hochstetter, Cincinnati, Ohio. U.S. Pat. 928,915, July 20, 1909.

AN inorganic pigment (insoluble in, and not capable of chemical interaction with, glycerin) is ground up with a mixture of glycerin and a sulphonated oil, such as Turkey-red oil.—C. A. M.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Abaca fibre; Tensile strength of machine- and hand-stripped —. R. F. Bacon. Philip. J. Sci., A, 1909, 4, 163—165.

EXPERIMENTS made by the author show that machine-stripped abaca fibres are stronger than those stripped by hand.—F. SODX.

PATENTS.

Threads and filaments of cellulose; Manufacture of —. A. Lecœur, Rouen, France. Eng. Pats. 14,143, July 3, 1908, and 28,149, Dec. 24, 1908.

SOLUTIONS of colloidal hydrated cuprammonium oxide can be prepared in two ways; firstly, by treating a solution of a copper salt with ammonia and caustic alkalis with subsequent dialysis of the solution, and secondly, by the simultaneous action of air and ammonia on metallic copper with subsequent dialysis as described in Eng. Pat. 16,442 of 1906 (see Fr. Pat. 374,277; this J., 1907, 761). The liquors thus prepared will be hereafter referred to as liquors A and B respectively. If liquor A is so prepared as to contain more than 12 grms. of copper per litre, it contains deleterious compounds which cannot be removed by dialysis. A solution containing only 12 grms. of copper per litre is however only capable of dissolving 30 grms. of cellulose, and this proportion is too small for the manufacture of a sufficiently strong filament. It is found that the best product is obtained if a mixture of the two liquors be employed, the proportions being such that the resulting mixture contains about 25 grms. or more per litre of copper in the state of colloidal hydrated cuprammonium oxide, but of which no more than about 12 grms. of copper per litre is derived from liquor A.—P. F. C.

Artificial silk and like threads; Apparatus for use in the manufacture of —. H. G. Tetley, London, and J. Clayton, Braintree. Eng. Pats. 19,157 and 19,158, Sept. 11, 1908.

ACCORDING to these inventions, the hollow spindle, which is rapidly rotated, is carried on a swinging frame so that when the nozzle is moved into a convenient position for inspection, the wheels which rotate the spindle are thrown out of gear. A pump for forcing the viscose through the spinning apparatus is likewise so mounted that it can be disengaged from the driving gear at will. The viscose passes from a supply pipe to the pump, is then forced through a filter carried by the frame on which the spindle is mounted, and afterwards travels through the rotating spindle to the nozzle, which is immersed in a coagulating bath. The thread, which is twisted by the rotation of the spindle and nozzle, is led over suitable guides to a winding reel which is provided with means for laying the thread as it is wound. This winding reel can also be put out of gear and replaced by another reel when required. All the driving means of the apparatus are geared so that they have the required relative speeds, which can be altered at will by change wheels. In the second of the present patents (No. 19,158), claim is not made for a rotatable nozzle.—P. F. C.

Artificial silk; Production of threads of —. Fürst Guido Donnersmarck'sche Kunstseiden und Acetatwerke. Fr. Pat. 398,424, Jan. 11, 1909.

THE twist may be given to the thread either during the process of spinning, or afterwards in a separate operation.

With viscose-silk it has been proposed to revolve the spinneret, so that twist would be imparted during coagulation, but in general, the coagulated thread is carried over a roller from which it falls into a rapidly rotating box. The degree of twist is dependent upon the relative speed of the roller and the box. These methods are not applicable, however, in the case of the cuprammonium and the nitrocellulose products, as the fibres obtained, do not appear to coagulate sufficiently rapidly to stand the mechanical strain. The twisting of the thread in a separate operation, has the advantage that the degree of twist can be more accurately controlled. The silk after coagulation is wound directly upon bobbins of small diameter; these are fixed in a winding machine and are rapidly revolved whilst the thread is reeled off into hanks.—F. M.

Volatile liquids, such as alcohol and ether, in the state of vapour diluted with air; Process for the recovery of — in the manufacture of artificial silk, smokeless powders and analogous operations. Soc. "L'Air Liquide" (Soc. anon. pour l'Etude et l'Exploit. des Proc. G. Claude) Fr. Pat. 397,791, Mar. 6, 1908.

THE recovery of the alcohol and ether present in the atmosphere of factories in which the manufacture of artificial silk (from collodion), smokeless powder, etc., is carried on, is not easy, owing to the high degree to which the vapours are diluted with air. In the present process the mixture of vapour and air is compressed and cooled and passed through an apparatus in which progressive refrigeration is possible. The compressed and cooled mixed gases are further cooled by permitting them to expand, and are then used as cooling agents for a further quantity of the compressed gases. By this arrangement very low temperatures may be reached, but it is essential that the temperature should not be such as would cause the separated liquids to freeze and block the apparatus.—F. M.

Bleaching wool; Apparatus for removing grease from, and —. D. Bouchat, Verviers, Belgium. Eng. Pat. 3196 Feb. 9, 1909.

THE wool is fed into the long arm of an inverted siphon, together with the liquid with which it is to be treated. It passes down the pipe, and is forced by the weight of the material behind it along the horizontal portion of the siphon, and up the short arm, from which it is delivered to squeezing rollers. In its passage through the siphon, it is first thoroughly impregnated, and then, by the pressure in the lower arm, it is partially freed from the impregnating liquid, which flows from perforations in the short arm of the siphon into a tank, from which it is pumped to the top of the entry pipe.—F. M.

Alkali peroxides in a soapy material; Package for the preservation of — [for bleaching]. E. Herrmann. Fr. Pat. 398,418, Jan. 12, 1909. Under Int. Conv., Jan. 12 and July 17, 1908.

THE alkali peroxide is packed in a closed vessel which is itself embedded in powdered material of a soapy character, contained in an outer package. When this outer package is opened and the contents emptied into a boiler used for washing, the inner package, which is sealed by a layer of some easily fusible material, such as a mixture of stearic acid and oleine, sinks, and opens automatically beneath the surface of the warm water. Hydrogen peroxide is formed, and caustic soda, which is rendered harmless, partly by the stearic acid and partly by sodium bicarbonate which may form an ingredient in the outer package. The ends of the inner cylinder may be closed by loose caps, held in position by an annular layer of the fusible material, so as to open very readily; or, the wall may consist of a spiral of iron wire made into a cylinder by tinning, and, instead of opening at the ends, a segment, running the length of its surface, may be closed by a layer of fusible material, the rest being tinned. It is claimed that less oxygen is wasted than with existing modes of packing, since decomposition takes place at a lower temperature (40°—45° C.) and beneath the surface of the water; there is also less danger of explosion.—F. SODX.

yeing, bleaching, etc.; Apparatus for —. A. W. Thompson, Manchester, N.H. U.S. Pat. 926,782, July 6, 1909.

HE apparatus comprises a vat, and a compression plate cover for the material. The cover is held in position by "dogs" detachably mounted on the same and extending radially over the edges of the vat. The extensions of the threaded vertical rods fixed to the exterior of the vat, and the "dogs" are then pressed down by means of weights.—F. M.

yeing machine. J. Richardson and J. F. Neef, Philadelphia. U.S. Pat. 927,599, July 13, 1909.

an open dye-vessel, a vertical shaft carries two sets of dial arms, the upper set being fixed, whilst the lower set is capable of being adjusted at any suitable distance from it. The arms of the two sets serve to carry the hanks in a stretched condition, and means are provided whereby they may be revolved upon their own axes. Loose material, perforated drums are carried vertically between the upper and lower arms, and the material is dyed therein.—F. M.

ool; Apparatus for supplying liquid to —. W. J. Murray, Bristol, Pa. U.S. Pat. 927,998, July 13, 1909.

HE apparatus is combined with a gill-box and consists of a liquid supply tank and a series of cocks or faucets opening into a trough-like spreader. The walls of the trough are parallel and close together, so that the viscosity of the liquid will prevent a too rapid discharge through the narrow slit which extends longitudinally along the bottom of the trough. The wool is carried on a belt beneath the opening and takes up the regulated supply of liquid, means being described whereby the cocks are opened and closed simultaneously with the starting or stopping of the machine.—F. M.

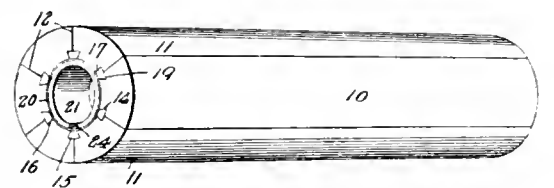
rn dyeing machine. C. Corron. Fr. Pat. 397,798, Mar. 7, 1908.

are attached, and revolve excentrically. The driving is effected by means of bevelled wheels, 9, 9', working through a worm gearing on the driving shaft, 5. By means of a change motion which is described, the direction of rotation of the driving shaft is periodically reversed, but at unequal intervals, so that the same portions of the hank are not always out of the liquor at the "change over."—F. M.

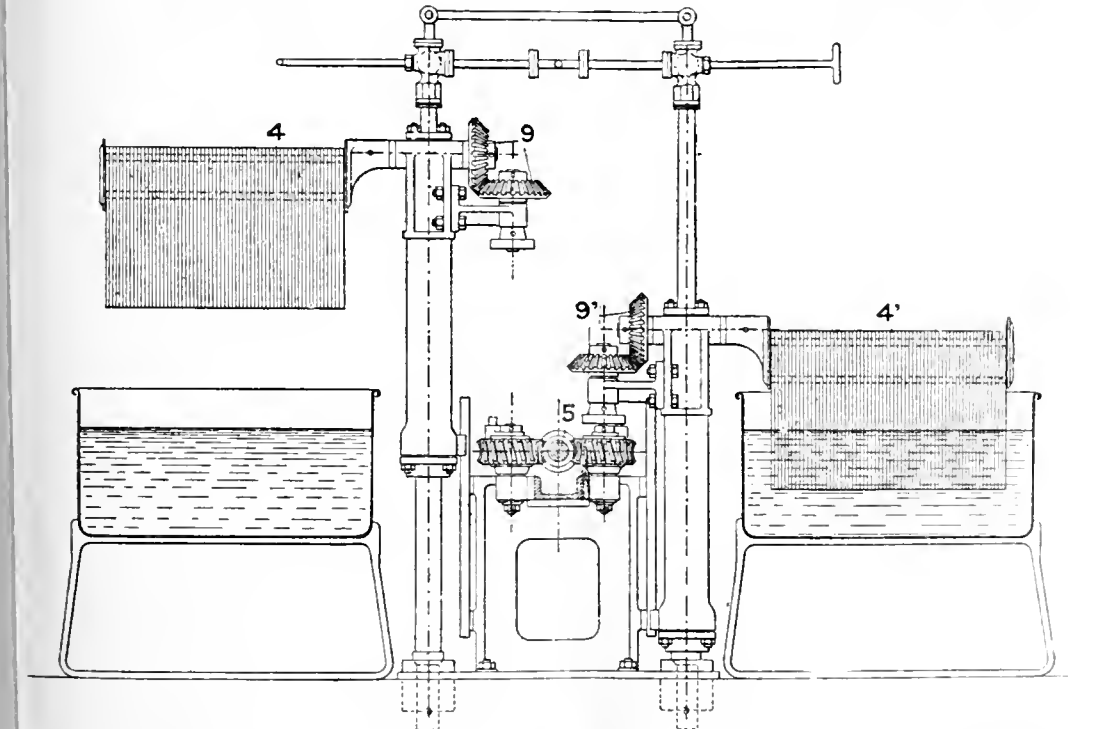
Weighting, dyeing or otherwise treating silk; Machine for — at various temperatures. C. Lump et Cie. Fr. Pat. 398,238, Mar. 18, 1908.

IN Fr. Pat. 383,947 of 1907 (this J., 1908, 445), a centrifugal dyeing machine is described, which however suffers from the defect that the spindle seat of the cage cannot be cooled and, when hot dye-liquors are in use, becomes overheated. In the case of an "overdriven" machine, the boss is now made hollow, and cold water is circulated through it to keep it cool, and in the case of an "underdriven" machine, the spindle bearings are hollow and are cooled in the same way. The silk is wound on bobbins which are placed on perforated tubes fitting into holes in the side of the cage, and the latter may be slowly or rapidly revolved by means of suitable gearing.—F. M.

Rolls for use in printing, paper making, textile and kindred arts. H. Brubaker, York, Pa., and H. D. Hershey, Columbia, U.S.A. Eng. Pat. 21,096, Oct. 6, 1908.



THE roll, 10 (see Fig.), is made up of a number of longitudinal wooden sections, 11. The lower corners of the



machine is especially useful in the dyeing of small lots of yarn, as the arms, 4, 4', upon which the hanks are supported may be revolved and manipulated quite independently of each other. These arms are raised and lowered by means of hydraulic rams, to which they

are attached, and revolve excentrically. The driving is effected by means of bevelled wheels, 9, 9', working through a worm gearing on the driving shaft, 5. By means of a change motion which is described, the direction of rotation of the driving shaft is periodically reversed, but at unequal intervals, so that the same portions of the hank are not always out of the liquor at the "change over."—F. M.

longitudinal keys, 19, arranged at intervals upon its surface. These keys, which are detachable from the metal tube, correspond in length and shape with the recesses, 14, of the sections, 11. A supporting ring, 21, provided with a keyway, 24, is arranged in each end of the tube, 20. When the roll is to be attached to a source of power, the end of a power shaft is inserted into these rings and is held therein by means of a key driven into the slot, 24.—P. F. C.

Printing process [for tri- and tetrabromindigo]. Farbenfabriken vorm. F. Bayer und Co. Fr. Pat. 398,571, Jan. 16, 1909. Under Int. Conv., May 30, 1908.

Owing probably to the great solubility of the leuco-derivatives of tri- and tetrabromindigo, these dyestuffs when printed in the same way as indigo, do not yield such full shades as would be expected. This objection is overcome, by incorporating with the printing mixture salts of the higher fatty acids, or organic sulphonic acids such as phenolsulphonic acid, benzylanilinesulphonic acid or naphthylaminesulphonic acid, etc.—F. M.

Skins; Machine for the "carroting" of— L. Beaulieu. Fr. Pat. 397,904, Dec. 16, 1908.

In the "carroting" of skins with mercury nitrate solution, it is desirable to impregnate the hair or fur with the reagent, without wetting the skin itself. In the present machine, the skin is passed between a pair of rollers provided with deep longitudinal grooves, the corrugations of the upper roller being roughened, with the object of raising the hair or fur. The skin then glides over an inclined table, provided with longitudinal channels, and below a rotating brush which is supplied with just sufficient of the mercury nitrate solution to impregnate the hair or fur. The skin is then passed between a second pair of grooved rollers and under a second rotating brush, which serves to distribute uniformly the mercury solution. The longitudinal channels of the supporting table are disposed quite close together, so that the area of contact of skin and table is as small as possible, and hence the danger of the flesh side of the skin becoming wetted with the mercury solution is reduced to a minimum.—A. S.

Linen; Process for the treatment of laundry— J. Paschka, Steglitz, and A. Koch, Berlin, Eng. Pat. 27,800, Dec. 21, 1908.

The linen after being washed and ironed, is coated with a solution of water-glass and then dried. When soiled, the treated linen can be cleaned by wiping it with a wet cloth. An addition of barium chloride to the solution of water-glass increases the suppleness of the prepared linen.—P. F. C.

Proofing of jute, hemp, linen, wool and other fibres. M. J. C. F. R. Lainville. Fr. Pat. 398,502, Jan. 4, 1909.

The process is intended specially for the "tannage" of fibres, woven, for instance, into a form suitable for sandals. The material is impregnated with a hot solution of gelatin, glue, gum, etc., in water containing glycerin, and is then dried. It is afterwards placed in a cold solution containing potassium bichromate, chrome alum, chromium tannate, tannin and formaldehyde, and again dried in a stove and, exposed to light, in the air.—F. M.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Nitric acid from the air; Manufacture of— in Austria. F. Russ. Zeits. f. Elektrochemie, 1909, 15, 544—548.

The process for obtaining nitric acid from the air, devised by H. and G. Pauling, is being worked by the Salpetersäure-Ind. Ges., at Patsch, near Innsbruck, in Austria. An arc is generated at the lowest point of two electrodes, set in a vertical plane at a considerable angle to each other, by a high-tension alternating current. The arc travels upwards between the electrodes until it attains a length of about

1 metre, to begin again at the bottom at the next half period of the current. A current of air is passed upward and fan-wise between the electrodes, and is deflected and cooled in the upper portion of the arc-zone by a horizontal current of "circulating" air which has already passed through the system; the velocity of this circulating air is less than that of the main supply. In order to start the arc readily, and yet not to oppose too great a resistance to the air, two subsidiary horizontal electrodes, consisting of thin strips of metal, are placed close together at the lowest point of the main electrodes; the current passes between the subsidiary electrodes at first, and then travels upwards as described, between the main electrodes. The latter are of iron, and are water-cooled; they last for 200 hours, the subsidiary electrodes being less durable. Lately, a special current of higher voltage than the main current has been used to start the arcs. Two sets of electrodes are combined in series by a special arrangement of wiring within each furnace; each furnace takes 40 kilowatts at 4000 volts, and deals with 600 cb. metres of air (exclusive of the "circulating" air) per hour, producing 60 grms. of nitric acid (HNO_3) per kilowatt-hour. The gases leave the furnace with a concentration of 1 per cent. of nitrogen oxides. A series of absorption towers, produce nitric acid of 35—40 per cent. strength, which concentrated to 60 per cent. by the heat of the gases sodium nitrite is also produced in a special plant. The factory at Patsch has 24 furnaces at work, using about 15,000 h.p. Two other factories, each with a capacity of 10,000 h.p., are in course of erection, one in the south of France, the other in the north of Italy.—A. G. L.

Acetic acid in Italy. Bd. of Tr. J., Aug. 12, 1909. [T.R.]

THE internal tax on the production of pure acetic acid and on the rectification of impure acetic acid is modified as shown in the subjoined statement:—

Classification.	Rates of the internal tax	
	As fixed by Law of 15th July, 1906.	As now fixed
	Lire etc. per 100 kilograms.	Lire etc. per 100 kilograms.
Acetic acid, pure, containing in anhydrous acetic acid:—		
10 % or less	15 00	15 00
More than 10 and less than 30 % ..	90 00	51 00
30 % or more, but less than 50 % ..		90 00
50 % .. " " 70 % ..		126 00
70 % .. " " 90 % ..	180 00	162 00
90 % or more		180 00

It should be noted that pure acetic acid imported into Italy is subject to the internal tax in addition to the Customs duty.

Sulphates; Formation of certain double— Barr. Compt. rend., 1909, 149, 292—295.

A DOUBLE sulphate of strontium and potassium $\text{K}_2\text{SO}_4\cdot\text{SrSO}_4$, is obtained by mixing solutions of the respective sulphates. It is the only double salt formed at temperatures between 0° and 100° C. The double sulphate of strontium and ammonium, $\text{SrSO}_4\cdot(\text{NH}_4)_2\text{SO}_4$, is a white crystalline salt, which is only stable in the presence of large quantities of ammonium sulphate. A double sulphate of lead and potassium, $\text{PbSO}_4\cdot\text{K}_2\text{SO}_4$, is produced by contact of lead sulphate with a solution of potassium sulphate, or by precipitation from a solution of lead acetate or nitrate. It is decomposed by water. The double sulphate of lead and ammonium, $\text{PbSO}_4\cdot(\text{NH}_4)_2\text{SO}_4$, is also decomposed by water, and to insure stability the solution must contain considerable quantities of ammonium sulphate. The author has been unable to prepare a double sulphate of strontium and sodium, or of lead and sodium.—C. A. M.

Silicates; Determination of alkalis in— G. Starck. Z. anal. chem., 1909, 48, 415—428.

THE present paper deals more especially with the determination of potassium and sodium in silicates when the

atter have been decomposed by means of hydrofluoric and sulphuric acids. It is shown that the resulting alkali sulphates may be converted into their corresponding chlorides by the addition of barium chloride, and the determination of the potassium may then be carried out directly without removing the excess of barium chloride. Methyl alcohol is employed for washing the potassium-platinum chloride precipitate, barium chloride and sodium-platinum chloride being soluble in this alcohol. The details of the method are as follows: The residue consisting of the mixed alkali sulphates is weighed, dissolved in water and transferred to a measuring flask of such capacity that, when the flask is filled to the mark, the solution shall be from 0.015 to 0.030-N., assuming all the alkali to be that of sodium. Sufficient hydrochloric acid is added to make the acidity of the solution approximately $N/10$, the mixture is boiled, and barium chloride solution is added drop by drop: the quantity of barium chloride employed, is calculated from the weight of the mixed sulphates, taking the latter to be all sodium salt. After cooling, the solution is diluted to the mark, filtered, and an aliquot portion of the filtrate is evaporated to dryness, after the addition of platinum chloride solution. The residue is moistened with water, and allowed to dry at the ordinary temperature, and then treated with small successive quantities of 80 per cent. methyl alcohol. The alcoholic washings are poured through a weighed asbestos filter on to which the precipitate is also brought and washed with the alcohol until the washings are colourless. After being dried at 130°C ., the filter and precipitate are weighed. If desired, the weighed precipitate may be dissolved, and the solution tested for barium, a correction being made if any be found.—W. P. S.

Hydrogen peroxide; Determination of acids in — by titration. O. Lüning. Z. angew. Chem., 1909, 22, 1549—1550.

ACCORDING to Endemann (this J., 1909, 473), the quantity of free acids in hydrogen peroxide cannot be determined correctly by titration in the cold, the higher value obtained by boiling with excess of alkali and then titrating back with acid, being the true one. The author has made experiments with pure hydrogen peroxide to which different quantities of sulphuric and hydrochloric acids were added, and found, on the contrary, that correct results are obtained by titration in the cold, the higher results obtained by Endemann's method being inaccurate.—A. S.

Phosphorus; Allotropic states of —. P. Jolibois. Compt. rend., 1909, 149, 287—289.

By fractional decantation with water, red phosphorus is separated into coarse granules of a deep violet colour, and fine yellowish-red particles which will remain suspended in the water for several months. A simple titration will convert one kind into the other, and the author therefore suggests that the colour of phosphorus, so long regarded as characteristic of its allotropic form, may be solely due to the fineness of the particles. The colloidal phosphorus obtained by suspending the finest particles in water cannot be regarded as a distinct allotropic form. On heating red phosphorus in sealed tubes to 200°C . in the absence of air, the colour changes from violet to red, and the specific gravity rises from 2.18 to 2.37. No further change in the density occurred after continuing the heating for $2\frac{1}{2}$ hours at 450°C ., and for $\frac{1}{2}$ hours at 600°C . Hence the specific gravity is not, as commonly believed, a function of the temperature to which the phosphorus has been heated. Commercial red phosphorus, obtained by heating white phosphorus, is in an unstable condition, and even at the temperature at which it is prepared (280°C .) the catalytic action of a trace of iodine is sufficient to transform it into the stable modification, to which the author gives the name of *monomorphic phosphorus*. Incomplete conversion of red phosphorus into this stable form results in the formation of a purple-coloured product, which microscopical examination indicates to be in a state of solid solution, and not to consist of particles of the two varieties in juxtaposition. On fusing red phosphorus at 725°C ., a modification of violet colour with a sp. gr. of 2.27 was obtained. On

cooling the tube suddenly, this product remained unaltered in appearance and density—a result contrary to the experience of Chapman (this J., 1899, 518), who by this means obtained white phosphorus.—C. A. M.

Hydrogen phosphides, P_2H_6 and P_2H_2 ; Preparation and properties of the solid —, and action of liquefied ammonia on them. A. Stock, W. Böttcher, and W. Lenger. Ber., 1909, 42, 2839—2863.

EXISTING methods for the preparation of the solid yellow hydrogen phosphide, P_{12}H_6 , are faulty. The authors found that the best method is one based on the fact that the spontaneously inflammable hydrogen phosphide decomposes, with separation of the solid yellow phosphide, when it comes in contact with granulated calcium chloride. Calcium phosphide is introduced into a flask containing warm water, and the gas evolved is led first through a tube in which the greater part of its moisture is deposited, then through three tall tubes packed with the granulated calcium chloride, and finally through a wash-bottle containing concentrated hydrochloric acid. The calcium chloride then becomes coated with solid yellow hydrogen phosphide. It is introduced, in small portions at a time, into dilute hydrochloric acid, cooled to 0°C ., the mixture being vigorously agitated, and protected from direct sunlight. When the calcium chloride has dissolved, the solution is siphoned off, and the phosphide is washed with ice-cold water, alcohol, and anhydrous ether, and dried over sulphuric acid and phosphorus pentoxide in a vacuum exsiccator in an ice-chest. The pure freshly-prepared phosphide is a canary-yellow, odourless, amorphous powder, of sp. gr. 1.83 at 19°C ., neutral to litmus paper: when kept in the air, it soon evolves phosphine and becomes acid. It may be preserved unaltered over sulphuric acid or phosphorus pentoxide in the dark, but rapidly decomposes when exposed to the light. When it is heated *in vacuo*, evolution of gas begins at 60°C ., ceases at about 200°C ., and then begins again at about 260°C ., continuing until the phosphide is almost entirely converted into red phosphorus, phosphine, and hydrogen. The gas evolved, at first consists of pure phosphine, and the orange-coloured residue left, is a new phosphide of the composition, P_6H_2 , and sp. gr. 1.95 at 16°C . This new phosphide is best prepared by heating the yellow phosphide at 175°C . *in vacuo* or in a current of carbon dioxide until gas is no longer evolved. It is almost identical with the yellow phosphide in its chemical properties, but differs from the latter in its behaviour with liquefied ammonia. When the yellow phosphide is treated with liquefied ammonia, phosphine is evolved and a red colloidal solution of the orange-coloured phosphide is produced. When this solution, which is also produced when the orange-coloured phosphide is treated directly with liquefied ammonia, is evaporated, a black compound of salt-like character, and of a composition varying between the limits, $\text{P}_6\text{H}_2\cdot\text{NH}_3$ and $(\text{P}_6\text{H}_2)_2\cdot\text{NH}_3$, is produced. The orange-coloured phosphide can be regenerated from the black salts by heating *in vacuo* or by treatment with acids.—A. S.

Volumetric determination of lead, and of sulphuric acid in sulphates. Oddo and Beretta. See XXIII.

Ammonium sulphate in Japan. For. Office Ann. Series, 1909, [T.R.]

THE British Consul at Kobe, Japan, states that in ammonium sulphate of British production there has been an increase of over £330,000 on the last five years' average and of £71,000 over last year's import. Nevertheless, what with the over-production of fertilizers by the Osaka manufacturers, and the refusal of the farmers to purchase, the trade was in a deplorable condition. As in many other lines, fertiliser factories had sprung up in such numbers as to make it impossible for profits to be reaped.

Phosphates in the Palm Islands (Germany). Bd. of Tr. J., Aug. 5, 1909, [T.R.]

UNDER the style of the German Phosphate Company an association has been formed at Bremen with a capital of

£225,000 to work the phosphate stocks in the Island of Angaur (Palem Islands). The German Government will share in the profits of the company.

PATENTS.

Ferric sulphate; Manufacture of — and making same up with more or less waste products to produce cakes or slabs [for sewage treatment]. W. Pochin and J. H. Richardson, Salford. Eng. Pats. 15,239, July 18, 1908, and 17,976, Aug. 27, 1908.

THE waste hydrated ferric oxide, obtained in the extraction of alumina from bauxite or other aluminous ores, is treated with sulphuric acid and the solution evaporated to 160° T. Waste silicious material, or sand, is added to the above solution to act as absorbent, and the mixture is moulded into blocks, which then contain about 10 to 15 per cent. of waste silica, and are suitable for sewage purification. The faces of the blocks are preferably dressed with a coating of lime, cement, or clay, to facilitate handling and storage. Instead of waste silica, the aluminium sulphate compound, described in Eng. Pat. 25,227 of 1907 (this J., 1908, 898) may be used as carrier for the ferric sulphate, in which case the facing treatment of the slabs is probably unnecessary.—O. R.

Abrasive and polishing material [magnesium carbonate]. J. Leese, Manchester. Eng. Pat. 4819, Feb. 27, 1909.

POWDERED normal magnesium carbonate (magnesite), either by itself, or as a paste mixed with water or certain solutions, or pressed into blocks with wax or soap, is claimed as a new and improved abrasive and polishing material for metals.—O. R.

Alkali chlorides; Electrolysis of —. J. Billitzer, Vienna. U.S. Pat. 928,734, July 20, 1909.

THE cell is arranged so that part of the cathode product forms a layer containing alkali, separated from the electrolyte below it by a diaphragm, and this alkali is continuously run off at the level of the diaphragm, fresh solution being introduced below the diaphragm.—A. T. L.

Dolomites; Process of treating —. Soc. Minière de L'Hérault. Fr. Pat. 398,668, Jan. 21, 1909.

THE dolomite is heated to about 300° C., in order to get rid of organic matter, and then more strongly in retorts, so as to obtain a mixture of lime and magnesia. This is allowed to cool in closed receivers and is either utilised directly or treated with a solution of sugar which dissolves the lime, leaving the magnesia insoluble, and the calcium sacrate is then decomposed by passing a current of carbon dioxide, obtained in the process, through the solution, so as to precipitate the calcium as carbonate and regenerate the sugar solution. The process provides a means of utilising dolomites containing a comparatively small proportion of magnesium carbonate.—F. SODS.

Calcium carbonate; Chemical and mechanical process for the treatment of minerals containing —. F. Gisbert Buendia. Fr. Pat. 398,699, Oct. 1, 1908. Under Int. Conv., Oct. 1, 1907.

THE calcareous mineral is broken up into pieces of uniform size, which are calcined in a fixed kiln, at a moderate temperature. The calcined mineral is then treated with steam or water, which converts the lime formed into finely-divided calcium hydroxide, and leaves the other constituents of the mineral unattacked. The mass is next sifted through two sieves, the first with meshes of 5 mm., and the second with meshes of 1½ mm. The coarsest fraction so obtained is tested for calcium carbonate, and reburnt, if necessary. The intermediate fraction is treated with more water, and the calcium hydroxide obtained, added to the finest fraction, which contains the bulk of the lime. This last fraction is further purified by levigation, an apparatus being used in which the solid in descending through a zig-zag passage meets two upward currents of water, one a steady current, the other an intermittent current, which communicates a series of pulsations to the whole body of water. The finely-divided and specifically light calcium hydroxide is

discharged from this apparatus through an opening near the top, whilst the heavier minerals are discharged from time to time at the bottom. The process is designed to yield a pure lime, and is also adapted to the treatment of rocks containing calcium carbonate mixed with a little copper carbonate, etc.—A. G. L.

Nitrites; Transformation of — into nitrates. Badiscl Anilin und Soda Fabrik. Fr. Pat. 398,738, Jan. 23, 1909. Under Int. Conv., July 6, 1908.

ALKALINE-EARTH nitrites or mixtures containing them such as those obtained by using alkaline-earth bases as absorbents of nitrous gases, are treated at about 300° C. with the higher oxides of nitrogen, preferably in the presence of air or oxygen; they are thus completely converted into nitrates, and nitric oxide is also produced which acts as a carrier of oxygen to a further quantity of nitrite.—F. SODS.

Gases [oxygen] from solids; Obtaining —. C. Ridley London. Eng. Pat. 15,000, July 15, 1908.

THE claim is for a process of obtaining gases from solid in a continuous manner, applicable to obtaining oxygen from sodium permanganate, lead oxide, etc. The material is fed into a hopper and passes between a pair of rollers; it is then conveyed by screw conveyors first horizontally and then vertically, and is dropped into a vertical retort where it is heated with a current of steam or hot air, and the gas is driven out. The spent solid material is discharged from the bottom of the retort, and after reabsorbing oxygen from the air, is passed through the apparatus again.—W. H. C.

Air; Process for the separation of — into its elements [oxygen and nitrogen]. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Procédés G. Claude). Fr. Pat. 398,580, Mar. 26, 1908.

THE process consists essentially in submitting liquid oxygen, vaporised by the liquefaction of air, to three successive combined rectifications, effected (1), with the liquid, rich in oxygen, resulting from the partial liquefaction of the air in reflux tubes; (2), with the nearly pure liquid nitrogen, obtained by liquefying the more volatile remainder of the air; and (3), with the pure nitrogen, resulting at the top of the rectifying column and liquefied by refrigeration by means of evaporating oxygen. By way of example, an apparatus is described, consisting of a boiler, containing liquid oxygen and surmounted by a rectifying column. A double system of vertical tubes is immersed in the liquid, into one set of which is admitted purified air, compressed and cooled; this is partially liquefied in ascending the tubes, the liquid collecting below containing practically all the oxygen; the remaining air then descends the other set of tubes and nearly pure liquid nitrogen collects at the bottom. The oxygen, vaporised in the boiler by the condensing air, meets, as reflux liquid, in the lowest portion of the column, the air liquefied in the first set of tubes, containing about 48 per cent. of oxygen, and a gradual exchange of oxygen for nitrogen in the ascending gas takes place; the middle portion of the rectifying column is supplied with the more volatile portion of the liquefied air as reflux liquid, and this effects the removal of all but about 3 per cent. of the oxygen; in the highest section of the column, the reflux liquid is a portion of the pure nitrogen resulting from the rectification, which is liquefied in a system of tubes in a second boiler placed above the rectifier, by the evaporation of contained oxygen, at a lower pressure than the nitrogen. Air is separated by the process into very pure nitrogen and practically pure oxygen.—F. SODS.

Alkali peroxides [for bleaching]. Fr. Pat. 398,448. See V.

VIII.—GLASS, POTTERY, AND ENAMELS.

Clays; The colloidal substances in —. P. Rohland Z. Elektrochem., 1909, 15, 540–542.

THE degree to which clays can be “liquefied” by addition of alkalis, etc., depends largely on the amount of organic

natter they contain. Pure white kaolins are but little affected by such additions, whilst the dark coloured, highly plastic clays are readily "liquefied." A. Lotternoser has recently stated that lime-water is unsuitable for his purpose, but the author finds that a number of clays from Saxony, which are rich in organic matter, are readily liquefied by this reagent.—A. G. L.

Iron in pottery materials; Colorimetric determination of —. Hadank. *Sprechsaal*, 1909, 42, 445.

The colorimetric estimation of iron by ammonium thiocyanate is said to be quicker and more accurate than titration with permanganate. The author conducts the process in a König apparatus, consisting of a six-sided rotating prism to which are attached six strips of varying shades of red. Next to this is a cylinder containing the solution of the sample in hydrochloric acid to which has been added a pinch of chlorate. The matching of colours is then carried out in the usual way. The process is useful for estimating iron in cement, sand, tufa, manganese ore, sodium sulphate, clay and similar materials.—H. H. S.

PATENT.

China clay; Purification of —. A. G. Salamon, London, C. J. Grace, Steyning, and The Exploration Co., Ltd., London. Eng. Pat. 21,260, Oct. 8, 1908.

To the china clay emulsion, which is taken from the depositing vessels or channels, chlorine water and a small quantity of sulphuric acid are added, the mixture is pumped through filter-press, the resulting cake is washed as free as possible from chlorine and sulphuric acid, and finally dried if desired. It is claimed that by this procedure a clay of second quality can be converted into one of first quality. —O. R.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Cement industry of Germany. Bd. of Tr. J., Aug. 5, 1909. [T.R.]

The expectations of the German cement industry at the commencement of 1908 were not realised. In consequence of the financial crisis, large stocks accumulated during the summer at the cement factories. The latter sought relief in the export market, with the result that prices fell nearly 5 per cent.; whereupon several of the syndicates disposed of their stocks. The year was nevertheless regarded by the German cement works as good, because home prices, regulated by agreement between the syndicates, ensured a good profit. These agreements have been renewed for 1909, and the German cement works are now trying to raise the export prices. It is said also that efforts have been made with some success to secure the adhesion of the British and Belgian cement industries, and it is anticipated that it will be possible to form international agreements for the regulation of export prices. The total output of cement in Germany in 1908 is estimated to have been as follows:—

	Casks of 150 kilos.
Portland cement	23,000,000
"Iron" Portland and Slag	2,250,000
Roman	650,000
Total	25,900,000

The factories are, however, said to be capable of turning out nearly twice this quantity. Of the total number of cement factories in Germany, viz. 142, 97 manufacture only Portland cement.

PATENTS.

Basic fire-brick lining. S. B. Newberry, Baybridge, Ohio. U.S. Pat. 927,585, July 13, 1909.

The patent relates to the manufacture of refractory or basic bricks from hydraulic cement clinker, alone, or in admixture with an alkaline-earth. The clinker is used in granulated form, the bricks being made by moulding in the ordinary manner.—W. E. F. P.

Wood; Drying and treating —. C. Gillet, sen. Fr. Pat. 397,786, Mar. 6, 1908.

WOOD, preferably previously dried, is immersed in a bath of drying-oil, preferably boiled linseed oil, heated to a temperature of 100°–110° C. Planks 3–4 cm. in thickness are immersed in the oil for 24 hours, and are ready for use in 15–30 days.—A. G. L.

Agglomeration or hardening of powdered substances. Fr. Pat. 398,615. See X.

X.—METALS AND METALLURGY.

Ferro-manganese in the blast-furnace. J. Jakobi. *Stahl u. Eisen*, 1909, 29, 1119–1120.

The paper contains an account of the production of ferro-manganese in a South Russian blast-furnace, the trials extending over nine days. Two samples of ore were employed; both of these were rich in manganese (51.6 and 53.5 per cent.) and contained but little silica (7.80 and 6.20 per cent.). The contents of phosphorus were however rather high, so that, of the second ore (Ore II.), only small quantities could be employed. Using a charge as follows: Ore I., 5875 kilos.; Ore II., 1469 kilos.; hæmatite, 163 kilos.; limestone, 2448 kilos.; coke, 8160 kilos, 70 per cent. of the manganese was obtained in the ferro-manganese, 10 per cent. in the slag, and 20 per cent. was lost by volatilisation, etc. In the nine days' working, giving a total production of 718,896 kilos. of ferro-manganese (containing 78 to 83 per cent. of manganese), an average loss of 23.1 per cent. of manganese was shown, the slag, containing on an average 6.6 per cent. of manganese. The consumption of coke, extending over this time, amounted to 2272 kilos. per metric ton of ferro-manganese produced. In the production of the alloy, ore and coke were well moistened and the temperature of the mouth gases was kept as low as possible and never greater than 200° C. The author emphasises the importance of having a high air-blast temperature and in this particular his opinion is opposed to that of Stöckmann, who has stated that a temperature of 420° C. is quite sufficient.—C. A. W.

Iron and steel; The elastic limits of — under cyclical variations of stress. L. Bairstow. *Proc. Roy. Soc.*, 1909, A., 82, 483–485.

The results of the author's experiments are in harmony with the theory advanced by Bauschinger in 1886 in explanation of fatigue. It is shown that, between certain limits, and after a sufficient number of repetitions, iron or steel is capable of adjusting itself to cyclically applied variations of stress, the specimen becoming perfectly elastic throughout the whole cycle—when the adjustment is complete—without the occurrence of fatigue. A change of length, corresponding to that observed in an ordinary tensile test when the yield stress is exceeded, occurs in the specimen during the adjustment of the elastic limits to a given cycle of stress; but in the latter case the elongation is obtained even when the maximum stress in the cycle is less than the static yield stress, the increase in the elastic limits being greatest in specimens showing the highest elongations. Below the static yield point, iron and steel appear to be capable of maintaining their initial condition for a considerable time against cyclical variations of stress which ultimately produce a considerable change of length.—W. E. F. P.

Calcium sulphate; Behaviour of — at elevated temperatures with some fluxes. H. O. Hofman and W. Mostowitsch. *Trans. Amer. Inst. Min. Eng.*, 1909, 621—622.

DURING the testing of the action of different substances on calcium sulphate at high temperatures (see this J., 1909, 246), it was stated that no appreciable alteration was noticed when ferric oxide was heated alone in a current of dry air to 1500° C., but that, in the presence of calcium sulphate, complete decomposition took place at 1250° C. with the formation of calcium ferrite.

The author has since found that when using larger quantities of ferric oxide and heating alone for longer periods, decomposition commences at 1375° C. with the formation of some magnetic oxide.—F. R.

Heavy spar (barium sulphate); Behaviour of — at high temperatures and its reactions with some substances used in metallurgy. W. Mostowitsch. *Metallurgie*, 1909, 6, 450—467.

PURE barium sulphate can be heated in pure, dry air for 15—30 minutes at 1400° C. without decomposition; at 1500° it begins to dissociate to a small extent. When heated rapidly, it melts at 1580°, with partial decomposition into barium oxide, sulphur dioxide, and oxygen. Barium sulphate is decomposed by both silica and ferric oxide at 1000°. The sesqui-, bi-, and tri-silicate mixture sinter at 1350°, and fuse at 1400° C.; the melted mass contains undecomposed barium sulphate in solution. The degree of decomposition increases with the temperature and the proportion of silica present. The behaviour of mixtures of barium sulphate with one, two, and three molecular proportions of ferric oxide is similar, the sintering and melting-points being the same, but far more ferric oxide than silica is required to effect the same degree of decomposition; the ferrites formed, are thin liquids, solidifying to crystalline masses; they are capable of dissolving both barium sulphate and ferric oxide. The reduction of barium sulphate by carbon, begins at 600° and is practically complete at 800° C. With carbon monoxide, reduction begins at 650° and is nearly complete at 800° C. When heated to 1200° in an atmosphere of carbon monoxide, the barium sulphide formed loses a small proportion of its sulphur. The decomposition of barium sulphate into barium oxide, sulphur dioxide, and oxygen involves the absorption of a large quantity of heat (136,740 calories), and this may occasionally be useful in lowering the temperature of the slag in the converter treatment of lead and copper. Slags containing barium are very liquid, but specifically heavy. Such slags are able to dissolve iron from copper matte. When heated in a reducing atmosphere, barium sulphate is readily reduced to sulphide, which has a strong tendency to enter the matte; a matte containing 35 per cent. of barium has been obtained. Barium sulphide apparently tends to carry the noble metals into the matte.—A. G. L.

Mercury ores; Shortening the roasting period for —. W. B. Dennis. *Eng. and Min. J.*, 1909, 83, 112—116.

A FURNACE, designed by the author and constructed at Blackbutte, Oregon, is stated to have reduced the time previously required for roasting mercury sulphide ores (viz., 24 to 36 hours) to four hours, and to have resulted in a more complete roast with the consumption of less fuel. The furnace was designed in accordance with the principle that the speed at which heat will be absorbed by a substance is greater, the greater the difference between the temperature of the substance and that of the heating agent. It consists of a number of superimposed gas-fired hearths each with independent hot air- and gas-supplies so that the required temperatures may be maintained. The ore is fed in at the top and is dropped through from hearth to hearth by means of dumping grate-bars; it is moved successively into hotter zones, whilst still considerably below the temperature of that in which it was being heated, thus maintaining a "steep temperature slope."—F. R.

Boiling points of metals; Approximate determination of —. H. C. Greenwood. *Roy. Soc. Proc.*, 190 A 82, 396—408.

THE author recounts the difficulties which have attended previous attempts to obtain reliable data as to the boiling points of various metals, among which he names (1) the fact that many metals possess a high vapour tension at temperatures much below their actual boiling point; (2) errors arising from the conductivity of such vapour and from the presence of carbon in the metal. After trial of several methods the one eventually adopted was based on the employment of a vertical carbon tube resistance furnace, in which was suspended a long graphite crucible containing the metal under investigation. The depth of metal employed was usually about 30 mm. Temperature readings of the outer walls of the crucible were taken by means of a Wanner optical pyrometer, a side tube being provided exactly opposite the lower end of the crucible, and being so arranged that only the radiation from the crucible walls could fall on the pyrometer; the side tube was kept clear of vapours by a current of hydrogen. The measurements of the boiling points were carried out by slowly raising the temperature of the crucible and observing the surface of the metal from above through an absorbing glass. At first the surface remains perfectly still, but as the boiling point is approached a slight agitation is observed which soon becomes vigorous. In the case of most metals studied, the difference between the temperature indicated when a gentle agitation is first apparent and that at which the ebullition has become so violent that globules of metal are ejected, does not exceed 100° C. In order to decide whether the temperatures measured on the outer side of the crucible indicated with sufficient accuracy the actual temperature of the metal, similar experiments were conducted with an annular crucible heated from within, the outside temperatures being measured as before. Experiments made with lead proved a close agreement between the results obtained by the two methods.

For determination of the boiling point of metals which readily carburise, recourse was had to carbon crucibles "brasqued" with highly shrunk pure magnesia, special precautions being taken in their preparation to obviate cracking, to which they are very liable.

The following boiling points were determined by this method:—Aluminium, 1800°; antimony, 1440°; bismuth, 1420°; chromium, 2200°; copper, 2310°; iron, 2450°; lead, 1525°; magnesium, 1120°; manganese, 1900°; silver, 1955°; and tin, 2270° C.—R. C. P.

Iodometric determination of copper. Videgren. See XXII.

Lead poisoning and tinning. Extracts from Report by E. J. H. Lawes, June, 1909. (See this J., 1909, 797.)

IN their report for 1902, Dr. Legge (Medical Inspector) and Miss Anderson (Principal Lady Inspector) stated that they were struck at the extent of lead poisoning among the tinning operatives, and expressed their disagreement with a clause in the report of Mr. Gould's Lead Committee of 1893, to the effect that the health of the workpeople employed in the manufacture of any kind of hollow-ware was not much affected by their employment. They made careful inquiries into the causes of lead poisoning, and with the help of the Public Analyst of Wolverhampton reported tentatively that inhalation of lead dust was the chief cause, and that the amount of lead which might be absorbed by eating with unwashed hands was also sufficient to cause the symptoms. They considered that the processes of tinning were so different from those of enamelling that the subjects required separate treatment and promised a further inquiry and supplementary report upon the tinning industries.

G. E. Duckering made an important discovery, namely, the presence of lead chloride in the fumes given off from the tinned article, and though perhaps he goes rather far in saying that the danger is entirely due to the fumes, there is no doubt that the metallic lead dust and unwashed hands must now be regarded as inconsequential, compared with the danger of inhaling fumes con-

aining lead chloride whether in the form of vapour or dust, as lead chloride is very soluble in the human system."

The process of tinning.—"The making of 'tin plates' which are iron plates coated with tin—and the 'purchasing' of hollow-ware, both of which are different processes in which no lead is used, are not affected. The making of 'terne-plates' was also expressly exempted. A terne-plate is an iron plate coated with a mixture of tin and lead. They are mostly manufactured in South Wales. Owing to the difference of process and the chemical interactions which are not perfectly understood, this is a harmless industry and there is little or no evidence of lead poisoning in it. The iron plate after being cleaned in the pickling bath of dilute sulphuric acid, is washed in water and there are no chlorides brought into contact with the tinning metal; there is no excess of tinning metal on the surface of the iron plate, which is not wiped by hand, and no injurious vapours can be discovered. I need not dwell at length upon this process, which is explained and discussed in Mr. Duckering's report already referred to. The process of common tinning is interesting, and here again the chemical changes do not seem to be very well understood, although I have no doubt that Mr. Duckering's experiments have done much to explain them. The process is much the same in all branches of the industry. The article to be tinned, whether a sheet of copper or nickel or an iron hame for a horse collar or a cooking utensil, is plunged into a pickling bath containing dilute solution of hydrochloric acid: this is for the purpose of cleansing it from oxides which have collected upon its surface. It is then dipped into another bath containing 'killed acid,' which is hydrochloric acid imperfectly neutralised with metallic zinc, and is really a weak acid solution of zinc chloride containing a good deal of free hydrochloric acid. The result of the action of this acid upon an iron surface is to produce ferrous chloride. What the action of the acid is upon a copper or nickel sheet does not seem to be fully explained, but either zinc chloride or hydrochloric acid remains on the surface of the metal. The article is next put into the bath of molten metal, which contains a mixture of tin and lead of varying proportions according to the quality of article required. In some cases there is as much as 90 per cent. of lead, in others only about 15 or 20 per cent. of lead. Upon inquiry, during my several visits to factories, I found the amount of lead usually varied from 40 to 75 per cent. This bath is known as the 'dipping bath' and this part of the process, as 'dipping.' Lead is very much cheaper than tin, but another fact which makes the mixture of the metals popular is that whereas lead melts at 330° C. and tin at 235° C., the mixture melts at a lower temperature than either, viz., 171° C. to 188° C., according to the proportions. This has an important bearing upon the question of wiping, as the higher the melting point the sooner the metal sets, and the more difficult it is to wipe an article such as a kettle, which takes some time to wipe thoroughly.

"After immersion in the 'killed acid' the article is dipped in the bath of molten metal. I am satisfied that it is at this point the danger of lead absorption commences. Strong steamy fumes are immediately given off, and whether there is lead in them at first or not (Mr. Duckering thinks not) there is no doubt that lead chloride is soon generated. Either the zinc chloride or hydrochloric acid upon the surface of the metal article acts upon the lead in the bath; chloride of lead is formed and probably vapourised by the heat of the bath. If there is a hood with an adequate draught over the bath, these fumes ought to go up the chimney, but as a matter of fact the hood and the draught are not usually adequate, and I have no doubt some of these fumes enter the air of the shop breathed by the dipper and his assistant. After being dipped in the bath of molten metal for about half a minute, the article is found to be coated with the tinning metal which adheres to its surface. The fumes cease to rise, at any rate in the same obvious quantity, but it must not be assumed that evolution of vapour of lead chloride has ceased; on the contrary,

according to the evidence, the molten metal continues to give off vapour until it is set. Hence the danger of wiping, which is the next process. When the tinned article is taken out of the dipping bath, it has to be wiped whilst still hot, before the metal hardens. This is done in different branches of the industry with different substances—either tow, straw or hay, but never with a rag or cloth—and the object is to make the surface smooth by removing the surplus metal, as more adheres than is required to tin it. This wiping is usually done in the open shop, rarely under a cover, and very rarely under an adequate draught, though improvements have recently been made by some firms in this direction. As the trade is at present carried on I regard the wiping as the most serious source of danger owing to the length of time it takes, during which lead vapour is given off; also to the fact that probably there is more lead chloride given off in the fumes from wiping than from dipping; there is no method at present of removing these fumes during the wiping process and the worker stoops, and is very close to the article he is wiping."

Factory and Workshop Act. Dangerous and unhealthy industries. Regulations, dated June 30, 1909, made by the Secretary of State for the tinning of metal hollow-ware, iron drums, and harness furniture. Statutory Rules and Orders, 1909, No. 720.

WHEREAS the coating of metal articles with a mixture of tin and lead, or lead alone, has been certified in pursuance of Section 79 of the Factory and Workshop Act, 1901, to be dangerous; I hereby in pursuance of the powers conferred on me by that Act make the following Regulations and direct that they shall apply to all factories and workshops where tinning is carried on in the manufacture of metal hollow-ware, iron drums, and harness furniture.

Provided that these Regulations shall not apply to:—

- (a) Any process in silver plating.
- (b) Any process in which a soldering iron is used.
- (c) Any other process if and so far as it is exempted by written certificate of the Chief Inspector of Factories, on the ground that he is satisfied that any of these Regulations are not required for the protection of the persons employed, by reason of the intermittency or infrequency of the tinning or other special circumstances.

Any such certificate of exemption shall be subject to the conditions therein prescribed and may be revoked at any time.

These Regulations shall come into force on October 1, 1909, except that Regulation 1 shall come into force on April 1, 1910.

Definitions.

In these Regulations:—

"Tinning" means the dipping and wiping of any metal in the process of coating it with a mixture of tin and lead or lead alone where hydrochloric acid or any salt of that acid is used.

"Mounting," "Denting" and "Scouring" mean the mounting, denting, and scouring of hollow-ware articles tinned on the outer surface.

"Surgeon" means the Certifying Factory Surgeon of the district or a duly qualified medical practitioner appointed by written certificate of the Chief Inspector of Factories, which appointment shall be subject to such conditions as may be specified in that certificate.

"Suspension" means suspension from employment in tinning by written certificate in the Health Register signed by the surgeon.

"Efficient draught" means localised ventilation effected by heat or mechanical means for the removal of fumes or dust so as to prevent them as far as practicable from escaping into the air of any room in which work is carried on.

No draught shall be deemed efficient which fails so to remove smoke generated at the point where such fumes or dust originate.

Duties.

It shall be the duty of the occupier to observe Part I. of these Regulations.

It shall be the duty of all persons employed to observe Part II. of these Regulations.

PART I.*Duties of Employers.*

1. No tinning shall be carried on except under an efficient draught.

The article to be tinned shall not be removed from such draught from the time when dipping is commenced until wiping is completed.

This Regulation shall not apply to the wiping of sheet metal 18 inches or more in length, where the person employed is wiping such sheet metal for his own use in some other process of his work.

2. No person under 16 years of age shall be employed in tinning.

3. The skimmings from the dipping bath shall not be removed from under the efficient draught until they have been placed in a covered receptacle. When removed they shall not be deposited in any room in which work is carried on.

4. The dust and refuse collected from the floor shall not be deposited in any room in which work is carried on.

5. A Health Register containing the names of all persons employed in tinning shall be kept in a form approved by the Chief Inspector of Factories.

6. Every person employed in tinning shall be examined by the surgeon once in every three months (or at such shorter or longer intervals as may be prescribed in writing by the Chief Inspector of Factories) on a day of which due notice shall be given to all concerned.

The surgeon shall have the power of suspension as regards all persons employed in tinning, and no such person after suspension shall be employed in tinning without written sanction from the surgeon entered in the Health Register.

7. There shall be provided for the use of all women employed in tinning:

(a) a cloak room, or other suitable place, separate from any room in which work is carried on, for clothing put off during working hours;

(b) aprons or other equivalent protection.

8. There shall be provided for the use of all persons employed in tinning, mounting, denting, or scouring, a room, separate from any room in which such work is carried on, where such persons may have meals, unless the works are closed during meal hours.

9. There shall be provided and maintained in a cleanly state and good repair for the use of all persons employed in tinning, mounting, denting, or scouring, a lavatory, under cover, with a sufficient supply of clean towels, renewed daily, and of soap and nail brushes, and with either:—

(a) A trough with a smooth impervious surface, fitted with a waste pipe without plug, and of such length as to allow at least two feet for every five persons, and having a constant supply of warm water from taps or jets above the troughs at intervals of not more than two feet; or,

(b) At least one lavatory basin for every five such persons, fitted with a waste pipe and plug, and having either a constant supply of hot and cold water or warm water laid on, or (if a constant supply of heated water be not reasonably practicable) a constant supply of cold water laid on, and a supply of hot water always at hand when required for use by persons employed.

PART II.*Duties of Persons Employed.*

10. Every person employed in tinning shall present himself at the appointed time for examination by the surgeon as provided in Regulation 6.

11. No person employed in tinning shall:—

(a) After suspension, work at tinning without written sanction from the surgeon entered in the Health Register; or

(b) Interfere in any way, without the concurrence of the occupier or manager, with the means and appliances provided for the removal of dust or fumes, and for the carrying out of these Regulations.

12. Every person employed in tinning, mounting, denting, or scouring shall wash the hands before partaking of food or leaving the premises.

13. No person employed in tinning, mounting, denting, or scouring shall keep or prepare or partake of any food or alcoholic drink in any room in which such work is carried on.

H. J. GLADSTONE,
One of His Majesty's Principal
Secretaries of State.

Home Office, Whitehall.
30th June, 1909.

Mineral production of Potosi, Bolivia, in 1907. Bd. of Tr. J., Aug. 5, 1909. [T.R.]

THE products of Potosi are essentially mineral, and form 44 per cent. of the total exports of Bolivia. The official figures for the production in 1907, which are the latest available, are as follows:—

	£
Tin	2,220,000
Silver	440,000
Copper	6,000
Bismuth	75,000

Russian manganese ore. Chem. and Drug., Aug. 7, 1909.

IN 1908 the manganese producers of the Caucasus, expected that exports would expand so soon as contracts from India should expire. When the time drew near, the trade went from bad to worse, so that a large number of producers at Tchiaturi were compelled to either shut down, or liquidate. Only two or three of the sounder firms were able to continue production. Prices of manganese ore at the mines in 1908 were 1½d. per 36 lb., as compared with 4d. to 4½d. when the industry was in a flourishing condition. The high transport rates charged by the State railways and Indian competition have brought about the present unhealthy condition. On the other hand, the Indian and Brazil manganese industries have steadily forged ahead in European markets and elsewhere, as the following figures relating to exports show:

Year.	Brazil.	British India.	Poti and Batoum.
	tons.	tons.	tons.
1902.....	157,295	144,037	478,421
1903.....	161,926	171,804	439,915
1904.....	208,260	154,880	453,109
1905.....	224,337	282,334	313,095
1906.....	201,500	310,446	494,506
1907.....	231,410	611,692	490,759
1908.....	—	—	371,760

Manganese ore in the United States. U.S. Geological Survey, 1909. [T.R.]

FEWER mines were in operation in 1908 than in 1907. Eleven mines produced 6144 long tons, nearly all of which was used for chemical purposes. The production of manganiferous zinc residuum from New Jersey zinc ores amounted in 1908 to 110,225 long tons, an amount greater than in any preceding year. During 1908, 178,203 long tons were imported, valued at \$1,350,223, as against 209,021 tons in 1907, valued at \$1,793,143. India furnished the bulk, and a considerable amount came from Brazil.

PATENTS.

Lead fumes or waste metallic solutions and suspensions; Process for the recovery of marketable products from —. A. Levy-Mond, London. Eng. Pat. 12,317, June 6, 1908.

THE process consists in the utilisation of the small quantity of sulphuretted hydrogen contained in Mond gas and similar gases, for the precipitation of metals from such dilute solutions or suspensions as would otherwise be thrown away, thereby recovering the metals and purifying

the gases at the same time. The dilute metallic solutions or suspensions may be used instead of water for the rubbers, &c., of the gas plant, the precipitated metallic sulphides being then obtained in intimate admixture with the solid fuel particles of the crude gas, thus affording an easier reduction to metal in furnaces. The formation of sulphate fume in gas-fired lead furnaces may be obviated by the use of the purified gas.—W. E. F. P.

last furnace dust; Manufacture of briquettes from —. W. Schumacher, Osnabrück, Germany. Eng. Pat. 14,399, July 7, 1908.

THE patent relates to the addition of certain soluble salts to blast-furnace dust, or to mixtures of this with fine ores, powdered slags, &c., whereby the latent hydraulic binding capacity of the dust or mixture is set in action or increased. The chlorides and sulphates of the alkaline-earths, or the metals of the iron group, are the most effective, and are added in the form of aqueous solution, $\frac{1}{4}$ to 1 per cent. of the salt, or mixture of salts, being sufficient in most cases. The mixture is pressed into blocks which harden in a few hours, the hardening effect being intensified by the action of steam under pressure. Binding materials containing lime, or bodies from which calcium hydroxide is liberated, act disadvantageously upon the hardening process.—W. E. F. P.

powdered, residual or friable substances [pyrites, &c.]; Agglomeration or hardening of —. H. Delporte. Fr. Pat. 398,615, Jan. 19, 1909. Under Int. Conv., Jan. 18, 1909.

THE material, which may consist of roasted pyrites, blast-furnace dust or other residual products, is mixed with a certain proportion of coal-schist and the whole crushed very finely, water or other liquid (such as tar) being added, if necessary, so as to obtain a more or less consistent paste. During this operation, the aluminium silicates become uniformly distributed throughout the mass, forming a species of skeleton which binds together the pulverulent portions and so consolidates the whole. The process is assisted by the interposed particles of carbon and by the liquid added. The product may then be moulded into briquettes with or without pressure, according to the hardness it is desired to obtain, or it may be incorporated with other substances. The process of agglutination by the silicates may be advanced still further, and a more compact mass obtained, by a final drying or burning in air. The method may be applied in order to hasten the setting of ordinary and hydraulic cements or mortars.—C. A. W.

blast furnaces; Method and means for utilising the waste heat of —. A. Pfoser, Achern i/Baden, Germany. Eng. Pat. 14,511, July 8, 1908.

THE invention has for its object the better utilisation of the waste heat of masonry regenerators in blast-furnaces by the attachment of tubular metal air-heaters, such as described in Eng. Pats. 16,690 of 1907, 16,411 of 1884 and 3717 of 1876 (this J., 1908, 750). The heated air, instead of proceeding to the blast-furnace through the generator arranged for "air," passes directly to that arranged for "gas," the combustion of the gas resulting in an increase in temperature of the regenerator and of the blast air.—W. E. F. P.

slag; Manufacture of open-hearth —. T. S. Blair, jun., Elmhurst, Ill., Assignor to Blair Engineering Co., Chicago, Ill. U.S. Pat. 927,097, July 6, 1909.

IRON is first subjected to an acid Bessemer process. The metal and slag from this treatment are poured into a ladle to which lime is also added to convert the slag into basic slag. The whole is then charged into an open-hearth furnace, and the metal from other acid Bessemer treatments is added, the different converter charges being blown to different carbon contents.—A. G. L.

cementation process. E. Ferminne. Fr. Pat. 398,570, Jan. 16, 1909.

ABOUT 20–25 per cent. by weight of common salt (sodium chloride) is added to the usual cementation powder,

consisting of wood charcoal, and charred hide and horn. It is claimed that the cementation produced is more regular than when no salt is used.—A. G. L.

Tool and high-speed steel; Art of producing from foundry iron a product having cutting and other properties of high-grade — and metal product from cast iron. E. A. Custer, Philadelphia, Pa., Assignor to The Custer Sandless Casting Co., Delaware. U.S. Pats. 927,495 and 927,496, July 13, 1909.

THE process consists in quickly chilling molten foundry iron (with or without the previous addition of tungsten, nickel, vanadium, &c.) in a permanent metal mould, to the setting point, and then quickly cooling in a fluid bath to fix the homogeneity of the structure so established. The product, whilst retaining the appearance and chemical composition of cast iron, is capable of taking a temper and becoming permanently magnetised.—W. E. F. P.

Manganese ore for the production of briquettes; Treatment of —. A. Gutensohn, London. Eng. Pat. 17,246, Aug. 17, 1908.

CONCENTRATED manganese ore is mixed with 0.25 part of boric acid (or 0.5 part of borax) and 0.3 part of yellow ochre, and heated to redness, allowed to cool, and ground to powder. This powder is added to the ground manganese ore in the proportion of 3 per cent. The whole is heated to a semi-molten state, raked, and pressed into moulds to produce solid briquettes.—J. W. H.

Ores; Method of treating —. W. Kemp, Tucson, Ariz. U.S. Pat. 846,216, March 5, 1907.

THE method consists in treating the ore in the furnace described in Fr. Pat. 358,645 of 1905 (this J., 1906, 270). —O. F. H.

[Refractory] ores; Method of treating —, process of condensing fumes, and condenser. H. A. Hogel, New York. U.S. Pats. 927,046, 927,241, and 926,943, July 6, 1909.

THE ore is mixed with salt and if necessary with sulphur, and then heated and stirred in an oxidising atmosphere until the required metals (lead, copper, silver, gold, &c.) are volatilised. The fumes are conducted into a special condenser, where they are intimately mixed with air and a constantly circulating supply of water. During each circulation, the water is cooled and the admixed air allowed to escape. When the liquor is saturated with the soluble compounds from the fumes, it is run off and the solid residue and solution treated separately for the contained metals. The condenser used consists of a tubular boiler for the partial cooling of the fumes, and a closed circulating system of tanks and connecting pipes, in which the volatilised products are circulated by means of water-jet aspirators and pumps, one of the tanks being provided with a water seal, to permit the escape of the admixed air and gases.—F. R.

Ores and analogous substances; Treatment of —. A. A. Lockwood and M. R. A. Samuel. Fr. Pat. 398,660, Jan. 20, 1909.

THE method is intended primarily for the magnetic separation of ores, tailings, and concentrates. The material to be treated, is mixed, preferably in the form of an acidified paste, with particles of a magnetic or magnetisable substance and with a liquid which adheres to certain of the mineral components in preference to others, so that these alone remain attached to the magnetic constituents. The whole mixture is then exposed to a magnetic field in the usual way. In certain cases, of course, it may not be necessary to make any further addition of magnetic substances to an ore, which may contain a sufficiency in its natural condition. In an example given, with reference to a sample of Broken Hill zinc tailings containing 18.78 per cent. of zinc and 5.14 per cent. of lead, the ore was agitated with dilute sulphuric acid and the pulp so obtained, mixed with two parts by weight of finely-crushed cast iron and one part of coal tar. After further agitation and the addition of water, the mass was passed into the separator.—C. A. W.

Furnace; Roasting —. H. A. Hogel, New York. U.S. Pat. 926,942, July 6, 1909.

THE furnace consists of a brick-lined cylinder, rotating about its long axis at a small angle from the horizontal. The alternate longitudinal rows of fireclay bricks are made with a triangular cross-section and project somewhat towards the centre of the cylinder, forming shelves for the ore. The ends of the cylinder are surrounded by, but not in contact with, stationary caps which are arranged to deliver an annular blast of air into their open ends. Gas and ore inlets and outlets are provided in the upper and lower caps respectively. The furnace is adapted to run in series, the ore from the highest cylinder discharging into the upper end of the next, &c. —F. R.

Metallurgical furnace. R. G. Reilly, Corona, N.Y., Assignor to North American Reduction Co., Arizona. U.S. Pat. 927,283, July 6, 1909.

THE furnace consists of a feed chamber and of a combustion chamber surrounded by a jacket in which air is heated. This hot air is led to a number of hollow grate-bars provided with perforated nozzles and placed at the bottom of the combustion chamber. A hopper is provided below the grate, the ore finally passing into a passage below the hopper.—A. G. L.

Furnace; Movable and dismantlable — for the treatment of minerals and extraction of metals contained therein. E. Reetzka. Fr. Pat. 397,760, Dec. 19, 1908.

THE furnace is designed for the treatment of minerals at the mines. It consists essentially of a double-walled cylindrical chamber surmounted by a chimney and connected below to a conical portion, also double-walled, which ends in a grate of fire-bars. The whole is supported on four pillars. The conical portion of the furnace communicates with the chimney by four valved conduits; it is also provided with ports. The cylindrical part is provided in its upper portion with four openings for the introduction of ore, fuel, etc. Water is circulated between the double walls of the cylindrical and conical portions of the furnace, and also through eight vertical and horizontal tubes which are placed within the cylindrical portion, and help to cool the same.—A. G. L.

[*Nickel-manganese*] *alloys; Process of making* —. J. T. H. Dempster, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 926,980, July 6, 1909.

NICKEL is first melted with a decarbonising agent in a clay-lined crucible to reduce the quantity of carbon present. Other metals (e.g., chromium, or chromium and iron) and manganese are then successively added, and the mixture is cast before the manganese attacks the clay lining.—A. G. L.

Alloys of zinc with copper; Process of making —. S. Elliott, Newton, Mass. U.S. Pat. 927,843, July 13, 1909.

THE process consists in adding the copper to the molten zinc, and raising the temperature to the melting point of the required alloy.—W. E. F. P.

Zinc retorts; Condensation of the exhaust gases from —. Stewarts and Lloyds, Ltd. Fr. Pat. 397,731, Dec. 21, 1908.

THE gases as they emerge from the mouths of the retorts are made to pass through a cylindrical condenser having a length of not less than three metres. This condenser, which is fitted to the retort by means of an air-tight joint of asbestos, is almost entirely closed at its opposite extremity by a plug, an aperture being however arranged in the latter for the escape of the residual gases. Along its whole length, at certain intervals, the passage is obstructed by partitions or baffle-plates provided with small holes and movable, when necessary, on horizontal axes. In this way any zinc dust, which may tend to accumulate within the

perforations, may be readily removed. In order to avoid explosions within the tube, apertures are provided along the top; these are kept closed under normal conditions by means of flap covers.—C. A. W.

Metals; Soldering of —. Cie. Française d'Acétylène dissous. Fr. Pat. 398,090, March 14, 1908.

THE auxiliary substances, such as fluxes, cleaning agents, etc., are previously incorporated with the mass, or deposited on the surface of the soldering metal. The latter, for this purpose, may be in the form of a bundle of sticks, or in any other suitable condition. In this way the flux may be brought, in any proportions desired, exactly to the position where the weld is required, so that all waste is avoided. —C. A. W.

Aluminium; Soldering of —. F. Stalder, E. Scholl, and G. Dubach. Fr. Pat. 398,245, Jan. 2, 1909.

THE pieces of aluminium to be connected are cleaned covered with pure sulphur and passed through a flame. The sulphur having melted, the weld is made at the required point by means of an alloy composed of equal parts of tin and zinc. After application of the solder, a piece of pure tin is passed over the heated weld.—C. A. W.

Molybdenite; Process of treating commercially mineral containing —. A. Leduc. Fr. Pat. 398,539, March 25, 1908.

CRUSHED molybdenite is heated at a temperature slightly below a red heat in a mixed current of air and gaseous hydrogen chloride, molybdenum oxychloride ($\text{MoO}_3, 2\text{HCl}$) being volatilised. This is condensed and dissolved in water, and the aqueous solution evaporated to obtain molybdic acid.—A. G. L.

Metallic paint. Fr. Pat. 398,084. See XIII A.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A).—ELECTRO-CHEMISTRY.

Cathode-dish; Graphite —. J. W. Turrentine, Amer. Electrochem. Soc., Niagara Falls, May, 1909. Electrochem. and Met. Ind., 1909, 6, 279.

SIMPLE graphite electrodes, paraffined in order to overcome the porosity, are described, and details are given of the preparation of a graphite cathode dish. Where great accuracy is not required, these contrivances may be used in the place of platinum as insoluble electrode in electro-chemical experiments.—C. A. W.

Electrical conductivity of solutions; Influence of pressure on —. F. Körber. Z. physik. Chem., 1909, 67, 212–248.

PRESSURE increases the electrical conductivity of solutions but its influence diminishes as the temperature rises. The isotherms of change of resistance, in the case of dilute solutions of potassium chloride, show a minimum at each temperature, though the curves flatten as the temperature rises. The temperature-coefficient of the influence of pressure on the conductivity has (for potassium chloride) a maximum at 30°, and from 50° to 100° C. remains constant. In the case of sodium chloride, the influence of pressure on the ionic friction of the dissolved electrolyte and on the viscosity of the solvent, are alike, but this does not hold in the case of electrolytes—the influence of pressure on ionic friction being different for different ions. In dilute solutions of strong binary electrolytes the influence of pressure on ionic friction is additive and can be deduced by summation of the effects on the separate ions. Usually, the effect of pressure in lessening ionic friction is less for ions of high than of low atomic weight, but potassium and sodium form an exception to this. The isotherms of effect of pressure on ionic friction approach one another more nearly at higher temperatures.

but the hydrogen ion forms an exception to this. The influence of pressure on the conductivity of strong electrolytes is, even up to pressures of 3000 atmospheres, independent of the concentration till high concentrations are reached, when it begins to lessen. At very low concentrations it increases, because of the effect on the conductivity of the solvent. The isobars of pressure-change of conductivity in relation to concentration show a conspicuous maximum, at the same pressure for all concentrations. The figures for the effect of pressure on the dissociation of acetic acid at 20° C., calculated from the conductivity isotherms of sodium chloride and acetate, hydrochloric and acetic acids, agree well with those calculated from Planck's formula of the dependence of dissociation-constants on pressure, but at higher temperatures they show higher values for the effect of pressure.

—J. T. D.

Nitric acid from the air. Russ. See VII.

Electrolytic disinfectant. Alexander. See XVIII.

Electro-analytical precipitations and separations. Alders and Stähler. See XXIII.

PATENTS.

Electrolyzer. E. Hixon, Chicago, Ill. U.S. Pat. 927,970, July 13, 1909.

THE apparatus comprises a mixing tank, an electrolyzing tank, and a receiving tank, with suitable pipe connections. The electrolyzing tank contains a number of removable, vertically-disposed, transverse partitions, some of which have openings at the bottom, the remainder having openings at the top, the two sets being adjacent to opposite ends of the tank, as also are the electrodes.—W. E. F. P.

Soldering metallic filaments of electric lamps to their electrodes. Eng. Pat. 14,483. See II.

Filaments for electric lamps. Eng. Pats. 14,852 and 14,853. See II.

Electrolysis of alkali chlorides. U.S. Pat. 928,734. See VII.

(B.)—ELECTRO-METALLURGY.

Lash steel process and the electric furnace. F. A. J. Fitzgerald. Amer. Electrochem. Soc., Niagara Falls, May, 1909. Electrochem. and Met. Ind., 1909, 6, 268.

THE author considers the Lash steel process as worked in the ordinary open-hearth furnace and explains how it may be applied to the electric furnace. The process, which consists essentially in the smelting of an intimate mixture of iron ore, carbon, fluxes, and cast iron borings or granulated pig-iron, may, it is stated, be more advantageously carried out in the electric furnace, where the atmosphere is neutral. The oxidising atmosphere of the open-hearth furnace renders the control of the carbon content in the resulting steel a matter of difficulty, and, moreover, a certain amount of pig-iron or scrap has always to be added in addition to the Lash mixture. In the electric furnace this should not be required. As to the question whether the addition of metallic iron is necessary at all, experiments have been made comparing the reaction of the Lash mixture and a charge containing no granulated pig-iron. In the latter case it was shown that not only was the power consumption excessive, but the mixture showed a tendency to boil or froth instead of melting down quietly. Moreover, when no pig-iron was used, the consumption of electrodes in an arc furnace was very much greater. The presence of the pig-iron, in fact, reduces the amount of energy required to produce a unit weight of metal from the ore.—C. A. W.

Copper electro-deposition baths; Determination of the free acid in —. M. de Dehaisieux. Bull. Soc. Chim. Belg., 1909, 23, 310—314.

THE presence of excess of free acid in a copper electro-deposition bath has an important influence on the properties of the metal deposited, and it is necessary to have a rapid method of controlling the free acidity. Sims (Chem.

News, 1907, 253) proposed to add 4 drops of methyl orange to the solution diluted so that 100 c.c. contained 3 grms. of copper sulphate, and then to titrate with sodium bicarbonate till a green tint was obtained. The author confirms this method and shows that $N/2$ sulphuric acid and sodium bicarbonate can be titrated with accuracy in presence of varying amounts of copper sulphate. Conductivity curves for the neutralisation of free acid with increasing amounts of sodium hydroxide in presence of copper sulphate, show a fall till the neutrality point towards methyl orange is reached; the curve then remains flat till the copper salt has been precipitated, and rises again to the neutral point towards phenolphthalein.—E. F. A.

Electro-deposited alloys; The conditions which determine the composition of —. Part I. Copper-zinc alloys. S. Field. Faraday Soc., June 29, 1909. [Advance proof.]

THE effect of temperature, current density and composition of solution upon the electro-deposition of brass from cyanide solutions was investigated. Such solutions presented advantages in that copper and zinc ions were present in small quantities and were readily discharged together, although slight variations of E.M.F. gave rise to change of colour and composition of deposit. The products of anodic oxidation in such solutions were, however, ordinarily insoluble, and care had to be taken that insulating layers of insoluble cyanides did not form on the anodes. Experiments with solutions of copper formed by dissolving precipitated copper carbonate in a solution of potassium cyanide, showed that the warmed and agitated (40 to 50 per cent.) solution gave the best results, an anode efficiency of over 100 per cent., and a cathode efficiency of 95 to 98 per cent. being obtained. The anode remained clear and bright. The abnormal anode efficiency was partly due to the increased solvent action of the solution when agitated and also to the slight disintegration of the plate. The brassing solution was prepared by dissolving 100 grms. of copper-potassium cyanide and 100 grms. of zinc-potassium cyanide in water and making up the solution to 1200 c.c.; a mixture of zinc and copper carbonates was then agitated with it to remove the excess of cyanide, and the solution filtered. The solution was maintained at a temperature of 50° to 60° C. by means of a glass steam-coil. The composition of the brass deposit could be roughly deduced from the ratio of the weight of brass deposited to the weight of copper deposited in the voltameter. If the deposit were entirely copper, this ratio would be 2 and if entirely zinc, 1.028. The deposits obtained with the above solution although almost quantitative, were not physically uniform or good. The percentage of zinc in the deposit increased with an increase in current density, though in this solution it was below that of ordinary brass. The potential difference was low, the statements of the text-books being incorrect on this point. The zinc anodes became covered with copper by simple immersion, and it was only with heavy current densities that this deposit disappeared. By the addition of zinc cyanide to the solution, the percentage of zinc in the deposit increased, especially with high current densities, but the anode became less soluble. Copper was more freely deposited, although zinc preponderated in the solution. Upon dilution of the solution, the percentage of zinc in the deposit increased on account of the higher potential difference required to maintain the same current density. Quantitative deposition only occurred in warm solutions and an increase of temperature increased the percentage of copper in the deposit. On addition of free cyanide there was more difficulty in maintaining uniform deposition at ordinary temperatures while the rate of agitation had great effect on the deposit, which was always rough. The amount of gas generated was also reduced. With appreciable amounts of free cyanide the percentage of copper was always high even with high current density. Free cyanide, other than by dissolving the anode products, added little conductance to the depositing cell. These cyanide solutions were subject to continual changes of composition which soon prevented the exact repetition of similar effects.—J. W. H.

Alkali hydroxides; Electrolysis of fused — and solubility of the alkali metals in the melt. G. v. Hevesy. Z. Elektrochem., 1909, 15, 529—536.

ANHYDROUS mixtures of sodium and sodium hydroxide were fused together in closed metal cylinders at different temperatures for varying lengths of time. The cylinders were then cooled rapidly, opened, the metal separated from the hydroxide melt, and the free metal present in the latter determined, as well as the total alkalinity of the hydroxide melt. For temperatures up to 500° C., brass cylinders were used; for higher temperatures, nickel was employed; in both cases the cylinder containing the melt was enclosed in an outer cylinder of iron, also tightly closed. It was found that sodium is appreciably soluble in sodium hydroxide, 100 grms. of the latter dissolving 25.3 grms. of sodium at 480° C., 10.1 at 600°, and 6.9 at 800°. The solubility was independent of the duration of heating, and also of the proportion of sodium present, provided only that the latter was present in excess. Addition of metals such as thallium, cadmium, and gold, which produce a lowering of the freezing-point of sodium, depress the solubility of the latter by the amount required by the theory of solutions, as long as the metallic additions are not too large. Addition of zinc, on the other hand, which does not lower the freezing-point of sodium, has also no effect on the solubility of sodium in sodium hydroxide. Sodium diffuses very rapidly into sodium hydroxide, the velocity increasing with increase of temperature. Thus, on electrolyzing sodium hydroxide at 315°—340°, the current efficiency was 27 per cent.; at 360°—390° C. the current efficiency was nil. Addition of sodium chloride, bromide, and iodide had no effect on the solubility of sodium in sodium hydroxide. Similar results were obtained for mixtures of potassium and potassium hydroxide, but the solubility of the metal in the hydroxide is much smaller than for sodium, being 7.8—8.9 grms. of metal for 100 grms. of hydroxide at 480°, and 0.5—1.3 at 700° C. The velocity of diffusion is also much smaller; the electrolysis of potassium hydroxide at 320°—340° gave a current efficiency of 55 per cent., and at 365°—410° C. of 26 per cent.—A. G. L.

PATENTS.

Arsenical ores and speiss; Process of treating —. A. G. Betts, Troy, N.Y. U.S. Pat. 927,024, July 6, 1909.

SPEISS is treated by dissolving it as anode in a solution of a lead salt, lead being at the same time deposited on the cathode. Arsenic is "cemented" from the solution by means of metallic lead, and the metal contained in the speiss is deposited from the solution by electrolysis, using a lead anode, after which the solution left is used again for the treatment of a fresh quantity of speiss.

—A. G. L.

Ores or other materials; Treatment of — by electrical heating. Soc. di Montepioni. Fr. Pat. 397,999, Dec. 29, 1908.

THE apparatus is intended for the calcination and dehydration of iron ores, and, with certain modifications, for the reduction and recovery of volatile metals such as mercury, zinc or antimony. In its most simple form, it consists essentially of an upright tubular retort embedded in masonry and having walls composed of some refractory substance which conducts electricity, such as graphite or a mixture of graphite with any refractory earth. It may have any shape, circular or oval, but in every case the thickness of the walls at any point must be inversely as the temperature it is desired to attain there. The electrodes are arranged at the two opposite extremities of the apparatus, where the walls are very thick, so that, the current being made to run around the retort, the greatest heat will be developed at those central portions where the walls are thinnest. The velocity of the reaction is governed by the movement of a worm-conveyor which moves in a channel beneath the furnace and carries away the ore as it falls through the bottom. If it be necessary to recover the volatile products, as in the case of mercury or antimony ores, the arrangement is modified, the top of the retort being covered by a plate of refractory

material containing a central hole through which the ore is fed by means of a hopper. In this way an annular space is left free at the top, where the volatile gases collect and pass away through flues provided for the purpose. A further modification is necessary when the furnace is used for the distillation and recovery of zinc metal from its ores. In this case the retort is pierced at two points where the walls are thinnest, so that it communicates at these points with condensers of the usual type, embedded in the masonry.—C. A. W.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

African vegetable fats; Characteristics of —. M. Krause and Diesselhorst. Tropicplanzer Jahrg., 1909, 13 [6]. Chem. Rev. Fett- u. Harz-Ind., 1909, 16, 200—201.

Allanblackia Stehlmanni fat.—The tree, which is found in East Africa, produces a fruit containing about 30 seeds of the size and form of chestnuts, from which 54.5 per cent. of fat can be extracted. The fat, which is used locally for food, resembles lanoline in its action upon the skin. It could be used in the soap and stearin manufactures, for cosmetics, and possibly as a cheap substitute for lanoline. As the tree produces its fruit in great abundance, it would probably repay cultivation. The fat had the following characteristics:—Sp. gr. at 17.5° C., 0.8736; m. pt., 43° to 46° C.; refractive index at 50° C., n_D^{50} = 1.4503; saponification value, 188.6; iodine value, 37.48; m. pt. of fatty acids, 60° C.; and iodine value of fatty acids, 38.25.

Oil of Plukenetia conophora.—The plant, which is extensively cultivated in the fields in the district of Ossidinge (Cameroons), produces seeds, of about the size of a walnut. The kernels yielded 53.8 per cent. of a drying oil closely resembling linseed oil in its properties. It is used by the natives as an edible oil, and would be valuable as a substitute for linseed oil in the manufacture of varnish and linoleum. The oil had the following values:—Sp. gr., at 17.5° C., 0.9354; solidification point, —33° C.; saponification value, 192; iodine value, 177.3; refractive index at 17.5° C., $n_D^{17.5}$ = 1.4830; and iodine value of fatty acids, 187.4. The residue of kernel, after removal of the oil, contained 7.3 per cent. of nitrogen.

Oil of Ojok fruit.—The nuts of this tree, common in the district of Ossidinge, contained 52.24 per cent. of an oil with a pleasant taste. The expressed oil, which could be used as a foodstuff, had the following characteristics:—Sp. gr., 0.9333; solidification point, —22° C.; refractive index at 17.5° C., $n_D^{17.5}$ = 1.5068; saponification value, 189.9; and iodine value, 123.9.—C. A. M.

Halogen absorption of oils by the methods of Hübl, Wijs, Hanus, and McIlhenny; Comparative examination of the —. J. S. Remington and H. Lancaster. Brit. Pharm. Conf., Newcastle, July, 1909.

THE authors arrive at the following conclusions respecting the different methods for determining the halogen absorption of oils. Much better results are obtained by the Wijs than by the Hübl and Hanus methods. To get quick and accurate results by the Wijs method, there must be an excess of 70—80 per cent. of halogen. To get the maximum absorption by this method, two hours must be allowed for drying oils such as linseed oil, an hour for semi-drying oils, and half-an-hour for non-drying oils. The mixed Hübl solution deteriorates rapidly after 24 hours, whereas the Wijs and Hanus solutions will keep for several months. The McIlhenny bromine method is much superior to any of the above three methods in that the absorption is practically instantaneous, the solutions are easily prepared and keep well, and the method distinguishes between the bromine absorbed and the bromine substituted.—F. SUDS.

Miscibility curves of liquids; Use of — in analysis. Application of the method to edible oils. E. Louise. Comptes rend., 1909, 149, 284—286.

IN a previous communication (this J., 1907, 932) it was shown that oils formed double mixtures with acetone, and

that each oil had a characteristic *temperature of miscibility*. Further experiments have shown that in order to obtain constant values with the same kind of oil, it is essential that the sample should be dry, and that the acetone should always be of a definite standard. For this purpose the freed from glycerides solidifying above 15°C . is dried 3 days *in vacuo* over sulphuric acid. The acetone is taken with calcined sodium carbonate and filtered, the acetone mixed with dry sodium carbonate and distilled, and the portion distilling at 56° – 57°C . collected. To obtain a product with a constant amount of moisture, this acetone is standardised on petroleum spirit, which has itself been standardised on absolute alcohol. The latter forms a double mixture with petroleum spirit distilling at 210° – 215°C ., and the petroleum spirit forms a double mixture with acetone. Hence, by determining the respective *temperatures of miscibility*, a typical acetone can be prepared. This is kept in a vessel which will deliver portions of 20 c.c., and into which only dry air is admitted. It is shown that the curves of miscibility obtained with an acetone thus standardised are almost parallel, and very close to each other in the case of different samples of the same kind of oil. The curves given by cotton-seed and sesame oils fall below and are far removed from the curves of olive oil, whilst the curves of arachis fall above those of olive oils, without, however, being very far from them. It is possible by plotting the curves to determine approximately the proportion of sesame and cotton-seed oils in an adulterated sample of olive oil, and in the case of arachis oil the results will be less exact. The determination of *temperatures of miscibility* may also be used in the determination of water in *e.g.* oils, and in the analysis of petroleum spirit, glycerin, essential oils, &c.—C. A. M.

Parsley-seed oil; Unsaponifiable constituents of —. I. Matthes and W. Heintz. Ber. deuts. pharm. Ges., 1909, 19, 325–328.

A specimen of oil examined was of a dark green colour, and had a bitter pungent taste. It dissolved readily in ether, chloroform and carbon bisulphide and in a mixture of alcohol and ether. Its analytical values were as follows: sp. gr. at 15°C ., 0.9720; refractive index at 40°C ., 1.424; saponification value, 190.9; and iodine value, 187. A solution of the oil in a mixture of equal parts of alcohol and ether, yielded, on standing, a crystalline deposit with the characteristics described by Vongerichten and Köhler (this J., 1909, 662). This fat contained an unsaponifiable portion composed of a yellow oil with an aromatic odour, and of crystals suspended in it. The crystalline part, after treatment with warm alcohol and repeated recrystallisation from ether, melted at 69°C ., and had a composition corresponding to the formula $\text{C}_{28}\text{H}_{48}$, and a mean molecular weight of 289.1 ($\text{C}_{28}\text{H}_{48}$ = 284). To this hydrocarbon, which did not absorb iodine and gave the phytosterol reaction, the name "*petrosilane*" was given. It is mentioned that Etard isolated a hydrocarbon with the same formula and m. pt. from *Bryonia cretica*, and that Matthes and Sander (this J., 1908, 987) found a similar hydrocarbon in laurel-seed oil, which differed, however, from petrosilane and bryonane in being soluble in boiling absolute alcohol. Two hydrocarbons of the same composition and of similar form and solubility (m. pts. 60.5° and 67°C .) were also found by Schwalb in wax. The solid portion of the unsaponifiable matter soluble in alcohol yielded a substance melting at 88°C ., and corresponding in properties with melissyl alcohol crystals, melting at 133° to 145°C . and giving the phytosterol reaction. These consisted of a mixture of several compounds. The liquid soluble portion, separated from the alcoholic solution by chilling the liquid, was a yellowish brown oil with an iodine value of 111.75 and refractive index at 40°C . of 1.5154. The total quantity of the unsaponifiable matter in the parsley seed oil was about 14 per cent.—C. A. M.

Canic compounds [Oils]; Catalytic oxidation and reduction of —. S. Fokin. Z. angew. Chem., 1909, 22, 1451–1459; 1492–1502.

The author gives details of the experiments on which were based his conclusions on the drying of fatty oils (this J.,

1907, 1149; 1909, 98). He now groups certain metals found to accelerate the oxidation in an order different from that previously given:—(1) Cobalt, manganese, chromium, nickel, platinum, palladium. (2) Barium, lead, cerium. Where these metals effect a reduction their arrangement is in the reverse order. The phenomenon of a simple absorption of oxygen by unsaturated compounds, without the formation of decomposition products, may be brought about through the agency of metallic oxides. In such cases only about one-half of the theoretical amount of oxygen is absorbed, *i.e.* the autoxidation is semi-molecular. Thus, in an experiment with tung oil the absorption of oxygen in a film test, with a cobalt salt as the sicative, reached 8.6 per cent. in 24 hours, or "approximately half the theoretical amount (10 per cent.)." In a second experiment the plate was heated to 40 – 45°C . for 5 minutes, after having been exposed for 3 hours, and the increase in weight after 26½ hours was then 18.7 per cent.; so that here there was molecular autoxidation. After standing for a short time the varnish became slowly polymerised. With the aid of a cobalt sicative a rapidly drying varnish may be prepared from sunflower oil, which has hitherto been regarded as unsuitable for the purpose. Thus, a film of the oil exposed to the air at 17.5°C . had increased in weight by 8.8 per cent. in 19 hours. A film of the same oil containing 4 per cent. of cobalt sicative (cobalt, 0.33 per cent.) was no longer "tacky" after 6 hours, and after 17 hours' exposure had gained 12.1 per cent. in weight. Almond oil containing the cobalt salt showed an increase of 4.1 per cent. in weight after 12 hours' exposure, and of 4.7 per cent. after 30 hours' exposure under a pressure of 15 atmospheres (half the theoretical absorption = 5.3 per cent.). In each case the oil had become thicker, but no "skin" had formed. Linseed oil fatty acids mixed with one-tenth of the amount of cobaltous oxide required to form a neutral salt, heated at 130° to 150°C ., to dissolve the cobalt salt, and then exposed in a film at the ordinary temperature, showed a maximum increase in weight of 9.1 per cent. after about 18 hours. The film was not "tacky," and differed from linoleum in being soluble in alcohol. In like manner, a fish-liver oil containing 0.45 per cent. of cobalt, absorbed 9.64 per cent. of oxygen after 535 minutes at 18.5°C . (calculated amount = 9.89 per cent.). With regard to the action of the air upon the drying process, there is a great difference between the results obtained with free access and with limited access of air. Thus linseed oil left in a loosely-closed flask for 10 years had changed into a very heavy viscous fluid, which was quite insoluble in fresh linseed oil. It had a molecular weight (Raoult) of 1137, whereas a fully oxidised linseed oil would only have a molecular weight of 1062 (corresponding to an iodine value of 180). A film of this product exposed for 200 hours increased in weight by 7.24 per cent. "*Blown*" cobalt varnish:—Air was drawn through a cobalt varnish (Co = 0.33 per cent.), which before treatment yielded a film that ceased to be "tacky" after an exposure of 2 to 2½ hours. After the air had passed through it for 7 hours at the ordinary temperature the liquid thickened, and then yielded a film which remained "tacky" after an exposure of 1 hour 55 minutes. But after continuing the treatment for an additional 4½ hours the films were no longer "tacky" after 1¼ to 1½ hours. When air was drawn through the varnish for 7½ hours at 50°C ., the liquid became viscous and yielded a "non-tacky" film in 40 to 45 minutes. The rose colour had changed to dark brown, and the product had become nearly insoluble in petroleum spirit. A mixture of the insoluble portion with turpentine oil yielded a film devoid of "tackiness" in 30 minutes. Nickel varnish "blown" for 9 hours at 55° to 60°C . yielded a "non-tacky" film in 13½ hours. Further details are also given of experiments on the catalytic reduction of organic compounds with the aid of metals (see this J., 1906, 35; 1907, 169, 1149; 1908, 878; 1909, 98). The metals can be grouped into those which, like palladium and cobalt, form definite hydrides; and those which, like platinum and nickel, have not been proved to form such definite hydrides. The latter class gives the best results in reduction catalyses. It is shown that in the presence of 2 per cent. of platinum the speed of the reaction is so rapid that hydrogen absorption may be used as an

analytical method of determining the amount of a given unsaturated compound in a mixture (see this J., 1908, 878). By the use of these metallic catalytic agents it is possible to effect the reduction of nitro-, halogen and other derivatives of organic compounds, and probably also of aldehydes and ketenes. In the case of cyclic compounds with double linkages there is no appreciable reaction at temperatures below 100° C.—C. A. M.

Beeswax; Analysis of — H. Ryan. Proc. Roy. Dublin Soc., 1909, 12, 210—215.

SIMULTANEOUSLY with, but independently of Hehner (Soc. Public Analysts, Jan., 1909), the author has employed a method of determining beeswax in complex wax mixtures, which is based on the assumption that the molecular weight of cerotic acid is higher than that of any other "free" acid that may occur in such mixtures intended for the manufacture of candles. The acid value is first determined by heating 4 grms. of the wax with 60 c.c. of neutral absolute alcohol, and titrating the liquid, as soon as it boils, with $N/2$ alcoholic potassium hydroxide solution. The warm mixture is next mixed with 40 grms. of clean dry sand, and evaporated to dryness in a steam oven, and the residue extracted with petroleum spirit of low boiling point for about 4 hours. The extract is evaporated in a weighed flask, and the residue of "ester" dried in the oven until constant in weight. The difference between 100 and the percentage of ester gives the amount of free acids in the wax, and from these results the acid value of the free acids can be calculated. Assuming that the only free acids present, are crude cerotic and commercial stearic and palmitic acids, the percentage of the cerotic acid may be calculated on the assumption that its mean acid value in unbleached beeswax is 146, whilst the corresponding value for commercial stearic acid is 206. The percentage by weight of the crude cerotic acid, multiplied by the factor 7.5, gives the percentage of unbleached wax in the sample. Analyses of samples of genuine beeswax from Ireland, Chili, Sierra Leone, and Madagascar are given to show that beeswax of widely different origin varies but little in composition. Since montanic acid from montana wax (see p. 878) has a higher molecular weight than that of cerotic acid, a composition wax having acid, ester, ratio and iodine values and molecular weight of free acids identical with those of beeswax could be prepared by mixing montana wax with spermaceti, carnauba wax, and ceresin. Such a mixture was obtained by melting together 2 grms. of montana wax, 0.3 gm. of pure stearic acid, 5 grms. of spermaceti, 1.5 gm. of carnauba wax, and 1.2 gm. of ceresin. This preparation gave values very similar to those of genuine beeswax, with the exception that the m. pt. varied from 46° to 67° C. Apart from this, the mixture would pass as pure beeswax if examined by Hehner's method or that described above. It contains 21.4 per cent. of hydrocarbons, however, whereas beeswax only contains 11 to 14 per cent. Again, by hydrolysing the "ester" obtained in the determination of the free acids and separating the insoluble acids from the resulting soap, it will be found that their mean molecular weight is greater than that of the combined acids in myricin. Assuming these acids to consist of only palmitic and cerotic acids, the proportion of the latter, and the corresponding amount of carnauba wax or Chinese wax may be calculated. The percentage of cerotic acid found by the author in bleached beeswax was 13.32 per cent., whilst Hehner found 15.8 per cent. —C. A. M.

Montanin and montana (montan) waxes. Ryan and Dillon. See III.

Detecting paraffin wax in lard. Shrewsbury. See XVIII A.

Cotton seed at New Orleans. For. Ann. Series, 1909.

The exports of cotton-seed oil, stearine, cake, meal, and other products of the cotton-seed industry are increasing year by year. The value of the cotton seed sent to the crushing mills may be reckoned as worth about £21,000,000 when manufactured. There are 450 mills for crushing cotton seed in the United States, with a capital of £20,000,000, giving employment to 60,000 persons.

PATENTS.

Oil; Process of separating water from — J. W. Pittock, Assignor to The Oil and Waste Saving Machine Co., Philadelphia, Pa. U.S. Pat. 928,280, July 20, 1909.

The finely-divided mixture of oil and water, which may first be filtered, is projected, with or without the aid of centrifugal force, against a surface heated to a temperature sufficient to evaporate the water without decomposing the oil. A current of air may be used to accelerate the process.—C. A. M.

Oils that have been used for lubrication; Process and apparatus for purifying — O. F. Egeberg. Fr. Pat. 398,411, Jan. 11, 1909.

THE oil is heated at a low temperature (preferably between 30 and 50° C.) in a partial vacuum in order to expel water and is freed from insoluble impurities by filtration. The apparatus claimed for this process consists of a closed jacketed vessel, heated by means of hot water. The top of this vessel ends in a tubular prolongation, which is surrounded by a steam coil (the lower end of which opens into the water jacket) and is enclosed to prevent loss of heat. Within the tubulure is suspended a perforated cone to retain oil mechanically carried forward and return it to the vessel. The steam, still carrying some oil, passes through a coil cooled by water, and the condensed liquid falls into a compartment, an opening in which (controlled by a float) is connected with the vacuum pump. The apparatus is charged from a receptacle in which the spent oil is allowed to stand for the bulk of the water to separate. The water is then siphoned off, whilst the residual oil is drawn up through a tube into the jacketed pan.—C. A. M.

Soap; Manufacture of hygienic — A. Radisson. Fr. Pat. 398,302, Jan. 5, 1909.

ORDINARY soap is dried and incorporated with a certain proportion (say 5 to 15 per cent.) of a substance (such as a metallic or organic peroxides) capable of liberating oxygen on contact with water, and the mixture is formed into pieces of the desired shape.—C. A. M.

Soap press with cooling device. G. A. Khumpp. Ger. Pat. 211,624, Oct. 19, 1907. Addition to Ger. Pat. 126,609 Feb. 3, 1901.

THE patent relates to improvements in the apparatus described in the chief patent, which is fashioned somewhat after the style of a copying press (see Lewkowitsch, this J., 1904, 1100). The cover-plates of adjacent frames are connected by means of a right- and left-handed screw so that they can be simultaneously moved in opposite directions, thus altering the size of the moulds enclosed by the frames.—A. S.

Working up residues from manufacture of cane sugar. Fr. Pat. 397,843. See XVI.

Edible fat. Fr. Pat. 398,241. See XVIII A.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

Austria-Hungary. Imports of paints containing lead Ch. of Comm. J., Aug., 1909. [T.R.]

An Austro-Hungarian Decree of April 26th, 1909, provides that all paints and fillers containing lead must have the fact clearly and conspicuously indicated on the receptacle before they can be admitted into the country and put on the market. The decree affects the following products:—Lead ashes, litharge in powder form, yellow and red lead, white lead, sulphate of lead, colours and paints, ground or mixed with varnishes containing lead. The Decree which came into effect on May 1st, 1909, has been issued on sanitary grounds.

PATENTS.

Lithographic and autographic ink. A. Manche, A. Noclain, and A. Chavet. Fr. Pat. 397,923, Dec. 24, 1908.

A LIQUID lithographic and autographic ink which will keep well, and, when dried, be insoluble in water, is prepared by mixing resins, waxes, olein, oleic acid, etc., with water, rendered alkaline and coloured with a dyestuff-derivative of pararosaniline, aniline, or toluidine. Suitable proportions mentioned for the two portions of the mixture are:—(A) Distilled water, 1000 c.c.; Aniline Violet, 1 grms.; Diamond fuchsins, 2 grms.; and ammonia solution, 30 c.c. (B) Beeswax, 60 grms.; rosin, 25 grms.; and olein, 8 grms.—C. A. M.

Metallic paint. H. Gall. Fr. Pat. 398,084, March 13, 1908.

A POWDERED metal, e.g., aluminium, is incorporated with ethyl acetate, preferably containing sufficient nitrocellulose to give to the liquid the consistency of a syrup.—C. A. M.

(B.)—RESINS, VARNISHES.

Rosin oil acids. F. Schulz. Chem. Rev. Fett- u. Harz-Ind., 1909, 16, 186–189.

AN American rosin (type C) yielded on distillation, 3 fractions with the following characteristics:—

Fraction.	Per cent. on rosin.	Colour.	Sp. gr. at 15° C.	Flashing point (open test).	Acid value.
1	3.5	Yellow	0.958	31	53.8
2	10.9	Yellowish brown	0.997	83	63.8
3	10.7	Do.	1.002	85	65.0
4	10.5	Do.	1.006	94	66.6
5	10.8	Violet brown	1.011	98	67.8
6	11.1	Blue	1.010	88	36.4
7	9.7	Bluish-green	1.008	84	30.8
8	12.0	Grass green	1.008	84	30.2
Water, gas, coke	19.8				

In practice, 50 to 60 per cent. of rosin oil (*Harzstocköl*) is obtained before distillation of the "blue oil," and the author, therefore, mixed fractions 2 to 6 (54 per cent. on the rosin), and obtained an oil with the following values:—Sp. gr. at 15° C., 1.005; viscosity at 20° C., 192° (Engler); flashing-point, 92° C., and acid value, 60.5. Three other rosins (type F) yielded 53 to 65 per cent. of rosin oil with sp. gr. of 0.990 to 0.997, and acid value of 34.7 to 47.6, whilst a sample of waste pitch (brewers' pitch) produced 50 per cent. of rosin oil (sp. gr., 0.978; acid value, 19.6) and 27 per cent. of "blue oil" (sp. gr., 0.990; acid value, 7.8). In general, the yield of acids is in accordance with the rules that hold good for "cracking" distillation. With the increase in the height of the oil-vapours the quantity of acids falls. Rapid distillation or the use of a vacuum increases the proportion of acids. The fact that the acid value of the rosin falls during the distillation, has an important bearing on the theory of the distillation process. Thus a rosin with an initial acid value of 160.7 showed values of 155.7 to 157.9 in three experiments after 25 per cent. had been distilled. The rosin acids separated from the united fractions (2 to 6) and dried at 140°–150° C., were closely similar to those yielded by American rosin of type F or G. After purification by being dissolved in benzene and extracted with 4 per cent. sodium hydroxide solution, from which they were again separated by hydrochloric acid, these acids (constituting 18 to 29 per cent. of the rosin oil) melted at 60° C., and had a molecular weight of 291, and an optical rotation at 17° C. of $[\alpha]_D = +45^\circ$ in a 1 per cent. alcoholic solution. They were probably identical with Bischoff and Nastvogel's isosylvinic acid (This., J., 1890, 927).—C. A. M.

Philippine terpenes and essential oils. Manila *chmi* and Balas resin. Bacon. See XX.

PATENT.

Removing varnish, paint, and the like from wood and other surfaces; Composition for —. J. J. Manns, Leytonstone. Eng. Pat. 4592, Feb. 24, 1909.

"OIL lime soap" (2–10 per cent.) and water (1–5 per cent.) are thoroughly incorporated with a mineral oil at a temperature of 180°–190° F., and the whole allowed to cool. To form the composition, solvents such as benzene, naphtha, and methylated spirit are added to the above mixture in suitable proportions. A second form of the composition includes stearine, and another, in addition, wood flour.—J. W. H.

(C.)—INDIA-RUBBER, &c.

Rubber vine; A —. R. F. Bacon. Philip. J. Sci., A., 1909, 4, 166.

THE woody climbing vine, *Parameria philippensis* Radlk., contains a rubber-like gum, which is present to the extent of about 4–5 per cent. in the bark. When extracted by carbon bisulphide it is yellow, but turns black on exposure and becomes tacky. The various species of *Ficus* found in the Philippines are more likely to yield a satisfactory rubber.—F. SHDN.

Antimonium sulphuratum. Alcock. See XX.

Determining antimony in its sulphide preparations Howard and Harrison. See XX.

PATENTS.

Caoutchouc (vulcanised or otherwise) and similar products; Process for the regeneration of —. G. Capelle. Fr. Pat. 398,583, Dec. 15, 1908.

THE caoutchouc to be regenerated is mixed with products of the decomposition of caoutchouc or similar products. Thus the material may be dissolved in the distillate from the dry distillation of caoutchouc or similar substances (gums, resins, etc.), and the caoutchouc separated from the filtered solution. Or the waste rubber may be finely divided and incorporated with the viscid product obtained on superheating caoutchouc or similar products.—C. A. M.

[*Rubber*] *Latex; Products obtained by mixing — with gelatin, glue, starch, casein, gums and other plastic and viscous substances, viscose and other solutions of cellulose, and, in general, with all solutions containing alkali.* See, du Caoutchouc par le Latex. Fr. Pat. 398,705, March 30, 1908.

LATEX prepared and preserved by Morisse's process (Fr. Pats. 360,324 and 360,325 of 1905; this J., 1906, 82 and 487), or other methods, is incorporated with solutions of one or more of the substances mentioned above, to form more or less solid and transparent products, the elasticity of which will depend upon the proportions of materials used, and the mode of vulcanisation subsequently employed.—C. A. M.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Reaction of the tannins; Note on a ——. M. Philip. Collegium, 1909, 249—250.

THE author revives the test suggested by Eitner and Meerkatz (Gerber, 1885), and applies it to the newer tanning materials. 100 c.c. of a 2 per cent. solution of the tannin are digested for a few minutes with 0.5 c.c. of strong sulphuric acid, and after cooling and adding 20 grms. of common salt, the mixture is filtered. In a test-tube, 10 drops of yellow ammonium sulphide are mixed with 15 c.c. of distilled water, $1\frac{1}{2}$ —2 c.c. of the tannin solution are then added, and the whole is shaken and allowed to stand. Characteristic precipitates are obtained, thus:—

Material.	Nature of precipitate.	
	At first.	Later.
Chestnut extract	Brownish	Reddish
Oakwood extract	Yellowish brown	—
Oak bark	Yellowish	Brown
Valonia	Yellow-green	Chamois
Knoppertu	Yellowish	Red-brown
Myrobalans	Greenish yellow	—
Ivix-divi	Light greenish yellow	—
Hemlock	—	Yellow brown
Mallet bark	Yellow brown	—
Mimosa bark	Reddish white	—

No precipitate was obtained with quebracho, mangrove, pine bark, cutch and gambier. The author observes that precipitates are obtained with pyrogallol tannins, but not with those of the catechol group, and hence proposes to detect the former in the latter by means of this reaction, e.g., the presence of myrobalans in quebracho extract.

—H. G. B.

Tanning analysis; International method of ——. Practical trials with nickel basins. Schell. Collegium, 1909, 227.

THE use of pure nickel basins for the evaporation of tannin solutions is not recommended for the following reasons. The nickel appears to be slightly soluble in tannin solutions, the basins being 1—2 mgrms. lighter after each evaporation. The basins being rather thick, cool very slowly; and as they are very porous, it is difficult to obtain a correct weight owing to hygrometric fluctuations during weighing. German chemists find the use of pure silver basins very satisfactory, these possessing none of the disadvantages named above.—H. Br.

Tanning analysis and possible simplifications of the official method; The use of different basins in ——. U. J. Thuau and P. de Korsak. Collegium, 1909, 228—231.

A NUMBER of tests have been made on the evaporation of tannin solutions in nickel and porcelain basins of different shapes. The evaporation was found to be much more rapid in nickel than in porcelain, and in basins with large diameter and flat bottoms than in those of any other form. The basins were dried in an oven for three hours, cooled for a quarter of an hour, and weighed. The greatest difference in weight between the residues in the porcelain basins was 1 mgrm., whereas the difference between the residues in the porcelain and in the nickel basins was 3—4 mgrms., the latter giving the higher weight. On a second drying for half an hour, all the porcelain basins were found to be of constant weight, but the nickel had lost 1.4 mgrms. From these experiments it was concluded that the porcelain basin, glazed inside and out, with inclined sides and flat bottom and of large diameter (92 mm.) was the most efficient. A second series of tests using glass, aluminium and porcelain basins, again proved the superiority of the porcelain over all the others used.

—H. Br.

Consumption of tanning extracts and barks in U.S.A. in 1908. Bureau of the Census, Washington, D.C., 1909. [T.R.]

Tanning Extracts.

	1907.		1908.	
	Million lb.	\$1000 value.	Million lb.	\$1000 value.
Quebracho	145.3	4995	143.1	4934
Chestnut	134.8	2500	146.8	2853
Hemlock	40.1	968	40.8	1043
Oak	30.8	639	21.7	460
Palmetto .....	.5	12	.1	3
Other kinds	13.3	473	39.2	1263
Total	364.9	\$9649	392.1	\$10,558

Tan Bark.

	1907.		1908.	
	1000 Cords.	\$1000 value.	1000 Cords.	\$1000 value.
Hemlock	815.8	7010	810.2	7203
Oak	374.0	3933	307.8	3325
Other kinds	24.5	605	0.3	274
Totals	1214.4	\$11,553	1127.4	\$10,803

Returns were received in 1908 from 622 works as against 58 in 1907.

PATENTS.

Patent leather or artificial patent leather; Process of making ——. G. R. de Montlord, Boston, Mass. Assignor to The Hyd-leather Mfg. Co., New York. U.S. Pat. 928,235, July 13, 1909.

THIS process consists in preparing a solution of nitro cellulose, a solvent, a vegetable oil, alcohol, glycerol, spirits of turpentine, and a suitable pigment or dyestuff, immersing the leather or fabric in ethyl acetate, coating the surface of a glass plate with one or more layers of the said solution, uniting the leather or fabric with the coating on the glass plate by pressure, then drying the leather or fabric while on the glass plate and finally removing the coated leather or fabric from the glass plate.—T. H. P.

Leather from leather-waste; Process of reconstruction of ——. A. Exbrayat and M. Loup. Fr. Pat. 397,974, Dec. 29, 1908.

THE waste leather is softened by steam and then immersed for 24 hours in ammonia solution, pressed to remove the dissolved tannin, placed in a weak soda solution, and the washed in water. After this treatment, by beating with a hammer or under a percussion press, the waste leather is brought to its natural fibrous state. A further bath of bleaching powder solution bleaches and removes a tannin which may still remain. The substance is then washed, pressed and treated with a solution of albumin and again pressed. After tanning, which may be done with any desired material, the leather is placed in hydraulic press and then glazed. A waterproofing paste may then be applied if desired.—H. Br.

Leather-board; Manufacture of impermeable ——. E. S. Buffum and W. W. Carter. Fr. Pat. 398,199, Dec. 31, 1908. Under Int. Conv., Jan. 2, 1908.

THE pulp containing fibres of tanned hide, is neutralised with a soap solution and a soluble salt of a fatty acid added and the mixture heated and well stirred for about 1 hour. To this mixture, alum, aluminium sulphate, calcium chloride, or copperas (ferrous sulphate) is added which reacts with the soap, forming an insoluble precipitate on the fibres of the pulp. The pulp is then formed into sheets in the usual manner.—H. Br.

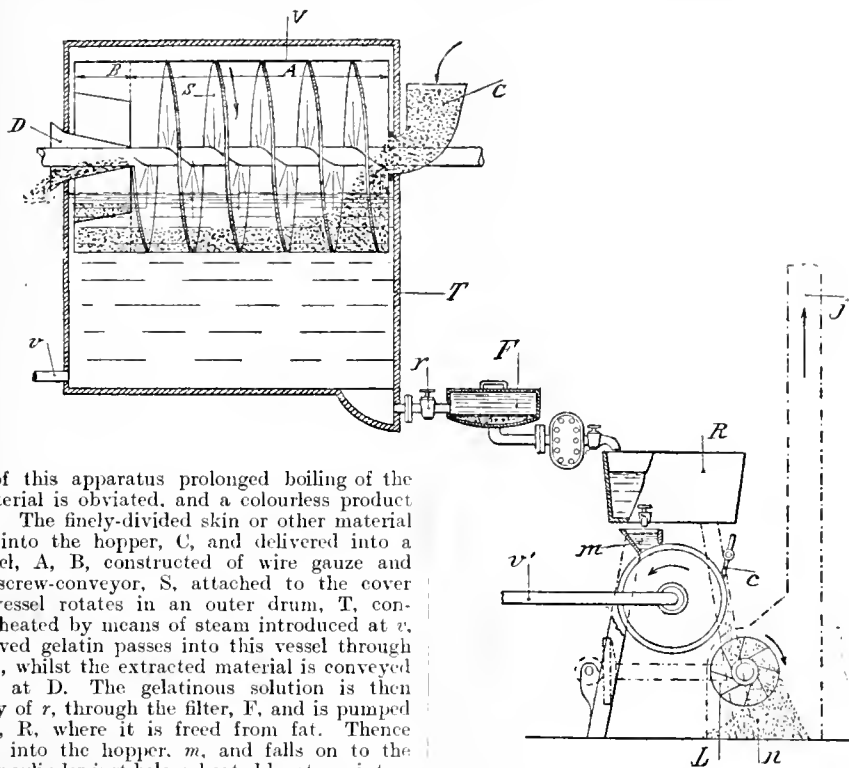
Glue and gelatin solutions and solutions of salts; Process of purification of ——. G. B. M. Spigno. Fr. Pat. 397,804, Dec. 22, 1908. Under Int. Conv., Dec. 22, 1907.

THIS process deals with the elimination of lime from glue and gelatin solutions, as well as the recovery of the acid

from solutions of salts, especially those employed in the annery. The glue or gelatin solution is treated with a slight excess of dilute sulphuric acid to decompose insoluble soaps and precipitate lime as calcium sulphate; barium carbonate is then added to precipitate excess of sulphuric acid, and the solution is well mixed. After settling, the solution is decanted or filtered. Where acids such as formic, lactic, or acetic acid have been used as solvents of lime they may be recovered by the above process.

—H. BR.

Glue; Process and apparatus for making colourless —, and for drying aqueous solutions of every kind. J. Lehmann. Fr. Pat. 398,598, Jan. 18, 1909.



By the use of this apparatus prolonged boiling of the gelatinous material is obviated, and a colourless product thus obtained. The finely-divided skin or other material is introduced into the hopper, C, and delivered into a rotatable vessel, A, B, constructed of wire gauze and containing a screw-conveyor, S, attached to the cover at V. This vessel rotates in an outer drum, T, containing water heated by means of steam introduced at v , and the dissolved gelatin passes into this vessel through the wire gauze, whilst the extracted material is conveyed to the outlet at D. The gelatinous solution is then passed, by way of r , through the filter, F, and is pumped into the tank, R, where it is freed from fat. Thence it is delivered into the hopper, m , and falls on to the rotating drying cylinder just below, heated by steam introduced at v' , where it is immediately dried into a thin film. This is detached by the scraper, c , and falls between the longitudinal wings (made of wire gauze) of the rotating cylinder, L, the drying being accelerated by a current of air passing up the chimney, j . The product falls in fine dry flakes at n .—C. A. M.

Glue solutions free from fat; Process for the manufacture of —. Actien-Maschinenbau-Anstalt vorm. Venuloth und Ellenberger and W. Schmidt. Ger. Pat. 211,574, Sept. 25, 1907.

In the preparation of glue solution from bones, by treatment with steam under pressure in closed boilers, the solution produced is led from the boilers into one of two tall, fat-separating vessels, connected at the bottom by a pipe and provided above with pipes for running off the separated fat. By means of suitable pipes and valves, the solution is forced by means of the steam pressure in the boilers, first from one of the tall vessels into the other, and then back again, the separated fat being drawn off from one and from the other vessel alternately, and the operations repeated until no more fat separates. In order to accelerate the separation of the fat, the tall vessels are heated by means of the waste steam from the boilers.—A. S.

Proofing of jute, hemp, &c. Fr. Pat. 398,502. See V.

XVI.—SUGAR, STARCH, GUM, &c.

Asparagus; Two new carbohydrates from —. G. Taurat. Comptes rend., 1909, 149, 48–50.

ASPARAGUS roots were found to contain besides sucrose and invert sugar, two new carbohydrates, *asparagose* and *pseudo-asparagose*. These latter were isolated by a series of fractional precipitations with baryta and alcohol from the aqueous extract of asparagus roots, free from young shoots. Asparagose, $(C_6H_{10}O_5)_n + H_2O$ (n = probably 15 or 16), m.pt. 198° – 200° C., $[\alpha]_D - 35.1^\circ$ when

anhydrous, is tasteless, and when not completely dehydrated acquires a horny condition, as does inulin. It was obtained by the author in fine microscopic needles. It is soluble in 2 parts of cold water, in 340 parts of 95 per cent. alcohol, 103 of 90 per cent., 69 of 80 per cent., 37 of 70 per cent., and in 16 of 60 per cent. alcohol; it is almost insoluble in anhydrous methyl alcohol. It has no reducing action on Fehling's solution, and gives no coloration with iodine. When hydrolysed with acetic acid it yields 93 per cent. of levulose and 7 of dextrose. It is hydrolysed with extreme slowness by invertase, and is destroyed slowly by yeast in presence of a fermentable sugar. It was not found possible to crystallise pseudo-asparagose, which was obtained as a white slightly hygroscopic substance, of specific rotatory power, $[\alpha]_D = 30.3^\circ$, easily soluble in cold water, much more soluble than asparagose, in ethyl alcohol of different concentrations, and soluble in 40 parts of anhydrous methyl alcohol. On hydrolysis it yields 86 per cent. of levulose and 14 of dextrose. It is hydrolysed slowly by invertase. Both asparagose and pseudo-asparagose are present to the extent of 6.7 per cent. in the juice of asparagus roots. The young shoots of asparagus used for culinary purposes do not contain appreciable quantities of these new carbohydrates, which are also absent from the red berries, although present in the green ones.—A. S.

Carbohydrates [starch, glycogen, dextrins]; Colorimetric method for the determination of molecular weights of —.
 II. (Differentiation between primary, secondary and tertiary alcohols). L. Wacker. Ber., 1909, 42, 2675—2680.

In a previous paper (Ber., 1908, 41, 266) the author proposed a method for the determination of the molecular complexity, in terms of hexose groups, of carbohydrates and polysaccharides. The method was based on the development of a red coloration with a strongly alkaline solution of phenylhydrazinesulphonic acid, and the intensity of the colour was ascertained to be constant for equimolecular concentrations of various carbohydrates. This suggests that the chromophoric group is a terminal radical, probably the terminal primary alcoholic group of the chain, since the cyclic alcohol, inositol, does not react. In the present paper the author deals more particularly with starch. The colour standards employed were prepared from $N/1000$ solutions of dextrose or preferably maltose, since it was remarked that the monohexoses give colorations of a slightly bluer tone than the polysaccharides, the results consequently appearing 5—10 per cent. higher. Experiments were first conducted to prove that the starch molecule is not depolymerised by the action of the sodium hydroxide employed. Ordinary starch gave numbers indicating that it is equivalent to 7 hexose groups, but since ordinary starch is a mixture, steps were taken to fractionate it by repeated extraction with boiling water, at a dilution of 1 per 1000. Each fraction was precipitated with alcohol, dried and tested separately; the results indicated: (1), "readily soluble granulose," 5 hexose groups; (2) "less readily soluble granulose," 6; (3), "once decocted starch cellulose," 7; (4), "repeatedly decocted starch cellulose," 8. Erythro-dextrin and achroo-dextrin both gave approximately equal values, viz., 4 hexose groups. Liver-glycogen from different sources showed a molecular complex of 10 hexose groups. For the differentiation between primary and other types of alcohols, $N/100$ solutions of the alcohols and typical standards are prepared, and either 10 or 20 c.c. of each are placed in cylinders and diluted to 100 c.c. A quantity of *p*-phenylhydrazinesulphonic acid is then weighed out, corresponding to 0.4 gm. per test, and is dissolved in sufficient water, with a little sodium hydroxide, to make a solution containing 0.4 gm. per 1 c.c. Each cylinder receives 1 c.c. of the freshly prepared solution, and then 25 c.c. of a 33 per cent. solution of sodium hydroxide are added to each. The contents of the cylinders are stirred every 15 minutes during the first 2—3 hours, and the colours are best observed after 7—8 hours. If the colours are required to keep for several days, 30 c.c. of 33 per cent. sodium hydroxide should be added after the estimation has been made. In the case of carbohydrates a concentration of $N/2000$ gives the best conditions for comparison. Primary alcohols treated in the above manner yield an intense red coloration, whilst secondary and tertiary alcohols show little more colour than a blank, which should always be made up with water under similar conditions. Primary, secondary and tertiary amines also give the same colour reaction, whilst amino-acids, such as glycocoll, give a Bordeaux-red coloration.—J. F. B.

Colloidal starch; Solubilisation of — under the action of alkalis. E. Fouard. Bull. Soc. Chim., 1909, 5, 828—834.

EXPERIMENTS were performed on a perfect solution of soluble starch, containing 25.79 grms. of starch per litre and perfectly neutral (see this J., 1909, 433). Twenty c.c. of this solution were treated in each case with 5 c.c. of potassium hydroxide solution of varying strengths and the mixture poured drop by drop into 250 c.c. of absolute alcohol. By this means the starch was all precipitated together with a quantity of alkali which was constant, for a given strength of the potassium hydroxide solution, if the whole was allowed to stand for some time. By determining the amount of alkali left in the liquid, the amount which was adsorbed by the starch was found. The determinations were made by chemical methods where the concentrations were large; the very low

concentrations were determined by measurements of the electrical conductivity of the solutions. It was found that if the amount of total alkali used, was compared with the amount adsorbed, a typical adsorption curve (hypobolic) was obtained. A similar curve was obtained when the perfect starch solution was replaced by a colloidal solution, but in this case the proportion adsorbed was less. The author comes to the conclusion that no chemical combination takes place and that the starch exhibits no acid functions. Solutions of ammonia and of piperidine are adsorbed to a much lesser extent than potassium hydroxide, by the soluble starch under the same conditions. The author concludes that the action is essentially ionic. The electrical conductivities of the liquids before precipitation with alcohol were also examined and compared with those of the alkali solutions alone. In every case the presence of perfectly soluble starch solution lowered the conductivity of the liquid, but to a much lesser extent in the case of ammonia and of piperidine than when potassium hydroxide solution was used, showing, according to the author, that the association of starch with the metallic ions takes place before coagulation.—E. F.

Starch; Colorations of colloidal and of completely soluble — with a solution of iodine in potassium iodide. M. Castoro. Gaz. chim. ital., 1909, 39, I., 603—607.

By heating chick-pea starch with 2 per cent. sulphuric acid for 5 hours on the water-bath, and filtering, a pseudo-solution is obtained, from which absolute alcohol precipitates white flocks of ordinary soluble starch. This is separated into two portions on treatment with water. The insoluble portion gives a blue-violet colour with iodine solution and corresponds to the amylopectin of Maquenne and Roux (see Gatin-Gruzewska, this J., 1908, 415). The other forms a pseudo-solution which gives an intense blue with iodine. On dialysis, this portion is further divided into a colloidal fraction giving a blue colour with iodine and corresponding to amylose (*loc. cit.*) and a perfectly soluble portion giving a violet colour with iodine. By heating a 5 per cent. potato starch paste with 0.1 per cent. of sulphuric acid for about 1 hour, and filtering, a clear mobile liquid is obtained which is coloured blue, with blue-green reflex, by iodine, and shows distinctly the "Tyndall phenomenon." On dialysis, the diffusible fraction also gives a blue colour with iodine and shows much less sharply the "Tyndall phenomenon"; on standing it becomes opalescent. If the starch paste be heated with 1 per cent. of sulphuric acid, the resulting pseudo-solution filters much more readily. The clear mobile filtrate shows distinctly the "Tyndall phenomenon" and with iodine gives a blue colour, with blue-violet reflex. On dialysis of this pseudo-solution, the diffusible portion gives a violet coloration with iodine. The different colorations of starch solutions with iodine are thus due to difference in the size of the particles in solution or pseudo-solution. Analogous differences are shown by colloidal gold solutions (See also Fouard, this J., 1907, 832; 1908, 238, 631, 1215).—A. S.

Constitution of perseulose. Bertrand. See XXIV.

Cereal products. J. H. Quine. See XVIII.

Oxydases. O. Dony-Henault. See XXIV.

PATENTS.

Sugar-house and distillery; Process for charging the diffusers used in the —. L. A. Lambert. Fire Addition, dated Mar. 23, 1908, to Fr. Pat. 396,628 Jan. 31, 1908 (this J., 1909, 617).

CLAIM is made for the application of the previously described process to a circular diffusion battery.—L. E.

Saturation contrivances for automatic diffusion, which, by effecting carbonation in the withdrawal cock, eliminate the saturators. C. E. Vallery. Fr. Pat. 397,752, Mar. 1, 1908.

THE liquid and compressed gas are contained in a vessel from which the liquid passes downwards through a series

if perforated, silvered copper discs. These discs are arranged one above another, the perforations of one disc not being directly above those of the next. The discs may be situated in the upper part of the withdrawal cock or elsewhere. The compressed gas from the vessel may be brought into contact with the liquid passing through the perforated discs, by a silvered copper tube passing downwards from the vessel through the centres of the discs; the tube is provided with perforations, so placed, that the compressed gas passes into the spaces between the discs, and saturates the liquid.—L. E.

Sugar; Process for working up residues from the manufacture of cane — A. Wynberg. Fr. Pat. 397,843; Dec. 24, 1908.

Filter press or other residues are reduced to small pieces, dried, and treated with a suitable solvent, such as ether, alcohol, carbon bisulphide, carbon tetrachloride, benzene, etc., whereby wax, or fatty substances, are dissolved, and a residue is left from which the sugar is extracted with water. The colour of the wax left on removing the solvent, varies from greenish-yellow to blackish-brown. The wax is refined and bleached by treatment with nascent chlorine, or with a substance such as fuller's earth, or by successive treatment with both these agents. The wax may be separated into a soft, pale-coloured, saponifiable wax, and a hard, darker-coloured, non-saponifiable wax, by suitable means, e.g., by crystallisation from benzene.—L. E.

Saccharine liquids; Process for purifying [sugar] juices and other — by hydrofluosilicic acid and soluble double fluorides. — L. Rivière. Fr. Pat. 398,063, Dec. 5, 1908. Under Int. Conv., Dec. 7, 1907. (See also this J., 1907, 936; 1908, 584, 702, 869, 1076.)

Diffusion or expressed juice, or other saccharine liquid, treated with hydrofluosilicic acid, or with one or more soluble fluorosilicates, in the state of crystallised salts preferably zinc or magnesium fluorosilicate or both, or with hydrofluosilicic acid and a metallic oxide or carbonate. Potash, soda, and other bases are thrown down, and the gelatinous precipitate also carries down suspended matter; in certain cases, insoluble compounds are formed between the acids combined as salts in the saccharine liquid and the bases of the soluble fluorosilicates. By this preliminary purification, the diffusion juice is rendered less liable to fermentation; it is then worked up in the ordinary way, and, as a result of the preliminary treatment, the proportion of molasses is reduced to a minimum. The following processes for making hydrofluosilicic acid and fluorosilicates are so claimed: A. Decomposition of alkali fluorosilicates by sodium bisulphate. B. Decomposition of native or precipitated calcium fluoride by sodium bisulphate, conversion of the hydrofluoric acid thus formed into hydrofluosilicic acid by addition of silica and finally into soluble fluorosilicates by digesting metallic oxides or carbonates with the hydrofluosilicic acid.—L. E.

XVII.—BREWING, WINES, SPIRITS, &c.

East juice; The role of the enzymes in — E. Buchner and H. Haehn. Biochem. Zeits., 1909, 19, 191—218.

Fresh yeast juice rapidly loses its power of fermenting sugar when kept. This has been ascribed to the influence of the endoptyptase which has been shown to be present in the juice, but it is unlikely that two enzymes present in a cell should be mutually inimical. Harden and Young (this J., 1908, 824) have shown that for fermentation to occur the zymase, the presence of a so-called co-enzyme is necessary. Yeast juice can be divided by dialysis by filtration through a gelatin filter into a residue and a filtrate, both separately inactive, but when combined capable of producing fermentation. The inactive residue can also be activated by addition of boiled east juice, which is similarly able to revive a juice which has lost its fermentative power by continued action on sugar. The co-enzyme appears to be an organic phosphoric acid compound not precipitable

by magnesia mixture, and destroyed by ignition, or by lipase; lecithin produces results similar in many respects to those yielded by the boiled juice. The authors show that the revivification of a yeast juice by boiled juice is not without limits. If the addition is made three days after the beginning of fermentation, the gas generated is always in notable amount, but if added only a day later, the juice often produces little or no effect. This is due to the fact that the co-enzyme originally present having been destroyed, its protective action is removed and the endoptyptase destroys the enzyme, which in consequence cannot be revived by further additions of boiled juice. Yeast juice stored at 22° C. without sugar, loses its power of being revived by boiled juice much earlier than if sugar had been present, which shows that the reduction of power occurring in the juice from day to day is not connected with the fermentation it may have produced. By studying the influence of additions of glycerin, disodium phosphate, and potassium carbonate, it has been sought to decide whether the co-enzyme really does disappear as the fermentative power of the juice decreases. In agreement with the old observations of Wittich and Hüfner on the preservation of enzymes, addition of glycerin was found to maintain the activity of stored juice for one or two days, after which it could be further stimulated by addition of boiled juice. Addition of 5 per cent. of disodium phosphate acted very beneficially in maintaining, or regenerating, the fermentative power, apparently protecting the zymase from the action of the endoptyptase by its slight alkalinity and also restraining the destruction of the co-enzyme by its phosphoric acid content. Potassium carbonate, in 2.5 per cent. strength, protects the zymase, so that revivification of a juice preserved with it, is always very marked, but it destroys the co-enzyme. Buchner and Klatte (Biochem. Zeits., 1908, 8, 533; and this J., 1908, 515), showed that a juice could be kept active for two or three weeks by repeated additions of sugar and boiled juice; the authors now show that a similar result can be obtained by repeated addition of boiled juice only. It thus appears that the co-enzyme shields the zymase from the action of the proteolytic enzyme, but is itself destroyed by some other agency, as digestion with trypsin does not destroy the revivifying action of a boiled juice. On the other hand, the power of the boiled juice is much reduced by the action of lipase, by standing with 2.5 per cent. potassium carbonate solution, and even by repeatedly boiling, all of which agrees with the assumption that the active substance is a readily hydrolysable organic phosphoric acid ester, and, as it can be readily precipitated from a boiled juice by alcohol, endeavours will be made to isolate such a compound.—R. L. S.

Top-fermentation systems; Technical and commercial points of [German] — F. Schönfeld. Woch. f. Brau., 1909, 26, 352—353.

In Germany two systems are in vogue in the top-fermentation breweries: the tun system and the cask system. The tun system affords a better working up of the yeast and a more complete purging of the beer; the latter clears more rapidly, leaves less deposit, and suffers less waste. In the cask system the yeast tends to fall back again when it works up to the top of the cask, and more remains in the beer to be separated by sedimentation, causing greater loss in racking. The smaller the casks the greater is the waste, and the cleansing of the beer is made more difficult by the necessity of frequently filling up the cask with beer already cleansed, in order that the yeast may work its way out of the bung hole. Tun fermentation can be carried out at a lower temperature than cask fermentation, since the resistance offered by the walls of the cask cannot be overcome at low temperatures. The oxygen-requirements of the yeast are not fully satisfied by the air entering the narrow bung-hole; the fermentation therefore tends to be sluggish and the crop of yeast a poor one. Besides providing for a high fermentation temperature in cask fermentation, it is also desirable to give a powerful aëration before fermentation sets in. This is best done by pitching the yeast in a tun and racking over into casks only shortly before the yeast begins to work up; the operation of racking aërates the beer. Other conditions

being equal, attenuation tends to go further in cask fermentation, than in tun fermentation. In tun fermentation it is possible to fractionate the yeasts of different fermentative capacities and physiological qualities, whereas this is impossible in cask fermentation, the whole mixture of all kinds of yeasts in all stages of maturity being expelled bodily together with the beer. In certain small breweries with irregular turn-over, the cask system may be advantageous, provided the casks are lacquered internally and fitted with some arrangement for catching the yeast at the bung-hole. In the case of certain beers, e.g., Berlin "Weissbier," it is absolutely essential to use the tun system, because these throw up a sticky scum of impurities, which must be removed by skimming.—J. F. B.

Fermentation; Pure — by a continuous process in closed steel tanks. P. Martens. Z. ges. Brauw., 1909, 32, 372—373.

Is the "Yeasting Forward System," recently introduced in America, the fermenting vessels consist of closed steel tanks, which are best of such size that one is capable of holding the whole of a brew. The sterile wort is run into the first of these tanks, in which it is pitched with a considerable quantity of yeast. While the wort is running in, it is aerated by means of an aerating cock, this aeration being repeated the next day. When the first head has formed on the wort—this occupies about 24 hours—the tank is connected by means of a hose with the second tank, into which one-half of the fermenting wort is allowed to pass. The second brew is then divided equally between these two tanks, the contents of the first being allowed to ferment to an end. On the next day, one-half of the contents of the second tank is introduced into a third tank, and so on. While the head is forming and for one day after it has formed, a three-way cock at the upper part of the tank is so arranged that the carbon dioxide passes into the air. But when all the air has been displaced from the tank, the carbon dioxide is drawn off, compressed and used for carbonation. During the whole fermentation, however, care is taken that a slight excess pressure prevails in the fermenting vessel. On the last day of the fermentation, a current of air is passed over the surface of the beer, the effect of this being that the yeast settles rapidly and compactly to the bottom of the vessel. This system is rapid, keeps the yeast almost pure and admits of the use of fermenting vessels of almost any size. Further, it effects a saving in labour.—T. H. P.

Stouts; The presence of yeasts which produce secondary fermentation in English and German — F. Schönfeld and J. Dehnicke. Woch. f. Brau., 1909, 26, 365—368, 377—379.

THE authors have examined a number of English and German bottled stouts and confirm the statements of van Laer, Claussen, and others, that English stout contains large numbers of secondary-fermentation yeasts which, when added to dark beers, produce a characteristic taste and odour of stout in the same. On the other hand, these yeasts were not found in German stouts, although other wild yeasts were found which to some extent gave a characteristic taste to the beverage. It appears that, whilst certain of the *Torula* species produce the best stout, other "wild" yeasts are capable of forming aromatic substances, though to a less extent than the former.—W. P. S.

Yeast after fermentation; The life of — E. Kayser and A. Demolon. Comptes rend., 1909, 149, 152—155.

IN the preparation of fermented beverages the yeast is not to be regarded merely as an agent for producing alcohol, intracellular reactions also intervene, resulting from the complex vital activities of the cells, which reactions may continue after the complete disappearance of the sugar. For instance, in practice, certain white wines which clarify badly may be treated successfully by leaving them in contact with coarse lees from December until the spring. The authors have previously shown that prolonged contact with the lees is accompanied by

phenomena of oxidation, attributable to the yeast and depending on the degree of aeration. They have now studied the influence of temperature, variety of yeast, life-history and nitrogenous nutrition of the yeast on the phenomena previously observed. They have worked with sterile, filtered wines, and yeast previously cultivated under aseptic conditions, the observations extending over a period of six months. In all cases a disappearance of alcohol was recorded quite apart from that due to evaporation, and particularly large when free access of air was allowed. It is definitely established that the yeast is capable of attacking the alcohol after fermentation. In some cases the production of aldehyde is remarkably large, this reaction being even capable of taking place at temperatures near 0°C. The previous history of the yeast and its nitrogenous nutrition play an important part in its activity after fermentation. The total acidity of the wine also decreases owing to the destruction of the fixed acids, and since this happens without exposure to air, it must be concluded that these acids are assimilable by yeast in absence of sugar. The changes in the furfural content suggest that the yeast plays a part in its formation, probably as the result of nitrogenous metabolism. The ethers and higher alcohols undergo very little change. The difference between the ordinary yeasts and the definitely alcohol-consuming yeasts is only one of degree.—J. F. B.

Ciders; Action of ultra-violet rays on fermenting — Maurain and Warcollier. Comptes rend., 1909, 149, 155—156.

THE authors have observed that exposure to the ultra-violet rays is capable of arresting the fermentation of cider. The cider itself absorbs the rays very largely, and in order to arrest the fermentation, it is necessary to make the exposure in very thin layers, or else to dilute the cider considerably. The source of the rays used, was a mercury-vapour lamp of quartz and the specimens were exposed in quartz cells. When the cider was exposed in layers of about 0.25 mm., a time of exposure of about 3 minutes was sufficient to arrest fermentation; in layers of 1 mm. in thickness, the absorption of the rays by the liquid was sufficiently great to prevent their action on the yeast furthest removed from the source of light. With cider diluted 20 times with water, an exposure of 1—2 minutes was sufficient to arrest fermentation in layers 1.75 mm. thick.—J. F. B.

Jamaica rum; Studies of fermentations in manufacture of — S. F. Ashby. Int. Sugar J., 1909, 11, 243—251, 300—307.

TWO types of yeast—budding yeasts and fission yeasts—can be isolated from rum washes. The budding yeasts ferment more rapidly than the fission yeasts, but they are far more sensitive to acids. Of the three common distillery acids, lactic acid is the least inhibitive, acetic acid is more so, and butyric acid is decidedly poisonous. Budding yeasts, on account of their greater activity, may predominate in liquids of low acidity, but the fission yeasts are practically always the fermentation agents in ordinary sugar-estate washes, which are generally too acid for the former type. Some of the fission yeasts possess bottom-fermentation characters, whilst others are top-fermentation yeasts. None of these yeasts is capable of developing the flavour of rum on its own account, the flavouring ethers (esters) being produced by the long contact of the alcohol with the acids of the wash, but the top fermentation yeast, owing to its slower action, prolongs this contact and thus favours the production of ethers (esters) and gives a better rum. The bottom yeast is a more rapid worker than the top yeast, giving an advantage of 2—3 days in the fermentation period; it gives a rapid and uniform main fermentation, but the wash "dies" slowly. The top yeast shows a uniform fermentation throughout, lasting for 7—9 days, during which 16—18 per cent. of proof spirit is produced. Washes containing up to 16 per cent. of sugar may be fermented in a reasonable time; stronger washes are uneconomical owing to sluggish fermentations. The yeasts attenuate about equally, but the bottom yeast gives a better yield

alcohol, because the yeast-crop is less. Owing to the exposure of the top-fermentation yeast to the air, it produces a far larger crop, and more sugar is consumed in the work of reproduction. The top-fermentation yeast leaves less unfermented sugar in the wash. The bottom yeast is capable of producing 25 per cent. of proof spirit in the presence of an excess of sugar, as against 23 per cent. for the top yeast; it also shows the injurious effect of alcohol at a higher concentration than the top yeast, i.e., 18 per cent. of proof spirit, as against 16 per cent. indications were obtained to the effect that the bottom yeast is probably unstable in type, and when kept in the presence of fermented wash, is liable to change over to the top-fermentation type. When molasses is stored for some weeks, it is liable to undergo spontaneous fermentation and a serious loss of sugar is liable to occur. The author has isolated the active agent of this fermentation in the form of a *Torula*, which is capable of fermenting only the invert sugar of strong molasses. Its activity is best checked by liming the molasses at the rate of 6 lb. for 100 gallons, the lime being added in the form of a milk with a minimum quantity of water. The author is also studying the "fruit ether" yeast of molasses; it works very slowly, washes set up with it fermenting in periods of up to 27 days. The yeast apparently produces both alcohol and acetic acid, but the increase of acid is low; the esterification, therefore, is probably in close relation with the vital activity of the yeast.

—J. F. B.

Enzymes and anti-enzymes. Vandevelde. See XVIII.A.

Disinfectant. "Keramyl." Prior. See XVIII.C.

Oxydases. O. Dony-Hénault. See XXIV.

PATENTS.

Kwass"; *Process for the production of* —. A. Eisenberg, St. Petersburg. Eng. Pat. 20,978, Oct. 5, 1908.

MASH is prepared at a temperature of from 45° to 70° C. from malted barley or rye, or from potato starch to which about 10 per cent. of malt has been added. When complete inversion of the starch has taken place, the mash is strained, boiled, cooled, and allowed to settle. The liquid is then drawn off, fermented by the addition of activated yeast, and, when the desired quantity of alcohol has been produced, the yeast cells are removed by suitable means. The liquid is next inoculated with organisms which produce lactic acid fermentation, and finally filtered into receptacles containing proportionate quantities of sugar syrup or honey and spice.—W. P. S.

Wine fermentation; Apparatus for — and decantation of sparkling wines under pressure. E. Charmat, Paris. U.S. Pat. 927,944, July 13, 1909.

In combination with apparatus for bottling effervescent liquids, an apparatus is arranged adapted to maintain uniform gaseous pressure, comprising fermentation receptacles, a pasteurising apparatus, cooling and decanting apparatus, a source of carbon dioxide or other inert gas, a "dosing" apparatus, a storage receptacle and a system of pipes arranged and combined to serve for the circulation of the wine through the apparatus and the inter-connection of the parts under gas pressure for the purpose of maintaining the same uniform throughout the apparatus; a system of pipes for the circulation of steam for pasteurising and for cleansing the interior of the vessels and pipes; a system of pipes for the circulation of a refrigerating medium through the cooling and decanting apparatus; an air inlet filter, the whole so combined that the fermentation receptacles are in communication with the atmosphere through the filter, whilst the remainder of the apparatus is in a closed cycle adapted to maintain the effervescent liquid under uniform gas pressure throughout.—T. H. P.

Vinegar; Process of making —. W. Antoni, Lodi, Cal. U.S. Pat. 928,578, July 20, 1909.

WINE, cider, or the like is subjected to partial distillation, at the ordinary or diminished pressure, the distillate being acetified by the quick process and the residue by the action of an acetified distillate. The two acetified liquids are then mixed.—T. H. P.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Nitrogen-free extractive matter in fodders and foodstuffs. J. König and W. Sutthoff. Landw. Vers.-Stat., 1909, 70, 343—403. Chem. Zentr., 1909, 2, 304—305.

THE nitrogen-free extractive matter of fodders and foodstuffs comprises carbohydrates of different kinds, acids, colouring matters, bitter principles, pectin substances, and methylated and acetylated compounds. Methods are available for the quantitative determination of the acids, the carbohydrates soluble in cold water, the pentosans together with the hemicelluloses soluble in dilute acids, and the cellulose, together with the accompanying cutin. The different methods which have been proposed for the determination of starch yield widely varying results. Mayrhofer's direct method is probably the most accurate, but is not always applicable. The inversion process, based on the use of steam under pressure, or of dilute acids, and determination of the sugar produced (allowance being made for the pentoses also formed) yields more accurate results than the fermentation process. Lintner's polarisation process yields good results even with materials poor in starch. The nitrogen-free extractive matter also contains not inconsiderable quantities of substances which cannot at present be determined and the nature of which is unknown, although from their high carbon content, they may probably be grouped with the "lignins." These substances with a higher carbon content than carbohydrates behave in a similar manner to the hemicelluloses. They are insoluble in cold water, but partially dissolve when treated with steam under pressure, or with dilute acids, e.g., the glycerin-sulphuric acid reagent of König. The portion soluble in water under pressure has a lower carbon-content than that soluble in glycerin-sulphuric acid, the carbon content of the latter portion being slightly higher than that of the lignin in the "crude fibre." The digestibility of the substances dissolved by glycerin-sulphuric acid is always less than, or equal to, but never greater than that of the insoluble "crude fibre." The authors' results show that analysis as performed at present, gives no insight into the actual content of "lignins," if this term be used to designate compounds containing more than 45.5 per cent. of carbon. Apparently the substances rich in carbon ("lignins") are present in different stages of condensation, in a manner analogous to the hexoses (dextrin, starch, hemihexosans, and cellulose-hexosan). The carbon-content of the digested "total nitrogen-free extractive matter" is uniformly higher than that of the digested nitrogen-free "crude fibre," of which relatively more cellulose than lignin is digested. Since the carbon-content of the digested "total nitrogen-free extractive matter" is also higher than that of carbohydrates (up to 45.5 per cent. for pentosans), the term "carbohydrates" would not be justified for this portion of fodders and foodstuffs rich in "crude fibre," whilst the name "nitrogen-free extractive matter" is a misleading description of substances which are not readily soluble. It is suggested that for the present the name "other nitrogen-free substances" be adopted.—A. S.

Birch-juice; Composition of —. W. Lenz. Ber. deutsch. pharm. Ges., 1909, 19, 332—343.

THE Birch-water obtained by tapping the trees (50 of which yield about 175 kilos. of juice in 4 days) is mixed with dextrose and milk of almonds and fermented into

birch-wine. The following table gives analytical results obtained with three commercial samples of the juice, and with a specimen obtained directly from the trees:—

	Sp. gr. at 15° C.	N/10 KOH required to neutralise 100 c.c.	Total solids in 100 c.c.	Ash.	Reducing sugars.
		c.c.	grms.	grms.	grms.
Commercial juice (Hamburg)	1.0220	20.08	0.4960	0.041	0.0269
Do. with addition of alcohol	(0.9926)	25.49	0.3088	0.033	0.0323
Commercial juice (Harz) with addition of alcohol ..	(0.9947)	22.35	0.2540	0.039	0.0135
Juice from trees	1.0071	7.00	1.6760	0.036	1.5400

The last of the above ("Juice from the trees") was obtained directly, in the spring of the present year. The remaining three were juices of 1908.

The sugar consisted in the main if not entirely of levulose. In each case large quantities of malates (notably calcium malate) were found, but oxalic, citric and tartaric acids were absent. The ash was characterised by the large excess of basic constituents. Thus, the ash of the fourth sample after being warmed with *N/10* sulphuric acid, the excess of which was titrated back, showed an alkalinity corresponding to 58.1 per cent. of potassium carbonate.

—C. A. M.

Protein substances; Hydrolysis of — by means of hydrofluoric acid. L. Hugonin and A. Morel. *Comptes rend.*, 1909, 149, 41—43.

HYDROFLUORIC acid behaves differently in its hydrolytic action upon proteins of different origin and of different degrees of resistance to its action. Thus in the case of substances, such as gelatin, which have been modified by boiling, complete hydrolysis is effected by a 15 per cent. solution of hydrofluoric acid, the products consisting of amino-acids. With stronger acid (20 to 30 per cent.) amino acids are still liberated, but are accompanied by di- and tripeptides. At a concentration of 35 per cent. of hydrofluoric acid, the products of hydrolysis include only a small proportion of amino-acids, for the polypeptides formed resist the further action of the acid, though they can be decomposed by a more profound hydrolysis. One of them yielded the following products: Arginine, lysine, phenylalanine, alanine, and glycocoll. At a concentration of 45 per cent. of acid, free diamines are no longer obtained, even after long-continued heating. Further experiments have shown that hydrofluoric acid in solutions of a concentration to liberate these peptides, does not effect the condensation of free amino-acids. In the author's opinion the peptides represent natural complexes pre-existing in the protein molecule. Some of them can be obtained as crystalline compounds (nitrates, picrates). Hydrofluoric acid may be used as a reagent which will show the presence not only of free amino-acids or their compounds, but also of other constituents belonging to the series of amino derivatives of the sugar group, some of which are reducing and others non-reducing substances. By the use of hydrofluoric acid at a suitable concentration proteins may be gradually hydrolysed on the boiling water-bath so as to yield a series of products in different stages of hydrolysis.—C. A. M.

Paraffin wax in lard; Rapid sorting-test for the detection of —. H. S. Shrewsbury. *Analyst*, 1909, 34, 348.

FIVE grms. of the melted lard are saponified with 20 c.c. of a reagent prepared by dissolving 453 grms. of sodium hydroxide in 1 litre of water and adding 500 c.c. of glycerol. The hot product of the saponification is dissolved in 50 c.c. of industrial (non-mineralised) methylated spirit, added drop by drop, and the appearance of the cooled solution is observed. Pure lard gives a clear solution, whilst in presence of as little as 2 per cent. of paraffin wax, opaque flocks are observed. After some time the solution sets to a slightly opalescent, but homogeneous jelly in the case of pure lard, but if 2 per cent. of paraffin wax be present, the opaque flocks impart a very characteristic cloudy appearance to the jelly.—A. S.

Enzymes and anti-enzymes. [Milk, etc.] A. J. J. Vandevelde. *Bull. Soc. Chim. Belg.*, 1909, 23, 288.

ADDITION of a solution of iodoform in acetone prevents all bacterial development in physiological media but does not

affect enzyme activity. The study of the autolysis of milk and of certain serums shows that when these are subjected to a preliminary heating for half an hour at 55° C.,

the proteolytic properties are increased. This behaviour is explained as due to the destruction of an anti-enzyme by heat, so that the action of the enzyme, having nothing to oppose it, is increased.—E. F. A.

Casinate; Refractive indices of solutions of the —, and the acid and alkali equivalents of casein. T. B. Robertson. *J. Physical Chem.*, 1909, 13, 469—489.

THE author's researches have led to the following conclusions: The difference between the refractive indices of two solutions of caseinate, which differ only in their casein content, is proportional to the difference between the percentages of casein which they contain. This relation may be expressed by the formula: $n - n_1 = a \times c$, where n = the observed refractive index of the solution, c = the percentage of casein which it contains, n_1 = a constant depending on the nature and concentration of the substance employed to dissolve the casein, and a = a constant numerically equal to the change in the refractive index of the solvent caused by the introduction of 1 gm. of casein to 100 c.c. By means of this formula the concentration of casein in a solution can be very accurately determined, the error rarely exceeding 2 per cent. of the quantity of casein in 100 c.c. The change in the refractive index of a solution of a base, which is caused by the introduction of casein is independent of the concentration and nature of the base; if the volume of solution be 100 c.c. and the weight of casein 1 gm., the change in the refractive index is 0.00152. The same constant holds for solutions of hydrochloric acid, so that whether the casein be acting as an acid or as a base, its effect on the refractive index of the solution is the same. The difference between a solution of sodium caseinate and that of water at the same temperature, is independent of the temperature between 20° and 40° C. The hydrochloric acid equivalent of casein (i.e., the quantity of acid required to just dissolve 1 gm. of casein) has been determined by the author. For solutions containing 1.25 per cent. of casein, it was found that 1 gm. of casein = approximately 32×10^{-5} equivalent-grm. of hydrochloric acid. Casein dissolves in alkaline solutions rapidly at first and later, more slowly. After the point of neutrality to litmus has been reached, additional casein only dissolves with extreme slowness; the neutral point to litmus is not, however, the limit of solubility. The sodium hydroxide equivalent of casein has been determined for solutions containing 2 per cent. of casein, and it was found that 1 gm. of casein, at "saturation" of the base, = 11.4×10^{-5} equivalent-grm. mols. of sodium hydroxide. The lithium hydroxide equivalent was the same. The acidity of solutions of bases "saturated" with casein was determined by means of indicators and was found to lie between 10^{-5} and 10^{-6} NH⁺; the hydroxyl concentration in these solutions, therefore, lies between 10^{-9} and 10^{-8} N. —J. F. B.

African vegetable fats. Krause and Diesselhorst. See XII.

Use of miscibility curves in analysis. Application of method to edible oils. Louise. See XII.

Pure Food Act (1908), in New South Wales. Bd. of Tr. J., July 27, 1909. [T.R.]

THE "Pure Food Act, 1908," came into force in New South Wales on July 1st, 1909.

The Act provides, *inter alia*, that no person may sell any article of food or any drug which is adulterated or falsified.

scribed, or which is packed or enclosed for sale in any manner contrary to the provisions of the Act, or any food or drug mixed with other materials whereby such food, &c., is rendered dangerous or injurious to health or whereby its quality or potency is injuriously affected.

The Governor may, by notification in the "Gazette," prohibit the advertising or sale of any food or drug or appliance which is injurious to life or health, or which by reason of its inactivity or inefficiency is useless for the advertised purposes of cure.

The sale of any substance or compound as a disinfectant, germicide, antiseptic or preservative may also be prohibited.

The Act, which also provides for the inspection and analysis of foods, &c., may be seen by persons interested in application at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

PATENTS.

Milk; Preparation of coagulated —. S. Slavoff, Kezanlik, Southern Bulgaria. Eng. Pat. 14,249, July 4, 1908.

FRESH, boiled, or pasteurised milk is coagulated by means of a pure culture of *streptococcus bulgaricus acidus lactis*, which has been separated from the other species of micro-organisms in ordinary coagulated milk. A separate strain is made for maintaining the temperature at 35° to 45° C. during the coagulation. It is stated that coagulated milk thus prepared will keep 40 to 50 days in a fresh condition.—C. A. M.

Desiccating apparatus [for milk]. J. Roeh, Assignor to Crystallised Milk Co., Spokane, Wash. U.S. Pat. 927,169, July 6, 1909.

THE liquid (milk) to be desiccated, is delivered on to the surface of a heated rotating drum, the temperature of which can be varied at will, from a spraying device attached to the feed tank which is caused to move to and fro in a direction parallel to the axis of rotation of the drum.—W. H. C.

Cereal products. J. H. Quine, Rochester, New York. Eng. Pat. 15,474, July 21, 1908. Under Int. Conv., July 29, 1907.

GRAIN is made for a process of treating bran, in order to recover the mineral constituents for admixture with ordinary flour, &c. The bran is treated with water to extract soluble salts, and the residue then treated with an acid solvent (e.g., hydrochloric acid) and water, and subsequently with an alkaline (sodium hydroxide) solution of sufficient strength to extract gluten, &c. but not to dissolve cellulose. The acid and alkali in the second and third extracts are neutralised, and the whole of the extracts are united and evaporated to dryness, preferably *in vacuo*, and the residue reduced to a powder.—C. A. M.

Flour or ground cereals; Process for treating —, [increasing the water-binding capacity]. A. Waldmeyer, Zürich, Switzerland. Eng. Pat. 24,425, Nov. 13, 1908.

THE flour is heated to a temperature between 70° and 100° C., and a current of air is meanwhile passed over it, the temperature giving the best result varies, and must be determined for each batch of flour treated. (Reference is directed to Eng. Pats. 3469 of 1880, 11,466 of 1904, and 15,597 of 1905; see this J., 1908, 862).—W. P. S.

Beetroot flour; Production of —. L. Dautrebande, Daussoulx, Belgium. Eng. Pat. 1074, Jan. 15, 1909.

THE beetroots are washed and placed in a drying chamber at a temperature which is raised gradually from 36° to 60° C. When the beetroots have lost about 10 per cent. of their weight, they are removed from the chamber, sliced, and the slices are further dried in a current of air, first at a temperature of about 70° C. and then at 90° C. Finally, the dry slices are ground. If a brown flour be desired, the flour is again placed in the hot-air oven.

—W. P. S.

Keratin; Process of producing digestible substances from —. C. Neuberg, Charlottenburg, Germany. U.S. Pat. 926,999, July 6, 1909.

KERATIN or keratin substances are converted into digestible albumoses and peptones containing sulphur, by treatment with dilute mineral acids at a moderate temperature. The reaction is at an end when a diluted sample of the liquid, which has been treated with phosphotungstic acid or other reagent for albumoses, and filtered, is free from any considerable quantity of amino-acid. The albumoses and peptones formed in the main portion of the liquid are then at once isolated.—A. G. L.

Fat; Process for the manufacture of an edible —. S. Rigaut. Fr. Pat. 398,241, Mar. 18, 1908.

FROM 40 to 70 parts of cocoanut oil, 15 to 40 parts of stearine, and 15 to 25 parts of oil or lard are melted together and emulsified with about 10 parts of milk, or milk and water. The emulsion is then cooled, and again mixed. Substances such as lecithin, lactose, &c. may be added, and the oil employed may consist of any suitable vegetable oil. The oil and fat may be bleached previously, if desired.—W. P. S.

(B.)—SANITATION; WATER PURIFICATION.

Water; Detection of very small quantities of sodium carbonate in —. J. Flamand. Bull. Soc. Chim. Belg., 1909, 23, 296—299.

THE ordinary method of expressing the results of the analysis of the dissolved salts in water in terms of magnesium and calcium carbonate, calcium and sodium sulphate, and sodium chloride, does not indicate a further possible content of sodium carbonate, the presence of which is indicated by the appearance of a red coloration when the water is boiled with hops. These small quantities of alkali carbonates may be estimated by the method described by Seyffert (this J., 1908, 515).—E. F. A.

PATENTS.

Water; Process for the purification of —. G. Lambert. Third Addition, dated Jan. 6, 1909, to Fr. Pat. 361,435, May 3, 1905 (this J., 1906, 862, 1063; 1907, 888).

MANGANOUS phosphate, $Mn(PO_3H_2)_2 \cdot 2H_2O$, may be used in place of the manganese sulphate recommended in the original specification. Its use enables a treated water to be obtained which is quite free from manganese salts.—W. P. S.

Manufacture of ferric sulphate and making same up with more or less waste products to produce cakes or slabs [for sewage treatment]. Eng. Pats. 15,239 and 17,976, See VII.

(C.)—DISINFECTANTS.

Disinfectants; Principles involved in standardising —, and the influence of organic matter on germicidal value. H. Chick and C. J. Martin. Journal of Hygiene, 1908, 8, 634—697.

A DISINFECTANT varies in efficiency with regard to organisms, as much as ten times, according to the organism tested. For spores, metallic salts rank highest as germicides. The action of phenol and emulsified disinfectants on spores, is too feeble for practical consideration. A virulent type of any particular species is as a rule more difficult to kill than a non-virulent type. With mercuric chloride the reduction caused by blood serum is much greater than with phenol. The presence of finely divided organic matter—animal charcoal, dust, bacteria, faeces, etc.—affects the germicidal value of emulsified disinfectants containing tar acids, in a much greater degree than that of solutions of phenol. The tar acids can be removed by the addition of any of the finely divided forms of organic matter just referred to. Three per cent. of finely divided powder of dried faeces in suspension had the effect of reducing the efficiency of phenol to the extent of about 10 per cent., and of commercial cresols from about 30 to 50 per cent.

Electrolytic disinfectant. F. W. Alexander. Annual Report for 1908 of Medical Officer of Health for the Metropolitan Borough of Poplar. 80—84.

THE plant for the preparation of a disinfecting fluid containing magnesium hypochlorite (see this J., 1906, 1102; 1908, 158) has now been in operation for 3 years; in 8 hours 185 gallons of solution containing 4.5—5 grms. of available chlorine per litre are produced. During 1908, the cost of repairs, renewals, and improvements for the whole installation was less than £45. 28,280 gallons of the solution were manufactured, the total cost (excluding labour) being £56 2s. 5d., made up as follows:—Electricity, 4543 units at 1½d. per unit, £28 7s. 10d.; magnesium chloride, 47 cwt. 3 qrs. 10 lb., £10 9s. 3d.; salt, 6 tons, £9 18s.; caustic soda, £5 17s. 4d.; water, £1 10s. In the past 3 years, 60,000 gallons of the solution have been manufactured at a total cost for electricity and materials of about £120, and 12 zinc electrodes have been replaced at a cost of less than £2. A sample of the solution which contained 4.818 grms. of available chlorine per litre on March 27, 1906, contained 3.785 grms. after keeping till Oct. 29, 1908. According to a report by Klein, 1 oz. of the fluid to 150 oz. of water will kill the cholera germ in 2½ mins., and will also kill the typhoid bacillus. In referring to the financial aspect, it is stated that in the 3 years the plant has been working, it has paid for itself and also for the construction of the depot where it is installed, and has also resulted in a saving of over £1200 to the Borough.—A. S.

Disinfectant. "Keramyli." E. Prior. Allgem. Z. Bierbrau. n. Malzfabrik., 1909, 37, 354—355.

"KERAMYL" consists of an aqueous solution of commercial hydrofluosilicic acid, the sample examined by the author containing 26.01 per cent. of the acid and small proportions of silicic and sulphuric acids, ferric oxide, alumina, lime, and alkalis. In 2 per cent. solution, keramyli exerts a vigorous solvent action on iron and zinc and a somewhat less, but still appreciable action on tin; copper and brass, on the other hand, are only slightly attacked. Experiments with *Sacch. Froberg*, *Mycoderma cerevisiae*, *Bact. acetii*, *Bact. fluoresc. liquef.*, *Oidium lactis* and *Pentacillium glaucum* show that a 1 per cent. solution of keramyli destroys these organisms in 12 hours, whilst, with a 2 per cent. solution, 4 hours is sufficient. Strongly infected rubber hose and filtering material were also disinfected in 4 hours by a 2 per cent. solution of keramyli.—T. H. P.

PATENTS.

Sheep dips for disinfecting, &c.; Manufacture of cleansing fluids for use as —. W. G. Little, East Grinstead, and H. Morris, Doncaster. Eng. Pat. 16,982, Aug. 12, 1908. Addition to Eng. Pat. 26,608, Dec. 2, 1907 (this J., 1908, 587).

A MORE or less solid compound may be produced by mixing 85 parts of coal tar creosote, 15 parts of sulphonated (but not neutralised) castor oil, and 6.5 parts of saturated sodium hydroxide solution, the quantity of alkali added being sufficient to neutralise the sulphonated oil. The mixture is heated to boiling and then allowed to cool. When stirred with water the compound produces an emulsion suitable for the purposes in question.—W. P. S.

Vines, &c.; Insecticide for use on —. Soc. Chimique des Usines du Rhône (ancien. Gilliard, P. Monnet et Cartier). Fr. Pat. 398,281, Mar. 19, 1908.

A SOLUTION, containing from 500 to 1000 grms. of copper salicylate per 100 litres, is employed for the purpose. The copper salicylate may be prepared by mixing copper sulphate solution with calcium salicylate solution; barium or sodium salicylate can be used in place of the calcium salt.—W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

Sulphite wood pulp; Determination of resin in —. A. Steinschneider. Z. angew. Chem., 1909, 22, 1410—1411. THE author confirms the fact recorded by Opfermann (this J., 1909, 324) that the amount of resin extracted

from a pulp by alcohol is always greater than that extracted by ether under the same conditions. Working with a highly resinous pulp prepared from waste wood, he found, after 5 hours' extraction, 1.15 per cent. of resin with ether, and 1.54 per cent. with alcohol. Further, whereas a more prolonged extraction with ether yielded no increased quantity of resin, the quantity extracted by alcohol increased as the time of extraction was extended, and amounted to 1.84 per cent. with 20 hours' extraction. According to the author the extracts obtained by means of the two solvents are identical in their nature, and possess nearly identical constants. For the determination of the absolute resin contents of a pulp, a very prolonged extraction with alcohol is certainly more accurate than the ether method, but the latter is far more rapid and convenient for comparative purposes. The difference in the results obtained by the two methods is attributed to the higher temperature which is obtained when alcohol is used in the Soxhlet apparatus.—J. F. B.

Paper trade of Argentina. Bd. of Tr. J., July 29, 1909. [T.R.]

THE following particulars respecting the position of the paper trade of Argentina have been received from H.M. Consul at Buenos Aires:

The values of the imports of paper and paper manufactures in each of the last five years were as follows:—

	Paper and Cardboard.	Paper Manufactures.	Total.
	£	£	£
1904.....	463,000	335,000	798,000
1905.....	451,000	369,000	820,000
1906.....	569,000	406,000	975,000
1907.....	693,000	438,000	1,131,000
1908.....	652,000	527,000	1,179,000

The value of the import trade has increased from 4,000,000 dols. gold in 1904 to 6,000,000 dols. in 1908. The most important item in the trade is that of paper in rolls for newspapers. The quantity of this imported has risen in five years from 6,400 tons to 12,200 tons, and there is every probability of a further increase. In the city of Buenos Aires alone there are published about 50 daily papers, with a daily circulation of a quarter of a million. The total number of newspapers, reviews, and other periodicals published in the Republic has been estimated at from 400 to 500.

The United States of America and Germany supply the bulk of the paper imported. The imports from the Dominion of Canada, however, increased from 125 tons in 1904 to 577 tons in 1907.

The item next in importance is that of cardboard, the importation of which is almost monopolised by Germany and Holland. The United Kingdom supplies only a very small amount, and that is much less than was furnished in 1904.

With the one exception of cigarette paper, British goods appear among all the classes of paper material imported. It is, however, only in a few lines, such as toilet and photographic papers, lithographic and blank books that they are supplied to any considerable extent.

Local products.—There are four paper factories in the city of Buenos Aires and six in the Province. These have a share capital of 7,000,000 dols., and their annual turnover amounts to 5½ millions. The factories employ some 1500 hands, and are equipped with machinery of, from 4000 to 5000 horse-power.

The raw material used is mostly wood pulp, which is all imported. No successful arrangement has been made to make use of any locally grown product, straw, flax or other fibre. The paper turned out from the factories consists largely of wrapping paper, and printing paper of an inferior grade, no high-class paper being produced.

The import of wood pulp has increased from 19,000 tons in 1904 to 18,500 tons in 1908. In 1907 the principal sources of supply were: Germany, 10,000 tons; Brazil, 3500 tons; and Sweden, 2300 tons. Canada does not appear at all.

A large quantity of waste paper is also worked up in the local paper factories. Potato pulp is also used: in 1908 180 tons were imported from Holland and Germany.

PATENTS.

Peat fibre; Treatment of — and its manufacture into paper and board. L. Franz. Admont, Austria. Eng. Pat. 13,994, July 1, 1908.

In the mechanical preparation of peat for the manufacture of paper, the newly cut peat is charged through a hopper into a press with an endless screw, which forces it through a nozzle in the form of an endless rope, which is then cut by a revolving knife into discs of uniform thickness. These discs are broken up in water and passed through a centrifugal separator with an annular screen, through which the fine fibres pass, whilst the coarse particles are retained. The refined fibres are then treated in a washing machine to remove minute impurities and earthy matters. The washed fibre is next converted into pulp by means of a kneading machine and its particles are then separated according to size by a machine consisting of two "centrifugal plate" separators. Each grade of half-stuff thus obtained is finally mixed in beating engines with other suitable fibres for the manufacture of paper or board.—J. F. B.

Wood pulp; Process of manufacturing —. C. B. Clark, Bangor, Me. U.S. Pat. 927,950, July 13, 1909.

In the manufacture of wood pulp by the sulphite process, a portion of the liquor is removed from the digester when the digestion has proceeded so far that the resinous matters, etc., have been removed from the wood, but have not become completely resolved and soluble. The digestion is then continued with the residual liquor.—F. M.

Wood pulp mills; Reclaiming apparatus for —. C. B. Clark, Bangor, Me. U.S. Pat. 927,951, July 13, 1909.

COMBINED with the digester are two tanks, one for storing the liquor from the digester, the other for clarifying the same. The woody matter is separated from the liquor in the clarifying tank, and may be removed without disturbing the main body of the liquor.—F. M.

Hats of straw, palm-leaf, etc.; Manufacture of —. H. P. Pearson, London. U.S. Pat. 927,674, July 13, 1909.

THE process consists in treating the hat with a solution of nitrocellulose in acetone to which a "sulphurous acid" and a drying agent have been added, so that the hat receives a thin, transparent coating of the same.—F. M.

Threads and filaments of cellulose. Eng. Pats. 14,143 and 28,149. See V.

Rolls for use in printing, paper making, etc. Eng. Pat. 21,096. See V.

Impermeable leather-board. Fr. Pat. 398,199. See XIV.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Strychnine from brucine; Separation of —. G. Pinchbeck. Brit. Pharm. Conf., Newcastle, July, 1909.

THE author has found that a solution of nitrogen peroxide in nitric acid (sp. gr. 1.42) gives good results in the quantitative separation of strychnine and brucine. The amount of strychnine in *Nux vomica* and its preparations can be determined by this method. The total alkaloid from 2 grms. of the drug, 5 c.c. of the liquid extract, or 25 c.c. of the tincture, are dissolved in 15 c.c. of 3 per cent. sulphuric acid, and the temperature of the mixture brought to 25° C. 1.5 c.c. of nitric acid of sp. gr. 1.435 at 15.5° C., and containing 1 per cent. of nitrogen peroxide, are then added and the mixture set aside for 15 minutes. The liquid is made alkaline with sodium hydroxide and shaken successively with 10, 5, and 5 c.c. of chloroform. The chloroform solution is washed with sodium hydroxide solution, and distilled down to about 1 c.c. in a tared

flask. 2 c.c. of amyl alcohol are added and driven off by a current of warm air. The residue is then dried at 110° C.—F. SHDN.

Strychninesulphonic acids; Preparation of isomeric —. H. Leuchs and W. Schneider. Ber., 1909, 42, 2681—2685.

THE authors consider that there must be a $-\text{CH}_2\text{CH}_2-$ grouping in strychnine and that each of the hydrogen atoms in this grouping can be replaced by a sulphonic group to give a different sulphonic acid. Three isomeric sulphonic acids have been isolated. Strychnine is dissolved in water at 40°—50° C. by means of sulphur dioxide, and precipitated manganese dioxide is added. After the reaction the three isomeric acids can be separated by crystallisation. Strychninesulphonic acid I. has been already described (this J., 1909, 106). Strychninesulphonic acid II., $\text{C}_{21}\text{H}_{22}\text{O}_5\text{N}_2\text{S}\cdot 2\text{H}_2\text{O}$, crystallises from 300—320 parts of boiling water in short massive prisms, which dissolve easily in alcohol and alkalis, but not in dilute hydrochloric acid. It melts with decomposition at 370° C., and has $[\alpha]_D = -138^\circ$ at 20° C. in $N/10$ caustic alkali. The third isomeride can be crystallised from 10 parts of boiling water, and forms transparent flat polyhedra, or four-sided tablets. It decomposes at 276° C. (corr.). It dissolves in alkalis and in 20 per cent. hydrochloric acid, and is soluble with difficulty in alcohol. In $N/10$ sodium hydroxide, it has $[\alpha]_D = +163.3^\circ$ at 20° C. The second and third isomerides give the strychnine reaction with chromic acid.—F. SHDN.

Papaverine; Synthesis of —. A. Pictet and A. Gams. Comptes rend., 1909, 149, 210—212.

VERATROL was converted into acetoveratrone by the action of acetyl chloride and aluminium chloride. This was converted into the isonitroso derivative (m.pt. 131° C.), and reduced by stannous chloride to form the hydrochloride of aminoacetoveratrone,



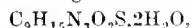
On treating the salt with homoveratroyl chloride and sodium hydroxide, homoveratroylaminoacetoveratrone was produced. This has the constitution,



and forms shining leaflets melting at 142° C. On reduction with sodium amalgam in alcohol, the ketonic grouping is reduced with the production of homoveratroylhydroxy-homoveratrylamine, which forms colourless needles melting at 124° C. The elements of water were removed by the action of phosphorus pentoxide in xylene, and papaverine m.pt. 147° C. was produced.—F. SHDN.

Ergothioneine; A new base from ergot —. C. Tanret. Comptes rend., 1909, 149, 222—224.

AN alcoholic extract of ergot was treated with mercuric chloride solution, and the precipitate collected and washed. It was suspended in water, decomposed with hydrogen sulphide, and the liquid filtered and evaporated. In this way *ergothioneine hydrochloride* was obtained, 1 kilo. of ergot yielding about 1 gm. The free base,



crystallises in colourless leaflets, which melt with decomposition at 290° C. on the Maquenne block. It has $[\alpha]_D = +110^\circ$, dissolves easily in water, but only slightly in absolute alcohol. The salts with mineral acids are acid to litmus. The hydrochloride, $\text{B}\cdot\text{HCl}\cdot 2\text{H}_2\text{O}$, melts at 250° C. on the Maquenne block. Solutions of the salt give precipitates with potassium mercuric iodide, iodine in potassium iodide, and mercuric chloride, but not with picric acid or tannin.—F. SHDN.

Guaiacol and quinine as reagents for hydrogen peroxide. G. Denigès. Bull. Soc. Pharm. de Bord., June, 1909, 247; Pharm. J., July, 31, 1909.

PLACE in a test-tube, 0.3 c.c. of a 5 per cent. alcoholic solution of guaiacol, and 2 c.c. of sulphuric acid (sp. gr. 1.840), and shake; add a single drop of solution of hydrogen peroxide, and again shake. With hydrogen peroxide of about 10 volumes there is quickly developed, after the

production of a transitory brown tint, a very fine blue-green coloration. With more dilute solutions, the final blue coloration only is observed. For very dilute solutions, up to three drops may be added, shaking after each; the reaction in these conditions is still distinct with a medicinal hydrogen peroxide diluted 1:1000. The quinine reagent is applied thus:—1 to 2 centigrams of quinine sulphate is dissolved by shaking in 2 c.c. of concentrated sulphuric acid; there is then added 0.5 c.c. of hydrogen peroxide solution, with shaking, when there is quickly developed a yellow colour so intense that it may be used as a means of determining with fair accuracy the amount of hydrogen peroxide present. This reaction, though less delicate than that with guaiacol, is more characteristic, and by inversion may be used as a means of identifying quinine.

Matico leaves and oil. H. Thoms. Seventh Int. Congr. Appl. Chem., London, 1909. Z. Riech- u. Geschmackstoffe, 1909, 1, 127—128, 136—138.

AN examination was made of several varieties of matico leaves and the oil produced from them. *Piper camphoriferum* C.D.C. yielded 1.11 per cent. of oil, which had $n_D^{20} = +19^{\circ} 21'$ and the sp. gr. 0.9500 at 20°C ., and contained borneol and camphor. The oil from *Piper lineatum* Ruiz and Pavon amounts to about 0.44 per cent., and has $n_D^{20} = +8^{\circ} 45'$ and the sp. gr. 0.958. It distils for the most part between 140° and 150°C . at 15 mm., and appears to contain a fair proportion of a sesquiterpene. *Piper augustifolium* var. *Ossanum* C.D.C. contains 0.87 per cent. of oil, in which Japan camphor and borneol are present. The oil from *Piper acutifolium* R. and P. var. *suberbasifolium* was found to contain small amounts of acids and phenols, together with pinene, dillapiol, and a sesquiterpene.—F. SHDN.

Sapphire: Presence of dimethoxy-2,3-methylenedioxy-4,5-allyl-1-benzene in the essential oil of —. M. Delépine. Comptes rend., 1909, 149, 215—217. (See this J., 1909, 623.)

ON distilling that portion of the essential oil of sapphire (*Crithmum maritimum* L. Omb.) which boils below 200°C ., the author obtained two fractions. About 5 per cent. of the total amount of oil boiled between 90° and 95°C . at 13 mm., and about 40 per cent. at 157° — 158°C . at 13 mm. The second fraction consists of a substance, $\text{C}_{15}\text{H}_{14}\text{O}_4$, isomeric with apiol, and found to be identical with dimethoxy-2,3-methylenedioxy-4,5-allyl-1-benzene, the dillapiol of Thoms (Arch. Pharm., 1904, 242, 344). One kilo. of the fresh seeds of sapphire yield 7—8 grms. of oil, whilst the dried seeds yield 30 grms.—F. SHDN.

Philippine terpenes and essential oils. Manila elemi. R. F. Bacon. Philippine J. of Sci., A, 1909, 4, 93—111.

THE source of true Manila elemi is *Canarium luzonicum* A. Gray. The greater proportion of different samples of elemi yielded phellandrene on distillation; whilst a few were found to contain limonene. 12—18 per cent. of elemi consists of terpenes, 12—15 per cent. is a higher boiling oil, from which Semmler has isolated elemicin, whilst the remainder, about 70 per cent., is a light brown, transparent resin, with a brilliant fracture. The resin dissolves in most solvents and the solutions on evaporating leave a brilliant varnish, which, however, dries slowly. Mixed with copal it gives more satisfactory results. Limonene hydrochloride was treated with magnesium, and the product allowed to act upon orthoformic ester. In this way, dihydroterpene, and probably, diterpene were produced. When the magnesium compound of limonene hydrobromide was treated with benzaldehyde, dihydrolimonene was obtained. Similar results were obtained when acetaldehyde was used in place of benzaldehyde. A mixture of limonene dihydrobromide and benzaldehyde was allowed to act upon magnesium, when a white crystalline compound was obtained which decomposes at about 212°C ., and has the composition $\text{C}_{10}\text{H}_{16}\text{Br}_2$ or $\text{C}_{20}\text{H}_{32}\text{Br}_4$. Tetrahydrolimonene was also produced. α -Phellandrene hydrobromide subjected to the Grignard reaction in the presence of benzaldehyde, gave benzoin. α -Phellandrene

hydrochloride can be converted into dipentene by the action of an alcoholic solution of potassium hydroxide.—F. SHDN.

Philippine terpenes and essential oils. Lemon grass oil. Blumea balsamifera. Lantana camara. Oil of Ylang-ylang. R. F. Bacon. Philippine J. Sci., A, 1909, 4, 111—132.

THE plant, *Andropogon citratus* D.C., from which lemon grass oil is obtained, is found in the wild state and is cultivated in the Philippines. With good ground and three cuttings of the grass per year, a yield of about 240—300 kilos. of oil per hectare can be obtained. Lemon grass is not profitable as a permanent crop. Several quantities of the grass grown by the author yielded oil containing 77—79 per cent. of citral, and of good quality.

The leaves of *Blumea balsamifera* D.C. contain 0.1 to 0.4 per cent. of a yellow oil, which consists of nearly pure l-borneol. This would work out to a yield of 50—200 kilos. of oil per hectare.

An oil, with an odour like that of sage and boiling below 140°C . at 11 mm. was obtained from the leaves of *Lantana camara* L., which is a very abundant weed.

AFTER further work with various samples of Ylang-ylang oil, the author considers that it is characterised by a low refractive index, low optical activity, and high ester numbers. A quantity of the flowers was extracted with light petroleum, and the solvent distilled off below 40°C . at 40 mm. A dark resinous oil was obtained, which gives the true odour of the flowers when diluted. It had the sp. gr. 0.940 at $30^{\circ}/4^{\circ} \text{C}$., $n_D^{30} = 1.4920$ at 30°C ., ester value 135, and acetyl value 208.

THE leaves of a species of *Fagara* yield an oil containing limonene. The oil from the mint, *Hyptis suaveolens* Poir., contains menthol. *Champaca* flowers from *Michelia champaca* and *M. longifolia* Bl. were subjected to enflourage with paraffin oil. By this means the paraffin acquired a fine strong odour, and might be used as a base for perfumes. The flowers of *Plumeria acutifolia* Poir., the supposed source of "frangipani," were extracted with light petroleum, and gave a gummy oil with a satisfactory odour. Oil of zedoary (*Curcuma zedoaria* Rose.) has a dark greenish-brown colour, with the sp. gr. 0.933 at $30^{\circ}/4^{\circ} \text{C}$., and $n_D^{30} = 1.4920$ at 30°C . The oil dissolves in two volumes of 80 per cent. alcohol.—F. SHDN.

Philippine terpenes and essential oils. Balao resin. R. F. Bacon. Philip. J. Sci., A, 1909, 4, 121—127.

THE source of Balao resin is *Dipterocarpus vernicifluus* Blanco, or *D. grandiflorus* Blanco. It is used by the Philippine natives as a varnish, and although it gives a tough hard coat, dries very slowly. A quantity of the resin was distilled at ordinary pressure, and the volatile portion redistilled in a vacuum. In this way a sesquiterpene was separated, which boiled at 118° — 119°C . at 8 mm., had the sp. gr. 0.9104 at $30^{\circ}/4^{\circ} \text{C}$., $n_D^{30} = 1.4956$ at 30°C ., and $n_D^{30} = +116.4$ at 30°C . It boils at 261° — 262.4° (corr.) at ordinary pressure, when it becomes slightly yellow. The oil of *supa* contains a large amount of eadinene.—F. SHDN.

Camphor: Determination of — in spirit of camphor. E. Deussen. Archiv. Pharm., 1909, 247, 307—313.

FIVE grms. of the spirit of camphor are weighed off into a tared 50 c.c. Erlenmeyer flask, then treated with exactly 20 grms. of cold-saturated ammonium sulphate solution and 30 grms. of water. The mixture is well shaken, and set aside in an ice-chamber for about 12 hours. The separated camphor is collected on a small smooth filter, and washed with 70 to 90 grms. of water until free from sulphate. The moist magma of camphor is drained and aggregated into a ball with a nickel spatula. The filter is covered with a watch-glass, and another small watch-glass and a piece of card, about the size of a postcard, are tared. The camphor is spread out thinly with the nickel spatula upon a porous tile, covered for some minutes with a watch-glass, then transferred quantitatively to the tared card, covered with the tared watch-glass, and weighed. The amount of camphor found by this process is within 4 to 6 per cent. of the total quantity present.

Natural (dextro) camphor thus obtained has a marked extro-rotation in alcohol or benzene solution, and the amphoteric acid it yields on oxidation with nitric acid, melts at 187° C. Artificial camphor, *i*- (or racemic) camphor, obtained under like conditions, is optically inactive, and the camphoric acid it affords on oxidation melts at 204°–205° C.—J. O. B.

Organic arsenic compounds. Internat. Congr. of Appl. Chem., 1909. W. Harrison Martindale.

THE author has prepared a number of organic arsenic compounds, which appeared likely to prove of therapeutic interest. Many of these bodies he made on a manufacturing or experimental scale, and in most instances provided methods of procedure and has pointed out means of overcoming difficulties encountered. Amongst other data the melting points of the substances, when of value, the arsenic contents according to theory and as found practically, the solubilities, and the relative toxicities have received attention.

A few definitions will now be useful.

Arsenic acid indicates arsenic acid, $\text{AsO}_3(\text{OH})_2$, in which one of the hydroxyls is replaced by an organic radiide.

Arsinic acid constitutes a dialkyl or dialkyl derivative of arsenic acid—i.e., cacodylic acid—and its homologues; e.g., phenyl-arsinic acid, $(\text{C}_6\text{H}_5)_2\text{AsO}_3\text{H}$. It should be understood that the French and German chemists do not as a rule make these distinctions.

Arylarsonate.—This term is used to indicate an aromatic arsonate.

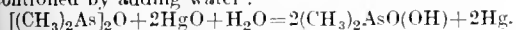
Arsanilic acid is a name given to *p*-aminophenyl arsonic acid, the sodium salt of which is in such repute, therapeutically, at the present day.

Arsenic.—This term one finds in the French literature as referring to aromatic arsenic bodies containing two atoms of arsenic believed to be coupled together by a double linkage—e.g., $\text{C}_6\text{H}_5-\text{As}=\text{As}-\text{C}_6\text{H}_5$, arsenobenzene, comparable with $\text{C}_6\text{H}_5-\text{N}=\text{N}-\text{C}_6\text{H}_5$, azobenzene.

(i.) **Aliphatic series.**—The Cacodyle bodies (of the aliphatic series) are now superseded by substances better from the therapeutic point of view.

Cacodylic acid, or dimethyl-arsinic acid, $(\text{CH}_3)_2\text{AsO}_3\text{H}$. Cacodylic acid is prepared by the oxidation of arsenium dimethyl (cacodyle), $(\text{CH}_3)_2\text{As}-\text{As}(\text{CH}_3)_2$, as it is more correct to view cacodyle as tetramethyldiarsine and all cacodylates as derived from this diarsine, and of cacodyl oxide, $(\text{CH}_3)_4\text{As}_2\text{O}$.

A portion of Cadet's liquid is surrounded by cold water in a suitable vessel, and mercuric oxide is added in small quantities at a time. The vigorous reaction is further controlled by adding water:



If the mercuric oxide be in excess, part of the acid forms mercury cacodylate. When the odour of cacodyle has disappeared one adds, drop by drop, cacodyl oxide to reduce the mercury cacodylate. This point is known by the odour becoming perceptible, and by the fact that the solution no longer deposits metal mercury. The liquor is evaporated to dryness and the acid recrystallised from boiling alcohol.

Cacodylic acid is neutral to methyl orange and phenolphthalein. It melts at 200° C., and has an arsenic content of 54.3 per cent.; solubility, 2 in 1 of water (about) and 1 in 4 of 90 per cent. alcohol. Cacodyle is poisonous, but the acid and its salts are comparatively harmless. The latter have, however, fallen into disfavour by reason of this harmlessness—i.e., their stability and lack of arsenical effect. They pass through the system and appear, principally in the urine, in an unaltered condition. Another portion is reduced in passage through the organism to a volatile cacodyl oxide which is exhaled.¹ The salts of cacodylic acid used in medicine may be briefly enumerated:

Sodium cacodylate (P. Helv.), $(\text{CH}_3)_2\text{AsO}_2\text{Na} + 3\text{H}_2\text{O}$. Arsenic-content, 35 per cent. Commercially, usually contains 18 to 25 per cent. of water. Soluble 2 in 1 water.

Magnesium cacodylate, $[(\text{CH}_3)_2\text{AsO}_2]_2\text{Mg} \cdot \text{H}_2\text{O}$. White amorphous powder, soluble 1 in 3.

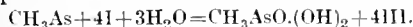
Iron cacodylate, $[(\text{CH}_3)_2\text{AsO}_2]_3\text{Fe}$. Yellowish powder, soluble 1 in 15 in water.

Guaiacol cacodylate, $(\text{CH}_3)_2\text{AsO} \cdot \text{O} \cdot \text{C}_6\text{H}_4(\text{OCH}_3)(?)$. Valeur states the composition of this substance is apparently simply $(\text{CH}_3)_2\text{AsO} \cdot \text{OH} \cdot \text{C}_6\text{H}_4\text{OH}(\text{OCH}_3)$ —i.e., equimolecular proportions of each.²

Strychnine cacodylate, $\text{C}_{21}\text{H}_{22}\text{N}_2\text{O}_2 \cdot (\text{CH}_3)_2\text{AsO} \cdot \text{OH}$. White crystalline powder.

Ethyl cacodylic (Diethylarsinic) acid, $(\text{C}_2\text{H}_5)_2\text{AsO}_3\text{H}$, and the propyl derivative $(\text{C}_3\text{H}_7)_2\text{AsO}_3\text{H}$ have also been prepared.

Di-sodium methylarsenate, or, sodium mono-methyl arsonate, arrhenal. "New Cacodyle," $\text{CH}_3\text{AsO}(\text{ONa})_2$. Prepared by the interaction of methyl iodide and sodium arsenate in presence of excess of alkali. Soluble about 1 in 1 in water, only slightly in alcohol 90 per cent. A solution of the salt (strongly acidified) with hydrogen sulphide gives a precipitate of mono- and di-sulphide of methylarsine. Arrhenal solutions do not precipitate with baryta water (sodium cacodylate does), nor with magnesia mixture (nor does sodium cacodylate), nor by cold solution of calcium chloride (ditto sodium cacodylate), but are precipitated by nitrates of silver (white silky ppt.; sodium cacodylate none) and mercury (also sodium cacodylate; both yellow, arrhenal the darker of the two). Mercuric chloride, gives a reddish-yellow ppt. with arrhenal, and a white precipitate with sodium cacodylate. Sodium-*p*-aminophenylarsonate gives a white precipitate with these reagents in every case. Arrhenal may be estimated by dissolving about 0.2 gm. in 1 to 2 c.c. of water and adding 15 to 20 c.c. of hydrochloric and hypophosphorous acid mixture.³ After twelve hours dilute with 15 to 20 c.c. of water and filter, washing the residue with water. To the filter and its contents add a known excess of N/10 iodine solution, shake well, and titrate excess with sodium thiosulphate—



The black body CH_3As is quantitatively produced from 1 molecule $\text{CH}_3\text{AsO}(\text{ONa})_2$ therefore 4 atoms of iodine = 1 molecule arrhenal. Bougault⁴ suggested this reagent for testing for traces of arsenic in glycerin (arsenite or arsenate) and for cacodylate. For the latter it is exceedingly delicate.

To prepare the test, dissolve 20 grms. sodium hypophosphite in 20 c.c. water and add 200 c.c. hydrochloric acid (1.17 sp. gr.). Sodium chloride is thrown out and removed. To apply the test, 5 c.c. glycerin is mixed with 10 c.c. of the reagent. Place in water-bath—brown deposit.

This methylarsine,⁵ CH_3As , is also obtainable by action of sodium hypophosphite, and sulphuric acid on sodium cacodylate. $2\text{H}_3\text{PO}_2 + \text{AsCH}_3\text{O}(\text{OH})_2 = 2\text{H}_3\text{PO}_3 + \text{CH}_3\text{As} + \text{H}_2\text{O}$, as a yellow oil insoluble in water, with strong garlic odour. It polymerises to $(\text{CH}_3\text{As})_n$ —probably the same body as made by Bougault by reducing methyl arsonic acid. (Arrhenal has also been standardised by precipitating methylarsenate of silver with aid of excess of AgNO_3 and estimating the excess of latter with thiocyanate, using iron alum as indicator). Arrhenal is reduced by sulphur dioxide to methylarsenoxide, AsCH_3O . The di-sodium derivative of this, $\text{AsCH}_3\text{O}(\text{ONa})_2$, yields with methyl iodide cacodylic acid, which on reduction gives cacodyl oxide, $(\text{CH}_3)_4\text{As}_2\text{O}$, the sodium compound of which, $\text{As}(\text{CH}_3)_2\text{ONa}$, reacts with methyl iodide to form trimethylarsine, $\text{As}(\text{CH}_3)_3$ —two arsenious compounds can be made containing one, two, or three methyl groups.⁶

Di-iodomethylarsonic acid,⁷ $\text{CHI}_2\text{AsO}(\text{OH})_2 \cdot \text{H}_2\text{O}$. May be prepared by oxidising with nitric acid in the cold the body CHI_2AsI_2 , a constituent of the dense black oil formed by interaction of 5 parts amorphous arsenic with 42 parts iodoform in presence of benzene or toluene at water bath temperature, otherwise the reaction may be explosive. When the interaction is complete, distil off the solvent. After oxidising, filter off the magma (much charged with iodine), wash it with cold water, and

² Barbary et Réber, Bull. Sci. Pharm., 1902, 2, 121.

³ Bougault, J. Pharm. Chim., 1907 (VI), 26, 13–20.

⁴ Bougault, J. Pharm. Chim. (VI) 15, 1902, 528.

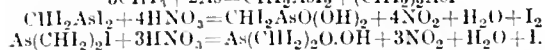
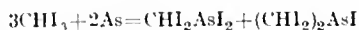
⁵ Compt. rend., 1904, 138, 1705–1707.

⁶ Auger, Compt. rend., 1903, 137, 925–927.

⁷ Comptes Rendus, 1907, 145, 808.

evaporate the acid liquor gently at not exceeding 40°–50°. Yellow crystals throw out containing H_2O , which should be recrystallised from warm water. The insoluble portion is treated with boiling benzene or toluene to remove the iodine. The residual yellow powder contains tetraiodocacodylic acid, which one purifies by dissolving in ammonia and reprecipitating with acid. For oxidising I used strong nitric acid added to the substance with the layer of supernatant toluene.

The following formulae convey an idea of the interactions:

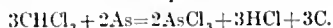


Sodium di-iodo-methyl-arsenate. $\text{CHI}_2\text{AsO.OH.ONa} + \text{Aq.}$ This salt I prepared in feathery crystals in appearance similar to quinine sulphate. The acid was dissolved in alcohol and neutralised with sodium bicarbonate, adding water to aid solution. It is very soluble in water.

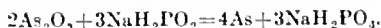
Tetra-iodocacodylic acid. $\text{As}(\text{CHI}_2)_2\text{O.OH}$. This acid forms small yellow crystals insoluble in water.

Sodium tetra-iodocacodylate. $(\text{CHI}_2)_2\text{AsO.ONa.6H}_2\text{O}$. This salt was obtained in beautiful yellowish crystals from the above acid by means of a water-alcohol solution.

Amorphous arsenic, referred to previously, is very active chemically. It, for example, unites at ordinary temperature with methyl iodide, whereas ordinary powdered arsenic has to be heated to 160°–200° to react with this substance. Similarly chloroform decomposes:



This amorphous form of arsenic is made by precipitating a hydrochloric acid solution of arsenious acid with stannous chloride or a hypophosphite. I found it was best to work in concentrated arsenical solution, adding the hypophosphite in the solid condition in portions and heating the while. I have not employed stannous chloride for the purpose. Assumed reaction:

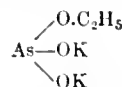


Tetra-methyl arsonium iodide. $\text{As}(\text{CH}_3)_4\text{I}$.⁸ A white substance, becoming reddish brown in the light, made by heating arsenic with CH_3I at 220° for twenty-four hours. Crystallisable from methyl alcohol in tetrahedra. The substance yields coloured precipitates with many metallic salts. Author's experiments with it were not successful. He tried the amorphous arsenic in addition to the ordinary form. Special apparatus is necessary to overcome the difficulties usually appertaining to sealed tubes, stoppered pressure bottles, etc.

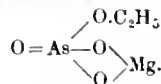
Acetic arsenious anhydride,⁹ or triacetic arsenious anhydride. $\text{As}(\text{O.CH}_2\text{CO})_3$. Is prepared by dissolving arsenious acid in acetic anhydride, and is obtainable as colourless needles melting at 82°. Readily soluble in chloroform and ethyl acetate, less in benzene and carbon disulphide. Decomposes in moist air. It is difficult to obtain in the anhydride form. A molecular proportion of arsenious oxide readily dissolves in six molecular proportions of acetic anhydride. The arsenic content of two fractions removed from the crystallising dish indicated dissolution.

Magnesium methylarsenate. $\text{C}_2\text{H}_5\text{AsO.OOMg}$. Is prepared¹⁰ by treating a solution of potassium arsenite with ethyl iodide. When the reaction is complete the solution is acidified with dilute hydrochloric acid and filtered. Chlorine is passed into the filtrate, and the iodine precipitated is removed by filtration. The liquid is made alkaline with ammonia, treated with a large excess of magnesia mixture, and left twenty-four hours. The liquid is filtered and evaporated. The salt is readily soluble in acids, but not in alkalies—very slightly in water. Usually contains 1 molecule of water. It is decomposed by heat into magnesium oxide, metallic arsenic, methane, ethylene, and water.

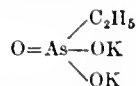
It is a little difficult to understand why, according to these conditions, an ethyl-arsenite of potash is not produced with formula



and ultimately the magnesium body of the formula



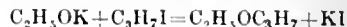
as the result of passing chlorine into the liquor, as above mentioned. Apparently there is a change over to the pentavalent arsenic thus



without the actual assumption of fresh oxygen. There is proof of the fact that the alkyl radicle is directly joined to the arsenic by the reduction to the corresponding arsine which contains the radicle in direct union with arsenic:



*Normal propyl arsonic acid.*¹¹ $\text{C}_3\text{H}_7\text{AsO}(\text{OH})_2$. To arsenious oxide (1 mol. proportion) and potassium hydroxide (6 mol. weights) water *q.s.* is added to dissolve. After cooling add alcohol *q.s.* to incipient precipitation, then 2 mol. proportions *n*-propyl iodide and shake. Either some propyl iodide or some potassium arsenite will be precipitated, but the mixture is made homogeneous by adding either water or alcohol, or both. Keep in a tight stoppered bottle for a number of days. $\text{As}(\text{OK})_3$ is first formed, leading to production of $(\text{C}_3\text{H}_7)_2\text{AsO}(\text{OK})_2$ and KI , and the unavoidable side reaction:—



also takes place. Distil to remove alcohol and the ethyl propyl ether. Add hydrochloric acid to incipient precipitation, then pass chlorine into the liquid until the pure white double salt $\text{As}_2\text{O}_3.2\text{KI}$ first formed is dissolved and all the iodine precipitated. The filtrate is then heated with magnesia mixture to precipitate the arsenate; on boiling the filtrate from the ammonium magnesium arsenate with more magnesia mixture, the magnesium salt of normal propyl arsonic acid precipitates as pearly white soapy crystals. The yield is stated to be 42 per cent. The salt has the composition $\text{C}_3\text{H}_7\text{AsO.OOMg}$. It contains, like magnesium ammonium arsenate dried over 100°, 1 mol. of water to 2 of the anhydrous salt. The free acid (*n*-propyl arsonic), in acicular crystals, is made by treating the magnesium body in the cold with a calculated quantity of concentrated sulphuric acid and extracting with alcohol. The same remarks regarding the possible formation of potassium propyl arsenite, etc., apply as under "Magnesium Ethyl Arsonate."

Iso-amyl arsonic acid. $\text{C}_5\text{H}_{11}\text{AsO}(\text{OH})_2$. The preparation of this acid is analogous with that for normal propyl arsonic acid by treatment of arsenious acid 150 parts (2 mols.) with potassium hydroxide 254 parts (6 mols.) and iso-amyl iodide 300 parts (2 mols.) in presence of alcohol. After two to three days distil off the alcohol, carefully neutralise the liquid, and filter from the double salt $\text{As}_2\text{O}_3.2\text{KI}$. Upon acidifying after some time shining crystals form of the composition $\text{C}_5\text{H}_{11}\text{AsO}(\text{OH})_2$.

The same remarks apply here as under the corresponding ethyl and propyl bodies.

Up to the present only a few of the arsonic acids in the aliphatic series have been prepared and examined; obviously of each acid innumerable salts suggest themselves as worthy of experimental trial. In the aromatic series, however, experimentation has been more prolific.

(ii.) *Aromatic series. Potassium phenyl-arsenite.* $\text{C}_6\text{H}_5\text{As}(\text{OK})_2$. Arsenious chloride and mercury diphenyl combine¹² by heating one hour at water-bath temperature

⁸ Chem. Zentr., 1907, 1/152, from Arch. Exp. Path. Pharm., 56, 101–114.

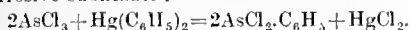
⁹ Bull. Soc. Chim., 1905 [iii], 33, 1139–1143.

¹⁰ Am. Chem. J., 1905, 33, 101–153; also J. Amer. Chem. Soc., 1906, 28, 347–361.

¹¹ J. Amer. Chem. Soc., 1906, 28, 347.

¹² Berichte, 8, 1316, 9, 1566.

with a reflux condenser, forming phenyl-arsenious chloride and corrosive sublimate:—

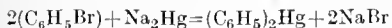


The organic body is separated from the arsenious trichloride employed in excess, by fractionating (boiling-point 252° — 255° C.). It is very caustic to the skin—this I most certainly verified. Another way of making is to heat triphenylarsine with arsenic trichloride.¹³ Phenyl arsenious chloride is not affected by water, but can be converted by alcoholic potash into potassium phenyl-arsenite, potassium chloride separating out. Though at first obtained in yellow (impure) crystals it was ultimately purified to white from absolute alcohol. It is a very poisonous substance. Soluble in absolute alcohol in all proportions.

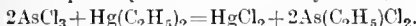
Sodium phenyl-arsenite. $\text{C}_6\text{H}_5\text{As}(\text{ONa})_2$. Also produced from the acid by neutralising.

Note.—The necessary diphenyl mercury for the above-mentioned method of manufacture is prepared by mixing benzene monobromide with an equal volume of xylene and excess of sodium amalgam containing not too much sodium.

A little acetic ether is a useful addition. The reaction—



—is complete after a few hours' boiling. A little benzene is added to the flask containing the diphenyl body, sodium bromide and metal mercury, the liquor is filtered off in a hot-water funnel, and the substance recrystallised from benzol. Melting-point, 120° . It may be pointed out this method is equally applicable for producing the dihalogen derivative of a primary arsine in the fatty series,¹⁴ e.g.:



Potassium phenyl arsenite on warming with concentrated hydrochloric acid is converted into phenyl-arsen-chloride again. By using hydrobromic or hydriodic acid phenyl-arsen bromide or iodide can be made.

Sodium in absolute alcohol or sodium amalgam reduces phenyl arsenious chloride to arsenobenzene¹⁵—



but hydrogen peroxide will oxidise it to—

Phenyl-arsonic acid. $\text{C}_6\text{H}_5\text{AsO}(\text{OH})_2$. On saturating phenyl arsenious chloride with chlorine, *phenyl-arsenic tetrachloride*, $\text{C}_6\text{H}_5\text{AsCl}_4$, is formed—a yellow solid substance. This decomposes violently with water or moist air, forming a solid oxychloride, $\text{C}_6\text{H}_5\text{AsOCl}_2$,¹⁶ at first (probably). On further addition of water the dibasic phenyl-arsonic acid as above is produced, forming long white needles soluble in cold water to some extent, very soluble in hot. Melting point 168° .

In author's experiments, a few drops of water added, rendered the chlorination more vigorous. A shorter method of manufacture is to pass chlorine into a mixture of 25 parts phenyl-arsenious chloride, $\text{C}_6\text{H}_5\text{AsCl}_2$, with 100 parts of water until the oily globules have disappeared. One then warms to the point at which on cooling the liquid remains clear, evaporates to dryness to derive off hydrochloric acid, and then purifies by recrystallisation from warm water.¹⁷

Diphenyl-arsinic acid. (Phenyl-cacodylic acid) $(\text{C}_6\text{H}_5)_2\text{AsO} \cdot \text{OH}$. To produce this acid one may start from diphenylarsenous chloride, $(\text{C}_6\text{H}_5)_2\text{AsCl}$. This body is left behind as a much less volatile fraction (333°) on fractionating mono-phenyl-arsenious chloride from the arsenious trichloride as previously described. The best method of procedure is to pass chlorine rapidly through diphenyl-arsenous chloride, $(\text{C}_6\text{H}_5)_2\text{AsCl}$, in the presence of a considerable amount of water, then warm to 60° — 70° , not exceeding this temperature. When chlorination is completed with formation of the trichloride $(\text{C}_6\text{H}_5)_2\text{AsCl}_3$, evaporate on a water-bath to dryness, and take up the residue with hot water, from which the acid separates.¹⁸

In author's experiments ether was used as solvent; otherwise the whole mass was likely to go solid.

Diphenyl-arsinic acid is obtainable in long needles.

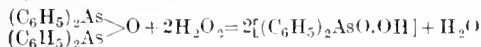
Soluble with difficulty in cold water, easily in hot. Melting at 174° .

Another way of making phenyl-cacodylic acid would be by oxidising diphenyl-arsen oxide, $(\text{C}_6\text{H}_5)_4\text{As}_2\text{O}$ (phenyl-cacodyl oxide), produced by the action of magnesium phenylbromide on arsenious acid in ethereal solution.¹⁹ Approximately the reaction may be represented by the following equation:



The magnesium in finely powdered condition is dissolved in the benzene monobromide in absolute ether, and the arsenious oxide is added; it dissolves with heat evolution. After a little time the brown magnesium body separates in an apparently crystalline condition. The mixture is heated on the water-bath half an hour (diphenyl body is formed in this period and triphenyl arsine after three hours' heating). Distil off part of the ether, then add carefully water and acetic acid. The ether layer is removed, dried with sodium sulphate, filtered, and evaporated: an oily body is obtained which becomes solid in a few days. It is dried on porous clay and then has melting-point 90° — 91° . The precaution specially necessary in this reaction, is to dehydrate the ether with sodium and to use a little methyl or ethyl iodide to promote interaction. The compound is to be recrystallised from ether.

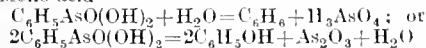
The author oxidised this diphenyl arsenious oxide with hydrogen peroxide.



(There was more reaction in the presence of alkali.) Ultimately effervescence ceased and the substance (sodium phenyl-cacodylate) became practically solid.

Although Bansen originally stated that cacodylic acid was non-poisonous, it was proved later by Schulz²⁰ that 0.3 grm. of (pure) acid neutralised with alkali was a fatal dose for a rabbit. Schulz advanced the following as the possible explanation of what occurs in the body:

(a) Mono-acid—

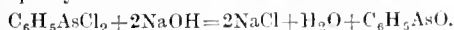


(b) Di-acid—

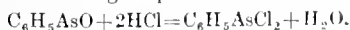


The formation of benzene seems improbable. In any case both the phenyl-arsonic and diphenyl-arsinic acids are poisonous.

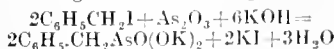
*Phenyl-arsenious oxide.*²¹ $\text{C}_6\text{H}_5\text{AsO}$. This body (mentioned for theoretical interest only) is prepared on lines exactly analogous with the Baeyer method of making cacodyl oxide from cacodyl chloride by pouring water on to phenyl-arsenious chloride, warming gently, and adding sodium carbonate in small portions until effervescence ceases. Cool, and pour the aqueous liquid from the cake, dissolve the latter in hot alcohol, filter, and evaporate over sulphuric acid. The oxide is obtained as a crystalline crust. At ordinary temperatures it has the odour of anise; heated it is most penetrating to the nostrils. Another way of proceeding²² is to act on dichlorophenyl-arsine with caustic or carbonated soda—



Phenyl-arsenious oxide is insoluble in water. It melts at 119° — 120° . Warmed with hydrochloric acid, phenyl-arsenous chloride is again produced—



Benzyl-arsonic acid.—This body is stated to be easily prepared according to the following reaction:



Dissolve the substances in alcohol and water as under iso-amylarsonic acid, free from alcohol by distillation; first neutralise, then carefully acidify the residue with hydrochloric acid. A precipitation of benzyl-arsonic acid

¹³ Michaelis, *Berichte*, **27**, p. 264; *Valeur*, p. 150.

¹⁴ La Coste, *Annalen*, **208**, 33.

¹⁵ *Valeur*, p. 149.

¹⁶ *Berichte*, **10**, 622.

¹⁷ La Coste, Michaelis, Loesner, *Annalen*, **201**, p. 203.

¹⁸ Michaelis, *Annalen*, **201**, 231; *Annalen*, **321**, 151.

¹⁹ *Berichte*, 1908, **41**, 2767.

²⁰ *Berichte*, 1879, **1**, 23.

²¹ *Berichte*, **10**, 622.

²² Michaelis and La Coste, *Annalen*, **201**, p. 191.

to the extent of 60 per cent. is stated to occur. The acid has melting-point 167°. Soluble with difficulty in cold water, but easily in hot.

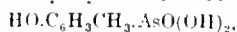
p-Tolyl-arsenic acid, $\text{CH}_3\text{C}_6\text{H}_4\cdot\text{AsO}(\text{OH})_2$, is of interest in view of a recent report of its efficacy on trypanosomes (*vide* Sodium Arsanilate).

In making this acid chlorine was rapidly passed through *p*-tolyl-arsenious chloride, $\text{C}_7\text{H}_7\text{AsCl}_2$, in a vessel with five times its weight of water, then warmed to 60°–70°. When chlorination was complete the liquor was evaporated on a water-bath to dryness. The residue was taken up with hot water, from which the acid crystallises.

Tolyl arsenious chloride is made from arsenic trichloride and mercury ditolyl, $\text{Hg}(\text{C}_7\text{H}_7)_2$. The ditolyl body is made from *p*-tolyl bromide, which in turn is prepared by the action of bromine in the cold on toluene.

p-Benzo-arsenic acid, $\text{COOH}\cdot\text{C}_6\text{H}_4\cdot\text{AsO}(\text{OH})_2$. This acid has been prepared by oxidising *p*-tolyl-arsenic acid with alkaline permanganate.

p-Hydroxyphenyl-arsenic acid $\text{HO}\cdot\text{C}_6\text{H}_4\cdot\text{AsO}(\text{OH})_2$, two forms of hydroxytolyl-arsenic acid



phenyl-glycine *p*-arsenic acid



sulphur derivatives *p*-amino-phenyl-arsenious sulphide $\text{NH}_2\cdot\text{C}_6\text{H}_4\cdot\text{AsS}$, *p*-acetyl-amino-phenyl-arsenic sesquisulphide $\text{O}(\text{NH}\cdot\text{As}\cdot\text{C}_6\text{H}_4\cdot\text{As})_2\text{S}_3$, and phenyl-glycine arsenic disulphide $\text{COOH}\cdot\text{CH}_2\cdot\text{NH}\cdot\text{C}_6\text{H}_4\cdot\text{AsS}_2$ have been made the subjects of German patents.²³

Sodium *p*-aminophenyl arsanilate, or arsamin, atoxyl, soamin, sodium arsanilate, $\text{NH}_2\cdot\text{C}_6\text{H}_4\cdot\text{AsO}\cdot\text{OH}\cdot\text{ONa} + \text{Aq}$. For method of manufacture of this body Ehrlich and Berthelm²⁴ should be consulted.

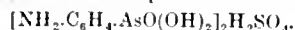
This salt is stated to crystallise with 5H₂O and to lose 3H₂O by efflorescence. Its arsenic content varies in consequence from about 20 to 25 per cent. The amount of water found by Moore, Nierenstein, and Todd²⁵ was rather less than 4H₂O. Author's experiments indicated practically 4½H₂O in a foreign commercial product, while his own substance contained 19 to 22 per cent.

Ehrlich and Berthelm state that the salt is produced with 2 and with 6 H₂O, according to the solvent employed. Author assumes the tendency to efflorescence to be due to the fact that the salt has been crystallised from water. To employ alcohol would therefore be very much better.

The anhydrous substance is readily soluble in methyl alcohol, and practically insoluble in ether, acetone, benzol, or chloroform. Reactions of its aqueous solution with solutions of various metallic salts and a detailed account of its therapeutic action are given.²⁶ That atoxyl is sodium arsanilate, and not the anilide of arsenic acid, $\text{C}_6\text{H}_5\text{NH}\cdot(\text{OH})_2\text{AsO}$, nor the anilide of met-arsenic acid, $\text{C}_6\text{H}_5\text{NH}\cdot\text{AsO}_2$, can be shown—(1) By the fact that it cannot be hydrolysed into aniline; (2) it contains a primary amino group; (3) the arsenic-acid radicle can be replaced by iodine yielding *p*-iodoaniline. The now somewhat classic confusion between Béchamp's arsenic anilide and the acid obtained from commercial atoxyl, which was called meta-arsenic anilide (though a sodium salt), may be cleared up by the statement that Ehrlich and Berthelm found the two substances to be identical chemically.

Arsanilic acid, $\text{NH}_2\cdot\text{C}_6\text{H}_4\cdot\text{AsO}(\text{OH})_2$, is slightly basic. Its hydrochloride is immediately hydrolysed by water. It is soluble, however, in methyl and ethyl alcohol.

The sulphate has the composition



Acetyl *p*-aminophenyl-arsenic acid,



forms glistening leaflets, easily hydrolysed by hot alkalis and acids, does not react with naphthoquinone sulphonie acid, and forms a sodium salt. To show basicity of the substance arsanilic acid, if one adds mineral acid in excess to a solution of atoxyl, the precipitate first formed redissolves;

acetic acid in excess, however, does not cause re-solution, for which reason sodium acetate throws out *p*-aminophenyl-arsenic acid from a solution in mineral acid. These facts may well be tabulated:

(1) Sodium arsanilate + H₂SO₄ = arsanilic acid → H₂SO₄ salt.

(2) Sodium arsanilate + acetic acid = arsanilic acid → not acetic acid salt.

(3) [Arsanilic acid]·H₂SO₄ + sodium acetate = [arsanilic acid + acetic acid] + Na₂SO₄.

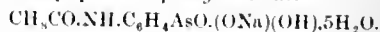
Atoxyl solutions should be made with cold boiled water, unsterilised and stored in the dark.²⁷ Before use boil two minutes. Must not be allowed to become alkaline. Boiling the solution is stated to be liable to liberate arsenic acid.

Gadamar says²⁸ that atoxyl is not decomposed by hydrogen-sulphide solution. This is believed to be true to a limited degree only,²⁹ according to the temperature employed—i.e., if the hydrochloric solution be hot the arsenic is precipitated quantitatively, whereas at 0° C. the precipitate is probably $\text{NH}_2\cdot\text{C}_6\text{H}_4\cdot\text{AsS}_2$. I understand, nevertheless, that Lockermann is in error, and that the anilin radicle is present in his arsenic precipitate.

Atoxyl may, it is stated, be estimated in manner exactly as for Arrhenal (*q.v.*), 4 atoms of iodine corresponding to 1 molecule of atoxyl.³⁰ In trying the method I found that the substance turned yellow as distinct from the arrhenal result, and the wash-liquor caused further deposition. I discarded this method in favour of fusing with magnesium nitrate and the volumetric process described later.

Detection in urine.—If 5 c.c. of normal urine is heated to 100° for thirty to forty-five minutes with 10 c.c. of the hydrochloric-hypophosphorous acid reagent and a drop of N/10 iodine solution, it assumes a dark-brown colour, while if 0.25 mgrm. of atoxyl or arrhenal be present the darkening is only slight. 0.01 grm. of atoxyl per 250 c.c. of urine may be detected by this reagent.³⁰ Further, delicate tests for atoxyl are supplied by Covelli.³¹

Sodium acetyl-*p*-amino-phenylarsenate.



Also arsacetin (reg. trade mark; patented), acetyl-atoxyl. This salt is prepared³² by neutralising acetyl-arsanilic acid with warm concentrated soda solution *q.v.* It occurs as a white crystalline powder soluble 1 in 10 of water.

For acetylating sodium arsanilate 31 parts are treated with acetic anhydride 55, adding, after interaction, water 300 and hydrochloric acid 52 parts.

This body is stated to be even less toxic than atoxyl. Solutions of acetyl-atoxyl can be sterilised by heat without decomposition, and can be stored without alteration. Sodium benzoyl-arsanilate, $\text{NH}\cdot\text{OC}\cdot\text{C}_6\text{H}_5\cdot\text{C}_6\text{H}_4\cdot\text{AsO}\cdot\text{OH}\cdot\text{ONa}$,

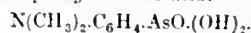
Sodium benzoyl-acetyl-arsanilate,



as also

Sodium-*p*-hydroxy-phenyl-arsenate, $\text{OH}\cdot\text{C}_6\text{H}_4\cdot\text{AsO}\cdot\text{OH}\cdot\text{ONa}$ have been prepared. These bodies have been tested³³ both as to protein precipitation and action on trypanosomes: those yielding precipitates with protein containing arsenic were the most active on trypanosomes. The hydroxyl body last mentioned and the benzoyl-acetyl-atoxyl were void of action. The conclusion arrived at was that the NH₂ grouping is an essential adjuvant to the arsenic in combating trypanosomes.

Dimethyl amino-phenyl-arsenic acid,



p-dimethylaminophenyl arsenic acid³⁴ (previously described by Michaelis and V. Brnder, "Ann." 320, 296)

²⁷ Yakimoff, Chem. Zentr., 1908, i, 979, ex Deutsch. Med. Woch., 1908, 34, 200–202.

²⁸ Apoth. Zeitung, 1902, 2, 566.

²⁹ Chem. Zentr., 1908, ii, 1542–1543, ex Deutsch. Med. Woch., 1908, 34, No. 34.

³⁰ Bougault, J. Pharm. Chim., 1907, VI., 26, 13–20.

³¹ Chem. Zeit., 1908, 32, 1008; J. C. S. Abs. II., Nov., 1908, 1000.

³² Berichte, No. 12, July 20, '07, p. 3292.

³³ Nierenstein, *ibid.*

³⁴ Berichte, Michaelis, 41, '08, 1514.

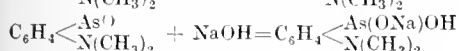
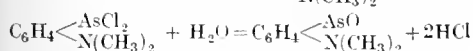
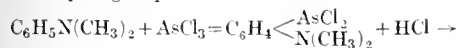
²³ This J., 1909, 328 and 383.

²⁴ Ehrlich and Berthelm, Berichte, '07, 40, 3292.

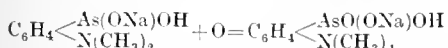
²⁵ Moore, Nierenstein, and Todd, Bio-Chem. J., 1907, 2, 300–324.

²⁶ J. Pharm. Chem., 1907 [VI], 25, 528–537.

is made by oxidising dimethyl-anilin-arsenious oxide, $(\text{CH}_3)_2\text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{AsO}$, with hydrogen peroxide in presence of alkali. Pour over 5 grms. of the body in question 100 c.c. water and 20 c.c. of 15 per cent. NaOH and then gradually 6 c.c. of 30 per cent. H_2O_2 and precipitate as soon as complete solution occurs with dilute acetic acid. Instead of isolating this dimethyl-aniline-arsenious oxide (see "Ann." 270, 139, for preparation) one can convert it direct: 15 grms. dimethyl-aniline are mixed with 25 grms. arsenious chloride and heated two hours on a water-bath, and poured into 300 to 400 c.c. cold water. The mixture dissolves in the water. Add sodium hydroxide in excess until the dimethyl-anilin-arsenious oxide at first thrown out redissolves (it goes milky at first). Shake out the dimethylanilin used in excess with petroleum ether and add hydrogen peroxide to the alkaline liquor. Dilute acetic acid separates the body. (To ascertain whether sufficient hydrogen peroxide had been used a little *liquor iodi* was employed, causing chocolate precipitate showing excess of hydrogen peroxide).

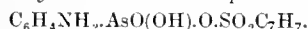


then



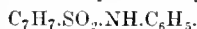
Sodium dimethylaminophenylarsonate or sodium dimethyl arsanilate. $(\text{CH}_3)_2\text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{AsO} \cdot \text{OH} \cdot \text{ONa} \cdot 5\text{H}_2\text{O}$. Sodium dimethyl-arsanilate crystallises in leaflets, is slightly soluble in cold water and in alcohol, more so in hot and in dilute acetic and mineral acids.

p-Amino-phenyl-arsenic-toluene-sulphonate.



This body is a new compound prepared by the Schotten and Baumann reaction by condensing para-toluene sulphonic chloride, $\text{C}_7\text{H}_7\text{SO}_2\text{Cl}$ (a by-product in sulphonating toluene), with sodium arsanilate.

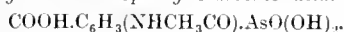
It would have the advantage of splitting up into a comparatively innocuous body in the system—



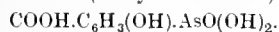
It is obtainable in a white crystalline condition soluble in hot water.

Trisodium arsenite reacting with *p*-toluene sulphonic chloride yields sodium toluene sulphinate and trisodium arsenate.³⁵ It has been suggested that the chloride first reacts with the alkali, forming sodium hypochlorite, $\text{NaO} \cdot \text{OH}$, which then oxidises the arsenite to arsenate.

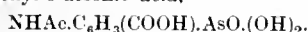
1-Carboxy-6-acetaminophenyl-3-arsenic acid.



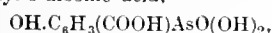
This has been made³⁶ by oxidising 6-acetaminotolyl-5-arsenic acid in aqueous solution with potassium permanganate. White needles containing 1 molecule of water, melting-point about 230°. Hydrolysed with alkali or acid yields 1-carboxy-6-aminophenyl-3-arsenic acid (anthranil-arsinic acid), $\text{COOH} \cdot \text{C}_6\text{H}_3(\text{NH}_2) \cdot \text{AsO}(\text{OH})_2$, in needles, melting-point 245°, which may be diazotised and coupled with amines and phenol. An aqueous solution of the diazo-sulphate of this body yields 1-carboxy-6-hydroxyphenyl-3-arsenic acid (salicylarsonic acid):



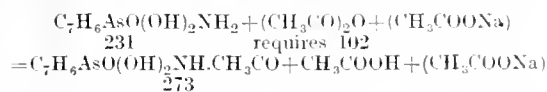
2-Amino-tolyl-5-arsenic acid. $\text{NH}_2 \cdot \text{C}_7\text{H}_6 \cdot \text{AsO}(\text{OH})_2$. Patented.) 2-Amino-tolyl-5-arsenic acid forms a sodium salt, $\text{C}_7\text{H}_5\text{O}_3\text{NAsNa}$, in colourless crystals. It may be acetylated, forming the body, $\text{NHAc} \cdot \text{C}_7\text{H}_6 \cdot \text{AsO}(\text{OH})_2$. This is oxidisable with alkaline permanganate into 2-acetylaminocarboxyphenyl-5-arsenic acid,



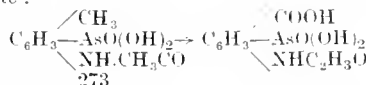
On diazotising, this substance is converted into 2-hydroxy-carboxyphenyl-5-arsenic acid,



in colourless needles. To produce the 2-amino-tolyl-5-arsenic acid 23 parts of arsenic oxide and 130 parts of orthotoluidine (*i.e.*, about ten times as much toluidine as is required) may be heated together. There is some spontaneous heat evolution before solution is effected. The following indicates the acetylation:

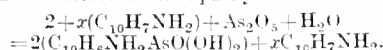


and the following the oxidation with potassium permanganate:



Diazotising is then effected by treating with sulphuric acid and sodium nitrite.

Amino-naphthyl-arsenic acid.³⁷ $\text{NH}_2 \cdot \text{C}_{10}\text{H}_6 \cdot \text{AsO}(\text{OH})_2$. Is prepared on lines corresponding with arsanilic acid by heating α -naphthylamine with α -naphthylamine arsenate at 200°C.; in other words, heating arsenic acid with an excess of α -naphthylamine—



Naphthylamine 230 parts with arsenic acid 23 parts and water sufficient to dissolve were heated to 200° for two hours and treated with sodium hydroxide in the customary manner, passing through the acid stage to purify. The salt was ultimately obtained in pinkish-coloured crystals.

Dicamphoryl arsenic acid.—Quite recently Dr. Morgan³⁸ and Miss Micklethwaite have described this body, made by condensation of arsenious chloride with sodium camphor in dry toluene, a monobasic acid of formula $\text{C}_{20}\text{H}_{30}\text{O}_4\text{AsH}$ being ultimately obtained—*i.e.*, $(\text{C}_{10}\text{H}_{15}\text{O})_2\text{AsO} \cdot \text{OH}$ —almost insoluble in water, readily in benzene, chloroform, &c. The alkali salts are, however, extremely soluble. The author has repeated these experiments.

It is difficult to generalise on the effects which all the foregoing bodies would have on the system. So far as the organic radicle is concerned, if its importance is not outweighed by the arsenic and the arrangement of that element in the molecule of the substance, one may point out that in general, fatty bodies tend to give rise to tremor, convulsions, and paralysis, whilst aromatic bodies produce anaesthesia. Further generalisations³⁹ as to benzene compounds are that—

- (i.) Those containing hydroxyl are antiseptic.
- (ii.) Those containing an amido group or an acid amide are hypnotic.
- (iii.) Those containing an amine and an alkyl are analgesic.

Contrary to the fact that fatty acids are as a general rule easily oxidised in the system, the benzene ring in a medicinal chemical is rarely broken up. Benzene itself is oxidised to phenol. Naphthalene is eliminated as a glycuronic derivative.

It is of interest to recall that arsenic derivatives lose their physiological characteristics on being converted into salts of arsonium bases. These possess a strong curare-like action (paralysing ends of motor nerves of muscles). This occurs, it will be noticed, simultaneously with a change from the 3 to the 5 valent atom.

Iodoform; [Alleged] Formation of —, from carbon dioxide in presence of ammonia. A. Labat. J. Pharm. Chim., 1909, 30, 107–109.

It is found that the supposed formation of small quantities of iodoform by the action of iodine on carbon dioxide in presence of ammonia as stated by Guerin (this J., 1909, 220), does not occur. The iodoform found is derived, not from the carbon dioxide, but from a trace of a ketonic impurity, probably acetone, in the liquid ammonia. It is not invariably formed under the conditions of the

³⁵ Berichte, 1909, 42, 480–483.

³⁶ Kahn and Benda, Berichte, '08, 41, 3859–3865.

³⁷ O. and R. Adler, Berichte, '08, 41, 931.

³⁸ J.C.S. Trans., Dec., '08, 2144.

³⁹ Francis and Brickdale, Chemical Basis of Pharmacology.

experiment, with all solutions of ammonia; and when produced, is obtained with equal facility, and in the same quantity, by the action of iodine on the ammonia alone, without the intervention of any carbonic acid gas.—J. O. B.

Anthranol; *Some reactions of* ——. R. Padova. *Comptes rend.*, 1909, **149**, 217—220.

When anthranol is boiled with a solution of phenylchloroform in toluene, hydrochloric acid is evolved and dichlorobenzylanthrone, is produced which crystallises from acetone in small, slightly grey prisms melting at 158°—159° C. When heated with pyridine, this substance loses a molecule of hydrogen chloride and forms *o*-chlorophenylanthraquinomethane. This substance crystallises in small prisms with a faint rose colour, gives a dark red coloration with concentrated sulphuric acid and melts at 130°—131° C. Arylanthramines, $R.NH.C_{11}H_9$, can be formed by heating anthranol with excess of arylamines. Phenylanthramine melts at 197°—198° C.; *o*-naphthylanthramine at 199°—201° C., *β*-naphthylanthramine at 213° C. Phthalylideneanthrone can be formed by heating phthalyl chloride in xylene with anthranol. It crystallises in transparent brown leaflets, melting at 262°—264° C. If anthranol be treated with phenanthrenequinone in acetic acid, oxidation takes place and dianthrone, decomposing at 232°—250° C., is produced. When diphenylanthraquinomethane (anthrafuchsone) is reduced with zinc dust and acetic anhydride, it yields acetoxy-10-anthryl-9-diphenyl-methane, melting at 228°—229° C. The solutions of this substance have a strong violet fluorescence.—F. SHDN.

Nitrosobenzene; *New method of preparing* ——. B. Oddo. *Gaz. chim. ital.*, 1909, **39**, I., 659—661.

NITROBENZENE can be obtained, in a yield of 56 per cent. of the theoretical quantity, by the action of nitrosyl chloride on phenyl-magnesium bromide. The nitrosyl chloride is passed into a solution of phenyl-magnesium bromide in anhydrous ether, contained in a flask fitted with a reflux condenser, until it is no longer absorbed. The product is treated with ice and then distilled with steam. The nitrosobenzene is purified by crystallisation from ether. The nitrosyl chloride is preferably prepared by the method of Francesconi and Bresciani (*Gaz. chim. ital.*, 1904, **34**, II., 13), based on the direct union of chlorine with nitric oxide by means of the catalytic action of carbon. It can be preserved in the form of a solution in anhydrous toluene, from which it is expelled by warming.—A. S.

Phenol; *Oxidation of* ——. *Effect of some forms of light and of active oxygen upon phenol and anisol.* H. D. Gibbs. *Philip J. Sci. A.*, 1909, **4**, 133—151.

PURE phenol remains colourless in the sunlight when in contact with indifferent gases, but becomes coloured in the presence of oxygen (this J., 1909, 326). The rate of coloration is slow at the ordinary temperatures, but is fairly rapid at the boiling point of phenol. Oxidation is the cause of the coloration, and quinol, quinone and catechol are produced, and probably, phenoquinone. Active oxygen, that is, ozone or the oxygen liberated at the anode of an electrolytic cell, reacts easily, producing the above-mentioned substances besides glyoxylic acid and carbon dioxide. Glasses which have the most complete ultra-violet absorption retard the reaction of sunlight in the greatest degree. Ozone could not be detected in pure dry oxygen exposed to sunlight. Phenol methyl ether is not coloured by ozone, oxygen, or sunlight. In order to obtain perfectly pure phenol, it must be distilled out of contact with oxygen.—F. SHDN.

Hydroxylamine; *Alkalimetric determination of* ——. A. Stähler. *Ber.*, 1909, **42**, 2695—2696.

THE hydroxylamine is reduced with titanous chloride or titanous sulphate solution, and the resulting ammonia distilled into *N*/10 acid which is then titrated back. The method may be also used for all nitrogenous organic compounds which are reduced by titanous chloride or sulphate, forming volatile amines. The reduction is

carried out in mineral acid solution, the titanous salt being added with shaking until a permanent pink coloration is produced, and the ammonia distilled in the usual manner after addition of potassium hydroxide solution in excess; the titanium hydroxide which is then precipitated, should be of a bluish colour.—E. F.

Primary, secondary, and tertiary alcohols; *The Sabatier-Senderens test for distinguishing between* ——. G. B. Neave. *Analyst*, 1909, **34**, 346—348.

ACCORDING to Sabatier and Senderens (this J., 1903, 577, 657), by the catalytic action of finely-divided copper at 300° C., primary alcohols yield hydrogen and aldehydes, secondary alcohols yield hydrogen and ketones, and tertiary alcohols yield water and unsaturated hydrocarbons. In the author's experiments, the vapours issuing from the tube containing the copper were condensed, and portions of the distillate were treated with:—(1), a solution of magenta decolorised by sulphur dioxide: red coloration indicates aldehydes; (2), a solution of semicarbazide hydrochloride and potassium acetate: ketones give a white precipitate; (3), bromine: unsaturated hydrocarbons cause decolorisation. The test was found to be satisfactory in the case of the 13 primary, 9 secondary and 8 tertiary alcohols examined. The method is useful for the preparation of the corresponding aldehydes from ethyl and normal propyl alcohols, a yield of about 50 per cent. being obtained in the former case.—A. S.

Bismuth salicylate; *Determination of free salicylic acid in* ——. J. B. P. Harrison. *Brit. Pharm. Conf.*, Newcastle, July, 1909.

IN order to determine the free salicylic acid in bismuth salicylate, 1 gm. of the salt is shaken up with 10 c.c. of methylated ether, sp. gr. 0.720, the liquid filtered, evaporated to small bulk on the water bath, and then allowed to evaporate spontaneously. The residue is dissolved in 0.5 c.c. of distilled water and the free salicylic acid determined colorimetrically by means of ferric chloride. The amount of free acid extracted in this way is about one-half of that actually present. 10 grms. of the bismuth salt, containing known amounts of free salicylic acid were extracted in a Soxhlet apparatus. It was found that chloroform and ether of sp. gr. 0.720 were the only satisfactory solvents. Chloroform extracts the whole of the free acid and does not decompose the salt, but it requires a longer time. Ether is quicker, and although it decomposes the bismuth salt, does so to a constant amount. Evaporation of the solvent can be avoided by shaking it with a known volume of standard alkali, neutralising and determining the salicylic acid colorimetrically, but this method is not generally applicable.—F. SHDN.

Antimonium sulphuratum. F. H. Alcock. *Brit. Pharm. Conf.*, Newcastle, July, 1909.

COMMERCIAL *Antimonium Sulphuratum* contains sulphur in various forms, some of which interfere with the uses of this compound. The sulphur may be present in the free state, as sulphuric acid, calcium sulphate, sulphide or thiosulphate, or as the normal antimony trisulphide. Calcium phosphate has also been found, and sodium salts. The test suggested by Tilden should not be forgotten, namely, that antimony sulphide should impart nothing to water.—F. SHDN.

Antimony in its sulphide preparations; *Determination of* ——. D. L. Howard and J. B. P. Harrison. *Brit. Pharm. Conf.*, Newcastle, July, 1909.

THE following method for the determination of antimony can be applied to *Antimonium Sulphuratum*, and the golden sulphide of antimony. 0.5 gm. of this substance is weighed into a 60 c.c. nickel crucible and mixed with 4 grms. of sodium carbonate and 4 grms. of sodium peroxide. The whole is covered with a thin layer of peroxide, and carefully heated at first with a very small flame. The heating is then to be increased till the contents have completely melted. The melted substance is dissolved in a small quantity of water, and sufficient hydrochloric acid added to bring the antimony into solution. The liquid is heated to drive off all chlorine and made up to

50 c.c. If the black sulphide is being analysed, 3 grms. each of sodium carbonate and peroxide are needed for each 0.5 gm. of substance. The sodium carbonate is employed as a diluent or moderator of the action of the peroxide. 100 c.c. of the clear liquid are filled with potassium metabisulphite, made alkaline with phenolphthalein with sodium hydroxide, and tartaric acid is added till the precipitate first formed is redissolved. Three grms. of sodium bicarbonate are added, and the titrimony estimated by titrating with $N/10$ iodine solution. The sulphur is determined by precipitating the clear liquid with barium chloride in the usual way.

—F. SHDN.

Diphenylcarbazine; Use of symmetrical — in volumetric analysis. Determination of mercury in mercurous salts. B. Oddo. *Gaz. chim. ital.*, 1909, **39**, I., 666—671.

THE author uses as an indicator for the determination of the end point of the titration of mercurous salts with sodium chloride solution, symmetrical diphenylcarbazine $(C_6H_5)_2N.H.NH.C_6H_5.CO$, which has already been proposed by azeneuve (this J., 1900, 1007, 1040) as an analytical agent, and has been used by the author in the volumetric determination of copper (this J., 1903, 1066). The intense red coloration produced by mercurous salts with the agent is not affected by small quantities of nitric acid. The process is as follows:—The solution of the mercurous salt is rendered nearly neutral by addition of sodium carbonate, and is then titrated with a $N/10$ solution of sodium chloride, the end of the reaction being attained when a drop of the clear solution no longer gives a coloration on a test-paper prepared with an acetic acid solution of diphenylcarbazine. For the determination of mercurous in presence of mercuric salts, the solution is first treated with a known excess of $N/10$ sodium chloride solution, the mercurous chloride filtered off and washed, and the mercuric salt in the filtrate precipitated with hydrogen sulphide. After filtering, the solution is boiled to expel hydrogen sulphide, and the excess of sodium chloride titrated with mercurous nitrate solution.—A. S.

Analytic oxidation and reduction of organic compounds. Fokin. See XII.

Determining molecular weights of carbohydrates. II. Differentiating between primary and secondary and tertiary alcohols. Wacker. See XVI.

Amylacetate for celluloid factories in the Netherlands. Bd. of Tr. J., July 29, 1909. [T.R.]

DUTCH Royal Decree, dated the 30th June, provides for the duty-free admission under conditions prescribed in the Decree of the 11th August, 1908, of amylacetate for use in the manufacture of articles of celluloid.

Camphor exports of Japan. For. Off. Ann. Series, 1909. [T.R.]

THE figures for 1908 show a reduction from £513,000 to £10,000, as well as a decline in quantity from 1,820 to 1,076 tons. Meanwhile Chinese camphor and the various kinds of synthetic camphor which are being produced continue to prove most formidable competitors.

PATENTS.

Crystallized crystals of laxative salts; Production of —. T. Kerfoot, Ashton-under-Lyne. Eng. Pat. 15,306, July 20, 1908.

SALTS which possess laxative properties, such as sodium phosphate or phosphate, or magnesium sulphate, are rendered soluble by recrystallising them from a solution of one or more essential oils in water. The essential oils used could possess antiseptic properties, and may be used in approximately saturated solution. Pine oil and cinnamon oil are mentioned as being especially suitable.—T. F. B.

Pharmaceutical preparation [ergot] and process for obtaining the same. Knoll und Co., Ludwigshafen, Germany, Eng. Pat. 27,038, Dec. 12, 1908. Under Int. Conv., Dec. 23, 1907.

ERGOT and its extracts soon decompose and cannot be kept in stock longer than a year. According to this invention a permanent product, which retains the full effect of the fresh drug, is obtained from the aqueous extract of ergot, after removal of the fat, by neutralising, concentrating, and then treating it exhaustively with alcohol and ether of high percentage. By this treatment inactive substances separate out together with very small proportions of the active principles, whilst the main portion of the latter remains in the alcohol-ether solution. The latter is concentrated and dried, preferably *in vacuo*, and after admixture with lactose or other suitable substances, it is made into a permanent preparation.—J. F. B.

Therapeutic compound [from laudanum]; Manufacture of a —. H. S. Wellcome, London, and F. L. Pyman, Dartford. Eng. Pat. 314, Jan. 6, 1909.

WHEN laudanum (*N*-methyltetrahydropapaverine) is oxidised, e.g., by means of manganese dioxide and sulphuric acid, veratraldehyde is formed, together with a new base, 2,3-methylaminoethyl-4,5-dimethoxybenzaldehyde. The veratraldehyde is removed from the acid oxidised mixture by filtering, neutralising with sodium carbonate, again filtering, and extracting with benzene; the alkaline solution is mixed with sodium hydroxide and extracted with benzene, the benzene extract being shaken with dilute hydrochloric acid to neutralise the base. The new substance forms colourless needles, of m. pt. 123°—124° C. Its hydrochloride melts at 61°—62° C., its aurichloride at 169° C., and its picrate at 169°—170° C.—T. F. B.

Physiologically active base; Method of manufacture of a — [*p*-Hydroxyphenylethylamine]. H. S. Wellcome, London, and G. Barger, Herne Hill. Eng. Pat. 1560, Jan. 22, 1909.

WHEN *p*-hydroxybenzylcyanide is reduced, *p*-hydroxyphenylethylamine is produced. For example, 5 grms. of the above cyanide are dissolved in a little boiling alcohol, and 7—10 grms. of sodium are gradually added, the solution being kept boiling and concentrated. When the sodium is dissolved, the solution is neutralised with hydrochloric acid, evaporated to dryness, and extracted with absolute alcohol. The free base is obtained by rendering the solution of the hydrochloride alkaline with sodium carbonate, evaporating to dryness *in vacuo*, and extracting with boiling xylene, in which the base is slightly soluble. It is readily soluble in water and in warm alcohol; its m. pt. is 161° C., and it distils at 161°—163° C. (2 mm. pressure) and at 175°—181° C. (8 mm. pressure).—T. F. B.

Medical preparation [nuclein rich in iron] from yeast and process of manufacturing the same. A. Ascoli, Milan, Italy. Eng. Pat. 5571, March 8, 1909. Addition to Eng. Pat. 21,820, Oct. 15, 1908.

THE precipitate obtained by treating yeast according to the original patent (see Ger. Pat. 194,950; this J., 1908, 644), is washed and dried at about 50° C., with or without a vacuum. The dry product obtained is tasteless and stable. If, in the preparation of the product, a more dilute solution of alkali has been used than that described in the original patent, the temperature of drying must be raised.—T. F. B.

Tartar; Process for treating substances containing crude —, in order to render colouring matter insoluble. V. Garin and F. David. Second Addition, dated Mar. 7, 1908, to Fr. Pat. 374,276, April 12, 1906. (See this J., 1907, 778.)

PROLONGED boiling (e.g., for about 45 mins.), after treatment with formalin, may replace the drying specified in the principal patent.—F. SODN.

Surrender of Letters Patent under Section 26 (3) of the Patents and Designs Act, 1907. London Gazette, Aug. 13, 1909.

THE Comptroller-General has, on the application of the inventors, revoked the Letters Patent granted to Knoll, Daeger and Knoll for "Manufacture of santalol esters from sandal wood oil," No. 17,511, of Feb. 10, 1905 (this J., 1906, 233).

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENT.

Photographic reproduction of colours. E. C. G. Caille, Levallois-Perret, France. Eng. Pat. 15,050, July 15, 1908. Under Int. Conv., July 16, 1907.

A SCREEN for colour photography is prepared by superposing on a transparent surface, three transparent layers, one layer being ruled with parallel lines and the others with dots to fill the spaces between the lines; the layers are coloured orange, green, and violet respectively, and the screen is provided with guide-marks. An opaque "support" is then prepared to correspond exactly in ruling to the screen, the patterns being coloured with the colours complementary to those on the screen. This support is covered with a silver bromide-gelatin emulsion. The object to be reproduced is photographed on a photographic plate through the screen, and the resulting negative is printed in the usual manner on a support prepared as above, which is then developed and fixed. The result is a reproduction in colour of the original, but covered by a series of black dots consisting of reduced silver. These are bleached by means of a 1—2.5 per cent. solution of mercuric chloride, and the print is dried, without washing. Cupric chloride, or other chloride capable of converting silver into its chloride, may be used in place of mercuric chloride. Certain modifications of the above process are also described.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives; Thirty-third Annual Report of H.M. Inspectors of —. 1908.

Factories and magazines.—The number of factories under continuing certificate was 33 and under licence 105. The number of magazines under continuing certificate was 92 and under licence 348. During the year 154 visits were paid to factories, and 436 to magazines. There was an objection, during the course of the year, by the local authorities at Perranporth, Cornwall, to the granting of an amending licence for the storage of cordite. An appeal was made against this refusal, and an inquiry was held by one of the inspectors, with the result that the appeal was allowed.

Importation.—The amount of foreign blasting explosives containing nitroglycerin imported during the year was 1,086,205 lb., but of this quantity 656,250 lb. were transhipped to other countries. The amount of blasting explosives imported, not containing nitroglycerin, was 6,100 lb. The number of detonators imported was almost 18,000,000, but of this number almost 2,000,000 were immediately transhipped for other countries. 399 tons of fireworks were imported during the year.

Accidents.—The number of accidents from fire or explosion, of which the Department had cognisance during the year was 392, causing 34 deaths, and injuring 402 persons. The number of deaths (3) from accidents by fire or explosion in the manufacture of explosives, was much below the average for the decade (7).

Heat test committee.—A meeting of the officials of the explosives department and representatives of the trade was held on Dec. 15, 1908, to consider the question of the heat test for explosives. The general feeling of the meeting is stated to have been:—(1). That although the heat test was second to none as regards reliability; and as a test of purity in manufacture was, by reason of its

convenience and adaptability to all natures of nitro compounds, practically indispensable, it was undoubtedly highly desirable that where important interests were involved, a verdict of rejection should not depend on single test. (2). That, if substantial financial assistance were to be forthcoming from the trade, it was of the utmost consequence that any check test or tests should be formulated under the *auspices* of a body of experts of unquestioned authority such as a joint committee representing the Home Office, War Office, Admiralty, and lastly, the trade itself.

Chemical Advisers' Report.—Messrs. Dupré report that out of 416 samples examined, 58 were rejected. The rejections were for the following reasons, and in the numbers stated:—Heat test (16); exudation (8); containing mercury (10); incorrect composition (24); too sensitive (2).

There was a drop in the number of samples received from the Customs, and also in the number of samples examined in connection with the Home Office testing station at Woolwich. 56 tests for mercury were made and 183 special tests on gun-cotton. As regards the rejection of permitted explosives for incorrect composition, it is stated that this number is considered to be moderate considering the amount of these explosives now used, the complexity of the composition in many cases, and the smallness of the margin that can be allowed for error of manufacture.

The fund provided by the Treasury for the investigation into the heat test and other stability tests has been exhausted. A large amount of work has been done and Messrs. Dupré hope to have an opportunity of publishing all the results at a future date. In regard to the question of mercury in explosives, as stated in the report for 1907, it was found that 0.001 mgrm. of mercury under favourable conditions, has a marked influence on the heat test. With the conditions under which the spectroscopic test is worked, less than 0.01 mgrm. cannot be detected with certainty. Considering the explosive for which the smallest quantity is taken for the heat test, and the largest for the spectroscopic test, *viz.*, cordite, one thousandth of a 0.001 mgrm. of mercury, or a quantity sufficient to affect the heat test, on the 25 grains taken for this test, is, very approximately, 1 part in 2,000,000; while 1 part in 2,000,000 on the 15 grms. employed for the spectroscopic test is very nearly 0.01 mgrm., or the smallest quantity that can be detected. The two tests are therefore, in this case, strictly comparable, while in the case of all other explosives, under the tests at present prescribed, the heat test is the more sensitive. When considering the amounts of materials that might influence the heat test, their action under the most favourable conditions must be considered, such, *e.g.*, as would obtain if mercuric chloride in solution, were painted on the outside of the explosive. It is considered that the presence, in however minute a proportion, of an unnecessary ingredient, which may be objectionable, justifies the rejection of the material containing it, regardless of the quantity required to do actual harm. If it can be proved that the precautions necessary to avoid the presence of such minute traces would seriously hamper the trade as a whole, a compromise might become necessary. The results of a very large number of tests, made on many samples to which there was no reason to suspect a deliberate addition of mercury, have shown that it is, to say the least, highly improbable that the spectroscopic test, as carried out, will detect such mercury as may find its way into the explosive in the ordinary process of manufacture. A large amount of work on the stability and purification of gun-cotton was carried out and many interesting and suggestive results obtained, but no definite statement could, for the moment, be made upon this matter.

Testing station at Woolwich.—Captain Deaborough reports that eight explosives were submitted to the official test. Seven of these tests were successful with the result that one new explosive which was tested three times on account of variation in the percentage of the ingredients and in the nature of the wrapper, was added to the list. A table in the report shows the ignitions of firedamp, or coal dust, which were brought to the notice

of the department during the year. One of these was particularly noteworthy in that it occurred with the use of carbonite. This explosive, when tested by the instemmed shot system gives the result that a charge of 1000 grms. fails to ignite the most sensitive gas mixture. In the particular case, at Whitwood Colliery, a charge of under 350 grms. ignited firedamp; no coal dust was involved. It is not implied that this proves that the Continental system of testing is wrong; but it demonstrates that the advocates of that system of testing explosives are not warranted in making the statement that it is always safe to use charges not exceeding the *charge limite*. This is the first recorded instance, in this country, of an ignition of firedamp by carbonite. An ignition occurred at the Glencoe Colliery in Natal, on Feb. 13, 1908. According to the report of the Commission appointed to inquire into the accident, the ignition was occasioned by the firing of a charge of 6 oz. (about 70 grms.) of carbonite, in a shot hole 2 feet 9 inches in length, stemmed to the mouth with damp sandy loam. A shot had been fired the previous day, but had only "chambered" the coal leaving the face and stemming intact. The shot which caused the ignition was planted 5 inches from the former shot-hole. There was evidence to show that the coal, which it was intended to bring down, had apparently not been loosened or shaken by the shot fired on the previous day. On firing the shot, eight persons were injured by the resulting ignition; three of them subsequently succumbed to their injuries. The coal was also found to be on fire. Subsequently explosions occurred which caused great loss of life.

The following list gives the amount of explosives used in Great Britain in mines and quarries from details supplied by the Mines Department:—

Explosive.	Quantity used.	Percentage of total.
	lb.	
Permitted explosives	8,297,738	26.9
Unpowder	18,736,168	60.9
Ignite	2,737,468	8.9
Fast gelatin, dynamite, and gelatin dynamite	668,401	2.2
Beddite	249,996	0.8
Various	103,952	0.3
Total	30,793,723	100.0

—G. W. McD.

Explosives in coal mines. Home Office Order, July 3, 1909, No. 748.

The following is a complete list of the names of permitted explosives as defined in the Schedules to the Explosives in Coal Mines Order of the 17th December, 1906, as amended by the Orders of the 8th April, 1907, of the 6th May, 1908, of the 20th August, 1908, of the 2nd April, 1909, of the 20th April, 1909, and of the 3rd July, 1909:—

Explosives in 1st Schedule.

Abbeite.	Dominate.	Permitite.
Ablonite.	Dragonite.	Permonite.
Amasite.	Electronite.	Permonite II.
Ammonal.	Excellite.	Phoenix Powder.
Ammonal B.	Extra Carbonite.	Pit-ite.
Ammonite.	Faversham Powder.	Rexite.
Amvis.	Fracturite.	Ripping Ammonal.
Amphosite.	Good Luck.	Rippite.
Arkite.	Haylite No. 1.	Roburite No. 3.
Bellite No. 1.	Kolax.	St. Helen's Powder.
Bellite No. 3.	Kynite.	Samsonite.
Bobbinate.	Kynite Condensed.	Stow-ite.
Bronite.	Minite.	Thunderite.
Cambrite.	Monobd Powder.	Titanite.
Carbonite.	Negro Powder.	Titanite No. 1.
Cellite.	Nobel Ammonia Powder.	Tutol.
Cellite.	Nobel Carbonite.	Victorite.
Dydlite.	Nobel Carbonite.	Virtite.
Colliery Steelite.	Normanite.	Westfalite No. 1.
Cornish Powder.	Oaklite No. 1.	Westfalite No. 2.
Curtisite.	Oaklite No. 2.	Withnell Powder.
Hammerite A.	Odite.	

Explosive in 2nd Schedule.

Bickford's Igniter Fuze.

The Secretary of State has made an Order adding the following explosives to the Schedule of the "Explosives in Coal Mines Order of Dec. 17th, 1906":—

Nobel Ammonia Powder.

Ingredients.	Parts by weight.	
	Not more than	Not less than
Ammonium nitrate	86	82
Nitroglycerin	9	7
Wood-meal (dried at 100° C.) ..	8	6
Moisture	2	0.5

provided that the cases are thoroughly waterproofed with ceresine and resin, and that the explosive shall be used with a detonator of not less than No. 6 strength (i.e., one containing 15 grs. of a composition consisting of 80 per cent. of mercuric fulminate and 20 per cent. of potassium chlorate).

Samsonite.

Ingredients.	Parts by weight.	
	Not more than	Not less than
Nitroglycerin	60	57
Nitro-cotton	4	3
Potassium nitrate	19	17
Wood-meal (dried at 100° C.) ..	7	5
Moisture	1.5	—
Ammonium oxalate	14.5	12.5

provided that the explosive be contained in a non-waterproofed wrapper of parchment paper, that it be used only with a detonator of not less strength than No. 6, and that, if frozen, it be thoroughly thawed before use.

Titanite No. 1.

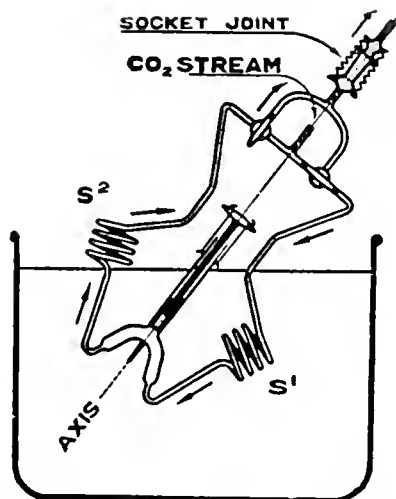
Ingredients.	Parts by weight.	
	Not more than	Not less than
Ammonium nitrate	88	85
Trinitrotoluol	8	6
Curcuma charcoal (dried at 100° C.)	6.5	4.5
Moisture	1	—

provided that the explosive be contained only in a case of stout paper thoroughly waterproofed with paraffin and that it be used only with a detonator of not less strength than No. 6.

Nitroglycerin; The velocity of decomposition of — by heat. R. Robertson. J. Chem. Soc., Trans., 1909, 95, 1241—1248.

THE mode of decomposition of nitrocellulose at temperatures below the exploding point, has been worked out by Will (this J., 1901, 609; 1902, 1470, 1554), who gave an equation expressing the quantity of nitrogen disengaged as a function of the temperature. Further work on this subject has been done by the author (this J., 1902, 819; 1907, 639). In the present communication

the decomposition of nitroglycerin is dealt with, when free from the catalytic accelerative action produced by its volatile products of decomposition. The difficulties due to the volatility of nitroglycerin, and the risks of explosion were overcome by the use of the apparatus figured. Jena glass wool, soaked in 0.3 to 2.5 grms. of nitroglycerin dissolved in acetone, which was subsequently evaporated off was placed in the horseshoe-shaped tube, closed by a ground and mercury-sealed plug. A current of carbon dioxide could be sent down the right-hand spiral, through the glass wool, and up



the other spiral, or *vice versa*, according to the position of the stopcocks. At the upper end of the apparatus is a slip joint, between which and a supporting pivot at the bottom, the whole apparatus could be rotated about its axis. The carbon dioxide used contained only 0.02 per cent. of gas unabsorbed by caustic potash solution and, to eliminate any oxygen, was passed over red-hot copper. It was passed through at the uniform rate of 1000 c.c. per hour. The spiral, *s*¹, was immersed in an oil-bath, the temperature of which was maintained uniform by means of a stirrer. It served as a pre-heating worm for the current of carbon dioxide. The spiral, *s*², above the heated oil, and protected from it by asbestos cards, was cooled by an air blast. It served to condense any volatilised nitroglycerin. After a suitable period, the apparatus was rotated through 180 degrees, when the spirals exchanged functions. Any nitroglycerin which might have condensed in *s*² was thus restored to the system. The gaseous products of decomposition were led off, for examination, through the slip joint by means of fixed glass tubes, the use of indiarubber being thus avoided. As a precaution against the carrying over of nitroglycerin, the gases were passed through an ice-cooled worm immediately on leaving the decomposition apparatus. The mixture of carbon dioxide, of which the volume was known, and volatile products of decomposition was usually passed through an observation tube, in which the concentration of nitrogen peroxide was determined by the spectroscopic method, and from this the weight of nitrogen disengaged as nitrogen peroxide was calculated. In most cases the gases issuing from the observation tube were then passed through hot reduced copper asbestos and copper oxide asbestos and into a gas burette containing caustic potash solution, where the unabsorbed nitrogen was measured every quarter of an hour. The following conclusions were arrived at:—

(1). The disengagement of nitrogen peroxide proceeds in a perfectly uniform manner. Thus from 0.5 gram. of nitroglycerin at 120° C., nitrogen peroxide was found, by the spectroscopic method, to be present in the stream of carbon dioxide in the following concentrations for 16 successive quarter hours: 0.04, 0.07, 0.09, 0.11, 0.11, 0.12, 0.12, 0.12, 0.13, 0.13, 0.12, 0.12, 0.12, 0.12.

These results agree with the volume of nitrogen, after combustion, unabsorbed by a solution of caustic potash.

(2). The nitrogen is disengaged for the most part, not entirely as nitrogen peroxide, and the estimation of the nitrogen existing as such, by the spectroscopic method agrees with the results of estimation by combustion and other methods. In this respect nitroglycerin differs from gun cotton, from which the nitrogen disengaged as nitrogen peroxide at 135° C. amounts to only about 40 per cent. of the total nitrogen. The following table shows the results obtained.

Disengagement of nitrogen from 2.5 grms. of nitroglycerin

Temperature °C.	Total nitrogen (by combustion).	Nitrogen as peroxide (spectroscopic).
135	4.87	4.33
130	2.72	2.90
124.9	1.62	1.57
119.8	0.74	0.80
115.0	0.36	0.39
110.2	0.29	0.20
105.0	0.10	0.086
100.5	0.044	0.043
95.0	0.021	0.024
90.3	0.009	0.010

(3). The rate of decomposition is a function of the temperature and increases from 95° C. to 125° C., being doubled in a rise of 5° C.

(4). Nitroglycerin has a higher rate of decomposition than gun cotton under similar conditions and at the same temperature.—G. W. McD.

PATENTS.

Explosives. B. E. D. Kilburn, London. From C. Pieper Berlin. Eng. Pat. 12,506, July 27, 1908.

The claim is for a mixture in equi-molecular proportion of starch, ammonium perchlorate, and sodium or potassium nitrate. A suitable binding material may be added if desired.—O. R.

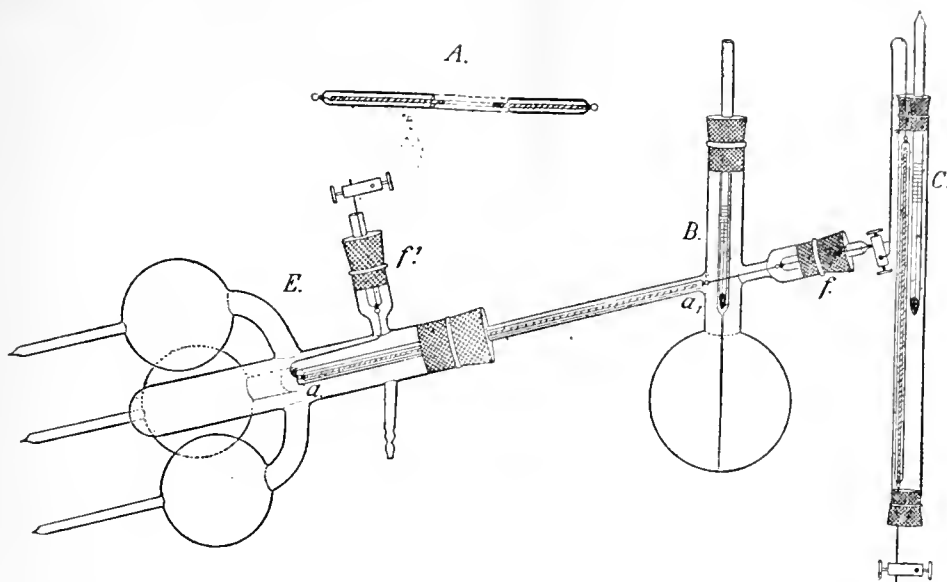
Volatile liquids from smokeless powder manufacture, &c., Recover of —. Fr. Pat. 397,791. See V.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Vacuum distillation apparatus, with electrically heated delivery tube for solid substances having high or low melting points. J. Bredt and A. van der Maaren-Jansen. Annalen, 1909, 367, 354—358.

The authors have devised a distilling apparatus by means of which choking of the delivery tube by the substance solidifying can be avoided. It consists of a distillation flask, B, provided with a second neck, *f*, in line with the delivery tube, *aa*₁. The delivery tube, *a'a*, is connected by a cork to the receiver, E. The heating arrangement, A, shown separately, is formed by wrapping a nickel wire, 1.75 metres long and 0.2 mm. diameter, round a glass rod 2 mm. thick. This rod is held in a sealed tube of 4.5 mm. outside diameter, and is fastened at one end only to allow for expansion. The heating arrangement must be as long as the delivery tube, which in this case was 6 mm. internal diameter. The connecting wires, *a/a*₁ and *a/a*₂, are made of platinum 0.3—0.4 mm. thick, so as not to become heated by the electric current. In order to control the temperature of the delivery tube, the glass tube, C, contains another similar heating arrangement



in the same circuit and a thermometer. By means of suitable resistances the delivery tube can be heated to any temperature up to 300°C .—F. SHDN.

PATENT.

Measuring and recording device for apparatus for gas analysis. J. Fehner. Ger. Pat. 211,739, Dec. 14, 1907.

With this apparatus the quantity of a gas is measured by determining the weight of a given liquid displaced by the gas. The gas to be measured passes into a vessel, from which it displaces the liquid through a siphon tube to a vessel resting on one arm of a balance, the other arm of which may be connected to a recording device. In order that the amount of liquid to be weighed shall not be too large, a vessel may be disposed just in front of the siphon tube: a definite portion of the displaced liquid fills this vessel, and only the remainder passes through the siphon tube and is weighed.—A. S.

INORGANIC—QUALITATIVE.

Saiacal and quinine as reagents for hydrogen peroxide. Denigès. See XX.

INORGANIC—QUANTITATIVE.

Electro-analytical precipitations and separations; Some rapid —. H. Alders and A. Stähler. Ber., 1909, 42, 2685—2695.

In the separation of liquid amalgams a thin-walled glass flask is used, of 75 to 100 c.c. capacity and 10 mm. diameter in the neck. The bottom of the flask is markedly concave and three platinum wires 0.6 to 0.7 mm. thick are sealed through the outer edge of the base. The cell itself weighs about 20 grms. and holds about 10 grms. of mercury which forms a ring round the edge of the base. The anode consists of iridio-platinum wire, 0.5 mm. thick wound into a horizontal coil at the bottom. The vertical portion of the wire is 10 cm. long, and passes through a small funnel, which serves to prevent loss of liquid during the rotation of the anode. The cell is placed on a sheet of bright copper in electrical contact with the platinum feet. The anode is rotated 400 to 600 times a minute. Generally a current of 3 to 4 ampères is used for electrolysis. Mercury can be rapidly and accurately determined in this cell from solution in either nitric or sulphuric acid. After connecting up with the source of current, the solution is gently warmed and so much nitric acid added, whilst stirring, that a current of 3 to 4 amps. is obtained at 5 to 6 volts. In 10 minutes

a drop of the electrolyte is tested with ammonium sulphide solution, and the current passed for a further 5 minutes when no more mercury can be detected. The cell is washed with hot water during passage of the current, with use of a pipette, then washed with alcohol and ether and dried for 15 to 30 minutes in a vacuum desiccator. The results are said to be very accurate. Similar experiments were tried with zinc: from solutions of the sulphate, with lead: from a mixture of nitric and phosphoric acids, and with iron: from sulphuric acid solution of ferric sulphate, but in all these cases the amalgam which is formed, oxidises on the surface during washing. For the determination of copper, from solution of the sulphate, and silver, from the nitrate, the method gave very accurate results, and was in every way suitable. Mercury could be accurately determined, from solution of the chloride, in presence of arsenic. One c.c. of strong nitric acid was first added to 100 c.c. of the liquid, which was then electrolysed at 5 to 5½ volts, E.M.F. for 15 minutes; sodium hydroxide solution was then added until the liquid was only faintly acid, the current continued for a further 5 minutes, and the cell washed out as usual. The mercury was bright and coherent. In the residual liquid the arsenic was determined in the usual manner with magnesia mixture. Both results were accurate. In presence of phosphoric acid, arsenic, selenium and some other substances, lead cannot be determined in the usual manner as dioxide at the anode; if one attempts to deposit it as metal on the cathode, in the presence of reducing agents to prevent formation of the dioxide, a very spongy and oxidisable precipitate is obtained. The authors attempted to determine the lead as liquid amalgam in their apparatus, but without satisfactory result, owing to loss on washing. But they were able to determine this metal rapidly and accurately by deposition simultaneously with a known amount of mercury. To the solution of the lead salt containing a slight excess of nitric acid a known amount of mercury nitrate or chloride was added in solution, together with a few c.c. of strong phosphoric acid solution, and the liquid electrolysed in a platinum dish with stirring, the dish forming the cathode. The electrolysis lasted about 20 minutes, with an E.M.F. of 10 to 11 volts. The dish was finally washed with water, alcohol and ether and dried for 15 minutes in the desiccator. The use of mercurous nitrate was more accurate than that of mercuric chloride. The deposit of lead and mercury was removed from the platinum dish with dilute nitric acid, and this caused a slight loss of platinum. Lead can be accurately determined in this manner in presence of quinquivalent arsenic, if phosphoric acid be added. Otherwise the determination

is carried out in precisely the same manner as in the absence of arsenic. Attempts to determine lead in the presence of antimony and of selenium were not satisfactory.—E. F.

Chromium, copper, nickel, cobalt, zinc, and lead; Indirect volumetric determination of —. A. Bacovescu and E. Vlahuta. Ber., 1909, 42, 2638—2642.

If solutions of chromium, copper, nickel, cobalt, zinc, or lead salts are treated with freshly precipitated manganese carbonate, chromium is precipitated as hydroxide, the other metals as carbonates, whilst an equivalent amount of soluble manganese salt is produced. After filtering off and washing the precipitate, the manganese solution can be titrated and the amount of substituted metal calculated. The salts to be determined should be normal; if free acid be present, this must be neutralised. The manganese solution is titrated with potassium permanganate in presence of zinc sulphate. The authors have tested the method by working with standard solutions of the various metals. In most cases heating for several hours was necessary to effect complete double decomposition, and the method is practicable only in the case of copper, chromium and lead. Manganese hydroxide can also be used for the precipitation and answers for the determination of copper, zinc, chromium, cobalt, and nickel salts. Lead salts cannot be determined with the hydroxide as they form partly soluble double salts. The method is in practice carried out as follows: One to two drops of nitric acid are added to a mixture of equal volumes of approximately *N*/1 solutions of manganese sulphate and potassium hydroxide or carbonate respectively. The liquid is decanted off and the precipitate washed carefully, and is then added to the solution to be determined. After boiling for several minutes, the precipitate is filtered off and washed, and the solution titrated with potassium permanganate. An excess of the manganese salt is necessary and a ratio of 2:1 has been found satisfactory.—R. L.

Copper; Iodometric determination of —. E. V. Videgren. Z. Anal. Chem., 1909, 48, 539—545.

The sample (2—3 grms. of ore) is dissolved in 10—20 c.c. of a mixture of equal volumes of concentrated sulphuric and nitric acids. When sulphuric acid fumes appear, the flask is cooled, 30—40 c.c. of hydrochloric acid of sp. gr. 1.1 are added, and evaporation carried on till spitting begins. Then, 10—15 c.c. of concentrated sulphuric acid are added, and the evaporation can now be carried to complete expulsion of hydrochloric and nitric acids without fear of loss by spitting. Or, for greater security, the evaporation with concentrated nitric and sulphuric acids may be done in a 400 c.c. beaker, and after cooling, an addition be made of 20—30 c.c. of dilute hydrochloric (sp. gr. 1.1) and 20—30 c.c. of dilute sulphuric acid (sp. gr. 1.4), after which evaporation is carried on till sulphuric acid fumes appear. After cooling, the solution is diluted with water; the greater the amount of iron to be reduced and removed, the more water must be added, to allow for loss by evaporation during the heating (for 3 grms. of purple ore, containing say 0.16 per cent. of copper and 60 per cent. of iron, the volume should be 200 c.c.). The solution is now boiled, as Low recommends, with a strip of aluminium sheet, 145 mm. by 25 mm. by 1 mm., till the iron is completely reduced and the copper precipitated (8—30 minutes); the copper comes down in dense flocks, which can be readily washed. The sides of the beaker are washed down with weak sulphuretted hydrogen water, the aluminium strip is similarly washed, the copper allowed to settle to the bottom, the perfectly clear liquid poured off, and the copper washed by decantation with 100—150 c.c. of the sulphuretted hydrogen water. It is now dissolved in a mixture of 20 c.c. each of 3½ per cent. potassium chlorate solution, hydrochloric acid (sp. gr. 1.1) and sulphuric acid (sp. gr. 1.4), per gramme of metal, the solution is evaporated till all chlorine and hydrochloric acid are expelled, cooled, dissolved in water—(for 0.01 gm. of copper, 20—30 c.c., for 0.4—0.5 gm., 100—200 c.c. of water) potassium iodide added, and the iodine titrated as usual. If arsenic or antimony be present,

5 c.c. of 25 per cent. sodium acetate solution must be added before adding potassium iodide. Should the liquid decanted from the precipitated copper not be quite clear, it must be filtered, the filter washed free from iron with weak sulphuretted hydrogen water, the filter broken and the precipitate washed through, 10 c.c. of hot chlorate and acid mixture poured through, the filter washed, the liquid evaporated to about 4 c.c., 20 c.c. of water and 5 c.c. of sodium acetate solution added, and the liquid separately titrated.—J. T. D.

Lead; Volumetric determination of —, and of sulphuric acid in sulphates. B. Oddo and A. Beretta. Gaz. chim. ital., 1909, 39, I., 671—675.

The authors find that the method of determining lead by titration with potassium chromate is greatly improved by using as indicator an acetic acid solution of diphenylcarbazide, which is a very sensitive reagent for chromates (see Cazeneuve, this J., 1900, 1040). The solution containing the lead salt is acidified with acetic acid, or if it contain free mineral acid, is treated with ammonium acetate before titration. The end point is best ascertained by placing on filter paper a drop of the titrated solution and a drop of the diphenylcarbazide reagent, and noting the colour where the drops intersect. In utilising this method of determining lead for the determination of sulphuric acid in sulphates, by precipitating with a soluble lead salt, it is necessary to filter off the lead sulphate, as the reaction, $\text{PbSO}_4 + \text{K}_2\text{CrO}_4 \rightleftharpoons \text{PbCrO}_4 + \text{K}_2\text{SO}_4$, is reversible. The sulphate solution is treated with a known excess of lead nitrate solution, the precipitate filtered off, and washed well with cold water, and the excess of lead in the filtrate determined as described above.—A. S.

Nickel; Separation of — from iron by means of ammonia. V. Hassreidter. Z. angew. Chem., 1909, 22, 1492.

It has previously been shown (Z. angew. Chem., 1908, 21, 66) that by using a concentrated solution of ammonia (sp. gr. 0.90 to 0.92) retention (adsorption) of zinc by ferric hydroxide precipitated from a solution containing iron and zinc may be entirely prevented. In like manner the use of a concentrated solution of ammonia for the precipitation of the iron from a solution which also contains nickel gives a precipitate practically free from nickel. The conditions are shown by examples of which the following are typical:—

Total volume.	Ammonia solution (sp. gr., 0.92).	Iron.	Nickel.	Nickel in filtrate.
c.c.	c.c.	grms.	grms.	grms.
250	200	1	0.25	0.2527
250	200	0.25	1.00	0.0085

—C. A. M.

Nitric acid; Determination of —, by means of nitron. C. Paal and A. Ganghofer. Z. anal. Chem., 1909, 48, 545—555.

The authors have repeated the work of Hes on the influence of dextrin, peptones, and gelatin on the determination of nitrates by means of nitron. Dextrin, added in amounts of 0.5—2.0 grms. to a solution of 0.175 gm. of potassium nitrate in 100 c.c. of water, was found to delay the separation of the nitron precipitate, 16 hours instead of 4 being needed for the purpose, but was without sensible influence on the accuracy of the results. Peptone (0.5 gm. in the same solution) gave results much too high, and on removal of the added peptone by normal lead acetate, by formaldehyde, or by tannin and lead acetate, results sometimes too high and sometimes too low were obtained. Addition of 20—25 drops of sulphuric acid to the peptone-containing solution, however, corrected this, and the results so obtained were quite accurate. Gelatin, up to 0.5 gm., was without sensible influence on the results (save as to duration of the separation), but 1 gm. gave results about 1 per cent. too high. Even when 2 grms. were added, and then removed by tannin and lead acetate to remove excess of tannin, the results,

though low, were sufficiently near for practical use. Some repetitions of the authors' former experiments with meat extracts confirmed their earlier results, and showed that saltpetre in meat can be conveniently determined by means of nitron.—J. T. D.

Determining alkalis in silicates. Starek. See VII.

Determining acids in hydrogen peroxide. Lünig. See VII.

Colorimetric determination of iron in pottery materials. Hadank. See VIII.

Determining free acid in copper electro-deposition baths. Debaisieux. See XI B.

Detection [and determination] of small quantities of sodium carbonate in water. Flamand. See XVIII B.

Determining antimony in its sulphide preparations. Howard and Harrison. See XX.

Diphenylcarbazine in volumetric analysis. Determination of mercury in mercurous salts. Oddo. See XX.

ORGANIC—QUALITATIVE.

Reaction of the tannins. Philip. See XIV.

Determining molecular weights of carbohydrates. See XVI.

Differentiating primary and secondary and tertiary alcohols. Wacker. See XVI.

Detecting paraffin wax in lard. Shrewsbury. See XVIII A.

Guaiacol and quinines as reagents for hydrogen peroxide. Denigès. See XX.

Reactions of anthranol. Padova. See XX.

Distinguishing primary, secondary, and tertiary alcohols. Neave. See XX.

ORGANIC—QUANTITATIVE.

Determination of naphthalene in gas. Rutten. See II.

Use of miscibility curves in analysis. Application of method to edible oils. Louise. See XII.

Analysis of beeswax. Ryan. See XII.

Use of different basins in tanning analysis. Schell, and Thuan and de Korsak. See XIV.

Determining resin in sulphite wood pulp. Steinschneider. See XIX.

Separating strychnine from brucine. Pinchbeck. See XX.

Determining camphor in spirit of camphor. Deussen. See XX.

Determination of hydroxylamine. Stähler. See XX.

Determining free salicylic acid in bismuth salicylate. Harrison. See XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Sun as source of heat in chemical experiments; The —. A. Stock and H. Heynemann. Ber., 1909, 42, 2863—2866.

The authors point out the advantages to be obtained by using the sun as a source of heat, when the substance to

be heated is contained in a glass vessel from which the air has been completely removed. The heat can be concentrated on the substance itself, so that its support does not need to be specially refractory. By working in a complete vacuum a much higher temperature can be obtained than if air be present, loss of heat by conduction being reduced to a minimum; no interference from foreign gases is to be feared; and any gases evolved can be collected in a pure state for examination. In the authors' experiments, a plano-convex lens of 40 cm. diameter and 50 cm. focal length was fixed in a wooden frame, on a support, so that it could be turned in all directions. On the lower side of the wooden frame was an iron support, to which the flask containing the substance to be heated was fixed. The substance itself was placed in a magnesia crucible, and the flask was connected to a mercury pump. With this apparatus, crystallised silicon (m.pt. 1450° C.) was melted in a few seconds, whilst pieces of copper and cast-iron melted almost instantaneously. With manganese, the flask rapidly became coated with a mirror of the metal. When the junction of a thermo-couple was suspended freely in the centre of the flask, this showed a temperature of 1030° C. *in vacuo* and only 675° C. in an atmosphere of air under otherwise identical conditions. It is proposed to continue the experiments on a much larger scale.—A. S.

Thorium chloride and bromide; Hydrates of —. E. Chauvenet. Comptes rend., 1909, 149, 289—292.

If the hydrated chloride, $\text{ThCl}_4 \cdot 8\text{H}_2\text{O}$, be left under a bell jar at the ordinary temperature, the crystals lose their form, and eventually give the hydrate, $\text{ThCl}_4 \cdot 7\text{H}_2\text{O}$, described by Krüss. When the normal hydrate with 8 mols. of water is heated at 50° C. in a current of hydrogen or dry hydrochloric acid gas, or when it is left for several days in a dry vacuum, the hydrate, $\text{ThCl}_4 \cdot 4\text{H}_2\text{O}$, is formed. By heating the normal hydrate on the water-bath, the chloride, $\text{ThCl}_4 \cdot 2\text{H}_2\text{O}$, is produced, whilst at temperatures above 100° C., an oxychloride, ThOCl_2 , is eventually obtained. The author has been unable to prepare the hydrated chloride containing 9 mols. of water described by Rosenheim and Schilling (Ber., 1900, 977). The normal hydrated thorium bromide, $\text{ThBr}_4 \cdot 12\text{H}_2\text{O}$, obtained by dissolving thorium hydroxide in alcoholic hydrobromic acid crystallises in long needles. When dried under a bell jar it is converted into the hydrate, $\text{ThBr}_4 \cdot 10\text{H}_2\text{O}$, and on exposure in a dry vacuum gives the hydrate of Rosenheim and Lesinsky, $\text{ThBr}_4 \cdot 7\text{H}_2\text{O}$. The existence of a hydrated bromide containing 8 mols. of water is doubtful. When heated at 50° C. the normal bromide is converted into the compound, $\text{Th}(\text{OH})\text{Br}_3 \cdot \text{H}_2\text{O}$, analogous to the chloride, $\text{Th}(\text{OH})\text{Cl}_3 \cdot \text{H}_2\text{O}$, formed as intermediate product on heating the normal hydrated chloride at temperatures above 100° C. The oxybromide, ThOBr_2 , is produced at about 165° C., whereas the corresponding oxychloride is formed at about 250° C.—C. A. M.

Perseulose; Constitution of —. G. Bertrand. Comptes rend., 1909, 149, 225—227.

PERSEULOSE is obtained by oxidation of perseït, a sugar found in the kernels and leaves of *laurus persica*. The author has proved the presence of a ketonic grouping in perseulose by the following reactions:—Perseulose is not oxidised by bromine in the presence of water. When reduced with sodium amalgam in a solution containing a slight excess of sulphuric acid, two alcohols are produced, namely, *perseitol* (m. pt. 188° C., $[\alpha]_D^{20} = +1.20^\circ$), and a laevo-rotatory alcohol which is very soluble in water and alcohol, and probably contains seven carbon atoms, and for which the author proposes the name *perseulitol*. The production of two isomeric alcohols in this way indicates the presence of a ketonic rather than an aldehydic grouping in perseulose.—F. SHDN.

Oxydases; Investigation of —. O. Dony-Hénault. Bull. Acad. Sciences Belg., 1909, 342—409. Bull. Soc. Chim. Belg., 1909, 23, 318—320. (Compare this J., 1908, 823.)

The blue coloration with guaiacum tincture, attributed to the oxydases, is very sensitive to alkalis; it is caused

by alkali associated with small quantities of mineral substances, particularly manganese, and is destroyed by the presence of the slightest excess of acid. The reaction is neither more nor less characteristic of oxydases than the oxidation of hydroquinone under similar conditions. The reaction of oxydases with guaiacol-red coloration and formation of a precipitate, considered by Bertrand as characteristic of laccase, is not influenced by the presence of manganese salts with or without alkali. But the reaction may be reproduced by the association of ferric salts (ferric chloride) and alkali in suitable proportions. This reaction is affected by very slight variations, certain specimens of guaiacol do not give it; it corresponds to an oxidation by free oxygen and must be rejected as a test for oxydases. The "oxydases reaction" given by milk is no doubt due to the content of alkali and iron. Laccase may be considered to be composed of:—(a), a colloidal substratum coagulable by alcohol; (b), various elements entangled in the coagulum at the time of its formation. These last form two groups: (1), those which are fundamental on account of their giving the typical reactions of laccase; these include manganese and iron salts and alkalis; (2), the accessory elements which have no direct bearing on the oxidations caused by laccase, but which affect its sensitiveness to heat, etc. Very active artificial laccases are obtained when sodium-potassium tartrate is added to the mixtures of manganese salts and alkali, as it prevents their mutual precipitation. For guaiacum and hydroquinone two stages of oxidation exist according to whether the catalyst is used in an acid, or alkaline medium. For the guaiacol reaction of laccase there exists an optimum and a limit of alkalinity; for guaiacol and hydroquinone, on the other hand, the oxidation increases with the concentration of alkali. The author considers laccase to be a fortuitous association of mineral catalysts and it cannot be classed with the digestive or hydrolysing enzymes. The specific action which, together with the sensitiveness to change of temperature, is characteristic of an enzyme is attributed rather to the substratum than to the catalyst itself. Enzymes are extremely sensitive to hydrogen and hydroxyl ions; the colloidal protein element in them seems only to act as an absorbing envelope. Citrates and tartrates owe their catalytic activity towards manganese salts and polyphenols mainly to the hydroxyl ions to which they give rise.

—E. F. A.

Evolution in applied chemistry, (Address). O. N. Witt. Seventh Internat. Congr. Appl. Chem., London, 1909.

THE men who in the past devoted their thought and energy to problems which we now call chemical had to reach their ends with the help of sound empiricism. Though their progress was slow, it was sure, so that to this day we have sometimes occasion to marvel at their successes. More than that, we may safely say that some of our best industrial methods would never have been discovered if we had had chemical theory only to guide us. Science itself stands on an empirical basis—we cannot draw general conclusions unless we have well-established observations to start from.

It is, perhaps, not superfluous to remember these facts at the present time, when the brilliant success of theoretical chemistry is apt to make us forgetful of the services derived from purely empirical methods of research. Empiricism investigates without foregone conclusions, whilst theoretical science verifies logical deductions. Science forces Nature to divulge its secrets; empiricism is quite content to pick up the treasures it may come across in its ramblings through unexplored regions. Nature is still full of unknown treasures; why should we cease to search for them? Why should we expect success only from logical deduction?

One of the best combinations of empiricism and theory is the examination of old empirical industrial processes by the methods and in the light of modern chemical science. A great deal of valuable information has been obtained in this way; much more remains to be discovered. It is this conviction which led me to propose to the last Congress at Rome that a special section should be estab-

lished in these Congresses for the history of Applied Chemistry. The history of chemical science, as it exists now, is almost entirely devoted to theoretical systems and to the life of those who created them. The history of industrial methods is not so complete as one might wish it to be.

As far as the history of our nineteenth century chemical industry goes, the materials for studying it are not wanting. The patent literature of the various countries is in itself an inexhaustible source of information, which can be largely supplemented from text-books and endless files of periodicals. But it is not so if we begin to inquire into the applied chemistry of previous centuries. The mysterious communications of the mediæval alchemists have been frequently examined; but Pliny remains our almost exclusive source of information about the chemical arts of the antique world. Yet these arts were many and highly developed, and Pliny's information was distinctly superficial.

How much more might be gathered about the chemistry of past times, has been shown by the researches of such men as Berthelot and Edmund von Lippman, who combined the accomplishments of distinguished chemists with those of the Orientalist in the study of Arabic and Hebrew authors. Who knows what a host of information may yet be lying dormant in unread Egyptian papyri and palimpsests!

But the sovereign means of discovering these lost secrets is in the careful study and analysis of the products which ancient times have fortunately left us as proofs of their skill and knowledge. How much has been done in that respect by that one great master, Marcelin Berthelot, who found in such work the recreation of the later years of his life! How much more remains still to be done!

Thus we may hope to know at some future time more of the accomplishments of past generations than we do at present. And we may also hope that some of the methods thus rediscovered will awake to fresh life like mummy wheat, which is said to take root and grow if you plant it in fresh soil. Have we not greeted with delight the *terra sigillata* of the Romans, when the process for its manufacture was rediscovered by Fischer, a Bavarian potter, and has not a considerable industry sprung from the resurrected use of lanolin or wool-fat, which was a panacea of the Greeks two thousand years ago?

Yet such discoveries will remain inheritances from the dead, and the cases of their resurrection to life will not be numerous. But we have living empiricism at our doors, which we allow to die and to sink into oblivion without attempting to study it and to learn the lesson it has to teach—a treasure of information of incalculable magnitude, hoarded up in the course of centuries by the skill and patience of countless millions of men, who were and are as keen in the study of nature as they are reluctant to draw general conclusions from their observations.

This great treasure is the industrial experience of the Eastern nations. It is an undoubted fact—and if it were not, a single visit to the South Kensington Museum would prove it—that the people of Persia, India, China, Japan, the inhabitants of Burma, Siam, Cambodja, and the innumerable islands of the Pacific are possessed of methods for the treatment and utilisation of the products of nature which are in many cases equal, if not superior, to our own. These methods must be to a large extent based upon chemical principles. Is it not strange that we know so little about them, and that little generally only indirectly through the accounts of travellers who were no chemists? If all these peculiar methods were fully known and described by persons who have seen them applied and watched their application with the eyes of a chemist, it would certainly be not only of interest, but also of the greatest utility to our own industry. For it is the elucidation of empirical methods which, in the new light that science sheds upon them, leads to new departures and to progress. Who can deny the advantage which the industry of cotton-dyeing and calico-printing derived from the study of the Turkey-red process, which a century ago was bought as an Eastern trade secret by the French Government and generously placed at the disposal of European dyers? Would the making of porcelain have been invented in Europe if the impulse for it had not come

from the East? Is there no connection between the introduction of Chinese porcelain and the invention of Delft, the curious observations of Réaumur on devitrification, and even the work of that great and original genius, Josiah Wedgwood? And would that supreme triumph of the application of pure chemical science to industry, the synthesis of indigo, ever have been accomplished if indigo as a natural dyestuff and its extraordinary method of application by vat-dyeing had not come to us from the East? What a stir has been created even in these very latest days by the extension of this ancient Eastern method of dyeing to other shades than those of indigo!

We live in a period when the intellectual nations of the East wake up from their political sleep of centuries, when they issue from their seclusion and demand their share of Atlantic civilisation. But their awakening means going to sleep for their industrial methods. These methods, ingenious as they undoubtedly are, cannot compete with ours in being applicable on a manufacturing scale. So our processes are transferred to the coasts of the Pacific, and their own methods are abandoned and forgotten. The Eastern industries cannot keep pace with ours, not because they are inferior in their results, but because they toil on foot whilst ours are motoring. In this struggle for existence the fittest means the quickest and the cheapest.

Yet I am certain that many a new and good result might be obtained from the combination of Eastern and Atlantic achievements. Examples of such happy blending are not missing. See what that great and original English inventor, Lord Masham, the very type of an Atlantic genius, has made of the wild silks of India!

It seems to me that these International Congresses ought to make it one of their important duties to watch over the intellectual wealth of the past and to collect it before it disappears for ever. Let the chemists of all countries, who flock together in these gatherings, entrust to their keeping the old indigenous industrial methods of their nations; let the reports of these Congresses, which are distributed over all the world, become a treasure-trove of ancient motives for new development!

If we consider how our present chemical industry has been evolved from empirical processes such as our ancestors practised them, and as they still exist in the countries of the East and even in some parts of Europe, we can easily observe a gradual transformation similar in many respects to the one that living nature had to go through in evolving the present types of plant and animal life. It is here that the parallels between biology and chemistry offer themselves. They are interesting and not useless to consider. It would be strange indeed if we could not gather some acceptable hints from surveying the broad expanse of the human toil and thought of centuries.

Chemistry and the law. Rt. Hon. Lord Alverstone.
Int. Congress of Appl. Chem., 1909.

THE Lord Chief Justice, speaking on the subject of legislating upon and dealing with scientific knowledge, wished to approach the subject from the broadest possible standpoint, and to consider the principles upon which legislation should proceed not in this country alone but in all civilised countries. He did not believe there ought to be different rules in different countries, but as far as possible they ought to see whether in the British Empire, France, Germany, the United States, and other great countries they could not approximate to an international code in connection with the proper protection of inventions. It was from that point of view he wished to consider a step which had recently been taken in Great Britain, a step which to a certain extent followed the example of some other nations with regard to the making it a condition that there should be working in the country in which a patent had been taken out. In his opinion that was a step in the wrong direction which would discourage inventors, and which would make people revert to secret processes, one of the worst forms by which inventions could be developed. Further, it was hard upon the genuine inventor, who was often a very bad man of business

indeed. He had always maintained that view. He would take a kindred illustration—the enactment adopted in England, against his express wish, destroying provisional specifications. Let them protect the inventor as much as they liked, but let them not do anything to destroy public knowledge. Take the case of the scientific men, many of whom had the power of invention and were always thinking of something new, but who often were wholly unfitted to work out the inventions themselves. The real advantage to the public in those circumstances lay in other people taking up the invention and working it. At present the working of a patent was compulsory, and an application might be made to revoke the patent even in the country in which the patentee resided, and that appeared to be driving an idea to an excess. He knew there was a strong impression—he was not the least in favour of it from the Protectionist point of view—that by this means they would then develop the industry of the particular country. It seemed to him that if they were to lay down this test about working they would meet with many difficulties, for the working was different in dealing with chemical products and wholesale manufactures, and between subordinate parts in an old machine and an entirely new machine. They were approaching the subject from the wrong standpoint. He wanted in the first place to protect the inventor so that the product of his invention would be used with advantage to himself and with the largest advantage to the public. If they desired to interfere with the monopoly rights of a patentee, the proper view to take was that there should be freedom of working on a fair licence, if the patentee did not sufficiently work the patent himself. Under those conditions the difficulties about injunctions would to a large extent disappear. If a patentee were a dog-in-the-manger, and would not allow his patent to be worked except on prohibitive terms, by all means have an independent tribunal which should say on what conditions and on what terms the patent ought to be worked. But if they allowed people who really wished to work that patent to do so on fair terms under licence, they need not put on the patentee the burden of working it when he did not wish to do so. There were numbers of illustrations which showed that compulsory working would not be a real remedy for the evil, and would at the same time impose upon many patentees a very great burden. The inventor should be given a fair and not an excessive reward for his invention, and should be freed from those commercial difficulties which had embarrassed so many men. If there were a capitalist, a merchant, or a manufacturer who felt he could make good public use of a patent, let him work it on terms fair to the patentee, but do not let them say that a patent was to be revoked because the patentee was not able to work it. He hoped it was not too late to suggest from an international point of view that patents should be worked by those desirous of working them on fair royalties, paid to the patentee. There ought to be international recognition of invention and discovery. There was no class of invention to which the observations he had made applied more strongly than to the chemical industry. It seemed to him that knowledge was the birthright of no particular nation, but ought to be shared by the whole human race. There ought to be no temptation to bottle up or keep secret the discoveries of scientific men or the results of their labours. The perfect system would be to give every inventor a fair and full—might he say a generous?—reward for his invention, and relieve him in many cases of the anxiety of developing it, so that he might be free to pursue his studies for the benefit of mankind, and to investigate the inexhaustible fields of knowledge yet unexplored.

Fawcett v. Fraser. Decision under Patents and Designs Act, 1907. Times, Aug. 20, 1909.

ON Aug. 19 the Comptroller-General dismissed an application by Thomas C. Fawcett (Limited), of the White House Engineering Works, Leeds, under Section 27 of the above Act, for the revocation of Letters Patent No. 3677 of 1898. The patent in question related to mills for crushing or pulverising rock, quartz, and other materials

and particularly to the class of mills in which the material was crushed between the interior of a revolving ring and the exterior of a roll within the ring.

Mr. Fraser, the proprietor of the patent in question, carried on business in New York, and in February, 1908, in consequence of the passing of the Patents Act, he appointed Mr. Von Gruerber his sole agent in this country for the purpose both of selling the machines and of starting manufacture. Mr. Von Gruerber inserted advertisements in newspapers with a view of obtaining suitable works for the manufacture of the machines in this country. Replies were received from these advertisements and a firm was selected for the purpose of starting manufacture, and was supplied with a model mill. The first machine was started in the same month, and was finished in November; but it was admitted that a considerable number of the parts of this machine were imported from America. A second machine was commenced in November, and this machine was not finished until July, 1909; the explanation given of this delay being that they were waiting for some improved portions of the machine, made under a later patent, which were to come from America in the first instance, and also that there was no immediate demand for the machine. According to the evidence this second machine was made almost entirely of English work, with the exception of the rolls and ring, and Mr. Von Gruerber stated that he was making every effort to get the proper steel for their manufacture in this country. The two machines so manufactured were, it appears, sold in the United Kingdom to British firms. A third machine had now been taken in hand, and it was stated that the rough castings for this had all been made in London, and that it could be completed, if necessary, at any time within a fortnight. It was further shown in evidence that the only manufacture abroad, outside the United States, was in Germany, and that the rate of sale there was an average of two machines per year to the various countries supplied including Germany. The price at which the machine was offered was £520.

Upon these facts the Comptroller-General, following the principles laid down in "Kenrick v. Jefferson" (26 R.P.C., 383), held (1) that there was a manufacture in this country sufficient to meet the present demand for the machines here, and that sufficient reasons had been given for the absence of a more extensive manufacture at present. Foreign countries had not been given any undue preference over this country, nor had there been any conduct on the part of the patentee which would hamper or prevent him carrying out his obligations to carry on an adequate manufacture here. The demand in foreign countries was, as stated above, two machines a year, and if the demand here were to be of similar extent the present manufacture would be amply sufficient to supply this. (2) That, although hitherto the machines had not been made completely in this country, the most distinctive portions—namely, the rolls and the ring—having been supplied in each case from abroad, it was a sufficient answer that these required somewhat special material, and that the patentee was anxious not to prejudice the early sales of the machines by obtaining inferior material. The machine as a whole was now substantially made in this country, and there appeared to be no reason why the ring and the rolls should not also be manufactured here at an early date. (3) That the machines were offered at a reasonable price. In trying these cases of revocation the question was whether or not the price was, broadly speaking, a *bona fide* one, and was not a price adopted for the very purpose of checking and diminishing the demand for the home-manufactured article, and the evidence here was that the machine was offered at the same price both in America and in all foreign countries.

In dismissing the application with costs, the Comptroller-General pointed out that the determination of this case upon the present material and at the present stage did not necessarily decide the issue for all time. If the manufacture of this machine were not adequately carried on in the future, as promised by the patentee, it would be open to the applicants to come again to the Comptroller under the section and ask for revocation, and at a later stage the reasons which called for more lenient treatment now would not, probably, be available.

Trade Report.

The new Patent Treaty between the United States and Germany. Oil, Paint and Drug Rep., Aug. 9, 1909.

THE following is the official text of the new patent treaty just signed by the Secretary of State, and the German Ambassador, in Washington. It was ratified in Washington and Berlin, August 1:—

Article I.

The provisions of the laws applicable, now existing or hereafter to be enacted of either of the contracting parties under which the non-working of the patent, working pattern (Gebrauchsmuster), design or model carries the invalidation or some other restriction of the right, shall only be applied to the patents, working patterns (Gebrauchsmuster), designs or models enjoyed by the citizens of the other contracting party within the limits of the restrictions imposed by the said party upon its own citizens. The working of a patent, working pattern (Gebrauchsmuster), design or model in the territory of one of the contracting parties shall be considered as equivalent to its working in the territory of the other party.

Article II.

This agreement shall take effect from the date of its promulgation and remain in force until the expiration of twelve months following the notice of termination given by one of the contracting parties.

Article III.

The present agreement shall be ratified, and the ratifications shall be exchanged at Washington as soon as possible.

Washington, this 23rd day of February, 1909.

Netherlands Customs Decisions. Bd. of Tr. J., Aug. 5, 1909.

A DECREE of the Dutch Ministry of Finance, dated the 17th June, fixes the tariff classification of the following articles:—

Articles.	Rate of duty.
	dorins, cts.
Fireproof bricks or pots, provided with an opening which can be closed by a fireproof plug, for use in ascertaining the heat of gas ovens, dutiable as "Pottery".	5 % ad val.
Soya oil, a fatty saponifiable oil dutiable, as "Oils not specially mentioned".....	100 kilogs. 0 55
Diacetyldioxime (dimethylglyoxime), a powder prepared from acetic acid, in bottles of 10 gms., without directions as to use....	Free.
Methylacetic acetic methylester, dutiable as "Pyroligneous spirits, &c.".....	litre 1 15
Naphlatan, a medicine composed of mineral oil and a little soap, in tins of 50, 100, 200, 400 or 800 gms., provided with directions for use, dutiable as "Small wares"....	5 % ad val.
Coloured printing ink, and mixing inks for printing inks, for use in commercial printing works, in any packing.....	Free.
Lysol, a disinfectant, dutiable as "Soap, other, soft".....	100 kilogs. 1 00
Asphalt tar compound, a paint, consisting of a solution of asphalt in heavy coal tar oil, dutiable as "Paints ground in oil".....	5 % ad val.

Special beer priming.—A liquid to be added to extracts in breweries, consisting of a semi-inverted sugar syrup with a purity factor of 92, is subject to the excise duty on sugar.

Russian trade possibilities. For. Off. Ann. Series No. 4295. [T.R.]

THE following information is from the report by the British Vice-Consul at Nicolaieff:

Stationary requisites.—Foolscap paper is exclusively of Russian make. Letter paper comes mostly from

Germany, though a little of the best quality is British. Ink comes chiefly from Germany. There is a little of Russian production. A market might be found for British ink if expense were saved by direct importation. India-rubber bands are principally of Austro-Hungarian make. Copying paper is imported from Germany. British manufacturers might compete if they arranged to sell direct.

Colours, paints, varnishes, and wallpaper.—There is a large sale of zinc white. It is at present of Russian production, but the United Kingdom might compete if direct sales were made. The better qualities of ochre, bought through Odessa, come from Marseilles: the average retail price is 1½d. to 1¾d., per lb., or 14s. to 16s. 4d. per cwt. The cheaper kinds, for sale to the peasants, come from the Caucasus and are sold at ¾d. per lb. There is a certain import of special sorts of enamel paints, but the greater part is made in the country. There is a possible market for imported varnishes of the best qualities. A market might so be found for British wallpapers of the best qualities.

Drugs and perfumery.—Drugs and perfumery are imported, but Russian perfumery commands the largest sale. A direct trade might increase the import.

The following information is from the report of H.M. Consul-General at Odessa:

Vegetable butter.—Vegetable butter is daily becoming more and more popular. The two factories at Odessa and the one at Kieff which recently started its manufacture from copra cannot meet the demand. The present wholesale price is £2 8s. per cwt. The import duty on copra is 1s. 7½d. per cwt.; the import duty on vegetable butter is 10s. 9d. per cwt.

Toilet soaps and scents.—British toilet soap is little imported into South Russia. The French and the home-made articles are generally purchased. This is partly on account of their gay wrappers designed to recommend the articles to purchasers of small presents—a purpose for which they are often used in Russia.

Scents are largely imported from Germany and France.

Paper.—It might be profitable for paper manufacturers to examine the material sold in Russia. Strong paper of long fibre pulp and strong brown paper for wrappers are not to be had.

Roumanian chemical industry, 1908. Chem. Ind., 1909, 32, 403—404.

The chemical industry comprises 51 industrial establishments, including 23 petroleum refineries, 13 stearine and soap works, 6 vegetable oil works, 4 producing sulphuric acid and artificial fertilisers, 3 for the manufacture of varnishes and paints, and 2 for the production of wax candles. The hands employed number 2264; the invested capital amounts to 16.4 million francs, the working capital 10 million francs, and the annual value of the output is 25.6 million francs. The soap and stearine candle industry produces enough to supply the home market, except in the case of fine scented soap the manufacture of which has recently been started; and a small quantity of candles imported from Austria; at the raw material, stearine, has to be imported from Holland, France and Belgium, tallow from Hungary. Candle wicks from Bohemia, France and Italy. Pressed tallow comes from America; coconut oil and resins via Trieste and Hamburg; caustic soda from Belgium; essential oils, essences and glycerine from Germany and France. Paraffin wax and candles are made in a newly erected works at Campina. The largest of the vegetable oil works, at Bukarest, is well equipped, and has silo accommodation for 200 wagon loads of oil seeds. The annual output of oils is about 1200 tons and 200—300 wagon loads of oil cake are produced. The linseed oil produced is worked up into varnish and paint; and soap is made from the crushing waste. Salt, the most important mineral product of the country, is a State monopoly. The annual output is 95,000 tons, of which about 30,000 tons are exported to adjoining countries and Egypt. The petroleum industry is flourish-

ing, though the output has not increased, and large quantities of crude oil have to be imported from Galicia. Great expectations, however, are formed as to the new oil districts of Pacureti and Tintea. The exports of oil via Konstantza amounted to about 363,000 tons, of which France took nearly 124,000 tons, England 96,000 tons, India 52,000 tons, Egypt 44,000 tons, Italy 20,000 tons, Belgium 17,700 tons, Germany 5,200 tons and Austria-Hungary 3,300 tons. The price of "benzine" (sp. gr. 0.710—0.715) receded from 21 francs f.o.b. Konstantza to 17 francs, but improved on the formation of a syndicate. The exports to England amounted to 20,800 tons, 67,400 tons being consigned to France and 4290 tons to Italy. Refined oil was exported to the extent of 5270 tons to Germany, 35,880 tons to England, 3306 tons to Austria-Hungary, 17,160 tons to Belgium, 43,830 tons to Egypt, 805 tons to France, 51,849 tons to India and 15,800 tons to Italy. Distilled petroleum was exported to France alone, where the duty is less than on refined, the quantity amounting to 55,670 tons. Owing to the growing inland consumption of residuum for fuel purposes, only 7800 tons were exported. In the East, Roumanian oil has to meet keen competition on the part of Russia in case oil, of which 1,200,000 cans (17,400 tons) were exported.—C. S.

Hungarian chemical industry: Present condition and prospects of the —. G. Bokor. Seventh Int. Congr. Appl. Chem., London, 1909. Chem. Ind., 1909, 32, 403.

The large works producing acids and alkalis are more than capable of supplying the needs of the home market. Sulphuric acid manufacturers have an abundant supply of raw material in the rich pyrites of Upper Hungary and Siebenbürgen. The output of ammonia-soda exceeds the home requirements; and the manufacture of caustic soda is shortly to be commenced. The bone glue industry produces for export; and large quantities of wood spirit and acetone, from wood distillation, are consigned to Austria, Switzerland and England. Four large works produce tannin, which is also exported; and the starch industry exports products to the value of about £208,000 (5 million kronen) per annum. For the last nine years, the petroleum refineries have dealt almost exclusively with Galician crude oil, and contribute largely to the export trade of the country. The future prospects are favourable for the soap, vegetable oils, pharmaceutical products and colour industries, though these need to be further developed. It is doubtful whether the coal-tar dyestuff industry is calculated to flourish in Hungary; but there is a possibility of the lucrative production of mineral pigments. The law relating to the encouragement of industries has largely favoured the construction of new chemical works; but improved chemical training and revision of the patent law are needed.—C. S.

Books Received.

Treasury Department. Public Health and Marine—Hospital Service of the United States, Hygienic Laboratory. Bulletin No. 49. March, 1909. DIGEST OF COMMENTS ON THE PHARMACOPOEIA OF THE UNITED STATES OF AMERICA. [8th Decennial Edition.] For the period ending December 31, 1905. By MURRAY GALT MOTTER and MARTIN J. WILBERT. Government Printing Office, Washington. 1909.

Two volume, containing 295 pages of subject matter, classified as follows:—I. Preface. II. List of literature reviewed—Journals, and pharmacopoeias. III. General comments: (i.), General principles followed in revising the pharmacopoeia. (ii.), Scope. (iii.), Analytical data. (iv.), Biological remedies. (v.), Vegetable drugs. (vi.), Pharmaceutical preparations. IV. International standards. (i.), International conference for the unification of pharmacopoeial formulae for patent medicaments (Brussels Conference). (ii.), Foreign pharmacopoeias. (iii.), Pharmacopoeial history. V. Comments on official articles.

EINRICHTUNG VON LABORATORIEN UND ALLGEMEINE OPERATIONEN. Von Dr. VICTOR SANTER. Wilhelm Knapp's Verlag, Halle a.S. 1909. Price M.2.70.

8vo volume, containing 65 pages of subject matter, with 53 illustrations. The subject matter is arranged under the following class-headings:—I. Organisation of the analytical laboratory. Capacity and function of the analyst outside the laboratory. II. Position and general arrangement of the laboratory. III. General operations: (a), Sampling and reducing to physical condition for analysis (pulverisation, &c.). (b), Balance and weighing. (c), Indirect weighing. (d), Estimation of quantities by measuring. (e), Solids. (f), Gases. (g), Evaporation. (h), Filtering, washing, and precipitation. (i), Drying and igniting. IV. Special methods of analysis usual in technology: (a), Volumetric analysis. (b), Electrolysis. (c), Colorimetry.

DIE ELEKTROCHEMISCHEN VERFAHREN DER CHEMISCHEN GROSS-INDUSTRIE. IHRE PRINZIPIEN UND IHRE AUSFÜHRUNG. Von Dr. JEAN BILLITER. I. Band. Elektrometallurgie wässriger Lösungen. Wilhelm Knapp's Verlag, Halle a.S. 1909. Price M.12.70.

8vo volume, containing 284 pages of subject matter with 117 illustrations and numerous tables. The subject matter is classified and arranged in the following chapters: Introduction. Theory of ions. Faraday's law. Law of dilutions, &c. Polarisation, &c. CHAPTER I. COPPER.—(a), Its electrolytic refining. (b), Electrolytic production of copper from copper ores. (Processes of Marchese, Höpfner, Siemens and Halske). (c), Cathodic separation, and electrolytic preparation of finished articles. II. SILVER.—(a), Electrolytic refinement. (b), Electrolytic preparation from alloys. III. GOLD.—(a), Electrolytic gold refining. Electrolysis with crude gold anodes. (b), Electrolytic gold recovery from ores. IV. LEAD.—(a), Electrolytic lead refining. (b), Lead recovery from ores. V. ZINC.—(a), Electrolytic zinc extraction. (b), Zinc recovery from ores. (c), Processes in the electrolysis of zinc chloride and zinc sulphate solution. Zinc from zinc sulphate solutions (Process: Siemens and Halske). Zinc from zinc chloride solutions (Process: Höpfner). VI. The detinning of tinplate. VII. NICKEL. Its electrometallurgy. VIII. (i.), Refining of bismuth and cadmium. Extraction of antimony and mercury. (ii.), Electrolysis with soluble anodes, in the recovery of metallic compounds (Iron—lead colours).

CIMICA GENERALE E APPLICATA ALL'INDUSTRIA. VOLUME II.—CHIMICA ORGANICA. Del Dott. E. MOLINARI. U. Hoepli, Milano, 1908 and 1909. Price, Lira 18.

THE work is issued in two 8vo volumes containing 956 pages of subject matter, with 486 illustrations, and an alphabetical index. The subject matter of the whole work is classified as follows:—PART I.—I. General part: Purification of organic substances; analysis; calculation of formulae; determination of molecular weights by chemical methods; polymerism; valency of carbon, constitutional formulae, isomerism; metamerism, pseudoisomerism, tautomerism, desmotropy; stereoisomerism; homology and isology, classification of organic substances; official nomenclature; relations between physical properties and chemical composition and constitution. II. Special part: Derivatives of methane. (A.) Hydrocarbons. (B.) Halogen derivatives of hydrocarbons. (C.) Alcohols. (D.) Derivatives of alcohols. (E.) Acids. PART II.—(F.) Derivatives of acids. (G.) Polyvalent aldehydic and ketonic alcohols. III. Special part: Cyclic compounds. (A.) Isocyclic compounds: Aromatic hydrocarbons. (B.) Halogen substitution derivatives of benzene. (C.) Sulphonic acids. (D.) Phenols. (E.) Quinones. (F.) Nitro-derivatives. (G.) Amino-derivatives. (H.) Nitro-, amino-, and thio-phenols. (I.) Azo-, diazo-, and diazo-amino-compounds and hydrazines. (L.) Aromatic alcohols, aldehydes, and ketones. (M.) Hydroxy-alcohols and aldehydes, and ketonic alcohols. (N.) Aromatic acids. (O.) Hydrogenised benzene derivatives. (P.) Condensed benzene nuclei. (Q.) Heterocyclic compounds. (R.) Colouring matters. (S.) Textile fibres. (T.) Protein substances, glucosides, and substances of uncertain or unknown constitution. Appendix.

PATENT OFFICE LIBRARY: SUBJECT LISTS, NEW SERIES B.F.-BL. SUBJECT LIST OF WORKS ON THE LAWS OF INDUSTRIAL PROPERTY (PATENTS, DESIGNS, AND TRADE MARKS) AND COPYRIGHT IN THE LIBRARY OF THE PATENT OFFICE. Love and Malcolmson, Ltd., 4 and 5, Dane Street, W.C. Patent Office, 25, Southampton Buildings, London, W.C. 1909. Price 6d.

POCKET-BOOK size, 80 pp., and a key to the classification of Headings (B.F. to B.G.). This volume superseded *Patent Office Library Series*, No. 3, published in 1900.

SOME ELECTRO-CHEMICAL CENTRES. A report to the Electors of the Gartside Scholarships. By J. N. PRING, M.Sc. (Gartside scholar), Manchester. At the University Press, 1908. Price 1s. 6d.

8vo volume, containing 136 pages of subject matter and an alphabetical index. The report is based principally on information acquired during visits to several countries, on "the continent of Europe and to the United States and Canada, including British Columbia, during the years 1907 and 1908." The subject matter is classified as follows:—I. Cost of power production. II. Niagara Falls. III. The copper refineries of New Jersey. IV. Canadian water powers and electro-chemical centres. V. Electric smelting of iron ores and steel production. VI. Ozone and water purification. VII. Gold and silver refining. VIII. Electrical manufacture of carbon bisulphide. IX. Electro-chemical industries in the Alps, France, and Belgium. X. Electrical fixation of atmospheric nitrogen. XI. Power centres and electro-chemical works in Great Britain.

DYEING IN GERMANY AND AMERICA, with a Chapter on Colour Production. A Report to the Electors of the Gartside Scholarships on the results of a tour in Germany and the United States in 1905-6. By SYDNEY H. HIGGINS, M.Sc., Gartside Scholar. University Press, Manchester, 1907. Price 1s. Sherratt and Hughes, Manchester: 34, Cross Street; London: 33, Soho Square, W.

8vo volume, containing 105 pages of subject matter, and the alphabetical index. The subject matter is classified and arranged under the following chapter heads:—I. General. Distribution of the industry in America and Germany. Development of the art of dyeing. Influence of chemistry. Opposition to progress. Hank dyeing and washing. Cloth dyeing. II. Cop dyeing. III. Sulphur colours, and indigo. IV. Mercerising. V. Bleaching. VI. The industry in the United States. VII. Lowell, Lawrence, and Fall River, Mass. VIII. Conditions of the industry. IX. Efficiency in the industry. X. Colour production.

BAMBOO FOR PAPERMAKING. By R. W. SINDALL. Marchant, Singer and Co., London. 1909. Price 2s.

8vo volume, 60 pp., printed on paper produced from the bamboo, and describing the possibilities of bamboo for paper-making, the habit and growth of the plant, its flowering and propagation, with information as to price and supply; to which are added particulars of experiments on paper manufacture therefrom, and the necessary plant and mill equipment. The whole is the outcome of a visit made in 1905 to Burma by the author, at the request of the Indian Government, which is prepared to offer special terms to those who will undertake the manufacture. (See also this J., 1907, 1157.)

Patent List.

I.—PLANT, APPARATUS, AND MACHINERY. APPLICATIONS.

17,903. Epstein. See under VII.

17,914. Goldstein. Manufacture of highly absorbent carbonaceous material. Aug. 3.*

18,013. Stuble and White. Apparatus for separating dust from air or gases.* Aug. 4.

18,194. Newton (F. Bayer und Co.). Steam traps. Aug. 6.

18,397. Crighton, and Klein Engineering Co. Apparatus for cooling liquids. Aug. 10.

18,452. Bary. *See under X.*

COMPLETE SPECIFICATIONS ACCEPTED.

11,557 (1908). Allan and Richmond. Boilers for melting bitumen, pitch, marine glue, and grease. [Post dated Nov. 30, 1908.] Aug. 11.

16,817 (1908). Faller. Evaporating boilers for use in crystallising liquids. Aug. 18.

17,500 (1908). Joy. Apparatus for raising and forcing water and other liquids and semi-liquids. [Cognate Appl., 3407 of 1909.] Aug. 11.

22,184 (1908). Jeffcock and Yardley. Separator for treating steam and other gaseous and liquid bodies. [Cog. Appl., 9230 of 1909.] Aug. 11.

3623 (1909). Vautin. Generation of steam from the heat contained in slags. Aug. 18.

5365 (1909). Dehne. Milk separators and other centrifugal machines. Aug. 18.

8164 (1909). Wilkinson, Heywood, and Clark, Ltd., and Gordon. Dipping tanks. Aug. 18.

H.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

17,889. Schuster. Regenerative coke ovens. Aug. 3.

18,123. Tigges. Gas producers. [Ger. Appl., Aug. 6, 1908.]* Aug. 5.

18,413. Jones. Quenching coke. Aug. 10.

18,593. Izod. Manufacture of ozonised or oxygenised carburetted vapour or gas. Aug. 12.

18,652. Crombie. Treating fuel and collecting the by-products. Aug. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

16,157 (1908). Hiller, and National Boiler and General Insurance Co. Gas-testing burner for producer gas plants. Aug. 11.

16,448 (1908). Bethge. Combustible mixtures for producing actinic light. Aug. 18.

16,610 (1908). Versen. Gas producers. [Rights under Section 91 not granted.] Aug. 18.

16,762 (1908). Ziegler and others. *See under V.*

21,249 (1908). Seymour. Horizontal regenerative coke oven. Aug. 18.

11,890 (1909). Crossley and Rigby. Gas producer plant primarily for recovering ammonia. Aug. 11.

III.—DESTRUCTIVE DISTILLATION. TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

18,076. Hercog and Linke. Process for producing condensed petroleum. Aug. 5.

18,120. Weiser. Process for separating paraffin from paraffin butter and apparatus therefor.* Aug. 5.

18,334. Noad. Distilling shale and other bitumens. Aug. 9.

18,604. Smith, Mitchell, and Askham. Tables or slabs for dry-cleaning processes with volatile liquids. Aug. 12.

18,605. Smith, Mitchell, and Askham. Recovering volatile solvents. Aug. 12.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

18,117. Imray (Meister, Lucius, und Brüning). Manufacture of new vat dyestuffs. Aug. 5.

18,461. Wetter (Chem. Fabr. Grünau, Landshoff, und Meyer A.-G.). Manufacture of new alizarin preparations suitable for dyeing and printing.* Aug. 10.

18,477. Claus and Co., and Claus. Manufacture of a thiazine dyestuff. Aug. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

12,167 (1908). Johnson. (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Aug. 11.

339 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Aug. 18.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

17,967. Dykes and Dykes. Dyeing, bleaching, and mercerising machine. Aug. 4.

18,016. Nowicki. Hygroscopic substitute for cotton-wool.* Aug. 4.

18,086. Loewe. Process for the manufacture of artificial silk or for coating and glossing textiles and apparatus therefor. [Fr. Appl., Sept. 18, 1908.]* Aug. 5.

18,391. Wittington. Printing calico, paper, and yarn. Aug. 10.

18,448. Resch and Gutsch. Apparatus for use in chemical cleaning. [Ger. Appl., Aug. 31, 1908.]* Aug. 10.

18,461. Wetter. *See under IV.*

18,481. Daniels. Apparatus for dyeing wool. Aug. 11.

18,649. Scholefield and Downham. Dyeing and bleaching fibres.* Aug. 13.

18,701. Johnson (Badische Anilin und Soda Fabrik). Production of shades on vegetable fibre. Aug. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

16,557 (1908). Crombie. Apparatus for making fibres from solutions. Aug. 11.

16,762 (1908). Ziegler, and Oberbayerische Kokswerke und Fabrik Chemischer Produkte A.-G. Method of depriving peat and like vegetable fibrous materials of superfluous moisture. Aug. 11.

2024 (1909). Koreinek. Production of samples representing printed textile fabrics. Aug. 11.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

17,903. Epstein. Treatment of air for different purposes. Aug. 3.

17,951. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia and apparatus for use therein. Aug. 3.

17,955. Rowley. Process for the conversion of crude phosphatic rock into water soluble phosphate. Aug. 3.

18,203. Bender. Process for production of oxides of nitrogen.* Aug. 6.

18,206. Palmer and Stead. Apparatus for use in deodorising carbon dioxide. Aug. 6.

18,286. Vender. *See under XXI.*

18,329. Wolff. Obtaining tin tetrafluoride from tin scrap. Aug. 9.

18,433. Levi. Electrochemical production of phosphatic fertilisers.* Aug. 10.

18,661. Robinson (Morton and Co.). Apparatus for purifying air. Aug. 13.

18,700. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. Aug. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

14,349 (1908). Brotherton and Wyld. Saturator for the manufacture of ammonium sulphate. Aug. 18.

16,156 (1908). Gartenmeister. Process for purifying chlorates. Aug. 11.

16,542 (1908). Otto. Production of ozone. [Date Appl. for, Aug. 10, 1907.] Aug. 11.

17,356 (1908). Peniakoff. Process for rendering silica contained in sodium aluminate insoluble for the purpose of obtaining silica-free alumina. Aug. 11.

20,366 (1908). Ellis (Chemische Werke vorm. Dr. H. Byk). Manufacture of nitric acid. Aug. 18.

25,965 (1908). Meyer. Process of manufacturing sulphide of zinc. [Date Appl. for, Dec. 3, 1907.] Aug. 11.

11,890 (1909). Crossley and Rigby. *See under II.*

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

18,118. Sauvageon. Electric furnaces for the continuous manufacture of glass. Aug. 5.

18,322. Quertinmont. Apparatus for making sheet or plate glass.* Aug. 9.

18,323. Quertinmont. Manufacture of glass.* Aug. 9.

18,713. Voelker. Forming bodies from semi-liquid quartz.* Aug. 14.

COMPLETE SPECIFICATION ACCEPTED.

9853 (1909). Sievert. Glass making apparatus. Aug. 11.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

18,088. Rhodin. Production of hydraulic cement from blast furnace slag. Aug. 5.

18,230. Wilson. Manufacture of cement, plaster, and concrete. Aug. 7.

18,293. Wilson. Manufacture of cement, plaster, and concrete. Aug. 9.

18,357. Pink. Making artificial marble and floor and wall coverings. Aug. 9.

18,670. Associated Portland Cement Manufacturers, Bamber, and Baxter. Drying slurry. Aug. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

23,988 (1908). Rhodin. Manufacture of slag cement. Aug. 18.

2534 (1909). Mueller. Process of impregnating wood. [Date Appl. for, Feb. 15, 1908.] Aug. 11.

2599 (1909). F. L. Smith and Co. Treatment of stony or earthy materials for the manufacture of cement. [Date Appl. for, Feb. 27, 1908.] Aug. 11.

5908 (1909). Chisholm. Method of treating wood. Aug. 11.

7530 (1909). Owen. Preparing asbestos fibre for insulating purposes. Aug. 11.

X.—METALS AND METALLURGY.

APPLICATIONS.

17,911. Monge. Manufacture of metallised articles.* Aug. 3.

18,176 and 18,178. Martin. Process for separation of complex ores. [Pat. of Addn. to No. 4531 of 1909.] Aug. 6.

18,198. Soc. Anon. "Le Ferro-Nickel." Light aluminium alloys. [Fr. Appl., Aug. 29, 1908.]* Aug. 6.

18,239. Beauchamp. Process for extraction of zinc. [Addition to 17,330 of 1909.] Aug. 7.

18,349. Hargreaves. Production of iron or steel direct from the ore.* Aug. 9.

18,451. Bary. Process and apparatus for casting metals. Aug. 10.

18,452. Bary. Furnaces. Aug. 10.

18,610. Hoff. Process and apparatus for heating, melting, refining, and decomposing metals.* Aug. 12.

18,731. Hoy and Rogerson. Welding steel or iron and flux therefor. Aug. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

16,552 (1908). Thompson (Wm. Sauntry Metals Co.). Process for the treatment of steel and iron. Aug. 11.

16,806 (1908). Marks (Gio Ansaldo, Armstrong, and Co.). Manufacture of cemented armour plates of steel for ships. Aug. 11.

16,820 (1908). Clark. Coating of iron or steel with copper, or other metal, such as silver or gold, which alloys with copper. Aug. 18.

22,092 (1908). Richford. Process of producing lead or other metal in thread-like or finely divided form. Aug. 11.

23,779 (1908). Stalder, Scholl-Scholl, and Dubach. Process for soldering aluminium. Aug. 18.

3623 (1909). Vautin. *See under I.*

8272 (1909). Jeffery. Flux for use in soldering aluminium with ordinary tin and lead solder and copper bit. Aug. 11.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

18,118. Sauvageon. *See under VIII.*

18,433. Levi. *See under VII.*

18,590. Marino. Preserving or protecting from peroxidation the lead supports of the positive electrodes of storage batteries.* Aug. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

24,355 and 24,356 (1908). Schauli. Depolarisers for electric batteries. [Date Appl. for, July 9, 1908.] Aug. 18.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

18,236. Tuckfield and Garland. Bleaching and purifying fats and oils. Aug. 7.

18,588. Nicholson. *See under XIV.*

COMPLETE SPECIFICATIONS ACCEPTED.

26,133 (1908). Landemann (Geh. Korting A.-G.). Manufacture of pulverised soap. [Request under Section 19 not granted.] Aug. 18.

1550 (1909). Justice (Mills and Battle). Extraction of oil from materials such as seed. Aug. 11.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES: INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

COMPLETE SPECIFICATIONS ACCEPTED.

16,476 (1908). Williamson (Taylor). Preservative antifouling and anticorrosive paint. Aug. 11.

17,557 (1908). Fraser. Paint or composition for colouring articles and surfaces. Aug. 18.

26,521 (1908). Langbein-Pfahhauser Werke A.-G. Process for rustproof coating of iron and steel. [Date appl. or, Dec. 21, 1907.] Aug. 18.

(B.)—RESINS, VARNISHES.

APPLICATION.

18,149. Morris. Preservative materials for leather. Aug. 6.

(C.)—INDIA-RUBBER.

APPLICATIONS.

18,493. Newton (F. Bayer und Co.). Insulation of metallic threads or wires. [Under Rule 13, May 13, 1909.] Aug. 6.

18,503. Gallagher and Rendle. *See under XIV.*

18,678. Melsom. Treatment and utilisation of waste rubber, vulcanite, and ebonite. Aug. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

18,929 (1908). Upson (Christy). Implement for tapping *Funtumia Elastica* and other rubber producing trees. Aug. 11.

23,814 (1908). Asimont and Galley. Instrument for use in the tapping of rubber trees. Aug. 11.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

18,149. Morris. *See under XIII B.*

18,411. Cave-Browne-Cave. Treatment of leather, fur, and skins. Aug. 10.

18,468. Meiro. Extraction of grease and glue from bones. Aug. 10.

18,503. Gallagher and Rendle. Method of combining leather and rubber.* Aug. 11.

18,588. Nicholson. Process and apparatus for extracting fat from bones. Aug. 12.

COMPLETE SPECIFICATION ACCEPTED.

9383 (1909). Buffum and Carter. Waterproof leather-board and process of preparing it. [Pat. of Addn. to No. 28,219, 1908.] Aug. 11.

XV.—MANURES, &c.

APPLICATIONS.

17,937. Patent-Press-Kartoffel-Industrie Hermann Gumpel. Process for treating raw potatoes so as to obtain a durable product for agricultural and industrial purposes.* [Ger. Appl., 7th May, 1909.] Aug. 3.

17,955. Rowley. *See under VII.*

18,433. Levi. *See under VII.*

XVI.—SUGAR, STARCH, GUM, &c.

COMPLETE SPECIFICATION ACCEPTED.

26,619 (1908). Cie. Industrielle des Alcools de l'Ardeche. Apparatus for converting wood into fermentable sugars and other products. [Date Appl. for, June 9th, 1908.] Aug. 18.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

18,028. Compagnie Industrielle des Alcools de l'Ardeche. Separating apparatus for use in the manufacture of alcohol.* [French Appl., Oct. 16, 1908.] Aug. 4.

18,216 and 18,217. Kuhn. Manufacture of fermented beverages. [Addition to No. 4622 of 1908.] Aug. 6.

18,218 and 18,219. Kuhn. Manufacture of beverages. Aug. 6.

18,530. Faulkner and Duncan. Manufacture of malt preparations. Aug. 11.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

17,992. Loring. Art of ageing and conditioning flour. [Pat. of Addn. to No. 12,781 of 1908.] Aug. 4.

18,201. Buer. Process for the production of butter flavour.* Aug. 6.

18,337. Collett and Eckardt. Process for production of dietetic cocoa.* [Norwegian Appl., Aug. 10, 1908.] Aug. 9.

COMPLETE SPECIFICATION ACCEPTED.

22,221 (1908). Goetz and Jones. Processes of pasteurisation. Aug. 18.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATION.

18,429. Welcome. Deodorising and drying nighsoil.* Aug. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

16,397 (1908). Grossmann. Treatment of sewage-sludge. Aug. 11.

17,244 (1908). Liversedge. Process for purification of water or sewage. Aug. 18.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

17,871. Roeckner and Voss. Manufacture of boxes from pulp. Aug. 3.

17,952. Temperley, Wild, and Wild. Engines for use in breaking and bleaching paper-making materials. Aug. 3.

18,086. Loewe. *See under V.*

18,342. Müller, and Rheinische Kunstseide-fabrik A.-G. Manufacture of viscous spinning solutions of cellulose.* Aug. 9.

18,399. Chapman. Pulp for paper making. Aug. 10.

18,426. Woltzer. Producing artificial silk, horsehair substitutes, films, and the like. Aug. 10.

18,694. Heydenhaus, Banhegyi, and Glaser. Celluloid substitute and process for manufacturing the same. Aug. 13.

XX.—FINE CHEMICALS, ALKALOIDS,
ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

17,928. Newton (F. Bayer und Co.). New pharmaceutical compound. Aug. 3.

18,317. Wellcome and Pyman. Manufacture of new therapeutic compounds. [Addn. to No. 14,918, 1909.] Aug. 9.

18,540. Buer. Obtaining lecithin from seeds of leguminous plants.* Aug. 11.

XXI.—PHOTOGRAPHIC MATERIALS AND
PROCESSES.

APPLICATIONS.

18,532. James (Cie. Gen. de Phonographes, Cinematographes, et Appareils de Precision). Photographic printing.* Aug. 11.

18,553. Krayn. Multicolour photography. [Ger. Appl. Aug. 12, 1908.]* Aug. 11.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

18,279. Vender. Manufacture of smokeless powder.* [Italian Appl., Aug. 8, 1908.] Aug. 7.

18,280. Vender. Denitration and recovery of acid mixtures adapted for use in nitration.* [Italian Appl., Aug. 8, 1908.] Aug. 7.

18,281. Vender. Purification of trinitrotoluene (1. 2. 4. 6)*. [Italian Appl., Aug. 8, 1908.] Aug. 7.

18,551. Easton. Explosives. Aug. 11.

18,622. Wesler. Explosives.* Aug. 12.

COMPLETE SPECIFICATION ACCEPTED.

9992 (1909). Schmitz. Manufacture of igniting compositions. Aug. 18.

Journal of the Society of Chemical Industry.

No. 17, Vol. XXVIII.

SEPTEMBER 15, 1909.

No. 17, Vol. XXVIII.

Journal and Patent Literature.

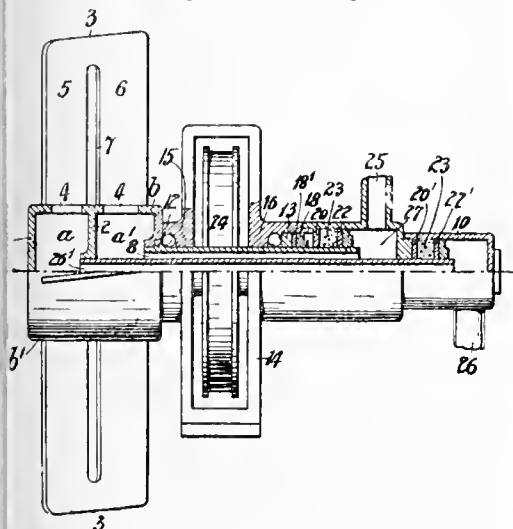
—PLANT, APPARATUS, AND MACHINERY.

Compressors for gases. (Frankfort Internat. Aeronaut. Exhibition.) Times Eng. Suppl., Aug. 25, 1909, 18.

THE great heat developed by the compression of hydrogen to 200 atmospheres has led to the manufacture of high pressure compressors which do the work in three stages. The compressors contain three high-pressure cylinders arranged in tandem. In the first cylinder compression takes place to 6 atmospheres, in the second to 36 atmospheres, and in the third to about 200 atmospheres. These compressors are made for air, hydrogen, oxygen, nitrogen, carbonic acid, or acetylene up to 1000 atmospheres pressure, but for more than 250–300 atmospheres four stages are employed, two twin-cylinders being used. All valves are arranged in a vertical plane with the cylinders. These machines take up very little space, are simple, and every part is easily accessible and transportable. They seem to require very little attention, and are used in chemical factories as well as in connection with military air-ships.

PATENTS.

Cooling and refrigeration of liquids or fluids. W. Hewitt, London. Eng. Pat. 20,381, Sept. 28, 1908.



THE apparatus consists of a hollow hub, 1, divided into two chambers, *a*, *a*¹, by the partition, 2. The hub is provided with projecting hollow blades or wings, 3, also divided by partitions, 7, into two chambers which communicate respectively with the chambers, *a*, *a*¹, by the ports or openings, 4. The apparatus is provided with a concentric hollow trunnion, 8, within which is a tube, 261, communicating at one end with the compartment, *a*, of the chamber, 1, and at the other with the chamber, 10, which forms the outlet for the liquid. The hollow shaft, 8, is secured upon it, a driving pulley or chain wheel, 24, 25, 26, indicate the admission- and exit-orifices respectively, of the stationary chambers, 27 and 10. The liquid to be cooled is forced into the stationary chamber, 25, passes along the outer hollow shaft, 8, into the chamber, *a*¹, and thence through 4, 6, 5, and into the chamber, *a*, from which it is discharged through the central hollow trunnion, 261, into the chamber, 10. The liquid partakes of the revolution of the hub and wings and is cooled by the air. If desired the liquid may be circulated through the hub and wings by a centrifugal pump carried on the hollow trunnion.—W. H. C.

Separating solid matters from air; Centrifugal apparatus for —. A. Lebrasseur, Paris. Assignor to The Sturtevant Engineering Co., Ltd., London, England. U.S. Pat. 928,673, July 20, 1909.

A CONICAL chamber has an inlet pipe fixed tangentially and a conical exit pipe fixed centrally at its top. The annular space between the exit pipe and the conical chamber contains a continuous spiral vane forming a spiral passage of increasing cross-sectional area for the entering air. Above the opening of the exit pipe a flat disc is carried on short columns to spread the air leaving the apparatus.—J. W. H.

Packing and process of making same. T. Murphy, Cleveland, Ohio. U.S. Pat. 928,875, July 20, 1909.

LEAD and Babbit metal are melted, and a mixture of graphite and mica stirred in until the whole is in a granular state. Asbestos fibre and oil are then incorporated with the mixture until a compact pliable mass is obtained, forming the packing in question.—J. W. H.

Centrifugal machine for separating heavy from light materials. Jahn-Kommanditgesellschaft, Maschinenbau-Anstalt, Eisengiesserei und Kesselschmiede. Fr. Pat. 399,829, Feb. 22, 1909.

A CONICAL drum closed below and open above and provided with a helical blade on its interior surface is mounted on an axis so that it can be rotated. The materials to be separated are fed into the open top of the drum from which the heavier particles are also discharged. The lighter particles are discharged through openings in the bottom of the drum arranged at a greater distance from the axis than the semi-diameter of the upper opening of the drum.—W. H. C.

Filtering liquids; Process for — and apparatus therefor. J. Resines, Matanzas, Cuba. Eng. Pat. 23,720, Nov. 5, 1908.

SEE Fr. Pat. 396,173 of 1908; this J., 1909, 591. Reference is directed, under Sect. 7, Sub-Sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 3064 of 1892, 7491 of 1896, and 20,850 of 1899.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

PATENTS.

Fuel for internal combustion engines. G. B. Selden, Rochester, N.Y. U.S. Pat. 928,803, July 20, 1909. (Renewed May 13, 1909.)

TO a suitable liquid hydrocarbon, a pierate of a suitable hydrocarbon, such as naphthalene, is added. A peroxide such as hydrogen peroxide may be a further addition.—J. W. H.

Tar and liquid hydrocarbons; New method of utilising — for heating. E. Hovine. Fr. Pat. 399,274, Feb. 9, 1909.

THE tar and liquid hydrocarbons are gasified in the upper part of a gas-producer charged with coke, this producer being worked with a blast of air sufficient only to maintain the necessary temperature. The gases formed from the tar, &c., mixed with a certain quantity of producer gas, are led away and burned in a furnace. The upper part of the producer is provided with one or more inclined surfaces which are maintained at red heat by the fire in the producer, and the tar is run on to these surfaces in thin streams. The coke which is formed on these inclined surfaces is raked from time to time into the producer fire and serves to maintain the level of the fuel.—A. T. L.

Hot air furnace. J. M. Keller, Youngstown, Ohio. U.S., Pat. 928,259, July 20, 1909.

THE furnace has a circular grate with a central hole. A gas producer shell having an opening at its side for feeding the fuel and an opening in its base, is supported at a short distance above the grate. A perforated cylinder with a perforated conical top and carried by a lever, closes the lower opening in the gas producer shell, and passes through the hole in the circular grate. By this means the fuel may be made to fall on the circular grate, while the gases generated, can pass through the perforations. The whole is enclosed in a shell over which the air to be heated, passes, provision being made for the removal of ash, &c.—J. W. H.

Gas-furnace. J. Bueh, Dessau, Germany. U.S. Pat. 928,494, July 20, 1909.

PARALLEL streams of gas and air, are delivered into a combustion chamber having projections from its roof, and movable baffle plates on its hearth, to modify the course of the burning gases.—J. W. H.

Gas producers. A. B. Duff, Pittsburg, U.S.A., and The Gas Power and By-Products Co., Glasgow. Eng. Pat. 7780, April 1, 1909.

THE patent relates to producers of the type having a rotatable water-sealed top-plate carrying adjustable water-cooled pokers for stirring the fuel by the rotation of the top-plate. The top-plate is carried by a vertical flange extending downwards from its periphery and resting on rollers in an annular water seal, and it is guided by rollers on vertical spindles, which bear against its periphery. The pokers are pivoted in the top-plate about the middle of their length, and their upper ends engage nuts working on horizontal screwed rods, so that the lower ends of the pokers can be given a lateral movement by turning these rods. The top-plate may be water-cooled, if desired.—A. T. L.

Gas producer plants primarily designed for the recovery of ammonia. W. J. Crossley and T. Rigby, Manchester. Eng. Pat. 11,890 of 1909; date of application, Aug. 27, 1908.

IN gas producer plants of the Mond type, or of the type described in Eng. Pat. 24,144 of 1906 (this J., 1907, 957), the vapours given off during the concentration and evaporation of the ammonium sulphate liquors are added to the air supply for the producer, or to a part of it, preferably at the outlet of the air saturating tower. The air supply to which the acid vapours have been added is passed through a washer containing heated alkaline liquor, and thence to the superheater. This alkaline liquor may be drawn from the mechanical gas-washer or from the ash-pit of the producer, and it is preferably kept at the desired temperature by circulating through a jacket around the gas main at the outlet of the superheater. The air leaves the alkaline washer saturated at 80° C., and less steam from auxiliary sources need be added than with the known types of plant. The economy thus effected is equivalent to 5 per cent. of the heat value of the coal gasified, and may amount to 10 per cent. with fuels such as peat which give large yields of ammonia.—A. T. L.

Gas-producer for the manufacture of gas free from tar. Soc. L. Bontillier et Cie. Fr. Pat. 399,160, April 11, 1908.

TWO producers are described, in each of which the gases formed from bituminous fuel in one producer chamber pass through a second producer chamber charged with fuel which has been coked in the first chamber. (1). The two chambers are superposed and the fuel column is continuous. Bituminous fuel is fed into the lower chamber at the bottom of the fuel column by means of a screw conveyor, and is evenly distributed by means of a rotating grate of inverted conical form. The producer is worked with an up-draught. The fuel is coked in the lower chamber and is forced up into the upper chamber as more fresh fuel is forced in. The tarry gas formed in the lower chamber passes through the coke in the upper

chamber and leaves the producer by an outlet above the fuel column. (2). The two chambers are arranged one above the other and each is provided with a grate and worked with an up-draught. Bituminous fuel is fed into the upper chamber from a hopper in the ordinary way, and the coked fuel is allowed to fall from time to time into the lower chamber through a valved pipe of large diameter which passes up centrally through the grate in the upper chamber. The tarry gas from the upper chamber is led by a down-pipe and delivered beneath the grate in the lower chamber. The gas, mixed with air, passes up through the coked fuel and leaves by an outlet in the upper part of the lower chamber.

—A. T. L.

Gas producers. W. B. Chapman. Fr. Pat. 399,203 Feb. 6, 1909.

THE cylindrical shell of the producer is formed of several independent rings or sections which are rotated at different speeds, one or more of these sections including the upper most remaining fixed. One of the rotating sections is provided with a water-cooled tube which passes across the interior of the producer and aids the rotary movement of the fuel. A charging hopper is mounted on the top plate near the walls of the producer, and a water-cooled depending bell is arranged beneath the hopper, and extends below the level of the gas outlet so as to form a coking-chamber. Gases from the upper part of this coking chamber are drawn by an injector through a down pipe and are delivered into the producer fire at or below the zone where the fuel is stirred and broken up by the water-cooled tube. The lowest section of the producer is rotated and carries an inverted conical shell extending downwards into the ash-pit. The inlet for air and steam is formed by a hollow pyramid arranged centrally in the ash-pit; and this pyramid in conjunction with the rotating conical shell serves to break up the cinders and aid their passage to the ash-pit. A conical cap, protecting the open top of the hollow pyramid, is provided with four arms or blades extending horizontally towards the walls of the producer but inclined similarly to propeller-blades so as to stir the rotating fuel column. Alternatively these arms or blades may be fixed to the lowest section of the rotating shell. The various improvements are described in connection with two producers, one of which is of the suction-type and suitable for use on ships.

—A. T. L.

Gas-producer plant yielding purified gas. Soc. Métallurgique de la Madeleine-lez-Lille. Fr. Pat. 399,295 Feb. 10, 1909.

THE producer, which is of the suction type but may be worked by means of a blower if desired, is provided with a removable producer chamber comprising a cylindrical iron casing lined internally with alternate rings of refractory material and of asbestos. This lining is sufficiently yielding to withstand shock and vibration, and renders the producer suitable for use on vehicles and boats. The gas is purified by passing it through a series of tubes provided with external cooling ribs, and fitted internally with removable spiral-shaped metal brushes. These tubes may be arranged horizontally beneath the floor of a vehicle, or they may be vertical.

—A. T. L.

Gas producer with central rotating grate. H. Küpper. Fr. Pat. 399,562, Feb. 16, 1909.

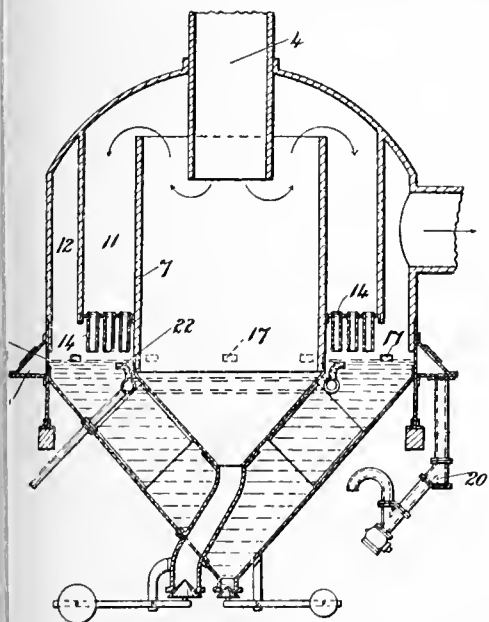
THE body portion of the producer and a central conical grate, which are rotated in opposite directions, are provided with sharp wedge-shaped projections to break up the clinker and facilitate its passage to the ash-pit. The rotating portion of the shell of the producer is sealed in water both at the lower and at the upper end. The lower part of this rotating shell is formed with an outer casing through which water is circulated for cooling the shell and the projections. The conical grate is formed of three superposed ring-shaped castings having sharp projections as described, the uppermost and smallest ring being surmounted by an oblique conical casting which is kept cool by admitting steam within it. The

gs are spaced apart sufficiently to allow the air and am which are delivered within the grate to pass between m into the producer.—A. T. L.

s-testing burner for producer gas plants. E. G. Hiller, and The National Boiler and General Insurance Co., Manchester. Eng. Pat. 16,157, July 30, 1908.

E burner comprises a cylindrical cleansing chamber h a gauze cap or hood forming the burner orifice. A bin, having flanges of cruciform shape, and wound with led wire, is placed vertically within the cleansing mber, the upper flange resting on the walls of this mber, so as to suspend the bobbin within it. The mber is enlarged at the lower end so that the gas has access to the coils of wire, which intercept tar, etc. en used with suction gas producers, the gauze of the ner prevents the passage of flame inwards should a it be applied while the engine is at work.—A. T. L.

cleaners [for blast-furnace gas]. J. Ruddiman, Yonkers, Vestchester, U.S.A. Eng. Pat. 5572, March 8, 1909.



apparatus comprises an inner dry dust-collecting ber, 7, arranged beneath the gas inlet pipe, 4, and annular chambers, 11, 12, in which the gas is further ed by impinging on the surface of the water in the part of the cleaner. The gas passes from the ber, 11, to the chamber, 12, through a number of tubes, 14, reaching nearly to the surface of the water. Inner chamber, 7, is kept cool by the water which unds the lower part of it. The scum on the surface e water is carried away through outlets, 17, into an ar chamber, 18, provided with a drain-pipe, 20. water inlet nozzles, 22, are arranged so as to direct ow of scum towards the outlets.—A. T. L.

ndescent gas mantles. J. W. Layton-Fisk, Cardiff. Eng. Pat. 4860, Feb. 27, 1909.

inforce and strengthen ordinary mantles, these are d in a solution obtained "by melting silica with its weight of potassium or sodium silicate in solution, diluting the mixture with distilled water." The mantle n dried and placed over a Bunsen flame, and whilst arm, is sprayed with a dry finely-powdered mixture ee parts of talc and 1 part of "muschelkalk alk one."—A. T. L.

Incandescent gas mantles. J. Fellner, London. From Oherfelt und Co., Berlin. Eng. Pat. 5260, March 4, 1909.

AFTER the fabric of the mantle has been impregnated, reinforcing threads which have been previously inapreg-nated and hardened are threaded through it and secured with the mantle to the carrier ring. The hardening of the reinforcing threads may be effected by adding didymium and beryllium nitrates to the solution with which the threads are impregnated.—A. T. L.

Metallic filaments for electric incandescent lamps, and manufacture of same. H. Kuzel. Fr. Pat. 399,007, Jan. 20, 1909. Under Int. Conv., Feb. 22, 1908.

FILAMENTS bent to a horse-shoe or U-shape are manu-factured by suitably loading the filament with weights or springs. The weights or springs are attached to the filament by hooks or clips formed of insulating material, or by hangers which bear upon a length of the filament so as to give it the desired curvature. The bend of the U-shaped filament may thus be curved in any desired manner, or it may be made right-angled or polygonal. The shaping of the filament may be effected during its manufacture or after it is finished.—A. T. L.

Peat and like vegetable fibrous materials; Method of depriving — of superfluous moisture. M. Ziegler, München, and Oberbayerische Kokswerke und Fabr. Chem. Produkte, Beuerburg, Germany. Eng. Pat. 16,792, Aug. 10, 1908.

SEE Fr. Pat. 395,637 of 1908; this J., 1909, 592.—T. F. B.

Fuel briquettes and briquettes for smelting purposes; Process of utilising bituminous brown coal and peat in the manufacture of —. A. Zindler, Berlin. Eng. Pat. 22,033, Oct. 17, 1908.

SEE Fr. Pat. 395,385 of 1908; this J., 1909, 512.—T. F. B.

Gas producers. G. L. Morton. Fr. Pat. 399,388, Feb. 11, 1909. Under Int. Conv., Feb. 15, 1908.

SEE Eng. Pat. 3462 of 1908; this J., 1908, 848.—T. F. B.

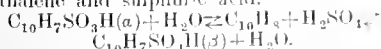
Filaments for electric incandescence lighting; Manufacture of — from powdered tungsten or other slightly ductile metals. Siemens und Halske Akt.-Ges. Fr. Pat. 399,261, Feb. 9, 1909. Under Int. Conv., Feb. 11, 1908.

SEE Eng. Pat. 2853 of 1909; this J., 1909, 647.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Naphthalene. Sulphonation of —; Quantitative examina-tion. P. C. J. Euwes. Rec. Trav. Chim. Pays-Bas, 1909, 28, 298-338.

THE author finds that when 1 mol. of naphthalene is heated, at 50° C., with 1 mol. of sulphuric acid, the α -sulphonic acid is formed in an almost pure state; as the temperature is raised to 150°–160° C., the amount of β -acid increases to a maximum. On heating to a still higher temperature, disulphonic acids and sulphonates are formed in increasing quantities and the amount of unattacked naphthalene decreases. The duration of the heating has much influence on the product; the primary product is the α -acid which is transformed into the β -acid. Nevertheless at the temperatures 143° C. and 158° C. an equilibrium between the two acids is attained. This equilibrium is probably due to hydrolysis of the two acids, with formation of naphthalene and sulphuric acid.



At 129° C. the process is more complicated as an intramolec-ular change of α -acid into β -acid probably takes place at the same time. The presence of water accelerates the attainment of equilibrium very greatly; after addition of 4 per cent. of water, equilibrium was attained after heating for two hours, whereas in absence of water six hours

heating was required. The quantity of unattacked naphthalene was greater in the presence of water. In presence of sulphur trioxide, disulphonic acid was obtained, whilst addition of phosphorus pentoxide caused the formation of sulphones. The sulphates of mercury and lead did not influence the rapidity with which equilibrium was attained. —E. F.

Baku petroleum: Filtration of — through fullers' earth. V. F. Herr. *Petroleum*, 1909, 4, 1284-1287.

A FILTERING layer of sufficient thickness separates from the crude oil all the unsaturated, high-molecular, aromatic and similar bodies that give the Nastjukoff "formolite" reaction (this J., 1904, 1082). On the other hand, the naphthenes, dinaphthenes, paraffins, and in fact all the bodies that do not give the above reaction (small quantities of benzene homologues being left out of consideration) pass through the filtering medium. —C. S.

Petroleum industry of Galicia. Board of Trade J., Aug. 26, 1909. [T.R.]

THE year 1908 was marked by greatly increased production and such unprecedentedly low prices that many of the oil producers were threatened with ruin. By the end of 1907 the price of crude oil had fallen to 1s. 3d. per 100 kilos. During the first three months of 1908 there was a slight rise in prices, but in April and May a number of new wells were struck, and the enormous over-production which followed caused the greatest embarrassment to the industry, while the existing storage and railway transport arrangements proved totally inadequate.

In view of the critical condition of the industry, the Austrian Railway Minister promised to introduce the use of oil instead of coal on the State railways in Galicia; he also arranged for improved transport facilities. A provincial association of oil producers, representing 80 per cent. of the total production, was formed, and this body made a contract with the State railways for the delivery of 220,000 metric tons of oil per annum. The railway authorities, however, found that it was not safe to use the oil in its crude state in railway locomotives, but that the benzene would have to be extracted first. The Producers' Association had not the capital to build the necessary works for this process, or the new reservoirs required; accordingly, the Government undertook to build a factory for extracting the benzene at Drohobycz, and to lease it to a cartel of the Austrian refineries which is being formed, and which will undertake to purify the oil for the use of the State railways. The State will pay the Producers' Association direct for the crude oil required at a price considerably higher than the present market price, and which has been fixed with reference to the cost of the coal that would have been required for the locomotives. The State will further build the reservoirs and lease them to the oil miners at a rate just sufficient to cover the interest and amortisation of the capital. The Government has introduced a Bill in the Reichsrath by which a concession will in future be necessary for carrying on the business of storing, handling, and refining crude oil in Austria, and the provincial authorities will be empowered to refuse this concession at their discretion.

In 1908 the amount of crude oil produced in Galicia was 1,734,235 metric tons, as compared with 1,175,974 tons in 1907 and 760,443 tons in 1906; 15,906 metric tons of mineral oils were imported into Austria-Hungary in 1908, as compared with 18,816 tons in 1907 and 27,339 tons in 1906; and 370,600 tons were exported in 1908, as compared with 217,258 and 195,885 tons respectively in 1907 and 1906. The export of mineral oils from the Monarchy, chiefly in the shape of refined petroleum or benzene, has risen enormously during the last few years, having increased proportionately more rapidly than the total production, of which it now forms about the fifth part. Nearly two-thirds of the export are sent to Germany; then follow France, Switzerland, Turkey, Italy, and the United Kingdom, the last-named country only taking 4500 tons. In 1906, 12,521 tons of paraffin wax were produced in Austria, of which 11,371 tons were exported; in 1907, 15,937 tons were produced, the export being 14,737 tons, and in 1908, 28,520 tons were produced and 27,220 tons exported, of which 1,660 tons went to the United Kingdom. The

total production of ozokerite in Boryslaw during 1908 was 2,050 tons; of this 675 tons were shipped from Hamburg and Stettin to America and the United Kingdom, and 1,222 tons were consumed on the Continent.

PATENTS.

Agglomeration of charcoal obtained by the distillation of olive kernels in closed vessels. Las Industrias del Olivo. Fr. Pat. 399,341, Dec. 18, 1908.

THE carbonaceous residue left in the retort after distilling olive kernels is roughly powdered and agglomerated with starch paste. A small proportion of sodium potassium nitrate or other oxidiser is added to facilitate the combustion of the product. After mixing, agglomerating and forming into balls, the latter are dried either in the air or in stoves. —W. H. C.

Woody residues [olive kernels]: Process for the continuous distillation of —. Las Industrias del Olivo. Fr. Pat. 399,342, Dec. 18, 1908.

THE materials to be distilled are fed through a charging hopper into the upper end of a vertical cylindrical retort set in a furnace. A number of metal frustums of cones are superposed within the retort which is provided with a hopper at its lower end for the discharge of the solid residue and is also connected both at the top and at the bottom to a condenser. —W. H. C.

Coal-tar: Process for obtaining mineral grease and agglomerated coke by distillation of —. S. J. Sauvage. Fr. Pat. 399,359, Jan. 20, 1909.

A MIXTURE of 100 parts of coke dust, 50 parts of coal-tar, 5 parts of lime and 15 parts of water is heated and distilled for four hours at a temperature of from 800° to 1000°. Mineral grease and an inflammable gas distil over at agglomerated coke is left behind in the retort. —W. H. C.

Tar, tar-oils, resin oils and other similar distillate products: Process for the purification of —. Sprenger. Fr. Pat. 399,760, Feb. 8, 1909. Und. Int. Conv., Jan. 5, 1909.

THE oils, after being washed with caustic alkali solution in the ordinary manner to remove phenols, etc., are heated either with or without pressure with another portion of caustic alkali solution and a metal in a fine divided condition. This treatment renders the resin and other similar impurities soluble in water. The oil is separated, washed once or twice with hot water and then redistilled. It is stated that oils treated in this manner undergo oxidation in addition and that after redistillation they are not liable to darken in colour on standing. —W. H. C.

Lead bath dissociator for hydrocarbons and all industrial residues. E. A. Barbet. Fr. Pat. 399,722, April 2, 1908.

THE hydrocarbons to be treated are introduced in a continuous stream below the surface of molten lead contained in a closed vessel set in a furnace and provided with a pipe leading to a condenser. The hydrocarbons are vaporised by the heat and the bubbles of vapor rise up through the lead and impinge upon the under surface of a flat hood, which is suspended just below the surface of the molten metal. The flat top of the hood is corrugated, and it is suspended by rods which pass through the cover of the vessel and are attached to external screws so that the inclination of the flat hood and the depth to which it is immersed can be varied without opening the vessel. By this means the time of contact between the vaporised hydrocarbon and the molten lead can be varied in order to obtain at will either liquid gaseous products. —W. H. C.

Oxidising agent: New —, and method of manufacture. Soc. Electrolytique des Acétates Français. Fr. Pat. 399,937, May 8, 1908.

WOOD charcoal is boiled with dilute hydrochloric acid, washed and then boiled with distilled water, dried, and calcined in a closed vessel. When cool the product

exposed to oxygen under pressure. The oxygen is condensed within the pores of the charcoal which, it is said, then forms an energetic oxidising agent. The charcoal thus treated is used to convert alcohol into dehyde and acetic acid.—W. H. C.

IV.—COLOURING MATTERS AND DYE STUFFS.

Dye stuff industry of Germany and the new American Customs tariff. Chem. Zeit., 1909, 33, 875. [T.R.]

THE German dyestuff industry is seriously affected by a new American tariff. Although the tax (30 per cent. of the value) on dyestuffs remains the same, the following materials are now admitted free:—Naphthylamine- and naphthol-sulphonic acids and their sodium and potassium salts, aminonaphtholsulphonic acids, aminosalicic acid, nitrochlorobenzene, diaminostilbenedisulphonic acid, etanilic acid, *p*-nitraniline and dimethylaniline. The American manufacturers can thus produce many important dyestuffs from duty-free materials, and so compete with the imported German goods. As a consequence of this competition it will be necessary for German firms to erect branch works in the United States.—J. C. C.

PATENTS.

Aminobenzonitrile and its substitution products; Process for preparing —. Kalle und Co., A.-G. Ger. Pat. 212,207, Dec. 6, 1907.

Good yields of *o*-aminobenzonitrile, and its derivatives are obtained from *o*-nitrobenzonitrile or its derivatives by reduction with iron and acetic or hydrochloric acid at temperatures not exceeding 70° C.—T. F. B.

Aminoanthraquinones; Process for preparing —. Badische Anilin und Soda Fabrik. Ger. Pat. 211,958, July 16, 1908.

TO OBTAIN aminoanthraquinone derivatives, *e.g.*, the halogen derivatives, are only partially acetylated by acetic hydride in presence of sodium acetate. If, however, the acetylation is carried out by acetic acid or anhydride in presence of fuming or concentrated sulphuric acid, the reaction is complete and rapid. The process is applicable to all primary and secondary aminoanthraquinones and their derivatives.—T. F. B.

Aromatic carboxylic acids from the corresponding aldehydes; Process for preparing negatively substituted —. Badische Anilin und Soda Fabrik. Ger. Pat. 211,959, Aug. 2, 1908.

NEGATIVELY substituted aromatic aldehydes are easily converted to the corresponding carboxylic acids, without formation of chlorine substitution products, by treatment with hypochlorite solutions in presence of alkali. The process is suitable for the oxidation of nitrobenzaldehydes, benzaldehyde sulphonic and carboxylic acids, etc. —T. F. B.

Colouring matters of the anthracene series; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12,167, June 4, 1908.

SEE Fr. Pat. 390,677 of 1908; this J., 1908, 1107.—T. F. B.

Uses of leuco compounds of indigo colouring matters; Manufacture and use of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 24,605, Nov. 16, 1908.

SEE Fr. Pat. 396,794 of 1908; this J., 1909, 596.—T. F. B.

Colouring matters and intermediate products; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 1245, Jan. 18, 1909.

SEE Fr. Pat. 398,602 of 1909; this J., 1909, 832.—T. F. B.

Disazo dyestuffs for cotton; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 16,092, July 29, 1908.

SEE Fr. Pat. 397,613 of 1908; this J., 1909, 698.—T. F. B.

Dyestuffs of the azine series; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 18,729, Sept. 7, 1908.

SEE Fr. Pat. 394,357 of 1908; this J., 1909, 239.—T. F. B.

Basic dyestuffs; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 20,367, Sept. 28, 1908.

SEE Fr. Pat. 395,793 of 1908; this J., 1909, 469.—T. F. B.

Basic dyestuffs; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 21,911, Oct. 16, 1908.

SEE Addition of Nov. 23, 1908, to Fr. Pat. 395,793 of 1908; this J., 1909, 595.—T. F. B.

Azo dyestuffs; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,349, Nov. 2, 1908.

SEE Ger. Pat. 208,498 of 1908; this J., 1909, 469.—T. F. B.

Flavopurpurine; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,601, Nov. 16, 1908.

SEE Ger. Pat. 205,097 of 1907; this J., 1909, 85.—T. F. B.

Anthracene compounds; Production of new —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 399,495, Jan. 6, 1909. Under Int. Conv., May 26, June 1, and Sept. 7, 1908.

SEE Ger. Pat. 210,019 of 1908; this J., 1909, 650. Succinic acid may be replaced by malonic acid, adipic acid, maleic acid, or other dibasic acid.—T. F. B.

Azo dyestuffs; Manufacture of substitutive —. Soc. pour l'Ind. Chimique à Bâle, Basle. Eng. Pat. 5792, March 10, 1909. Under Int. Conv., March 10, 1908.

SEE Addition of March 10, 1908, to Fr. Pat. 337,449 of 1903; this J., 1909, 832.—T. F. B.

Dyestuffs dyeing from the vat, like indigo; Production of halogenated —. Soc. pour l'Industrie Chimique à Bâle. Sixth Addition, dated April 10, 1908, to Fr. Pat. 372,627, Dec. 17, 1906.

SEE Eng. Pat. 8531 of 1908; this J., 1909, 517.—T. F. B.

Thioindigo dyestuffs; Process of making oxides of —. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 399,645, April 27, 1908.

SEE U.S. Pat. 898,738 of 1908; this J., 1908, 1015.—T. F. B.

Dyestuffs derived from galloxyaniline; Process for producing blue to violet —. Fabr. de Prod. Chimiques ci-dev. Sandoz. Fr. Pat. 399,799, Feb. 20, 1909.

SEE Eng. Pats. 6270 and 6272 of 1909; this J., 1909, 879, and 832.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

Textile materials; Electrical charge of — when immersed in water or solutions of electrolytes. J. L. des Bancelles. Comptes rend., 1909, 149, 316–319.

IN connection with the theory of dyeing, the author has studied the electrical charge assumed by textile materials when immersed in various liquids. In order to determine this charge, the author used Perrin's apparatus, consisting of a U-tube containing the liquid and a porous plug of

the substance to be investigated in one of the branches of the U. When this tube is placed in an electric field, some of the liquid passes through the diaphragm, and this migration indicates the sign and the magnitude of the electric charge assumed by the substance in presence of the particular liquid. The electric field employed measured about 12 volts per centimetre. In presence of distilled water the common textile materials assume a negative charge; wool takes a higher charge than cotton and unboiled silk. In presence of an alkaline solution the charge increases without changing its sign. In acid liquids it decreases and may even change its sign; this has so far only been observed in the case of silk, because the concentration of acid is limited to below $N/500$ owing to the evolution of gas. The presence of polyvalent ions modifies the electrical charge of the textiles. When these are immersed in alkaline liquids or water, the negative charge decreases under the action of positive ions (barium, calcium, zinc) and increases under that of negative ions (sulphate, ferrocyanide). The textile materials obey in general the laws established by Perrin in his researches on electrification by contact. Mordanting appears to effect no appreciable modification of the charge assumed by textiles in water. On the other hand, dyed textiles show different charges from undyed; dyeing with Methylene Blue considerably lowers the charge taken by wool; this is possibly due to the presence of free ions of Methylene Blue.—J. F. B.

Dyeing air and fur. F. J.—G. Beltzer. Rev. Gen. Mat. Col., 1909, 13, 187, 224.

AN account is given of the Green process for dyeing Aniline Blacks on hair and fur. This process is based upon a catalytic action produced by a small quantity of a para-diamine or a paraminophenol in the dye liquor. The catalyst serves to convey atmospheric oxygen to an aniline salt in its oxidation to Aniline Black. The great advantage of the method is that the aniline salts of organic acids may be employed. Paraphenylenediamine, diparaminodiphenylamine, diparaminoditolylamine, benzidine, tolidine, diamidine, diparaminophenylmethane, and their analogues, homologues, and derivatives (sulphonic, carboxylic, etc.) can be employed as the catalyst. Substances which yield a *p*-diamine can also be used, such as quinone-imines, *p*-nitrosophenol, *p*-nitrodimethylaniline, *p*-aminophenyl-quinone-monoxide, and their analogues, homologues and derivatives. Formule are given for utilising the process to give "raven blacks," "brown blacks," "red blacks," etc., using either methods of brush dyeing, or immersion methods.—H. G. B.

Dyeing: The intervention of osmotic pressure in —. Rosenstiehl. Comptes rend., 1909, 149, 396–399.

THE author points out that, under the influence of pressure, solid substances can be made to adhere rigidly to one another and regards the process of dyeing as a similar phenomenon. The necessary pressure in the dye-bath is provided by the osmotic pressure which is increased when salts (or, in the case of wool and silk, sulphuric acid) are added to the bath.—J. C. C.

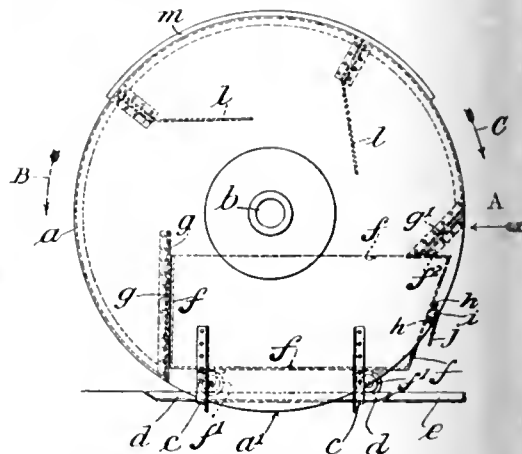
PATENTS.

Ammoniacal copper oxide [Cuprammonium] solutions for spinning artificial threads and the like; Process of producing —. P. Friedrich, Berlin. Eng. Pat. 4104, Feb. 19, 1909. Under Int. Conv., Feb. 19, 1908.

"AMMONIACAL copper oxide cellulose solutions," which can only be produced and preserved at low temperatures, acquire a high degree of permanence when "carbohydrates" are incorporated in them, and the products obtained from these solutions are exceedingly waterproof and elastic. If the ammonia be caused to evaporate, such a stable solution behaves quite differently from a pure ammoniacal copper oxide cellulose solution, which, as soon as its percentage of ammonia falls below 70 grms. per litre, is no longer able to keep in solution the entire quantity of cellulose, becoming gradually converted into a rigid, brittle, non-transparent blue mass. Under like conditions, solid precipitates are not thrown down from the new

solutions; on the contrary they remain quite homogeneous, but increase in toughness as the ammonia escapes from them. When the ammonia has entirely evaporated caoutchouc-like, but perfectly transparent product remain behind which, when dried finally, harden, but keep their transparency. The new solutions may also be coagulated by the ordinary precipitation methods. Example:—An ammoniacal copper oxide cellulose solution containing 7 per cent. of cellulose is prepared in a kneading machine in one of the known ways, a small quantity of glycerin being mixed with the ammonia. No more ammonia is used than is equivalent to the weight of cellulose. About 35 per cent. of "potato syrup (glucose)," reckoned on the weight of cellulose (the syrup containing about 30 per cent. of solid matter in solution), is added gradually to the solution, and the whole mass is kneaded for some time.—P. F. C.

Carbonising rays and other materials; Machine for —. J. Fitton, Ossett, Yorkshire. Eng. Pat. 16,692, Aug. 8, 1908.



A CYLINDER, *a*, is provided with hollow trunnions, *l*, for the admission of the gases by which the carbonisation of the material is effected. One section of the circumference of the cylinder is left open, and on the lower portions of the side plates are attached brackets, *c*, which carry rails, *d*, projecting at each end a little beyond the side plates. In alignment with the rails, *d*, are rails, *c*, leading from the machine to the drying room. Adapted to fit into and close up the open section of the cylinder, is a wagon, *f*, sufficiently large to hold enough material for one carbonisation and provided with wheel *h*, which will run on the rails, *d*, and abut against a stop plate, *g*. The wagon is held in this position by sliding bars, *h*, supported by the front of the wagon and adapted to fit into holes or recesses in the end plates. At the upper portion of the entrance opening to the cylinder is a stay, *g*¹, which in conjunction with a lip, *f*², on the front end of the wagon at its upper side forms a device for preventing undue escape of gases from the cylinder. The wagon revolves bodily with the cylinder, the material therein being distributed by means of forks, *l*. The apparatus rotates during the carbonising process in the direction of the arrow, *B*. When the process is completed the cylinder is partially rotated in the opposite direction to permit the material to fall into the wagon which is then withdrawn along the rails, *d* and *c*. The apparatus may be provided with a balance plate, *m*. —P. F. C.

Wool scouring by electricity. B. Lagye and R. Vandatto. Fr. Pat. 399,875, Feb. 24, 1909.

AN ordinary wool-scouring machine is employed, and current of electricity is made to pass between the prongs of the rakes which are used to draw the wool through the machine. As the wool passes between these prongs the action of the current assists in removing the foreign

natter clinging to the fibre. This scouring action is uniform, and is not attended by any shrinking of the fibre.—S. H. H.

Bleaching of textile fibres. J. Vernier. Fr. Pat. 398,985, Apr. 7, 1908.

THE process is designed for the bleaching of textile fibre, specially silk, in a cold bath and with only one treatment. The bath contains hydrogen peroxide, ammonia, and water. For example, 1 kilo. of silk is immersed in a bath containing 500 grms. of hydrogen peroxide, 20 grms. of ammonia, and 3 litres of water for 10 hours; the silk is then rinsed in water.—S. H. H.

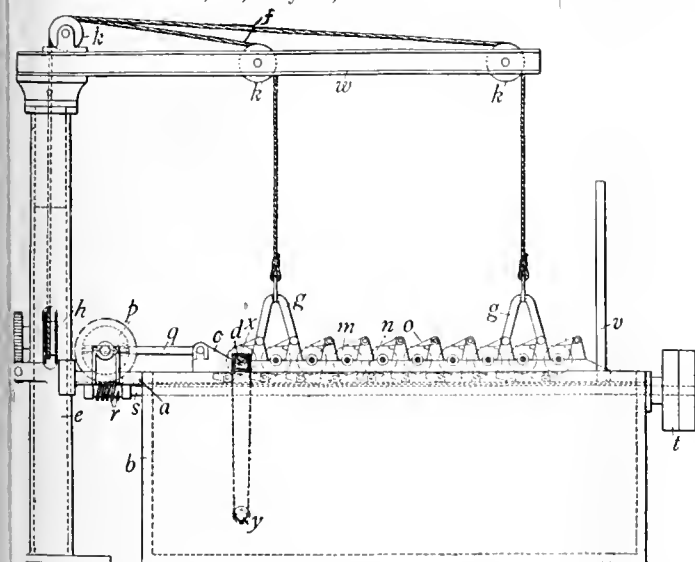
Mercerising cloth; Process and apparatus for —. Heberlein et Cie. Fr. Pat. 399,904, Feb. 25, 1909.

THIS machine differs from other mercerising machines in that the rinsing with water takes place directly the cloth leaves the impregnating mangle and not after the full width has been attained by stretching. In this way the stretching force is applied gradually and is capable of regulation to enable the machine to be used on all classes of fabrics. The extension is caused by a series of curved bar expanders. The cloth passes through the caustic soda lye, is squeezed, again impregnated, and again squeezed before passing out of the mangle on to the expanders. Two of these expanders are placed above the wash water and six others below. After travelling over these, the cloth is again squeezed before passing into a second wash-box also containing expanders. A third wash-box contains more expanders; a fourth simply gives a final rinse. The recovery of the caustic soda by this counter-current system is said to be very efficient.—S. H. H.

Dyeing, bleaching and washing machine. N. Labonty, Woonsocket, R.I. U.S. Pat. 929,314, July 27, 1909.

THE material to be treated is arranged inside a cage, which is mounted so that it can slide piston-wise inside a closed operating tank, which is connected by supply pipes with a storage tank containing the liquid necessary for the treatment. The cage is drawn backwards and forwards by a piston rod, and means are provided for forcing liquid into the operating tank at opposite ends alternately.—P. F. C.

Dyeing machine. D. Gillies, Kidderminster. Eng. Pat. 15,997, July 28, 1908.



HORIZONTAL beam, *a*, of channel section, is arranged so as to extend across a rectangular dye-vat, *b*. This beam, secured at one end to a vertical standard, *c*, carries reciprocating carriage, *e*, which is provided with hank-

supporting poles, *d*. The carriage can be raised or lowered by ropes, *f*, which are connected to the carriage at one end by hooks, *g*, and can be wound at the other end around a drum, *h*. The poles, *d*, extend on each side of the beam, *a*, and are rotatably mounted on the carriage. Upon the axis of each pair of poles, a ratchet wheel, *m*, is eccentrically mounted, and each ratchet is provided with a pair of pawls. The first, *n*, secured to the beam below the ratchet, produces the rotation of the poles; the second, *o*, mounted on the carriage above the ratchet, prevents a return motion produced by the weight of the hanks. Reciprocation of the carriage on the beam is effected by a crank disc, *p*, a connecting rod, *q*, and worm gearing, *r*. The poles are loaded with hanks with the carriage in an elevated position. The carriage is then lowered to convey the hanks into the vat, and the reciprocating mechanism is set in motion. The hanks have then a triple motion. They are swayed to and fro by the reciprocating movement of the carriage, they are rotated by the action of the stationary pawls on the ratchets, and lastly, owing to the eccentricity of the poles they are moved upwards and downwards.—P. F. C.

Dyeing yarns, fabrics, and the like; Apparatus for —. C. Corron, St. Chamond, France. U.S. Pat. 929,562, July 27, 1909.

THE material to be dyed is hung over a number of eccentric rotatable reels which are arranged above the dye-vat, alternate reels being rotated in opposite directions. The driving gear can be reversed in direction and varied in speed. Means are provided for raising or lowering the framework which carries the reels.—P. F. C.

Dyeing cotton and analogous fibres with sulphide dyestuffs. F. H. E. Dupetit. Fr. Pat. 399,124, Apr. 9, 1908.

THE cotton is dyed in a bath containing the sulphide dyestuff, sodium sulphide, and sodium carbonate, and is then passed into dilute acetic acid. In this way carbon dioxide is liberated from the carbonate and sulphuretted hydrogen from the sulphide; the carbon dioxide gas prevents the reduced dyestuff from becoming oxidised on the fibre, and the sulphuretted hydrogen reduces any particles of dyestuff on the fibre which have already become oxidised. The oxidation takes place on washing with water and may be completed by a weak oxidising bath.—S. H. H.

Resist effects and resist pastes for vat dyeing; Production of —. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 25,312, Nov. 24, 1908.

THE process is carried out by printing on the material a resist paste containing a soluble manganese salt and an oxidising agent, and then dyeing the material with the vat dyestuff according to the usual methods. Among the vat dyestuffs which can be resisted in this manner are indigo, thioindigo, the indanthrene dyestuffs, and the sulphur dyestuffs. Coloured resists can be obtained by using material which has been prepared with sodium β -naphtholate and subsequently applying a diazo-compound, either mixed with the reserve paste or otherwise. *Example* :— Resist for white: Dissolve 500 grms. of manganous chloride in 350 grms. of a 50 per cent. gum thickening and then add 75 grms. of china clay, 25 grms. of sodium bichromate, and 50 grms. of water, and stir well.—P. F. C.

Indanthrene dyestuffs; Process for reserving —. Kalle and Co. Ger. Pat. 211,526, June 15, 1906. Addition to Ger. Pat. 210,682, May 23, 1906 (see this J., 1909, 833).

THE process described in the principal patent for pro-

ducing white and coloured reserves under indigo, thio-indigo, and sulphide dyestuffs, may also be applied to indanthrene dyestuffs. —T. F. B.

Multicolour effects on fabrics of vegetable fibres and artificial silk: Process for producing —. E. Dierichs. Ger. Pat. 211,956, Nov. 14, 1907.

DYED cotton fibres are woven with undyed artificial silk, and the fabric thus obtained is treated with an alkaline solution, whereby the colour is partially discharged from the cotton and is taken up by the artificial silk. An example is given in which two lots of cotton are mordanted with tannin and dyed with Methylene Blue and Brilliant Rhoduline Red; the fabric made from these and the artificial silk is treated for half to three-quarters of an hour, at 40–50° C., with a 1 per cent. solution of sodium sulphide. —T. F. B.

Artificial threads: Apparatus for the manufacture of glossy —. T. Chandelon, Fraipont, Belgium. Eng. Pat. 19,276, Sept. 14, 1908.

SEE FR. Pat. 391,009 of 1908; this J., 1909, 241. —T. F. B.

Dyeing half-wool. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 22,690, Oct. 26, 1908.

SEE FR. Pat. 395,679 of 1908; this J., 1909, 471. —T. F. B.

Drying yarns and the like: Apparatus for —. P. Tschur, Wattrelos, France. Eng. Pat. 23,721, Nov. 5, 1908.

SEE FR. Pat. 378,247 of 1907 and Addition thereto; this J., 1907, 1136, and 1908, 1101. —T. F. B.

Dyeing yarn in hanks: Process and apparatus for —. A. J. Boult, London. From E. Esser und Co., Textil-Maschinen- u. Tuchscher-Messer-Fabr., Gölitz, Prussia. Eng. Pat. 26,616, Dec. 8, 1908.

SEE FR. Pat. 397,189 of 1908; this J., 1909, 792. —T. F. B.

Printing: Process of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,972, Nov. 9, 1908.

SEE FR. Pat. 396,983 of 1908; this J., 1909, 598. —T. F. B.

Printing with brominated indigo. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,742, Dec. 21, 1908.

SEE FR. Pat. 398,571 of 1909; this J., 1909, 882. —T. F. B.

Starch: Process for producing soluble —. A. Paira and Die Administration der Minen von Buchsweiler Actienges. Eng. Pat. 9370, 1909. See under XVI.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Boric acid: Volatilisation of —, by ignition in a stream of carbon tetrachloride and methyl alcohol vapours. P. Jannasch and H. F. Harwood. J. pr. Chem., 1909, 80, 131.

CARBOXY tetrachloride vapour alone does not decompose boric acid, but when boric acid is heated to dull redness in a stream of the mixed vapours of carbon tetrachloride and methyl alcohol it is readily and completely volatilised. Probably a mixture of these two vapours with hydrochloric acid gas would volatilise the boric acid from borates. —J. T. D.

Ammonia: The solid hydrates of —. F. F. Rupert. J. Amer. Chem. Soc., 1909, 31, 866–868.

WITH aqueous solutions of ammonia, maximum freezing-points, each –79° C., were obtained when the quantities of ammonia present were 49 per cent. and 65 per cent. These proportions correspond respectively to the hydrates $\text{NH}_3 \cdot \text{H}_2\text{O}$ (monohydrate) and $2\text{NH}_3 \cdot \text{H}_2\text{O}$ (semihydrate), the theoretical percentages of ammonia being 48.59 in the former and 65.40 in the latter. The monohydrate was

obtained in very small colourless crystals, suggestive in appearance of sodium and potassium hydroxides, the crystals of the semihydrate being much larger, transparent, and needle-shaped. Solutions containing from about 25 to 60 per cent. of ammonia are very viscous at temperatures below about –60° C. At –100° C. the 33 per cent. solution can hardly be stirred. —W. E. F. P.

Chlorine: Manufacture of anhydrous — from moist dilute gases, and its industrial application in chlorine detinning. E. A. Sperry. J. Ind. and Eng. Chem., 1909, 1, 511–518.

THE chlorine produced in electrolytic processes is generally diluted with other gases and saturated or supersaturated with moisture. By subjecting such gases to the action of a spray of diluted brine, practically the whole of the chlorine separates in the form of solid chlorine hydrate which can be separated from the brine. The hydrate is subsequently decomposed by using it to chill the supplies of brine and of crude gas, and by utilising the heat developed in compressing the anhydrous chlorine gas preparatory to liquefaction, in the final stage of the process. The chlorine gas liberated from the hydrate is again refrigerated in order to completely free it from moisture and is then compressed and liquefied. It is stated that in the near future liquefied chlorine will be as easily obtainable on the American market as it has been for some years in Germany. The most important application of the liquefied chlorine is the detinning of tin-plate scrap. It is important that the scrap be perfectly dry, since as little as 1 per cent. of moisture is sufficient to convert practically all of the stannic chloride produced into solid hydrated chloride, which cannot readily be distilled or purified, and which adheres tenaciously to the iron scrap. The crude scrap is compressed into billets, cleaned, heated to considerably above 100° C., and treated with the anhydrous chlorine in a suitable reaction vessel, being subjected to a comparatively small centrifugal action during the reaction, in order to facilitate the penetration of the chlorine and expose fresh surfaces of the scrap. It is stated that several tons of scrap may be thoroughly detinned in 60–90 mins. with a relatively small apparatus. The resulting "black scrap" is freed from stannic chloride by steam, and then from any ferric chloride produced, and is afterwards made the cathode in an electrolyte consisting of a hot, weak alkaline lye. If a current of about 300 amperes per ton of scrap be passed for about 30 mins., it is stated the treated scrap can subsequently be exposed to ordinary weather conditions for upwards of a year without serious depreciation. (See also this J., 1907, 1279; 1908, 26, 128, 160, 287, 343, 404, 451, 628, 749, 985). —A. S.

Phosphoric acid: Quantitative volatilisation of —, and separation from the metals of the ammonium sulphide group. Jannasch and Jilks. See XXIII., Inorg. Quantit.

Vanadic acid: Quantitative volatilisation of —, from its compounds by ignition in a stream of carbon tetrachloride vapour. Jannasch and Harwood. See XXIII., Inorg. Quantit.

Copper sulphate (and copper salts): Gravimetric determination of —. P. B. Dallimore. See XXIII.

Nitrates from air: Manufacture of — in Germany. Board of Trade J., Aug. 19, 1909. [T.R.]

IS full working order the principal German works at present engaged in the manufacture of calcium nitrate can produce about 21,500 tons per annum, a quantity which will be increased to about 41,500 tons when the plant now in course of construction is completed and in operation. Projects for a number of other works are under consideration, the most important of which is that of a company which is contemplating the erection of large nitrate works in Bavaria. A factory has also been built in the Tyrol by a Westphalian company, and is capable of producing about 3600 tons of nitric acid. It is estimated that 1300 tons of nitrate of lime were sold in Germany in January and February last.

Barium compounds; Production of — in the United States. U.S. Geol. Survey, 1909. [T.R.]

THE following table shows the production of crude barytes in the United States since 1900:—

	Tons.		Tons.
1901.....	49,070	1905.....	48,235
1902.....	61,668	1906.....	50,231
1903.....	50,397	1907.....	89,621
1904.....	65,727	1908.....	34,615

After the panic in the latter part of 1907 the trade in barytes products came practically to a standstill, and mills that operated at all during 1908 had nearly sufficient material on hand to last throughout that year, consequently the production of the mines was greatly curtailed.

The average price of crude barytes per short ton (\$3.20) in 1908 was only 6 cents less than in 1907, and it was higher than in any year except 1907. Prices per short ton quoted by dealers toward the close of 1908 were as follows:—"American ground," \$14 to \$17.50, and "floated," \$18 to \$21; in May, 1909, these prices were respectively, \$12 to \$17, and \$17 to \$20.

The total quantity of barytes reported as refined by mills in Kentucky, Missouri, North Carolina, Tennessee and Virginia was 28,415 short tons, valued at \$318,096, an average price per ton at the mills of \$11.19, a decrease of 23.3 per cent. as compared with \$14.59 per ton in 1907.

At the close of 1908 there were 16,471 short tons of crude barytes unsold, according to the reports from all the producing districts. Most of this stock was produced in 1907.

The imports of barytes for consumption during the last five years and the imports of barium compounds during the last three years have been as follows:—

Barytes.

	Manufactured.		Unmanufactured.	
	Tons.	Value.	Tons.	Value.
		dols.		dols.
1904.....	6,630	48,658	7,492	27,363
1905.....	4,803	39,803	14,256	62,459
1906.....	4,807	37,296	9,190	27,584
1907.....	11,507	96,542	20,544	76,883
1908.....	3,401	29,168	13,661	58,822

Barium compounds.

	1906.	1907.	1908.
	dols.	dols.	dols.
Witherite, barium carbonate	55,405	24,552	22,159
Barium binoxide.....	152,403	167,519	181,533
Barium chloride.....	65,242	79,333	42,291
Artificial barium sulphate ..	61,961	85,713	73,131
	335,011	357,117	319,114

Sicilian sulphur industry; Bill for regulating the —. Board of Trade J., Aug. 19, 1909. [T.R.]

A BILL for the regulation of the sulphur industry has been presented to the Italian Parliament by the Minister of Agriculture, Industry, and Commerce. It modifies and is intended to take the place of the Laws of 15th July, 1906, 6th June, 1907, and 5th July, 1908, relative to the institution of the obligatory "Consortio" or Association of sulphur mine owners. The object of the principal modifications is: (1) To simplify administration and reduce the number of Directors; (2) to authorise the "Consortio" to cede to one party or company the sale of its total production for the whole term of the former's existence (12 years from 1st August, 1906); and (3) to restrict the output as far as possible to the consumption.

PATENTS.

Nitric oxide; Concentration of — [arising out of the electrical oxidation of atmospheric nitrogen]. Allgem. Elektrizitäts-Ges.m.b.H., Berlin. Eng. Pat. 8426, Apr. 15, 1908. Under Int. Conv., Apr. 19, 1907.

THE oxides of nitrogen are first absorbed in a suitable apparatus by a weak basic oxide, such as oxide of zinc, copper, or lead, and the mixture of nitrate and nitrite so obtained, is subsequently decomposed at a higher temperature, under reduced pressure it desired, with evolution of pure nitrogen peroxide.—O. R.

Nitric acid; Manufacture of —. F. L. Schmidt, Charlottenburg, Germany. U.S. Pat. 928,545, July 20, 1909.

CALCIUM nitrate is decomposed with the equivalent quantity of sulphuric acid, and the calcium sulphate, which is deposited, is filtered and washed with dilute nitric acid and water.—O. R.

Sulphuric acid; Concentration of — in Kessler's apparatus. J. Teisset and L. Prat. Fr. Pat. 398,212, Dec. 31, 1908.

IN the ordinary Kessler apparatus, the parallel channels, in which concentration takes place, are replaced by transverse baffles of refractory material. An external fan aspirates the gases through the apparatus, with consequent increased yield of sulphuric acid, and a regenerative system of heating causes much more rapid concentration in the saturating tower.—O. R.

Pyrites; Mechanical furnace for roasting —, with distributor and dust chambers. F. L. Coureau. Fr. Pat. 399,479, Feb. 15, 1909.

THE furnace consists of a number of superposed hearths, over which rakes and other tools for turning over and carrying forward the pyrites or other material are made to travel, by means of parallel endless chains on either side of the furnace. After passing backwards and forwards alternately over the hearths from the top to the bottom of the furnace, each rake passes out through a door opening automatically, and then travels upwards, becoming cooled in the process, and into the furnace again by another door at the top. The material is fed into the furnace by an automatic registering device, the rate of feed being regulated by that at which the material is being carried forward and discharged. In order to secure regular combustion and prevent leakage of air into the furnace, this and the mechanism is cased in sheet iron, the necessary doors being fitted with asbestos. The raking tools are very readily replaced, when occasion requires.—F. SOOX.

Alkali carbonates; Manufacture of —. L. Rivière. Second Addition, dated Jan. 30, 1909, to Fr. Pat. 396,448, Nov. 16, 1908. (See this J., 1909, 707.)

FOR the regeneration of hydrofluosilicic acid, silicon fluoride is made to react with hydrogen fluoride in the gaseous state, instead of in aqueous solution as in the principal patent, and the acid, thus produced, is collected in water or used directly for the production of alkali fluosilicates. By way of example, an apparatus is described for the simultaneous decomposition of the alkali fluosilicate, as in the First Addition (*loc. cit.*), and for the continuous production of hydrogen fluoride, as also for the interaction of the gases. In this apparatus, the reacting vessels and crucibles are grouped around a common chimney, and there is a device for turning the covers and stirring gear of the hydrogen fluoride generators through an angle, so that, while one set of vessels is in use, another set is being recharged. Hydrogen fluoride is produced at such a rate, that it combines with all the silicon fluoride coming from the crucibles, the two gases being discharged into an annular reaction box running round the central chimney.—F. SOOX.

Sodium sulphate; Manufacture of —. D. A. Peniakoff, Selzaete, Belgium. Eng. Pat. 3189, July 10, 1908. Under Int. Conv., Jan. 29, 1908.

A MIXTURE of sulphur dioxide, superheated steam, and air, passes slowly into slightly inclined, revolving, iron

tubes, down which sodium chloride, powdered or briquetted, slowly descends in the reverse direction to the gaseous mixture. Means are provided for constantly stirring and raising the sodium chloride, and for exposing it to sulphurous gases of increasing activity as it descends, until it finally emerges, entirely converted into sodium sulphate. By mixing the sodium chloride with ferruginous bauxite, or other aluminous material containing ferric oxide, and subjecting the mixture to the same treatment as above, a product is obtained, which may be directly used for the manufacture of sodium aluminate.

—O. R.

Ammonium sulpho-phosphate for the treatment of vintages and musts, and its process of manufacture. A. Hubert. Fr. Pat. 399,142, Feb. 5, 1909.

AMMONIUM sulpho-phosphate is prepared by allowing mono-, di-, or tri-ammonium phosphate to absorb sulphur dioxide, or by mixing ammonium bisulphite with phosphoric acid or ammonium phosphate. The products, which may be solids, or in solution, are used for the treatment of vintages or musts.—F. SODX.

Copper sulphate; Direct manufacture of — from metallic copper. A. P. C. Pautin and L. J. A. Couvert. Fr. Pat. 399,413, April 21, 1908.

COPPER sulphate is manufactured directly from metallic copper by treating this with dilute sulphuric acid, in the presence of hot compressed air or a mixture of air and sulphur dioxide. Contact with lead is found to hasten the solution of the copper, though the lead is not itself attacked. The copper is packed in a series of leaden towers, generally three in number, and the mother liquors from previous crystallisations, containing the necessary acid, are pumped to the top of the first tower, to be distributed intermittently; this liquid, descending over the copper, meets an ascending current of hot compressed air, which is injected below and escapes through holes in the side of the tower into pipes which are sealed hydraulically; the solution collecting at the bottom of the tower passes by an overflow into a tank, from which it is pumped to the second tower which is similar; from the third tower, the now concentrated solution is sent to the crystallisers.—F. SODX.

New salts derived from alkali, alkaline-earth, and earth peroxides; Manufacture of —. G. F. Jaubert. Fr. Pat. 399,720, April 29, 1908.

THE new products, derived from any peroxide which may be used for the preparation of hydrogen peroxide,

are obtained by acting on the peroxide in question with any acid, organic or inorganic, or with an ester, either directly or in the presence of a medium, in which hydrogen peroxide is insoluble or nearly insoluble. The salts, thus formed, are very stable when dry; they contain all the active oxygen of the peroxide and are immediately dissociated by solution in water, hydrogen peroxide being liberated. Four examples are given:—(1), *Sodium perchloride*, which is prepared by slowly passing dry hydrogen chloride, with vigorous agitation, into 8 kilos. of sodium peroxide suspended in 100 litres of carbon tetrachloride, until 7.5 kilos. have been absorbed; (2), *sodium performate*, obtained by adding 9.5 kilos. of formic acid, drop by drop, to a similar mixture of the peroxide; (3), a salt produced by slowly adding 12 litres of ethyl acetate to 8 kilos. of sodium peroxide, suspended in 80 litres of chloroform; (4), *sodium perbenzoate*, prepared by mixing 12.5 kilos. of benzoic acid with 100 litres of carbon tetrachloride, and then gradually adding 4 kilos. of sodium peroxide. In all cases the temperature is kept below 30° C. during the process; the salts separate in the solid state.—F. SODX.

Oxides [especially ferric oxide]; Manufacture of —. H. L. Doherty, New York. U.S. Pat. 927,644, July 13, 1909.

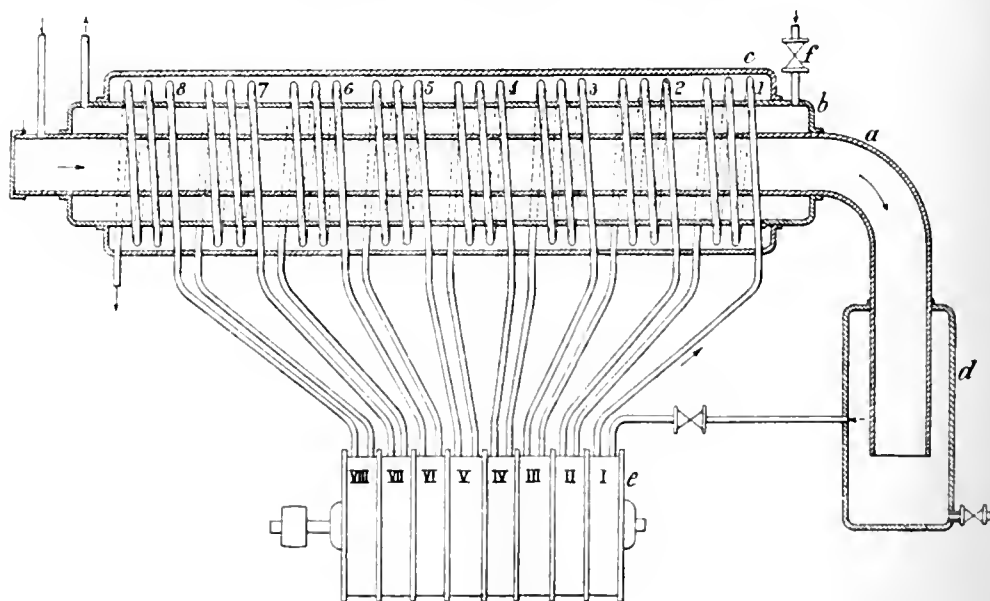
Moist, finely-divided metallic iron, is oxidised by a current of air until the temperature begins to rise; the current of normal air is then replaced by a current of air diluted with nitrogen, until the temperature begins to sink, when normal air is again used to finish the reaction.—O. R.

Ammoniacal copper oxide; Process of obtaining stable solutions of —. Chem. Fabr. Bettenhausen Marquart und Schnlz. Fr. Pat. 399,911, Feb. 25, 1909. Under Int. Conv., Mar. 25, 1908.

THE stability of solutions of ammoniacal copper oxide may be increased by the addition of 1–2 per cent. of such substances as the polyhydric alcohols, sugars, starches, or gums. Moreover, by the previous addition of one of these substances, the preparation of the solution is facilitated, and the copper concentration may be increased to 5 per cent. or more, without cooling.—F. SODX.

Carbon dioxide; Separation [by liquefaction] of — from gaseous mixtures. J. G. Behrens. Fr. Pat. 397,767, Dec. 22, 1908.

THE compressed gases are passed through (a), the innermost of the three concentric tubes, (a), (b), and (c)



Condensation of carbon dioxide takes place in a receiver (*d*), from which the compressed, unliquefied gases pass into a turbine (*e*), which is divided into eight compartments. From each of these compartments (I.), (II.), (III.), etc., in turn, the compressed gases pass into the next compartments (II.), (III.), (IV.), etc., by way of spiral condensers (1), (2), (3), etc., which are situated inside the outer tube (*c*). In each passage from one compartment of the turbine to the next, the gases are allowed to expand till their pressure is reduced by one-eighth, the consequent absorption of heat serving to cool the tube (*e*), which is filled with alcohol. The cold produced in the latter is communicated to the tube (*a*) by the agency of the tube (*b*), in which carbon dioxide circulates; this carbon dioxide enters (*b*) in the liquid form through the tap (*f*), evaporates inside (*b*), and returns, at the extremity opposite to (*f*), in the gaseous form to the compressor.

—O. R.

Ozone: Apparatus for manufacturing — Felten und Guillaume-Lahmeyerwerke Act.-Ges., Frankfurt-on-Maine, Germany. Eng. Pat. 6014, Mar. 12, 1909. Under Int. Conv., Sept. 9, 1908.

The claim is for a control mechanism in conjunction with an apparatus used for ozonising water. The flow of water through the apparatus operates a switch, which closes the electrical circuit, a non-return valve being connected to the ozone-pipe between the switch and the ozone apparatus, to prevent water from getting into the latter.—O. R.

Air: Apparatus for liquefying — J. F. Place, Glenridge, N.J., Assignor to American Air Liquefying Co., New York. U.S. Pat. 927,594, July 13, 1909.

The apparatus consists of one or more high-pressure pipes, enclosed in a low-pressure conduit provided with a liquid air evaporating container; compressed air is supplied to one end of the pipe, and a high-pressure liquefying condenser is situated at the other end, having a liquid air discharging valve, which connects the condenser with the container. The condenser is so arranged as to be submerged in the liquid air previously produced in the container. Between the condenser and the compressed air supply, is a pressure releasing air valve, which is connected with the high-pressure pipe, and is arranged to deliver air from the high-pressure pipe to the low-pressure conduit.—O. R.

Liquefaction, in large quantities, of gas or mixtures of gases having a low critical temperature: Process and apparatus for the — [Separation of air into oxygen and nitrogen.] United States Liquid Air and Oxygen Co. Fr. Pat. 399,416, Dec. 8, 1908.

In this process for the liquefaction of air, all impurities liable to clog the apparatus are eliminated before the gas is allowed to enter the liquefier; this is effected by a preliminary regenerative cooling, in which the lowering of temperature is brought about by the almost adiabatic expansion of the gas itself, no other refrigerating agent being employed. The air is first compressed in several stages, preferably four, after each stage passing through a cooling arrangement in which water circulates. On leaving the last compressing cylinder, the gas, possibly at a temperature of 100° C. or more, passes through a trap, in which some of the accompanying oil and moisture are deposited, and then travels, in a divided circuit, through a cooler, consisting of multiple pipes of small diameter, in which the gas is rapidly cooled to the ordinary temperature by the surrounding air. It then passes successively through three regenerative coolers, all of which are so arranged that oil and water, condensing from the gas, may drain into appropriate traps. After this, it is allowed to expand almost adiabatically, doing external work in some form of expansion engine, the gas being more effectively cooled in this way than by free expansion, and much of the energy expended in compression being recovered; the cooled and expanded air is used as the counter current in the regenerative coolers, and is then again compressed. When the temperature of the high-pressure air, issuing from the final refrigerator, is reduced

by the regenerative process, until the gas is almost free from oil and water vapour and partially freed from carbon dioxide (perhaps at -50° C.), it is sent to the liquefier, and in this the current is divided between several tubes of small diameter, enclosed in a double-jacketed spiral, and, after passing down a central spiral, the gas is allowed to expand freely, in two stages, passing from a central high-pressure chamber in the lower part of the liquefier, into a surrounding chamber at intermediate pressure, and then into a third chamber enclosing the second, in which the pressure is reduced almost to the normal. Inner and outer regenerative jackets enclosing the spirals, communicate with the intermediate and low-pressure chambers respectively. Some of the air is liquefied in the process of expansion, and the rest passes out through the external regenerative coolers, as counter-current. In order to make use of the apparatus for the separation of air into oxygen and nitrogen, liquid air is allowed to accumulate in the expansion chambers of the liquefier; the liquid in the intermediate chamber then continuously evaporating by absorbing heat from the inner high-pressure chamber, gives a gas consisting almost entirely of the more volatile nitrogen, and the product passing into the outer chamber is sufficiently rich in oxygen to give the commercially pure gas by its continual evaporation in that chamber. The apparatus is suitable for dealing, not only with air, but with any gas or gaseous mixture having a critical temperature below -18° C.

—F. SODN.

Chlorates: Process for purifying — R. Gartenmeister, Elberfeld, Germany. Eng. Pat. 16,456, Aug. 4, 1908.

SEE Fr. Pat. 392,604 of 1908; this J., 1909, 21.—T. F. B.

Sodium aluminate: Process for rendering silica contained in — insoluble for the purpose of obtaining pure alumina free from silica. D. Peniakoff, Selzaete, Belgium. Eng. Pat. 17,356, Aug. 18, 1908.

SEE Fr. Pat. 392,187 of 1908; this J., 1908, 1204.—T. F. B.

Cryolite: Manufacture of artificial — from fluorspar. G. Loeschmann, Hannover, Germany. Eng. Pat. 19,738, Sept. 19, 1908.

SEE Ger. Pat. 205,209 of 1907; this J., 1909, 140.—T. F. B.

Compounds containing nitrogen and oxygen [nitrogen oxides]: Manufacture of — J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 20,406, Sept. 28, 1908.

SEE Fr. Pat. 396,375 of 1908; this J., 1909, 599.—T. F. B.

Ammonium phosphate: Manufacture of — N. Caro, Berlin, and T. E. Scherle, Emmerich on Rhine. Eng. Pat. 26,726, [Dec. 9, 1908. Under Int. Conv., Jan. 24, 1908.

SEE Fr. Pat. 397,282 of 1908; this J., 1909, 724.—T. F. B.

Peroxides of alkalis: Method of and means for packing — for household use. E. Herrmann and Co., Vster, Switzerland. Eng. Pat. 711, Jan. 11, 1909. Under Int. Conv., Jan. 15, 1908.

SEE Fr. Pat. 398,448 of 1909; this J., 1909, 880.—T. F. B.

Nitrogen from combustion-gases: Process for the manufacture of pure — A. Frank and N. Caro, Berlin. Eng. Pat. 16,963, Aug. 12, 1908.

SEE Ger. Pat. 204,882 of 1907; this J., 1909, 90.—T. F. B.

Liquefaction of gases: Process and apparatus for the — more especially applicable to the liquefaction of air and its separation into commercial oxygen and nitrogen. E. C. R. Marks, London. From U.S. Liquid Air and Oxygen Co., Los Angeles, Cal., U.S.A. Eng. Pat. 25,829, Nov. 30, 1908.

SEE Fr. Pat. 399,416 of 1909; preceding.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

PATENTS.

Glass; Process for annealing and hardening — J. F. Farling, Bluffton, Ind. U.S. Pat. 928,860, July 20, 1909.

GLASS is submerged in an aqueous solution of saltpetre, common salt, and "wood-lye," which is heated to boiling, after which the glass is packed between a mixture of slaked lime, chloride of lime, salt, saltpetre, and powdered alum, and subjected to the action of dry heat. After cooling, the glass is finally cleansed by means of dilute sulphuric acid.—O. R.

Earthenware articles; Process of manufacturing lavatory-basins or other — J. Clifford, Chicago, Ill., and C. Weedans, Trenton, N.J. Assignors to Monument Pottery Co., Trenton, N.J. U.S. Pat. 929,390, July 27, 1909.

A SOLUTION of potassium silicate, or of potassium silicate and carbonate, is thoroughly incorporated with the clay mixture, which is poured into plaster of Paris moulds, until the latter are full. After the mixture has settled down in the moulds, owing to the absorption of water by them, the pouring operation is repeated, and the mixture is allowed to set and harden in the moulds, until of sufficient strength to permit of its removal without injury.—W. C. H.

Tiles; Machine for coating flooring or ornamental — and similar products, The Ceramic Machinery Co. Fr. Pat. 399,269, Feb. 9, 1909.

SEE Eng. Pat. 3139 of 1909; this J., 1909, 796.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Blast furnace slags; Experiments to test the influence of chemical composition on the hydraulicity of — H. Passow, Stahl und Eisen, 1909, 29, 1267-1273.

THE several constituents of blast furnace slag were fused together in various proportions in a graphite crucible, and the molten mixture was poured into cold water, so as to obtain as glassy a product as possible. To the finely ground material was added 10 per cent. of a cement, prepared by clinkering a mixture of limestone and blast furnace slag. These mixtures were then briquetted with 3 times their weights of standard sand, and tested for tensile strength after different periods in air, under fresh water, and under sea water. The author concluded that: (1), glassy slags had no cementitious properties *per se*, but would only set hard in conjunction with lime, or with substances capable of yielding lime; (2), a slag containing less than 50 per cent. of bases was of very little value as a basis for cement; (3), the cementitious value of a slag was dependent, not only on a high proportion of bases, but also on the ratio of the amount of bases to the amount of silica contained, a high proportion of silica and a low proportion of alumina being, within certain limits, prejudicial to the cementitious value; (4), The presence of magnesia up to 13 per cent. in glassy slags often increased the cementitious value of such slags without being in any way deleterious; (5), the presence of calcium sulphide up to 12 per cent. likewise increased the cementitious value without injury to the product; (6), calcium sulphide up to 12 per cent., in the presence of 5 per cent. of magnesia, had no harmful effect; (7), all the trial mixtures that possessed cementitious properties, attained a greater degree of strength and hardness under sea water than under fresh water.—O. R.

PATENTS.

Self-filling composition, C. L. Norton, Manchester, Mass., U.S.A. U.S. Pats. 929,002, 929,003, and 929,004, July 27, 1909.

(1). THE composition consists of 20 parts by weight of "asbestiform fibres," 10 to 12 parts of hydraulic cement,

and 50 parts of water, this proportion of water being insufficient to produce mobility of the fibres in the mixture. (2). The composition consists of 1 part by weight of magnesium oxide, 2½ to 3 parts of asbestiform fibre, and 6 to 7 parts of water, this amount of water being insufficient to allow the fibres to be motile in the mixture. (3). The process consists in compressing a mass comprising fibres, cementing material, and a setting liquid. Portions of the foundation fibres in the mass are felted into self-sustaining filtration webs and only those portions of the material which lie between the webs are supported. By compression, the surplus liquid is expressed through the webs, whilst the cementing material is retained on them.—W. C. H.

Aluminous material; Method of treating — A. C. Higgins, Worcester, Mass., U.S.A. U.S. Pat. 929,219, July 27, 1909.

ALUMINOUS material is fused in an electric furnace at a temperature well above the state of quiet fusion, and sufficient to prevent substantial segregation of impurities. The resulting product is then cooled or chilled into a pig or solid mass.—W. C. H.

Cement and the like; Process and apparatus for burning — B. E. Eldred, Bronxville, N.Y., Assignor to The Eldred and Palmer Co., New York. U.S. Pat. 928,512, July 20, 1909.

IS a rotary kiln, a travelling stream of powdered cement material is calcined by means of a mixture of burning gas, its products of combustion, and air, in definite proportions, and is then clinkered by a separate source of heat.—O. R.

Cement; Process and apparatus for burning — B. E. Eldred, Bronxville, N.Y., Assignor to The Eldred and Palmer Co., New York. U.S. Pat. 928,513, July 20, 1909.

CALCINED cement material, at or near the clinkering temperature, is introduced into the upper end of a closed rotary kiln. Burning is effected by means of a jet of powdered coal, which is fed into the lower end of the kiln, a pair of regenerators being provided, with flues opening into the lower end of the kiln, on either side of the coal jet. Means are provided for alternately passing the waste gases of the kiln and the air used for producing the coal jet, through each of the regenerators.—O. R.

Cement; (1) Apparatus for making, (2) Process of making — R. W. Lesley, Haverford, and H. S. Spaekman, Ardmore, Pa., Assignors to Pine Street Patents Co., New Jersey. (1) U.S. Pat. 929,144, and (2) 929,145, July 27, 1909.

RAW cement material is coarsely crushed, and continuously fed into a rotary calcining kiln, provided with an independent fuel supply, in which carbon dioxide is expelled from the raw materials. The air supplied for supporting combustion in this kiln is pre-heated by contact with the calcined material discharged from the kiln. Means are provided for finely grinding and mixing the calcined material, and for continuously feeding the finely ground mixture into a clinkering kiln, heated to the clinkering temperature by producer gas. The clinker is passed into a rotary cooler, which serves to preheat the air supplied for combustion in the clinkering kiln. The flame in this kiln travels in the opposite direction to the feed of the material which is being clinkered. The plant is arranged so that the material is continuously passed through the different stages of the process by mechanical means.—W. C. H.

Artificial stone, mortar, plaster, and the like; Process for rendering — waterproof, heat and electricity non-conducting, and soundproof. J. Kathe, Cologne, Germany. Eng. Pat. 15,100, July 16, 1908.

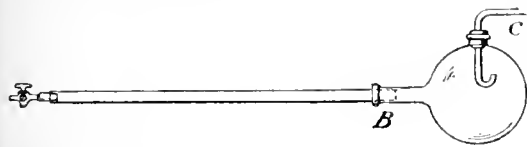
SEE Fr. Pat. 396,486 of 1908; this J., 1909, 602.—T. F. B.

X.—METALS AND METALLURGY.

Copper smelting; High silica slags in Mexican —. C. A. Heberlein. Eng. and Min. J., 1909, 88, 107—108.

AN account is given of the blowing in of a new water-jacketed smelter at Magistral, Mexico, together with a table of analyses of the slags obtained during the first month. The charge consisted of ore, iron ore and lime, and the consumption of fuel, which at the commencement was 12 per cent. per ton of charge, was reduced during the run to 8.1 per cent., equivalent to 6.96 per cent. of fixed carbon, with an average of 7.5 per cent. of sulphur in the charge. The slag produced is essentially a bisilicate slag having an average composition of 50 per cent. of silica, 22 per cent. of lime, 20.5 per cent. of ferrous oxide, and 4.5 per cent. of alumina, the copper content being about 0.22 per cent. In the presence of this large amount of silica, the alumina undoubtedly acts as a strong base, and the author believes, from his experience at the Copper Queen on slags as high as 32 per cent. of alumina, that, contrary to C. E. Shelby (see this J., 1908, 903), alumina in slags always acts as a base. Comparative analyses of Magistral and Mansfeld slags are given.—F. R.

Aluminium; Analysis of —; *Direct determination of metallic aluminium*. E. Kohn-Abrest. Ann. Chim. anal., 1909, 14, 285—289.



IN order to determine directly the percentage of aluminium volatilised as chloride (i.e., the metallic aluminium present) by the method already given for the analysis of the commercial metal (this J., 1909, 839), special precautions must be taken to condense the whole of the chloride vapour and to effect its solution in water without loss. The author describes an apparatus, in which this is conveniently carried out. The tube shown is 75 cm. long and 1.6 cm. in diameter; at one end it communicates by a two-way tap with a source of pure dry hydrogen, which is freed from oxygen by passage over heated copper, and with an apparatus for generating pure dry hydrogen chloride; at the other end of the tube is attached the receiver, B, of about 500 c.c. capacity; the exit tube from this communicates with a second vessel, each tubulure of which is furnished with a tap, and this is connected to a wash-bottle containing sulphuric acid. The tube is heated, 7—8 cm. from the anterior end, over 15 cm. of its length, the thermometer being placed outside the tube. After drying the apparatus, the sample of aluminium is introduced into the heated part of the tube in a shallow porcelain boat, and the heating in hydrogen and hydrogen chloride is carried out as described (*loc. cit.*), a fairly rapid current of hydrogen chloride being used. At first the reservoir is cooled by water, but most of the chloride condenses in the tube itself. When the attack is complete, the boat is allowed to cool in a current of hydrogen, and is then withdrawn and weighed, chlorine and iron being determined in the residue. In order to dissolve the sublimed aluminium chloride, a bulb tube, containing water, is attached to the anterior end of the combustion tube, and a partial vacuum is produced in the vessel connected with the receiver, by means of a filter pump; water is then sucked into the apparatus by closing the tap between this vessel and the pump, and opening that between it and the receiver. The solution and rinsings are made up to a known volume, and the chlorine determined volumetrically with silver nitrate, the corresponding quantity of aluminium being then calculated; iron is also determined, if present in appreciable quantity, and a correction made, 1 of chlorine corresponding to 0.5290 of iron and to 0.2535 of aluminium.

The method may be used also for the determination of aluminium in its alloys with many metals, such as indium, cadmium, zinc, magnesium, glaucinum, cerium, thorium, barium, calcium, copper, lithium, sodium, potassium, iron, and chromium.—F. SOHN.

Silicides of the alkaline earth metals. O. Hönigschmid. Monatsh. f. Chem., 1909, 30, 497—508.

CRUDE silicides of calcium, barium and magnesium, obtained by Goldschmidt's process (see this J., 1908, 948) and suitable for use in place of aluminium in certain thermite reactions, were examined and found to consist of definite silicides of the earth metal in admixture with iron silicide and free silicon. Two crude silicides of calcium were examined. One, prepared with excess of silicon, contained the silicide, CaSi_2 , whilst the other, prepared with excess of calcium, contained Hackspill's silicide, Ca_3Si_2 (this J., 1908, 684), and was free from the lower silicide, CaSi_2 . In the case of barium and of magnesium, one silicide only is formed, having the formula, BaSi_2 or Mg_2Si .—A. T. L.

Silicone. O. Hönigschmid. Monatsh. f. Chem., 1909, 30, 509—525.

"SILICONE," a compound containing silicon, hydrogen and oxygen obtained by Wöhler by dissolving calcium silicide, CaSi_2 , in strong hydrochloric acid, was analysed and found to have the formula, $\text{Si}_2\text{H}_3\text{O}_2$. On heating "silicone" *in vacuo*, or in a current of hydrogen, the whole of the hydrogen is liberated, and a greyish black substance is left. The hydrogen in "silicone" is therefore probably attached to the silicon and not to the oxygen atoms. The greyish black substance is probably the suboxide, Si_2O_2 , analogous with Dicks' carbon suboxide, C_2O_2 . It dissolves in potassium hydroxide solution, and in hydrofluoric acid, with evolution of hydrogen. On heating the suboxide to 400° C. in chlorine or in hydrochloric acid, silicon tetrachloride and silica are formed. Wöhler's "leucone," a white substance formed by leaving the dark yellow "silicone" in air or in the presence of water, was found to have the formula, $\text{Si}_2\text{H}_3\text{O}_4$. It is not the final product of atmospheric oxidation. When heated *in vacuo*, "leucone" loses hydrogen, leaving a golden brown residue which has the formula of a second suboxide, Si_2O_4 .—A. T. L.

Anhydrous chlorine and its application in chlorine detinning. Sperry. See VII.

Blast furnace slags; Experiments to test the influence of chemical composition on the hydraulicity of —. R. Passow. See IX.

Metals; Corrosion of — *underground by electrolysis*. A. A. Knudson. See XIV.

Mercury Statistics. A. S. Pickering. Sept., 1909. [T.R.] Imports.

	1909.	1908.	1907.	1906.
August	Bottles, 974	Bottles, 643	Bottles, 756	Bottles, 500
January—August	39,980	40,929	38,687	37,296
Exports.				
August	1,467	2,150	2,191	3,562
January—August	8,887	14,506	21,279	18,270
Average price,				
August	£8 2 0	£7 17 6	£6 16 6	£7 1 0

Mineral production of New South Wales. Board of Trade Journal, Aug. 26, 1909. [T.R.]

THE following statistics of the mineral production of the State of New South Wales during the years 1907 and 1908 are taken from the annual report for 1908 of the Department of Mines of that State:—

Minerals.		1907.		1908.	
		Quantity.	Value.	Quantity.	Value.
Alumite	Tons	2,088	£ 5,115	1,082	£ 2,705
Antimony (metal and ore)	"	1,752	46,278	117	1,141
Bismuth (metal and ore)	"	16	5,268	9	2,017
Chromite	"	30	105	—	—
Coal	"	8,657,924	2,922,419	9,147,925	3,353,093
Coke	"	251,609	159,316	283,873	199,933
Copper (ingots, matte, and ore) (a)	"	10,998	727,774	9,071	502,812
Diamonds	Cts.	2,530	2,056	2,205	1,358
Gold	Oz. fine	247,363	1,050,730	224,792	954,854
Iron (b)	Tons	29,902	178,632	40,207	118,224
Iron oxide	"	1,595	1,961	1,827	1,857
Ironstone flux	"	10,659	7,707	8,087	6,199
Lead (pig, &c.) (c)	"	19,768	374,182	14,936	186,746
Lime	"	23,587	19,458	24,922	21,610
Limestone flux (d)	"	41,667	16,162	53,668	14,779
Marble (e)	"	—	2,200	—	2,200
Molybdenite	Tons	22	3,564	8	929
Noble opal	"	—	79,000	—	41,800
Platinum	Oz.	276	1,014	135	439
Portland cement	"	—	141,548	—	184,400
Silver (ingots and matte) (f)	Oz.	2,043,887	257,314	2,430,163	253,926
Silver-lead, ore, concentrates, &c.	Tons	134,079	3,658,632	358,730	1,906,275
Shale (oil)	"	47,331	32,055	46,303	26,068
Scheelite	"	196	23,781	154	11,082
Stone (building, &c.) (g)	"	—	119	—	220
Stone (grindstones) (g)	"	—	194	—	204
Tin (ingots and ore) (h)	Tons	1,914	293,305	1,795	205,447
Wolfram	"	207	26,325	86	6,742
Zinc (specier and concentrates)	"	237,219	536,620	276,720	600,883
Sundry minerals and ores	"	—	1,544	—	1,661
Total value		—	10,577,378	—	8,699,607

(a) Exclusive of the copper produced in the State during the year from ore imported for treatment from other States of the Commonwealth. (b) Including iron made from scrap. (c) See silver-lead. (d) Value at smelting works. (e) Value at quarries of quantity disposed of. (f) The bulk of the silver is contained in the concentrates, &c., despatched from the Broken Hill Field and treated outside the State. (g) Quantity exported only. (h) Exclusive of tin refined in the State from imported ores.

Barium compounds in the United States. See VII.

PATENTS.

Steel; Toughening — S. S. Wales, Munhall, Pa., Assignor to Carnegie Steel Co., Pittsburg, Pa. U.S. Pat. 928,347, July 20, 1909.

THE steel is heated to a temperature between 775° and 875° C., chilled by means of water, and again heated to between 500° and 650° C. It is finally quenched by "a cooling liquid."—C. A. W.

Ballistic plate. S. S. Wales, Munhall, Pa., Assignor to Carnegie Steel Co., Pittsburg, Pa. U.S. Pat. 928,348, July 20, 1909.

As a new article of manufacture a ballistic or armour steel plate is manufactured free from chromium, but containing vanadium (below one per cent.), and varying quantities of tungsten and nickel. As an instance, the composition tungsten, below one per cent.; nickel, from three to ten per cent.; vanadium, below one per cent., may be taken as typical.—C. A. W.

Ferro-silicon; Treatment of acid slags and silicious iron ores for the manufacture of — in the electric furnace. C. Bertolus. First Addition, dated Jan. 26, 1909, to Fr. Pat. 393,818 of Aug. 31, 1908.

THE slag or ore is agglomerated with silica and with sufficient carbon to completely reduce the iron and partly reduce the silica. When heated in the electric furnace the excess of silica combines with the alumina and lime, or manganese, forming a fusible silicate slag which readily separates from the ferro-silicon. Ferro-silico-aluminium is made by using an excess of reducing agent and increasing the percentage of alumina by the addition of bauxite, aluminium silicate, or the like.—F. R.

Galvanising; Method of — G. L. Patterson, T. L. Morner, and C. H. Zieme, New Castle, Pa. U.S. Pat. 928,398, July 20, 1909.

THE zinc in the form of flue-dust is incorporated with finely divided clay in a suitable liquid, finely divided carbon being added, so that an inert and chemically non-reactive vehicle, together with a reducing agent, is

obtained. The surface to be coated is dipped in the composition, and, after withdrawal, is subjected to the action of heat.—C. A. W.

Silicon nitride; Manufacture of — A. Sinding-Larsen, Christiania. U.S. Pat. 928,476, July 20, 1909.

IN a chamber, which forms part of, or which is connected with, an electric furnace, silicon vapour or finely divided silicon is heated in the presence of an atmosphere consisting chiefly of nitrogen.—O. R.

Ores, mattes, etc., containing sulphur; Preliminary treatment of — previous to smelting. J. Savelsberg. Fr. Pat. 399,101, Feb. 3, 1909.

ORES, mattes, etc., containing sulphur are crushed to about 2–3 mm. diameter, and mixed with sufficient sand, or ores containing silica, to form ferruginous silicates. The mixture is agglomerated by being moistened and then strongly heated in a furnace through which a current of air passes; part of the sulphur burns off, and part combines with the copper or other metals, the iron being completely converted into oxide.

(See also this J., 1908, 128, for process for ores free from sulphur.)—F. R.

Zinc blende; Separation of — from other metalliferous constituents, in concentrates, &c. E. J. Horwood. Fr. Pat. 399,272, Feb. 9, 1909.

COMPLEX lead-zinc ores are first concentrated by an oil or other flotation process, and the concentrates heated to 300° C. to 400° C., or they are digested in a suitable acid bath, with or without heat, for the purpose of partially sulphating the galena, the zinc blende being practically unaltered by the treatment. The treated concentrates are again concentrated by the previous process when it is found that the particles of galena, coated with lead sulphate, no longer float, thus enabling the unaltered blende to be readily separated.—F. R.

Gold; Process for the precipitation of — from solutions, and for the decolorisation of solutions of sugar or other substances. H. Hay and B. E. Tennent. Fr. Pat. 399,877, Feb. 24, 1909.

THE property that charcoal possesses of precipitating gold from solution, is said to be due to the presence of hydrogen

carbonyl in the charcoal; the object of this patent is to increase the quantity of hydrogen carbonyl, by heating wood charcoal in a muffle or retort to between 700° and 1400° C., and passing steam over it. When cool the charcoal is said to be capable of precipitating 20 times the amount of gold from solution that untreated charcoal can. The treatment also improves the efficiency of the charcoal for the removal of vegetable colouring matter from solutions of sugar or other substances.—F. R.

Steel and iron; Process for the treatment of —. W. P. Thompson, Liverpool. From William Sauntry Metals Co., Portland, Maine, U.S.A. Eng. Pat. 16,552, Aug. 5, 1908.

SEE Fr. Pat. 393,452 of 1908; this J., 1909, 145.—T. F. B.

Cemented armour plates of steel and alloys of steel, for ships and other uses; Manufacture of —. E. C. R. Marks, London. From Soc. anon. Italiano Gio. Ansaldo Armstrong Co., Genoa, Italy. Eng. Pat. 16,806, Aug. 10, 1908.

SEE Fr. Pat. 393,355 of 1908; this J., 1909, 145.—T. F. B.

Armour plates and other articles of steel or alloys of steel for ships and other uses; Manufacture of —. E. C. R. Marks, London. From Soc. Anon. Italiano Gio. Ansaldo Armstrong Co., Genoa, Italy. Eng. Pat. 16,972, Aug. 12, 1908.

SEE Fr. Pat. 393,355 of 1908; this J., 1909, 145.—T. F. B.

Iron; Process for the direct extraction of — from ores. W. S. Simpson and H. Oviatt. Fr. Pat. 399,901, Feb. 5, 1909. Under Int. Conv., Nov. 16, 1908.

SEE U.S. Pat. 918,381 of 1909; this J., 1909, 527.—T. F. B.

Steel; Process for making — direct from the ore. W. S. Simpson and H. Oviatt. Fr. Pat. 399,902, Feb. 5, 1909. Under Int. Conv., Nov. 16, 1908.

SEE U.S. Pat. 918,382 of 1909; this J., 1909, 527.—T. F. B.

Magnesium and alloys thereof; Melting and casting —. G. W. Johnson, London. From Chem. Fabr. Griesheim Elektron, Frankfurt, Germany. Eng. Pat. 15,038, July 15, 1908.

SEE Fr. Pat. 393,080 of 1908; this J., 1909, 27.—T. F. B.

Minerals of any kind; Process and apparatus for the treatment of — for the purpose of extracting the metal they contain. B. Junquera, Santa Susana, Spain. Eng. Pat. 21,921, Oct. 16, 1908.

SEE Fr. Pat. 394,719 of 1908; this J., 1909, 370.—T. F. B.

Crucible furnaces. A. J. Boulton, London. From Kroeschell Bros. Co., Chicago, U.S.A. Eng. Pat. 1786, Jan. 25, 1909.

SEE U.S. Pat. 910,091 and 911,271 of 1909; this J., 1909, 207, 247.—T. F. B.

Silicon nitride; Process of making —. A. Sinding-Larsen and O. J. Storm. Fr. Pat. 399,445, Feb. 13, 1909. Under Int. Conv., Feb. 17, 1908.

SEE U.S. Pat. 928,476 of 1909; preceding.—T. F. B.

Zinc ores; Treatment of — by a preliminary fusion followed by precipitation of the metal by molten iron. Imbert Process Co. Fr. Pat. 399,854, May 5, 1908.

SEE Eng. Pat. 13,492 of 1908; this J., 1909, 144.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

PATENTS.

Electric arcs in series; Impts. relating to the working of —. H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 6429, March 17, 1909.

THE electric arcs are arranged in series with the main working circuit, and a high pressure auxiliary arc-striking

circuit, provided with an ohmic or inductive resistance, is connected in parallel with all but one of the arcs. The auxiliary circuit may be provided with a high pressure generator independent of the main generator, or may be supplied with current from the secondary coil of a transformer, the primary being arranged as a shunt with the main working circuit.—B. N.

Diaphragm; Electrolytic — and method of making same. A. G. Betts, Troy, N.Y. U.S. Pat. 929,276, July 27, 1909.

AN asbestos board diaphragm for use in aqueous electrolysis is prepared by cementing together the fibres in an asbestos board with an easily fusible substance that is insoluble in the solution to be used. For example, powdered sulphur is dusted on to the surface of the board, and the latter heated until the sulphur fuses.

—F. R.

Electrolytic cell. J. McPhail, Assignor to W. J. Burke and H. R. Nelson, Carteret, N.J. U.S. Pat. 929,469, July 27, 1909.

THE cell consists of a rectangular containing vessel, having internal brackets or ledges at opposite ends, to support an inner vessel of U-shaped cross section, composed of wire netting lined with a fibrous material to act as a diaphragm. The inner vessel is furnished with slate ends, adapted to fit into the brackets of the outer vessel.—F. R.

Water; Apparatus for the electrolysis of —, with platinum electrodes. J. Greil. Fr. Pat. 399,279, Feb. 9, 1909.

A NUMBER of tubes are suspended vertically in an outer vessel containing the acidulated water to be electrolysed. Each tube contains a thin platinum sheet, extending nearly to the bottom of the tube, the upper end of the latter being closed but permitting electrical contact with the platinum plate. The tubes are all of the same length, but those containing negative electrodes, in which the hydrogen is collected, have double the capacity of the others, so that the level of the electrolyte decreases equally in each tube.—F. R.

Electrodes for accumulators. H. J. Haddan, London. From Nya Akkumulator Aktiebolaget Jungner, Fliscryd, Sweden. Eng. Pat. 21,004, Oct. 5, 1908.

SEE Fr. Pat. 395,138 of 1908; this J., 1909, 315.—T. F. B.

Wool scouring by electricity. Fr. Pat. 399,875, Feb. 24, 1909. See V.

(B.)—ELECTRO-METALLURGY.

Metals; Corrosion of — underground by electrolysis. A. A. Knudson. J. Franklin Inst., 1909, 168, 132—152.

THE object of the paper is to set forth the present position of electrolytic action upon subsurface metals, due to railway currents. In the single trolley system which, with the exception of the double underground trolley at New York and Washington, is in general use in America, the current is carried to the cars by a single overhead wire, reinforced by copper feeders, the return current being theoretically conveyed to the power house by the rails. As the rails are "grounded," the return current becomes divided and a portion flows along such water or gas mains as the damp soil, acting as a conductor, brings within range, the amount transmitted being in inverse ratio to their several resistances. Though the condition of the track, therefore, has much to do with the proportion of current leaving it, yet with 90 or 100 lb. rails, well bonded and with suitable auxiliary copper feeders, some current will return by indirect paths underground. At New York, part of the current flowing over the Brooklyn Bridge used to return by a number of different channels, crossing the river in various places, some as far as two miles away, but when the Williamsburg bridge was built, most of the stray currents were practically short-circuited by the mass of metal and are now conveyed by it back to the power station in Brooklyn. A test for current flow

upon one of the paths of the current, a 6 in. water pipe, coming down from the bridge, showed a maximum of 70 amperes passing through it into the water mains. The identity of these currents with those of the railway, is confirmed by systematic observations of their variation of potential, which is found to be governed by the strength of the railway current; the variations of the latter caused, for instance, by the press of traffic between 5 and 7 o'clock in the evening, is faithfully reproduced in detail by the current flowing through the water mains, as is shown by comparative curves. The most destructive effect of electrolysis is shown where the current passes out from a main to another conductor, resulting in the well-known "putting" and eventual perforation of the metal, but damage is also caused to the joints of the pipes by the current passing along them, the inside of the joint being chiefly affected by the electrolytic action. The author describes and illustrates a number of cases of corrosion, including that of water meters, but though he considers that the damage may be lessened by improved track returns, he believes that the only remedy lies in a non-grounded return.—F. R.

PATENTS.

Furnaces; Electric — for the treatment of ores and the like. B. E. D. Kilburn, London. From E. Oesterle, Muncie, Indiana, U.S.A. Eng. Pat. 15,645, July 23, 1908.

THE furnace comprises a hollow circular floor or hearth surrounded by an annular chamber having water-jacketed walls, the lower inner edge of the walls forming a circular lip just above the level of the molten metal on the hearth. A gas, such as carbon monoxide, preferably heated, is forced through openings in the top of the annular chamber, and down through the ore contained in it, issuing from under the circular lip and acting upon the surface of the molten metal.—B. N.

Aluminium ores; Treatment of — and aluminium silicate ores. F. J. Tone, Assignor to the Carborundum Co., Niagara Falls, N.Y. U.S. Pats. 929,517 and 929,518, July 27, 1909.

A MIXTURE of aluminium silicate and emery is mixed with sufficient carbon to reduce the silica and all other compounds except alumina, and is placed as a resistance conductor between the electrodes of an electric furnace. It is then heated to the fusing point, but not the reduction temperature of alumina, and the fused alumina separated from the reduction products.—F. R.

Iron and steel and other metals; Electric production of —, and furnaces for carrying out the same. Aktiebolaget Elektrometall, Stockholm, Sweden. Eng. Pat. 6088, March 13, 1909. Under Int. Conv., Aug. 1, 1908.

THE furnace consists of a smelting chamber, with two adjustable electrodes or groups of electrodes hanging in the chamber from the cover, so that the current passes in the form of arcs to the smelting bath. Each electrode or group is connected with one of the terminals of one pole of a two-phase alternating current system, the terminals of the other pole being connected with a fixed electrode or group of electrodes arranged in the bottom of the chamber. The latter electrode or electrodes may be formed either wholly or partly of a lining of magnesite, dolomite, or the like, wholly or partly surrounded by or arranged on a mass, such as graphite, which acts as an insulator against heat, but at the same time is, even when cold, a conductor of the electric current; or the lining of magnesite, etc., may be mixed with pitch, tar, or the like.—B. N.

Electroplating plant. W. R. King, Newark, N.J., Assignor to the Hanson and Van Winkle Co., N.J. U.S. Pat. 929,312, July 27, 1909.

FOR electroplating long lengths of metallic material, such as wire or ribbon, the material passes from a drum or reel, on which it is wound, continuously and successively into a heated metallic potash-tank, which is connected to one pole of an electric circuit, over a contact rod

connected to the other pole of the circuit, through a cold water tank, a pickling bath, a second cold water tank, over a second contact rod, through a copper-bath tank connected to the other pole by contact rods from which anodes are suspended adjacent to the upper and under sides of the material to be plated, through a third cold water tank, an electroplating tank with electric connections similar to the previous tanks, finally through a hot water tank and a drying chamber and is collected on a drum or reel. The tanks are furnished with internally arranged guide rolls.—F. R.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Whale oil industry in Natal. Board of Trade J., Aug. 19, 1909. [T.R.]

THE whaling company which has been working from Durban during the last two years has now completed the erection of a new factory and plant, and expects to increase the production of oil very largely during the present season. 106 whales were taken during the latter part of last season. Arrangements have been made to manufacture fertilisers from the residue of the carcass of the whale, new works having been erected at a cost of nearly £15,000 for this purpose.

Soaps and oils in Turkey. Board of Trade J., Aug. 19, 1909. [T.R.]

THERE is a growing demand for yellow bar and fancy toilet soaps of all descriptions, preferably of the cheaper kinds. The annual decrease of the olive crop and the increased demand for olive oil for food leaves little native oil for soap making. The objection to using animal fat makes it necessary to resort to vegetable oils. Experiments are being made with corn (maize) oil from the United States and with linseed oil from the United Kingdom; 800 barrels of the former and 700 of the latter were imported in 1908. If these are found satisfactory there is likely to be a large demand for them in future.

PATENTS.

Oil; Means for purifying waste —. C. A. J. Albert, Kvillebäcksvägen, Sweden. U.S. Pat. 929,266, July 27, 1909.

THE apparatus consists of a tank divided into upper, middle, and lower compartments. The oil is supplied to a box in the upper chamber; this box contains a filter and wicks are provided for feeding the oil from the box into the upper chamber. Filters are placed in each chamber and a pipe reaches from the upper to the lower chamber. The oil is heated while it is in the upper and lower chambers, and in the latter the oil is brought into contact with a solution of common salt. Means are provided for distributing the oil from the middle chamber.—W. P. S.

Saturated compounds from solid or nearly solid unsaturated fatty acids or their esters; Process for preparing — by hydrogenation in presence of nickel. E. Erdmann. Ger. Pat. 211,669, Jan. 19, 1907.

SOLID or semi-solid, unsaturated acids or esters are converted into saturated compounds by introducing them, in the form of powder or fine drops, together with hydrogen, into a vessel containing finely divided, heated nickel. The nickel may be deposited on asbestos or other suitable substance. Oleic acid is quantitatively converted into stearic acid, and linoleic and linolenic acids are also readily hydrogenated. For example, oleic acid is sprayed, by means of compressed hydrogen, on a rotating tube of earthenware impregnated with reduced nickel, which is placed within a closed nickel cylinder, the apparatus being heated to 180° C. The stearic acid is finally passed through a layer of pumice impregnated with nickel.

—T. F. B.

Hydroxychlorofatty acids and their glycerides; Process for preparing — by the action of hypochlorous acid on fatty acids and their glycerides. Consortium I. Elektrochem. Industrie, and G. Imbert. Ger. Pat. 212,001, Jan. 6, 1907.

FATTY acids and their glycerides may be converted into hydroxylated and chlorinated fatty acids by treatment with an aqueous solution of alkali hydroxide saturated with chlorine, but a large excess of this solution is necessary. If alkali carbonates or bicarbonates are used in place of hydroxides, the excess required does not exceed 10 per cent., and the reaction proceeds equally well. For example, 329 kilos. of oleine (iodine value 86) and 123 kilos. of calcined soda are dissolved in 1600 litres of water, and 87.5 kilos. of chlorine are passed into the solution; a thick, white, creamy emulsion is thus produced, from which the free acid may be precipitated by addition of the calculated quantity of dilute sulphuric acid.—T. F. B.

Oil from oleaginous materials such as seed; Process of and apparatus for extracting —. P. M. Justice, London. From J. E. Mills, Chapel Hill, N.C., and H. B. Battle, Montgomery, Ala., U.S.A. Eng. Pat. 15,500, Jan. 21, 1909.

SEE U.S. Pat. 913,751 of 1909; this J., 1909, 373.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(B.)—RESINS, VARNISHES.

Turpentine oil; Fractional distillation of — in a current of steam. W. C. Geer. Chem.-Zeit., 1909, 33, 859.

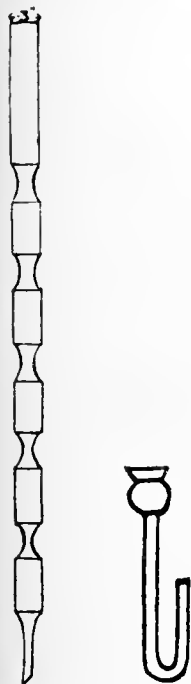


Fig. 1.



Fig. 2.

WITH the aid of the distillation tube here illustrated it is possible to effect an almost complete separation of the constituents of an oil of turpentine. The apparatus consists of a glass tube about 3 cm. in diameter, provided at regular intervals with constrictions of different diameter, the smallest being at the bottom and the largest at the top. In each of these constrictions is placed a V-shaped tube filled with water, and having at the top a collar of wire gauze. On distilling a turpentine oil which consists in the main of a single constituent, the temperature of the steam leaving this tube remains almost constant, whereas a sudden rise of temperature takes place when other constituents begin to distil. The use of this apparatus also obviates the risk of altering the composition of an oil of turpentine by too high a temperature. Analyses are given of the 10 to 12 fractions thus obtained in the distillation of a sample of ordinary turpentine, and of three samples of wood turpentine. Tables are also given.

—C. A. M.

Report of Principal Chemist of the Government Laboratory for the year ended 31st March, 1909. See XVII.

PATENTS.

Varnishes; New substances to be used as — and for impregnation and insulation, and method for their production. O. Diesser, Zürich-Wollishofen, Switzerland. Eng. Pats. 16,737, Aug. 8, 1908, and 11,166 of 1909; date of Appl., Aug. 8, 1908.

SEE Fr. Pat. 393,948 of 1908; this J., 1909, 210.—T. F. B.

Resinous distillation product similar to turpentine oil; Process for the manufacture from terpenes of a —. O. P. Pellnitz, Breslau, Germany. Eng. Pat. 27,024, Dec. 12, 1908. Addition to Eng. Pat. 19,833 of 1908, Sept. 20, 1907.

SEE Addition of Dec. 8, 1908, to Fr. Pat. 394,467 of 1908; this J., 1909, 803.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Rubber samples from German E. Africa. Gummi Zeit., 1909, 23, 1464. From Der Pflanzer, 1909, 5, No. 2.

THE samples were some sent for exhibition at the Rubber Exhibition, Olympia, 1908, and were examined and valued in the laboratory of the "Vereinigte Gummiwaren-Fabriken Harburg-Wien." The following results were obtained:—

Sample No.	Botanical origin.	Loss on washing	Resin. Wax.			Ash. M.p.	
		per cent.	per cent.	per cent.	per cent.	°C.	
1	Manihot Glaziovii	0.00	5.8	5.2	1.22	140	
1c	"	0.00	6.5	3.5	1.42	145	
2A	"	0.00	6.8	7.4	1.40	140	
18	Laudolphia Kirkii	3.20	3.1	1.9	0.42	145	
22	Manihot Glaziovii	11.20	9.3	4.8	3.40	140	
23	"	32.00	6.8	4.3	2.48	150	
25	"	28.90	9.3	5.0	1.70	130	
26	"	27.30	1.07	3.8	1.84	130	
27	"	10.00	6.6	5.8	2.48	150	
28	"	19.20	6.3	4.9	2.02	145	

Samples 1 and 1c were from 3½-year-old trees grown in Anani at 850 metres; latex coagulated on tree trunk, and rubber washed. Sample 2A from 2½-year-old trees grown at 450 metres, coagulation, &c., as in sample 1. Sample 18, collected by natives. Sample 22, was coagulated on the tree, and the crude rubber smoked. Sample 23 was from 4-year-old trees in the Muanza district. Samples 25–27 were coagulated on the tree, sample 26 being afterwards washed with 2.5 per cent. acetic acid, and sample 27 smoked. Sample 28 was from 2½-year-old trees in the Morogoro district.—E. W. L.

Rubber; Production of — from the latex of Kickxia cluscia. C. Kinkelbach and A. Zimmermann. Gummi Zeit., 1909, 23, 1464; from Der Pflanzer, 1909, 5, No. 3.

THE latex of *K. cluscia* cannot be coagulated by the method employed in the case of *Manihot* (viz., coagulation on the tree-trunk itself), on account of the sluggishness with which the change occurs. The latex is therefore collected, and the rubber may be obtained from it by one or other of the following methods:—(1). By diluting the latex with 10 to 20 times its own volume of water, separating the aqueous liquid from the rubber cream, washing the cream with water, and finally separating the rubber by means of a filter-press. (2). By the use of "Purub" [a solution of hydrofluoric acid—see this J., 1908, 1029, 1074]. The use of this coagulant does not appear to be attended by any distinct advantages, though experiments with it were not extensive, owing to lack of material. (3). By simple dilution with water. Further experiments are, however, necessary before it can be definitely decided whether this method is suitable for use on the large scale.—E. W. L.

Rubber; Determination of — in raw rubber, as tetrabromide. C. Harries and H. Rimpel. Gummi Zeit., 1909, 23, 1370–1371.

THE authors have compared the results obtained by Bidde's later method of rubber estimation (see this J., 1907, 1057) with those obtained for the same samples by means of the nitrosite method (Harries, this J., 1901, 1123; 1902, 1404; 1903, 103; 1908, 81; also Gummi-Zeit., 1907, 21, 1205). Determinations were also made with samples of highly purified Para rubber, prepared by triple precipitation from benzol solution.

combined with alternate extraction with acetone for 24 hours (see Harries, this J., 1905, 448, and Ber., 1905, 38, 1198). The results are given in the following table:—

Kind of rubber.	Rubber-content.	
	Nitrosite method.	Bromide method.
	Per cent.	Per cent.
Gaayule (crude)	88.8	76.2
Ceylon Para (sheeted)	96.0	88.8
Congo (Equateur, crude)	92.09	85.3
Para, chemically pure	101.8	86.1
" " "	99.47	91.8

It was observed that in carrying out the bromide process, hydrobromic acid was invariably produced, indicating either that some substitution occurs, or that hydrogen bromide is eliminated in the following way:—



The insoluble bromination product is without doubt a tetrabromide, $\text{C}_{16}\text{H}_{16}\text{Br}_4$, but the authors find that a product containing a higher percentage of bromine passes into the filtrate, being soluble in a mixture of two parts of carbon tetrachloride with one part of alcohol. This product was isolated by carefully evaporating the filtrate in a vacuum at 20° – 30° C., when a red oil, interspersed with crystals, and which gave off hydrobromic acid when exposed to the air, remained behind. On leaving this in a vacuum over sulphuric acid and caustic potash, a dark brown solid was obtained. This was purified by precipitation from its solution in carbon bisulphide with petroleum ether. When the percentage of rubber, calculated from the weight of the soluble product on the assumption that it is a tetrabromide, was added to the percentage calculated from the insoluble product, the sum was, in every case examined, greater than 100. The soluble product amounted in three instances to 8, 10, and 15.3 per cent. respectively, calculated as rubber in the original sample. In its present form, therefore, the Budde method does not give reliable results.—E. W. L.

Rubber; Plantation v. wild —, "Times," Sept. 1, 1909. [T.R.]

THE quality of plantation rubber has recently been the subject of complaint. In standard works it is stated that plantation rubber will not keep more than six months; at the end of that time it will be full of bacteria, whilst wild rubber improves with keeping. It is evident that this is now appreciated by manufacturers, as the price of the Amazon wild rubber (containing 15 per cent. of water) has for a considerable period fetched only 3d. below plantation rubber (with under 5 per cent. of water). This margin has disappeared; for the first time hard fine rubber, with its high percentage of water, has fetched more than plantation fine, and where resiliency is desirable, such as motor tyres, the demand is for wild rubber. The faults with wild rubber are not in the rubber itself, but difficulties in working, which wild rubber companies have experienced. The chief of these difficulties is that of transport. In transport over the Andes to the Pacific ports a quantity is lost owing to the mortality amongst the moles which carry it. Through the want of adequate labour many rubber companies have failed.

PATENTS.

Elastic composition suitable as a material for making tyres and foot coverings. K. Lengfellner, Berlin. Eng. Pat. 25,726, Nov. 28, 1908. Under Int. Conv., Nov. 29, 1907. SEE Fr. Pat. 396,814 of 1908; this J., 1909, 615.—T. F. B.

Rubber in sheets; Manufacture of — and application of rubber to fabrics and similar materials. T. Gare. Fr. Pat. 399,192, Feb. 6, 1909. Under Int. Conv., Feb. 12, 1908.

SEE Eng. Pat. 3112 of 1908; this J., 1909, 319. T. F. B.

Ebonite and vulcanite; Process of making —. O. C. Immisch. Fr. Pat. 399,613, Feb. 18, 1909.

SEE Eng. Pat. 3940 of 1908; this J., 1909, 374.—T. F. B.

Rubber, ebonite, or vulcanite articles; Process of making —. O. C. Immisch. Fr. Pat. 399,614, Feb. 18, 1909. Under Int. Conv., Feb. 18, 1908.

SEE Eng. Pat. 3659 of 1908; this J., 1909, 374.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Clarification of tanning extracts; Valuation of dark blood albumin for the —. J. Jedlicka, Gerber, 1909, 35, 211.

The author records the determinations he usually makes in estimating the value of blood albumin samples, and gives the methods by which he operates. (1) The estimation of moisture may be carried out in two ways. About 2 grams of albumin are dried for 6 hours at 100° C., and the loss in weight noted. A greater or less time in drying results in inconstant results. Usually 9–12 per cent. of moisture is found. Estimation may also be made by distillation with petroleum. From 20–25 grms. of albumin are distilled for about $\frac{1}{2}$ hour with 50 c.c. of petroleum until 15–20 c.c. of distillate are obtained. Comparative experiments gave the following results:

Experiment.	Gravimetric method.	Distillation method.
	per cent.	per cent.
(1)	9.1	9.3, 9.6
(2)	11.0	11.3
(3)	10.1	10.6
(4)	8.5	8.2
(5)	8.9	8.8

(2) Estimation of mineral ash is made by ignition at a low temperature. About half the residue consists usually of alkali chlorides. The author has observed here two classes of albumins, one giving 2.5 to 3.5 per cent., and the other giving 5.5 to 6.5 per cent. of ash. (3) Estimation of insoluble matter is brought about by washing 5 grams of blood albumin by decantation, using 500 c.c. of water and completing the operation in one day. The residue is dried on a tared filter paper at 100° C. The drying may be hastened and oxidation prevented by washing finally with ether or acetone. The ease of solution of the soluble portion is a valuable criterion of the sample to the extract manufacturer. The "insolubles" vary between 5.4 and 20.7 per cent. on the dry albumin, but are usually from 8 to 9 per cent. (4) Estimation of the decolorising power of the insolubles is considered a criterion of the value of blood albumin. Small decolorisation experiments are carried out with two infusions, one containing and the other not containing the insolubles. (5) Estimation of total nitrogen is made by the ordinary Kjeldahl process. The quantity varies between 14.3 and 15.8 per cent., reckoned on the dry albumin. A calculation of the quantity of "useful albumin" is brought about by subtracting the water, ash, and "insolubles" from 100, and adding on the "effective insolubles."

—H. G. B.

Negative adsorption, and the estimation of the swelling action of acids on hide powder and pelt. E. Stiasny. Gerber, 1909, 35, 183, and 197.

It is pointed out that the amount of adsorption of colloid bodies does not increase as the colloidal nature of these bodies is enhanced. This is illustrated by the substances which act as efficient tanning agents, these being all bodies intermediate between the crystalloids and the undoubted colloids. Crystalloids will not tan on account of the reversibility of their adsorption, and it has many times been observed that pure colloids are not adsorbed at all. In the latter case, an adsorbing agent acts on a solution of a colloid so that the solvent is taken up but not the dissolved substance, thus raising the concentration of the dissolved colloid. Such phenomena are not common

and are usually termed "negative adsorption." The author refers to the work of Herzog with chromed hide powder and formaldehyde-gelatin, and disagrees with his explanation that the negative adsorption observed with egg albumin solutions is due to the semi-permeability of the tanned exterior of the fibres. Experiments with white hide powder (untreated) show that the negative adsorption is actually greater in this case than with chromed hide powder. A solution of egg albumin containing a little chloroform was filtered many times through glass wool until quite clear. On evaporation, 10 c.c. of this solution gave a dry residue of 91.5 mgrms. Three grams of dry white hide powder (containing 13.5 per cent. of moisture) were placed in 50 c.c. of albumin solution and allowed to stand overnight. After filtering the mixture, 10 c.c. were evaporated to dryness and yielded a dry residue of 107 mgrms. As 50 c.c. of solution contain 0.4575 gm. of dry residue, and 1 c.c. of filtrate gave 0.0107 gm. of residue, and assuming that no albumin was adsorbed,—the volume of the residual solution was $0.4575 : 0.0107 = 42.76$ c.c. The original volume of the albumin solution (50 c.c.) + the moisture in the hide powder (0.406 c.c.)—the volume of the residual liquor (42.76 c.c.), gives the amount of water taken up by the hide powder (7.646 c.c.). Hence the percentage of water in the powder after the experiment is $7.646 \times 100 : (3 + 7.646) = 71.8$. A quite similar experiment with chromed hide powder (containing 12.8 per cent. of moisture) showed 61.7 per cent. of water in the powder after the experiment. Thus white hide powder shows negative adsorption to a greater extent. Confirmatory experiments were made with hide powders first wet with a known excess of water and then placed in the albumin solution. The filtrate shows then naturally a decrease in the dry residue obtained from 10 c.c., but this is only partly accounted for by the water originally added, and is therefore due partly to negative adsorption. After these experiments, the white hide powder contained 0.6 per cent. and the chromed hide powder 62.9 per cent. of water. The high results obtained in these experiments justify the assumption that no albumin has been adsorbed. The author next employed these phenomena to study the swelling action of acids. The amount of swelling was ascertained by the percentage of water taken up by the hide powder, and the amount of acid adsorbed was ascertained by titrating the residual liquor. White hide powder was thoroughly wet back by standing with a measured excess of water for one hour, and the albumin solution and standard sulphuric acid then added. After shaking three minutes the mixture was filtered. The calculation of results is similar to the case recorded. The results obtained are given in the following table:—

Sulphuric acid solution employed.	Percentage of water in swollen hide powder.	Percentage of sulphuric acid in swollen hide powder.
N/1	79.7	4.75
N/2	81.75	2.9
N/4	83.19	1.655
N/10	85.385	0.914
N/20	86.3	0.62
N 40	85.65	0.445
N/100	68.06	0.086
Water only	79.53	—

The figures are averages of duplicate or triplicate experiments which showed good concordance, especially with the more dilute solutions. It will be noted that the swelling increases with the concentration of the acid, attains a maximum, and then decreases again. The difference between the swelling obtained with acid solutions and with water only is not so striking as was expected. With regard to the acid adsorbed, it is shown that relatively more is taken up from the more dilute solutions, at the experiment with N/100 acid is a notable exception. The author next investigated whether these results hold good with actual pelt. A glass vessel of 250 c.c. capacity was employed, the ground glass stopper of which had a glass cap on which to place the platinum wire that held the pelt. About 20 grams of pelt were suspended thus in water for some hours and then weighed. This gave the

normal weight of wet pelt. The piece was next suspended in the acid solution for four hours and again weighed. This weight—less the normal pelt weight—gave the water and acid content (a). Titration of the residual liquor showed the amount of acid adsorbed (b), and hence (a)—(b) is the water content, i.e. the swelling. The pelt was a strip taken from the middle of a butt, and as constant as possible throughout its substance. It was stored in chloroform water covered with a layer of toluene and in a cool chamber. The results obtained in these experiments are shown herewith:—

Concentration of acid solution.	Grams of water taken up by 1 gram of pelt.	Grams of acid taken up by 1 gram of pelt.
Sulphuric acid.		
4N	-0.4219	0.4850
3N	-0.1239	0.1483
2N	-0.0145	0.0571
1N	-0.0086	0.0520
N	-0.0026	0.0300
$\frac{1}{2}$ N	0.0431	0.0179
$\frac{1}{3}$ N	0.0422	0.0162
$\frac{1}{4}$ N	0.0514	0.0157
$\frac{1}{5}$ N	0.0312	0.0149
$\frac{1}{6}$ N	0.0285	0.0123
Acetic acid.		
4N	-0.2325	0.3230
2N	-0.0998	0.1490
N	0.0534	0.0540
$\frac{1}{2}$ N	0.0739	0.0430
$\frac{1}{3}$ N	0.0694	0.0139
$\frac{1}{4}$ N	0.0452	0.0102
$\frac{1}{5}$ N	0.0218	0.0075

Negative numbers show negative swelling, i.e. that the pelt gives up water to the solution. It will be noticed that this phenomenon occurs with the stronger solutions. As the concentration decreases, this shrinkage gradually disappears and the pelt begins to swell. The swelling attains a maximum and then decreases. The concentration for maximum swelling appears to be a specific constant for each acid. The agreement in duplicate experiments was not so good, however, in these experiments, on account of the differences in the texture of the pelt. As, moreover, the relation between the swelling of hide powder and of hide was not definite, because of the fibrous structure of the latter, further work was not attempted.—H. G. B.

Glucose in leather; Determination of — H. G. Bennett. *Collegium*, 1909, 289.

ATTENTION is called to the method of Wood and Berry (Proc. Cambridge Phil. Soc., 12, Pt. II.) for estimating glucose. Fehling's solution is reduced in the usual manner and the cuprous oxide transferred to a solution of ferric sulphate in sulphuric acid. The amount of ferrous salt thereby formed is readily determined by titration with standard permanganate. The method is said to possess considerable advantage in speed over the gravimetric method for determining the copper. The following results were obtained by independent workers in estimating glucose in a leather:—

	Method.		
	Gravimetric.	Wood and Berry.	Volumetric.
	per cent.	per cent.	per cent.
Observer (1) ..	15.7	15.3	16.7
Observer (2) ..	15.7	15.3	16.3

—H. G. B.

Gelatin; Composition of — Z. H. Skraup and A. von Biehler. *Monatsh. f. Chem.*, 1909, 30, 467–479.

The authors have studied the hydrolysis of gelatin with hydrochloric acid. They find that gelatin contains no other component than was previously known to exist in it and calculate its percentage composition as follows:

glycocoll 12.4, alanine 0.6, pyrroline 10.4, leucine 9.2, aspartic acid 1.2, glutaminic acid 1.8 (the author's number), phenylalanine 1.0, oxypyroline 3.0, glutaminic acid 15.0 (E. Fischer's number, doubled), lysine 6.0, histidine 0.4, and arginine 9.3, so that the composition of dry gelatin so far as 66 per cent., is known with certainty. It is probable, however, that this number should be raised to 86 owing to loss in working, ash, &c.—J. C. C.

Fur and hair: Dyeing — F. J. G. Beltzer. See V.

PATENTS.

Leather-dressing process, G. W. Childs, New York, U.S. Pat. 929,552, July 27, 1909.

THE leather, after it has been tanned and whilst still moist, is impregnated at the ordinary temperature with a liquid dressing having a sp. gr. of 1.05 to 1.3 and containing the inert solid matter from waste tanning liquor mixed with active tanning liquor.—W. P. S.

Leatherboard; Waterproof — and process of preparing the same, E. S. Buffum, Newton, and W. W. Carter, Needham, Mass., U.S.A. Eng. Pat. 28,219, Dec. 28, 1908. Under Int. Conv., Jan. 8, 1908.

SEE Fr. Pat. 398,199 of 1908; this J., 1909, 896.—T. F. B.

Leather articles and their manufacture, H. Mackay, Fr. Pat. 399,074, Feb. 2, 1909.

SEE Eng. Pat. 2504 of 1909; this J., 1909, 666.—T. F. B.

Leather; Artificial — and its manufacture, Fiber Products Co., Fr. Pat. 399,658, Feb. 22, 1909.

SEE Eng. Pat. 1130 of 1909; this J., 1909, 804.—T. F. B.

XV.—MANURES, &c.

Phosphatic materials containing different proportions of phosphoric acid soluble in citric acid as manures for meadows, H. Svoboda, Z. Landw. Versuchsw. Oesterr., 1908, 732. Biedermann's Zentr., 1909, 38, 540—544.

IN view of conflicting opinions as to the relative manurial value of materials containing different proportions of phosphoric acid soluble in citric acid, comparative experiments were made with: (1), and (2), samples of Thomas meal, and (3), a phosphatic chalk, the relative proportions of total phosphoric acid and of phosphoric acid soluble in citric acid in the three fertilisers being:—(1), 14.41 and 13.23; (2), 17.0 and 11.51; and (3), 23.15 and 7.00 per cent. The experiments were extended over a period of three years, in order to allow of the observation of the after-effects of the fertilisers. The results varied considerably with the nature of the weather, but on the whole the fertilisers with relatively low proportions of soluble phosphoric acid produced the greatest increase of yield in the period of the tests. Fertilisers containing a high proportion of phosphoric acid soluble in citric acid produce a considerable effect in a short time, but if the value is to be measured by the effect produced over several years, the proportion of total rather than of soluble phosphoric acid is the important factor.—A.S.

[*Sugar*] *Cane soils: Action of soluble fertilisers on* — C. F. Eckart, Report of Work of the Experiment Station of the Hawaiian Sugar Planters' Assoc., Bulletin 29, [Div. of Agric. and Chemistry,] Honolulu, Hawaii, 1909, pp. 1—88.

THE data presented were obtained from a crop of plant cane, planted in 1905, and the succeeding ratoons were cut during the present season in each of the several localities. The experiments thus practically cover a period of four years, and permit a comparison of the effects of fertilisers applied to plants and ratoons. The ordinary, so-called "agricultural method" of analysis, in which the amounts of the soil elements soluble in a solution of hydrochloric acid of definite strength (sp. gr. 1.115) are determined, was found unsuitable for affording an index of soil fertility, indicating not the availability

to plants of the important nutrients in the soil, but rather the total supplies of the essential elements. The "aspartic acid method" of Maxwell was used as giving a nearer approach to a reliable fertility-index. According to him a one per cent. solution of aspartic acid takes out of Hawaiian soils in 24 hours the same amounts of lime, potash and phosphoric acid that are removed during the production of ten crops of cane. The conclusions reached from a review of data obtained from these and other fertiliser tests are that the profit resulting from the application of fertilisers or manures will depend largely on other factors than the chemical composition of the soil. The relative effects on the growth of sugar cane of different combinations of fertiliser materials, when these materials are added to a given soil, will be determined chiefly by (a) the extent to which their several ingredients directly or indirectly lessen the deficiencies of available plant nutrients; (b) the extent to which they cause the bacterial flora to approach an optimum balance for the regular production of sufficient nitrates or assimilable nitrogen compounds, and (c) the degree and manner in which they produce physical changes in the soil. The greatest loss from the use of improper mixtures of fertilisers is apt to occur on acid soils, and in such cases considerable risk is involved from the continued application of mixtures containing ammonium sulphate, potassium sulphate, and superphosphate, when lime dressings are not previously given. The chemical and physical analysis of a soil will usually prove of value in indicating the best cultural methods to follow in maintaining or improving its fertility, and may also indicate in a general way certain of the plant food deficiencies in given cases, but the data from more extended field experiments with a large variety of soils, when reviewed in connection with the comparative analysis of the soils, using both weak and strong acids as solvents, may indicate a somewhat definite relationship between the analytical figures and the order of importance which phosphoric acid and potash should assume in cane fertilisers in given cases. Such experiments should be carried out on very long, narrow, parallel and contiguous plots or strips, with the untreated check areas lying immediately adjacent. The great importance of "resting" fields in rotation on Hawaiian plantations, and growing upon them leguminous crops, is very clearly indicated. This applies more particularly to the irrigated plantations. Nitrogen is the most important element to be considered in the fertilisation of the sugar cane in the Hawaiian Islands, and when applied in mixed fertilisers some risk of reduced efficiency is entailed if either the potash or phosphoric acid (in the form of soluble salts) be made to exceed the weight of this element. In most cases it is safer, when applying nitrogen, potash and phosphoric acid in the form of soluble salts, to arrange that the mixed fertiliser shall contain equal quantities of these elements, which are not to exceed 60 lb. per acre in the case of each element.

—L. J. DE W.

Sodium chloride (common salt) as a fertiliser for sugar beets, F. Strohmer, H. Briem, and O. Fallada, Oesterr.-Ung. Z. Zuckerind. u. Landw., 1908, 763. Biedermann's Zentr., 1909, 38, 545—546.

COMPARATIVE field experiments showed that in the case of a soil provided with a sufficiency of the ordinary plant foods, an application of common salt increases not only the yield of beetroots, but also the yield of sugar, and does not appreciably affect the quality of the beets.—A. S.

Manganese in some of its relations to the growth of pineapples, W. P. Kelley, J. Ind. and Eng. Chem., 1909, 1, 533—538.

ON some of the upland plains of the Hawaiian Islands on which pineapples are cultivated, there are black areas on which the plants will not grow well, very little fruit being produced and this of inferior size and quality, whilst the foliage acquires a yellowish-white colour. The only important difference in the chemical compositions of the black soil and the surrounding red soil is that the former contains much more manganese than the latter, and it was found that there is a close correlation between the degree of yellowing of the pineapples and the per

centage of manganese in the soil. The yellow plants are more active oxidising agents than green plants from the red soil; they have badly developed roots and contain but little chlorophyll. It is probable that the black colour of the soil is due, in part, to the presence of higher oxides of manganese.—A. S.

Sugar beets; A new proof of the favourable action of common salt in the cultivation of —. H. Briem. Deutsche Landw. Presse, 1909, 223. Biedermann's Zentr., 1909, 38, 546—548.

SOME results obtained by the application of common salt in the culture of sugar beets are shown in the following table:—

Manure per hectare (10,000 sq.m.).

		Leaves.	Beets.	Sugar.	Sugar.
		kilos.	kilos.	per cent.	kilos.
I. Unmanured		127.8	486.9	20.3	98.8
II. 300 kilos. of superphosphate	+306 kilos. of sodium nitrate	156.2	636.0	20.5	100.9
III. do.	+230 " " ammonium sulphate	162.7	551.7	19.9	109.8
IV. do.	+210 " " common salt	143.3	535.0	20.2	108.7
V. do.	+340 " " potassium nitrate	172.4	579.0	20.1	114.6
VI. do.	+150 " " ammonium sulphate and 105 kilos. of common salt	148.9	516.1	20.0	163.2

In view of these results, Strohmmer suggests that manuring with a mixture of denatured salt and ammonium sulphate might prove a satisfactory solution of the problem of replacing sodium nitrate in the cultivation of the sugar beet.—A. S.

XVI.—SUGAR, STARCH, GUM, &c.

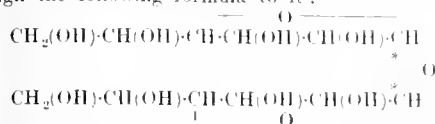
Diffusion process; The Hyros-Rak — in the campaign, 1908—9. K. Andrlík, V. Staněk and J. Urban. Z. Zuckerind. Böhm., 1909, 33, 667—675.

THE authors have made comparative investigations of the working of the Hyros-Rak diffusion process (two batteries, of 6 and 8 diffusers respectively), and that of the ordinary process. Their results indicate that the former process can be worked continuously on the large scale and that the average loss of sugar is not greater than in the ordinary diffusion process. The exhausted slices obtained by the Hyros-Rak process were found to contain about 18 per cent. of dry substance, whereas those obtained by the ordinary process contained less than 7 per cent. The diffusion juices obtained by the Hyros-Rak process possessed practically the same average density and purity as those of the ordinary diffusion juice, and presented no difficulty in the subsequent processes of manufacture. The power required to work the Hyros-Rak process is moderate, and, in course of time, further improvement in this direction will certainly be effected. A battery of 6 diffusers should be more convenient and more economical than one consisting of 8 diffusers.—L. E.

Disaccharides of the type of trehalose; Synthesis of new —. E. Fischer and K. Delbrück. Ber., 1909, 42, 2776—2785.

If a dry, ethereal solution of β -acetobromoglucose is shaken with dry silver carbonate, and a small quantity of water is gradually added, part of the acetobromoglucose is converted into a tetraacetylglucose, whilst another part is converted into an octaacetyl derivative of a disaccharide. Two forms of the octaacetyl derivative are obtained; one of these is crystalline and probably an individual substance, whilst the other is amorphous and probably a mixture. Both forms are easily hydrolysed by barium hydroxide; the disaccharide obtained from the crystallised octaacetyl derivative has practically no reducing action on Fehling's solution, but is easily hydrolysed to *D*-glucose on warming with dilute acid. Hence, it resembles trehalose, but differs from this sugar in that its rotatory power is $[\alpha]_D^{23} = -39.4^\circ$, and the

authors therefore provisionally, call it isotrehalose, and assign the following formula to it:



Since the starred carbon atoms are asymmetric, three stereoisomerides are theoretically derivable from *D*-glucose. The disaccharide preparation obtained from the amorphous octaacetyl derivative appears to be a mixture; it differs from isotrehalose in that its rotatory power is only about $[\alpha]_D^{22} = -1.3^\circ$.—L. E.

Yield per are (100 sq.m.):

Stachyose; Action of ferments on —. J. Vintilescu. J. Pharm. Chim., 1909, 30, 167—173.

TANRET has shown that stachyose, $\text{C}_{21}\text{H}_{42}\text{O}_{21}$, is a tetrose, completely hydrolysed by dilute mineral acids into four monose molecules; namely, one each of *laevulose* and *glucose*, and two of *galactose*. He also found that with such ferments as yeast invertin, the ferments of *Aspergillus*, emulsin, and diastase, hydrolysis is, at first, but partial, one molecule of *laevulose* and one of the triose, *mannitriose*, being formed. Ultimately, this triose is slowly hydrolysed by emulsin and by *Aspergillus* ymase; the action of invertin was not determined. The author finds that with invertin the hydrolysis does not proceed further than the conversion of stachyose into *laevulose* and *mannitriose*. To complete the hydrolysis of the latter triose, the intervention of another ferment is necessary. Such a ymase occurs in the complex emulsin ferment of almonds. Emulsin, when allowed to act on the hydrolysis product subsequent to the action of invertin, effects the complete hydrolysis of the *mannitriose* molecule. This particular ferment of almond emulsin has not hitherto been indicated and has now been named *mannitriase*. It is also obtained by cultivating bakers' top-fermentation yeast in a solution of stachyose; and may be isolated by precipitating these culture liquids, without previous filtration, by means of alcohol. With these two ferments it is therefore possible to demonstrate the presence of stachyose in vegetable tissues by the biological method of Bourquelot. The aqueous extract is first subjected to the action of invertin, and subsequently to that of emulsin (or *mannitriase*). Observation of the optical deviation of the respective hydrolysis liquids will then furnish evidence of the presence or absence of stachyose.

—J. O. B.

Starch; Direct determination of —, according to the process of G. Baumert and H. Bode. G. Baumert. Z. Unters. Nahr. u. Genussm., 1909, 17, 167.

THE author proposes a modification of the above process for the determination of actual starch in potatoes, and it applies in the case of all starches of whatever source. Three grams of the most finely pulverised substance, are intimately triturated in a beaker-glass with 2—5 c.c. of water, and then, with stirring and cooling in a current of cold water, this triturated mixture is treated with 10 c.c. of hydrochloric acid of sp. gr. 1.19. After the swollen mass has at length become liquefied, which requires at most ten minutes, an excess of sodium hydroxide solution of 20 per cent. strength is gradually added, with continual stirring and cooling. The contents of the

beaker-glass are now poured and rinsed out with water into a $\frac{1}{2}$ -litre flask, filled up to the mark, and then filtered. Twenty-five c.c. of the filtrate after addition of about 1 gm. of fine floccular asbestos, whilst being vigorously stirred, are now precipitated with 50–60 c.c. of alcohol, and as soon as the precipitate has completely settled, it is collected in a previously ignited, small asbestos funnel and washed with alcohol to which 3 to 5 c.c. of dilute hydrochloric acid have been added (to decompose the sodium-starch compound), and then further washed with 80 per cent., afterwards with absolute alcohol, and finally with ether. After drying the funnel, it is weighed, and then the contents are ignited in a current of oxygen, the funnel after cooling being weighed again. The loss of weight represents the starch.

Sugar cane soils; Action of soluble fertilisers on —. C. F. Eckart. See under XV.

Sugar beets; Sodium chloride as a fertiliser for —. F. Strohmer, H. Briem, and D. Fallada. See XV.

Sugar beets; New proof of the favourable action of sodium chloride in the cultivation of —. H. Briem. See XV.

Molasses; Fermentation of Hawaiian —. S. S. Peck and N. Decrr. See XVII.

Gold; Process for the precipitation of — from solutions, and for the decolorisation of sugar solutions, etc. H. Hay and B. E. Tenment. See X.

PATENTS.

[Sugar] *Finely divided material; Apparatus for drying —.* R. S. Kent, Brooklyn, New York. U.S. Pat. 914,052, March 2, 1909.

THE principal feature of the apparatus is a conveyor movable in such a manner as to pour or spill finely-divided moist material, particularly moist granulated sugar, over an edge of considerably greater length than the straight edge over which such material is usually delivered. It has been found in regular commercial use of such an apparatus that in the drying of granulated sugar, considerably over 25 per cent. of the time heretofore required to dry such sugar is saved. The inclined rotatory drum conveying the material to be dried has one or more series of blades (or flights) projecting from and lying close to the wall of the drum, some or all of the blades having irregular spilling edges, with scoop-like teeth, of considerably greater length, viewed flatwise of the blade, than a straight line connecting its terminal points. Two sets of blades may be arranged at different points in the length of the drum, the blades of one set being inclined with respect to those of the other. The drum is mounted so as to turn about an axis disposed at an acute angle to the horizontal. There are also means for passing a gaseous drying medium through the drum.—L. J. DE W.

Frothing of liquids [sugar solutions] during manipulation; Process for preventing the —. H. Hamelle. Fr. Pat. 399,855, May 5, 1908.

THE liquid is mixed with a non-saponifiable liquid lubricant, e.g., the hydrocarbons obtained from petroleum or coal-tar. These bodies, which must be of lower specific gravity than the liquid undergoing treatment, prevent the formation of froth without contaminating the product. In order to prevent the lubricant leaving the apparatus with the product, a partition or weir is provided near the point where the discharge pipe leaves the containing vessel, this weir being arranged so as to prevent the whole of the liquid from being withdrawn. The layer of lubricant which floats on the surface is thus retained and serves again for the next operation.—W. H. C.

Starch; Process for the production of soluble —. A. Païra and Die Administration der Minen von Buchsweiler Actiengesellschaft, Alsace, Germany. Eng. Pat. 9370, April 20, 1909.

IN this process, starch is rendered soluble by treating it, in admixture with dilute solutions of inorganic or organic acids, with air, best at 40°–50° C. The change is acceler-

ated by adding, either before or during the injection of the air, catalytic substances, such as salts of copper, iron, manganese, nickel, or cobalt. According to the duration of the process, the degree of solubility of the final product is regulated. If hydrochloric acid be the acid employed a 3 per cent. solution is recommended.—T. H. P.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt analysis; Diastatic catalysis of hydrogen peroxid applied to —. H. van Laer. J. Inst. Brewing, 1909, 15, 553–569.

IN determining the catalytic activity of a malt, the author now uses 6 grms. of the finely-ground sample and 25 c.c. of a solution containing 0.85 gm. of hydrogen peroxide per 100 c.c. (see this J., 1906, 550), the volume of gas evolved in 1 minute being reduced to 0° C. and 760 mm. pressure and calculated on 6 grms. of the dry malt. These separate estimations should be made and the mean of the three taken, although in no case do the differences amount to as much as those frequently met with in determination of diastatic power. With the exception of malts very poor in catalase, the volume of oxygen liberated, although it increases with the amount of the enzyme present, does so less rapidly, so that the figures obtained for different malts are not proportional to their catalytic activities. With green malt kept at 20–35° C. during the first 24 hours of kilning, if there is a good draught the increase of catalytic activity, calculated on the dry matter, is insignificant; but if the kiln draws badly, and the tepid malt consequently retains its moisture at forcing temperatures, there is a considerable increase, sometimes as much as 30 per cent. on the initial figure, of the catalytic activity during the first 24 hours. While the temperature is rising from 35° C. to the final heat, the catalytic activity slowly decreases if the kiln draws well; but if the draught is bad and moisture consequently abundant, there is a rapid drop in catalytic activity as soon as 50° C. is reached. The catalytic activity of ground malt is affected by acids and alkalis in a manner contrary to that exhibited by the diastatic power, that is, it increases with the number of hydroxyl ions present in the solution of hydrogen peroxide, the maximum being reached when the mixture of peroxide and malt flour is nearly neutral to phenolphthalein. Thus, when the 25 c.c. of peroxide solution contained 1/10,000 gm.-mol. of sodium hydroxide, a malt having the catalytic activity 38 gave the value 72; further addition of alkali produced a diminution of the catalytic activity. A weaker base, such as ammonia, produces a less change. Acids of varying strength, such as hydrochloric, sulphuric and oxalic acids, diminish the catalytic activity by amounts dependent on the extents to which they are ionised. The retarding action of the chloroacetic acids increases with the amount of substituted chlorine. Glycocoll acts as a very weak base, asparagine as a very weak acid, and hydrolysable salts, such as aluminium chloride, as acids. Tri- and di-potassium phosphates act as bases and mono-potassium phosphate as an acid.—T. H. P.

Enzymes; Studies on —. II. *The measurement and influence of the concentration of hydrogen ions in enzyme actions.* S. P. L. Sørensen. Comptes rend. lab. de Carlsberg, 1909, 8, 1–168.

IN enzyme actions a distinction must be made between acidity and concentration of hydrogen ions; it is only the latter which plays a part in enzyme fissions. The concentration of hydrogen ions is best represented by its normality factor in powers of 10, e.g., a centinormal concentration of ions would be 10^{-2} , and in the case of any solution at 10^{-p} concentration of ions, p_H is termed the "exponent" of the hydrogen ions. In enzyme fissions this concentration of hydrogen ions plays a part similar to that of the temperature, and curves illustrating its influence may be plotted with the quantity of substance hydrolysed in a unit time as ordinates and the exponents of the hydrogen ion concentrations as abscissas. Such curves are very similar in appearance to the temperature curves. For measuring the concentration of hydrogen

ions in any solution, no method is permissible which involves in its performance a change of this concentration; ordinary alkalimetric methods cannot be used. The author has employed two methods: an electrical method which is accurate but laborious, and a colorimetric method which is less accurate but very simple. The electrical method depends on the measurement of the E.M.F. of a cell having one electrode of calomel immersed in a $N/10$ solution of potassium chloride, and the other electrode of platinum immersed in the liquid under examination. He has constructed curves showing the exponents of hydrogen ion concentrations equivalent to any observed E.M.F. without calculation. This method serves for the standardisation of comparative standards for the colorimetric method, which depends on the use of a number of suitable indicators which change colour within definite limits of hydrogen ion concentration. These colours are compared with known solutions prepared with mixtures of primary and secondary phosphates standardised by the electrical method. A series of 20 suitable indicators has been investigated by the author: they fall into 5 groups according to the limits governing their turning points, but all of them are not available in all cases: some of the ordinary indicators, e.g., Congo Red cannot be used at all in this class of work. A study of the action of invertase showed that the concentration of hydrogen ions most favourable to its inverting action on sucrose is practically independent of the origin and quantity of the invertase used and of the nature of the acidifying agent present. Under the conditions adopted, the optimum concentration corresponds to $p_H^+ = 4.4-4.6$. These experiments have shown the necessity, in all studies on the kinetics of the reaction, of taking into account the concentration of the hydrogen ions; neglect of this influence accounts for the discrepancies between the views of various investigators of the kinetics of inversion. The optimum concentration of hydrogen ions, in all the enzyme actions studied, changes with the duration of the action and the temperature, owing to the spontaneous decomposition of the enzymes. After prolonged action the optimum exponent for invertase tends towards the alkaline side. In the case of catalase, the optimum concentration of hydrogen ions at a temperature of 0°C . is about the neutral point, but after prolonged action it tends slightly towards the acid side. In digestions by pepsin at a temperature of 37°C . the optimum concentration of hydrogen ions is distinctly dependent on the time: for short durations the optimum exponent is slightly less than 2, but as the time is prolonged it moves towards the acid side.—J. F. B.

α - and β -Methyl-d-glucosides; The splitting of — by enzymes. H. Bierry. *Comptes. rend.*, 1909, 149, 314–316.

THE splitting of α -methyl-d-glucoside was attributed by Fischer at first to invertase, but later he regarded maltase as the active enzyme. The question however arose whether the splitting of this glucoside is actually performed by maltase or by some other enzyme which accompanies this latter in the yeast-preparations employed. This question was solved when enzymes were found in certain yeasts and in the blood and pancreatic extracts of animals which were capable of hydrolysing maltose but were inactive towards α -methyl-glucoside. By digesting the narrow intestine of the dog in presence of antiseptics, the author has obtained an extract capable of hydrolysing the α -methyl-glucoside at a temperature of 38°C . For this enzyme he proposes the name of α -glucosidase, since it appears to be different from maltase. The pancreatic extracts of the horse and dog do not hydrolyse the α -glucoside, but readily hydrolyse maltose. The intestinal extract of the dog has only a very slight action on the β -methyl-glucoside, and the pancreatic extracts are also without action upon it. The gastro-intestinal juice of *Helix pomatia* hydrolyses both the α - and the β -methyl-glucosides, but the β - compound is split far more readily than the α . The same juice rapidly hydrolyses maltose and amygdalin.—J. F. B.

Yeast; Invertase of —. E. Salkowski. *Zeits. physiol. chem.*, 1909, 61, 124–138.

IN a previous communication the author has shown that all preparations of invertase contained variable proportions of yeast gum, yielding mannose on hydrolysis, and concluded that endeavours to prepare the ferment pure, must prove fruitless so long as the sole criterion available was the inverting power of a sample (*Zeits. physiol. chem.*, 31, 305). The present research is directed to determine whether the yeast gum is an integral part of the invertase molecule, or an accidental contamination. Fresh pressed and dried yeasts were extracted with water near the freezing point, or with chloroform water, and the filtrates investigated. In all cases it was found that, contrary to usual acceptance, notable quantities of invertase were dissolved out of the cells. The chloroform water extracts were sometimes obtained free from gum, whence it is concluded that the gum is not an integral part of the invertase molecule. Invertase is not destroyed by putrefactive bacteria.—R. L. S.

Beer yeast contaminated with lactic acid bacteria; The influence of various pasteurising temperatures on top fermentation —. F. Schönfeld and W. Rommel. *Woch. f. Brau.*, 1909, 26, 397–400.

A PURE culture of yeast "A" from the Berlin brewing school collection was grown in wort alone, with cultures of various lactic acid bacteria isolated from Berlin "Weissbier" beer, and with *B. ascendens*, an acetic acid bacterium. Young, actively growing cultures and beers containing yeast and bacteria in suspension were pasteurised at $45-45^\circ\text{C}$. The results show that the yeast alone can withstand heating for half an hour at 65°C . The yeast is slightly restricted in growth and fermentative power by the lactic bacilli but is otherwise unaffected; in some instances, contrary to the statements of Henneberg, it was able to withstand higher temperatures than the bacilli. In all cases the critical temperature has been the same for both fermenting power and vegetative growth. Budding yeast cells in all cases were able to withstand higher temperatures than those present in month old beer. In presence of *B. ascendens*, budding yeast cells were destroyed at 50°C . and old cells at 45°C .—R. L. S.

Initial heats; Calculation of — and underletting heats. G. W. Smallwood. *J. Inst. Brewing*, 1909, 15, 540–549.

IN view, firstly, of the difficulty of measuring the true initial heat of a mash and, secondly, of the inaccuracy of the usual formula employed for calculating such heat, the author gives the following expression for arriving at the striking heat to be employed to obtain a certain initial heat: $[(A+BC)y+wx]/(A+B+w) - z = 0$, where $A=0.392$, $B=0.0054$, C is the percentage of moisture present in the malt, x the striking heat, y the temperature of the grist, z the initial heat of the mash and w the amount of liquor mashed per quarter, in barrels. Taking the average proportion of moisture in a malt as 3.4 per cent., the above equation simplifies to $(0.41 y+wx)/(0.41+w) - z = 0$, an extra 1 per cent. more or less of moisture lowering or raising the initial heat a little less than 0.2 degree. For the calculation of either the amount of underletting liquor at a certain temperature, or the temperature of a certain amount, to be used to raise the heat of the mash to a definite temperature, the author gives the formula: $[(A+B)z+xw]/(A+B+w) - y = 0$, where A is the amount of liquor mashed per quarter in barrels, $B=0.41$, x is the heat of the underlet liquor, y the heat of the mash after underletting, z the initial heat of the mash, and w the amount of underlet liquor in barrels. It is important that the temperature of the grist be taken into account as heat is generated during milling operations, especially where a friction mill is used; further, the grists are, as a rule, at a lower average temperature on Monday mornings than on other days, owing to the longer time of standing. The heat due to diastatic action does not enter into the equation for calculating the initial heat of a mash, the result obtained being the mean heat of the mash at the time of actual mixing. Neither does the formula for calculating the amount or temperature of the underlet liquor to be used take into account the heat

generated by diastatic action between the times of mashing and underletting; in practice, this amount of heat will probably be found to be very nearly constant and could be added to the initial heat. —T. H. P.

Brewhouse; Possible economies in the —. O. Francke
Woeh. für Brau., 1909, 26, 317.

Sifting of the grist.—The author thinks that all the advantages offered by Kubessa's and other processes, depending on the grading of the malt grist, may be gained by simpler means, e.g., preliminary mashing, "stands" during mashing for digesting proteins, steeping with warm lime-water, etc. A simple grist-mill, with long heavy rolls, giving a grist comparatively free from large particles, is more useful than a grading machine.

The protein question.—The attitude of the brewer towards the proteins has completely changed in recent years, and instead of desiring to avoid them, he endeavours to utilise them to the utmost. Thus the short high-temperature mashing process has given way to the long low-temperature methods.

Mashing and clarifying.—Malts are now shorter grown than formerly, and it is necessary, in a manner, to complete their modification in the mash tun, so as not to lose extract. The simple mashing process of the future will consist of a slow mixing process with cold preliminary mash, $\frac{1}{2}$ to 1 hour "stand" at 50° C. for the sake of the protein, a saccharification "stand" at about 70° C., decoction of the whole mash, finishing off at 75° C. by mixing in the cold infusion for completing saccharification, and clarifying through a mash filter at 75° C. The Schmitz method of clarification is destined to do good service in the future.

Omission of the boiling of the wort.—Many of the objects with which the boiling of the wort is effected are probably superfluous under modern conditions. For instance, it is not now necessary for sterilisation and caramelisation. As regards the coagulation of proteins, extraction of hops and clarification, these may be effected by the decoction of the entire mash if the finely ground hops be added to the mash tun. In this way the consumption of hops may be reduced by 25 per cent., because there is less loss of volatile matters owing to the shorter time of boiling, and the hops are fully sparged with the grains. It is desirable, however, in order to avoid gluten turbidity, to chill the wort to 0° C. before pitching, and then to warm it up again to the pitching temperature. —J. F. B.

Alcoholic fermentation; Inhibitive influence of certain acids on —. M. Rosenblatt and M. Rozenband.
Comptes rend., 1909, 149, 309—312.

In studying the inhibitive action of various acids on alcoholic fermentations the authors have established that for every acid there is a certain minimum concentration below which no effect at all is produced. They have determined this limit in each case, as well as the concentration which is required to inhibit entirely all fermentative action. These two limits bear no relation to each other. Results are tabulated for a large number of mineral and organic acids, the experiments being effected with pressed top-fermentation beer yeast in sucrose solutions, and controlled by blank fermentations without acid. The most powerfully inhibitive acid was found to be dichloroacetic acid which completely stops fermentation at a concentration of N/100; then follow benzoic and salicylic acids which inhibit fermentation at N/60 strength. Sulphuric acid only completely stops fermentation at the comparatively high concentration of 9.8 grms. per litre, or N/5, but it begins to retard it at as low a concentration as N/4000. Several acids are incapable of bringing about a complete inhibition of fermentation, even in the form of saturated solutions, such acids are *p*-hydroxybenzoic, tartaric, succinic, boric and arsenious acids, but the saturated solutions of most of these are not very concentrated. Of the ordinary organic acids which may be present in fermenting liquids, acetic acid stops fermentation at N/2 and begins to have an effect at N/100; for the other acids the corresponding limits are: lactic, 2N and N/200; isobutyric, 3N and N/100; propionic 4N and N/200; *n*-butyric, 5N and N/200; citric, N/1 and N/66. It is somewhat surprising that the fermenta-

tive action of beer yeast should resist the presence of such comparatively large proportions of acids, when the extreme sensitiveness of many enzymes to the presence of mere traces of acid is considered. This resistance is probably due to the fact that the fermentation of sugar is endocellular, and the membrane of the yeast cell is probably only slightly permeable to acids, thus protecting the internal enzymes from their toxic action. —J. F. B.

Report of the Principal Chemist of the Government Laboratory upon the work of the Laboratory for the year ended 31st March, 1909. With appendices. Wyman and Sons, Ltd., Fetter Lane, E.C., and 32, Abingdon Street, Westminster, S.W., or E. Ponsonby, 116, Grafton Street, Dublin. 1909. Price 3d. [T.R.]

The total number of analyses made in the two branches of the Government laboratory during 1908-9, was 176,922, against 191,034 in the previous 12 months—a decrease of 14,112. This, however, does not include all the analyses performed, as a large number of samples are tested at the 18 stations maintained at the outposts, and if this work is included the total number of examinations is brought up to 329,649.

Arsenic in beer, &c.—Of the 559 samples of beer, wort, and materials used by brewers, 30 were found to contain arsenic in excess of the limits laid down by the Royal Commission on Arsenical Poisoning—viz., the equivalent of one-hundredth of a grain of arsenious oxide per pound in the case of solids, or, per gallon in the case of liquids. Of 114 samples of malt examined, only one exceeded the limit, the amount found, being one twenty-fifth of a grain per pound. In 278 samples of glucose, invert sugar, caramel, &c., none exceeded the limit; the greatest amount found was $\frac{1}{2}$ this grain per gallon—this being in a yeast food.

The quantities of methylated spirits made during the years ended March 31st, 1907, 1908 and 1909, were:—

	1909.	1908.	1907.
	Bulk gallons.	Bulk gallons.	Bulk gallons.
Ordinary and industrial methylated spirit for manufacturing purposes	2,542,910	2,589,500	2,445,600
Mineralised methylated spirit, mainly for domestic use .	1,628,190	1,583,000	1,590,000
Total	4,171,100	4,173,400	4,035,600

Thus whilst there has been a decrease in the industrial or manufacturing spirit of 46,590 gallons compared with 1908, there has been an increase of nearly the same quantity in the mineralised methylated spirit used mainly for domestic purposes. The net decrease is, therefore, only 2,300 gallons. The decrease in the manufacturing spirit is probably partly due to the general trade depression that has affected all manufacturing operations during the past year. The price of alcohol used in making methylated spirit has been twice increased during the year, and now stands at a higher figure than for many years. The distillers alleged that, as the prices of the materials and fuel used by them had all increased, they had no option but to increase the price of the alcohol. The prices of the methylated spirit had, of course, to be correspondingly increased. But, although the increased prices are a serious disadvantage to manufacturers using industrial alcohol, it is pointed out that the rise in prices of alcohol has been greater in Germany and other Continental countries than in the United Kingdom. As mentioned in former reports, the quantity of industrial methylated spirit issued to manufacturers does not fully represent the quantity of such spirit actually used in manufacturing operations. In many cases this spirit is only used as a temporary solvent for one or more of the substances employed in the manufacturing operations, or for crystallising and purifying purposes. In such cases the Commissioners of Inland Revenue permit the spirit so used to be recovered by distillation, and spirit thus

covered is used again in similar operations, so that the quantity of fresh industrial methylated spirit bought by manufacturer represents the waste or loss only, and not the quantity of spirit employed in his operations. The greater efficiency in the recovery plant in recent years thus tends to somewhat mask the actual increase which has occurred in the use of methylated spirit for industrial purposes. During the year ended March 31st last, 535 applications connected with the use of methylated spirit have been referred to this department, making a total of 1,904 since the introduction of industrial methylated spirit in October, 1906. From this, it is concluded that the advantages of the new industrial methylated spirit are fully appreciated by manufacturers, and that the new regulations with reference to its use appear to be generally accepted as satisfactory by manufacturers who use the spirit.

For the preparation of mineralised methylated spirit, 94 samples of mineral naphtha representing 6,201 gallons were examined, and 202 samples representing 6,178 gallons were approved, two samples representing 23 gallons being rejected as unsuitable. Eighty-seven samples of "petroleum ether," representing 2,866 gallons, were examined, and all, except one sample representing 37 gallons, were found suitable for mixing with industrial methylated spirits used in certain manufacturing operations where an additional safeguard is required. The use of pure duty-free spirit (undenatured ethyl and methyl alcohols) in the science laboratories of universities, colleges, &c., again shows an increase compared with previous years. The quantity issued to these institutions during the year ended March 31st last was 4,815 proof gallons, against 3,323 in 1908 and 4,017 in 1907. As in the case of industrial methylated spirit, there has been a decrease in the quantity of specially denatured alcohol used for manufacturing purposes. In the year ended March 31st last only 439,038 proof gallons were issued to manufacturers as compared with 473,509 proof gallons in 1908. The quantity issued is greater than in 1907, when only 31,898 proof gallons were issued. Practically the whole of the alcohol used for manufacturing purposes, except 0,940 gallons of methylic alcohol which is not made in this country, was of British manufacture.

The total quantity of duty-free spirit expressed in proof gallons used for all purposes, domestic and manufacturing, during the years ended March 31st, 1909, 1908, and 1907, was as follows:—

	1909.	1908.	1907.
	Proof gallons.	Proof gallons.	Proof gallons.
Industrial methylated spirit for domestic use . . .	2,395,306	2,339,782	2,338,000
Industrial methylated spirit for manufacturing	3,884,739	4,115,593	3,717,000
Spirit otherwise denatured—manufacturing	439,038	473,509	432,000
Used in universities, colleges, &c.	4,815	4,323	4,000
Total	6,723,898	6,933,207	6,491,000

The total quantity of foreign spirit used for manufacturing purposes during the year ended March 31st, 1909, including pure absolute alcohol and methyl alcohol (21,185 proof gallons), was equivalent to 24,706 proof gallons, or about 15,000 bulk gallons.

For the purpose of controlling the use of methylated spirit a great many samples have been examined. Two instances of methylated spirit being used illegally in making medicinal preparations were discovered, the offenders being subsequently prosecuted and fined. Six cases of unlicensed sale of methylated spirit were also dealt with. Several cases were found where methylated spirit was being used for purposes which were not in themselves illegal, but for which the requisite authorisation had not been obtained. In these instances the traders were cautioned against a repetition of the irregularity. Many traders are authorised to use industrial alcohol in making special articles. Fifty-nine samples of industrial

alcohol have been analysed in the eight months which have elapsed since the order was issued. No cause for complaint was found in respect of 52 of these samples. The remaining seven, however, were not in accordance with the requirements, and the traders were cautioned against further disregard of the restrictions imposed. Nevertheless, the result is not unsatisfactory, as the irregularities in question were hardly in any case suggestive of intentional fraud, but rather of carelessness or an imperfect sense of responsibility.

A return of the quantities of industrial methylated spirit used in manufacturing operations and for other purposes in the United Kingdom during the years ended March 31st, 1908 and 1909, is given. The manufacturing operations enumerated are:—

Nature of Manufacturing Operations or other purposes for which the Industrial Methylated Spirit was used.	Quantity used.	
	1909. Gallons.	1908. Gallons.
Manufacture of		
" Finish for sale	336,135	363,074
" Varnishes, polishes, and lacquers for sale	858,278	886,485
" Stains, paints, enamels, &c., for sale	66,184	49,203
" Varnishes, finish, stains, lacquers, &c., and spirit used for polishing purposes in manufacturers' own workshops	253,689	257,100
" Felt hats	120,643	116,590
" Celluloid, xylonite, and similar substances	28,554	19,561
" Oil-cloths, leather-cloths, pegamoid, and similar substances	111,892	200,944
" Linoleum and similar substances	320	536
" Smokeless powders, fulminates, and other explosives	19,702	18,596
" Soap	140,964	136,399
" Electric lamp filaments	14,688	15,291
" Electric cables	8,511	4,937
" Incandescent gas mantles	18,060	16,888
" Ether	160,294	166,466
" Chloroform	11,808	19,941
" Ethyl chloride and bromide	932	835
" Solid medicinal extracts	23,224	21,261
" Alkaloids and fine chemicals	17,263	21,146
" Embrocations, liniments, and lotions	30,717	30,006
" Surgical dressings	9,095	5,311
" Capsules and other medicinal appliances	1,232	2,270
" Hair washes	10,583	6,444
" Cattle medicines	1,677	1,357
" Plant washes, insecticides, and sheep dips	9,617	8,431
" Aniline and other dyes	2,988	4,270
" Fireworks and matches	5,716	4,460
" Photographic plates and papers, and other photographic purposes	39,418	37,423
" Steel pens	3,251	2,324
" Silk, crape, and embroidery	8,397	6,595
" Artificial flowers, &c.	3,867	2,630
" Rubber	1,990	3,327
" Artificial silk	—	—
" Ships' compasses, spirit levels, &c.	620	695
" Inks	2,002	2,094
For dyeing and cleaning operations in		
" laundries and dye works	47,319	42,889
" Calico printing	4,495	5,479
" Preservation of specimens in museums and hospitals	8,737	8,442
" Educational and scientific purposes in colleges and schools	4,951	4,968
" Analytical and scientific purposes in the laboratories of analysts, works chemists, &c.	8,322	4,421
" Use in hospitals, asylums, and infirmaries	36,718	40,593
" Electrotyping and printing	1,542	1,381
" Various miscellaneous manufactures, including cements, disinfectants, &c.	9,102	10,740
" Admiralty dockyards and War Office, arsenals and workshops, chiefly for varnishes and polishes	18,832	15,293
Total quantity used	2,476,586	2,567,090

Wine; Action of ultra-violet rays on the acetic fermentation of —. V. Henri and J. Schnitzler. *Comptes rend.*, 1909, 149, 312–314.

THE ultra-violet rays arrest the acetic fermentation of wine. The rays employed were obtained from a mercury lamp of quartz, and the wine was exposed in a flat dish at a distance of about 15 cm. below the lamp. Volumes of liquid ranging from 50 to 200 c.c. were exposed, in layers ranging from 1 to 4 cm. in thickness. The fermentation was studied in the case of a sour, red Algerian wine, the quantity of acetic acid already present being known. After exposure to the rays for periods of 5–30 minutes, the samples were replaced in the incubator and the further production of acetic acid was determined after 3–9 days. An exposure of 30 minutes' duration under the above conditions completely arrests the acetification. A shorter exposure produces a retardation. The appearance of the wine after 30 minutes' exposure is similar to that produced by the addition of a few drops of hydrogen peroxide; after a few days a slight precipitate of a dark colour is formed and the wine is slightly decolorised and its shade changed. The presence of air is essential for this action of the ultra-violet rays, but their action is not due to the production of ozone in the air. The active rays are those at the extreme end of the spectrum, having a wave-length below 3021. —J. F. B.

Molasses; Fermentation of Hawaiian —. S. S. Peck and N. Deerr. Hawaiian Sugar Planters Assoc., Bull. No. 28, Dept. of Agriculture and Chemistry, 1–54.

THE work described in the bulletin was carried out with the object of learning to what extent, and with what profit to the Hawaiian islands, the waste molasses of the mills could contribute to the alcohol supply of the United States, since, by the passing of the Denaturing Act of June, 1906, Congress has made possible the use of alcohol in the arts and manufactures, and in the production of light and power. In 25 Hawaiian molasses, the average content of sugars from the crop of 1908 was 51.68 per cent. Of these sugars, 83 per cent. can be converted by fermentation into alcohol. An unfermentable body, which has the same reducing power on copper solutions as glucose, is present to the extent of 6.13 per cent. of the sugars, or 3.17 per cent. of the molasses. The United States revenue regulations governing molasses distilleries, are based on an estimated yield of from 80 to 95 per cent. of proof spirit from the molasses. The yields in proof spirit of Hawaiian molasses, vary from 62 to 93 per cent., the average being 77 per cent. A modification of the regulations would be necessary before a molasses-distilling enterprise could be profitably installed in the islands. Molasses contains a sufficiency of nutrients for the development and action of yeast. Mineral stimulants give no apparent increase in the yield. Molasses contains no non-sugars which have a deleterious action on the fermentation. Aeration shortens the time of fermentation, without any increase in the yield of alcohol. Attenuation is not as great in molasses of Hawaii, as in those of most countries where molasses is fermented, on account of the smaller quantities of sugars therein. Fermentation under pure culture increased the yield in alcohol 22 per cent. over that when working under the usual factory conditions with adventitious fermentation. The lees or residue from fermentation gives a fertiliser containing potash, nitrogen, and a small quantity of phosphoric acid. Molasses as a source of alcohol and fertiliser has a value of about 8.3 cents per gallon, exclusive of freight and interest. Of the yeasts from various countries where molasses is fermented, most are budding yeasts of the type *Saccharomyces cerevisiae*; that from Peru is, however, a fission yeast. Most of the yeasts worked well in sugar concentrations up to 14.6 grms. per 100 c.c., the fermented wash containing up to 7.85 per cent. of alcohol by volume. A *Monilia* was isolated from the yeast from Natal, which gives an aroma resembling that of the best Jamaica rum. This was grown in pure culture in molasses wort; there were formed 7558 parts of esters as ethyl acetate per 100,000 of alcohol; at the same time a pure culture of yeast gave only 18 per 100,000. The esters were shown to consist

chiefly of ethyl acetate and butyrate. It is suggested that this *Monilia*, or to some closely allied form, is due to peculiar fruity odour of high-class rums. —L. J. DE W.

Whisky; Final Report of the Royal Commission on —. Blue-book (Cd. 4796), 1909.

THE present report deals with certain reservations which were made in an interim report issued in June, 1906 (this J., 1906, 825); the matters thus reserved include the advisability or otherwise of attaching special significance to particular designations, such as "Scottish whisky," "Irish whisky," "grain whisky," and "malt whisky"; of placing restrictions upon the use of such designations as trade descriptions, or of requiring such designations to be used in connection with the sale of whisky. The report also states the grounds upon which the Commissioners arrived at the conclusions set out in their interim report, and deals with subjects which they have inquired into other than whisky. A short history is given of the term "whisky" and the question of processes is dealt with at some length. During the last eight years, practically no materials other than malt and unmalted grain have been used in either pot or patent stills in Scotland, and no other materials have been used to any great extent in pot or patent stills in Ireland during the last 50 years, and the Commissioners see no reason for excluding the use of maize, which is now very extensively used in the patent still process. The conclusions of the Commissioners as to the processes of distillation may be summarised as follows:—The spirit which is produced and sold to the public in the United Kingdom at the present time under the name of whisky is distilled in various kinds of apparatus which may be broadly classified as pot and patent stills. The former are used in the manufacture of whiskies with special and pronounced characteristics in the matter of flavour and taste. They vary *inter se*, those used in Ireland for the distillation of fermented wort, derived from malt and unmalted barley, rye, and oats, differing, for example, in some respects, from those used in Scotland for the distillation of fermented worts derived from various cereals, principally maize, with the addition of a proportion of malt. The patent still is adapted for the economical production from such materials of whiskies which in general have less of the pronounced characteristics above referred to. In the distilling season 1906–7 there were in England 8, in Scotland 150, and in Ireland 27 distilleries actually working. In England 3 of these distilleries were using both pot and patent stills, and 5 patent stills only. In Scotland 137 were using pot stills only, 10 were using patent stills only, and 3 were using both pot and patent stills. In Ireland 18 were using pot stills only, 2 were using patent stills only, and 7 were using both pot and patent stills. But the patent still distilleries are of so much greater productive capacity than those using the pot still, that in the year 1907, 22,000,000 proof gals. of spirits were produced from patent still distilleries in Scotland and Ireland against 14,000,000 proof gals. produced from pot stills. Thus, nearly two-thirds of the potable spirits produced at the present time in Scotland and Ireland are distilled in patent stills. The evidence shows that such spirits have been frequently described as "whisky" by distillers and traders since the patent still came into use, and that for many years a section of the public, particularly in parts of Scotland and Ireland, has recognised patent-still spirit, without admixture, under the name of "whisky," and has purchased it as whisky, no attempt being made by the distillers or vendors to conceal the method of distillation. Moreover, spirit produced in the patent still has long been employed for blending with or diluting whiskies of different character distilled in different forms of still. This has been by far its greatest use, and most of the whisky now sold in the United Kingdom contains in greater or less degree spirit which has been obtained by patent still distillation. Again, apart from the fact that pot stills differ so much that a comprehensive legal definition would be difficult to frame without either excluding certain types of still which are now commonly recognised as pot stills, or including other types which are not now looked upon

Alcoholic liquors; Prohibition of importation of — into Iceland. Board of Trade J., Aug. 19, 1909. [T.R.]

IN virtue of an Icelandic Law which has recently received the Royal Assent, the importation into Iceland of all alcoholic liquors containing more than 2½ per cent. of alcohol is to be prohibited from the 1st January, 1912. The prohibition will not, however, apply to alcoholic liquors to be used for medicinal or ecclesiastical purposes, nor to spirit for use in industrial undertakings, chemical laboratories, natural history museums, or for use in general for burning.

Spirit industry of Austria-Hungary. Brit. and Col. Drug., Aug. 21, 1909. [T.R.]

A HEAVY fruit crop, from which unusually large amounts of fruit spirit have been produced, has lowered the demand for other alcohol. The exports of spirit to the Dalmatian Provinces have fallen off considerably, and the use of industrial alcohol has exhibited no development. In consequence of this position a spirit trust is now in course of organisation. The firms already negotiating with the view of amalgamation represent an annual production of nearly 300,000 hectolitres out of a total of about 1,600,000. The Hungarian Government proposes to reduce the quantity allowed to be distilled in the kingdom from 853,000 to 808,000 hectolitres.

PATENTS.

Beer; Process for the treatment of — with a view to its sterilisation and the precipitation of the albumin contained therein. F. Rogerson, London. Eng. Pat. 20,086, Sept. 24, 1908.

OZONE or ozonised air under pressure is admitted into the bottling cylinder and is also admitted to the bottle before filling, and is allowed to escape from this latter into another cylinder and thence into the air. Prior to this process, the beer is admitted under pressure into the upper part of a cylinder and allowed to flow down over a gauze surface, ozone or ozonised air being admitted to said cylinder under pressure and allowed to mix intimately with the beer; the ozone or ozonised air is then allowed to escape from the cylinder under pressure, the beer being finally filtered.—T. H. P.

Fermented beverages; Process of making — by preliminary compression. E. W. Kuhn. Fr. Pat. 399,648, Feb. 19, 1909.

SEE Eng. Pat. 4622 of 1908; this J., 1908, 826.—T. F. B.

Ammonium sulpho-phosphate for the treatment of vintages and musts, and its process of manufacture. A. Hubert. Fr. Pat. 399,142. See VII.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Meat; The application of formaldehyde to —. G. S. Buchanan and S. B. Schryver. Report to the Local Gov. Board, 1909, Food Report No. 9, 1–12.

THE report deals with an investigation on the use of formaldehyde for the preservation of meats; the methods of applying the preservative, such as washes, and treatment with formaldehyde vapour in safes and in the chilling hold of ships, are described, and the results of experiments with meat thus treated are given. It was found that formaldehyde can not only be recovered from the surface of the meat, but from parts below the surface. Portions of meat were also tested after cooking. Boiling and roasting appeared to reduce or even to remove the formaldehyde, but grilling seemed merely to make the formaldehyde penetrate further into the substance of the meat. Where muscular surface was exposed to formaldehyde vapour, the contamination was relatively large (1 in 3500), and the common depth of penetration into muscular tissue was 20 mm. under a thin superficial layer of connective

tissue. The following method for detecting and determining small quantities of formaldehyde in meat, etc. is given:—The meat is heated in a boiling water-bath for 5 minutes with water to every 10 c.c. of which have been added 2 c.c. of a 1 per cent. phenylhydrazine hydrochloride solution. In most cases, where the amount of formaldehyde is 1 part in 50,000, or less, 10 c.c. of water and 2 c.c. of the reagent are used for 10 grms. of meat. After cooling, the liquid is filtered through a loose plug of cotton-wool and to 12 c.c. of the filtrate are added 1 c.c. of 5 per cent. potassium ferricyanide solution and 4 c.c. of concentrated hydrochloric acid. In the presence of formaldehyde a brilliant magenta-like colour is developed, which reaches its full intensity in a few minutes and keeps without marked deterioration for several hours. By comparison of the colour with standards made from known amounts of formaldehyde, the amount of formaldehyde in any given sample of meat can be ascertained.

—W. P. S.

Casein; Action of methyl iodide on —. Z. H. Skraup and E. Krause. Monatsh. f. Chem., 1909, 30, 447–465.

THE authors' process for the methylation of casein is as follows:—50 grms. of casein are well stirred with 100 c.c. of absolute alcohol and a solution of 13 grms. of potassium hydroxide in 25 c.c. of absolute alcohol is added gradually in small portions. The mixture is now heated under reflux condenser with 50 grms. of methyl iodide for 2 hours. The same amount of alcoholic potash and methyl iodide is then added and the whole again heated until no further alkaline reaction is observed. Excess of methyl iodide and alcohol is distilled off, and the residue treated with 500 c.c. of boiling water, whereby a portion remains undissolved. About 190 grms. of ammonium sulphate are added and the precipitate collected. It is dissolved in three times its weight of hot, 10 per cent. alcohol and reprecipitated with ammonium sulphate; this operation is repeated five times. The precipitate is then dissolved in hot, 10 per cent. alcohol, freed from sulphuric acid by means of barium chloride, evaporated, and finally dried in a vacuum. 145 grms. of the iodine compound of methylecasein are thus obtained from 350 grms. of casein. On hydrolysis with dilute sulphuric acid no tyrosine or lysine could be detected and much less histidine and arginine, but considerably more glutamic acid, phenylalanine and leucine were obtained than from casein.—J. C. C.

Calcium sacrate in milk; Detection of —. S. Rothenfusser. Z. Untersuch. Nahr. u. Genussm., 1908, 18, 135–155.

IN the method proposed the sucrose is detected by means of a solution of diphenylamine in acetic and hydrochloric acids after the milk has been treated with ammoniacal basic lead acetate solution, in order to remove casein, lactose, etc. The author shows that when a 1 per cent. of lactose is treated with an equal volume of this clarifying reagent a precipitate is produced immediately, whilst a solution of sucrose remains perfectly clear. The details of the process are as follows:—The milk or cream is mixed with an equal volume of a solution prepared by mixing 2 vols. of basic lead acetate solution (Ph. G. IV.) with 1 vol. of 10 per cent. ammonia; the mixture of milk and reagent is well shaken and at once poured on a filter. Four c.c. of the filtrate and 8 c.c. of a solution containing 20 c.c. of 5 per cent. alcoholic solution of diphenylamine, 60 c.c. of glacial acetic acid, and 120 c.c. of hydrochloric acid (1:1), are mixed in a test-tube which is then placed in a boiling water-bath for 10 minutes. A bright blue coloration is produced if as little as 0.05 per cent. of sucrose be present; with larger quantities a deep blue colour is produced. Milk free from sucrose does not give the slightest coloration. The presence of preservatives, such as formaldehyde, hydrogen peroxide, sodium carbonate, boric acid, salicylic acid, and benzoic acid, has no influence on the sensitiveness of the test, and these substances do not themselves give a coloration with the diphenylamine reagent.—W. P. S.

Carbonophosphates in milk; The existence of — and their decomposition by pasteurisation. A. Barillé. Comptes rend., 1909, 149, 356—358.

THE presence of carbonophosphates (see this J., 1903, 193) in milk is considered by the author to be proved by the fact that calcium carbonate and dicalcium phosphate are precipitated from milk when the latter is heated to a temperature of 50° C. for 24 hours. The carbon dioxide liberated from the milk at this temperature is that formed by the dissociation of the carbonophosphates, and a determination of the soluble phosphate, the carbonophosphate, and the insoluble phosphates in milk affords a means of ascertaining what changes the phosphatic constituents of milk undergo when the milk is heated. The author finds that carbonophosphates are practically eliminated from ordinary pasteurised milks. —W. P. S.

Sterilisation by means of ultra-violet rays and its application to butter-making. Dornic and Daine. Comptes rend., 1909, 149, 354—356.

WATER may be sterilised by subjecting it to the action of ultra-violet rays, and the process is a convenient one for the treatment of water used in dairies for washing butter. It is pointed out that there is little use in sterilising the cream, if the butter, after it has been churned, is washed with water containing organisms capable of producing rancidity. The authors employ a glass-lined wooden tank containing glass partitions, over which the water flows during its passage through the tank. Two quartz electric lamps (220 volts and 3.5 amperes) are fitted in holes in the cover of the tank, but are not immersed in the water. About 3000 litres of water can be treated per day in one tank, and whilst the sterilization attained is not absolute, the number of bacteria originally present in the water is reduced to a negligible figure. For instance, water containing 11,000 bacteria (*B. fluorescens liquefaciens* and *Micrococcus prodigiosus*) per c.c., showed only 45 colonies after treatment. It is impossible to sterilise butter itself by means of ultra-violet rays, since the ozone produced by the lamps imparts an unpleasant taste to the fat; the same is the case with cream, and, to a certain extent, with milk. —W. P. S.

Manganese in some of its relations to growth of pineapples. Kelley. See XV.

PATENTS.

Food; Apparatus for preserving — by means of liquid air. J. E. Place, Glenridge, N.J., Assignor to American Air Liquefying Co., New York. U.S. Pat. 927,595, July 13, 1909.

THE apparatus comprises an insulated enclosure to be cooled, surrounding a separate insulated compartment. Inside the latter is a receptacle which is kept charged with liquid air, and is exposed to the air currents of the compartment. This holder is connected with the compartment by means of a spring valve, which is arranged to open at a predetermined light pressure. An operating "gate" connects the outer enclosure with the inner compartment, and is actuated by a thermostat, which is arranged to open or close the gate, as the temperature rises or falls in the outer enclosure. —O. R.

Bedroot flour; Manufacture of —. L. Dautrebande. Fr. Pat. 399,141, Feb. 5, 1909.

SEE Eng. Pat. 1074 of 1909; this J., 1909, 903. —T. F. B.

(B.)—SANITATION; WATER PURIFICATION.

Nitrates; Determination of — in water containing chlorides. R. Marcellé. Ann. Chim. anal., 1909, 14, 303—304.

THE disturbing influence of chlorides on the determination of nitrates by the method of Grandval and Lajoux (this J., 1909, 740) may be overcome by rendering the chlorine insoluble, before adding the reagent. A solution of silver sulphate is added to 10—25 c.c. of the water to be examined, one or two drops in excess of the quantity calculated to

precipitate all the chloride being used; the mixture is stirred and evaporated to complete dryness on the sand-bath, and, after cooling, 1.5—2 c.c. of the reagent, instead of the usual 1 c.c., are added to the residue, and this is very carefully mixed with the reagent by means of a stirring-rod. The determination is finished in the usual way, the solution being made up to a known volume with water (the evaporating dish is rinsed out finally with ammonia); most of the precipitate is dissolved by the excess of ammonia and filtration is rarely necessary. The silver sulphate solution is prepared by dissolving 10 grms. of silver nitrate in a little water and evaporating, in the presence of sulphuric acid, until most of this acid has disappeared, a little ammonium sulphate being added towards the end of the operation; after cooling, about 40 c.c. of water are cautiously added and sufficient ammonia to completely dissolve the residue, and the volume is finally made up to 80 c.c., so that every c.c. precipitates about 25 mgrms. of chlorine. Accurate results are said to be obtained with this method, even in the presence of 5 grms. of sodium chloride per litre, and it is applicable to the determination of nitrates in effluents from sewage treatment. —F. SOPH.

PATENTS.

Aerated or carbonated water or other beverages; Manufacture of — at low temperatures. R. S. Lloyd. London. Eng. Pat. 15,552, July 22, 1908.

THE claim is for the use of two coils, one in the solution tank and one in the carbonating or aerating tank, so that the expanded gas which is used directly for cooling the liquid in the solution tank is also used for cooling the liquid in the carbonating or aerating tank. —W. H. C.

Water; Process and apparatus for removing iron from — by means of air. H. Reisert, Cologne, Germany. Eng. Pat. 18,355, Sept. 1, 1908.

WATER is introduced, in the form of spray, into the top of a vertical cylinder, through the bottom of which air is forced. The level of the water is kept constant by means of a valve, which releases the air pressure when the water sinks too low. After depositing a portion of the mud, the water passes to a second cylinder, where it is filtered successively through coarse and fine material. —T. F. B.

Liquids; Purification of — by ozone. Cie. Franç. de l'Ozone, Paris. Eng. Pat. 15,854, July 25, 1908. Under Int. Conv., July 26, 1907.

SEE Addition of July 26, 1907, to Fr. Pat. 354,298 of 1905; this J., 1908, 35. —T. F. B.

(C.)—DISINFECTANTS.

Formaldehyde; Application of — to meat. G. S. Buchanan and S. B. Schryver. See XVIII.

Formaldehyde; Determination of — in commercial solutions. O. Blank and Finkenbeiner. See XXIII.

PATENT.

Disinfectant; Process of manufacturing a —. A. Brick. Vienna. U.S. Pat. 929,383, July 27, 1909.

ETHEREAL oils and formaldehyde are mixed with a soap solution containing alcohol, the mixture is heated, cooled, and to the cold mixture are added incompletely saponified oils containing alcohol. —W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

Papers for permanent records; Durability of —. H. W. Wiley and C. H. Merriam. Paper Specifications. E. P. Veitch. U.S. Dept. of Agric. Report No. 89, Apr. 22, 1909, 1—51. [T.R.]

THE general aim of the recommendations of the committee on paper for Departmental use, is directed towards decreasing the weight and bulk of papers by improving their quality, whereby economies of space and trans-

port charges and reduction of the waste of raw materials now occasioned by the manufacture of needlessly large amounts of heavy, inferior papers are effected. It is recognised that for certain purposes, notably the reproduction of illustrations, this principle cannot be rigorously applied, but it is desirable to reduce these exceptions to the lowest possible limits. The use of coated papers should be discouraged. Where possible, supercalendering should take the place of heavy loading or coating for giving the desired printing surface, and systematic experiments are in progress to determine the most suitable relations between the fineness of illustration blocks and the quality of the paper. A recommendation is made to the effect that a small edition of every publication should be printed on thin strong paper for distribution to public libraries, etc. The report contains a summarised account of the methods of paper testing, based, with a few modifications, on the standard German methods of procedure. The chief modification as regards apparatus is the adoption of the American bursting-strain testing machine (Mullen's type), in preference to the direct tensile-strain machine employed in Europe. The apparatus for testing transparency and folding qualities are the ordinary German models. The extreme importance of the last-mentioned test in determining the durability of the paper is fully recognised. The use of good materials properly prepared is ensured in these specifications, where necessary, by reducing the absolute values found for the mechanical properties of the paper to "specific" values, by dividing them by the relative weight of the paper, thus enforcing the principle of maximum quality with minimum weight. But the metric system is discarded, and the denominator selected for this purpose is an arbitrary one, viz. lb. per ream of 500 sheets measuring 24×36 ins. Thus the "strength factor," taking the place of the metric "breaking length," is the bursting strain in lb. divided by the weight in lb. per standard ream; the "folding factor" is the number of double folds resisted by a strip, tested under metric conditions, divided by the lb. per ream; this calculation assumes that the resistance to folding, of a given paper, increases proportionally with its weight. The breaking stretch of a paper is not taken into account in these specifications. The conception of "bulk" or specific volume, as a factor in the qualities of the paper, is adopted in the form of the "thickness factor," i.e. the thickness of the paper in ten-thousandths of an inch divided by the weight in lb. per standard ream, and each specification provides for the restriction of bulk by specifying a maximum thickness factor. Restriction of the quantity of ash is aimed at in all cases, the only papers permitted to contain more than 5 per cent. of ash being printing papers for half-tone blocks. Uncoated supercalendered papers containing 10 per cent. of ash are allowed for blocks containing up to 135 lines per inch; 25 per cent. of ash is permitted for blocks with 150 lines per inch; for finer blocks coated papers are permitted, but not for text; wherever possible the coating should be on one side only; the ash of coated papers must not exceed 10 lb. per standard ream per side. Coated papers of the first grade are specified as composed of all-rag fibres and casein is excluded from the coating composition. The ash of fine ledger, bond and post papers must be cut down to a maximum of 1 per cent.—J. F. B.

Celluloid industry in Japan. Chem. and Drug., Aug. 28, 1909. [T.R.]

THE imports of celluloid into Japan during the past four years have been as follows:—

	1905.	1906.	1907.	1908.
	£	£	£	£
Total imports	49,686	81,812	32,070	66,831
From Germany . . .	44,654	63,660	26,591	53,051
From Great Britain	4,777	15,779	4,758	11,991

The general duty on celluloid is £2 11s. per 60 kilos., and on celluloid goods the duty is 40 per cent. *ad val.*; the imports of the latter in 1907 being valued at £1,580, and in 1908 at £3,260. Of the raw materials required

to manufacture celluloid, camphor and sulphuric acid are obtained in Japan and are very cheap. It is this fact, in combination with the growing demand in East Asia, which has suggested the establishment of celluloid factories to be worked with Japanese capital. The Japanese Celluloid and Artificial Silk Factory is the principal concern. It has a nominal capital of from £100,000-£200,000, one-quarter of which has been paid up. The company will commence to manufacture celluloid at Aboshi, near Himeji, and later it will take up the manufacture of artificial silk and the chemicals necessary for the production of both articles. Two years are expected to elapse before the factory gets to work. The Sakai Celluloid Co. is building a celluloid factory at the town of Sakai. This Company has a capital of £200,000, of which £112,500 is in the hands of the founders. The buildings are expected to be completed by the beginning of 1910.

PATENTS.

Paper: Apparatus for treating fibres in the manufacture of —. P. A. Sparre, Paris. Eng. Pat. 16,104, July 29, 1908.

This apparatus, in which the fibres are pressed and macerated without being unduly reduced in length or in strength, consists of a series of troughs which hold the fibre, and stampers or beaters, pivotally suspended at the end of pivoted beams which are intermittently lifted and dropped by means of a sprocket wheel. A further set of levers, connected with the sprocket wheel, imparts a swinging motion to the beaters. By these means the beaters move alternately down each side of the troughs, and move upwards when they reach the bottom of the troughs.—T. F. B.

Paper pulp: Apparatus for making barrel bodies from —. W. H. Decker, Assignor to Solvay Process Co., both of Syracuse, N.Y. U.S. Pats. 928,247, 928,248, and 928,249, July 20, 1909.

The apparatus described has the object of producing bilged barrel-bodies direct from paper-pulp in a vat. It consists essentially of a bilged forming-roll, and a transferring roll, with a concave surface, which transfers the web and builds up the body on a bilged mandrel. The transfer roll is composed of hollow, independently rotatable sections mounted on a hollow shaft, the interior of which communicates with the interior of each of the sections. The transfer roll is in immediate contact with the bilged mandrel, but it may be driven independently by a bilged driving roll. A bilged auxiliary roll may also be interposed between the forming roll and the concave transfer roll, and out of contact with the former. This auxiliary roll receives the web of pulp from the forming roll and delivers it by gravity to the transfer roll, the bilged form of the web being preserved by blasts of air.—J. F. B.

Cellulose structures: Method of manufacturing —. P. Friedrich, Berlin. Eng. Pat. 17,967, Aug. 26, 1908. Under Int. Conv., Aug. 26, 1907.

SEE GER. Pat. 205,883 of 1907; this J., 1909, 362.—T. F. B.

Cellulose derivatives: Process for producing soluble —. L. Lilienfeld. Fr. Pat. 399,460, Feb. 13, 1909.

SEE Eng. Pat. 8708 of 1908; this J., 1909, 257.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Ergothionine: a new alkaloid from ergot. C. Tanret. J. Pharm. Chim., 1909, 30, 145–153.

A NEW base, ergothionine, $C_8H_{15}N_3O_8S_2H_2O$, crystallising from water in rhombic lamellae, m. pt. about 290° C., with subsequent decomposition, has been isolated from the alcoholic extract of ergot. Ergothionine is soluble to the extent of 1:8.6 of water at 20° C.; very soluble in hot water; sparingly dissolved by strong alcohol; 1:30 in 60 per cent. alcohol at 20° C. and 1:6 or 1:7 in the

me at boiling point; less soluble in stronger spirit; very sparingly soluble in methyl alcohol, and in acetone; soluble in ether, chloroform, and benzene. The aqueous solutions are dextro-rotatory, $[\alpha]_D^{20} = +110$. The oil is not volatile. When freshly prepared, it is odourless; but develops an unpleasant odour on keeping. It was isolated by extracting the drug with 90 per cent. alcohol, distilling off the solvent, and removing fats and resins from the distillation residue by filtration. The latter was freed from colouring substances and more or less altered ergotinine by precipitation with 20 per cent. sulphuric acid; after removing excess of this with barium hydroxide, the filtrate was treated with basic lead acetate solution. The filtrate from this was treated with sulphuric acid to remove the excess of lead, rendered alkaline, and shaken out with chloroform to remove other bases. The separated aqueous portion was acidified with acetic acid and the ergothioneine precipitated as mercuric chloride compound by means of an 8 per cent. solution of mercuric chloride added until the precipitate at first formed, then dissolved and finally re-precipitated, ceased to increase further in volume. The mercuric chloride-compound was composed with hydrogen sulphide, and the aqueous solution of ergothioneine hydrochloride evaporated under reduced pressure to a syrup. On cooling, the salt crystallised out. The yield was about 1 per mille. The free base was obtained by treating the aqueous solution of its hydrochloride with calcium carbonate. As thus obtained it was contaminated with traces of calcium chloride, which caused it to crystallise in an acicular form. It was purified by recrystallisation from boiling 60 per cent. alcohol. Ergothioneine is a very feeble base; it does not react with litmus; but its salts are generally crystalline. The acids in these behave towards indicators as if they were free. Ergothioneine salts are precipitated by potassium-mercuric iodide, by mercuric chloride, and by solution of iodine in potassium iodide; but not by picric acid, nor by tannin; nor by sodium silicotungstate, except on very strong solutions. The free base is removed from very strong aqueous solution by tannin. When fused with kali, then treated with acid, hydrogen sulphide is evolved, when the solution of the alkaloid is heated with chloroform and potassium hydroxide, a green colour is formed, changing to blue on neutralisation. The hydrochloride, $\text{H}_{15}\text{N}_3\text{O}_2\text{S}_2\cdot\text{HCl} + 2\text{H}_2\text{O}$, forms fine orthorhombic crystals; stable when preserved from air. Although its hydrochloric acid reacts as if free, its solutions may be evaporated dryness at 100°C . without loss of acid. Since it forms definite silver compound, $(\text{AgCl})_2(\text{C}_9\text{H}_{15}\text{N}_3\text{O}_2\text{S}_2)_2\cdot\text{Ag}_2\text{O}$, the silver nitrate, the amount of chlorine present cannot be determined directly, but must be found by the soda-salt method. The phosphate, $\text{C}_9\text{H}_{15}\text{N}_3\text{O}_2\text{S}_2\cdot\text{H}_3\text{PO}_4$, forms hygroscopic needles. The sulphate $(\text{C}_9\text{H}_{15}\text{N}_3\text{O}_2\text{S}_2)_2\cdot\text{H}_2\text{SO}_4 + 1\frac{1}{2}\text{H}_2\text{O}$, is soluble 1 : 7 in water at 10°C . The hydroiodide $\text{H}_{15}\text{N}_3\text{O}_2\text{S}_2\cdot\text{HI} + 2\text{H}_2\text{O}$ forms fine orthorhombic crystals. The mercuric-chloride, $\text{HgCl}_2(\text{C}_9\text{H}_{15}\text{N}_3\text{O}_2\text{S}_2\cdot\text{HCl})$, after first dissolving, is precipitated in needles. The platinohydrochloride is amorphous. Ergothioneine forms several ditivine compounds with iodine.—J. O. B.

Terpenes and essential oils; 109th Communication. Formation of active α -pinene from nopinone. The erythritol of terpinolene. Hydrocarbons from various sources containing terpinene. A sesquiterpene present in Siberian pine-needle oil. O. Wallach. *Annalen*, 1909, 368, 1—22.

Synthesis of active α -pinene from nopinone.—Nopinonic acid (m.pt. 84° — 85°C .) was distilled slowly in a current of hydrogen. The portions distilling below 55°C . were united, freed from acid and distilled over dium. When oxidised with excess of permanganate, the fraction yielded nopinonic acid, m.pt. 126° — 127°C ., pinene-glycol, m.pt. 75° — 77°C ., and a small amount of a keto-acid. A better yield of the keto-acid was obtained by oxidising the fraction boiling at 160° — 162°C ., using permanganate. The acid, $\text{C}_{10}\text{H}_{16}\text{O}_3$, melted at 59° — 60°C ., and had $[\alpha]_D^{20} = -93.2^\circ$ in chloroform; the micarbazone melted at 205°C . These results show the substance to be identical with β -pinonic acid, which is derived from α -pinene. The author concludes that both α -pinene and β -pinene are formed in the distillation

of nopinolacetic acid. When nopinolacetic acid is distilled with acetic anhydride, an acid, $\text{C}_{10}\text{H}_{16}\text{O}_3$, is produced, which melts at 58° — 59°C . When boiled with sodium hydroxide solution, an acid, $\text{C}_{11}\text{H}_{18}\text{O}_3$, is formed, which melts at 85° — 86°C ., and is isomeric with nopinolacetic acid. β -Pinene can be easily converted into terpin hydrate by allowing it to stand with a mixture of alcohol and nitric acid of sp. gr. 1.225. When β -pinene is oxidised with alkaline permanganate at 0°C ., nopinonic acid and a glycol, m.pt. 75° — 77°C ., are produced. The glycol when further oxidised at 50°C ., does not yield any nopinonic acid.

The erythritol of terpinolene.— γ -Terpineol, m.pt. 69°C ., was converted into terpinolene by heating on the water-bath with anhydrous formic acid. The terpinolene was oxidised with permanganate, when erythritol, $\text{C}_{10}\text{H}_{18}\text{O}_4$, was produced, which melts at 149° — 150°C . after being dried at 100°C . and 145°C .

Hydrocarbons from various sources containing terpinene.—The terpinene obtained from terpinene dihydrochloride, from pinene or from sabinene hydrate, contains two modifications, (1) α -terpinene, $\Delta^{1,3}$ -dihydrocymene, and (2) a hydrocarbon which yields erythritol, m.pt. 237°C ., on oxidation. This latter substance cannot be terpinolene, and is styled γ -terpineol, and is, perhaps, $\Delta^{1,4}$ -dihydrocymene. Bihydrocarvylamine hydrochloride on dry distillation yields a hydrocarbon boiling at 174° — 178°C ., and giving on oxidation small amounts of $\alpha\alpha'$ -dihydroxy-methylisopropyladipinic acid, and erythritol, m.pt. 237°C ., indicating the presence of a little terpinene. If the phosphate is subjected to dry distillation instead of the hydrochloride, rather larger amounts of α -terpinene are formed. Carvenone was treated with phosphorus pentachloride dissolved in light petroleum. The liquid was treated with ice-water, and the oil dried and distilled. The products obtained from several experiments differed from each other in their physical properties and in their composition.

A sesquiterpene present in Siberian pine-needle oil.—A fraction boiling between 240° and 280°C . was obtained from a Siberian pine-needle oil, which contained borneol esters and a sesquiterpene. The fraction after boiling with potassium hydroxide solution was fractionated. The portion distilling between 250° and 270°C . was dissolved in glacial acetic acid and saturated with hydrogen chloride. The mixture was treated with water, and the oil which separated, solidified in a freezing mixture. After crystallising the solid from methyl alcohol, it melted at 79° — 80°C ., and had the composition, $\text{C}_{15}\text{H}_{24}\cdot 3\text{HCl}$. When treated with sodium acetate and acetic acid, the original sesquiterpene was liberated. This boiled at 260° — 268°C . with a little decomposition, had the sp. gr. 0.8725, and n_D^{20} 1.4903 at 20°C . The corresponding hydrobromide, $\text{C}_{15}\text{H}_{24}\cdot 3\text{HBr}$, melts at 84°C . The trihydrochloride is identical with that obtained by Burgess and Page from limene (this J., 1904, 455). A similar hydrocarbon has also been obtained from opoponax oil (this J., 1904, 1236).—F. SUDOX.

Cinnamic acids from various sources. E. Erlenmeyer. *Ber.*, 1909, 42, 2649—2655.

SYNTHETIC cinnamic acid can be resolved into two isomeric acids, the cinnamic acid of storax, or natural cinnamic acid, and heterocinnamic acid. These isomerides differ in their physical properties (see *Ber.*, 1909, 42, 502). The natural cinnamic acids obtained from storax, Peru balsam, Honduras balsam, *Alpinia malaccensis*, oil of cassia, and the acid obtained from natural allocinnamic acid by the action of acetic anhydride, all have similar properties, but contain small amounts of heterocinnamic acid. The methyl ester of natural cinnamic acid was distilled. The principal portion boiled below 271°C ., and yielded pure natural acid on hydrolysis. A very small portion distilled between 271° and 275°C ., and gave an acid resembling the natural acid, but with an odour like that of heterocinnamic acid. The residue [i.e., boiling above 275°C .] yielded the synthetic acid. The acid obtained from benzalacetone by the action of sodium hypochlorite consists of a mixture of natural cinnamic acid and heterocinnamic acid. When benzaldehyde, malonic acid, and glacial acetic acid are

heated, benzalmalonic acid is produced, and when heated yields allocinnamic acid and natural cinnamic acid. The acetic acid mother liquors yielded a benzalmalonic acid which gave heterocinnamic acid on heating. The ester produced by the condensation of acetoacetic ester and benzaldehyde, when hydrolysed, yields the synthetic acid similar to that produced by the Perkin synthesis. Commercial phenylpropionic acid as well as the phenylpropionic acid prepared from synthetic cinnamic acid yield natural cinnamic acid on reduction. The propionic acid prepared from heterocinnamic acid yielded in different experiments each of the three isomerides of cinnamic acid. Various samples of cinnamic acid prepared by the Perkin synthesis, under various conditions and with altered amounts of the reacting materials, were examined and found to be identical with the synthetic cinnamic acid.—F. SUDX.

Cinnamic acids; Dependence of the differences in the — upon the original substances from which they are prepared. E. Erlenmeyer. Ber., 1909, 42, 2655—2675.

BENZALDEHYDE can be separated into two fractions. Of these, the lower-boiling fraction yields natural cinnamic acid, whilst the higher-boiling fraction yields heterocinnamic acid. Natural cinnamic acid can be obtained as follows:—(1), from natural sources; (2), from synthetic cinnamic acid by crystallisation, distillation of the esters, fractional precipitation, or through phenylpropionic acid; (3), from natural benzaldehyde containing hydrocyanic acid, from commercial benzaldehyde after distillation, from the benzaldehyde obtained by the oxidation of natural cinnamic acid, and from the benzaldehyde recovered in the ordinary synthetic process; (4), from commercial benzaldehyde in the presence of copper or copper acetate. It can also be made by methods already indicated (see preceding abstract). Synthetic cinnamic acid can be prepared:—(1), from commercial benzaldehyde; (2), from benzaldehyde free from hydrocyanic acid; (3), from benzaldehyde obtained by the oxidation of natural cinnamic acid at a high temperature and without neutralising the alkali; (4), from blood albumin; (5), from heteropropionic acid; (6), from synthetic β -bromocinnamic acid; (7), from benzalacetone; (8), from a mixture of the more or less soluble benzalmalonic acids; and (9), by mixing heterocinnamic acid and the α -cinnamic acid of storax. Heterocinnamic acid can be made:—(1), from synthetic cinnamic acid by various methods of separation; (2), from heterophenylpropionic acid; (3), from heterodibromocinnamic acid; (4), by the action of cold concentrated sulphuric acid on the synthetic acid and the natural acid; (5), from the heterobenzaldehyde obtained from heterocinnamic acid itself; (6), from the heterobenzaldehyde which is obtained by distillation from synthetic and natural benzaldehyde; (7), from the more easily soluble benzalmalonic acid. As the crystals of these three cinnamic acids are too small to be measured, the corresponding dibromides were prepared, and their measurements were found to be different. Measurements of the conductivity show that the acids differ slightly in strength. The author concludes that the differences observed in the properties of these acids is due to isomerism.—F. SUDX.

Boric acid; Volatilisation of —, by ignition in a stream of carbon tetrachloride and methyl alcohol vapours. Jannasch and Harwood. See VII.

Butyric and formic esters [esters]; Alcohol for use in making —. Oil, Paint, and Drug. Rep., Aug. 16, 1909, [T.R.]

THE U.S. Internal Revenue Bureau has refused to permit the use of denatured alcohol in the manufacture of butyric and formic esters, on the ground that such esters are chiefly used as flavouring materials in beverages, and also because a certain amount of undecomposed alcohol remains in the finished product.

The original denatured alcohol law barred this class of preparation from the benefit of the statute, but the supplemental law was enacted for the specific purpose, among others, of permitting "definite chemical substances" to be

made with the use of denatured spirits. Under this supplemental statute applications were recently made for authority to use denatured spirits in the production of these esters, but the request has been refused.

PATENTS.

Iron albuminate preparation. E. Laves, Hanover, Germany. U.S. Pat. 929,452, July 27, 1909.

A product, which remains stable in aqueous solution is prepared by mixing 30 kilos. of basic ferric chlorid solution with 200 litres of water and adding 8 kilos. of albumin dissolved in 200 litres of water; to the resulting ferric albuminate are then added 6 kilos. of ferri saccharate and 300 grms. of alkali. (See also this J. 1907, 33, 637).—W. P. S.

Azo dyestuffs [medicinal] from p-aminophenylarsinic acid. Process for preparing —. Act.-Ges. f. Anilinfabr. Ger. Pat. 212,018, June 28, 1907.

THE diazo compound of p-aminophenylarsinic acid is combined with naphthols, aminonaphthols, naphthyl amines, or their sulphonic acids. The resulting dyestuff are said to be applicable to medicinal uses.—T. F. B.

Phenylarsenious oxide and arsenobenzene; Process for preparing derivatives of —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 212,205 Feb. 5, 1908. Addition to Ger. Pat. 206,057, April 1, 1907 (this J., 1909, 328).

HOMOLOGUES and carboxylic acids of p-aminophenylarsinic acid (with the exception of the N-dialkyl derivatives, which are disclaimed, being already known) are converted into the corresponding derivatives of phenyl arsenious oxide and arsenobenzene by reduction. The products are less toxic and stronger in their action toward trypanosomes than the arsenic acid derivatives from which they are obtained. These latter are prepared by heating o- or m-toluidine or p-xylidine with arsenious acid; the products can then be substituted in the amino groups, and the methyl groups can also be oxidised to carboxylic acid groups.—T. F. B.

Salts of disulpho-acetaldehyde sulphylic acid; Process for preparing —. Chem. Fabr. von Heyden A.-G. Ger. Pat. 212,070, July 11, 1908.

ACETALDEHYDE sulphonylates can be used as external medicaments, but they develop a mercaptan-like odour. The salts of disulphoacetaldehyde sulphylic acid do not possess this disadvantage; they may be prepared by reducing sulphurous acid, free or combined, by means of suitable reducing agents, in presence of salts of acetaldehyde-disulphonic acid.—T. F. B.

Isobornyl esters from pinene hydrochloride; Processes for manufacturing —. J. H. Lütkehermölle, Brussels. Eng. Pat. 14,752, July 11, 1908. Under Int. Conv. July 12, 1907.

SEE Fr. Pat. 392,247 of 1908; this J., 1909, 41.—T. F. B.

Borned and bornol esters from pinene; Process for making —. G. Austerweil, Neuilly, France. Eng. Pat. 18,049, Aug. 27, 1908. Under Int. Conv., May 12, 1908.

SEE Fr. Pat. 392,159 of 1908; this J., 1909, 41.—T. F. B.

Pharmaceutical compound [Mercuric p-aminophenylarsinate]; Manufacture of a —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,428, Nov. 13, 1908.

SEE U.S. Pat. 914,108 of 1909; this J., 1909, 442.—T. F. B.

Tobacco extract; Manufacture of concentrated —. C. F. Gloystein, Henderson, Ky., U.S.A. Eng. Pat. 24,742, Nov. 17, 1908. Under Int. Conv., Jan. 10, 1908.

SEE U.S. Pat. 899,865 of 1908; this J., 1908, 1080.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Toning of P.O.P. prints: Sulphide — H. E. Smith. Phot. J., 1909, 49, 330—332.

THE following simplified process is recommended for the sulphide toning of prints on "printing-out" papers:—The prints are transferred from the frame to a solution of ammonium phosphate made alkaline with ammonium carbonate, where they remain about ten minutes, when they are fixed, without washing, in a thiosulphate solution, also made alkaline by ammonium carbonate. After thoroughly washing, they are treated with the thiomolybdate solution as before (see this J., 1908, 833).—T. F. B.

PATENTS.

Photographic printing: Method of preparing solutions used in the gum bichromate process for —. See. Anon. La Photographie des Couleurs, Antwerp, J. Sury, Wyneghem, and E. Bastyns, Antwerp. Eng. Pat. 27,686, Dec. 19, 1908.

ALL the materials necessary for the preparation of paper for the "gum bichromate" process, are mixed in powder form, agglomerated if desired by a suitable binding medium, so that the solution may be prepared at once and as required. The following example is given:—Colouring matter, 20 parts; gum arabic, 20 parts; white sugar, 1 part; potassium bichromate, 4 parts. For use, 1 gm. is dissolved in 2 c.c. of water. For making colour photographs, three different coloured mixtures are prepared, and the picture prepared by superimposition.—T. F. B.

Three-colour screens for photography: Process of making —. J. Bamber. Fr. Pat. 399,320, Feb. 11, 1909. Under Int. Conv., Feb. 13, 1908.

SEE Eng. Pat. 3252 of 1908; this J., 1908, 1132.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives: Report of the Chief Inspector of — for Cape Colony, for the year ending Dec. 31st, 1908.

THE following table gives the amounts and values of explosives imported into the Colony for the years 1907 and 1908:—

	1908.	1907.	1908.	1907.
	lb.	lb.	£	£
Dynamite: blasting compound and powder	4,374,050	4,053,190	149,039	133,807
Gunpowder	41,602	51,658	4,437	4,807
Nitrocotton	237,449	196,146	16,620	13,689
Fuse	—	—	9,914	13,903
Detonators	—	—	13,595	12,312

Of the above trade the United Kingdom takes 59 per cent., Germany, 34 per cent., Norway 5·3 per cent., Belgium 1·6 per cent., the small remaining amount coming from various other countries. 1834 samples of explosives were examined, and of this total, 1599 were blasting gelatin (the chief explosive imported), of which 1478 were passed, 66 rejected, and 55 returned as doubtful. The output of the Cape Explosives Factory, at Somerset West, during the year, was as follows:—

	Tons (2000 lb.).
Dynamite	1,605
Blasting gelatin	4,592
Gelignite	2,968
Gelatin dynamite	12·5
Total	8,577·5

The above total represents an increase of 459 tons on the previous year. The consumption of dynamite is

decreasing rapidly, blasting gelatin taking its place. Some experiments were carried out to ascertain whether local conditions had any effect on the heat test of explosives. It is well known that ozone acts upon the potassium iodide starch-paper producing discoloration, similar to that obtained in testing an explosive. It was found that heat-test papers exposed in a pine wood became discoloured within 10 minutes, whilst those placed in the open country, in the same locality, remained unaltered.

—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.**APPARATUS.****PATENT.**

Gas analysis: Apparatus for —. G. V. Cederborg. Denver, Colo. U.S. Pat. 928,027, July 13, 1909.

THE apparatus consists of a combination of two pairs of chambers, one chamber of one pair being movable. Fixed tubes connect one pair, and a flexible tube connects the opposite pair of chambers. The first chambers and tubes contain a sealing liquid and are provided with a pipe for supplying the gases to be analysed. The introduction of the latter is regulated by automatic mechanism, and means are provided for the production of a vacuum. A tank containing an absorbing liquid is interposed between the two sets of chambers, so that the gases may be directed from the first pair of chambers, through the tank into the opposite pair of chambers, the volume of unabsorbed gases being registered in the movable chamber.—O. R.

INORGANIC—QUANTITATIVE.

Calcium and magnesium: Quantitative separation of —. W. C. Blasdale. J. Amer. Chem. Soc., 1909, 31, 917—922.

As the result of experiments with the mixed carbonates of the two metals, in proportions ranging between pure calcite and pure magnesite, the author finds that the occlusion of magnesium oxalate by the calcium precipitate may be obviated by adopting the following method of procedure. When the amount of magnesium does not greatly exceed that of the calcium present, the slightly acid solution, containing 0·6 gm. of the sample and 3·5 gm. of ammonium chloride, diluted to 300 c.c., is heated to boiling, when 1 gm. of oxalic acid is added. The liquid is then neutralised, during a period of five minutes, with a 1 per cent. solution of ammonium hydroxide, and allowed to stand for an hour before filtering. In the presence of relatively large quantities of magnesium, the precipitation is best effected in two stages, in the first of which only sufficient oxalic acid is used to combine with all the calcium, the liquid being then neutralised and allowed to stand for ten minutes, after which the remainder of the oxalic acid is added, the solution made alkaline, and allowed to stand for an hour.—W. E. F. P.

Phosphoric acid: Quantitative decomposition of metallic phosphates, with volatilisation of the —. P. Jannasch and W. Jilke. J. pr. Chem., 1909, 80, 113—127.

ALL the phosphates of this group, except that of aluminium, are completely decomposed by heating in a stream of carbon tetrachloride vapour, and the volatilised phosphorus chlorides formed can be collected in water and the phosphoric acid determined. The substance (0·3 gm., with or without admixture with powdered quartz) is placed in a quartz boat in a combustion tube drawn out at the further end, in which has been previously placed a loose plug of glass wool about 15 cm. long, the object of which is to condense the volatile metallic chloride formed. The carbon tetrachloride is volatilised from a large test-tube immersed in a bath of sulphuric acid at 200° C.; this test-tube has ground into it a tap-funnel with a capillary exit tube and a T-connection below the stopcock so that a stream of carbon dioxide or other

indifferent gas can be passed through the apparatus, and the rate of introduction of carbon tetrachloride can be varied at will. The drawn-out end of the combustion tube is connected with a tube passing through the neck of a flask containing water; the neck of the flask forms an angle of 135° with the combustion tube, and the connecting tube ends above the water in the flask. The flask is again connected with a "bull-stair" of ten or twelve bulbs, also containing water. The substance is first heated to about 200° C. in a slow stream of carbon dioxide till all water is expelled from it, and from the combustion tube; then the carbon dioxide is stopped and carbon tetrachloride vaporised, the temperature being raised to dull redness. With ferric phosphate, this suffices, but with the other phosphates of the group, an hour at this temperature and an hour and a half at bright redness are needed. When decomposition is complete the carbon tetrachloride is shut off, the carbon dioxide started, and the glass wool plug is gently heated till the whole of the carbon tetrachloride which may have condensed on it, along with any associated phosphorus compound, is driven forward into the receiver. The phosphorus in the receiver is present chiefly, though not entirely, as phosphoryl trichloride.

—J. T. D.

Vanadic acid; Quantitative decomposition of vanadium compounds with volatilisation of the —, by ignition in a stream of carbon tetrachloride vapour. P. Jannasch and H. F. Harwood. *J. pr. Chem.*, 1909, 80, 127—134.

On heating alkali-metal vanadates, and vanadium-containing minerals (vanadinite, endlicheite, carnotite) in a stream of carbon tetrachloride vapour (see preceding abstract), the vanadium is completely volatilised, and can be collected in dilute nitric acid in the receiver. The solution is afterwards reduced by means of sulphurous acid, and the vanadium determined by permanganate. If mixtures of alkali vanadate and phosphate be intimately mixed with four times as much common salt, and then heated in carbon tetrachloride for four or five hours at a temperature just insufficient to soften the combustion tube, the whole of the vanadium and phosphorus are found in the receiver; and after determining the vanadium by reduction and titration with permanganate, the phosphorus can be precipitated and determined. Alkali phosphates, which alone are unaffected by carbon tetrachloride, are completely decomposed if previously mixed with four times their weight of sodium chloride.—J. T. D.

Copper sulphate [and copper salts]; Gravimetric determination of —. P. B. Dallimore. *Pharm. J.*, 1909, 83, 271.

This new method depends on the fact that hypophosphorous acid reduces copper salts to metallic copper, just as mercurial salts are reduced to metallic mercury. Three grms. of the salt are heated on the water-bath, with constant stirring, with an excess of hypophosphorous acid diluted with an equal volume of water. Previous solution of the copper sulphate in water is not needful. In a few minutes the metal is quantitatively precipitated. The clear liquid is decanted, the precipitate collected, washed first with water, then with alcohol, and finally with ether. After drying for a few moments in a current of air it is transferred to a tared porcelain crucible, ignited until constant in weight, and weighed as cupric oxide.—J. O. B.

Aluminium; Analysis of —. Direct determination of metallic aluminium. E. Kohn-Abrest. *See X.*

Nitrates; Determination of — in water containing chlorides. R. Marcille. *See XVIII.*

ORGANIC—QUALITATIVE.

Calcium succate in milk; Detection of —. S. Rothenfusser. *See XVIII.*

ORGANIC—QUANTITATIVE.

Phosphorus; Indirect colorimetric determination of — with uranium acetate and potassium ferrocyanide. R. B. Gibson and C. Estes. *J. Biol. Chem.*, 1909, 6, 349—357.

Is the method proposed for the determination of phosphorus in organic substances, the phosphorus is obtained in solution by fusing the substance with alkali and nitrate in the usual way; an excess of uranium acetate solution is then added to the solution and the uncombined uranium is determined colorimetrically after filtering off the precipitated uranium phosphate. After the substance has been fused with a mixture containing 4 parts of sodium hydroxide to 1 part of potassium nitrate, the melt is dissolved in water, the solution is acidified with sulphuric acid, boiled to remove nitric oxide, and diluted to a definite volume. Or, the substance may be digested with sulphuric acid, as in the Kjeldahl process, and the colourless solution then diluted. The phosphoric acid is determined in the dilute acid solution as follows:—*Reagents required.* (1). Standard uranium acetate solution containing 35.461 grms. of uranium acetate per litre and carefully standardised by titration (with ferrocyanide as indicator) against a disodium phosphate solution equivalent to 0.005 gm. of phosphorus pentoxide per c.c.; Fifty c.c. of this uranium acetate solution are diluted to 1000 c.c. for the colorimetric determinations. (2). Sodium acetate-acetic acid solution containing 20 grms. of sodium acetate and 100 c.c. of 30 per cent. acetic acid per litre. *Process.*—An aliquot portion of the phosphoric acid solution under examination is placed in a flask, a piece of litmus paper is added, and ammonia (sp. gr. 0.90) is run in until the solution is alkaline. The solution is boiled until the litmus paper turns red and the whole is concentrated to a volume of about 15 c.c. Five c.c. of the sodium acetate solution and 50 c.c. of the dilute uranium acetate solution are added, the mixture is diluted to exactly 100 c.c. and allowed to stand over-night. A solution containing 50 c.c. of the uranium acetate solution and 5 c.c. of the sodium acetate solution in 100 c.c. is similarly made up for comparison. The precipitated uranium phosphate is then removed by filtration and 10 c.c. of the clear filtrate are placed in a 100 c.c. measure together with 1.5 c.c. of 10 per cent. potassium ferrocyanide solution. The red-brown colour is usually fully developed in the course of 2 minutes, but there may be sufficient sulphate present to delay the development of the colour for 15 minutes. Water is next added to make the volume up to 100 c.c., and the coloration is compared with that obtained on similarly treating 10 c.c. of the comparison solution. The colour is permanent for several hours. Nitric acid and nitrates, and, to a less extent, chlorides, intensify the coloration, a maximum and constant point being reached at comparatively low concentrations of the salts. Sulphates delay the development of the colour slightly and in high concentrations have an inhibiting action. If the above directions be followed, the results obtained are, however, stated to be quite trustworthy.—W. P. S.

Formaldehyde; Determination of — in commercial solutions. O. Blank and Finkenbeiner. *Pharm. Zeit.*, 1909, 54, 624.

FORMALDEHYDE is oxidised into formic acid by means of hydrogen peroxide, and the acid thus formed is titrated. Three grms. of the solution, or 1 gm. of solid formaldehyde polymer, are treated in a capacious Erlenmeyer flask with 25 to 30 c.c. of twice normal standard sodium hydroxide solution; after 3 minutes 50 c.c. of pure (neutral) 2.5 to 3 per cent. hydrogen peroxide solution are run in, through a funnel, to prevent loss by spurring. After standing for 2 or 3 minutes, the funnel is washed down, and the free sodium hydroxide remaining is titrated back with twice normal sulphuric acid with litmus indicator. With solutions containing less than 30 per cent. of formaldehyde, the oxidation-mixture should be allowed to stand for 10 minutes before titration. The results obtained are more accurate than those of the processes of the Japanese or German pharmacopœias.—J. O. B.

Baku petroleum; Filtration of — through fuller's earth. [Separation of naphthenes, dinaphthenes, paraffins, &c., from terpenes, and unsaturated hydrocarbons. V. F. Herr. See III.

Valuation of dark blood albumin for the clarification of tanning extracts. J. Jedlicka. See XIV.

Negative adsorption, and estimation of the swelling action of acids on hide powder and pelt. E. Stiasny. See XIV.

Glucose in leather; Determination of —. H. G. Bennett. See XIV.

Starch; Direct determination of —. G. Baumann. See XVI.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Ketones; Synthesis of fatty unsaturated —. F. Bodroux and F. Taboury. Comptes rend., 1909, 149, 422—423.

WHEN ketones containing the grouping, COCH_3 , are heated with calcium carbide, condensation takes place with the elimination of water and the formation of an unsaturated ketone. Propanone forms mesityl oxide, isophorone, and xylitene. Butanone gives a ketone, $\text{C}_8\text{H}_{14}\text{O}$, which is a colourless liquid, boiling at 164°C . at 760 mm., and with the sp. gr. 0.853 at 25°C . The semicarbazone melts at 114°C .— 115°C . When reduced with hydrogen at 180°C . in the presence of nickel, the ketone is converted into a saturated ketone, which boils at 153°C .— 155°C . at 760 mm., and has the sp. gr. 0.820 at 24°C . The semicarbazone melts at 102°C . The unsaturated ketone is probably methyl-3-heptene-3-one-5. Methyl-2-pentanone-4 yields trimethyl-2,4,8-nonene-4-one-6, which is a colourless liquid with a pleasant odour, boiling at 217°C .— 219°C . at 760 mm., with the sp. gr. 0.838 at 18°C ., and with n_D^{20} 1.4491 at 18°C . The oxime boils at 143°C .— 145°C . at 17 mm. The ketone is slowly reduced by hydrogen at 280°C . in the presence of nickel, and trimethyl-2,4,8-nonanone-6 is produced. This substance boils at 210°C .— 212°C . at 760 mm., has the sp. gr. 0.820 at 18°C ., and n_D^{20} 1.4262. The oxime boils at 138°C .— 140°C . at 15 mm. Mesityl oxide yields a ketone, $\text{C}_{12}\text{H}_{18}\text{O}$. This is a yellow liquid with an unpleasant smell. It boils at 238°C .— 242°C . at 741 mm., and has the sp. gr. 0.937 at 17°C . It forms two semicarbazones, one gummy, the other melting at 165°C .— 166°C .—F. SHUX

Carbonic acid; Decomposition of — by ultraviolet rays. H. Herchfinkel. Compt. rend., 1909, 149, 395—396.

ULTRAVIOLET light decomposes dry carbon dioxide at the ordinary temperature into carbon monoxide and oxygen. In confirmation of Ramsay and Cameron's results the author also finds that carbon monoxide is produced by the action of radium emanation on carbon dioxide.—J. C. C.

Properties of radium. Extract from Address of Prof. J. J. Thomson. Brit. Assoc., Winnipeg, 1909.

BEFORE the discovery of radium it was supposed that the supplies of heat furnished by chemical changes going on in the earth were quite insignificant, and that there was nothing to replace the heat which flows from the hot interior of the earth to the colder crust. Now when the earth first solidified it only possessed a certain amount of capital in the form of heat, and if it is continually spending this capital and not gaining any fresh heat it is evident that the process cannot have been going on for more than a certain number of years, otherwise the earth would be colder than it is. Lord Kelvin in this way estimated the age of the earth to be less than 100 million years. Though the quantity of radium in the earth is an exceedingly small fraction of the mass of the earth, only amounting, according to the determinations of Strutt and Joly, to about five grms. in a cube whose side is 100 miles; yet the

amount of heat given out by this small quantity of radium is so great that it is more than enough to replace the heat which flows from the inside to the outside of the earth. This, as Rutherford has pointed out, entirely vitiates the previous method of determining the age of the earth. Strutt has shown that if radium behaves in the interior of the earth as it does at the surface, rocks similar to those in the earth's crust cannot extend to a depth of more than forty-five miles below the surface.

Though the discovery of radio-activity has taken away one method of calculating the age of the earth it has supplied another. The gas helium is given out by radio-active bodies, and since, except in beryls, it is not found in minerals which do not contain radio-active elements, it is probable that all the helium in these minerals has come from these elements. In the case of a mineral containing uranium, the parent of radium in radio-active equilibrium with radium and its products, helium will be produced at a definite rate. Helium, however, unlike the radio-active elements, is permanent and accumulates in the mineral; hence if we measure the amount of helium in a sample of rock and the amount produced by the sample in one year we can find the length of time the helium has been accumulating, and hence the age of the rock. This method, which is due to Strutt, may lead to determinations not merely of the average age of the crust of the earth, but of the ages of particular rocks and the date at which the various strata were deposited; he has, for example, shown in this way that a specimen of the mineral thoriumite must be more than 240 million years old.

The physiological and medical properties of the rays emitted by radium is a field of research in which enough has already been done to justify the hope that it may lead to considerable alleviation of human suffering. It seems quite definitely established that for some diseases, notably rodent ulcer, treatment with these rays has produced remarkable cures; it is imperative, lest we should be passing over a means of saving life and health, that the subject should be investigated in a much more systematic and extensive manner than there has yet been either time or material for. Radium is, however, so costly that few hospitals could afford to undertake pioneering work of this kind; fortunately, however, through the generosity of Sir Ernest Cassel and Lord Iveagh, a Radium Institute, under the patronage of his Majesty the King, has been founded in London for the study of the medical properties of radium, and for the treatment of patients suffering from diseases for which radium is beneficial.

Trade Report.

Foreign Patents in England.

THE Patents and Designs Act, 1907, came into force on Aug. 28 of last year so far as regards Section 27, which deals with the revocation of patents worked outside the United Kingdom. The Act gives power to any person to apply to the Comptroller-General for the revocation of a patent, after it has been in existence four years, on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside the United Kingdom. During the year which has elapsed since Section 27 came into force, 69 applications for revocation of foreign patents have been made to the Comptroller-General. In 10 cases only were patents revoked by that official. In four of these cases the patentees appealed to the High Court, and in two cases relating to improvements in electric arc lamps, the decision of the Comptroller-General was reversed, evidence having been adduced which was not placed before the Comptroller-General, the effect of which was to show that the patented process was being adequately carried on in this country. The two other appeals to the High Court were unsuccessful,

so that the number of patents finally revoked was eight. Those revoked related to the following articles or processes:—Artificial stone slabs and tiles (two patents), sewing machines, umbrellas, adhesive stays or fastening straps used in box making, the lubrication of gig-mills, a steam motor-car, and locks. In another case, that of a patent connected with the manufacture of china clay, the Comptroller-General made a conditional order of revocation. The Act gives him power to revoke a patent either (a) forthwith, or (b) after such reasonable interval as may be specified in his order, unless in the meantime it is shown to his satisfaction that the patented article or process is manufactured or carried on within the United Kingdom to an adequate extent. In the case in question the patent was ordered to be revoked at the end of the present year unless in the meantime the requisite proof of "adequate" working is given. Of the other applications, four were dismissed by the Comptroller-General, in addition to the two cases in which Mr. Justice Parker reversed the decisions of that official. Twenty-eight applications were withdrawn after they had been lodged, in many cases, it is understood, because evidence was forthcoming of "adequate" working. There remain 26 cases which are still officially pending, although in one or two instances the applications have lapsed through effluxion of time.

In the first seven months of this year there were 17,869 patents applied for—an increase of 1,566 as compared with the corresponding period of 1908, though

only an increase of 319 upon the larger figures for the first seven months of 1907. Sixteen fewer patents were taken out in 1909 by American subjects than in 1908 and 331 fewer than in 1907. The decrease in German patents has been consistent—2,000 in 1907, 1,822 in 1908, and 1,735 in 1909, and the same may be said of the Austrian patents—253, 234, and 192 respectively. French patents, which were 620 in 1907 and 670 in 1908, decreased to 560 in 1909.

French patents for processes. Chem. and Drug., Aug. 21, 1909.

The Conseil d'Etat has just given a decision regarding the question of the possibility or legality of taking out French patents for processes employed in manufacturing pharmaceutical preparations. It has long been laid down that the medicament itself—that is, the remedy for human suffering—cannot be patented. This particular case dealt with an application for the patenting of a process of manufacture of a fatty substance extracted from bacterial bodies which is suitable for therapeutic use. This process, it was claimed, would produce various remedies according to the nature of the bacteria treated. The Government Commissary objected to any distinction being made between the remedy and the method of its manufacture. To patent the process was tantamount to patenting the remedy itself. The Conseil d'Etat adopted this view, and dismissed the appeal for refusal of patent.

Chemical trade of Japan in 1907 and 1908: Foreign. Chem.-Zeit., 1909, 33, 930.

Imports.

	1907.		1908.	
	Quantity.	Value.	Quantity.	Value.
Drugs, chemicals, &c.:		£		£
Acetic acid (4)	713	20,500	—	21,400
Bismuth subnitrate	—	18,000	—	8200
Essential oils	—	24,500	—	30,500
Phosphorus	5901	56,300	4289	37,900
Potassium chloride	3651	121,200	2638	87,900
Potassium cyanide	607	37,200	325	22,200
Calined soda	15,101	89,500	14,516	82,500
Caustic soda	10,168	119,600	9385	114,400
Drugs, &c., not specially defined	—	561,200	—	501,800
Dyestuffs and pigments:				
Aniline dyestuffs	3328	252,300	2747	207,300
Gold, silver, and platinum solutions	—	27,800	—	21,700
Indigo, dry, natural	205	76,600	51	18,500
" synthetic	1381	523,300	1418	534,700
Oil colours	1599	42,100	1322	34,500
Antiseptic colours	—	33,300	—	25,600
Dyestuffs not specially defined	—	203,300	—	207,300
Metals:				
Aluminium	1101	184,100	450	43,100
Lead in pigs, ingots, and sheets	4382	87,100	4612	99,800
Copper tubes	563	49,700	561	56,900
Nickel	257	45,400	520	86,000
Tin in blocks, ingots, and sheets	805	142,300	750	100,300
Zinc, block zinc, and zinc plate	8111	238,100	8828	209,100
Metals not specially mentioned	—	331,000	—	207,800
Oils, fats, and waxes:				
Kerosene	70,165,626	1,462,300	72,207,833	1,542,000
Lubricating oils	5759	61,500	8106	94,500
Paraffin wax	5706	152,600	7654	210,700
Other oils, fats, and waxes	—	263,000	—	409,700
Fertilisers:				
Ammonium sulphate	62,152	839,900	66,445	808,000
Bones	19,548	92,300	18,430	76,500
Bone manures	11,426	75,400	8987	49,800
Dried fish	9358	57,700	4489	26,400
Fish guano	17,873	147,800	16,343	132,800
Oil cakes	405,814	2,148,000	527,076	2,499,000
Phosphorite	127,262	398,200	119,189	342,100
Superphosphate	24,237	89,000	1420	4200
Sodium nitrate	5892	65,000	5887	62,200
Manures not specially defined	—	118,300	—	182,400
Various:				
Wood pulp for paper making	15,964	168,100	18,338	185,300
Dynamite and other explosives	—	86,400	—	55,800
Perfumes and cosmetics	—	59,500	—	49,200
Rubber and gutta-percha, raw and in blocks	371	106,300	517	118,700
Celluloid in blocks and bars	118	32,700	265	68,200
Portland cement	45,046	136,500	16,377	43,000
Sugar	—	2,049,500	—	2,020,700

(4) The import duty on acetic acid has recently been increased in order to protect the home industry.

Exports.

	1907.		1908.	
	Quantity.	Value.	Quantity.	Value.
Drugs, chemicals, &c. :—		£		£
Camphor	1820	513,200	1076	210,600
Camphor oil	1113	37,600	750	21,700
Ginseng	—	31,900	—	28,600
Menthol crystals	39	34,500	32	26,900
Peppermint oil	—	29,900	—	30,500
Patent medicines	—	72,200	—	59,000
Sulphur	31,136	11,400	30,250	105,900
Drugs, &c., not specially defined(2)	—	160,300	—	151,000
Various :—				
Antimony and antimony articles	—	38,400	—	25,100
Fish oils	21,466	303,700	21,119	247,900
Vegetable wax	2155	109,300	2,272	96,500
Other oils and waxes	—	47,400	—	53,600
Portland cement	28,189	95,900	33,420	97,600

(2) These include sulphuric acid, bleaching powder, and potassium iodide, the exports of which for 1907 were 3327 tons (£22,950), 313 tons (£4150), and 309 cwt. (£10,390) respectively.

—A. S.

German Customs tariff ; Modifications in the —. Board of Trade J., Aug. 19, 1909.

The following statement shows some of the modifications of the German Customs Tariff resulting from the financial measures which have recently received legislative sanction :—

grinding, and by boring or drilling. IV. Hardness determined by resistance to shearing. V. Hardness and tenacity. VI. New method for estimating hardness. VII. Hardness, and resistance to splitting. VIII. Mohs' scale of hardness. IX. Further investigations of minerals and metals. X. Hardness and solubility. XI. Hardness

Tariff No.	Articles.	Rate of duty.	
		Former	New
		Mks. per 100 kilos.	Mks. per 100 kilos.
277	Acetic acid, crystallised acetic acid, and acetic anhydride; the immediate receptacle and contents weighing—		
	20 kilos. or more	12	42
	Less than 20 kilos.	48	78
347	Ether of all kinds, simple and compound; also cognac oil (grape oil)—		
	In casks	160	275
	In other receptacles	240	350
	NOTE.—The Bundesrat is empowered to reduce the rates of 275 marks and 350 marks prescribed in No. 347 to 225 marks and 300 marks respectively.		
356	Perfumery and cosmetics (e.g., hair dye, face washes and other toilet preparations) containing ether or alcohol; head, mouth or tooth washes containing ether or alcohol; perfumed or fragrant extracts (essences, tinctures) and waters containing ether or alcohol; toilet vinegar	300	400
	NOTE.—The Bundesrat is empowered to reduce the rate of 400 marks prescribed in No. 356 to 350 marks.		

Books Received.

TRINIDAD LAKE ASPHALT. PREVITÉ AND CO., 2, Crosby Square, London, E.C. 1909.

AMPHLET containing 15 pages of subject matter, and two illustrations. The matters treated of are as follows :—
I. The concession and its statistics. II. The pitch lake. III. Crude and purified Trinidad lake-asphalt, with analyses. IV. The crude and purified article compared. V. The bitumen in the Lake-asphalt. VI. The mineral matter in the asphalt. VII. The insoluble non-bituminous organic matter. VIII. The specific gravity, and melting point. IX. The refined Trinidad lake-bitumen. X. Its manufacture. XI. Fluxes to be used. XII. Analyses of two standard Lake bitumens.

Die HÄRTE DER FESTEN KÖRPER UND IHRE PHYSIKALISCH-CHEMISCHE BEDEUTUNG. Von Dr. VIKTOR PÖSCHL. Theodor Steinkopff's Verlag. Dresden. 1909. Price M. 2.50.

70 volume, containing 84 pages of subject matter, with our illustrations and one table; also an alphabetical dex of names of authors. The subject matter is arranged and classified as follows :—I. Older methods for the determination of hardness. II. Hardness, as determined by Hobeln, and Auerbach. III. Determination by

and chemical composition. XII. Hardness, chemical composition, crystalline form, and density.

ANNUAL STATEMENT OF THE TRADE OF THE UNITED KINGDOM WITH FOREIGN COUNTRIES AND BRITISH POSSESSIONS, 1908. Volume II. [Cd. 4,784]. Wyman and Sons, Fetter Lane, E.C. Price 3s. 5d.

This volume contains abstract and detailed tables of imports from, and exports to, each country; abstract and detailed tables of imports and exports at each port; tables showing the amount of Customs revenue received at each port or place; details of the transshipments under bond of certain articles; an account of the quantities of articles liable to Customs duties remaining in bond, and details of the transshipments of free goods on through bills of lading (see also this J., 1909, 820).

STATISTICAL ABSTRACT FOR THE UNITED KINGDOM IN EACH OF THE LAST FIFTEEN YEARS FROM 1894 TO 1908. [Cd. 4,805.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 8d.

This publication embodies in a concise form statistical data available from official sources in regard to the finances, trade, shipping, agriculture, fisheries, railways, tramways, banking operations, &c., of the United Kingdom during the past fifteen years.

*New Books.

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Belluomini G.: Manuale pratico del caldaio costruttore di caldaie a vapore e di altri apparecchi industriali. 2a ediz. Manuali Hoepli. Milano, 166 fig., p. x, 248. 1909. Lire 3.

Bericht der Versuchsstation f. Zuckerindustrie in Prag f. d. J. 1908. XIII. (X, 182 S. m. Abbildgn. u. 2 Tab.) Lex. Svo. F. Rivnác, Prag, 1909. M 3.—

Birkenbach, Dr. L.: Die Untersuchungsmethoden des Wasserstoffperoxyds. (142 S.) 1909. M. 4.40; geb. in Leinw. M. 5. F. Enke, Stuttgart.

Brown, William: Mechanical Stress and Magnetisation of Iron. Part 2. Being the Scientific Proceedings of the Royal Dublin Society. Vol. 12. New series, No. 17. London. 1909. Williams and Norgate. 1s.

Cardier, J.: Leçons sur les alliages métalliques. Gr. in-8 (25/16) av. 124 fig. et 24 pl. Vuibert et Nony. Paris. 1909. 12 fr.

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Curtler, W. H. R.: A Short History of English Agriculture. Cr. Svo, pp. 380. London. 1909. Clarendon Press. Net 6s. 6d.

Da Ponte, M.: Distillazione delle vinacce, del vino, delle frutta fermentate e di altri prodotti agrari. Fabbricazione razionale del cognac, estrazione del cremore di tartaro, utilizzazione di tutti i residui della distillazione, analisi dei mosti, vini e tartari: preventivi, piante, statuti, legge italiana sugli spiriti. 3a ediz. interamente rifatta. Manuali Hoepli. Milan., 169 fig., p. xv, 826. 1909. Lire 8.50.

Directory of the Chemical Industries of the World, Germany excepted. Completely revised edition. 1909. Berlin: W. Verlag v. R. Mückenberger, Dörnbergstr., F.

Fayol, Amédée: Le Caoutchouc. Gr. in-8. Berger, Paris. 1909. 7 fr. 50.

Ferrari Domenico: Il trattamento naturale ed artificiale delle acque di fognia secondo i moderni sistemi di epurazione biologica. Bologna. Svo. con tav. 1909. Lire 25.

Ferrari Egidio: Corso teorico-pratico di enologia (Tecnica enologica-Economia enologica-Commercio dei vini-Alterazione dei vini-Analisi dei vini-Fabbricazione dell'aceto). Torino, Svo fig., p. xi, 554. 1909. Lire 6.50.

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Harris, Gilbert Dennison, Maury, J.C., and Reincke, L.: Rock salt, its origin, geological occurrences and economic importance in the State of Louisiana, together with brief notes and references to all known salt deposits and industries of the world: made under the direction of the State Experiment Station. Baton Rouge, La. [Louisiana Geological Survey] 1908, [1909.] 11 + 259 p. il, pls. maps, diagrs., Svo. (Louisiana Geological Survey, bull.) pap. (Add. pubs. for price.)

Thering, Geh. Reg.-R. Albr. v.: Die Gasmaschinen. Berechnung, Untersuchung, u. Ausführg. der m. gasförm. u. flüss. Brennstoffen betriebenen Explosions- u. Verbrennungskraftmaschinen. II. Tl. Die Verbrennungsmaschinen. Zugleich 3. völlig umgearb. Aufl. der deutschen Ausg. des Werkes "Die Gasmaschinen" v. Gust. Chauveau. (X, 470 S. m. 341 Fig. u. 8 Taf.) Lex. Svo. Leipzig, W. Engelmann. 1909. M. 24.—; geb. in Leinw. M. 25.80.

Jolles, Gewerbemuseums-Doz. Dr. Adf.: Die Nahrungsmittel, ihre Herstellung u. Verfälschung. In gemeinfassl. Darstellg. Mit e. Pilzmerkblatt. (VIII, 209 S.) Svo. Wien; F. Deuticke. 1909. M. 3.!

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Parker, C. E. and J. G.: Tanners' Year Book, 1909. W. B. Moston, Penketh, Warrington, England. Price 2s. 6d. An Svo vol. of pp. 138, with 7 portraits and 5 plates.

Philips, Earle Bernard: The disinfection of sewage and sewage filter effluents: with a chapter on the putrescibility and stability of sewage effluents. Wash., D. C. United States, Office of the Superintendent of Documents 1909. 91 p. fold. diagrs., tabs. (United States, Dept. of the Interior, Geological Survey bulletin; Water supply paper.) pap. (Add. Superintendent for price.)

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*Dissertations.

[Prices vary, ranging from two to three shillings.]

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- Küng, A.*: Zur Kenntnis der Homologen des Arginins und weitere Beiträge zur Kenntnis der Zersetzungsprodukte des Paracaseins beim Käse-Reifungsprocess. Zürich. 1909. (66 S.) 8°.
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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom also all the works and dissertations in foregoing List can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

19,118. Turquand and Turquand. Apparatus for detecting dangerous gases. Aug. 20.

19,169. Simon. Automatic recording apparatus for measuring gaseous fluids. [Ger. Appl., Nov. 2, 1908.]* Aug. 20.

19,456. Schulz and Philipp. Vessels for containing volatile and other liquids. Aug. 24.

19,626. Talansier. Apparatus for emulsifying, pulverising, and homogenising liquid. Aug. 26.

19,694. Maschinenbauges. Martini und Hüneke. Production of non-oxidising protective gas for use with inflammable liquids. [Ger. Appl., Nov. 27, 1908.]* Aug. 27.

19,709 and 19,710. Zerkowitz. Apparatus for separating liquids. [U.S. Appls., Aug. 28 and Nov. 30, 1908.]* Aug. 27.

19,767. Küppers. Apparatus for measuring gases.* Aug. 28.

19,773. Lennox. Apparatus for washing smoke, condensing steam, or evaporating water from a liquid. Aug. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

17,385 (1908). Swan. Purification of steam or other gaseous media. Aug. 25.

17,564 (1908). Kerr and Graham. Drying cylinders. Sept. 1.

28,520 (1908). Sauerbrey. Cast iron evaporator having field tubes. Sept. 1.

3738 (1909). Thompson (Maschinenfabr. Augsburg-Nürnberg). Tanks for liquids. Sept. 1.

12,739 (1909). Calico Printers' Assoc., Browning, and Barlow. Apparatus for separating solid impurities from viscous or gummy solutions. Sept. 1.

12,870 (1909). White. Filters. Aug. 25.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

18,808. Weber. Manufacture of metallic filaments for incandescence lighting.* Aug. 16.

18,838. Jones. Treatment of gases from coke ovens or gas retorts. Aug. 16.

18,920. Jones. Treatment of gases from coke oven or gas retorts. Aug. 17.

18,965. British Thomson-Houston Co. (General Electric Co.). Electrodes for arc lamps, &c. Aug. 17.

19,040. British Thomson-Houston Co. (General Electric Co.). Electrodes for arc lighting. Aug. 18.

19,196. Johnston and Clark. Gas manufacture. Aug. 20.

19,300. Streubel and Wigankow. Manufacture of mantles for incandescence gas lamps.* Aug. 21.

19,357. Krause. Gas producing furnaces or ovens. Aug. 23.

19,395. Zohrab and Massey. Treatment of peat. Aug. 23.

19,419. Bröcker. Gas-producing furnaces or ovens. Aug. 24.

19,445. Coppée. Coke ovens.* Aug. 24.

19,513. Wright. Gas producers of regenerative furnaces. Aug. 25.

19,639. Cambridge. Apparatus for producing gas. Aug. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

16,333 (1908). Bechevot. Gas generators. Sept. 1.
17,978 (1908). Crossley and Rigby. Recovery of by-products in gas producer plants primarily designed for recovering ammonia. Sept. 1.

28,554 (1908). Schäffler. Manufacture of flat incandescent filaments for metallic filament lamps. Aug. 25.

4973 (1909). McKay and Cheney. Water-gas generators. Aug. 25.

5768 (1909). Schmiedt. Gas-purifying apparatus. Sept. 1.

8920 (1909). Fabry. Coke ovens. Sept. 1.

12,010 (1909). Ekenberg. Briquetting carbonised peat and the like. Sept. 1.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

19,081. Davies and Windsor-Richards. Treatment of liquid hydrocarbons. Aug. 19.

19,087. Newton (Bayer und Co.). Manufacture of ketone alcohols. Aug. 19.

19,088. Newton (Bayer und Co.). Manufacture of methylene ketones. Aug. 19.

19,157. Denner-Meier. Process for working petroleum. Aug. 20.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

18,822. Ransford (Cassella und Co.). Manufacture of sulphide dyestuffs derived from carbazol. Aug. 16.

19,086. Newton (Bayer und Co.). Manufacture of azo dyestuffs. [Addition to No. 1397 of 1909.] Aug. 19.

COMPLETE SPECIFICATIONS ACCEPTED.

21,585 (1908). Newton (Bayer und Co.). Manufacture of basic dyestuffs. Sept. 1.

25,816 (1908). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Sept. 1.

26,478 (1908). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. Aug. 2.

17,546 (1909). Johnson (Badische Anilin und Soda Fabrik). See under XIII A.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

18,828. Inray (Meister, Lucius, und Brünig). Production of coloured woollen effects in unions. Aug. 16.

19,135. Amley. Treating textile piece goods, warps, &c., with liquids. Aug. 20.

- 19,213. Tate. Waterproofing fibrous materials.* Aug. 20.
 19,218. Bontemps. Machine for printing webs of textile fabric. Aug. 20.
 19,349. Aderholdt. Drying and finishing wet dyed yarns and fabrics.* Aug. 23.
 19,737. Young. Bleaching textile fabrics. Aug. 28.
 19,776. Margotin. Bleaching fabrics, threads, and other material. [Fr. Appl., Sept. 18, 1908.]* Aug. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

- 17,083 (1908). Rhodes. Apparatus for treating with liquids wool, yarn, and other fibrous material. Aug. 25.
 17,713 (1908) and 2437 (1909). Calico Printers' Assoc., and Davis. Calico printing. Aug. 25.
 17,957 (1908). Johnson (Robeson). *See under XIV.*
 2313 (1909). Heimann. Treatment of fabrics. Sept. 1.
 6486 (1909). Dean. Vats for dyeing, &c. Aug. 25.
 6876 (1909). Meister, Lucius, and Brünig. Producing colour effects on fabrics. Aug. 25.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

- 18,816. Boulton (Kritzer). Lime-hydrating apparatus.* Aug. 16.
 18,825. Sulphates, Ltd., Thwaites, and Ralph. Treating liquors containing metallic compounds to obtain iron, zinc, and cobalt compounds. Aug. 16.
 18,923. Boulton (Ladd). *See under VIII.*
 18,945. Beindl. Production of hydrocyanides and cyanides. Aug. 17.
 19,689. Johnson (Badische Anilin und Soda Fabrik). Continuous production of nitric acid. Aug. 27.
 19,755. Chem. Werke vorm. Dr. H. Byk, and Schmidt. Manufacture of borates containing active oxygen.* Aug. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

- 17,220 (1908). Hertkorn. Products containing iodine. Aug. 25.
 17,520 (1908). Kühne. Removal of sulphur dioxide from gases and its recovery as sulphuric acid. Aug. 25.
 17,608 (1908). Mond. Producing iron carbonyl. Aug. 25.
 17,978 (1908). Crossley and Rigby. *See under II.*
 19,528 (1908). Ashworth. Production of reducing agents. Aug. 25.
 794 (1909). Bailey and Stevenson. Production of borax from native boron compounds. Aug. 25.
 4494 (1909). Beskow and Ekedahl. Removing superphosphates from decomposition chambers. Sept. 1.
 9145 (1909). Cie. Indus. des Alcools de l'Ardèche. Recovery of sulphurous acid from solutions. Aug. 25.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

- 18,923. Boulton (Ladd). Treatment of clay, bauxite, kaolin, &c.* Aug. 17.
 19,080. Doulton and Noke. Decoration of pottery. Aug. 19.
 19,282. Clark and Johnson. Machine for dipping and glazing tiles, pottery ware, bricks, &c. Aug. 21.

COMPLETE SPECIFICATION ACCEPTED.

- 17,432 and 17,433 (1908). Ling, Rendle, and Colbrook. Reproduction of images on glass, ceramic, metallic, or other surfaces. Aug. 25.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

- 18,887. Forrester (Blanc Stainless Cement Co.). Manufacture of Portland cement.* Aug. 17.
 18,997. Nash. Cement kiln.* Aug. 18.

- 19,282. Clark and Johnson. *See under VIII.*
 19,459. Lake (Pine Street Patents Co.). Manufacture of cement clinker.* Aug. 24.
 19,460. Coward. Composition for making waterproof paving slabs, building blocks, &c. Aug. 24.

COMPLETE SPECIFICATION ACCEPTED.

- 25,637 (1908). Winkler. Building material capable of replacing wood. Sept. 1.

X.—METALS AND METALLURGY.

APPLICATIONS.

- 18,817. Hommel and Durant. Treatment of complex zinc ores. Aug. 16.
 18,826. Gröndal. Concentrating oolitic ironstone and similar iron ores.* Aug. 16.
 18,962. Wolff. Treating metals for desulphurising and deoxidising purposes.* Aug. 17.
 18,996. Gutensohn. Recovery of zinc, lead, and silver from their sulphide ores. Aug. 18.
 19,091. Woolford. Collection of metallic fumes. Aug. 19.
 19,092. Woolford. *See under XIII.A.*
 19,308 and 19,309. Boulton (Ashcroft). *See under XI.*
 19,386. MacIvor, Hommel, and Metals Extraction Corporation. Manufacture of zinc oxide for smelting. Aug. 23.
 19,663. Lavington (Brown). Ore treatment. Aug. 27.
 19,717. Bednell. Preventing oxidation of metals. Aug. 28.
 19,740. Wheeler. Continuous reduction and melting of ores by means of gaseous fuel. Aug. 28.
 19,764. Timm. Production of metals. [Ger. Appl., Oct. 12, 1908.]* Aug. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

- 11,142 (1908). Cowper-Coles. Manufacture of armour plate. Sept. 1.
 17,432 and 17,433 (1908). Ling and others. *See under VIII.*
 17,611 (1908). Siemens und Halske A.-G. Increasing the ductility of tungsten. Sept. 1.
 25,035 (1908). Heide (Titanium Alloy Manufacturing Co.). Copper and its alloys. Sept. 1.
 269 (1909). Crosco. Extracting gold and silver from crushed ore and ore slimes. Aug. 25.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

- 19,308. Boulton (Ashcroft). Treatment of sulphide ores or products by chlorine or sulphur chloride and electrolysis. Aug. 21.
 19,309. Boulton (Ashcroft). Treatment of sulphide ores or products by electrolysis. Aug. 21.
 19,466. Salpetersäure-Ind.-Ges. Electric furnaces for treating gases by means of flame arcs. [Ger. Appl., Aug. 25, 1908.]* Aug. 24.

COMPLETE SPECIFICATIONS ACCEPTED.

- 15,031 (1908). Bianco. Electrolytic galvanising process. Aug. 25.
 18,513 (1908). Röschling'sche Eisen- u. Stahlwerke, and Rodenhauser. Electric induction furnaces. Sept. 1.
 23,193 (1908). Brachmann. Electro-deposition of metals. Aug. 25.
 23,930 (1908). Connor, Stubbs, and Electrolytic Alkali Co. Electrodes for use in electrolysis. Aug. 25.
 24,139 (1908). Gerbing. Electroplating articles of non-conductive material. Aug. 25.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATION.

- 19,137. Jack. Laundry soap. Aug. 20.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

APPLICATIONS.

19,092. Woodford. Conversion of antimonial ore into white pigment. Aug. 19.

COMPLETE SPECIFICATION ACCEPTED.

17,546 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matter suitable for use as a pigment or lake. Sept. 1.

(B).—RESINS, VARNISHES.

APPLICATIONS.

19,109. Marks (Southern Manufacturing Co.). Baths for extracting products from wood.* Aug. 19.

19,777. Pagès, Camus, et Cie., and Bardy. Manufacture of artificial resins by pyroigneous substances and secondary acetates. [Fr. Appl., Sept. 9, 1908.]* Aug. 28.

(C).—INDIA-RUBBER.

APPLICATIONS.

19,016. Smith. Substitute for indiarubber. Aug. 18.

19,467. Immisch. Manufacture of articles from waste rubber, ebonite, &c. Aug. 24.

19,701. Wallace. Production of isoprene. Aug. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

11,300 (1909). Caldwell and others. Manufacture of filling or stutling material. Aug. 25.

18,269 (1909). Wilderman. Manufacture of ebonite resistant to chlorine. Sept. 1.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATION.

19,332. Leach. Leather products. [U.S. Appl., Feb. 17, 1909.]* Aug. 23.

COMPLETE SPECIFICATIONS ACCEPTED.

17,956 (1908). Johnson (Robeson). Treatment of waste sulphite liquor. Sept. 1.

17,957 (1908). Johnson (Robeson). Tanning hides or skins and mordanting fibrous materials. Sept. 1.

17,958 (1908). Robeson. Treatment of hides, skins, and leather. Sept. 1.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATION.

19,768. Greenwood, Stocks, and White. Manufacture of gum tragacanth. Aug. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

17,887 (1908). Mills (Arabol Manufacturing Co.). Liquefying organic colloids. Aug. 25.

17,888 (1908). Mills (Arabol Manufacturing Co.). Treatment of starch. Aug. 25.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

19,014. Faulkner and Duncan. Manufacture of malt preparations. Aug. 18.

19,257. Kluge. Production of a denaturing agent for spirits.* Aug. 21.

19,391. Board and Ling. Conversion of starch in brewing or distilling and manufacture of a brewing material. Aug. 23.

19,449. Walpole. Treatment of malt for brewing. Aug. 24.

COMPLETE SPECIFICATION ACCEPTED.

5409 (1909). Roth. Malt kilns. Aug. 25.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A).—FOODS.

APPLICATION.

19,560. Hoffmann. Process of sterilising milk.* Aug. 25.

(B).—SANITATION; WATER PURIFICATION.

APPLICATION.

19,483. Hundle, Whitaker, and Knewstubb. Treatment of sewage. Aug. 25.

COMPLETE SPECIFICATION ACCEPTED.

17,641 (1908). Waite. Purification of trade effluent, &c. Sept. 1.

(C).—DISINFECTANTS.

COMPLETE SPECIFICATION ACCEPTED.

2472 (1909). Schneider. Manufacture of disinfectants. Sept. 1.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATION.

19,539. Von Alpenburg and Von Alpenburg. Making prepared sheets from the cores of palm trees. [U.S. Appl., Aug. 27, 1908.]* Aug. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

17,956 (1908). Johnson (Robeson). See under XIV. 3883 (1909). Armitage and Hbetson, Ltd., and others. Method of glazing paper, cardboard, &c. Sept. 1.

11,625 (1909). Lederer. Manufacture of cellulose compounds in definite shapes. Aug. 25.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

18,896. Kaufmann. Making compounds and isolating elements by splitting aromatic stibine compounds. [Ger. Appl., Aug. 18, 1908.]* Aug. 17.

19,197. Martindale. Treatment of radio-active substance. Aug. 20.

19,348. Hardy and Willecock. Obtaining products from blood or its plasma or serum. Aug. 23.

19,766. Stapler. Manufacture of solid perfume.* Aug. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

17,220 (1908). Hertkorn. See under VII.

10,021 (1909). Weiss. Medicinal preparation. Aug. 25.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

COMPLETE SPECIFICATION ACCEPTED.

11,147 (1909). Bamber. Three-colour screens for photography and their manufacture. Aug. 25.

XXII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATION.

19,297. Hohmann. Automatic gas-analysing apparatus.* Aug. 21.

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—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Evaporating boilers for use in the crystallisation of liquids. O. Faller, Munich, Germany. Eng. Pat. 16,817, Aug. 10, 1908.

THE boiler is provided with a wide central return flow tube, on each side of which a group of inclined heating tubes, surrounded by a steam jacket, is arranged. The heating tubes are made narrow to promote rapid circulation and thus prevent incrustation, and are inclined in order that any crystals formed in the liquid during its passage up the tubes may be projected into the central return tube. The latter is made of greater cross-section than the sum of the cross-sections of the heating tubes, and is prolonged downwards so that the returning liquid has a long period of comparative rest to enable the crystals to attain such dimensions that they are not easily drawn up again with the circulating liquid into the heating tubes.

—W. H. C.

Raising and forcing water and other liquids and semi-liquids. B. C. Joy, London. Eng. Pats. 17,500, Aug. 20, 1908, and 3407, Feb. 11, 1909.

A CLOSED vessel provided with inlet and outlet valves and mains for the liquid to be raised is connected by non-return valves to a supply of explosive gas and to a supply of water. When the pressure within the vessel is lower than or equal to that of the atmosphere, both the liquid to be raised and the explosive gas enter the vessel. As soon as the pressure rises above that of the atmosphere, the liquid and gas inlet valves close, the resistance of the spring controlling the ignition device is overcome, and the explosive mixture is fired. The pressure resulting from the explosion drives the liquid up the delivery main until the pressure has fallen again to that of the atmosphere, when the non-return valve on this main closes. Water is now injected into the vessel and assists in cooling the residual gases, with the result that a partial vacuum is formed within the vessel and it begins to fill again.

—W. H. C.

Dipping tanks. Wilkinson, Heywood and Clark, Ltd., London, and C. Gordon, Blackheath. Eng. Pat. 8164, April 5, 1909.

IN order to facilitate the removal of the agitating gear from a dipping tank in which objects are dipped into paint or varnish, etc., the horizontal agitator which works in the bottom of the tank is driven by an easily removable vertical shaft placed at one end of the tank. This shaft is provided at its lower and upper ends with bevel wheels, which engage respectively with a bevel wheel on the end of the agitator shaft, and with the driving mechanism.—W. H. C.

Melting apparatus. W. M. Carr, New York, Assignor to C. H. Speer, Chester, Pa. U.S. Pat. 929,831, Aug. 3, 1909.

A CRUCIBLE or container is supported within a refractory casing or jacket, so as to leave a narrow flame passage around the crucible. Suitable fuel is introduced through an opening near the bottom of the casing and is supplied with air for its combustion through the hollow trunnions on which the casing is supported. The air passes from the trunnions through a tortuous passage

formed in the walls of the casing adjoining the flame passage and becomes heated on its way to the combustion chamber.—W. H. C.

Refrigerating systems; Separating oil from ammonia in — C. D. Bauer, Springfield, Ohio. U.S. Pat. 930,128, Aug. 3, 1909.

THE oil and ammonia flow from the refrigerating apparatus through a trap to a tank heated by a steam coil and provided below with an outlet for the oil. From the top of this vessel the ammonia vapour passes to a second tank connected to the suction side of the pump of the refrigerating apparatus and cooled internally by a water coil and externally by water spray.—W. H. C.

Carbonator. L. M. Keeler, Scarsdale, and J. Rampp, New York. U.S. Pat. 930,189, Aug. 3, 1908.

THE apparatus consists of a closed chamber having at its upper part a vertical cylinder. The combined gas and liquid inlet pipe enters the top of this cylinder and discharges into a central conduit around which are arranged a number of chambers with small discharge openings in their lower surfaces, the lower of these chambers being provided with circumferential rims extending below the bottoms of the chambers. The liquid is discharged through the small openings and falls into the main chamber.—W. P. S.

Furnace. W. C. Willan, Charleston, S.C., Assignor to The Libbey Glass Co., Toledo, Ohio. U.S. Pat. 931,663, Aug. 17, 1909.

THE claim is for a furnace provided with a central vertical shaft extending through the floor of the furnace and driven by worm gear from below. A table is supported upon the shaft within the furnace and is rotated. The furnace is provided with suitable openings in the side wall for the introduction and withdrawal of the articles to be heated, which are placed upon and rotated with the table. The table is also provided with several vertical shafts arranged in a ring, the shafts passing through the table. Each of these shafts carries a smaller table at the upper end and at the lower end is provided with a gear wheel which engages with a toothed ring set in the floor of the furnace, so that as the larger table rotates, each of the smaller tables is independently rotated.—W. H. C.

Separating liquids of different specific gravity, especially fat and glue solution; Apparatus for — H. Meyer. Ger. Pat. 212,643, Sept. 27, 1907.

THE mixture of liquids is introduced through a pipe into a vessel in which separation takes place by gravity. As the level of the mixture rises, the lighter liquid flows over the edge of a receptacle disposed within the vessel, whilst the heavier liquid flows out at the bottom through a pipe, which is bent at right angles, and then extends upwards nearly to the height of the rim of the inner receptacle. The difference between the heights of this pipe and the rim of the inner receptacle is so adjusted in relation to the difference between the specific gravities of the two liquids, that only the lighter liquid can flow into the inner receptacle, and only the heavier one can overflow from the pipe. In using the apparatus for the separation of fat from glue solutions, the vessel is preferably mounted in the upper part of the evaporator; the fat flows into the inner receptacle, and the glue solution

overflows from the pipe into the evaporator, so that evaporation and separation of the fat are effected in one apparatus at the same time.—A. S.

Gases or vapours; Apparatus for subjecting — to the action of liquids. C. H. Fowler and E. A. Medley, Great Crosby, U.S. Pat. 928,118, July 13, 1909.

SEE Eng. Pat. 27,391 of 1908; this J., 1908, 1196. —T. F. B.

Extracts; Process of making —. W. Wiegand, Merseburg, and R. Bieder, Frankfurt, Germany. U.S. Pat. 930,909, Aug. 10, 1909.

SEE Fr. Pat. 386,820 of 1908; this J., 1908, 760. —T. F. B.

Furnace; Hearth —. F. Dahl, Bruckhausen, Germany. U.S. Pat. 931,916, Aug. 24, 1909.

SEE Eng. Pat. 21,103 of 1907; this J., 1908, 1007. —T. F. B.

II.—FUEL, GAS, AND LIGHT.

Combustible gases; Systematic separation of —. G. de Voldere, Bull. Soc. Chim. Belg., 1909, 23, 323–346.

THE author suggests a general method for the quantitative analysis of a gaseous mixture which may contain nitrogen, oxygen, hydrogen, carbon monoxide, carbon dioxide, and hydrocarbons of the series, C_nH_{2n+2} , C_nH_{2n} , C_nH_{2n-2} , C_nH_{2n-4} , and C_nH_{2n-6} . The method consists in the successive absorption of groups of gases by suitable reagents, together with determinations of the contraction and of the volume of carbon dioxide formed on complete combustion, before and after each such absorption. The first operation is the complete combustion of a part of the gas, giving a contraction, C_1 , and yielding a volume of carbon dioxide equal to D_1 ; by absorbing the excess of oxygen after the combustion, the nitrogen is directly determined. A separate portion of the original gas is next treated with alkaline pyrogallate, which absorbs a volume, C_2 , made up of a volume, x , of carbon dioxide, y , of oxygen, and z , representing a part of the hydrocarbons, C_nH_{2n-6} . A portion of the residue left after the absorption is exploded, giving a contraction, C_3 , and a volume, D_3 , of carbon dioxide. The differences, $C=C_1-C_3$ and $D=D_1-D_3$, are the values due to the combustion of a mixture consisting of volumes, x of carbon dioxide, y of oxygen, and z of hydrocarbons, C_nH_{2n-6} . The observed data are sufficient for the determination of x , y and z with the aid of the known relations, $C=y+z$; $D=x+6z$, and $C_2=x+y+z$. The analysis is continued in a similar manner with the residue from the first absorption, the absorbents used being fuming nitric acid which absorbs the remainder of the gases, C_nH_{2n-6} , and a part of the carbon monoxide, and afterwards fuming sulphuric acid or bromine water which absorbs the gases, C_nH_{2n} and C_nH_{2n-2} . The residue from the final absorption consists of carbon monoxide, hydrocarbons, C_nH_{2n+2} (including hydrogen), and nitrogen, and the final combustion gives the data for determining the three corresponding volumes; the quantity of hydrogen may be determined separately by partial combustion of a portion of this residue with palladium-asbestos. It will be seen that the method does not permit of the separate determination of hydrocarbons of the same series unless special absorbents are available. The limitations of the method are given generally by the following laws, in which hydrogen is to be included in the series, C_nH_{2n+2} , carbon dioxide in the series, C_nH_{2n-6} , and oxygen and carbon monoxide in the series C_nH_{2n-4} :—It is not possible by a single complete combustion to determine the constituents of a mixture containing: (1), more than two members of the same series; (2), more than three members belonging to different series, and in each case the formula of each gas must be known; and (3), it is not possible by a single complete combustion to determine the total volumes of gases of each series in a mixture containing gases of more than two series, and the nature of the two series must be known. The converse of (2) is not always true—for example, a mixture of methane, carbon dioxide, and carbon monoxide cannot be analysed by a

combustion only; but a mixture containing two gases of one series and one gas of another series can always be so analysed. The analytical methods commonly use are shown to be particular cases of the general method described.—A. T. L.

PATENTS.

Fuel. G. B. Selden, Rochester, N.Y. U.S. Pat. 929,500, July 27, 1909.

AN improved fuel for internal combustion engines prepared by adding to a liquid hydrocarbon, a volatile peroxide or a vehicle carrying the same, and a nitr compound such as nitrobenzene.—R. L.

Coke-ovens; Horizontal regenerative —. H. V. Seymour, Leeds. Eng. Pat. 21,249, Oct. 8, 1908.

Two superposed flues are constructed beneath the soot wall of each oven and are each separately connected to the regenerator flues which are placed side by side, longitudinally, one on either side of the centre line, below the battery of ovens. The vertical heating flues on each side of the oven are alternately connected to one or other of the sole flues. The heating gas is supplied by pipes to a flue which passes beneath the vertical flues in each side wall of the oven. In one phase of the working, the gas enters the bottom of each alternate vertical flue and then meets the preheated air from one of the sole flues connected to the regenerator which is in communication with the air. The gas burns and the products of combustion pass up one vertical flue and down the next to the other sole flue, which is connected to the other regenerator in communication with the chimney. When the dampers are reversed, the currents of gas and air flow in the reverse directions.—W. H. C.

Gas producers. B. Versen, Dortmund. Eng. Pat. 16,610, Aug. 6, 1908.

THE patent relates to producers of the type in which air mixed with gaseous products of distillation from the upper part of the producer is delivered into the centre of the combustion zone, and the invention consists mainly in forming the central blast-pipe of inverted conical form whilst the walls of the producer chamber at the level of the combustion zone are of conical form, so that the area of the fuel column increases rapidly as the fuel descends through the combustion zone, the object being to prevent the clinker hanging up. The conduit for the distillation gases passes centrally down through the fuel column to the combustion zone, and the air-supply pipe may pass down the interior of this conduit, or it may pass up from the lower part of the producer and open into the lower part of the gas conduit. The lower conical portion of the gas conduit, forming the blast-pipe is water-jacketed and the lower part of the producer forms a water-trough for the reception of the clinker.—A. T. L.

Gases; Process of obtaining by-products from —. G. Hilgenstock, Dahlhausen-on-Ruhr, Germany. U.S. Pat. 928,974, July 27, 1909.

FOR the extraction of by-products from the gases of the dry distillation of coal, the gas coming from the retorts or coke ovens during the first period of the process, and containing the greater part of the tar, is separated from the substantially tar-free portion of the gas of the later period and is freed from its tar contents by injecting tar through it. Both portions of gas are subsequently combined and led into an acid bath for the extraction of ammonia.—R. L.

Gas washer. G. Wilton, London. U.S. Pat. 929,358, July 27, 1909.

THE gas washer comprises several washing units each consisting of a series of superimposed chambers provided with a liquid seal and bubbling hood device, and with a supplemental detachable apron in the form of an inverted tray resting on the hood. The hood, which is immersed in the liquid at considerable depth, has serrated edges and the apron has suitable perforations. Each washing unit has a liquid inlet at the top and an outlet at the bottom. The gas-supply main is common to all the

units, but supplies each independently from the others, and all the units discharge into a common gas-collecting main. Thereby the gas may be so divided into several streams that each is being washed in one unit only.—R. L.

Gas-purifier. T. A. Edison, Llewellyn Park, West Orange, N.J., Assignor to Edison Portland Cement Co., Stewartsville, N.J. U.S. Pat. 930,947, Aug. 10, 1909.

Dust is removed from gases by passing them through a filtering chamber containing shelves oppositely inclined and facing each other. Granular filtering material is supported by these shelves, which are arranged so that the plane of each shelf intersects the next lower oppositely inclined shelf. Means are arranged for continuously feeding the filtering material in at the top of the filtering chamber and removing it, together with the dust retained, from the bottom of the chamber, so that the filter always maintains the same degree of porosity. (See also U.S. Pats. 930,946, 930,948, and 930,949, page 984.)—A. G. L.

Producer gas; Purification of — L. A. Chevalet. Fr. Pat. 400,333, May 30, 1908.

The gas is freed from the tar which passes through the ordinary scrubbers and mechanical washers, by a final washing with a solvent oil such as creosote or anthracene oil. This final washing may be carried out in any known type of scrubber, and the patent covers the use of any oil obtained in the distillation of tar and boiling above 50° C.—A. T. L.

Incandescent mantles; Manufacture of — by the impregnation of fine threads with hydrated peroxides. J. Visseaux. Fr. Pat. 400,178, May 22, 1908.

The fabric of the mantle is first impregnated with salts of rare earth metals in the usual way and then soaked in a bath of concentrated hydrogen peroxide for two hours in order to convert the salts into the hydrated peroxides. The mantle is afterwards washed in water, dried, and incinerated.—A. T. L.

Incandescent mantles; Manufacture of — Soc. Française de Chaleur et Lumière. Fr. Pat. 400,378, Mar. 5, 1909.

The fabric of the mantle is woven with threads of artificial silk together with threads of ramie or cotton, thus combining the advantages of both materials.—A. T. L.

Incandescent gas mantles; Manufacture of — from artificial silk. R. Böhm. Fr. Pat. 400,444, Mar. 8, 1909.

Fabric of artificial silk is impregnated with the thorium and cerium salts of organic acids, such as the citrates, acetates, or with a mixture of these salts and the salts of mineral acids such as the nitrates. The impregnated fabric may afterwards be passed through an alkaline bath or through hydrogen peroxide, or it may be treated with alkaline vapours, in order to convert the salts into insoluble compounds.—A. T. L.

Combustible mixtures for producing actinic light. C. Bethge, Berlin. Eng. Pat. 16,448, Aug. 4, 1908.

The patent is for a slow-burning mixture of a reducible oxygen compound of a readily combustible rare earth metal with an excess of magnesium amounting to from 10 to 100 times the equivalent of the oxygen in such compound, with the addition of a small percentage of a radium compound if desired. The magnesium may be replaced by aluminium, calcium, barium, or strontium. The examples of suitable mixtures are 250 parts of magnesium powder with one of the following:—150 parts cerium oxide, with or without 8 parts of vanadic acid; 100 parts of cerium oxalate; 75 parts of calcium hydroxide; 50 parts each of cerium oxide and calcium hydroxide; 25 parts of manganese oxide; or 50 parts of cerium oxide and 25 parts of manganese oxide. In burning, the oxygen compound is reduced by the magnesium, the cerium or other metal is oxidised, and the oxide again reduced so long as there is an excess of magnesium present. 2 to 3 grams of these mixtures will burn for 30 seconds. Reference

is directed to Eng. Pats. 23,292 of 1901, and 3794, 27,267 and 27,268 of 1904 (this J., 1902, 792; 1905, 44, 210). —A. T. L.

Pyrophorous substances; Process for the manufacture of — for ignition and illumination. A. Lesmüller, München, Bavaria. Eng. Pat. 27,341, Dec. 16, 1908.

For the production of pyrophorous substances the rare-earth metals have been alloyed, by means of an electrolytic process, with other harder metals, e.g., iron. The patent claims the use of non-metals, e.g., silicon, titanium or boron, in place of metals, for this purpose. The substances so produced are very hard, economical in use and less subject to oxidation. The temperature of ignition is very low, so that when the pyrophorous substances are rubbed against a harder body, small particles are detached which inflame at once in the open air, and are adapted for igniting combustible gases. The addition of oxidising bodies produces substances suitable for flash-lights, etc. The alloys may be prepared:—(1), by mixing the silicon, titanium, etc., with the rare-earth metals in the decomposition chamber in which these have been separated by electrolysis; (2), by melting the metals in a magnesia crucible, under a cover of a molten salt, such as sodium chloride, to exclude air, and adding the silicon; (3), by fusing the metals either in an indifferent gas or in a vacuum before adding the silicon.—G. W. McD.

Filaments [for electric incandescence lamps]; Treating metal — C. T. Fuller, Schenectady, N.Y., Assignor to General Electric Company, New York. U.S. Pat. 929,578, July 27, 1909.

An oxide of tungsten is mixed with a carbonaceous binding material and the mixture so formed is shaped into threads. A number of these is baked in an atmosphere of hydrogen to effect complete reduction of the oxide. The filaments are subsequently fired to about 1500° C. in a reducing atmosphere until free from carbon, and the heating is continued until the tungsten is sintered to a condition of stable conductivity.—R. L.

Coke ovens. L. Bansart, Haime St. Paul, Belgium. U.S. Pat. 928,302, July 20, 1909.

SEE Fr. Pat. 390,204 of 1908; this J., 1908, 1010.—T. F. B.

Water-gas generators. W. E. McKay, Milton, and H. N. Cheney, Dorchester, Mass., U.S.A. Eng. Pat. 4973, March 1, 1909. Under Int. Conv., Nov. 11, 1908.

SEE U.S. Pat. 911,899 of 1909; this J., 1909, 237.—T. F. B.

Gas generator. I. A. Chavanne, St. Chamond, France. U.S. Pat. 930,532, Aug. 10, 1909.

SEE Eng. Pat. 8397 of 1908; this J., 1908, 1011.—T. F. B.

Purifying gases; Apparatus for — F. Sepulchre, Liege, Belgium. U.S. Pat. 931,229, Aug. 17, 1909.

SEE Eng. Pat. 254 of 1908; this J., 1908, 677.—T. F. B.

Filaments for electric lamps; Method of manufacturing — W. von Bolton, Charlottenburg, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 927,935, July 13, 1909.

SEE Fr. Pat. 382,899 of 1907; this J., 1908, 276.—T. F. B.

Electric incandescent lamp filaments; Process of forming — W. von Bolton, Charlottenburg, and F. Hartmann, Assignors to Siemens und Halske A.-G., Berlin. U.S. Pat. 930,723, Aug. 10, 1909.

SEE Eng. Pat. 2853 of 1909; this J., 1909, 647.—T. F. B.

Reducing oxides. [Preparing lower oxides of tungsten, molybdenum, rutherfordium, etc.] Eng. Pat. 5821. See VII.

Apparatus for analysing gas. U.S. Pat. 922,086. See XXIII. Apparatus.

Colorimeter. U.S. Pat. 931,189. See XXIII. Apparatus

Apparatus for analysis of industrial gases. Ger. Pat. 211,389. See XXIII. Apparatus.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Carbon bisulphide in benzol; Determination of —.
J. M. Weiss. *J. Ind. and Eng. Chem.*, 1909, 1, 604—605.

THE method is based on the conversion of the carbon bisulphide into potassium xanthate, the oxidation of the latter, and precipitation of the sulphur as barium sulphate. About 2.5 grms. of the benzol are treated with 2.5 c.c. of a saturated solution of potassium hydroxide in absolute alcohol, and after five minutes the mixture is heated at 60° C. for 1 hour under a reflux condenser. After addition of water, the benzol is expelled by heating on a steam bath, the aqueous solution is made strongly alkaline with potassium hydroxide, and excess of bromine water is added. The whole is heated, and if necessary more bromine water added, until oxidation is complete. The solution is then acidified, the excess of bromine expelled, and the sulphur determined as barium sulphate in the usual manner.—A. S.

Heptane (dimethyl-2,4-pentane); A new —, and its occurrence in Caucasian petroleum. G. Choum. *J. Russ. Phys.-Chem. Ges.*, 1909, 41, 327—344. *Chem. Zentr.*, 1909, 2, 587.

DIMETHYL-2,4-PENTANE was prepared from dimethylisobutylcarbinol by converting this into dimethyl-2,4-iodo-4-pentane by the action of hydrogen iodide gas in the cold, and then heating the iodo-derivative with fuming hydriodic acid in a sealed tube for seven hours at 200°—230° C. From the hydrocarbon the nitro-, amino-, and phenylthiourea derivatives were prepared, and these were found to be identical with the corresponding derivatives prepared from the fraction of Caucasian petroleum boiling at 80°—82° C. Dimethyl-2,4-pentane is a mobile liquid with a petroleum-like odour, b.pt., 83°—84° at 764 mm.; sp. gr. 0.6971 at 0° C., 0.6805 at 20° C.; $n_{20}^D=1.3825$; it is easily soluble in nitric acid of sp. gr. 1.52. Dimethyl-2,4-nitro-4-pentane prepared by heating the hydrocarbon with dilute nitric acid in a sealed tube for 9 hours at 100°—105° C. is a nearly colourless liquid with a camphor-like odour.—A. S.

Polynaphthenic acids. K. Charitschkoff. *J. Russ. Phys.-Chem. Ges.*, 1909, 41, 345—353. *Chem. Zentr.*, 1909, 2, 708.

A FRACTION of (Caucasian) petroleum boiling at 161°—166° C. at 754 mm., and having the sp. gr. 0.7800 at 15° C., yielded, when oxidised with air (compare this *J.*, 1909, 303), syrupy dibasic polynaphthenic acids, $C_{21}H_{24}O_4$, probably formed by the condensation of three molecules of naphthenic acids. These acids were easily soluble in benzene, toluene, alcohol, and carbon bisulphide, but only slightly soluble in petroleum spirit (ligron). A synthetic heptanaphthene (dimethylpentamethylene) prepared from toluene by reduction with hydriodic acid, yielded on oxidation in a similar manner, naphthenic or polynaphthenic acids. Distillates from Grosny petroleum behaved in an analogous manner. Cymene yielded cumic acid, and menthane gave a mixture of naphthenic and polynaphthenic acids.—A. S.

Analysis of calcareous asphaltum and paving mixtures.
Prettner. See IX.

PATENTS.

Ammonium sulphate; Saturator for the manufacture of —. E. A. Brotherton and W. Wyld, Leeds. *Eng. Pat.* 14,349, July 7, 1908.

THE saturator consists of an enclosed vessel, having an inclined bottom, and the upper portion divided into compartments by one or more depending partitions, serrated or perforated, or serrated and perforated, at their lower extremities. Gas inlet and outlet pipes are provided, and means whereby the acid may be introduced into the compartment nearest the gas outlet. The

vapours, as they travel towards the outlet, have to pass through a liquid of increasing acidity in each compartment. The partitions are of suitable depth to secure the requisite seal in the liquid, and, if more than one be employed, that nearest the ammonia inlet is the lowest, each succeeding partition having its bottom edge at a higher level than the preceding one. More thorough washing is effected in this, than in the usual type of vessel, local alkalinity also is avoided, and the separated sulphate readily flows down to the discharge valve.—F. SODS.

Ammonia gas from ammonia liquors; Method of obtaining purified —. C. M. Stine, Chester, Pa., Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. *U.S. Pat.* 929,726, Aug. 3, 1909.

TO obtain purified ammonia gas from ammonia liquors, a current of air is forced through the liquor, and, at the same time, the temperature is gradually raised to 100° C. or above.—F. SODS.

Melting bitumen material, pitch, marine glue, grease and the like; Boilers for —. J. Allan and J. Richmond, Glasgow. *Eng. Pat.* 11,557, Nov. 30, 1908.

THE claim is for a pitch boiler or melter of an elongated form provided with a cover and an outlet for the melted pitch, and supported on brackets within a casing. A hollow cone is formed within the boiler projecting upwards from the bottom to enable the heat to penetrate more easily the contents of the vessel. The cone is provided with an outlet above for the escape of the waste gases. The boiler is heated by burners supplied with liquid fuel under pressure from a store tank placed below.

—W. H. C.

Crude petroleum and illuminating oil; Process for transforming — into spirit (distilling below 150° C.). P. Sabatier. *Fr. Pat.* 400,141, May 21, 1908.

THE oil is vaporised and passed over finely divided metals heated to between 400° C. and a dull red heat. It is converted partly into gas and partly into low-boiling, unsaturated, oxidisable bodies of unpleasant odour. The latter are passed along with hydrogen or gases rich in hydrogen over finely divided metal, preferably nickel heated to between 150° and 300° C., in order to obtain products not having an unpleasant odour. The two stages may be combined so as to form a continuous process.—W. H. C.

Petroleum residues; Method of treating and utilising —. V. Kridlo, Prague, Austria-Hungary. *U.S. Pat.* 931,772, Aug. 24, 1909.

SEE *Eng. Pat.* 24,192 of 1906; this *J.*, 1907, 402.—T. F. B.

"Acid hydrocarbons" [from petroleum] as substitutes for fatty acids, oils, fats, and soaps. *Fr. Pat.* 399,212 See XII.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indigo and its competitors. F. Felsen. *Z. Farben-Ind.* 1909, 8, 215—219, 231—234, 247—252, 263—267.

THE author discusses the various basic, alizarin, substantive and sulphur dyestuffs which have been suggested from time to time as substitutes for indigo, and shows that the latter cannot be surpassed either from the point of view of cost of application or of chemical properties. Derivatives of indigo at present on the market are Dimethylindigo (as Indigo MLB/T Hoechst and Indig. BASF G Badische), monobromoindigo (as Indigo MLB/Hoechst and Indigo BASF/R Badische), mixture mono- and di-bromoindigo (as Indigo MLB/RR Hoechst), dibromoindigo (as Indigo RBN and RB Badische, Indig. MLB/2B Hoechst, and Ciba Blue B Chem. Ind. Base), tetrabromoindigo (as Ciba Blue 2B Chem. Ind. Base), bromindigo FB, Bayer, and Indigo MLB/4B Hoechst and pentabromoindigo (?) (as Indigo MLB/6B Hoechst).

Although some of these are faster to light and chlorine than indigo, they are considerably weaker in dyeing strength. It is shown also that the modern Indanthrene dyestuffs are very much more costly in dyeing than is indigo. The various processes of preparing the indigo vat are discussed as also the mode of application. At the end of the paper the author gives a table showing the relative cost of dyeing yarn with various brands of indigo and with other blue dyestuffs.—J. C. C.

Indigotin; The brominated derivatives of —. A. Binz and T. Marx. Z. angew. Chem., 1909, 22, 1757—1759.

With the displacement of natural indigo by the purer synthetic product the question of indigo analysis has lost somewhat in importance, but the use in practice of mixtures of synthetic indigo and its halogen derivatives, renders it desirable to find some method for the estimation of these compounds. Trials with a method of oxidation led to no useful results and the results obtained with Binz and Kufferath's method (extraction with a mixture of 25 parts of glacial acetic acid and 5 parts of concentrated sulphuric acid) were not reliable. Mono- and dibromo-indigo have only slight (if any) basic properties, and although some analyses showed a high percentage of acid in the precipitated product, the presence of this is due to the amorphous nature of the precipitate rendering the removal of the acid, by washing, a matter of some difficulty. Extraction with various solvents appears to give the best results. Thus, by extracting with alcohol, isatin derivatives are removed; treatment with chloroform removes tribromo-indigo, and by shaking the residue with a mixture of 80 parts of glacial acetic acid and 20 parts of concentrated sulphuric acid, indigo and monobromo-indigo are brought into solution. The proportion of indigo to monobromo-indigo is calculated from the bromine content of the dissolved portion. The residue is dibromo-indigo, which is practically insoluble in the acetic-sulphuric acid mixture.—F. M.

Bixin; Constitution of —. J. F. B. Van Hasselt. Chem. Weekblad, 1909, 6, 480—483. Chem. Zentr., 1909, 2, 624.

BIXIN, the red dyestuff of *Bixa orellana* (annatto) has the composition, $C_{25}H_{34}O_5$; it contains one hydroxyl and one methoxyl group. It melts at 189°C , and when heated in a current of hydrogen at 200°C evolves one molecular proportion of *m*-xylene, leaving a colourless residue. By the action of dilute potassium hydroxide solution on bixin, there are formed first, potassium bixinate, $C_{25}H_{30}O_3(\text{OK})$ (OCH_3), and then dipotassium norbixinate, $C_{25}H_{30}O_2(\text{OK})_2$. The latter when treated with dilute acids yields norbixin, $C_{25}H_{30}O_3(\text{OH})_2$, a bright red, crystalline substance, which decomposes at 240°C , and can be converted into bixin by partial methylation. By the action of zinc dust and glacial acetic acid, bixin and its derivatives yield dihydro-compounds; whilst by the action of bromine, white amorphous, unstable compounds containing 10 atoms of bromine are produced. The author is unable to confirm Zwick's statement (Arch. Pharm., 238, 58) that on heating with steam, bixin yields palmitic acid.—A. S.

Sensitiveness of dyestuffs to light. Von Hübl. See XXI.

PATENTS.

Colouring matters [dyestuffs] of the anthracene series; Manufacture of. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 339, Jan. 6, 1909.

A SULPHONIC acid of Indanthrene Blue, differing from that described in Eng. Pat. 12,185 of 1901 (this J., 1902, 338), is prepared as follows:—1 part of powdered Indanthrene Blue is introduced at 30°C into a solution of 1 part of anhydrous boric acid in 5 parts of sulphuric acid monohydrate. After stirring for several hours, 10 parts of monohydrate are added and the whole is heated for 4—5 hours at 130°C . After cooling, the mass is poured into ice and water, boiled for an hour, filtered, and the residue washed. The dyestuff yields a cornflower blue vat with alkaline hyposulphite (hydrosulphite).—J. C. C.

Indigo; Production of polyhalogenated derivatives of —. Badische Anilin und Soda Fabrik. Fr. Pat. 399,285, Feb. 9, 1909. Under Int. Conv., Mar. 4, 1908.

POLYHALOGENATED derivatives of Indigo are prepared by heating Indigo or its mono- or dihalogen derivatives with bromine to a high temperature in the presence of indifferent agents, whereby the Indigo is maintained in a finely divided condition. Example 1: 140 kilos. of powdered Indigo are heated (temperature of oil-bath: 170°C) and completely dried by means of a current of dry hydrogen, carbon dioxide, or air. 260—270 kilos. of bromine, preferably in the vaporous state, are added, and the mass kept at 170°C for 1—2 hours. Hydrogen bromide and excess of bromine are removed by a current of air and the product is boiled with water and a little sodium hydroxide. A yield of 90 per cent. of tribromo-indigo is thus obtained. Example 2: 140 kilos. of Indigo are finely ground with 400 kilos. of dry salt and the moisture is removed as described above. 350 kilos. of bromine are now added as before (temperature of oil-bath: 200° — 210°C) and the product treated as in the first example. A yield of 90 per cent. of the theoretical amount of tetrabromoindigo is thus obtained.—J. C. C.

Dyestuffs; Manufacture of new —. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. Eng. Pat. 3758, Feb. 15, 1909. Under Int. Conv., Aug. 31, 1908. Addition to Eng. Pat. 3602 of 1909.

In the process described in Eng. Pat. 3602 of 1909 (see Ger. Pat. 208,968; this J., 1909, 517) it is advantageous to use the nitroarylacyl derivatives of 2:5:7-amino-naphtholsulphonic acid. The diamino-compounds which are obtained on reduction, when developed by means of β -naphthol, yield shades very fast to soap. Example: 25 kilos. of *p*-nitrobenzoyl-*p*-phenylenediamine are diazotised and combined with 40 kilos. of *m*-nitrobenzoyl-2:5:7-aminonaphtholsulphonic acid in alkaline solution. 135 kilos. of crystallised sodium sulphide are now added and the mixture heated to 60 — 65°C until the nitro-dyestuff has disappeared. The resulting dyestuff furnishes red tints on unmordanted cotton, which by diazotisation and development with β -naphthol are rendered fast to washing.—J. C. C.

Xanthopurpurin; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 212,697, July 20, 1907.

PURPURIN can be reduced to xanthopurpurin (1,3-dihydroxyanthraquinone) by means of alkaline stannous oxide solutions, but the process is costly. It is now found that complete reduction is obtained by using alkaline solutions of hydrosulphite. In this case the carbonyl groups are not reduced, as is the case when anthraquinone is reduced by hydrosulphite.—T. F. B.

Azo-dyes [dyestuffs]. Wülfling, Dahl und Co., Act.-Ges., Barmen, Germany. Eng. Pat. 4859, Feb. 27, 1909. Under Int. Conv., Feb. 13, 1909.

CLAIM is made for a dyestuff specially suitable for making colour lakes, prepared by combining diazotised 2-naphthylamine-1-sulphonic acid with β -naphthol and abstracting the elements of water from the dyestuff. The new dyestuff is termed "F-anhydride," and it is dark red, whilst the original dyestuff is bright red. The anhydride formation is effected: (1), by treating the ordinary dyestuff with acetic anhydride; (2), by the action of cold concentrated sulphuric acid; (3), by effecting the combination at 40°C ; (4), by combining the diazo-salt and the β -naphthol in the presence of a saturated solution of salt. —J. C. C.

Red chromable dyestuffs; Manufacture of —. L. Cassella und Co., Ges.m.b.H., Frankfurt on the Maine, Germany. Eng. Pat. 8154, April 5, 1909. Under Int. Conv., April 7, 1908.

RED chrome dyestuffs are obtained by combining a diazosulphonic acid such as *p*- or *m*-diazobenzenesulphonic acid with an aminoalcohol ether, diazotising the product, and combining with salicylic or *o*- or *m*-cresotinic acid. An example is given in which diazotised sulphanilic acid

is combined in acid solution with *m*-amino-*p*-cresol ether ($\text{NH}_2 : \text{CH}_3 : \text{C}_2\text{H}_5\text{O} = 1 : 3 : 6$) and the product diazotised and combined with *o*-cresotinic acid in alkaline solution.

—J. C. C.

Dyestuffs; Production of red chrome —. L. Cassella und Co., Ges.m.b.H. First Addition, dated May 26, 1908, to Fr. Pat. 398,980, April 7, 1908 (see Eng. Pat. 8154 of 1909, preceding).

RED chrome dyestuffs are obtained by combining the diazo-sulphonic acids of aminocresol ethers, nitroaminobenzenes or nitroaminophenols or their homologues or analogues with an aminocresol ether, and combining the diazo-compounds of the aminoazo-dyestuffs thus obtained with salicylic or the cresotinic acids. Example 1: *m*-Amino-*p*-cresol ether monosulphonic acid is diazotised and combined with *m*-amino-*p*-cresol ether in hydrochloric acid solution. The product is diazotised and combined with *m*-cresotinic acid in alkaline solution. The resulting dyestuff is a deep brown powder dyeing wool in orange shades which become bluish-red on treatment with bichromate. Example 2: *m*-Nitro-*p*-sulphanilic acid is diazotised and combined with *o*-amino-*p*-cresol ether and the product diazotised and combined with *m*-cresotinic acid: the dyestuff produces orange tints on wool which change to deep garnet red on chroming. Example 3: Nitroaminophenolsulphonic acid ($\text{NH}_2 : \text{NO}_2 : \text{OH} : \text{SO}_3\text{H} = 1 : 3 : 4 : 5$) is diazotised and combined with *m*-amino-*p*-cresol ether and the diazotised product combined with *o*-cresotinic acid. The resulting dyestuff dyes wool scarlet red becoming deep bluish red on chroming.—J. C. C.

Tetrabromindigo; Manufacture of —. Kalle und Co., Akt. Ges., Biebrich on the Rhine, Germany. Eng. Pat. 15,088, June 28, 1909. Under Int. Conv., Aug. 1, 1908.

THE bromination of indigo is advantageously effected in presence of chlorosulphonic acid instead of concentrated sulphuric acid. Example: 15 kilos. of bromine are stirred into 50 kilos. of chlorosulphonic acid, and 5 kilos. of finely powdered indigo are added gradually at the ordinary temperature. The tetrabromindigo is filtered off, pressed, and dried.—J. C. C.

Vat dyestuff. P. Thomaschewski, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 928,891, July 20, 1909.

THE new dyestuff, which is a pyrimidone of the anthracene series, is obtained by condensing 1-amino-4- β -anthriminoanthraquinone with urea. It is a dark red crystalline powder giving a violet blue solution with concentrated sulphuric acid and, with alkaline hyposulphite (hydrosulphite), yields a vat from which cotton is dyed in fast, violet-red shades.—J. C. C.

Azo dyestuff. L. Hesse and O. Günther, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 931,423, Aug. 17, 1909.

CLAIM is made for the dyestuff prepared by combining diazotised aminoazobenzenesulphonic acid with 2-benzoyl-amino-5-naphthol-7-sulphonic acid. The sodium salt is a reddish-brown powder giving a blue solution with concentrated sulphuric acid and dyeing cotton in scarlet shades.—J. C. C.

Azo dyestuff. L. Hesse and O. Günther, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 931,424, Aug. 17, 1909.

CLAIM is made for the dyestuff prepared by combining diazotised 2-naphthylamine-4:8-disulphonic acid with *p*-xylydine, diazotising the product and combining it with 2-benzoylamino-5-naphthol-7-sulphonic acid. The sodium salt is a greenish powder giving a greenish-blue solution in concentrated sulphuric acid and dyeing cotton in dark red shades.—J. C. C.

Anthraquinone; Process for the production of halogenated derivatives of —. Farbenfabriken vorm. F. Bayer und Co., First Addition, dated Jan. 29, 1909, to Fr. Pat. 386,599, Jan. 27, 1908 (this J., 1908, 744).

HALOGENATED nitroanthraquinones are obtained by treating nitroanthraquinone sulphonic acids with halogens or halogenating agents. Example: To a solution of 100 kilos. of sodium 1:5-nitroanthraquinonesulphonate in 4000 litres of water are added 300 kilos. of hydrochloric acid (20 B.). The solution is heated to 90° C., a solution of 100 kilos. of sodium chlorate in 1500 litres of water added and the whole heated at 100° C., until no further precipitation of 1:5-nitrochloroanthraquinone occurs. This substance, when purified by crystallisation from glacial acetic acid forms yellow needles.—J. C. C.

Anthraquinone derivatives and products resulting therefrom; Process of obtaining new —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 400,186, Feb. 9, 1909. Under Int. Conv., Aug. 4, 1908.

MERCAPTANS of the anthraquinone series are condensed with chloroacetyl derivatives of aminoanthraquinones, whereby derivatives of thioglycollic acid are obtained of the general formula, $\text{A.S.CH}_2\text{CO.NH.A}$, where A represents anthraquinone or a derivative of it. The compounds produced furnish vats from which cotton is dyed in deep yellow, red to blue shades. Example: A mixture of 10 kilos. of chloroacetyl-1-aminoanthraquinone, 11 kilos. of anthraquinone-1-mercaptan (sodium salt), and 100 litres of alcohol is heated to boiling under a reflux condenser until no increase in the precipitate formed is noticed. The dyestuff gives with alkaline hyposulphite (hydrosulphite) a vat from which cotton is dyed in fast yellow shades.—J. C. C.

Anthracene compounds; Production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 400,500, Mar. 5, 1909. Under Int. Conv., Mar. 23, and April 10, 1908.

NEW anthracene compounds are obtained by treating 1-aminoanthraquinone or its derivatives with acid amides (except urethanes) or by heating 1-acylaminoanthraquinones with ammonia. Example 1: A mixture of 10 parts of 1:4-diaminoanthraquinone and 50 parts of formamide is heated to 180° C. until the mixture becomes yellow. The product is collected and can be crystallised from nitrobenzene. It is probably a dipyrimidine. Example 2: A mixture of 10 parts of 1:4-diaminoanthraquinone, 20 parts of formamide, and 40 parts of phenol is boiled for 1½ hours: an equal volume of alcohol is added and, on cooling, brownish-yellow crystals separate which are probably 4-amino-1-anthrapyrimidine. Example 3: A mixture of 10 parts of 1-aminoanthraquinone, 10 parts of urea and 10 parts of phenol are boiled for 4 hours. The product ($\text{C}_{15}\text{H}_9\text{O}_2\text{N}_2$) is precipitated by adding alcohol: it crystallises from nitrobenzene in yellow prisms. 1-Amino-4-*p*-tolylaminoanthraquinone may be similarly condensed, yielding 4-*p*-tolylamino-1-anthrapyrimidine, the sulphonic acid of which dyes wool violet. Example 4: A mixture of 17 parts of 1-methylamino-4- β -anthriminoanthraquinone (obtained by condensing 1-methylamino-4-aminoanthraquinone with β -chloroanthraquinone), 20 parts of urea, 10 parts of zinc chloride, and 80 parts of phenol is heated until the melt, originally blue, becomes reddish-violet. It is poured into sodium hydroxide solution, the dyestuff filtered off and washed with hot water and dilute hydrochloric acid. It gives a dull blue solution in concentrated sulphuric acid and when precipitated from this solution forms violet flocks which, with alkaline hyposulphite (hydrosulphite), give a vat dyeing cotton in violet-red shades. Example 5: 10 parts of the urethane of 1-aminoanthraquinone are heated with 200 parts of 20 per cent. ammonia in an autoclave to 150° C. The product consists of the anthrapyrimidine described in example 3.—J. C. C.

Anthraquinone derivatives containing nitrogen; Process for preparing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 212,436, May 27, 1908. Addition to Ger. Pat. 210,019, May 1, 1908.

IN preparing the condensation products from aminoanthraquinones and succinic acid, described in the

original patent (this J., 1909, 650), the succinic acid may be employed in the form of its anhydride, chloride, bromide, imide, imide, or other derivative which reacts readily. In some cases it is advantageous to add to the reaction mixture a condensing agent, such as boric acid, zinc chloride, etc.—T. F. B.

Gallocyaninesulphonic acids; Process for the production of new —. Farbenfabriken vorm. F. Bayer and Co. Fr. Pat. 399,636, Feb. 19, 1909. Under Int. Conv., May 13, 1908.

FEW gallocyanines are obtained by condensing nitroso-derivatives of primary or secondary amines with 1:2:3-pyrogallol-5-sulphonic acid. Example: A mixture of 8.6 kilos. of nitrosodimethylaniline hydrochloride, 24 kilos. of 1:2:3-pyrogallol-5-sulphonic acid (potassium salt) and 250 kilos. of methyl alcohol is boiled under a reflux condenser for 6 hours. After cooling, the dyestuff is filtered off. On chromed wool the shade produced is redder and purer than that produced by gallocyanine. —J. C. C.

Halogenated vat dyestuffs dyeing like Indigo; Production of —. Soc. pour l'Ind. Chim. à Bale. Fifth Addition, dated April 7, 1908, to Fr. Pat. 372,627. Dec. 17, 1906.

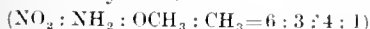
AT dyestuffs are obtained by condensing the α -aryldes of 2:3-diketodihydro-1-thionaphthene or its derivatives with indoxyl or its substituted derivatives and halogenating the products as described in the chief patent and the previous Additions. Example 1: 15 parts of 3-oxy-1-thionaphthene are dissolved in 150 parts of alcohol, —2 parts of sodium carbonate or acetate added and an alcoholic solution of 10.7 parts of nitrosobenzene. An energetic reaction results which necessitates the use of an efficient reflux condenser. The mass is further heated on the water-bath, filtered hot, and part of the alcohol distilled off. On cooling, the anilide crystallises in orange leaflets, m. pt. 147° C. Example 2: 23.7 parts of the anilide just described are boiled with 17.5 parts of acetylindoxyl or 13.5 parts of indoxyl, 10 parts of sodium carbonate and 100—120 parts of alcohol on the water-bath for three hours. The precipitated dyestuff forms small, deep violet crystals with a coppery lustre. It yields a yellow vat from which cotton is dyed in reddish-blue shades moderately fast to washing. Example 3: 4 parts of the dyestuff just mentioned are suspended in 100—140 parts of nitrobenzene, 27 parts of bromine added and the mixture is heated on the oil-bath in about half an hour to 220°—230° C.; it is maintained at this temperature for an hour and, on cooling, the brominated dyestuff is filtered off. It forms a coppery, deep violet powder giving a brownish-yellow vat from which cotton dyed in violet-blue shades becoming redder on soaping. The dyeings, after soaping, are fast to washing, light, and lustrous.—J. C. C.

Vat dyestuffs; Process for preparing red —. Ges. f. Chem. Ind. in Basel. Ger. Pat. 212,870, Dec. 3, 1907. Addition to Ger. Pat. 205,377, Jan. 17, 1907. (See Eng. Pat. 344 of 1908; this J., 1908, 399.)

PHENANTHRENEQUINONE derivatives, containing halogen groups attached to the naphthalene nucleus, are condensed with phenylthioglycol- α -carboxylic acid or with oxy-(1)-thionaphthene. The resulting dyestuffs have greater affinity for cotton fibre than the unsubstituted dyestuffs, and are faster to light and deeper in shade than the dyestuffs obtained by halogenating the unsubstituted dyestuffs.—T. F. B.

Red dyestuff insoluble in water and specially suitable for the manufacture of lakes; New —. Act. Ges. f. Anilinfabr. Fr. Pat. 399,132, Feb. 4, 1909.

A dyestuff prepared by combining diazotised 6-nitro-3-amino-4-cresol methyl ether



with β -naphthol forms a reddish-blue paste which is converted into a red lake by admixture with an appropriate substratum such as aluminium hydroxide, blanc, etc.—J. C. C.

Also colouring matters and intermediate products; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 26,478, Dec. 7, 1908.

SEE Addition of Dec. 5, 1908, to Fr. Pat. 373,475 of 1907; this J., 1909, 698.—T. F. B.

Also dyestuff and process of making same. P. Julius, Ludwigshafen, and L. Blangy, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 932,289, Aug. 24, 1909.

SEE Eng. Pat. 28,272 of 1908; this J., 1909, 304.—T. F. B.

Anthracene dyestuff and process of making same. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 929,442, July 27, 1909.

SEE Second Addition to Fr. Pat. 357,239 of 1905; this J., 1908, 1055.—T. F. B.

Anthracene dyestuff and process of making same. M. H. Isler and F. Kacer, Mannheim, and H. Wolff, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 929,443, July 27, 1909.

SEE Fr. Pat. 390,677 of 1908; this J., 1908, 1107.—T. F. B.

Anthracene dyestuff and process of making same. F. Kacer, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 931,618, Aug. 17, 1909.

SEE Fr. Pat. 386,606 of 1908; this J., 1908, 745.—T. F. B.

Compound of the anthracene series and process of making same. F. Kacer, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 932,290, Aug. 24, 1909.

SEE Eng. Pat. 19,172 of 1907; this J., 1908, 935.—T. F. B.

Sulphur [sulphide] dyestuff and process of making same. L. Haas, Heidelberg, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 931,598, Aug. 17, 1908.

SEE Eng. Pat. 2918 of 1909; this J., 1909, 517.—T. F. B.

Dyestuff and process of making same; Yellow —. E. Fussenegger, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 932,266, Aug. 24, 1909.

SEE Eng. Pat. 26,714 of 1908; this J., 1909, 210.—T. F. B.

Gallocyanine arylides, &c.; Leuco derivative of — and process of making same. C. Vaucher, Assignor to Dye-Works, formerly L. Durand, Huguenin, et Cie., Basle, Switzerland. U.S. Pat. 929,350, July 27, 1909.

SEE Fr. Pat. 394,136 of 1908; this J., 1909, 239.—T. F. B.

Brominated β -naphthylindigo. A. Schmidt and R. Voss, Assignors to Farberwerke vorm. Meister, Lucius, und Brüning, Höchst on Main, Germany. U.S. Pat. 932,334, Aug. 24, 1909.

SEE Eng. Pat. 5299 of 1908; this J., 1908, 1147.—T. F. B.

[Also] dyestuffs; Process for producing red, chrom. —. L. Cassella und Co. Fr. Pat. 398,980, April 7, 1908.

SEE Eng. Pat. 8154 of 1909; preceding.—T. F. B.

Dyestuffs for vegetable fibres. L. Haas, Fr. Pat. 400,022, May 15, 1908.

SEE Eng. Pat. 2918 of 1909; this J., 1909, 517.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Silk: Hydrolysis of — by strong acids and alkalis. E. Abderhalden, F. Medigrescanu, and L. Pincussohn. *Z. physiol. Chem.*, 1909, **61**, 204—209. (See also this J., 1909, 518.)

It is an open question whether in the ultimate hydrolysis of proteins, the resulting amino-acids are secondary products, and do not represent groups originally present. The present is a quantitative study of the hydrolysis of the protein of raw silk (wastes). 100 grms. were treated with (1), concentrated hydrochloric acid; (2), 25 per cent. sulphuric acid; (3), 25 per cent. sodium hydroxide solution; and (4), a saturated solution of barium hydroxide. The main products were identical, namely tyrosine, glycocoll, and alanine, of which the yields were approximately the same in all cases. The following are the approximate yields obtained per 100 grms. of raw silk:—Glycocoll, 26 grms.; tyrosine, 7 grms.; alanine, 12 grms. The results furnish further evidence of the individual constitutional characteristics of the proteins.

—W. N. B.

Silks: Proximate composition [and constitution] of various —. III. Monoamino-acids from Shantung tussah silk. E. Abderhalden and C. Brahm. *IV. Monoamino-acids from Bengal silks.* E. Abderhalden and J. Sington. *Z. physiol. Chem.*, 1909, **61**, 256—260.

THE authors have applied the methods previously described (this J., 1909, 240, 518) to the investigation of tussah silks. The hydrolysis of a Shantung variety with strong acids yielded a residue of considerable amount, which contained 16.5 per cent. of nitrogen, and on alkaline hydrolysis, yielded alanine. This residue is under further investigation. In the hydrolysis of the silk fibroin there were obtained per 100 grms., 14.5 grms. of glycocoll, 22 grms. of alanine, and 9.7 grms. of tyrosine, with small proportions (under 2 per cent.) of serine, leucine, proline, phenylalanine, and glutamic acid, respectively.

From degummed Bengal silks, the quantitative yields of ultimate products were similar, the only difference being the relatively high yield of glycocoll. The following numbers may be noted, the figures representing yields per 100 grms. of fibroin:—Glycocoll, 30.5 grms.; tyrosine, 10.0 grms.; alanine, 20.0 grms., with small proportions of serine, leucine, phenylalanine, and proline.—W. N. B.

Cotton from Southern and Northern Nigeria. Bull. Imp. Inst., 1909, **7**, 154—159.

FOUR samples of cotton from Ibadan and two from Lafenwa, S. Nigeria, proved of satisfactory quality, and, with one exception (which was stained brown and yellow in places, but possessed good length and lustre) compared favourably with standard commercial specimens of similar varieties. Two of the samples—rough native varieties—resembled Peruvian cotton in quality, and might possibly be utilised for mixing with wool in the manufacture of "union" yarns. Of seven further samples of unginned cotton from S. Nigeria (4 from Ishan, and 1 each from Hon, Abeokuta, and Meko), only that from Hon was of satisfactory quality. A small sample of cotton from Lagos was coarse and somewhat dark in colour, but was otherwise similar to rough Peruvian cotton. Two samples of cotton from Northern Nigeria, from Shonga and Nassarawa respectively, were examined. The former was similar in appearance to a low quality of brown Egyptian cotton, but was much rougher and inferior in colour. The sample from Nassarawa contained a small amount of immature fibre, and was of rather irregular strength, being weak in places. If free from immature fibres, it would be readily saleable as a rough-stapled cotton similar to Brazilian or Peruvian cotton.—A. S.

Sisal hemp from the East Africa, Uganda, and Nyasaland Protectorates. Bull. Imp. Inst., 1909, **7**, 160—161.

SISAL hemp from the E. Africa Protectorate (I.) consisted of well-cleaned fibre, nearly white, very lustrous, of excellent quality and good strength, and about 5 ft. long; it was valued at £29 per ton (Mexican Sisal hemp at £24). The Uganda sample (II.) was white, of fair lustre, very well cleaned, of rather uneven strength, and about 4 ft. 9 ins. long; it was valued at £27—£28 per ton (Mexican Sisal hemp at £25). The Nyasaland sample (III.) was nearly white, of good lustre, well cleaned, of excellent strength, and 4 ft. to 4 ft. 6 in. long; it was about equal in value to Mexican Sisal hemp. The results of the chemical examination of the samples are given in the following table (compare this J., 1907, 757).

	I.	II.	III.
	per cent.	per cent.	per cent.
Moisture	11.1	7.9	9.2
Ash	1.0	0.7	0.5
α -Hydrolysis (loss)	11.2	9.2	8.6
β -Hydrolysis (loss)	14.1	11.3	11.1
Acid purification (loss)	2.3	0.7	0.35
Cellulose	78.2	80.3	80.9

—A. S.

Mauritius hemp and "Likanga" fibre from Nyasaland. Bull. Imp. Inst., 1909, **7**, 162—163.

FOUR samples of Mauritius hemp were examined and were valued at £20, £20 10s., £20, and £19 per ton respectively, with "good fair" Mauritius hemp at £21 to £21 10s. per ton. The sample of "Likanga" fibre consisted of white, very lustrous, fine fibre, of poor and uneven strength, and about 3 ft. long. Similar fibre of better strength would be worth £20—£25 per ton in London.

—A. S.

PATENTS.

Fibres [artificial silk]: Apparatus for making — from solutions. W. A. E. Crombie, London. Eng. Pat. 16,557, Aug. 6, 1908.

THE cellulose solution is delivered from a perforated nozzle into a vessel through which the coagulating liquid flows without intermission, the level of the liquid in the vessel being kept constant. The outlet pipe, which is immediately below the spinning nozzle gradually tapers, and bends upwards, the effect being that the rate of flow of the coagulating liquid increases and the threads are carried to the end of the pipe without coming into contact with, and being damaged by the walls. Upon leaving the pipe the threads pass to grooved rollers, or inclined planes, for further treatment.—F. M.

Artificial fibres from nitrated cotton: Production of — Soe. Anon. des Celluloses Planchon. Fr. Pat. 399,218, April 15, 1908.

THE invention is an improvement on Fr. Pat. 382,718 of 1906 (this J., 1908, 221), being intended to increase the productive capacity of the machine therein described, and to regulate the formation of a fibre of collodion issuing from a nozzle into a vessel containing a liquid by which the solution of collodion is coagulated. The apparatus consists of a number of units, each complete in itself and each containing a nozzle and a vessel to receive the fibre ejected from that nozzle. The nozzles are fed by cylindrical vessels containing collodion and fitted with pistons which are operated by compressed air. By altering the air pressure the supply of collodion to the nozzles is regulated. Each cylinder supplies one or more nozzles. The nozzle is connected to the cylinder by a flexible tube provided with a tap and also with a filter. By a mechanical device the tube moves in a conical path, the nozzle describes a circular path in a horizontal plane, and the receptacle underneath the nozzle revolves on a vertical axis in such a way that its radius corresponds to the diameter of the circle described by the nozzle. The fibre is thus deposited in circles passing

through the centre of the receptacle and touching its inside wall. The fibre solidifies under the action of the liquid in the receptacle (see Fr. Pat. 361,960 of 1905; this J., 1907, 197), and in this way is said to give a product which can be readily taken out and further manipulated without damage.—S. H. H.

Silk product and process for the treatment of silk. J. Knup, Paterson, N.J., Assignor to The Hellwig Silk Dyeing Co. U.S. Pat. 931,433, Aug. 17, 1909.

In order to obtain a weighted silk of a uniform blue-black colour, the silk is weighted in successive baths containing tin tetrachloride, sodium phosphate and a silicate, then subjected to a bath of pyrolignite of iron, next to treatment with gambier, logwood and fustic, and finally to a bath containing logwood and soap.—J. C. C.

Embroideries; Production of — by local carbonisation. L. Cassella und Co., Ges.m.b.H. Fr. Pat. 399,529, April 23, 1908.

In embroidering with cotton thread upon a silk or wool ground, the removal of the silk or wool requires the use of a boiling bath of caustic alkali, whereby the shade of the dyed cotton may be injuriously affected. With silk or wool upon a cotton fabric, the cotton is removed by impregnating with sulphuric acid or a solution of aluminium chloride, and heating in a stove. Various drawbacks to this process disappear when the carbonising liquor is thickened with starch, dextrin, or glucose. The impregnation is more uniform, and by using aluminium sulphate the cellulose is not blackened on heating and the residues may be removed without leaving any stain on the embroidery.—F. M.

Stearine emulsions; Employment of — in bleaching. E. Lasbordes. Fr. Pat. 399,514, Feb. 8, 1909.

THE process consists in treating the material with a mixture of stearine ("emulsified or saponified") and hydrogen peroxide, sulphurous acid, sodium bisulphite solution, etc. The treatment is carried out at 30°–40° C. in a bath containing 5–15 per cent. of stearine and sufficient of the other ingredients to give the desired effect. Bleaching takes place rapidly, and the goods are finally rinsed and dried.—F. M.

Dyeing, mordanting or similarly treating slubbing, yarn and other fibrous material; Machine for —. J. Kershaw and J. T. Cole, Menston, Yorks. Eng. Pat. 16,329, Aug. 1, 1908.

To ensure even and regular dyeings, the material is alternately squeezed and permitted to expand as nearly as possible to its normal condition in the dye-liquor, thorough penetration of each individual fibre being thus obtained. Means are provided whereby the false bottom upon which the material is placed in the dye-vessel is slowly raised (compressing the material against the cover) and is then rapidly lowered, remaining at rest for such a period as will permit of the material expanding to the full extent before the squeezing operation is repeated.—F. M.

Dyeing; Machine for — with a circulating bath. L. Mascelli. Second Addition, dated May 5, 1908, to Fr. Pat. 380,671, Aug. 10, 1907 (this J., 1908, 20, 499).

Is the original specification, and the first addition thereto, claim was only made for the use of the machine for dyeing purposes. The present addition protects its employment for mordanting, rinsing, soaping, and similar operations.—F. M.

Dyeing fibrous materials; Apparatus for —. L. Mascelli. Second Addition, dated May 5, 1908, and Third Addition, dated Feb. 20, 1909, to Fr. Pat. 384,798, Dec. 6, 1907 (this J., 1908, 499 and 938).

(1). A SIMPLIFIED arrangement of vats and reservoirs is described, whereby the various treatments of the material may be carried out in one dye-vessel, with one reservoir. A second improvement in the dyeing of cheeses consists in mounting these upon perforated truncated cones which fit one into the other, and permit of the free circulation of the liquors through the material.

(2). The apparatus described in the First Addition to the original patent may be simplified by introducing only one intermediate heating vessel between the reservoir and the dye-vessel. The arrangement is described in detail.—F. M.

Textile materials; Apparatus for circulating, by means of a vacuum and of atmospheric pressure, the liquors employed in the treatment of —. L. Mascelli, Fr. Pat. 399,895, May 7, 1908.

THE material to be treated is placed in a closed vat, connected by pipes (with valves) with a cylindrical vessel placed at a higher level. This cylinder is also in connection with a second one in which a vacuum may be produced by means of a pump or by steam condensation. The liquors for the treatment of the material are contained in separate reservoirs, connected by pipes with the cylindrical reservoir, and are filled into this as required by diminishing the pressure in the vacuum cylinder. Under the influence of atmospheric pressure, the liquors flow through the material in the vat and may be circulated as desired.—F. M.

Two-colour effects on half-wool fibres and fabrics; Process for producing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 212,242, Dec. 18, 1907.

HALF-WOOL goods are treated for about half an hour, in the jigger, at about boiling temperature, with tannin and a metallic salt which forms no precipitate with tannin (e.g., zinc sulphate, sodium tungstate); the goods are squeezed, without rinsing, and then treated by the bisulphite process (see Eng. Pat. 8631 of 1907; this J., 1908, 559) with a sulphide dyestuff (which dyes the cotton) and finally with an acid dyestuff (which dyes the wool).—T. F. B.

Brown dyeings and printings; Process for producing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 212,793, June 7, 1907.

FAST brown dyeings or printings are obtained by combining a diazotised nitraniline, especially *p*-nitraniline, on the fibre, with a mixture of Chrysoidine or Vesuvine and a *m*-diamino compound or a substituted *m*-diamino compound, the following being specially suitable:—*m*-toluylendiamine, *m*-diaminoditolyldiamine, *m*-aminodimethylaniline, dimethyl-*m*-phenylenediamine, and dimethyl-*m*-toluylendiamine. The Chrysoidine or Vesuvine and *m*-diamino compound are preferably present in equal quantities. The shades produced are much deeper than those obtained by using twice the quantities of Chrysoidine or Vesuvine when employed alone. The process has a further advantage, that the Chrysoidine mixed with the diamino base dissolves easily and without residue in hot water, whereas alone it resinifies.—T. F. B.

Thread; Process of coating —. E. D. C. Bayne and L. A. Subers, Cleveland, Ohio. U.S. Pat. 929,651, Aug. 3, 1909.

THE process consists in opening the fibres composing the thread by heat, evaporating a volatile medium therein, and filling the interstices between the fibres with the plastic and vulcanisable coating material. A succession of thin coatings are evenly distributed on the thread in a vertical position, and each coating is dried by means of an air blast, the thread being finally shaped to a perfect cylindrical form between polished surfaces.—J. C. C.

Drying or otherwise treating textile fibres, fabrics, &c.; Apparatus for —. Tomlinson-Haas, Ltd., and J. Standeven, Manchester. Eng. Pat. 16,689, Aug. 8, 1908.

THE material is placed on superimposed, pervious trays, in an airtight casing. The trays are introduced at the top of the casing and are slowly transported to the bottom. In their passage they meet a current of hot air which is drawn through the apparatus, but this current after passing over one tray does not pass directly to the next, but is first diverted through a heating chamber. The air is

thus reheated to maintain a normal temperature, or its temperature may be gradually raised as it passes to the colder, moister material.—F. M.

Fatty acids recovered from the waste soapy waters from dye works and calico-printworks; Process for decolorising and purifying the — N. Planowsky and N. Philippoff. Ger. Pat. 212,708, Feb. 28, 1908.

SOAPY waters, obtained in dyeing and calico printing, are treated with mineral acids to recover the fatty acids in the usual manner; the mixture is then heated to 50—55° C., and filtered through a press, when the fatty acids pass through the press, freed from the dyestuffs which were present as laves. The fatty acids are now washed with hot water, completely freed from the water, and heated to 140° C. with zinc dust, or finely divided iron, or a mixture of the two; the mixture is agitated and its temperature quickly raised to 200—220° C. When the azo dyestuffs and alizarin are completely reduced, the metals are separated, and the fatty acids cooled to 100—110° C. and treated with about 40 per cent. of their weight of sulphuric acid of 65° B., to convert the reduction products into sulphonic acids, which are removed by treating with hot water, the sulfonated fatty acids being converted at the same time into hydroxy-fatty acids. The product is finally distilled with superheated steam.—T. F. B.

Cellulose solutions for making artificial threads; Process of making — P. Friedrich. Fr. Pat. 400,321, Feb. 13, 1909. Under Int. Conv., Feb. 19, 1908.

SEE Eng. Pat. 4104 of 1909; this J., 1909, 934.—T. F. B.

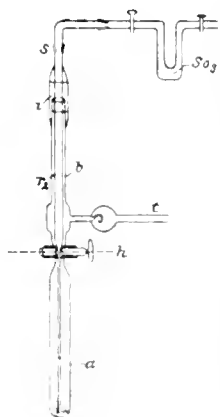
Printing colours containing vat dyestuffs in the form of their leuco compounds; Production of — Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 400,460, June 5, 1908.

SEE Eng. Pat. 15,352 of 1908; this J., 1909, 472.—T. F. B.

Soap compound [for making cotton non-inflammable]. Eng. Pat. 717. See XII.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Caro's acid. H. Arble. Z. angew. Chem., 1909, 22, 1713—1715.



THE author describes a simpler form of apparatus in which the synthesis of Caro's acid from sulphur trioxide and hydrogen peroxide (see this J., 1909, 363) can be effected. The modified apparatus is shown in the accompanying figure. The lowermost part of the cylinder, *a*, is placed in a refrigerating mixture, and a current of air, charged with sulphur trioxide, is drawn through the tube, *r*₂, and the capillary tube passing through the tap, *h*. The air leaves the apparatus through the tube, *t*, and is passed through sulphuric acid monohydrate to absorb excess of sulphur trioxide. As sulphur trioxide is gradually deposited

in *a*, the latter is moved downwards into the refrigerating mixture, the tube, *r*₂, being kept fixed and the remainder of the apparatus displaced; the joint, *i*, between *r*₂ and *b*, is composed of smooth asbestos paper held in place by rubber rings. When sufficient sulphur trioxide has been deposited in *a*, the tube, *r*₂, is withdrawn, and a reserve tube introduced. A small funnel tube, containing 100 per cent. hydrogen peroxide, and closed above and below by ceresin stoppers, is now fixed in *s*, and by removing the lower stopper and slightly raising the upper one, the requisite quantity

of the peroxide is allowed to flow into the capillary tube which projects through the tap, *h*, half-way into *a*. During this operation the cylinder, *a*, is well cooled, and *t* is connected with a drying apparatus. It is best to place the apparatus in an inclined position, so that the hydrogen peroxide first falls on to the side of *a*, and only slowly comes in contact with the sulphur trioxide. Samples of the Caro's acid produced by the interaction of the sulphur trioxide and hydrogen peroxide, can be withdrawn as required by means of the tube, *r*₂. Further experiments with the acid thus prepared confirmed the view that Caro's acid is monobasic monosulpho per-acid. (See also this J., 1909, 653).—A. S.

Acid sulphates of potassium. J. D'Ans. Z. anorg. Chem., 1909, 63, 225—229. (See this J., 1903, 1193; 1908, 854.)

A PHYSICO-CHEMICAL study of mixtures of aqueous solutions of potassium sulphate and sulphuric acid has shown that besides the compounds, K₂H(SO₄)₂ and KHSO₄, two other acid sulphates exist at 0° C., and one at 25° C. The salts are intermediate in composition between the two formulated above, but their exact formulae have not been determined.—F. SODN.

Phosphates; Quantitative determination of alkali — by direct acidimetry. E. Pozza-Escot. Bull. Assoc. Chim. Suer. et Dist., 1909, 26, 1162—1163.

A QUANTITY (e.g., 10 c.c.) of the solution of the alkali phosphate is treated with 2 drops of 0.2 per cent. solution of methyl orange and 5 drops of 1 per cent. solution of phenolphthalein, and then with dilute sulphuric acid until the methyl orange is just reddened. The solution is then rendered neutral to methyl orange by careful addition of alkali solution; at this point, the colour should be very distinctly yellow without any reddish tint. The solution, which now contains the whole of the phosphoric acid in the state of monobasic phosphate is titrated with *N*/1 or *N*/10 alkali, the end-point of the conversion of monobasic into dibasic phosphate being that at which the phenolphthalein is just reddened. One c.c. of *N*/1 alkali is equivalent to 0.071 gm. of phosphoric anhydride. The method is not applicable to phosphates other than those of the alkalis.—L. E.

Ammonium phosphate; its volumetric determination, with some notes on the availability of the lead oxide method. J. M. Wilkie. Chem. and Drugg., 1909, 75, 379—380.

THE lead oxide method for the determination of phosphoric acid gives accurate results in the analysis of ammonium phosphate, if the latter be free from non-volatile impurities, and the method be carried out as follows. The solution of the salt is evaporated with lead oxide on the water-bath, and the residue gently heated until ammonia is no longer evolved. The containing crucible is then cooled, and the inner walls washed with a few c.c. of water to carry down any phosphoric acid deposited thereon; the contents are now evaporated, and the residue ignited to constant weight. The phosphoric acid in ammonium phosphate can also be determined volumetrically by a modification of the author's method (this J., 1909, 68). The solution of the salt is boiled with a known volume of *N*/10 sodium hydroxide to expel ammonia, then a quantity of sulphuric acid equivalent to the alkali is added, and after further addition of sodium acetate and silver nitrate, the liberated acetic acid is titrated with barium hydroxide solution and phenolphthalein as previously described (*loc. cit.*). If great accuracy is not required, both the phosphoric acid and ammonia of ammonium phosphate may be determined by the following simple method. 10 c.c. of a solution of the salt (13.21 grms. in 100 c.c.) are treated with 30 c.c. of *N*/1 sodium hydroxide and concentrated to 5 c.c.; after mixing well with a few c.c. of hot water, the solution is titrated with *N*/1 sulphuric acid and methyl orange. If a c.c. of acid be used, the percentage of the theoretical quantity of phosphoric acid (H₃PO₄) is equal to 10 (30 - *x*). A further 10 c.c. of the original solution are titrated directly with *N*/1 sulphuric acid and methyl orange. If *y* c.c. of acid be used, the percentage of the theoretical quantity of ammonia (NH₃) is equal to 5(*y* + 30 - *a*).—A. S.

Solubility [of zinc sulphate and cadmium sulphate]; Influence of pressure (up to 1000 atmospheres) on —.
E. Cohen. Z. Elektrochem., 1909, 15, 600.

A DETERMINATION of the influence of pressure on the solubilities of zinc sulphate, $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$, and cadmium sulphate, $\text{CdSO}_4 \cdot 8\frac{1}{3}\text{H}_2\text{O}$, at 25°C ., shows that increase of pressure reduces the solubility of the former salt and increases that of the latter; the results are shown in the following table, the figures representing grams of anhydrous salt in 100 grms. of water:—

Pressure (atmos.).	Solubility.	
	Zinc sulphate.	Cadmium sulphate.
1.....	57.95	76.80
250.....	57.93	77.40
500.....	57.91	78.00
750.....	57.73	78.36
1000.....	57.55	78.73

—F. SODN.

Silver iodide; Solubility of — in sodium iodide solutions.
W. Krym. J. Russ. Phys.-Chem. Ges., 1909, 41, 382—385. Chem. Zentr., 1909, 2, 681—682.

THE curve representing the solubility of silver iodide in presence of sodium iodide at 25°C ., consists of three branches corresponding to the solubility of silver iodide, of the double salt, $\text{AgI} \cdot \text{NaI} \cdot 3\frac{1}{2}\text{H}_2\text{O}$, and of sodium iodide respectively. The saturated solutions had the following composition, expressed in grm.-mols. per 1000 grm.-mols. of water:—

	35.63 8.14	40.54 10.94	61.55 25.15	80.55 38.19	94.25 47.79	107.52 57.52	117.96 51.70
Sodium iodide							
Silver iodide							
Solid phase	Silver iodide						Double salt
Sodium iodide	134.40	135.83	133.81	129.02	122.56	117.11	111.52
Silver iodide	46.82	46.36	43.03	34.85	22.82	11.93	—
Solid phase	Double salt	Double salt and sodium iodide	Sodium iodide				

—A. S.

Graphite; Recent discoveries of — in British African Colonies. Bull. Imp. Inst., 1909, 7, 166—169.

OF the numerous occurrences of graphite and graphite-bearing rocks recently reported from British African colonies, those in Nyasaland and Rhodesia alone appear likely to be of commercial value. In the north-west of the Upper Shire District, Nyasaland, seven different parallel bands of graphite gneiss have been discovered, in which the graphite is interfoliated in large flakes with the other constituents of the rock. Samples proved to contain from 70.6 to 91.6 per cent. of carbon, and it is stated that if carefully cleaned, the material would probably yield flake graphite worth about £40 per ton. A sample of graphite from a deposit in the Angoniland District, Nyasaland, consisted of practically pure graphite, in the form of coarse flakes up to 2 ins. long, and resembling good Ceylon graphite. It was valued at £32 to £34 per ton, and was classed as "ordinary lump of superior quality." Steps are being taken to work the deposit. A sample of graphite from North-East Rhodesia contained 79.57 per cent. of carbon and 16.83 per cent. of ash, mostly felspathic material; it was of a lustrous black colour and possessed a coarsely crystalline structure resembling that of Ceylon graphite. A clean piece of graphite selected from the sample contained 99.33 per cent. of carbon.—A. S.

PATENTS.

Sulphuric acid; Concentration of — and apparatus therefor. J. Mackenzie, Middlesbrough. Eng. Pat. 6415, Mar. 17, 1909.

SULPHURIC acid is concentrated to about 150° Tw. in lead pans, and flows thence through a series of fused-

silica evaporating dishes, arranged in "cascade" form. By displacement of the liquid in successive dishes, the acid finally reaches the lowermost dish, from which it is discharged into a receiver. Any closed type of furnace may be used as source of heat, and the evaporating dishes are arranged in the form of steps over the furnace, a flue from the latter communicating heat to the underside of the dishes. The latter are provided with hoods, through which acid-proof pipes lead a current of air from a main through the acid, and assist the concentration of the latter by thorough agitation. The hot gases from the furnace enter the lower portion of the "cascade" concentrating chamber, and pass along underneath the evaporating dishes, then under the leaden pans, in which the first concentration of the dilute acid takes place, and thence to the chimney.—O. R.

Sulphuric acid; Process of manufacturing —. W. Hallock, New York. U.S. Pat. 930,471, Aug. 10, 1909.

SULPHUR dioxide is subjected to the influence of an ionising agent (e.g., radio-active material) in the presence of oxygen; sulphur trioxide is thereby produced.

—F. SODN.

Chemical-reaction furnace, and method of making [hydrochloric] acid. J. L. Tufts, Boston, Mass., Assignor to Merrimac Chemical Co. U.S. Pats. 930,441 and 930,442, Aug. 10, 1909.

THE furnace consists of two communicating superposed reaction chambers, each provided with ploughs, secured to a common rotatable vertical shaft, for working the material and transferring it from chamber to chamber. The material is worked at a moderate temperature in the

upper chamber, until portions become fairly solid, and these are continuously transferred to the lower chamber to be heated more strongly, the more fluid part being retained for further treatment in the upper chamber by arranging a suitable depression in the hearth. A dead gas space is provided between the hearth of the upper chamber and the flue beneath by an apertured partition between them. The second patent is for the continuous manufacture of volatile acids by means of the above furnace, for instance, that of hydrochloric acid from salt and sulphuric acid.—F. SODN.

Nitrates; Manufacture of —. W. A. Dyes, Manchester. From The Firm J. F. Lehmann, Muenich, Germany. Eng. Pat. 15,391, July 21, 1908.

CALCIUM nitrate is treated with a very slight excess of ammonium sulphate in aqueous solution, whereby practically all the calcium sulphate formed is precipitated, and after filtering, the clear solution of ammonium nitrate is evaporated. If the ammonium nitrate is required quite free from sulphate, its solution is first treated with the amount of barium nitrate, or baryta water, which is equivalent to the excess of ammonium sulphate present, after which it is filtered and evaporated.—O. R.

Cyanides from alkali or alkaline-earth oxides or carbonates, carbon, and nitrogen; Process for preparing —. N. Caro. Ger. Pat. 242,706, June 26, 1907.

It is known that the addition of a chloride to a mixture of carbon and an alkali or alkaline-earth oxide or carbonate facilitates the formation of cyanides. It is now found that fluorides possess the same property, and have the advantages over chlorides that they fuse at a higher

temperature, thus allowing the reaction to be carried out at temperatures above the point at which cyanide-formation takes place, without the melting of the mass; and also that the fluorides are not readily soluble in water, so that they can be easily removed from the products.

—T. F. B.

Zinc sulphide; Process of manufacturing — J. C. A. Meyer, Lyons. Eng. Pat. 25,965, Dec. 1, 1908. Under Int. Conv., Dec. 3, 1907.

ACCORDING to this invention, sulphuretted hydrogen is caused to react with a concentrated neutral solution of crude zinc sulphate, such as is obtained in metallurgical operations, until the solution is strongly acid and a state of equilibrium is reached. The operation takes place in two stages, first a slight current of the gas removing the heavy metals, and then, after filtration, pure zinc sulphide being precipitated by a second treatment. A large proportion of the zinc is precipitated, even from very concentrated solutions, and, being in contact with a strongly acid solution, the zinc sulphide is in a form which filters readily. The filtrate may be used for preparing a fresh solution of zinc sulphate.—F. SODX.

Lead arsenate; Manufacture of — E. E. Luther and W. H. Volek, Watsonville, Cal. U.S. Pat. 929,962, Aug. 3, 1909.

LEAD ARSENATES are produced in a single operation by roasting a mixture of white arsenic and a suitable lead compound, in combining proportions, in the presence of oxygen or an oxidising agent.—F. SODX.

Oxides; Process for reducing — [Preparation of the lower oxides of tungsten, molybdenum, vanadium, uranium, and titanium.] The British Thomson-Houston Co., Ltd., London, From General Electric Co., Schenectady, N.Y. Eng. Pat. 5821, Mar. 10, 1909.

CLAIM is made for the regenerative use of carbon monoxide as an agent for reducing the higher oxide of a metal to its lower oxide, particularly for the preparation of the lower oxides of tungsten, molybdenum, vanadium, uranium, and titanium. The metallic oxide is conveniently placed in a covered graphite or clay crucible which is entirely embedded in a carbon packing, contained in a larger crucible, also covered; the whole is then heated to 800° C. in a suitable furnace. Carbon monoxide is produced in the outer crucible and, rapidly diffusing through the heated inner crucible, reduces some of the metallic oxide; the carbon dioxide here formed passes back by diffusion and is once more converted into carbon monoxide by contact with the heated carbon, and complete reduction is thus soon effected. An advantage of the method is the absence of carbide or free carbon in the product. The process is very suitable for the preparation of tungsten dioxide for use in the production of lamp filaments.

—F. SODX.

Litharge; Method of making — J. E. Sullivan, Camden, N.J., Assignor to N.Z. Graves Co., Philadelphia, Pa. U.S. Pat. 931,522, Aug. 17, 1909.

"MONOXIDE of lead," obtained as a by-product in the manufacture of sodium nitrite, is heated for about 3 hours at 900°—1200° F., and the litharge thus produced is reduced mechanically to a "uniformly powdered commercial condition."—A. S.

Liquefaction of gas [air]; Apparatus for — G. A. Bobrick, Assignor to United States Liquid Air and Oxygen Co., Los Angeles, Cal. U.S. Pat. 924,137, June 8, 1909.

THE general plan of the apparatus is similar to that described in Fr. Pat. 499,416, Dec. 8, 1908 (this J., 1909, 939), except that, instead of free expansion being adopted in the ultimate liquefaction of the gas, means are provided for making one or both stages of the expansion as nearly as possible adiabatic. The details of an apparatus for the liquefaction of air, and its mode of working, are described by way of example. The devices previously indicated for the regenerative cooling of the high-pressure air and the jacketed coils of the liquefier are followed

by a separator and trap, in which liquid is separated from gaseous air; the latter is then admitted to an expansion engine, arranged within, or in close connection with, the liquefier itself, and in which the pressure is reduced from perhaps 300 to 60 lb. per sq. in.; the exhaust from this enters a second separator and trap, and liquid air passes thence to a receiver at low pressure, from which it may be withdrawn; from the first trap, the liquid is forced automatically and intermittently, as it accumulates into the second separator on the low-pressure side of the expansion engine, so that liquid cannot enter this machine. Part of the gaseous air from the second separator, at intermediate pressure, is utilised as a counter-current in the liquefier and coolers, and is then recompressed or passed through the external expansion engine to be used for further cooling, and part is allowed to undergo free expansion to atmospheric pressure, passing partially liquefied, to the final receiver, the gaseous portion returning through the outer envelope of the coils in the liquefier. For small plant, operated with pressures of 100—250 lb. per sq. in., the preliminary cooling of the external system may be effected by the circulation of expanded ammonia or some other refrigerating medium, and the liquefier may be constructed for expansion to take place in one stage, there being only one cooling jacket, surrounding the high-pressure spiral. In large plant, it may be desirable to provide means for both stages of the final expansion to be adiabatic.

—F. SODX.

Sulphur dioxide; Removal of — from gases and its recovery as sulphuric acid. H. Kühne, Goslar, Germany. Eng. Pat. 17,520, Aug. 20, 1908. Under Int. Conv. Aug. 20, 1907.

SEE Fr. Pat. 393,461 of 1908; this J., 1909, 90.—T. F. B.

Sulphuric acid; Manufacture, concentration, and simultaneous purification of — G. C. de Briailles, Paris. U.S. Pat. 928,844, July 20, 1909.

SEE Addition of Oct. 19, 1908, to Fr. Pat. 393,665 of 1907; this J., 1909, 473.—T. F. B.

Nitric acid; Manufacture of — G. B. Ellis, London. From Chem. Werke vorm. Dr. H. Byk, Charlottenburg, Germany. Eng. Pat. 20,366, Sept. 28, 1908.

SEE Ger. Pat. 208,134 of 1907; this J., 1909, 365.—T. F. B.

Hydrazoic acid; Process for making — R. Stollé. Fr. Pat. 400,445, March 8, 1908. Under Int. Conv., March 9, 1908.

SEE Ger. Pat. 205,683 of 1908; this J., 1909, 161.—T. F. B.

Borax from native compounds of boron; Process for the production of — G. E. Bailey and A. Stevenson. Los Angeles, Cal., U.S.A. Eng. Pat. 794, Jan. 12, 1909.

SEE U.S. Pat. 911,695 of 1909; this J., 1909, 309.—T. F. B.

Alum; Process of making iron-free — E. Strohbach, Dresden, Germany. U.S. Pat. 932,067, Aug. 24, 1909.

SEE Fr. Pat. 372,809 of 1906; this J., 1907, 527.—T. F. B.

Alkali silicates; Manufacture of soluble — R. E. Weissmüller, Runcorn, Assignor to W. Gossage and Sons, Ltd., Widnes. U.S. Pat. 932,204, Aug. 24, 1909.

SEE Eng. Pat. 23,794 of 1907; this J., 1908, 1018.—T. F. B.

Liquefaction of gases and separation of air into commercial oxygen and nitrogen; Process for the — G. A. Bobrick, Los Angeles, Cal. U.S. Pat. 924,136, June 8, 1909.

SEE Fr. Pat. 399,416, Dec. 8, 1908; this J., 1909, 939.
—F. SODX.

ERRATUM.—This J., Sept. 15; p. 937, col. 2, line 4 from bottom, for "3189, July 10, 1908," read "3189 of 1909; date of application, July 10, 1908."

VIII.—GLASS, POTTERY, AND ENAMELS.

Glass tubing; Bursting strength of ——. J. R. Roebuck. *Physic. Rev.*, 1909, 28, 264—276.

To join glass-tubing and metal, the glass is to be first coated with a platinum film, and the latter is then electroplated with a coating of copper about 1 mm. thick; it is then "sweated" into a brass or iron tube. It is stated that such a joint can withstand a pressure of 670 atmospheres without leakage. Commercial glass tubing with thick walls, must be annealed to ensure the highest bursting strength. In cases in which the wall thickness was greater than the bore of the tube, the bursting strength was 1.3 times the tensile strength of the glass, or thereabouts, and to all intents and purposes independent of both the bore and the wall thickness.

PATENT.

Glass-making apparatus. P. T. Sievert, Dresden, Germany. Eng. Pat. 9853, April 26, 1909.

THE invention deals with machines for making hollow glass articles, and especially with apparatus for reheating previously-shaped glass bodies, carried by a frame attached to a body, before the final blowing in a mould (see Eng. Pat. 18,917 of 1904). In order to minimise the expense of having to provide different carrying-frames for the different shapes of objects made, the same vertically movable carrier is used for the different shapes, carrying-frames only of different design being attached to these carriers, either by mechanical means, or else by electromagnetic devices. The frames are also supported in such a way that the space between carrier and frame can be altered at will.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Calcareous asphaltum and paving mixtures; Analysis of ——. Prettnr. *Chem. Zeit.*, 1909, 33, 917—918, 926—927.

THE author's results show that utterly erroneous values may be obtained for the gypsum present in asphaltum, if the gypsum be determined in the ash obtained by burning off the organic matter. During the ignition the "organic" sulphur reacts with any calcium carbonate present, with formation of calcium sulphate and sulphide. To determine the gypsum actually present, the mineral matter should be extracted by means of a special reagent, prepared by gradually adding about 300 c.c. of ether to 200 c.c. of hydrochloric acid (sp. gr. 1.19), with continual shaking and cooling, until no more ether is taken up by the acid. 15 c.c. of this reagent are gradually added in 3 or 4 portions to 1 or 2 grms. of the sample of asphaltum, contained in a 150 c.c. flask, placed in an inclined position. The whole is then stirred for 8—10 minutes with a flattened glass rod, 5 c.c. of ether being added during the stirring; 10—15 c.c. of water are then added and the stirring continued until decomposition is complete, after which 40—50 c.c. of hot water are added, and evaporation of the ether is completed by immersing the flask in hot water. The flask is then cooled, the aqueous solution decanted through a filter, and the residue washed 2 or 3 times with very dilute hydrochloric acid. In the filtrate gypsum is determined as usual. To determine total sulphur, 0.5—1 gm. of the finely powdered sample is gently heated with 7 grms. of sodium peroxide in a loosely covered nickel crucible. As soon as the reaction is over, the crucible is strongly heated for 5 minutes. The contents are then dissolved in hot water, the excess of peroxide decomposed by boiling, and an excess of hydrochloric acid and barium chloride added. The silica present does not interfere with the estimation. To determine the organic matter, two portions of 1—2 grms. each are decomposed as for the determination of

gypsum. The aqueous liquid from one portion is decanted through a filter-paper as before, and flask, glass rod and filter are dried, after washing, at 110° C. By the aid of 6 or 7 portions of 2—3 c.c. each of chloroform, the organic matter is then completely transferred to a platinum crucible; the solution is evaporated by heating and directing a current of air against the crucible, and the residue weighed after drying at 105°—110° C. The organic matter is next incinerated; the difference in the weights corresponds to the total organic matter present. The aqueous solution from the second flask is decanted through an Albin filter-tube; the flask and filter are dried, and the soluble organic matter only is obtained by digesting the contents of the flask with successive small quantities of chloroform, which are decanted through the filter-tube. The solution so obtained is evaporated as before, and the residue incinerated, the difference in weight giving the organic matter soluble in chloroform. The lime in the ash should always be converted into calcium sulphate, as variable quantities of the latter are produced during the ignition of the organic matter. Some analyses of Continental samples of asphaltum are given in the paper.

—A. G. L.

Clays; Experiments with ——. Rohland. *Speichsal.*, 1909, 42, 469—470.

ON bringing air-dry clays into sudden contact with a liquid, the clays are disintegrated more or less completely, liquids with a low viscosity having much more action than liquids with high viscosity. The following liquids act with intensity decreasing in the order named: ether, water, benzene, chloroform. The nature of the organic substance which gives clays their peculiar taste and smell is unknown. The substance can, however, be removed from clays by shaking the latter with an aqueous solution of ferric saccharate (i.e., ferric hydroxide dissolved in a solution of sugar). Bonis has previously connected this substance with the ammonia contained in clays, the peculiar smell being first augmented on treating the clay with potassium hydroxide solution, and then disappearing when the ammonia has been expelled.—A. G. L.

Portland cement; Rise in temperature during the setting of ——. Hossbach. *Tonind. Zeit.*, 1909, 33, 1983—1990.

THE rise in temperature during setting was determined with two cements of normal composition, one a slow-setting, the other a quick-setting cement. Tests were made on the neat cements, on sand (3:1) mortars, and on the same sand mortars after keeping them for 24 hours and then again mixing them with water. The tests were made by placing the gauged samples in vessels of sheet zinc surrounded by non-conducting material, and noting the temperature, at first every 5 minutes, and afterwards every 10 minutes. For each sample four different vessels were used, the smallest holding 142 c.c., or about the volume used for a Vicat needle test, the next 1420 c.c., the third 14,200 c.c., and the largest 142,000 c.c. In every case there was a rise of temperature during the gauging; with the smallest sample, a fall in temperature to practically room temperature then occurred, followed by a second rise in temperature, whilst with the three larger samples the initial rise was continued, although at a slower rate at first, to the maximum temperature. With the largest sample of the neat quick-setting cement, the maximum temperature reached exceeded 100° C. It was shown that the fall in temperature observed with the smallest (142 c.c.) samples was due only to the rate of cooling exceeding the heating produced by the reaction, and was not a real fall. For this purpose, samples of the same size were placed in water-tight vessels, which were immersed in water, the temperature of which was kept 0.2—0.3° C. below that of the cement, by the gradual addition of hot water. In this way, the rise in temperature obtained was continuous from the initial rise to the maximum temperature; here also a period was observed during which the rise slackened. It was found that the time which elapsed before the maximum temperature was reached, varied considerably for the different sized samples and for different mixtures, and was generally quite different from the initial or final

setting-times as indicated by the Vicat needle. It was also found that the mortars which were gauged a second time after keeping, developed but little heat after the second gauging, and gave very poor tensile and compression tests; it follows from this that mortars should be used as soon as possible after gauging.—A. G. L.

Cements; Determination of free lime in —. R. Brandenburg. Chem.-Zeit., 1909, 33, 880.

For the determination of free lime in cements, the author recommends boiling with a saturated solution of ammonium bromide in absolute alcohol, and estimating the ammonia produced. Ammonium bromide was not decomposed on boiling its alcoholic solution either alone or in presence of calcium carbonate. The absolute alcohol was produced by first distilling in presence of quicklime and then allowing to stand in contact with "activated" aluminium until evolution of gas could no longer be observed.—A. S.

PATENTS.

Abrasive material; New — and the process of its manufacture. J. Brightmore, Tideswell, Derbyshire, Eng. Pat. 3546, Feb. 13, 1909.

BLACK basalt is heated to a high temperature for about four hours in a suitable kiln or furnace, and is then fluxed by adding to it powdered fluorspar and reheating for a further two hours. The mixture is cooled by spraying with water, crushed, and pulverised.—O. R.

Wood; Method of treating —. W. B. Chisholm, Charleston, S.C., U.S.A. Eng. Pat. 5908, Mar. 11, 1909.

A SOLUTION, claimed to contain free sulphur in solution, is obtained by boiling together 4 parts by weight of sulphur and 1 of lime with water. The red solution obtained is filtered or decanted, and the filtered solution, heated to its boiling-point is used for impregnating wood, preferably immediately after preparation. On cooling, sulphur and calcium salts are deposited in the pores of the wood. Sodium, potassium, or ammonium hydroxide may be substituted for the lime. If the wood is to be used below the surface of water, it is, in addition, painted over with a fused mixture obtained by melting 4 parts of sulphur with 1 of lime.—A. G. L.

Wood; Process for impregnating —. W. A. G. von Heidenstam and K. L. F. Friedemann. Fr. Pat. 339,712, Jan. 26, 1909. Under Int. Conv., Feb. 15, 1908.

WOOD is impregnated with an aqueous solution of compounds of the cresols with lime. The impregnated wood is then exposed to the action of the air, or of flue-gases, when the cresols are liberated within the wood, with simultaneous formation of calcium carbonate.—A. G. L.

Mastic for paving; Method of manufacturing a —. J. H. Amies, Assignor to The Amies Asphalt Co., Philadelphia, Pa. U.S. Pat. 929,813, Aug. 3, 1909.

A MIXTURE of a base such as calcium oxide or hydroxide with mineral, earthy or fibrous material is added to asphaltic, resinous, or other carbonaceous material and the whole mixed with moist sand, and, if necessary, water, to produce a granular and friable mastic. A volatile oil may be mixed with the mineral ingredients before adding the bituminous material.—A. G. L.

Refractory substances; Process relating to —. R. Tripmacher, Schweidnitz, Germany. U.S. Pat. 930,575, Aug. 10, 1909.

POWDERED refractory substances are agglomerated by treatment with a liquid consisting of a saccharine solution and a chromium compound (chromic acid) emulsified with naphtha. A boron compound (boric acid) and a fluoride may also be added.—A. G. L.

Refractory bricks; Method of producing — from lime, silica or similar materials. S. W. Berglund. Fr. Pat. 399,384, Feb. 11, 1909.

QUARTZ, preferably finely divided, is first heated to about 1500° C. It is next powdered as finely as possible, mixed

with 2—6 per cent. of lime, and treated as usual in making sand-lime bricks. It is claimed that the bricks obtained are very refractory and undergo no change in volume on heating.—A. G. L.

Porous material [from slate]; Method of manufacturing a —. H. Senn, Szczakowa, and D. Klüger, Trzebinia, Austria-Hungary. U.S. Pat. 930,801, Aug. 10, 1909.

SLATE containing about 10 per cent. of organic matter is calcined at about 1200° C., whereby the material swells and assumes a cellular structure.—A. G. L.

Stones of all kinds; Process for the uniform colouring of —. W. Tapolski. Ger. Pat. 212,874, May 24, 1908.

ALKALI salts or ammonium salts, preferably of organic acids, are added to the metallic salt solutions used for producing coloured precipitates in the stones, in order to facilitate their penetration.—A. S.

Hydraulic lime; Process of making artificial —. N. Lambert. Fr. Pat. 399,848, Feb. 23, 1909.

THE lime-dust from lime-kilns is mixed with materials containing silica, alumina, and alkali in proportions suitable for a hydraulic lime.—A. G. L.

Slag cement; Manufacture of —. J. G. A. Rhodin, Liverpool. Eng. Pat. 23,988, Nov. 9, 1908.

MOLTEN slag is disintegrated by being caused to impinge on to the surface of a rapidly rotating disc or table, enclosed in a chamber into which finely divided salts, such as ferrous sulphate, are forced by means of an atomiser spray. The minute globules of slag chemically combine with the dry salts, forming a cement clinker, which when cooled and ground, is readily hydrated.—F. R.

Cement; Method of making an acid-proof —. H. Kayser, Darmstadt, Germany. Eng. Pat. 24,718, Nov. 17, 1908.

PORTLAND cement is mixed with the residue obtained in working bauxite, which contains soluble silica, or with infusorial earth.—A. G. L.

Cement; Treatment of stony or earthy materials, particularly for the manufacture of —. F. L. Smidth and Co., Copenhagen, Denmark. Eng. Pat. 2599, Feb. 3, 1909. Under Int. Conv., Feb. 27, 1908.

CEMENT raw materials, etc., are first crushed, with the addition of a certain amount of water, in a ball-mill, preferably of the kind in which the pounding force of the balls is utilised in addition to the friction between the materials and the balls. The crushed material is delivered to a stationary sieve provided with centrifugally acting stirrers, which force the slimes through the sieve; these stirrers consist essentially of hollow arms for feeding the material, and flat wings for beating it against the sieve. The slimes are delivered directly to the rotary kiln, or, preferably, to a tube-mill, in which they are ground finely, whilst the coarse particles are returned to the ball-mill.—A. G. L.

Portland cement; Apparatus for burning —. T. A. Edison, Llewellyn Park, Orange, N.J. U.S. Pats. 930,946, 930,948, and 930,949, Aug. 10, 1909.

A ROTARY cement kiln is provided with means for introducing the cement material diametrically across the kiln and directly in the path of the products of combustion of gas from a producer connected to the lower end of the kiln. The gases emerge from the kiln into a settling chamber of such size as to greatly reduce their velocity, so as to allow the coarser particles of dust to settle. Opposing walls of this settling chamber are made of loose granular material and form filters on which the fine dust is deposited, the products of combustion being drawn through the filters by the action of controllable exhaust fans. The dust-free products of combustion may be led to a heat-absorbing device, e.g., a feed-water heater, a by-pass arrangement being provided by which the gases can be shunted, if desired.—(See also U.S. Pat. 930,947, page 973.)—A. G. L.

Concrete compound; Process of producing a fire-proof — S. von Medvecsky, Arad, Hungary. Eng. Pat. 27,902, July 29, 1908.

A FIREPROOF concrete suitable for making stoves, etc., is obtained by mixing 2.5 parts of sand with 1.5 parts of a mixture consisting of 1 part of kaolin, 0.34 of soapstone and 0.16 of pumice stone, ashes, or lava, and 0.5 parts of Portland or other cement. Water, preferably in the form of steam, is added, and the whole moulded. To produce a porous product, 0.05 part of sodium chloride, borax, or other salt, or of lime, is added to the above. Clay may be substituted for a part or the whole of the concrete mixture.—A. G. L.

Concrete or cementitious compounds; Process of, and apparatus for, making — L. M. Reed, Cleveland, Ohio. U.S. Pats. 930,085 and 930,086, Aug. 3, 1909.

THE process claimed consists in mixing sand with hydraulic Portland cement, and "showering" the dry mixture into a stationary body of liquid. The apparatus consists of a receptacle open at the top and closed at the bottom or holding liquid; of an inverted T-shaped bar rapidly moving to and fro across the receptacle and some distance above it; of screens placed between the path of the bar and the top of the tank; and of means whereby the constituent materials of the concrete mixture are fed into the path of the bar.—A. G. L.

Food; Process of impregnating — H. A. Mueller, Malmö, Sweden. Eng. Pat. 2534, Feb. 2, 1909. Under Int. Conv., Feb. 15, 1908.

EE Fr. Pat. 399,712, preceding.—A. G. L.

Lithographic stone; Manufacture of — artificially. T. M. Thom, Cheshunt, Assignor to The British Stone and Marble Co., Ltd., London. U.S. Pat. 927,822, July 13, 1909.

EE Eng. Pat. 15,964 of 1907; this J., 1908, 859.—T. F. B.

Cement, mortar, and concrete; Method of making — water-tight. P. Mecke, Stettin, Germany. U.S. Pat. 929,152, July 27, 1909.

EE Ger. Pat. 200,968 of 1908; this J., 1908, 1021.—T. F. B.

Cement; Rotary kiln for burning — F. J. Poths, Hamburg, Germany. U.S. Pat. 929,167, July 27, 1909.

EE Fr. Pat. 391,454 of 1908; this J., 1908, 1154.—T. F. B.

X.—METALS AND METALLURGY.

Nickel-steel for bridges. J. A. L. Waddell. Proc. Amer. Soc. Civil Eng., 1908, 34, 726—923. Proc. Inst. Civil Eng., 1908—1909, 176, [2], 9—10.

INVESTIGATIONS and experiments upon the relative value nickel- and carbon-steel for bridges were carried on over period of three years.

The first step was to ascertain the percentage of nickel which would give the best results. This is limited by the fact that, if high, the material becomes too refractory for shop-working. The best percentage was found to be 5. The allowance of impurities in the nickel steel was as follows:—Phosphorus, 0.03 per cent.; sulphur, 0.04 per cent.; silicon, 0.04 per cent. The allowance of manganese was 0.75 per cent. to 0.85 per cent. The results of the tests upon low nickel-steel were, as an average of eleven tests, 61,300 lb. per square inch for the elastic limit, and 130,300 lb. per square inch for the ultimate strength. For high nickel-steel these figures were 71,600 and 114,000 lb. per square inch, respectively. Impact tests showed that the resistance of nickel-steel was less than that of carbon-steel, the relative values being 87 and 73 to 100, for low and high nickel-steel. Other tests such as hammering, drifting, close-punching, shop-tooling, and corrosion tests were also made.

The author concludes that, at present prices, it would be more economical to use nickel-steel for all kinds of railway bridges, and the larger the bridge the greater the economy. It would also be possible to construct bridges of greater

span with nickel-steel. It is generally regarded that the limit of span for carbon-steel bridges is 2000 feet, but with nickel-steel this could be increased to 2600 feet.

Iron; Peroxidation of — in [copper] blast furnaces. A. Rizo-Patron. Eng. and Min. J., 1909, 88, 367—368.

THE unsatisfactory results obtained in attempting to smelt certain pyritic copper ores, in the raw state, is said to be due to the formation of iron peroxide, instead of protoxide, in the slag. The author describes the attempt made to smelt an ore consisting of grey copper ore, copper and iron pyrites and a very little blende, in a silicious gangue. No difficulty was found in smelting the ore after it had been partially roasted, a matte containing about 35 per cent. of copper being obtained together with a good fluid slag. When, however, the same ore was smelted in the raw state, it was found impossible to produce a fluid slag, although the composition of the pasty, semi-magnetic slag formed, closely resembled (on the assumption that the iron was present as ferrous oxide) that of the fluid slag obtained from the partially roasted ore. It was found that the iron in this particular ore was very readily converted into the magnetic oxide, Fe_3O_4 , even at the low temperature of roasting, so it is thought that the iron tends to become peroxidised by the furnace blast, with the formation of infusible ferric silicate. When partially roasted ore is fed into the furnace, the peroxides already existing are reduced in the upper part of the furnace, and they, with the sulphates, react with the remaining sulphides, preventing the formation of magnetic oxide of iron. Mixing raw ore with roasted ore has the same effect.

—F. R.

Copper smelting; Theory of — N. Juschewitsch. J. Russ. Phys.-Chem. Ges., 1909, 41, 469—472. Chem. Zentr., 1909, 2, 761.

EXPERIMENTS in an electric furnace in an atmosphere of nitrogen showed that the reaction: $\text{Cu}_2\text{O} + \text{FeS} = \text{Cu}_2\text{S} + \text{FeO}$, begins at $280^\circ\text{--}285^\circ\text{C}$. and proceeds rapidly to completion at 700°C . The reaction: $2\text{CuO} + \text{FeS} = 2\text{Cu} + \text{Fe} + \text{SO}_2$, will take place at 455°C ., but is not complete even at 770°C .; the highest yield attained was 96 per cent. In the reaction: $\text{Cu}_2\text{S} + \text{Fe} = \text{FeS} + 2\text{Cu}$, at 600°C ., scarcely 6 per cent. of the sulphur of the cuprous sulphide combined with the iron, whilst in the reverse reaction: $2\text{Cu} + \text{FeS} = \text{Cu}_2\text{S} + \text{Fe}$, at the same temperature, 26 per cent. of the sulphur of the ferrous sulphide combined with the copper in 6 hours.—A. S.

Bronzes; Method for the analysis of — by electrolysis. A. Fischer. Z. Elektrochem., 1909, 15, 591—595.

FOR the analysis of bronze, 0.5—0.6 gm. of the very fine filings is slightly warmed with a solution of 6 grms. of tartaric acid and 1 gm. of monochloroacetic acid, strong nitric acid, to a total quantity of 2—2.5 c.c., being added from time to time. In presence of monochloroacetic acid, the alloy dissolves more rapidly, and the stability of the resulting solution is increased. The solution is made just alkaline with sodium hydroxide, warmed to 90°C ., and acidified with 2 grms. of tartaric acid. Separation of the copper is then effected by Sand's electrolytic method (this J., 1907, 490; 1908, 963), the solution being heated to its boiling point; for the last traces of copper a cathode potential of 0.7—0.8 volt, determined with the mercurous sulphate electrode, instead of 0.45—0.55 volt, as recommended by Sand, is necessary. The deposition of the copper is complete in 20—30 minutes. The solution, free from copper, is concentrated to about 120 c.c., and then rendered ammoniacal and mixed with 5 grms. of very pure ammonium sulphate; about 16 c.c. of ammonium sulphide and 2—3 grms. of sodium sulphite, to reduce polysulphides, are added, and the liquid is gently boiled for 5 minutes, with vigorous stirring. The sulphides of lead, zinc, and iron, thus precipitated, are filtered off and dissolved in nitric acid; the lead is separated by a known method, the solution is evaporated with sulphuric acid, and the zinc, after precipitation of iron as hydroxide, is reduced from alkaline solution. The tin is obtained, quite pure, by electrolysis the solution of the sulpho-salt at $40^\circ\text{--}50^\circ\text{C}$., first for 5—10 minutes with a current of about 3 amp., without

stirring, and then at 5 amp., with the stirrer rotating at about 500 revolutions per min.; the tin is deposited on a platinum cathode, which has been coated first with copper and then with tin. During electrolysis, which is complete in 20–30 minutes, sodium sulphite is added, as required. The whole analysis takes about 5 hours.—F. SOPN.

Tin and gold production of the Federated Malay States.
Board of Trade J., Sept. 9, 1909. [T.R.]

THE following particulars of the production of tin in the Federated Malay States in 1907 and 1908 are extracted from the report on the mining industries of the States for 1908, published as a Supplement to the "Selangor Government Gazette" of 30th July:—

State.	1907.		1908.	
	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£
Perak	25,678	4,292,008	27,844	3,644,504
Selangor	16,304	2,725,123	16,818	2,201,270
Negri Sembilan ..	4,473	747,738	3,823	500,347
Pahang	1,976	330,267	2,352	307,897
	48,431	8,095,136	50,837	6,654,018

The fluctuation of local prices in 1908 was between 73·37 dols. (on 26th March) and 59·00 dols. (on 4th January), as compared with 97·25 dols. (on 29th April) and 57·75 dols. (on 18th December) per picul in 1907. The average price was 66·78 dols., as compared with 85·28 dols. in 1907. (Dollar = 2s. 4d.)

Exports of tin during the first six months of 1908 and 1909 amounted to 24,600 tons and 22,800 tons respectively.

The output of gold during 1908 was 14,886 ounces, as compared with 15,353 ounces in 1907, a decrease of 467 ounces. The amount for each State was as follows:—

	1907.	1908.
	ozs.	ozs.
Perak	1,032	1,234
Selangor	35	Nil
Negri Sembilan ..	Nil	Nil
Pahang	14,286	13,652
	15,353	14,886

The figures for Perak show the production, but those for Pahang the exports. In addition to the above, there were exported from Negri Sembilan about 100 ounces of gold won on Kanaboi Limited land, the fineness and value of which had not been ascertained. A certain amount of gold (probably 1,000 ounces) was also won by Malays, working in Ulu Pahang under individual licences, but was not exported.

Uranium mining at Joachimsthal. Engineering, Sept. 10, 1909. [T.R.]

THE two uranium mines belonging to the Saxon company are the *Gewerkschaft Hilfe Gottes-Zeche*, which started operations in 1852, and the *Gewerkschaft Sächs Edelleutstollen*, which commenced in 1856. The two lodes of the latter mine now being principally mined are worked by an adit 1000 metres long, partly driven, so it is said, at least 600 years ago. The lodes are of variable width, ranging from 3½ yards to 1 in., the pitch-blende occurring as detached lumps embedded in the mica-schist. Some of these lumps may weigh several pounds, but a large amount of the ore mined does not run above 3 or 4 per cent. of uranium oxide.

The dressing plant at the mine is of somewhat rough construction, but appears to give satisfactory results. In the case of the rich ore very little treatment is required, hand-picking being followed by grinding in a ball mill, the product assaying about 60 per cent. uranium oxide. The poorer ore goes to a crusher preparatory to being fed to a battery of wooden stamps, from which it is taken on to a series of wooden percussion tables. These tables, which

are made on the spot, are actuated by cams on a 3-diameter wooden driving-shaft. The ore from the tables assays on an average 55 per cent. uranium oxide.

The bulk of the ore from these two mines is sold to the factory of the Austrian Government, who are now utilising the old silver-smelter near the new railway station as uranium factory. Practically the only competitive uranium works to those at Joachimsthal are at Brunswick where the radium salts are to be extracted from the Cornish pitch-blende.

Up to the present, for a considerable number of years the market prices of uranium salts have been entirely in the hands of the Austrian Government, the output of Saxony having dwindled considerably. As America and Spain contribute only a few tons of very low-grade ore there are only the two producing districts of Joachimsthal and Cornwall to be considered. Statistics show that in 1906, Austria produced 16 metric tons of ore, valued £10,901, while the Cornish output in 1906 was 11 tons of a value not stated. In 1907 the Cornish figure was 10 tons, valued at £6500, and the advance statistics for 1908 show very similar figures.

PATENTS.

Iron or steel; Treatment of — for preventing oxidation or rusting. Coslett Anti-Rust Syndicate, Ltd., and T. W. Coslett, Birmingham. Eng. Pat. 15,628, July 2, 1908.

IRON or steel articles, on which a coating of phosphate of iron has been deposited (see this J., 1907, 207) are digested in a solution of chromic anhydride for periods depending on the strength and temperature of the solutions. Cold solutions of one-third to 2 per cent. require from 10 to 30 minutes, while hot solutions of one-sixth of 1 per cent. or less, only require 5 minutes.—F. R.

Coating of iron or steel with copper or other metal, such as silver or gold, which will readily alloy with copper. W. C. Clark, Geelong, Australia. Eng. Pat. 16,820, Aug. 1, 1908.

THE article to be coated is "pickled," if necessary, in mineral acid, and then immersed in a saturated solution of cupric sulphate for 10 minutes. It is then dried, heated and passed into a bath of molten copper, or other suitable metal, upon which floats a layer of flux consisting approximately of 15 parts of boric acid, 13 parts of hydrofluoric acid, 4 parts of potassium tartrate, and 4 parts of ammonium chloride, with or without the addition of borax, alum, nitre, silica or soda (sodium carbonate).—F. R.

Titaniferous iron ores; Process of treating —. W. Borchers, Aix-la-Chapelle, Germany. U.S. Pat. 930,344, Aug. 10, 1909.

TITANIFEROUS iron ore is first smelted with carbon, and the reduced crude iron drawn off. The slag, rich in titanium, is converted into a reducing agent by strongly heating it with carbon and is then mixed, at a temperature of about 2000° C., with subsequent charges of ore, which are thereby reduced to silicious iron free from titanium and a slag rich in titanium and poor in silicon.—F. R.

[Iron-tungsten] alloy for making projectiles, &c. J. C. Wyckoff. Fr. Pat. 399,666, Feb. 20, 1909.

THE alloy consists of 21–33 per cent. of tungsten and 79–67 of iron. It is claimed that its high specific gravity and great hardness confer high ballistic properties on the alloy.—A. G. L.

Iron and steel waste; Transformation of — into cast steel. Soc. Anon. des Acieries de Franco. Fr. Pat. 400,382, June 2, 1908.

THE waste is smelted in presence of coke, anthracite, or some such material, a hot or cold blast being employed and limestone, fluorspar or alkaline salts being added if necessary. By the carbonisation of the metal in this way, an intermediate product is obtained, which is particularly suitable for transformation into steel by the ordinary methods of refining. If desired, a certain quantity

ity of new or waste cast iron may be added in the preliminary smelting, the principle of the operation remaining the same.—C. A. W.

Steel; Carbonisation of — to an exact carbon content. C. A. Keller. Fr. Pat. 400,461, June 6, 1908.

A STRONGLY compressed prismatic block of agglomerated carbon is suspended within the furnace by means of a cable passing through an aperture in the roof and wound over a winch or some such lifting device. The block is suitably balanced and arranged so that it may be raised, or lowered through the floating slag into the mass of liquid metal. A dynamometer is attached to the cable, or to the lifting apparatus, so that, as the carbon dissolves, the loss in weight may be read off directly, at any moment. In this way, knowing the weight of metal in the furnace, the content of carbon may be exactly regulated.—C. A. W.

Tin; Apparatus for extracting — from tin plate waste. H. Brandenburg, Kempen on Rhine, Germany. Eng. Pat. 16,895. Aug. 11, 1908. Addition to Eng. Pat. 2322 of 1908.

A place of removable perforated containers arranged between T-irons mounted on a rotating spindle (see his J., 1908, 813), two concentric drums are arranged about one spindle and the annular space between the two drums is used to contain the tin-plate scrap, which is caused to rotate in the caustic alkali lye. Access to the annular space is provided by a portion of the outer drum opening by means of a hinge, or an end segment being removable.—F. R.

Terpene-oil; Apparatus for recovering — from water-bath. [Tinning metal articles.] V. Fornozini, New Britain, Conn. U.S. Pat. 929,204, July 27, 1909.

A oil bath adapted for dipping articles in the process of tinning is so combined with a water bath that the articles after treatment in the oil bath can be cooled in running water. The oil which thereby accumulates in the water is recovered by allowing it to overflow together with some water, in a wide and shallow flow, into a separating vat, from the bottom of which the water is siphoned off, whilst the oil collects on top and may be drawn off through a suitable outlet.—R. L.

Lead or other metal or alloy in a thread-like or finely divided form; Process of producing —. E. P. Richford, London. Eng. Pat. 22,092, Oct. 19, 1908.

LEAD in a finely divided thread-like form, for use as packing in secondary batteries, etc., is obtained by melting the metal in a closed vessel, provided near the bottom with a lateral discharge pipe having perforations on its upper side, through which the lead is extruded by pneumatic pressure. The container and discharge pipe are separately heated to ensure fluidity of the metal, and if necessary cold air or water may be applied to cool the filaments as they immerge.—F. R.

Steam from the heat contained in slags; Generation of —. C. Vautin, London. Eng. Pat. 3623, Feb. 13, 1909.

WET steam is caused to flow through a trapped inlet to an enclosed vessel containing water. The low-pressure steam thus produced is conveyed to a low-pressure turbine, passing on its way, the incoming wet steam, which heats and dries it; the disintegrated slag is continuously removed by a conveyor. In order to more effectually granulate the slag, a circulating pump is arranged to discharge a stream of water directly against the incoming molten slag.—F. R.

Aluminium; Flux for use in soldering — with ordinary tin and lead solder and copper bit. W. G. Jeffery, Charlton, Kent. Eng. Pat. 8272, April 6, 1909.

THE flux is made by heating to boiling a mixture of one part of sal-ammoniac, three parts of glycerin, and four parts of water. The soldering bit is tinned in the usual way with the aid of the flux and the solder dipped in the flux and melted on the point of the bit. The fluxed solder

softens the oxide which is readily removed by rubbing with the point of the bit, its place being immediately taken by the solder.—F. R.

Aluminium; Solder for —. Z. Tamassy, Assignor to Z. B. Csiky and E. Ots, Cleveland, Ohio. U.S. Pat. 931,523, Aug. 17, 1909.

A SOLDER for aluminium is made by fusing together 130 grains of antimony, half a pound of zinc, half a pound of tin, and 44 grains of salicylic acid.—F. R.

Aluminium alloy; Unoxidisable — for making bearings, lugs, tyres, etc. V. Etienne. Fr. Pat. 399,928, Feb. 26, 1909.

THE alloy consists of: Aluminium, 75 parts; cadmium, 12; copper, 6; tin, 5; and nickel, 2 parts. The proportions may be varied, and the nickel or tin omitted if the ductility of the alloy is to be increased.—A. G. L.

Argentiferous lead ores; Treatment of —. O. H. Picher, Joplin, Missouri. U.S. Pat. 920,388, May 4, 1909.

SULPHIDE ores, mixed with carbon, are treated at a comparatively low temperature, in open-hearth furnaces, in a combined oxidising and reducing atmosphere. The gaseous products of the furnace, together with the admixed fume, pass through a series of settling and cooling flues, in which the argentiferous dust collects, the practically non-argentiferous blue fume being carried over and subsequently caught by screens. The lead fume is strongly heated in a combined oxidising and reducing atmosphere for the production of sublimed white lead and pig lead.—F. R.

[Metallic] Coated metal objects; Process of producing —. J. F. Monnot, Assignor to Duplex Metals Co., New York. U.S. Pat. 929,777, Aug. 3, 1909.

COATED metal objects consisting of unlike metals inseparably united are produced by pouring one metal, heated much above its melting point, into a suitable mould containing a highly heated solid body of the other metal submerged in an inorganic "wiping" material. The molten metal displaces the "wiping" material and solidifies in contact with the solid body.—F. R.

Compound metal body and process of producing same. J. F. Monnot, Assignor to Duplex Metals Co., New York. U.S. Pat. 929,778, Aug. 3, 1909.

COMPOUND metals consisting of a metal of the light metal group, such as aluminium, inseparably united to a ferrous metal (iron) are produced by bringing a body of such ferrous metal into contact with a supermolten mass of metal belonging to neither group, such as copper, and then bringing the coating so formed into contact with a molten mass of aluminium, or the like, and causing a layer to solidify thereon.—F. R.

Furnace; Ore-roasting —. A. R. Willley, Denver, Colo., Assignor to J. Seep, Titusville, Pa. U.S. Pat. 930,254, Aug. 3, 1909.

THE furnace consists essentially of a vertical chamber in which two pipes are arranged to conduct air from a conduit situated near the bottom, and open to the outer air, up the entire length of the chamber, meeting the falling ore as it is charged, by means of a hopper, into the top of the chamber. Means are provided for introducing heat to the ore at the top of the furnace.—F. R.

Iron and steel; Process for rustproof coating —. Langbein-Pfahhauser-Werke Akt.-Ges., Leipzig-Sellerhausen, Germany. Eng. Pat. 26,521, Dec. 8, 1908. Under Int. Conv., Dec. 21, 1907.

SEE Fr. Pat. 395,409 of 1908; this J., 1909, 480.—T. F. B.

Iron or steel; Preparation of — for casting. P. Rakowicz, Griesheim, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. U.S. Pat. 927,078, July 13, 1909.

SEE Fr. Pat. 396,009 of 1908; this J., 1909, 480.—T. F. B.

Armour plates; Method of treating —. S. S. Wales, Munnhall, Pa. U.S. Pat. 928,412, July 20, 1909.

SEE Eng. Pat. 9380 of 1908; this J., 1908, 1008.—T. F. B.

Steels; Process for the treatment of — for industrial purposes. E. Schneider, Le Creusot, France. U.S. Pat. 931,499, Aug. 17, 1909.

SEE Eng. Pat. 24,244 of 1908; this J., 1909, 1008.—T. F. B.

Gold and silver from crushed ore and ore slimes; Extracting —, and means therefor. A. F. Crosse, London. Eng. Pat. 269, Jan. 5, 1909.

SEE Fr. Pat. 395,230 of 1908; this J., 1909, 370.—T. F. B.

Soldering aluminium; Process for —. F. Stadler, E. Scholl-Scholl, and G. Dubach, Pieterlen, Switzerland. Eng. Pat. 23,779, Nov. 6, 1908.

SEE Fr. Pat. 398,245 of 1909; this J., 1909, 890.—T. F. B.

Welding metals; Process of —. H. Goldschmidt, Essen on Ruhr, Germany. Assignor to Goldschmidt Thermit Co., New York. Reissue No. 13,010, Aug. 17, 1909, of U.S. Pat. 729,573, June 2, 1903.

SEE this J., 1903, 801.—T. F. B.

Metals and metalloids from lead and copper slags; Process of recovering volatile —. W. Witter, Hamburg, Germany. U.S. Pat. 927,916, July 13, 1909.

SEE Fr. Pat. 392,422 of 1908; this J., 1908, 1210.—T. F. B.

Metal ingots; Process of casting —. J. F. Monnot, Assignor to Monnot Metallurgical Co., New York. U.S. Pat. 929,688, Aug. 3, 1909.

SEE Fr. Pat. 397,231 of 1908; this J., 1909, 799.—T. F. B.

Copper from a solution of a salt of copper; Process of obtaining pure metallic —. L. Junau, Paris. U.S. Pats. 930,967 and 930,968, Aug. 10, 1909.

SEE Addition of Oct. 27, 1906, to Fr. Pat. 367,452 of 1906; this J., 1907, 419.—T. F. B.

Corrosive gaseous fumes or smoke [from arc-fusing furnaces]; Method of treating —. C. B. Sprague, Salt Lake City. Assignor to United States Smelting, Refining, and Mining Co. U.S. Pat. 931,515, Aug. 17, 1909.

SEE Fr. Pat. 397,268 of 1908; this J., 1909, 799.—T. F. B.

Furnace for volatile metals. W. Hommel, Assignor to Metals Extraction Corporation, Ltd., London. U.S. Pat. 932,279, Aug. 24, 1909.

SEE Eng. Pat. 27,018 of 1907; this J., 1909, 427.—T. F. B.

Furnaces for volatile metals. The Metals Extraction Corporation, Ltd. Fr. Pat. 400,084, March 2, 1909.

SEE Eng. Pat. 27,018 of 1907; this J., 1909, 427.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A).—ELECTRO-CHEMISTRY.

Analysis of bronzes by electrolysis. Fischer. See X.

Formation of butyric acid from, and fixation of nitrogen by alcohol, under the influence of the silent electric discharge. Löb. See XX.

PATENTS.

Ozone; Production of —. M. P. Otto, Paris. Eng. Pat. 16,542, Aug. 5, 1908. Under Int. Conv., Aug. 5, 1907.

THE apparatus consists of a number of interchangeable elements, grouped, by means of travelling supports, upon a common frame. Each element consists of two outer low-tension plates and a central high-tension plate

dielectrics being provided between the central and the outer plates. Both high and low tension plates are made hollow and cooled by circulating water through them. A modified form consists in substituting a single metal plate for the dielectrics applied to either the high or low tension plates, together with the corresponding plate. —F. R.

Electrodes for use in electrolysis. C. C. Connor, Belfast, and J. W. Stubbs and The Electrolytic Alkali Co., Ltd., Middlewich. Eng. Pat. 23,930, Nov. 9, 1908.

THE electrode is constructed of two separated straight metal bars, connected at intervals to cross-bars of carbon by means of lead or other metal castings. Removable distance pieces are placed between the metal bars, thus forming, with the latter, moulds round the cross-bars for casting the lead. The conductor bars are covered with an insulating material impervious to the electrolyte, and finally with Portland cement. The ends of the carbon nipples are furnished with carbon blocks.—B. N.

Depolarisers for electric batteries. G. Schauli, London. Eng. Pats. 24,355 and 24,356, July 9, 1908.

(1). PHLORIDZIN ($C_{21}H_{21}O_{10}$) is added, as a depolariser, to the active ingredients of the battery with a view to preventing the liberation or escape of gases. Phloridzin is stated to have the property of absorbing ammoniacal gases to about 14 per cent. (2). Metallic manganese is melted and heated strongly for about 5 hours in a plumbago crucible until it combines with a portion of the carbon of the crucible. On cooling or pouring into moulds, a mass of carbonised metallic manganese is obtained, together with a manganese oxide ("carbon-manganic oxide") in the form of a black powder. The latter forms the new depolariser.—J. W. H.

Batteries; Electric —. H. de Martis, London. Eng. Pat. 26,285, Aug. 17, 1908.

THE invention relates to the use of a separating medium between the plates or electrodes of secondary electric batteries. This consists of vegetable woven fabric, from which the foreign matter, such as fat, resin, wax, pectic acid or the like, has been extracted, thus leaving only the fibrous portion of the material. The extraction may be performed with an ammoniacal copper solution, alcohol, or ether, or by continuous boiling, preferably under pressure.—B. N.

Electrolyte. A. Van Winkle, Assignor to The Hanson and Van Winkle Co., Newark, N.J. U.S. Pat. 930,815, Aug. 10, 1909.

THE electrolyte comprises a solution containing zinc fluosilicate, another salt of zinc, a salt of aluminium, and a small quantity of gelatin previously dissolved. —B. N.

Storage-battery elements; Process of preparing —. D. P. Perry, Chicago, Ill., Assignor to W. Morrison, Chicago, and M. A. Lombard, Des Moines, Iowa. U.S. Pat. 931,081, Aug. 17, 1909.

COPPER and cadmium are precipitated together as "hydrates" from a nitric acid solution containing 1 part of copper and 2 parts of cadmium. The precipitate is washed, dried, and secured to a suitable support for forming an element of a storage battery.—J. W. H.

Electrolytes; Process of preparing alkaline — for storage batteries. D. P. Perry, Chicago, Ill., Assignor to W. Morrison, Chicago, and M. A. Lombard, Des Moines, Iowa. U.S. Pat. 931,082, Aug. 17, 1909.

THE battery is filled with an alkaline zincate solution and charged, when zinc is deposited on the positive element. The electrolyte is then replaced by a "purified alkaline solution" and the battery discharged. By this means a suitable alkaline zincate electrolyte is regenerated. —J. W. H.

ases; Apparatus for treating — by electricity. I. Moscicki, Fribourg-Gambach, Switzerland. U.S. Pat. 930,212, Aug. 3, 1909.

THE electric furnace comprises a furnace chamber, with means for supplying the untreated gases and removing the gases after treatment, so that a continuous flow takes place through the chamber. The gas is made to pass through an annular electrode, the latter having "an inward-projecting edge lying in a plane transverse to the flow of the gases," and a second electrode with a plate-like terminal is placed concentric with, and within arcing distance of, the annular electrode, the plate-like terminal being in the direction towards which the gases flow. Means are provided for starting the arc, and for imparting a angular movement to the circular arc formed between the adjacent edges of the electrodes. A magnetic field produced by suitable means, the flux of the lines of force cutting the circular arcing space through which the gases flow.—B. N.

ases; Apparatus for generating — by electric discharges in air. J. E. Mitchell, St. Louis, Mo. U.S. Pat. 932,161, Aug. 24, 1909.

THE apparatus comprises a chamber provided with two rotatable electrodes having circular contacting surfaces, and forming the terminals of an electric circuit. The contacting surface of one electrode is in the form of a complete circle, whilst the surface of the second is formed of two separate segments of a circle, so that as the latter rotated, it turns the circular electrode, and the circuit alternately closed and opened, with the intermediate reduction of arcs. Means are provided for holding the circular electrode in yielding relation to the contacts "the first electrode," and "for adjusting the pressure between the electrodes," whereby good contact is secured between the two surfaces. A blast of air is delivered in proximity to the electrodes, and the gases produced are led off through a suitable exit.—B. N.

urnace; Electric —. F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 932,069, Aug. 24, 1909.

THE furnace has an arc reduction zone, and a receiving space below for the collection of the molten products, the two parts being separated by a hearth. The latter supports, and is practically impervious to, the charge, but is pervious to the molten products of reduction. The lower electrode consists of a resistance column, extending through the receiving space, and is adapted to heat the products of reduction.—B. N.

urnace; Electric —. G. C. Landis, York, Pa., Assignor to American Phosphorus Co., Camden, N.J. U.S. Pat. 932,296, Aug. 24, 1909.

THE furnace comprises a casing provided with a non-conducting lining, within which is a carbon lining forming working chamber. The casing is provided with two necks, the carbon lining extending into each neck. An inclined tapping opening extends laterally from the bottom of the working chamber through one of the necks, means being provided for closing the opening. A carbon terminal is embedded in the carbon lining, extending under the working chamber and laterally through the second neck of the casing, thus connecting it electrically to the carbon lining. A second electrode is supported within the chamber.—B. N.

urnace; Electric —. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., West Virginia. U.S. Pat. 932,368, Aug. 24, 1909.

THE furnace comprises a working chamber, with metallic electrodes extending into the same, and cooling jackets applied to the electrodes. The cooling jackets are adjusted longitudinally, for the purpose of regulating the cooling effect at the working ends of the electrodes.—B. N.

etrical resistances, fire-proof bodies, and constructional work; Composition applicable for use in —. W. A. Phillips, St. Louis, and F. R. Bacon, Milwaukee, U.S.A. Eng. Pat. 17,340, Aug. 18, 1908.

Fr. Pat. 393,430 of 1908; this J., 1909, 148.—T. F. B.

Insulating, impregnating, or protective materials or compositions. P. A. M. Cramer. Fr. Pat. 400,327, March 4, 1909. Under Int. Conv., March 9, 1908.

SEE Eng. Pat. 5279 of 1908; this J., 1908, 816.—T. F. B.

Electrolysing apparatus. E. L. Thorp, Nottingham, Assignor to The British Hosiery and Electrolytic Bleaching Co., Ltd., London. U.S. Pat. 930,902, Aug. 10, 1909.

SEE Eng. Pat. 25,839 of 1904; this J., 1906, 127.—T. F. B.

Electrode. H. Specketer, Griesheim, Assignor to Chem. Fabr. Griesheim Elektron, Frankfurt, Germany. U.S. Pat. 931,513, Aug. 17, 1909.

SEE Fr. Pat. 375,595 of 1907; this J., 1907, 930.—T. F. B.

Electric transformer-furnace. O. Frick, Stockholm. U.S. Pat. 932,013, Aug. 24, 1909.

SEE Fr. Pat. 372,801 of 1906; this J., 1907, 534.—T. F. B.

Filaments [for electric lamps]. U.S. Pat. 929,578. See II.

Sterilising fluids [electrically]. U.S. Pat. 930,023. See XVIII.A.

(B.)—ELECTRO-METALLURGY.

Iron; Pure electrolytic —. Z. Elektrochem., 1909, 15, 595—596.

THE Langbein-Pfanhauser-Werke Aktiengesellschaft of Leipzig is now producing on a commercial scale, plates and other articles of iron of at least 99.95 per cent. purity. The process which yields this pure iron is due to F. Fischer, and the iron is obtained electrolytically in a single operation, direct from the electrolytic bath, using merchant iron as anode. As would be expected, this iron is of quite extraordinary softness and ductility, and its electrical properties are just what experience of other irons of great purity and softness would lead one to predict. Its hardness, as measured by Brinell's method, is 92 before and 62 after annealing. On the same scale the hardness of steel is 300—500, of annealed copper 95, of gold 97, silver 91, and aluminium 52, so that the hardness of this electrolytic iron is far below that of pure silver and gold, and near to that of aluminium. On rolling out a $\frac{3}{16}$ -in. plate to one-fifth of that thickness the hardness rises to 175, but falls again to 60—62 on re-annealing. The iron is easily worked, can be cut with a knife or hammered out cold, and is easily welded. Articles shaped of it by the smith can be hardened throughout or only in parts and to any desired extent by making the parts to be hardened take up carbon from any of the usual hardening materials. Plates are at present being manufactured of all thicknesses from $\frac{1}{8}$ to $\frac{3}{16}$ -in. These plates appear to be specially adapted for the preparation of stereotypes, as the printing surface may be given any degree of hardness, whilst the ductility of the backing may be retained. Thin seamless tubes up to 1 inch are also being made, and one of the most interesting products of the factory is an armoured lead pipe of this diameter wholly encased in iron of 1 mm. thickness. It is said that the factory will shortly be turning out articles of almost all sizes and shapes, and at prices which will enable them to compete with existing manufactures quite apart from their properties, which would secure them the preference for special purposes.

Nickel; Electrochemical behaviour of —. A. Schweitzer. Z. Elektrochem., 1909, 15, 602—610.

FOERSTER (see this J., 1907, 643, 1014) has stated that the electrolytic separation of iron and nickel from solutions of their simple salts is retarded in a manner similar to that which has frequently been observed in the separation of metals from complex salts. Experiments by Mustad (Dissertation, Dresden, 1908) showed that in the case of iron, the cathode potential necessary for the separation of the metal at the ordinary temperature was considerably higher than the equilibrium-potential of iron as determined by Richards and Behr (this J., 1907, 326) and that it varied considerably with the current density used:

the variation of the separation-potential from the equilibrium-potential and its alteration with change of current density were less marked as the temperature was increased. The author has now made similar experiments with nickel in nickel chloride solution containing 0.5 per cent. of boric acid and in nickel sulphate solution containing sodium acetate in addition to boric acid. Just as in the case of iron, it was found that the potential necessary for the separation of the nickel rose with increase of the current density, and that the differences were less marked as the temperature was increased. For example, in nickel chloride solution, the separation-potentials (e_h) observed, with current-densities of $22 \cdot 10^{-4}$ and $182 \cdot 10^{-4}$ ampère per sq. cm. respectively, were:—at 16°C , 0.563 and 0.693 volt; at 52°C , 0.384 and 0.475 volt; at 75°C , 0.281 and 0.345 volt; and at 95°C , 0.241 and 0.275 volt. Conductivity measurements indicated that the high potential required for the separation of the nickel is not due to the formation of complex salts. The anodic (electrolytic solution) potential of nickel is affected even more strongly than the cathodic (electrolytic separation) potential by change of current density. Attempts to determine the equilibrium potential of nickel did not give conclusive results, but the values obtained, when taken in conjunction with those of Schoch (Amer. Chem. J., **41**, [3], 240) indicate that in $N/1$ nickel sulphate solution, the equilibrium-potential (e_h) of nickel lies between 0.20 and 0.33 volt.—A. S.

PATENTS.

Metals; Electro-deposition of —. J. J. N. Brachmann, Paris. Eng. Pat. 23,193, Oct. 30, 1908.

THE process relates to the electrolytic "metallisation" of articles which will not withstand the temperature of melted wax. The objects are first coated or impregnated by "steeping or injection with a mixture of ceresine (purified mineral wax), and paraffin or other analogous products, ordinarily derived from petroleum, lignite or other bituminous schists, dissolved in a suitable solvent." They are then covered with plumbago, to render the objects conductors of electricity, and the required metal is deposited directly on the articles, without an intermediate deposit of copper or the like.—B. N.

Metals; Electrolytic deposition of —. F. C. Mathers, Bloomington, Ind. U.S. Pat. 931,944, Aug. 21, 1909.

THE metal, or an alloy of the metal, is subjected as anode to an electric current, in a solution containing a perchlorate of the metal and free perchloric acid, the metal contained in the salt being deposited upon the cathode.—B. N.

Metals; Process for the electro-deposition of — by wet processes, dispensing with the preliminary scouring of the objects. A. Levy. Second Addition, dated Feb. 20, 1909, to Fr. Pat. 385,058, Feb. 25, 1907 (this J., 1908, 818 and 948).

THE deposition of metal is stopped, and the bath is transformed into a scouring bath with a soluble anode, by adding a quantity of a cyanide to the materials employed as the electrolyte described in the main patent.—B. N.

Ores [of refractory metals]; Method of reducing —. F. M. Rockett, Niagara Falls, N.Y. U.S. Pats. 930,027 and 930,028, Aug. 3, 1909.

THE ore is smelted in an electric furnace with a reducing agent containing silicon and boron, which are present in the necessary proportions to combine with the oxygen of the ore, whereby a metal or alloy, low in silicon and boron, is obtained. Or the ore is smelted with a boride, such as calcium boride, in an electric furnace, which is maintained at a temperature sufficient to practically eliminate boron from the reduced product, the slag being subsequently treated to recover the boron.—F. R.

[Copper] Ores; Process of treating —. P. L. T. Héroult, La Paz, France, Assignor to Soc. Electro-Metallurgique Française, Froges, France. U.S. Pat. 930,666, Aug. 10, 1909.

THE sulphide ore is fed into an electric arc furnace and gradually passed through a zone of fusion adjacent to

the arc. Sufficient oxygen or air is simultaneously injected into the ore, above the zone of fusion, to oxidise a large part of the sulphur and iron and leave only a black copper melt, with a slag consisting of iron and gangue.—F. R.

Magnesium; Electrolytic production of —. G. O. Seward and F. von Kugelgen, Holcombs Rock, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 931,092, Aug. 17, 1909.

TO a bath of magnesium chloride, in a state of fusion, an alkaline-earth chloride is added to increase its density, so that the electrolytically separated magnesium may float to the surface. Barium chloride or a mixture of barium and potassium chlorides is suitable for the purpose.—I. W. H.

Nickel and nickel alloys; Process for obtaining — from the natural nickeliferous iron-magnesium hydrosilicates known as garnierite. M. A. J. Roux and Soc. Le Nickel de la Nouvelle-Calédonie. Fr. Pat. 399,412, April 21, 1908.

GARNIERITE is first reduced by fusion with calcium carbide in an electric furnace. The powdered garnierite may be added to previously fused carbide, or the two substances, which may be agglomerated into briquettes, are fused together. If necessary, silicon, ferro-silicon, or boron, is added, so as to prevent the formation of metallic carbides. The melt obtained, which consists of silicides of nickel, iron, etc., together with metallic nickel, is then subjected to an oxidising process in the same or in a second electrical furnace. Air or oxygen is blown through the melt, to which peroxides of manganese, barium or calcium may also be added. The process is stopped when only nickel remains unoxidised.—A. G. L.

Metallic solutions; Electrolysis of — with insoluble anodes, and cathodes animated by a movement of displacement. F. Lacroix. Fr. Pat. 400,262, Feb. 26, 1909.

THE invention relates to the electrolysis of metallic solutions, particularly impure solutions, poor in copper, derived from ores containing iron. Insoluble anodes, preferably perforated, are employed, and are surrounded by convenient cylindrical cathodes, the latter or both electrodes being maintained in movement. Intense currents may thus be employed, yielding coherent and regular deposits. The deposits are produced with sufficient rapidity to practically suppress the solvent action of the iron salts on them, thus leaving these salts free to assist in the solution of the metal contained in the ore. Local currents between different parts of the cathode are also entirely suppressed by employing concentric electrodes.—B. N.

Electrolytic galvanising process. C. Bianco, Turin, Italy. Eng. Pat. 15,931, July 15, 1908.

SEE FR. PAT. 392,317 OF 1908; THIS J., 1909, 29.—T. F. B.

Electro-plating articles of electrically non-conductive material; Process of —. A. Gerbing, Bodenbach on Elbe, Bohemia. Eng. Pat. 24,139, Nov. 10, 1908.

SEE FR. PAT. 396,154 OF 1908; THIS J., 1909, 530.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Oil-production in the Italian and French Riviera. J. Slaus Kantschieder. Chem. Rev. Fett- u. Harz Ind., 1909, 16, 223–231.

A CONSIDERABLE amount of foreign olive oil is imported into Nice, the bulk coming from Italy and Tunis, and a small proportion from Spain, Turkey, Algiers, and Greece. The importations amounted to 8,264,900 kilos in 1907 as against 11,917,200 kilos in 1906. The quantities

of olive oil exported to various countries from Nice during 1906 and 1907 were as follows:—

Exported to—	1906.	1907.
	kilos.	kilos.
Austria-Hungary	351,000	370,000
Germany	748,000	749,000
Russia	436,000	624,000
England	234,000	206,000
Switzerland	313,000	289,000
Roumania	70,000	123,000
Servia	14,000	21,000
Bulgaria	4,600	5200

—C. A. M.

Wax of the sugar cane and its technical isolation. A. Wijnberg. Dissertation, Amsterdam, 1909. Deutsche Zuckerind., 1909, 34, 629—630.

In the working-up of the sugar-cane by the ordinary lime-defecation process, a considerable quantity (1 per cent. and more on the weight of the cane) of "mud" is obtained, which at the present time has little or no value. The author has found that this mud contains a relatively large proportion (10—12 per cent. on the dry substance) of the so-called "cane-wax." The nature and colour of the wax vary considerably with the variety and cultural conditions of the sugar cane. From 5000 kilos. of the fresh mud produced in Java, there was obtained by extraction with benzene, a considerable quantity of the crude wax, which proved to be a complex mixture of different substances. About 70 per cent. of the crude wax consisted of fats (glycerides of oleic, linolic, palmitic and stearic acids), together with hydroxy-acids, resin-acids, lecithin, phytosterol, and aromatic and colouring matters. The remaining 30 per cent. consisted of a wax-like substance, apparently identical with that obtained by scraping the bark of the sugar-cane. It was, however, not an individual substance, as stated by earlier workers. It contained about 45 per cent. of myricylalcohol, about 35 per cent. of a non-primary, crystalline alcohol, $C_{33}H_{65}O$, and also at least one crystalline substance, poorer in oxygen, almost insoluble in hot alcohol, and of high melting point (88° — 90° C.). In the sugar factories it is the practice to store the mud in heaps. Under these conditions, a kind of fermentation takes place, the fatty substances being almost completely decomposed, whilst the more resistant wax-like substance remains more or less unaffected. From the "fermented" mud the wax can be isolated by re-crystallisation from petroleum spirit. It is best refined by dissolving in petroleum spirit and treating with fuller's earth or similar material. In this way, a white or pale yellow wax is obtained which resembles carnauba wax in its hardness, appearance, and high melting point (82° — 88° C.). For the technical preparation of the wax, the "fermented" mud is dried, first in the sun and finally by waste smoke gases or in a Huillard furnace, then broken up, and extracted with benzene. The residual mud, after extraction, is still available as a manure, and may also be treated for the extraction of the sugar contained in it. (See also Fr. Pat. 397,843; this J., 1909, 899.)—A. S.

Carnauba wax; Saponification of — R. Berg. Chem.-Zeit., 1909, 33, 885—887.

THE author points out that, in determining the saponification value of carnauba and other waxes which are markedly resistant to saponification, all the methods which have been suggested to accelerate and complete the saponification introduce errors into the test. In employing sodium alcoholate (Kossel and Obermüller) the products of saponification are not attacked, but saponification is not complete. Complete saponification is arrived at by using an alcohol of high boiling point as the solvent, as suggested by Einhorn and later used on carnauba wax by Radcliffe (this J., 1906, 158). The method is open to the serious objection, however, that during the six hours' heating which is necessary, the alkali acts upon the alcohol in a manner which is so irregular as not to be controllable by a blank experiment. Following the lines of the method suggested by Marcusson for saponifying

montan wax, in which benzene is used as the solvent, the author works as follows, replacing the benzene by xylene. To 4 gms. of wax dissolved in 20 c.c. of xylene, 50 c.c. of $N/2$ alcoholic potash are added, the acid value being determined in the usual way during the addition of the alkali. The flask is fitted with a reflux condenser and heated for two hours on a vigorously boiling water-bath, which results in complete saponification being effected. The soap which is produced separates in part, and to dissolve this, 100 c.c. or more of alcohol are added until a clear solution is obtained, when titration is proceeded with in the usual way. In the exceptional case of saponification not being complete after heating on the water-bath, a few minutes' boiling on a wire gauze over a flame, with or without the further addition of xylene, as may be considered necessary, is sufficient to complete the reaction.

—J. A.

Montan wax; Composition of — K. Eisenreich. Chem. Rev. Fett- u. Harz-Ind., 1909, 16, 211—213.

THE commercial sample of Schliemann's purified montan wax examined by the author melted at 77° C., and gave the following analytical values:—Acid value, 93.02; saponification value, 94.56; iodine value, 12.00; acetyl acid value, 93.01; acetyl value, 11.18, and unsaponifiable matter, 29.07 per cent. Assuming that no other acid was present, the acid value corresponded to 72.66 per cent. of free montanic acid in the wax. By repeated recrystallisation from petroleum spirit and ethyl acetate, a pure white montanic acid (m. pt. 82.5° C.) was obtained. This was separated by fractional precipitation with magnesium acetate from an alcoholic solution into six fractions, the first four of which melted at 83° C., the fifth at 82.5° C., and the residue at 81.5° C. Elementary analyses of the fractions and other methods are said to give results agreeing with Hell's formula for montanic acid, $C_{29}H_{58}O_2$. The unsaponifiable matter had a composition corresponding to the formula, $C_{42}H_{86}O$, but no alcoholic hydroxyl group could be identified in it (see also this J., 1909, 894).—C. A. M.

Grease from sewage sludge. Bechhold and Voss. See XVIII.B.

PATENTS.

"Hydrocarbons with acid functions" [from petroleum]; Use of — as substitutes for fatty acids, oils, fats, and soaps. C. M. D. Bazin. Fr. Pat. 399,212, April 15, 1908.

It is stated that the "hydrocarbons with acid functions" obtained by treating petroleum with alkali and acidifying the resulting alkaline tar, may be used as substitutes for fatty acids for all technical purposes. Claim is also made for the use of amides, esters and salts of these acids for the same purpose. The acids form soluble soaps with alkalis, and give insoluble salts with alkaline-earth bases (notably alumina). As the latter do not become soft below 120° C. they can be advantageously used in the preparation of solid fats for sizing textile fabrics, etc.—C. A. M.

Fat; Process of extracting — from agricultural and industrial substances, and manufacture of the solvent used in the process. A. Guétan and H. Simenin. Fr. Pat. 400,105, May 20, 1908.

HOT or cold neutralised solutions of sulphonated liquid fatty acids are used for the extraction of fat both in the free state and in the form of calcium or aluminium soaps, etc., from industrial organic substances, such as bone, hides, etc. The solvent may be prepared by treating 10 parts of liquid fatty acids with 1 part of sulphuric acid (65° B.), agitating the mixture for 4 hours, decanting the sulphonated product, washing it with salt water, and neutralising it at a low temperature with a solution of caustic soda.—C. A. M.

Soap or other washing material: Manufacture of pulverised —, O. Lindemann, London. From Gebrüder Körting A. G., Lünden, Germany. Eng. Pat. 26,133, Dec. 3, 1908.

A DRIER soap powder than that made according to the process described in Eng. Pat. 25,276 of 1907 (this J., 1908, 345) may be prepared by forcing the liquid soap from a container through a pulverising apparatus and mixing it with superheated steam or highly heated air or gas as it escapes from the pulverising nozzle. The steam under a pressure of 1 or 2 atmospheres and at a temperature of about 300° C. issues from a chamber surrounding the nozzle. —W. P. S.

Soap or soap compound [for making cotton non-inflammable.] J. V. J. Hollingworth, Ashton-under-Lyne. Eng. Pat. 717, Jan. 12, 1909.

A SOAP to render cotton fabrics non-inflammable after washing is prepared by mixing a dry powdered soap (say, 180 parts) with sodium silicate (24 parts), and adding oleic acid previously saponified or made into a dry paste with potassium carbonate (8 parts), glycerin (7 parts) and sodium tungstate (4 parts). —C. A. M.

Soaps of every kind: Apparatus and process for making —, L. Rivière. Third Addition, dated Feb. 18, 1909, to Fr. Pat. 374,179, Jan. 12, 1907 (see this J., 1907, 769, 881; 1909, 317).

CLAIM is made for the use of sodium bisulphate (preferably that obtained as a by-product in the manufacture of nitric acid) for the liberation of fatty acids from insoluble and other soaps. It is stated that the fatty acids have a higher melting point and less colour than those liberated by a mineral acid. —C. A. M.

Emulsion and process for producing the same. J. Steckhausen, Crefeld, Germany. U.S. Pat. 931,520, Aug. 17, 1909.

SEE Fr. Pat. 396,493 of 1908; this J., 1909, 612. —T. F. B.

Decolorising and purifying the fatty acids recovered from soapy waters from dye-works, etc. Ger. Pat. 212,708. See V.

Improving the odour of vegetable oils; and modified cotton-seed oil. U.S. Pats. 929,845 and 930,280. See XVIII.1.

Improving the odour of lard substitutes; and animal-fat product. U.S. Pats. 929,925 and 929,926. See XVIII.1.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(I.)—PIGMENTS, PAINTS.

PATENTS.

Red lead, and apparatus for its manufacture. G. V. Barton, Runcorn. Eng. Pats. 13,458, June 24, 1908, 24,242, Nov. 11, 1908, and 26,259, Dec. 4, 1908.

MOLTEN metallic lead is converted into lead oxide by treatment with a blast of air and steam and continual stirring as described in Eng. Pat. 4660 of 1902 (this J., 1903, 150). To effect complete oxidation of the lead, the fumes from the furnace are carried to a sufficient height in a shaft of metal or other conducting material, which is kept at a red heat by gas flames or otherwise. The resulting lead oxide is free from metallic lead and is in such an extremely fine state of division that when converted into red lead it gives a product of greater brilliancy than can be obtained from ordinary litharge. The lead oxide furnace may be connected with a series of red-lead furnaces by means of branches radiating from the top of the shaft and each controlled by a valve, so that each red-lead furnace may be fed in succession. —C. A. M.

Coatings [for wood, metals, etc.]; Manufacture of fireproof and waterproof —, A. Levy, Amsterdam. Eng. Pat. 15,339, July 20, 1908.

MAGNESITE is calcined at a temperature of from 590° C. to 600° C., and to 100 parts of the calcined product are added 15 to 30 parts of dry magnesium chloride, 50 parts of calcium carbonate (powdered marble, chalk, etc.) and a pigment, preferably of mineral nature. The ingredients are thoroughly incorporated, and are mixed with the requisite quantity of water when required for use as fireproof and waterproof coating. If 10 to 20 parts of paper pulp, or cellulose, tramic fibre, etc., are added to the mixture, a product is obtained, which is especially suitable for decorating wall paper, cardboard, and the like. —O. R.

White lead; Process for making —, J. A. Erhslow, Los Angeles, Cal. U.S. Pat. 930,057, Aug. 3, 1909.

METALLIC lead in a fine state of division is made to pass alternately from a body of water to an atmosphere containing oxygen and carbon dioxide, the corrosion and attrition of the particles causing a scum of white lead to form upon the surface of the liquid. This scum is subsequently drawn off by suction, or otherwise, and dried. —C. A. M.

Ultramarine; Apparatus for the manufacture of artificial —, J. Luciani and V. Battesti. Fr. Pat. 399,211, April 15, 1908.

THE oxidising agents used in the manufacture of artificial ultramarine are placed in a perforated tube, which is then introduced into the centre of the cylinder containing the substances to be oxidised. The oxygen liberated by the heat from the stove surrounding the cylinder passes through the holes and effects rapid and uniform oxidation, so that the formation of gray products is completely prevented. The end of the perforated tube may also be connected with a supply of compressed oxygen, which may thus be made to permeate the mass at the required moment. —C. A. M.

Ultramarine; Process and apparatus for the manufacture of artificial —, J. Luciani. Fr. Pat. 400,103, May 19, 1908.

THE raw materials are heated together in such a way that heat is applied both at the centre and the outside of the mass, which is subsequently oxidised at the required moment by means of air introduced through longitudinal tubes. In the type of apparatus claimed, the reaction-vessel is conveniently constructed in the form of concentric cylinders, and the material is introduced into the space between the two walls. The gases of the furnace can thus pass through the central open space as well as over the exterior of the vessel. The end of the vessel is closed by a partition perforated with large openings for the introduction of the air tubes and with small openings for the escape of the gaseous products, and over this is fixed a cover which can be removed at the required moment for the oxidation. —C. A. M.

Printing inks and oil paints; Manufacture of —, F. G. Jagenburg. Fr. Pat. 399,604, Feb. 18, 1909. Under Int. Conv., Feb. 19, 1908.

AN aqueous solution of a dyestuff is incorporated with a thickening agent, composed of thickening substances (such as dry kaolin or hydrated aluminium silicate) and an oil (e.g. boiled linseed oil) or resin or resinous solution, or mixtures of these. Barium chloride or an analogous substance is then added, and the resulting precipitate (freed from water if desired) incorporated with a sicative. The process may be varied by adding the thickening agent to the precipitated pigment. Insoluble dyestuffs are first made into a paste with water and ground up with the thickening agent until the excess of water separates. Similarly, commercial pigments in the form of a slightly soluble paste are heated with water to the boiling point, and the thickening agent added to the liquid after cooling; after which the process is continued as described above.

—C. A. M.

Pigments; Method of increasing the technical effect of the means used to render — opaque, and of increasing the effect of filling materials for inflammable substances. G. Galy. Fr. Pat. 400,285, March 4, 1909.

THE wood flour or cork dust, etc., used for the purposes mentioned, is thoroughly incorporated by means of milling, etc., into a homogeneous mass, which may then be subjected to further treatment. Thus after the addition of fusible material (sulphur, celluloid) at a temperature lower than the ignition point of the wood, cork, etc., the mixture may be melted, cooled, reduced to fragments, and, if desired, again finely ground.—C. A. M.

Lead salts or oxides [red lead]; Process and apparatus for making —. G. V. Barton. Fr. Pat. 400,279, March 1, 1909.

SEE Eng. Pat. 13,458 of 1908; preceding.—T. F. B.

Azo dyestuff for manufacture of lakes. Fr. Pat. 399,132. See IV.

(B.)—RESINS, VARNISHES.

*Burmese varnish [sap of *Melanorrhæa Usitata*]; A chemical investigation of the constituents of —.* P. Sing. Indian Forest Records, 1909, 1, [IV.], 287—308.

BURMESE varnish is obtained from a deciduous tree, *Melanorrhæa Usitata* (Burmese, *thitsi*), occurring abundantly in Burma and Siam. The tree is closely allied to the Japanese lacquer tree, *Rhus vernicifera* (Japanese, *Urushi-noki*), and belongs to the same natural order, *Anacardiaceæ*. The sap is obtained by making a V-shaped incision in the stem and placing a bamboo cup to receive it. After 10 days, the flow of sap being very slow, the cup is emptied. The crude varnish obtained is purified by straining through coarse cotton cloth. Burmese varnish sets hard only in a cool moist atmosphere; it will not set by the action of heat, sunlight, or a dry atmosphere. It is a thick greyish fluid which on exposure to the air becomes first brown and finally jet black. The sp. gr. at 20° C. of a pure sample was 1.0016 (sp. gr. of pure Japanese lacquer at 20° C. = 1.0020). The method of chemical investigation was based on that used by Ishimatsu and also by Yoshida, when examining Japanese lacquer. A resinous extract (A) was made by treating the strained varnish with hot alcohol, and dried at 105° C. The residue was treated with dry ether and the extract dried and treated with hot alcohol, when a small quantity of fatty matter was obtained as residue, together with a further small quantity of resinous extract which was added to (A). The main residue was treated with water and the solution obtained diluted with more water and boiled, when a brownish precipitate (indicating albuminous matter) separated out and was filtered off. The filtrate containing the gummy constituents (B) was evaporated and dried until its weight was constant. The residue (C) which was insoluble in both hot alcohol and boiling water was dried at 100° C.

Examination of the constituents A, B, and C showed that the principal constituent of Burmese varnish is urushic acid ($C_{14}H_{18}O_2$), and that this and the other chief constituents are identical with those of Japanese lacquer.

Comparative analyses.	Burmese varnish.		Japanese lacquer.	
	I.	II.	I.	II.
A. Alcoholic extract (urushic acid)	86.24	83.24	85.15	80.00
B. Gummy matter	3.08	3.52	3.15	4.69
Oil matter	nil.	.53	?	?
C. Residue or diastatic matter	1.71	2.14	2.28	3.31
Moisture and other volatile matter	8.97	10.57	9.42	12.00
	100.00	100.00	100.00	100.00

The principles and conditions of use of Burmese and Japanese varnishes being the same, the author makes a number of suggestions for improving the Burmese lacquer

industry. Since rust attacks urushic acid, iron tools and vessels should be avoided or kept scrupulously clean. In collecting the sap, care should be taken to exclude dust. From Japanese practice it is known that the sap from the lower parts of a tree is the finest, and it would be better to collect it and use it separately for finishing coats. An inferior varnish can also be obtained from the branches of a felled tree by placing them partly in hot water and making incisions in their upper third parts which are out of the water. The juice before storing should be thoroughly stirred in shallow pans, to get rid of any volatile poisonous matter and to produce greater homogeneity. The air of the drying cellar should be kept moist by means of wet cloths. Sesame oil which is often added to Burmese varnish should be avoided and linseed oil used in its place.

With a natural varnish as fine as that of Japan, there seems no reason why the lacquer industry of Burma should not develop to a degree like that of Japan. (See this J., 1889, 906; 1894, 1071).—J. W. H.

Turpentine and rosin in the United States. Board of Trade J., Sept. 9, 1909. [T.R.]

A REPORT on the timber supply of the United States, issued by the Department of Agriculture, states that the production of naval stores in 1908 included more than 36 million gallons of turpentine and more than four million barrels of rosin, of which Florida and Georgia supplied two-thirds. About one-half of the product is exported. While the production of naval stores does not necessarily destroy the forests, the methods so far used, coupled with subsequent fires and wind storms, have resulted in the destruction of a great deal of saw timber.

PATENTS.

Wood; Method of treating — during distillation. H. W. Doughty, Amherst, Mass., Assignor to F. E. Waters, Baltimore, Md. U.S. Pat. 930,274, Aug. 3, 1909.

THE wood is pulped and the cellulose is hydrolysed by adding sulphuric acid to the retort during the heating to drive off the volatile oils. The acid solution is separated and the solid residue is treated with sodium hydroxide solution. The alkaline liquor obtained is filtered off and mixed with the acid solution obtained before, whereby the resinous acids are precipitated. The clear liquor is withdrawn and fermented, the alcohol produced being afterwards distilled off.—W. H. C.

Turpentine oil; Process for the manufacture of synthetic —. A. Poulverel. Fr. Pat. 400,180, May 23, 1908.

ROSIN oil is introduced gradually into a closed horizontal narrow tubular retort, charged with soda-lime and heated to about 400° C. After about 5—6 minutes, the retort is connected to a condenser and the products condensed. The distillate thus obtained is washed with concentrated sulphuric acid, then with caustic alkali, and afterwards with water. It is next treated with 0.5 per cent. of caustic soda lye or 3—5 per cent. of lime water, and distilled with steam. The product thus obtained is said to possess the same chemical and physical properties as natural turpentine oil.—A. S.

Dipping varnishes possessing covering power; Process for the preparation of —. H. Zwick. Ger. Pat. 211,573, May 26, 1907. Addition to Ger. Pat. 211,529, Feb. 10, 1907.

INSTEAD of the nitrocellulose used according to the main patent (see this J., 1909, 843), the cellulose esters of aliphatic acids, alone or mixed with nitrocellulose, are employed.—A. S.

(C.)—INDIA-RUBBER, &c.

Rubber from Southern India. Bull. Imp. Inst., 1909, 7, 163—166.

FIVE samples of rubber prepared from Ceara, Castilloa, and Para trees growing in the Government Experimental Gardens at Kullar and Burlar in the Nilgiri Hills, were examined. The results of the chemical examination,

and the commercial values (fine hard Para at 5s. 1d. per lb. and plantation Para biscuits at 5s. 3d.—5s. 9d. per lb.) are shown in the following table:—

	I.	II.	III.	IV.	V.
	per cent.	per cent.	per cent.	per cent.	per cent.
Moisture	2.8	1.5	0.2	0.8	0.4
Caoutchouc	80.2	62.7	86.1	92.0	91.5
Resin	6.2	32.0	12.8	2.6	3.9
Protein	9.5	0.9	0.5	3.0	3.7
Ash	1.3	2.29	0.4	1.6	0.5
Value, per lb. . .	5s. 6d.	3s. 2d.— 3s. 4d.	3s. 6d.— 3s. 8d.	5s.— 5s. 2d.	5s. 4d.— 5s. 5d.

Sample I. was Ceara rubber in the form of six biscuits of pale amber-coloured rubber of very good quality; it contained 76.5 per cent. of "soluble" and 6 per cent. of "insoluble" caoutchouc, reckoned on the dry rubber. No. II. was a rough sheet of dark brown Castilla rubber of inferior quality. No. III. consisted of rough sheets of Castilla rubber, varying in colour from light to dark brown. No. IV. consisted of biscuits of dark brown Para (*Hevea brasiliensis*) rubber, rather deficient in strength; it contained 88.8 per cent. of "soluble" and 4 per cent. of "insoluble" caoutchouc, reckoned on the dry rubber. No. V. consisted of two biscuits and three strips of Para rubber, rather uneven in colour, and of fair strength; it contained 90 per cent. of "soluble" and 1.9 per cent. of "insoluble" caoutchouc, reckoned on the dry rubber.—A. S.

Rubber; Direct determination of — in soft-rubber goods.
S. Axelrod. Chem.-Zeit., 1909, 33, 895.

IN replying to criticisms passed by Hinrichsen and others (this J., 1909, 843) upon his method for the direct determination of rubber in samples of hot-vulcanised rubber (this J., 1907, 1058), the author points out that his process was not designed to meet the case of hard rubber. Hence the error introduced by using the same factor, 314, for all cases can only be a small one, since the vulcanisation-coefficient of soft-rubber generally lies between 2.3 and 3 per cent., and, in an extreme case, if the coefficient were 4.4 per cent., the error due to this cause would only be 1.5 per cent. It is claimed that methods involving the use of a dried, weighed filter are quite usual in analytical practice, and easily carried out. Hydrobromic acid is not split off from the bromide if the drying be conducted at temperatures not exceeding 60° C. With the exception of the silicates the mineral matter in a vulcanised rubber sample is converted into bromides of the respective metals by the action of the bromine solution used, and the bromides are soluble in alcohol. Hence it is quite allowable to estimate the weight of actual vulcanised rubber bromide present in the precipitate from the bromine treatment, by subtracting from the total weight of the precipitate the weight of its ash. An exception occurs in the presence of lead, lead bromide not being soluble in the washing liquid. The appropriate treatment in this case is to moisten the bromide precipitate with sulphuric acid and a few drops of nitric acid, subsequently driving off the excess of acids and igniting. The error introduced by deducting the weight of lead sulphate thus obtained from the weight of the crude bromide is very small, seeing that litharge is rarely present in amounts exceeding 15 per cent. in rubber mixings. The error may, of course, be avoided altogether by estimating the lead oxide present. The author contends that the analytical error in the case of a mixing containing a maximum percentage of litharge, and having a vulcanisation coefficient as high as 4.5 per cent., is, by his method, as low as 3.48 per cent.—E. W. L.

Rubber goods; Analysis of —. F. Frank and E. Marckwald. Gummi-Zeit., 1909, 23, 1522—1524.

AXELROD'S tetrabromide method (this J., 1907, 1058) for the determination of rubber in rubber goods is subject, in certain cases, to errors as great as 10 per cent. This is not due, however, as stated by Hinrichsen (this J., 1909, 843) to the presence of mineral matter, but, as

pointed out by Harries and Rimpel (this J., 1909, 945), to the fact that a portion of the rubber, as bromine derivative, passes into solution in the mixed solvents employed. The authors criticise the method proposed by Hinrichsen (*loc. cit.*) for the determination of mineral matters. Employing three very different, typical mixings, they find that, working according to Hinrichsen's directions, the following difficulties are encountered:—(1), the organic matter is not completely dissolved, and some is held back on the filter with the mineral matter; (2), certain mineral constituents are partially or completely decomposed at the high temperatures employed, magnesium carbonate losing combined water and carbon dioxide, and golden sulphide (pentasulphide) of antimony being converted into trisulphide by loss of sulphur; (3), the solution of the vulcanised rubber in petroleum, when diluted with benzol, is exceedingly slow in clarifying by settling, and it is very difficult, sometimes impossible, to obtain a clear filtrate. By modifying the method in some of its details, the authors find it is possible to make it useful in cases where the method of dissolving in xylol in an autoclave (see this J., 1908, 989) is not available. They proceed as follows:—

The finely cut-up rubber sample is heated with heavy petroleum (b. pt. 230°—260° C.), or with paraffin oil of sp. gr. 0.86, for from 15 to 60 minutes. The solution is allowed to cool, and is then diluted with petroleum ether or light benzine, but not with benzol. Such diluted solutions are found to clarify in from two to ten hours. The solution is then filtered and the residue on the filter washed with the solvent used for dilution, dried, and weighed. The flask in which the solution was effected is also washed, dried, and weighed, to allow for any mineral matter not transferred to the filter. If antimony be present, the residue is washed first with ammonium sulphide, and the antimony estimated by difference, then with hot, dilute hydrochloric acid to remove all acid-soluble minerals, which are also estimated by difference. The final residue is ignited, and weighed again; the difference in weight obtained represents carbon black and organic matter not otherwise accounted for.—E. W. L.

Rubber crop of the Amazon Valley. Board of Trade J., Sept. 2, 1909. [T.R.]

THE following are the statistics of the rubber crops in the Amazon Valley for the seasons 1907-8 and 1908-9:—

	1907-8.		1908-9.	
	Rubber.	Caucho.	Rubber.	Caucho.
	metric tons.	metric tons.	metric tons.	metric tons.
Islands	8,346	—	8,944	—
Itaituba and Lower Amazon	1,199	126	1,542	275
Tocantins, Xingu, and Jary	—	679	—	729
Beni	867	227	1,045	488
Juruá	1,043	132	1,034	158
Purus	3,467	660	3,531	827
Manaos and Itacoatiara ..	13,336	4,154	13,031	4,204
Iquitos	1,540	964	935	1,327
Total	29,708	6,942	30,062	8,008
Grand total, rubber and caucho	36,650		38,070	

Rubber cultivation in the Malay Peninsula. Board of Trade J., Sept. 9, 1909. [T.R.]

THE progress of rubber cultivation in the Malay Peninsula continues to be rapid and successful. At the end of 1908 there were 37,440,020 trees, as compared with 27,558,440 a year before; 60,636 acres were planted during 1908, an increase of over 33 per cent. on the previous year, giving a total of 241,138 acres of rubber on the 31st December for the whole Peninsula. The output of dry rubber increased in 1908 by 56 per cent.; 3,539,922 lb., or 1,580 tons, being produced as against 2,278,870 lb., or 1,017 tons, in 1907. This was sold at an average price of about 4s. per lb.

The following figures show the amount of cultivated rubber exported from the Federated Malay States during the first six months of the years 1908 and 1909:—

	January—June, 1908.	January—June, 1909.
	lb.	lb.
Perak	189,633	364,890
Selangor	866,567	1,657,104
Negri Sembilan	325,958	441,247
Malacca	nil	nil
	1,382,158	2,463,241

Of the rubber exported from Selangor during the first six months of 1909, 25,030 lb. were produced in Perak and 177,522 lb. in Negri Sembilan.

PATENTS.

Rubber-like gum from its vegetable sources; Process of extracting — F. H. Hunkle, Roselle, N.J., Assignor to Continental Rubber Co., New Jersey. U.S. Pats. 931,120 and 931,121, Aug. 17, 1909.

1). THE vegetable matter is mechanically divided, immersed in fresh water until the woody fibre sinks, and the floating gum and bark removed and immersed in a fresh quantity of water until the bark sinks. The gum is then removed and consolidated. (2). The vegetable matter is softened by the action of steam, then mechanically divided, and immersed in water and subjected to the action of a series of hard-surfaced bodies moving independently in the water. The disintegrated material is left in the water until the heavier impurities settle, whereupon the floating gum is removed, subjected to the action of superheated steam under pressure, then compressed, and finally kneaded in presence of water in motion.—A. S.

Resins and gums; Manufacture of substitutes for — by the condensation of aldehydes and phenols. L. Helmi. First Addition, dated April 13, 1908, to Fr. Pat. 392,395, Sept. 23, 1907. (See Eng. Pat. 25,216, Nov. 13, 1907; this J., 1908, 412.)

CLAIM is made for the use of the salt of an amine (aniline hydrochloride or other aniline salt) as the condensing agent, and for the use of an acid to accelerate the process and to obtain a hard "resin."—C. A. M.

Para rubber; Manufacture of artificial — J. Blum and W. A. Carpenter. Fr. Pat. 399,345, Jan. 5, 1909.

A VEGETABLE substance, such as peat, is subjected to fermentation and simultaneously or subsequently treated with a reducing agent, so as to obtain a glutinous mass consisting of a hydrocarbon of the formula, $(C_5H_8)_x$. For this purpose the peat may be mixed with water and treated with the enzyme present in imperfectly formed caoutchouc or with an enzyme that will produce alcohols of a series higher than the olefine series, the fermentation being carried out at a temperature of about 60° C. (not exceeding 71° C.). The glutinous mass of hydrocarbon is next heated with water in which is suspended a nitrogenous substance (preferably the red substance resembling seed contained in red Upper Congo rubber), and to which mineral salts have been added, after which the mixture is cooled, and the layer of synthetical Para rubber removed from the surface, and purified by treatment with an alcoholic liquid.—C. A. M.

Caoutchouc; Process for obtaining pure — F. Boegel and A. Kiander. Fr. Pat. 399,459, Feb. 13, 1909.

THE crude material (e.g., inferior qualities of rubber) is freed from impurities by successive treatment with an alkaline solution, with a "hydrated compound of chlorine," and with acetone or formaldehyde.—C. A. M.

Goods of rubber, ebonite, or vulcanite; Method of manufacturing — O. C. Immisch, Finchley. U.S. Pat. 931,310, Aug. 17, 1909.

SEE Eng. Pat. 3659 of 1908; this J., 1909, 374.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tannin; Determination of — by electrolytic means. M. Corridi. Collegium, 1909, 281—283.

EXPERIMENTS are recorded with the method of tannin estimation proposed by Metzger (this J., 1908, 458), in which an electric current is passed through the tannin infusion and the tannin thereby precipitated, the non-tannins being then determined by the evaporation of 50 c.c. of the filtrate. The author found that the results obtained by this method do not agree with those by the hide powder method on account of the precipitation by the electric current of gums and other non-tanning substances. He also experienced difficulties in carrying out exactly the precise method proposed by Metzger, especially in obtaining complete precipitation of the tannin in the time specified and also in filtering off the precipitate. Continuous and alternating currents, moreover, were found to yield different results.—H. G. B.

Sulphurous acid in commercial gelatin. W. Lange. Arb. Kais. Gesundh.-Amt, 1909, 32 144—157. Chem. Zentr., 1909, 2, 738—739.

OF 32 samples of gelatin examined, 22 contained quantities of up to 0.125 per cent., and 10 contained more than that quantity of sulphurous acid; the five highest values found were 0.216, 0.219, 0.247, 0.371, and 0.467 per cent. For the determination of the sulphurous acid, 10—20 grms. of the gelatin are swollen in 500 c.c. of water for 15 mins., then warmed until dissolved, and after addition of 2—3 grms. of tannin to prevent foaming, distilled with 20 c.c. of phosphoric acid of sp. gr. 1.15, in a slow current of carbon dioxide; a current of carbon dioxide is also passed through the apparatus before distillation in order to displace the air. From 200 to 250 c.c. of the solution are distilled, and the vapours are collected in a solution of iodine in potassium iodide; after filtering, the sulphuric acid produced by the oxidation of the sulphurous acid in the distillate is determined as barium sulphate. A small quantity of sulphur trioxide is produced in the distillation, which is not derived from the sulphurous acid, and this must be taken into consideration.

Dry gelatin is capable of absorbing 10.1 parts by volume of sulphur dioxide; swollen gelatin contains much less sulphurous acid than does dry gelatin after treatment with sulphur dioxide. The treated gelatin does not evolve sulphur dioxide when exposed to air saturated with aqueous vapour at the ordinary temperature, nor does any oxidation to sulphuric acid take place. The amount of sulphur dioxide is considerably diminished by steeping the gelatin in water, and still more, if the gelatin be immersed in 1 per cent. hydrochloric acid for half an hour before steeping in water. The sulphur dioxide appears to be present in the gelatin in the free state, since on treatment with iodine solution, oxidation to sulphuric acid proceeds continuously to the end, and not in stages as in the case of complex compounds such as acetaldehyde- and dextrose-sulphurous acid (see this J., 1904, 832).—A. S.

PATENTS.

Waterproof leatherboard, and process of preparing the same. E. S. Buffum, Newton, and W. W. Carter, Needham, Mass., U.S.A. Eng. Pat. 9383 of 1909; date of Application, Dec. 28, 1908. Under Int. Conv., Jan. 2, 1908. Addition to Eng. Pat. 28,219 of 1908.

A PULP is prepared containing fibres of tanned leather, with or without fibres of other materials. The chromic and tannic acids present are neutralised by the addition of caustic soda, sodium carbonate, etc., and casein, albumin, or gluten (5—10 per cent.) is then added. After incorporation of the above mixture in the beater for about an hour, a precipitant, such as alum or aluminium sulphate (8—13 per cent.) is added, and the beater run for a further period of about one hour. Should a black material be required, a soluble sulphide is added.—G. W. McD.

Tannage of ungrained hides [sub leather] ; Method of —. Soc. Anon. des Mat. Tannantes et Colorantes. First Addition, dated May 20, 1908, to Fr. Pat. 396,025, Jan. 13, 1908 (this J., 1909, 804).

THE hides are swollen in a formaldehyde bath, tanned with tanning extract in a drum, and after drying more or less completely, given a second tannage in another drum.

—A. S.

Hides and skins ; Means for tanning and depilating —. C. J. Glase, Boston. U.S. Pat. 934,858, Aug. 24, 1909.

SEE FR. PAT. 362,663 OF 1906 ; THIS J., 1906, 770.—T. F. B.

Organic colloids ; Process of liquifying —. C. K. Mills, London. From The Arabol Manufacturing Co., New York. Eng. Pat. 17,887, Aug. 25, 1908.

SEE FR. PAT. 394,473 OF 1908 ; THIS J., 1909, 211.—T. F. B.

Melting bitumen, pitch, glue, &c. Eng. Pat. 11,557. See III.

Separating liquids of different specific gravity, especially fat and glue solution. Ger. Pat. 212,643. See I.

XV.—MANURES, &c.

PATENT.

Superphosphate reaction chambers ; Process and apparatus for emptying —. K. J. Beskow and M. Ekedahl. Fr. Pat. 399,907, Feb. 25, 1909.

WHEN the reaction is complete, the superphosphate is discharged by means of a series of scrapers or scoops, mounted on a vertical drum or other suitable device, which is rotated and capable of being moved as desired inside the chamber. The scoops attack the heap of superphosphate on the side, and carry the portions detached to the bottom of the chamber, where they are discharged through a suitable outlet.—A. S.

XVI.—SUGAR, STARCH, GUM, &c.

Beet juice ; Occurrence of optically-active non-sugar substances in —. J. Weisberg. Bull. Assoc. Chim. Sucrier, et Dist., 1909, 27, 77—83.

THE author maintains his conclusion that the diminution in the polarisation of beet juice after treatment by Herles' method (this J., 1908, 1168 ; 1909, 32) is not due to the precipitation or destruction by the lime of optically-active non-sugar substances, or to the influence of the large amount of basic lead acetate used (as maintained by Herzfeld and by Blan), but, in the main, at all events, to the precipitation of sugar as sucrate. This is brought about by the addition of the dry lime to the hot juice and subsequent heating of the liquid to the boiling point. The simultaneous addition of a large amount of normal lead acetate (forming with part of the lime a corresponding quantity of basic lead acetate) may also have an influence on the final polarisation, but does not prevent the precipitation of sugar as sucrate. Experiments described show that when the "calco-carbonic" purification of sound juice is properly carried out there is little or no diminution in the polarimetric readings. In the author's opinion the new method of Herles is unsuitable for the determination of sugar in beet-juice or diffusion juice.—C. A. M.

Wax of the sugar cane. Wijnberg. See XII.

Determining total sulphur in animal charcoal. Selvatici. See XXIII. Inorg. Quant.

Determining mineral constituents in plants [sugar beets, &c.]. Pellet. See XXIII. Organic Quant.

PATENTS.

Milk sugar ; Process of producing —. A. A. Dunham, Bainbridge, N.Y., Assignor to Casein Co. of America, New Jersey. U.S. Pat. 931,584, Aug. 17, 1909.

WHEY is boiled, filtered to remove albumin, filtered through clarifying material, and then concentrated by evaporation until it has a sp. gr. of about 22 B. The thin syrup thus obtained is again filtered, and evaporated to the crystallising point.—W. P. S.

Starch ; Process of treating —. C. K. Mills, London. From The Arabol Manufacturing Co., New York. Eng. Pat. 17,888, Aug. 25, 1908.

SEE FR. PAT. 394,467 OF 1908 ; THIS J., 1909, 213.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Yeast ; Poison secreted by —. A. Fernbach. Compt. rend., 1909, 149, 437—439.

THE author has carried out a number of experiments on the yeast-poison discovered by Hayduck (this J., 1909, 48) to be present in yeast. It was found that, when dried not only at a high temperature (70 C.) but also at 37 C., ordinary pressed yeast yields a yeast-poison when it is subsequently extracted with 0.1 per cent. hydrochloric acid and the filtered extract rendered neutral to alizarin. Different yeasts are affected by this poison in widely differing degrees, Pombé yeast being comparatively slowly killed by it. Another yeast, which was very sensitive to the extract obtained from pressed yeast, was found to yield a poison having an intensely toxic action towards Pombé yeast. The toxic yeast extract is readily attacked by moulds, but acts as a strong antiseptic towards bacteria. Like certain other toxins it is capable of passing through porcelain filters and destroyed by heating to 100 C. It can be completely volatilised by distillation in a current of steam at a temperature not exceeding 40 C., and it can, indeed, be separated from fresh yeast by distilling the latter with a little water in a vacuum, the distillation residue being quite inactive. The distillate, which possesses an activity equal to, or greater than, that of the yeast extract, gives none of the reactions for aldehydes.—T. H. P.

Wine ; French regulations for the analysis of —. Z. öffentl. Chem., 1909, 15, 262—268.

THE French Minister of Agriculture and the Minister of Commerce and Industry have issued the following regulations for the analysis of wines. The wine should be examined by tasting, &c., immediately the bottle has been opened, and a microscopic examination of the sediment must be made either after the wine has stood for 12 hours or been submitted to centrifugal action ; special attention should be given to the presence of yeasts, acid-forming bacteria, &c.

Alcohol.—This is determined by distilling 200 c.c. of the wine after neutralisation ; about 135 c.c. of distillate are collected, and the specific gravity is taken after diluting to a volume of 200 c.c.

Extract (in vacuo).—Five c.c. of the wine are placed in a flat-bottomed glass basin 70 mm. in diameter and 25 mm. high ; the basin is then placed under the receiver of an air-pump, and a basin containing sulphuric acid is placed over the first basin. The air is exhausted as far as possible from the receiver and the evaporation is allowed to proceed for 4 days at a temperature of 15° C., the residue being then weighed.

Reducing sugars.—One hundred c.c. of the wine are treated with powdered sodium bicarbonate and a small quantity of 10 per cent. lead acetate solution, then diluted to a volume of 110 c.c., mixed, and filtered. The filtrate is treated with sodium bicarbonate and animal charcoal, filtered, and the sugars are then determined by titration against Fehling's solution, the sugar being expressed as dextrose. The decolorised wine may also be examined in the polarimeter.

Sucrose and dextrin.—Should the wine show a considerable dextro-rotation in the polarimeter, it must be tested for sucrose and dextrin. For this purpose the cupreducing power is taken after the wine has been heated for 15 minutes with the addition of 2.5 c.c. of 10 per cent. hydrochloric acid to each 100 c.c. of the wine; the inverted line is treated with sodium bicarbonate and lead acetate before the determination is carried out. The difference between the two sugar determinations multiplied by 0.95 gives the amount of sucrose. Should sucrose not be present, the solution is again examined in the polarimeter, the presence of dextrin being denoted by the dextro-rotation remaining practically unchanged.

Total acidity.—Five c.c. of the wine are heated for a moment to 86° C. to remove carbon dioxide, and then treated with *N*/20 sodium hydroxide solution, using either phenolphthalein or litmus paper as indicator. The titration may also be carried out with standardised lime-water, without an indicator, the end point of the titration being ascertained by the appearance of a turbidity and a dark opalescent precipitate. The total acidity is expressed in mms. of sulphuric acid per litre of wine.

Non-volatile acidity.—The residue obtained on evaporating the wine *in vacuo* is dissolved in warm water, and treated as described above.

Volatile acidity.—This is ascertained by subtracting the non-volatile from the total acidity.

Free and combined volatile acidity.—When a wine contains a large amount of mineral matter rich in alkali carbonates, the suspicion is raised that the wine has been treated with an alkali. If such be the case, the true amount of volatile acidity is not obtained as described above, a part of it being fixed by the alkali, and this acidity must be determined after the alkali salt has been decomposed by the addition of tartaric acid. Five c.c. of the wine are treated with 5 c.c. of *N*/10 tartaric acid solution (prepared with 25 per cent. alcohol), the mixture is evaporated *in vacuo* as described under "Extract," 5 c.c. of *N*/10 sodium hydroxide are added to the residue in order to neutralise the tartaric acid introduced, and the solution is then titrated. The acidity thus found subtracted from the total acidity gives the total volatile acidity. In the case of normal wines the figure obtained is but little higher (from 0.1 to 0.3) than when determined without the tartaric acid treatment.

Total tartaric acid.—Twenty c.c. of the wine are mixed with 1 c.c. of 10 per cent. potassium bromide solution, and 40 c.c. of a mixture of equal parts of ether and 90 per cent. alcohol. After the lapse of 3 days, the liquid is decanted through a small filter, the residue is washed with the ether-alcohol mixture, and then dissolved in water and titrated, using phenolphthalein as indicator.

Potash.—The procedure is the same as for the determination of the total tartaric acid, except that 10 per cent. tartaric acid solution (in 20 per cent. alcohol) is used as precipitant in place of potassium bromide. The residue must be thoroughly washed, and finally rinsed with a little 95 per cent. alcohol to remove any traces of free tartaric acid.

Ash.—Twenty-five or 50 c.c. of wine are evaporated in a platinum basin, the residue is gently ignited until thoroughly carbonised, and is then further ignited at a dull red heat until the carbon has all burnt away. Should the carbon not burn readily, the ash may be moistened with a few drops of water and the ignition continued.

Potassium sulphate.—This is determined in the usual way, the sulphuric acid being precipitated as barium sulphate.

Chlorides. (Denigès' method.)—Red wine. Fifty c.c. of the wine are boiled in a porcelain basin for about 10 minutes; 2 c.c. of pure nitric acid are then added and the mixture is stirred. The colour of the liquid turns red, then yellow, and a coloured flocculent sediment is formed. Should these changes not take place within 1 minute, the mixture is again heated and a further quantity of 1 c.c. of nitric acid is added. Twenty c.c. of *N*/10 silver nitrate solution are next added, the mixture is cooled, transferred to a 200 c.c. flask, and diluted to be marked with water. The solution is mixed, filtered, and to 100 c.c. of the filtrate are added 15 c.c. of ammonia, 10 drops of 20 per cent. potassium iodide solution, and

10 c.c. of potassium cyanide solution, the titre of which exactly corresponds with the *N*/10 silver nitrate solution. The solution is then titrated with *N*/10 silver nitrate solution, the end point of the titration being taken when the solution becomes turbid and appears fluorescent. The number of c.c. of silver nitrate solution required multiplied by 0.234 gives grms. of sodium chloride per litre of wine.

White wine. Fifty c.c. of the wine are evaporated to a volume of 25 c.c., the nitric acid is added, and then, immediately, the silver nitrate solution. After cooling, the mixture is diluted to a volume of 200 c.c., and the determination carried out as described under red wine.

Citric acid. (Denigès' method.)—Ten c.c. of the wine are mixed with 1 gm. of lead peroxide, 2 c.c. of mercury sulphate solution (containing 5 grms. of mercuric oxide, 20 c.c. of concentrated sulphuric acid and 100 c.c. of water) are added, and the mixture is filtered. Five c.c. of the filtrate are placed in a test-tube, heated to boiling, and 1 drop of 1 per cent. potassium permanganate solution is added. When the solution has become decolorised, another drop of permanganate is added, and so on, until 10 drops have been added. Normal wines show a feeble turbidity; wines containing 0.1 gm. of citric acid per litre give a strong turbidity, and a precipitate forms if 0.4 gm. per litre be present. The actual quantity present may be ascertained by comparison with solutions containing known amounts of citric acid.

Foreign colouring matters.—The wine when rendered ammoniacal and shaken with amyl alcohol must not yield any colour to the latter, nor must it dye wool darker than a faint dirty red tint.

A further test for colouring matters consists in treating the wine with an excess of 10 per cent. mercuric acetate solution, then adding a slight excess of magnesia, boiling the mixture, and filtering. The filtrate should remain colourless when acidified with sulphuric acid.

Free mineral acids.—If the quantity of sulphuric acid (sulphate) in the ash of the wine is appreciably smaller than the quantity of total sulphuric acid, it is probable that free sulphuric acid is present. Free hydrochloric acid may be detected and determined in the distillate from the wine.

Sulphurous acid.—One hundred c.c. of the wine are acidified with phosphoric acid and distilled in an atmosphere of carbon dioxide in the usual way. The distillate is collected in a receiver containing iodine solution, and the resulting sulphuric acid is determined gravimetrically and calculated into sulphurous acid.

Salicylic acid, boric acid, hydrofluoric acid, and saccharin.—These are determined by the usual methods.—W. P. S.

Alcoholic liquors: Study of the action of hydrogen peroxide upon —. A. C. Chauvin. *Monit. Scient.*, 1909, 23, 567—570.

HAVING accidentally found that addition of a small quantity of hydrogen peroxide improves the flavour of a brandy and removes any musty odour that may be present, the author has systematically studied the influence of this reagent upon rum, and promises to continue his observations with other varieties of potable spirit. Rum was treated in nearly filled bottles with 1—5 per cent. of hydrogen peroxide for 10 and 30 days. The specific gravity and esters were slightly increased, the alcoholic strength, extract, furfural, and higher alcohols were reduced more or less, while the aldehydes were enormously increased, rising from 146 to 1256 per hundred thousand, the maximum figures being yielded after 10 days. The volatile acidity was increased.—R. L. S.

PATENTS.

Amylaceous materials: Process of treating — to facilitate their disintegration, saccharification, or cooking. A. Boidin. *Fr. Pat.* 399,987, April 8, 1908.

IN preparing raw grain or tubers for saccharification, the cell-membranes protect the starch granules from the action of the heat and water, so that a prolonged digestion is necessary for the complete gelatinisation of the starch. According to the present process, advantage is taken of the extremely powerful solvent action, both on proteins

and cellulose, of cultures of the bacteria which are obtained from the surface of the raw grains themselves. The liquefying bacteria are cultivated in suitable media for 3—4 days and the raw amylaceous material, whole or crushed, is steeped in the liquid at a temperature of 50° C. for 3 hours. The operation is ended when the material can be crushed between the fingers. The disintegration of the cell membranes is accompanied by a modification of the starch, which, after this treatment, no longer possesses the property of forming a paste with hot water. Consequently a very short digestion of the material under pressure is sufficient to yield a mobile solution of starch, which is ready for saccharification by the "amylase" process or otherwise.—J. F. B.

Liquefying diastase and diastatic extracts and meals; Preparation of —. H. J. B. Bombart. Fr. Pat. 399,792, Feb. 17, 1909.

A DIASTATIC preparation, which possesses only liquefying properties towards starch paste, is obtained by making an infusion of malted barley at a temperature of 75°—80° C., the final temperature being 80° C. An extract of soluble starch is prepared by the action of this diastase on plain or mixed farinaceous substances or starch in presence of water at 80° C. Diastatic meals are also prepared by mixing the diastase and starchy materials in the dry state, the proportions being 80 parts of starch to the diastase from 20 parts of dry malt.—J. F. B.

Brewing; Process of —. P. Landouzy. Fr. Pat. 399,181, Feb. 6, 1909.

For brewing purposes, the malt is first ground in a mill, and the grist and meal are separated from the bran by sifting and grading, with or without the help of a blast of air. The grist and meal are brewed together, and the mash is clarified in a filter or other suitable apparatus; the bran is not used in the process.—J. F. B.

Wine, beer, cider, perry, and other beverages; Sterilisation and improvement of — by means of mercury vapour lamps. J. Courmont and T. Nogier. Fr. Pat. 400,003, Mar. 1, 1909.

THE liquid to be sterilised is submitted to the action of the rays emitted by mercury-vapour lamps. The lamps may be suspended above the surface of the liquid or immersed in it.—W. P. S.

Wine, brandy, or alcohol; Process for developing a mature flavour in —. J. Roussel. Fr. Pat. 400,256, May 26, 1908.

THE wine, or other alcoholic liquid, is placed in a closed vessel where it is agitated with a quantity of added yeast. From 100 to 1000 grms. of moist yeast are used with every 100 litres of wine, and the mixing is continued for from 8 to 12 hours. The yeast is then removed by filtration; in the case of brandy or alcohol, the liquid may be re-distilled. The bouquet produced is dependent on the kind of yeast employed and on the duration of the mixing operation.—W. P. S.

Mares, pulps, etc.; Apparatus for the continuous distillation of —. A. and M. Garnier. Fr. Pat. 400,282, Mar. 3, 1909.

THE apparatus consists of a number of superposed inclined tubes which are connected alternately to a similar set of tubes inclined in the opposite direction, so that a lengthy continuous passage is afforded for the pulp. This is introduced at the end of the uppermost tube and forced through the apparatus by means of helical conveyors fitted in the tubes. Steam is admitted into the lowest tube and escapes, together with the alcoholic vapours, through a dome placed on the uppermost tube. The conveyors in the lower tubes are caused to move more slowly than those in the upper tubes and the steamed residue leaves the end of the bottom tube through a counterpoised valve.—W. P. S.

Wood; Apparatus for converting — into fermentable sugars and other products. Comp. Indus. des Alcools de l'Ardeche, Paris. Eng. Pat. 26,619, Dec. 8, 1901. Under Int. Conv., June 9, 1908.

SEE FR. Pat. 391,057 of 1908; this J., 1908, 1126.—T. F.

Treating wood during distillation. U.S. Pat. 930,274. S. XVIII.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Milk-sugar {lactose} in milk; Determination of —. Michaelis and Rona's "iron method." K. Oppenheim. Chem.-Zeit., 1909, 33, 927—928.

MICHAELIS and Rona's method (Biochem. Zeits., 1907, 329; 1908, 13, 121; 14, 476; 1909, 16, 60) for determining sugar in serum, etc., was applied to milk as follows: 10 c.c. of the milk were diluted with 13 c.c. of distilled water, after which 7 c.c. of colloidal ferric hydroxide solution were added drop by drop with continual shaking. The liquid was filtered through dry filter-paper, and the filtrate polarised in a delicate Schmidt and Haensch polarimeter. The results obtained agreed within about 0.3 per cent. with the obtained gravimetrically, the polarimeter results being uniformly higher. Good agreement with the calculated value was also obtained when known quantities of lactose were added to samples of milk containing known amount of sugar.—A. G. L.

African food grains; Some —. Bull. Imp. Inst., 1909, 7, 145—154.

Maize from S. Nigeria.—Several samples were examined but were mostly damaged by weevils. If preventive measures against weevils were organised, and steps taken to eliminate inferior varieties of the grain, it is probable that exports of maize from S. Nigeria could be largely increased, the local "white maize" being of fine quality. *Guinea corn (Sorghum vulgare) from N. Nigeria.*—One sample each of red and white Guinea corn ("red dari" and "white dari") were examined and were valued at 24s. and 26s. respectively per 480 lb. (Nov., 1907).

Rice from N. Nigeria.—The single sample examined consisted of large, partially cleaned, rather dark-coloured grains; it was valued at 9s. 6d. per cwt., quay terms (Nov., 1907), and considered to be equal to average Bengal rice.

Millet from S. Nigeria.—Samples of brown and grey millet were valued at £4 13s. 4d. and £5 2s. 8d. respectively per ton c.i.f. London (July, 1908).

"Tamba" millet from N. Nigeria.—The sample consisted of very small, round, reddish-brown seeds, with thin hard coats. The seeds contained 75 per cent. (by difference) of starch and only 5.3 per cent. of proteins; they would probably be saleable as a cattle-food at about £4 10s. per ton c.i.f. The grain is used in Nigeria for the manufacture of an intoxicant called "tamba."

Bobu (Ehusini corucana) grain from Uganda.—A sample of the small, round, reddish-brown grains, of which 10 weighed 6.25 grms., was valued at £4 10s. to £5 per ton c.i.f. delivered weights in London (Oct., 1908); it was classed as a small millet.

"Bambarra groundnuts" from N. Nigeria.—The sample consisted of pale buff-coloured seeds, with black spots round the hilum. The seeds, which are derived from the leguminous plant, *Peanutia subterranea*, contain 6.2 per cent. of fat and 16 per cent. of proteins, and whilst used as a cattle-food, could not compete with beans, peas, lentils, cottonseed cake, etc.

Seeds of Hibiscus subdariffa from N. Nigeria.—The seeds are of a dark greyish-brown colour, and have a faint musk-like odour. They contain 19.8 per cent. of fat and 26.8 per cent. of proteins, but would not be of much

service as a cattle-food, owing to the large content of indigestible "crude fibre" (15.5 per cent.), and the hard nature of the seed-coat.—A. S.

sulphurous acid in commercial gelatin. Lange. See XIV.

Determining mineral constituents in plants. Garbarini. See XXIII. Org. Quant.

Pure Food Act (1908): New South Wales. (See this J., 1909, 902.) [T.R.]

THE following are some of the standards and regulations laid down in the Act:—

Guarantee.—The forms of guarantee are prescribed which have to be given by individuals and companies, and packed goods may not be sold without a reference to the guarantee.

Colouring and flavouring.—The presence of colouring-matters and flavourings foreign to the food or drug must be indicated in one of three forms: "artificially coloured," "artificially flavoured," "artificially coloured and flavoured." The size of the printing type is indicated. The regulation does not apply to butter and cheese mixed with harmless vegetable colouring-matter.

Preservatives.—The regulation dealing with the use of preservatives forbids the use of preservatives other than salt, sugar, spices, wood-smoke, vinegar, and acetic acid, except where specifically allowed, and then the quantity and name of the preservative has to be indicated on the package in letters of a certain size.

Dietetic essences.—Essence of lemon must contain not less than 5 per cent. of lemon oil, for which the standard is an optical rotation at 25° C. of not less than +60° in 99-mm. tube," and "4 parts per cent. by weight of citral." Terpeneless essence of lemon must contain "not less than 0.2 part per cent. by weight of citral derived from oil of lemon." There are directions reserving the use of the words "vanilla" and "vanillin" to the natural products unless associated with the word "substitute." The vanilla essence must contain "not less than two-twentieths of one part per centum of vanillin."

Cocoa, if a mixture with starch, must be labelled with the proportion of starch present. The added alkali in soluble cocoa must not be more than 3 per cent., estimated as potassium carbonate.

Vinegar is defined as "the liquid derived from alcoholic and acetous fermentations." A 4-per-cent. standard is adopted, and mineral acids, lead, arsenic, and copper must be absent. Other varieties of vinegar must be so labelled. Vinegar substitutes must be so labelled.

Cream of tartar.—The standard is 95 per cent., and not more than 2 per cent. of sulphates, calculated as calcium sulphate. The baking-powder standard is the same as that in force in Victoria.

Edible oils and fats.—The sp. gr. of olive oil is 0.916 to 0.918 at 60° F., refractive index from 1.4660 to 1.4680, saponification-value between 185 and 195, iodine-number of less than 70 or more than 90. There must be no red colour with the Halphen test, and the clajdin test must yield a yellowish-white mass and a colourless liquid. Cocoa oil must conform to the olive-oil standard.

Castor oil is to have a sp. gr. of from 0.960 to 0.970, a refractive index of 1.4799, a saponification-value of from 83 to 188, and it must dissolve completely in absolute alcohol and in glacial acetic acid. The size of the lettering on the label is prescribed, and the words "castor oil" have to be followed by the words "for human consumption."

Arsenic-limit.—No food may contain more than a hundred-and-fiftieth part of a grain of arsenious oxide in the pint or pound.

Malt extract must contain not less than 70 per cent. of solids derived from malt, and is to conform to the characters and tests of the "British Pharmaceutical Codex"; but bakers' malt extract is only standardised in regard to the solids. Liquid malt extract is to contain not less than 50 per cent. of solids from malt, and malt and it is to contain 15 per cent. of cod-liver oil. Artificial syrups and cordials may contain not more than 1½ grain of sulphur dioxide to the pint.

PATENTS.

Oils: Art of "improving" the odour of vegetable —; and modified cottonseed oil. J. H. Filbert, Baltimore, Md. U.S. Pats. 929,845 and 930,280, Aug. 3, 1909.

(1.) THE vegetable oil is heated with animal crackling at a temperature lower than that at which the oil would burn, and subsequently separated from the animal tissue. The odour of hog's lard, etc., may thus be imparted to the oil. (2.) The oil is impregnated with the "essence of heated animal tissue" in such a way that on heating the product the odour of heated animal matter will predominate.—C. A. M.

Lard substitutes: Art of improving the odour of —; and animal fat product and process of making the same. J. H. Filbert, Baltimore, Md. U.S. Pats. 929,925 and 929,926, Aug. 3, 1909.

(1.) A LARD substitute, consisting of beef fat and cottonseed oil, is flavoured by combining it with "the essence of heated animal tissue." (2.) Animal fat is melted and mixed with hog crackling, the latter being removed when the fat has absorbed the characteristic odour of the crackling.—W. P. S.

Fluids: [Electrical] process for sterilising —. C. B. Bartley, Pittsburg, Pa. U.S. Pat. 930,023, Aug. 3, 1909.

THE liquid to be sterilised is subjected to the action of a direct current of electricity passing between terminals immersed in the liquid; at the same time it is subjected to a disruptive discharge between an immersed terminal and a terminal placed outside the liquid.—W. P. S.

Gelose or extract of marine alga: Manufacture of — as a basis for foods and pharmaceutical preparations. C. de La Guéronnière. Fr. Pat. 399,432, Feb. 12, 1909.

MARINE algae, e.g., a mixture of 75 per cent. of agar-agar and 25 per cent. of *Fucus crispus*, are dried and deprived of their woody portions. They are then washed with sterilised water containing 10 per cent. of salt and 1 gm. of hydrochloric acid per 10 litres. The algae are dried in the oven and ground to a powder. The powder obtained is mixed with 0.5–3 per cent. of roasted wheat flour or potato starch, and is then ready for the particular purpose for which it is required, e.g., soups, confectionery, pharmaceutical preparations, etc. It is used in proportions of 2–5 grms. per litre of water or milk.—J. F. B.

Vinegar from skimmed milk: Process for obtaining —. Cie. Franç. des Produits Lactés. Fr. Pat. 399,991, Feb. 26, 1909.

WHEY is submitted to the action of a ferment in the presence of an organic acid, such as citric acid, in order to invert the lactose. The solution is then fermented and the dilute alcoholic solution is separated into two portions. To one portion is added a quantity of alcohol and a culture of *Mycoderma aceti* which has been grown in a lactose medium. When acetic fermentation has taken place, quantities of this mother liquor are added to the other portion of the dilute alcoholic solution, and acetic fermentation is allowed to proceed.—W. P. S.

Pasturisation: Processes of —. A. Goetz and P. A. Jones, Grand Rapids, Mich., U.S.A. Eng. Pat. 22,221, Oct. 20, 1908.

SEE Fr. Pat. 395,489 of 1908; this J., 1909, 539.—T. F. B.

Starch and gluten from wheat flour: Process for obtaining —. F. A. V. Klopfer, Leubnitz, Germany. U.S. Pat. 929,861, Aug. 3, 1909.

SEE Eng. Pat. 11,159 of 1907; this J., 1907, 1289.—T. F. B.

Curing meat: Process of —. J. C. Lincoln, Assignor to The Electric Meat Curing Co., Cleveland, Ohio. U.S. Pat. 930,772, Aug. 10, 1909.

SEE Eng. Pat. 23,183 of 1908; this J., 1909, 670.—T. F. B.

(B.)—SANITATION: WATER PURIFICATION.

Sewage-sludge: Recovery of grease from —. Beechhold and Voss. *Gesundh.-Ing.*, 1908, 31, 742—744. *Proc. Inst. Civil Eng.*, 1908—1909, 176, [2], 79—80.

For the recovery of grease from sewage sludge, the authors state that it is not necessary to dry the sludge, and that it may be treated while still in the wet state with an acid, preferably sulphuric acid. By this means the colloids are broken up and rendered more suitable for the subsequent operation of removing the fat. Since the organic matters in sludge are readily attacked by micro-organisms, it is necessary to undertake the process with fresh sludge, which, in accordance with the situation from which it is derived, may contain from 3.38 to 26.79 per cent. of fat. Calculations are given to show the value of the grease which might be furnished by the sewage of the 60 million inhabitants of Germany; this the authors estimate to be worth £3,759,000 per annum. A description is given of certain experiments conducted on a commercial scale with 66 gallons of sludge in each case, to which enough 60 per cent. sulphuric acid was added to render the whole mass acid. This was then heated with a steam coil in a lead-lined tank to a temperature of 60° to 70° C. and mixed with the requisite volume of benzine to dissolve the fatty matters. The mixture was run off into the extractor and stirred continuously, and when thoroughly incorporated, the stirring was stopped, the temperature lowered, and the substance was allowed to settle, when the dissolved grease was drawn off. As the mean of five tests, the above volume of sludge yielded 26.8 lb. of raw fat. It is stated that as the outcome of their practical experiments the authors are convinced that a rational process of fat-extraction from sewage would prove commercially valuable, while the residual sludge would be better adapted for use as a manure.

Purifying effluents from sulphite wood pulp mills.
Klason. See XIX.

PATENTS.

Sewage sludge: Treatment of —. J. Grossmann, Manchester. *Eng. Pat.* 16,397, Aug. 4, 1908.

For the purpose of removing fatty acids and grease from the sludge, and producing a manurial residue, the following treatment is adopted. The sludge is dried to a suitable consistence and is then mixed with sulphuric acid. This mixture is then subjected to distillation by superheated steam, and the fatty acids and grease are separated from the distillate. The distillation is carried out in a horizontal vessel, heated externally, provided with a central hollow spindle carrying agitating arms. The superheated steam passes into the hollow spindle and out through perforations in the arms into the material which is being treated. (See also *Eng. Pat.* 19,922 of 1906; this J., 1907, 1077.)—G. W. McD.

Water, sewage, or other foul liquids: Process for the purification of — and means therefor. J. W. Liversedge, Leigh-on-Sea, Essex. *Eng. Pat.* 17,244, Aug. 17, 1908.

The water or sewage is conducted through a pipe to a central tank which may be divided into compartments; the flow of the water is regulated by a valve placed on the pipe. After sedimentation has taken place, the liquid passes through perforations in the walls of the tank and percolates through filtering and aerating material built so as to form a zone or bed round the central tank. The bed has sloping sides and a channel is provided at its foot. The liquid flows into the channel and comes into contact with a similar filter-bed placed outside the first. This arrangement of filter-beds and channels is repeated, to any desired extent, depending only on the dimensions of the walled tank which contains the whole. Each channel is provided with valves and is connected with a main outlet; these valves may be utilised to produce a reverse flow of the liquid for cleansing purposes or for conducting sediment to the central chamber, which is provided with a sludge outlet. Chemicals may be added to the water or sewage while it is in the central chamber.

—W. P. S.

Water: Method and apparatus for the purification of — by centrifugal force. H. Guillery. *Fr. Pat.* 399,713, Jan. 26, 1909.

Water containing matter in suspension is given a centrifugal motion, in an apparatus somewhat similar to a turbine, with the result that the suspended matter is removed.—G. W. McD.

(C.)—DISINFECTANTS.

PATENTS.

Disinfectants: Process for making —. H. Schneider. First Addition, dated Feb. 3, 1909, to *Fr. Pat.* 377,141, April 25, 1907 (this J., 1907, 1026).

DISINFECTANTS similar to those described in the original patent may be prepared by mixing 375 grms. of anhydrous oxalic acid with 750 grms. of phenol at a temperature of about 40° C. The mixture is thoroughly agitated until a sudden rise in the temperature takes place, and the resulting dry product is then pressed into the form of tablets for use. Alkali carbonates may be added to the solid product, or to its aqueous solution, in sufficient quantity to neutralise the oxalic acid portion of the phenolic ester.—W. P. S.

Wool flocks and similar materials: Process for the disinfection and antiseptic impregnation of — for mattresses. W. Waess. *Fr. Pat.* 399,138, Feb. 5, 1909. Under Int. Conv., Feb. 5, 1908.

THE wool is moistened with a 5 per cent. solution of carbolic acid, and allowed to stand for several days. The moistened material is then moved about in a drum, fitted with rotating arms, and heated to 80°—100° C. After drying in a current of air, it is impregnated with a solution of carbolic acid ("carbonic acid" in the claim) which has been emulsified with 2 per cent. of birch tar oil by means of ammonia. On air-drying, a thin film of the tar oil containing phenol is left, and in order to disguise any unpleasant odour, amyl acetate is added.

—G. W. McD.

XIX.—PAPER, PASTEBOARD, &c.

Sulphite wood pulp mills: Purification of effluents from —. P. Klason, Papierfabrikant, 1909, 7, Fest- und Auslandsheft, 26—31, 627—629, 671—672, 701—703, 795—800.

For the disposal of the waste lyes from sulphite pulp mills the correct principle consists in collecting them, with or without the wash-waters, in large reservoirs where they are cooled and aerated. They should then be discharged continuously and regularly into a river of sufficient volume. The main points to be considered are the proportion of water to organic matter and the quantity of oxygen dissolved in the water. If, on account of periods of drought, the volume of the river is restricted, large reservoirs should be provided for the storage of the lyes until the weather changes. According to the author's experience, no ill results whatever will occur from the continuous discharge into a river which ensures a thousand-fold dilution of the lyes, corresponding to the introduction of 100 mgrms. of foreign matters per litre. A flow of 1 cub. metre per second will deal with the by-products from the manufacture of 7½ tons of air-dry cellulose per 24 hours. The average volume of a river may be calculated approximately as 40—60 per cent. of the rainfall over the area drained by it. A reservoir capable of storing the lye and wash-waters for a week should be provided, and designed with a capacity equal to 70 times the weight of daily output of cellulose. The lye, diluted and infected with an equal volume of river water, will undergo a fermentation in the course of 7 days' storage, which will materially diminish the amount of organic matters ultimately discharged into the river. The auto-purification of river-water polluted with sulphite lyes may be divided into three stages. The first is a rapid fermentation of some of the organic matters by organisms

urished by the proteins, phosphates and salts extracted from the wood. The oxygen of the water is rapidly consumed and the carbonic acid increases. When the supply of oxygen fails, the organisms respire at the expense of the organic solids in solution, and powerful reducing processes supervene; this stage is the most noxious, and since the nitrogenous nutrition is limited, it extends over a longer period than the first stage. The final stage consists in a slow restoration of the natural condition of the matter by the action of chlorophyll-bearing algae under the influence of light. Experiments made by the author showed that water, at rest and at a constant temperature, solves atmospheric oxygen only slowly, but that variations of temperature act in the same way as mechanical agitation and cause a rapid aëration. The injuries to wood caused by sulphite lyes are principally indirect, brought about by the general deoxidation of the water; in resin and, in soft waters, the free acid also brings about certain objectionable results; the harm caused by fibres in suspension is practically negligible. Wood contains about 53 per cent. of cellulose, but yields only about 45 per cent. of pulp; the difference may be apportioned as follows: 4 per cent. dissolved by chemical hydrolysis; 1 per cent. sorted out in the cleaning and straining operations, and 1 per cent. discharged with the wash waters. Thus the effluents may be estimated to contain, in suspension, about 2 per cent. of the cellulose output of the mill; only about one-fourth of this suspended matter consists of true fibres, readily removed by sedimentation; the remainder consists of thin-walled parenchyma cells which do not settle out on standing.—J. F. B.

Sulphite-cellulose waste lyes and furfural-sulphurous acid. W. Kerp and P. Wöhler. *Arbb. Kais. Gesundh.-Amt.* 1909, 32, 120—143. *Chem. Zentr.*, 1909, 2, 710—711.

THE sulphur present in sulphite-cellulose waste lyes in the form of sulphurous acid (free and combined) amounts to about one-fifth to one-third of the total sulphur. The proportion of sulphurous acid in the lyes which can be exactly titrated with iodine increases with the dilution of the lye, and on continued titration with iodine, the reaction proceeds in stages; these features are characteristic of the behaviour of sulphurous acid compounds of aldehydes, i.e. combined sulphurous acid may therefore be considered to be present in the form of sulphurous acid compounds of the aldehydic constituents of the lyes, *viz.*, furfural, millin, xylose, mannose, galactose, and levulose. The lyes also contain a substance which, when the lyes are heated, acts as an oxygen-carrier and exerts an oxidising action on the sulphurous acid. The so-called calcium dithionates must be regarded as a mixture of different substances. The reaction constant of the composition of sodium-furfural sulphite in aqueous solution is 0.72×10^{-3} . In neutral solutions equilibrium is attained almost instantaneously, but less rapidly in acid solutions, although the amount of decomposition is considerably greater in the latter case. Combination of sulphurous acid and furfural takes place only at the aldehyde grouping, not at the double linkage, furfural having in this respect as a saturated aldehyde.—A. S.

Celluloid; Products of the explosion and combustion of —. B. Pfyfl and P. Rasenack. *Arbb. Kais. Gesundh.-Amt.* 1909, 32, 1—34. *Chem. Zentr.*, 1909, 2, 763—764.

IN the past few years there have been numerous fires in celluloid factories, and in nearly all instances, cases of poisoning by the fire-gases have occurred. The authors consider that the chief sources of danger are the products of explosion of celluloid, formed at a relatively low temperature. Two series of experiments were carried out. In the first, celluloid was heated until explosion (*i.e.*, sudden evolution of gas) took place, in a tube filled with carbon dioxide, nitrogen, or air at atmospheric pressure, in a vacuum over mercury; whilst in the second the celluloid was burned with, as far as possible, avoidance of explosion. The products of explosion of celluloid, with exclusion of air, consisted chiefly of carbon dioxide and carbon monoxide, nitrogen, nitric oxide, hydrogen cyanide, acrolein, and camphor; oxides of nitrogen other than

nitric oxide were not formed, nor were hydrocarbons and hydrogen. 100 grms. of celluloid yielded 17—18 litres of gas, stable at the ordinary temperature, and consisting of 4—7 litres of carbon monoxide, 7—9 litres of nitric oxide, 3—4 litres of carbon dioxide, and 0.5 litre of nitrogen. 100 grms. of celluloid yielded 0.7 gram of hydrogen cyanide, excluding a small quantity fixed by the acrolein. By explosion of celluloid in presence of air, nitrogen peroxide was formed in place of nitric oxide, and this reacted with the acrolein to form strongly reducing compounds, probably hydroxylamine derivatives. In presence of a sufficient quantity of air, and with small quantities of celluloid, the products of explosion were identical with those of complete combustion (carbon dioxide, water, and nitrogen); no hydrogen cyanide or carbon monoxide was produced on burning 1—2 grms. of celluloid. On burning celluloid with a restricted supply of air, larger quantities of hydrogen cyanide were produced than in the explosion of celluloid, 100 grms. of celluloid yielding about 1.2 grms. of hydrogen cyanide.—A. S.

PATENTS.

Wood pulp; Process for the preparation of — by means of oxides of nitrogen. J. E. Hedén. *Ger. Pat.* 212,838, July 14, 1908.

By the treatment of wood with oxides of nitrogen, oxalic and picric acids are said to be produced in addition to cellulose. According to the present patent, the wood is disposed in towers or other suitable chambers, and is subjected to the action of oxides of nitrogen and of water or dilute nitric acid, passing through the apparatus in opposite directions. It is stated that in this way, the wood pulp (cellulose) is obtained directly in one operation. The strong nitric acid, saturated with oxalic and picric acids, which is discharged at one end of the apparatus, is distilled to remove the nitric acid, and the oxalic and picric acids are recovered from the residue by crystallisation.—A. S.

Fibre; Method of soaking sheet —. I. W. Marshall, Yorklin, Del. *U.S. Pat.* 930,205, Aug. 3, 1909.

AFTER coating one side and the edges of the sheets of fibre with an adhesive waterproofing composition, the sheets are soaked in water to remove the chemicals contained in them.—G. W. McD.

Celluloid; Manufacture of plastic materials, as substitutes for —. S. Assadas. First Addition, dated May 8, 1908, to *Fr. Pat.* 387,537, May 8, 1907 (this J., 1908, 873).

A LITRE of the solvent used for moistening 1 kilo. of powdered nitrated paper, in order to render it non-inflammable, contains colophony (25—200 grms.), stannous chloride (200—400 grms.), ammonium chloride (5—50 grms.), and carbon tetrachloride (5—50 grms.). An alternative solution contains colophony (25—200 grms.), and either ammonium magnesium phosphate or magnesium phosphate (150—400 c.c.) in the "nascent state."—G. W. McD.

Plastic product. L. Desvaux and H. Allaire, Paris. *U.S. Pat.* 929,660, Aug. 3, 1909.

SEE *Fr. Pat.* 388,097 of 1908; this J., 1908, 873.—T. F. B.

Cellulose substitute. O. Müller, Assignor to Rheinische Kunstseide-Fabrik, Cologne, Germany. *U.S. Pat.* 930,874, Aug. 10, 1909.

SEE *Eng. Pat.* 3211 of 1906; this J., 1906, 865.—T. F. B.

Cellulose article; Coloured —. O. Müller, Assignor to Rheinische Kunstseide-Fabrik A.-G., Cologne, Germany. *U.S. Pat.* 931,634, Aug. 17, 1909.

SEE *Eng. Pat.* 6942 of 1906; this J., 1906, 775.—T. F. B.

XX. FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Aconite. F. O. Taylor. J. Ind. and Eng. Chem., 1909, 1, 549-567.

THE author gives a critical review of the literature on aconite and the valuation of its preparations. It may be taken as established that the root contains three alkaloids, viz., aconitine (acetylbenzoylaconine), benzoylaconine, and aconine. Dunstan and Cash have shown that aconine and, to a lesser degree, benzoylaconine act as antidotes to aconitine, and methods for the determination of the total alkaloids can give no accurate indication of the therapeutical value of aconite preparations. The best chemical method of assay is that based upon the determination of the ether-soluble alkaloid, but it is pointed out that besides aconitine, benzoylaconine is soluble in ether, and aconine is not completely insoluble. In the author's opinion no chemical method of assay has yet been devised which will give satisfactory results. For the standardisation of aconite preparations on the basis of the therapeutically available aconitine, the Squibb test is recommended as being simple, rapid, and superior in accuracy to chemical methods. The test is as follows:—Dilute the fluid extract (other preparations in proportion) so that 0.1 minim is contained in 1 fluid drachm of solution. Rinse out the mouth well to free the surfaces from mucus and saliva, and hold the 1 drachm of solution in the anterior part of the mouth for exactly one minute, and then discharge it. A distinct aconite (tingling) sensation should be perceived within 10–15 minutes. The proportions recommended by Squibb correspond to 1 part of fluid extract to 600 of water. In laboratory practice the author recommends dilutions of 1 in 700 for the fluid extract of the drug, 1 in 100 for the fluid extract of the leaves, 1 in 3000 for the extract of the root, and 1 in 500,000 for aconitine.—A. S.

Hydrolysis of glucosides by emulsin; Influence of quinol (hydroquinone), gallic acid and tannin on the —. A. Fichtenholz. J. Pharm. Chim., 1909, 30, 199-204.

QUINOL, gallic acid, and tannin all exert a retarding action on the hydrolysis of glucosides by emulsin. The action however is not uniform; it varies both with these compounds and with different glucosides. Thus, quinol has a very powerful retarding influence on the hydrolysis of arbutin, but its action is insignificant in the case of gentiopierin and of amygdalin. Gallic acid entirely arrests the hydrolysis of arbutin by emulsin, and almost entirely that of aucubin; other glucosides showed partial and variable progress of hydrolysis in presence of gallic acid. Tannin also varies in its action with different glucosides. It does not entirely arrest the hydrolysis of arbutin.—J. O. B.

Glycyrrhizic acid in other plants [besides Glycyrrhiza glabra]; Occurrence of —. A. Tschirch and S. Gauchmann. Z. allgem. österr. Apoth.-Ver., 1909, 47, 385–386, 393–394.

THE authors have found glycyrrhizic acid to be present in two plants besides *Glycyrrhiza glabra*. Small fragments of the root of *Periandra dulcis* Mart., from Brazil, were extracted with water, the extract boiled and filtered. The clear liquid was treated with dilute sulphuric acid, the precipitate collected, washed, and drained on porous earthenware. It was dissolved in warm alcohol, cooled, and more alcohol added, producing a precipitate. After standing, the liquid was filtered, and evaporated to dryness. The residue was taken up with alcohol, an equal volume of ether added, the liquid filtered, and again evaporated to dryness. The residue, which was glycyrrhizic acid, was a yellow powder, with a sweet taste. It dissolved in hot water, the solution forming a jelly on cooling. When purified through the potassium salt, and crystallised from hot dilute alcohol, glycyrrhizic acid, $C_{42}H_{62}O_{16}$, formed colourless crystals, melting at 195° C. when dried. The acid agreed in its properties with that obtained from *Glycyrrhiza glabra* (Arch. Pharm.,

1907, 97). *Cortex Monsia* obtained from *Pradosia lactescens* Radlk., which grows in Rio de Janeiro, was also found to contain this acid. The powdered bark was extracted with 70 per cent. alcohol, the alcohol distilled off and taken up with water. The clear aqueous liquid was treated with lead acetate, and the precipitate collected and washed. The precipitate was suspended in dilute alcohol (1:4), and decomposed by means of hydrogen sulphide. The filtered liquid was evaporated taken up with alcohol, filtered, and ether added. After standing, the clear liquid was evaporated to dryness dissolved in hot dilute alcohol, and treated with hide powder to remove tannic acid. On filtering and evaporating to dryness, the residue was found to consist of glycyrrhizic acid.—F. SIBB.

Vanilla in Hawaii. J. G. Smith. Brit. and Col. Druggist, 1909, 56, 208.

THE vanilla plant begins to flower during its second or third year, and continues flower production until seven or eight years old. Cultivation consists in keeping down the weeds and underbrush in the plantation. The vanilla plant only bears pods when the flowers are hand-pollinated. This is a delicate operation not difficult to learn. The pods mature in from six to eight months, becoming hard, thick, and greenish-yellow. They are gathered before ripe. After gathering, the green pods are spread out and exposed to the air for 24 hours, being roughly assorted into grades according to size. After being graded the pods are sweated between the folds of woollen blankets exposed to the heat of direct sunshine. During the period of fermentation the pods turn dark brown, become soft and leathery, and sweat freely. The pods are manipulated for several days until the proper degree of colour and aroma have developed. After fermentation they are dried in the sun for a few hours, and finally in cloth-covered trays, in the shade, with gentle heat. When fully dried—that is, when the pods no longer lose weight, but are still moist and pliable to the touch—they are packed tightly in tin boxes and are again manipulated in bulk for one or two months. When completely cured the pods are sorted to size and colour, tied in bundles, and these packages packed in tin-lined boxes which are soldered when full. The yield per acre in Hawaii has been estimated at about 13,000 pods, producing about 120 lb. of finished vanilla beans, fully cured and ready for the market. The industry is a very profitable one for persons having sufficient means who will give this industry their personal supervision. The price of the vanilla bean depends as much upon the outward appearance of the finished product as upon its actual quality, as indicated by aroma and flavour. Care is therefore necessary at every stage in the growth and fermentation of the crop. Five acres of vanilla in bearing should yield from 8400 to 8500 worth of beans per acre per annum, after the third year. There are vanilla plantations in the Kona district on the island of Hawaii, and in the Kona district of Oahu near Honolulu. Much land is still available which is quite suitable for the cultivation of this crop.

Petitgrain oil; Adulterated —. [Addition of ethyl tartrate and oleic acid]. E. J. Parry. Chem. and Drugg., 1909, 75, 410–411.

TWO samples of petitgrain oil adulterated by the addition of an ethyl tartrate, probably diethyl tartrate, are reported on. They had the following characters:—(A) Sp. gr. 0.908 at 15° C.; $[\alpha]_D^{20} = +8^\circ$; $n_D^{20} = 1.4622$; apparent esters, 48 per cent. (B) Sp. gr. 0.902 at 15° C.; $[\alpha]_D^{20} = +7^\circ$; $n_D^{20} = 1.4635$; apparent esters, 47 per cent. The odour of both was abnormal. When boiled under a reflux condenser, turbidity, increasing to a deposit, was observed. The amount of volatile acids obtained by distillation after saponification was equivalent to only 25 per cent. of the esters found to be present. The non-volatile acid was identified as tartaric acid.

TWO other samples were found to be sophisticated with free oleic acid. These had respectively the following characters:—Sp. gr. at 15° C., 0.904 and 0.9035; $[\alpha]_D^{20} =$

+2°30' and +2°; $n_D^{20}=1.4588$ and 1.4559; apparent esters, 43 and 46 per cent.; acid value, 10 and 15 per cent. The addition of aqueous potassium hydroxide solution rendered these oils semi-solid. This adulteration does not seriously affect the solubility.—J. O. B.

Bergamot; Essential oil of —. [*Adulteration with esters*]. J. C. Umney. *Chem. and Drugg.*, 1909, 75, 411.

THE prevailing high price of bergamot oil has induced a considerable amount of skilful adulteration. For this purpose, orange oil is employed together with sufficient of some foreign ester, to bring the "ester value" of the mixture up to the normal figure. In 1895, the author found the characters of genuine bergamot oil to be:—Sp. gr., 0.882–0.886 at 15° C.; $[a]_D$ not exceeding +15°; residue, not more than 6 per cent. when evaporated on the water-bath; esters, as linalyl acetate, not less than 38 per cent.; solubility in 80 per cent. alcohol, 1:2. Samples of guaranteed "pure" oil recently met with had the following characters: Sp. gr. at 15° C., 0.887; $[a]_D=+19°$ to +22°; esters, 41 to 45.5 per cent.; non-volatile residue, 4.4 to 4.5 per cent. Notwithstanding the normal ester value, the odour of these oils was poor when compared with authentic oil containing 40 per cent. of natural linalyl acetate. The optical rotation of these samples is abnormally high, and the residues low. The residue of normal bergamot oil rarely falls below 5.1 per cent. They proved to contain added terpineol acetate. After saponification, the characteristic lilac-like odour of terpineol was readily detected. These oils were probably mixtures of orange and bergamot oils with added terpineol acetate.

Terpineol acetate readily lends itself to this purpose. Its odour is weak, but pleasant; sp. gr., about 0.960; optically inactive; b. pt., 220–225° C. Commercial samples contained approximately 90 per cent. of the ester. It is now being supplied by manufacturers abroad, with instructions for mixing. Ethyl citrate, ethyl benzoate, and benzyl benzoate are also being offered for similar purposes. Genuine bergamot oil of the present season is found to differ very slightly in optical activity from the samples examined in 1905, the rotatory power ($[a]_D=+17°$) being somewhat higher; the other characters are normal.—J. O. B.

Citronellol and cinnamic aldehyde; Compounds of sulphurous acid with —. W. Kerp and P. Wöhler. *Arch. Kais. Gesundh.-Amt*, 1909, 32, 99–119. *Chem. Zentr.*, 1909, 2, 708–710.

THE authors' experiments were carried out with the addition-compounds of sodium bisulphite and citronellal and cinnamic aldehyde respectively, the sodium salts of citronellal-hydro-, and dihydro-sulphonic acid, $C_{10}H_{17}(HSO_3Na).COH$ and $C_{10}H_{17}(HSO_3Na).CHOH.SO_3Na$, the sodium salt of cinnamic aldehyde-dihydrosulphonic acid, $C_6H_5.CH(SO_3Na).CH_2.CH(OH).SO_3Na$, and phenyl-alphopropionic acid, $C_6H_5.CH(SO_3H).CH_2.COOH$, the addition-compound of sulphurous acid and cinnamic acid see this J., 1899, 169). In aqueous solutions of salts of the normal bisulphite addition-compounds of citronellal and cinnamic aldehyde, the complex anion decomposes into the aldehyde and bisulphite-ions, and the latter then unite with the unaltered complex anion, with formation of the corresponding aldehyde-dihydrosulphonic acid anion. The first reaction proceeds very rapidly in comparison with the second. The dihydrosulphonic acids of citronellal and cinnamic aldehyde, and citronellalhydro-sulphonic acid are much more stable than the addition-compounds of sulphurous acid and the aldehydes. Sodium phenylsulphopropionate is still more stable, yielding no sulphur dioxide even when warmed with sulphuric acid. The dihydrosulphonic acids of citronellal and cinnamic aldehyde are comparable with acetaldehyde-sulphurous acid, with respect to pharmacological action (see this J., 904, 832); citronellal-hydrosulphonic acid and phenyl-alphopropionic acid behave as inert sulphonic acids.

—A. S.

Chemical constitution and pharmacological or physiological action [of medicines]; Relation between —. R. Lüders. *Z. öffentl. Chem.*, 1909, 15, 282–288, 302–311.

THE author gives a summary of the leading facts already known concerning the relation between the chemical constitution and the physiological behaviour of substances used in medicine. Blake in 1839 (*Comptes rend.*, 1839; *Roy. Soc. Proc.*, 1841; *Ben.*, 14, 394; *Amer. J. Science and Arts*, VII., 1874, March) examined the action of metallic salts and found that the higher the valency of an element, the greater is the number of organs which its compounds can affect. Where one element forms compounds which are divided into two isomorphous groups, a member of one group will differ from a member of the other group in its action. For instance, ferric chloride is a haemostatic, whilst ferrous salts have no such action. Blake also found that within isomorphous groups, the toxicity increased with the atomic weight. Botkin (*Centralbl. f. med. Wiss.*, 1885, [48], discovered that solutions of sodium chloride when injected into the blood produced no effect, but that chlorides of other metals raised the blood-pressure. Bonchardat and Cooper observed that the effect of salts of potassium on the blood-pressure was greater than that of salts of rubidium and cesium. However the anti-epileptic properties of the bromides of the potassium group increase with the atomic weight, cesium bromide having the strongest effect. Calcium and strontium salts are almost innocuous compared with barium salts. Uranium is an eminently poisonous metal. According to Priestley (*Phil. Trans. Roy. Soc.*, 166; *J. Anat. and Phys.*, 11) the meta- and pyro-salts of vanadic and phosphoric acids are toxic, whilst the ortho-salts are not so. The organic compounds of arsenic, antimony, and phosphorus are less poisonous than the salts of these elements, and have, consequently, proved of therapeutic use. Krönig and Paul (this J., 1900, 1033) have shown that the activity of metallic salts, especially the salts of mercury, is dependent on the degree of dissociation. Mercuric cyanide and thiocyanate are less germicidal than mercuric chloride. The germicidal action of acids depends on the concentration of the hydrogen ions. With regard to carbon compounds, Richardson (*Med. Times and Gazz.*, Sept.-Oct., 1871) ascertained that the hydrocarbons of the methane series act as anaesthetics, and in large quantities produce cessation of the pulse and death. Schmiedeberg (*Arch. exp. Pathol. u. Pharmacol.*, 20, 201) stated that highly poisonous atom-groupings lose some of their toxicity when more or less substituted by hydrocarbons of the fatty series, for example trimethylarsine is less toxic than arsine. Conversely the activity of hydrocarbons is diminished or even destroyed by combination with other atoms or atom-groupings. Methylamine has similar properties to those of ammonia, but causes no narcosis. The methylation of alkaloids having different actions, produces substances which all paralyse the motor nerve-endings. The introduction of hydroxyl groupings lowers the activity of the fatty hydrocarbons. Hexyl alcohol is a strong narcotic, whilst mannitol is almost a food. Ammonia produces spasms of the throat, but methylamine, whilst equally irritating to the mucous membranes, is less poisonous. If an acid radicle is introduced, inactive substances are produced, such as acetamide. The presence of a nitro- or nitroso-grouping increases the toxicity of aliphatic or aromatic compounds when attached directly to a carbon atom. The nitrites, e.g., ethyl nitrite, lower the blood-pressure and accelerate the pulse. The toxicity of the cyanogen group is diminished by the introduction of alkyl groupings. Formaldehyde has a characteristic irritating and antiseptic action, but with acetaldehyde, propionaldehyde, etc., the action of the alkyl grouping becomes manifest, and after causing some irritation they bring about anaesthesia. The latter action disappears with the introduction of hydroxyl groupings, sugar, for instance, showing no anaesthetic action. Ketones show narcotic action and lowering of the blood-pressure in a smaller degree, and their activity appears to increase with the molecular weight. The introduction of sulphonic

or carboxyl groupings lessens the physiological action; phenolsulphonic acid is less active than phenol. Sulphur compounds become less toxic when the sulphur itself is attached to alkyl groupings. Chlorine and bromine, when introduced into compounds, increase the hypnotic effect, whilst iodine increases the antiseptic action. But iodine when substituted in the side-chain, forms potassium iodide in the body. Of ortho-, meta-, and para-substituted compounds, the latter are generally the most poisonous. The arrangement of the atoms in a group affects the physiological action. *Penicillium glaucum* attacks *d*-tartaric acid, but not *l*-tartaric acid. For higher organisms, *l*-tartaric acid is the most poisonous, coming next is *d*-tartaric acid, and finally racemic acid. *d*-Cocaine produces a shorter anaesthesia than *l*-cocaine, and *l*-nicotine is twice as poisonous as *d*-nicotine. The ammonium bases of alkaloids generally have a curare-like action. Of the two optical isomerides of suprarenine, the laevo modification alone has any therapeutic action. As to the connection between taste of substances and their constitution, the increase of the hydroxyl groupings in the aliphatic series increases the sweet taste, as in glycerol and the sugars for instance. E. Fischer (Ber., 35, 2660) found that *α*-amino-butyric acid had a sweet taste, whilst the *β*-acid tasted less sweet, and the *γ*-acid was insipid. All the antipyretics are derived from one of three substances: quinoline, aniline, and pyrazolone, each of which lowers the body-temperature. Quinine in addition decreases the rate of metabolism, as shown by a lessened output of nitrogen. The tasteless derivatives of quinine, aristoquine and euquinine, are antipyretic, but larger doses are required in malaria. Aniline cannot be used as an antipyretic, as it poisons the blood. This undesirable property disappears in acetanilide (antifebrin), which is a more rapid antipyretic than quinine, but is not a specific for malaria, and has less effect on the metabolism. Phenacetin is the least dangerous febrifuge. Antipyrine and pyramidone are stronger antipyretics than quinine, and do not decrease the metabolism, yet their action is not exactly the same as that of phenacetin. The hypnotics can be divided into four groups. The first includes chloral, trichloroisopropyl alcohol (isopral), and a condensation product of chloral and amylene hydrate known as dermid. These produce sleep, but may have a bad effect on the heart. The second group of hypnotics comprises sulphonal and its homologues, which have the drawback of being insoluble, and possess a tendency to cumulative action. Aldehydes containing no halogen such as paraldehyde and amylene hydrate, belong to the third group. The most important group of hypnotics consists of derivatives of urea, for example, methylpropylurethane (hedonal), diethylmalonylurea (veronal), and others. The sodium compounds of some of these are soluble, and can therefore be injected subcutaneously. Meyer has stated (Arch. f. exp. Path. u. Pharm., 1899, 42, 190) that the narcotic action of hypnotics depends on their ability to dissolve fats. If one of the hydroxyl groupings of morphine be replaced by a methoxyl grouping, codeine is produced, which is less narcotic and analgesic than morphine, and is more stable in the organism. Diacetylmorphine (heroin) differs from morphine in its effects. Substitutes for cocaine to be of use, must contain benzoyl-, ester-, and amine-groupings. This is shown in such local anaesthetics as the hydrochloride of benzoyltetramethyldiaminoethylisopropylalcohol (alypine), the hydrochloride of *p*-aminobenzoyldiethylaminoethanol (novocaine), and others. Organic arsenic compounds have been much used in medicine in recent years. Sodium *p*-aminophenylarsonate (atoxyl), acts upon trypanosomes, but has other actions upon the body which are deleterious. The acetyl derivative (arsacetin) has been used more often, but is still associated with harmful reactions. All the arsenic compounds which exert a destructive action on trypanosomes, have an amino-grouping in the para-position. Ehrlich (Biol. Zentralbl., 6, 214) has found that certain dyestuffs are taken up by definitive organs, "methylene blue" being absorbed by living nerve fibres.—F. SHON.

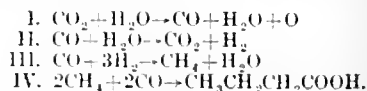
Ether: Purification of — G. Garbarini. Bull. Assoc. Chim. Sucr. et Dist., 1909, 26, 1165—1168.

On exposure to air, ether acquires oxidising properties.

The author has made experiments with a view to removing the oxidation product contained in ether that has been exposed to air, and has found that a dry preparation of ferrous hydroxide is a suitable reagent for this purpose. The reagent is prepared as follows:—Equimolecular proportions of crystallised ferrous sulphate and finely powdered calcium oxide are intimately mixed; interaction is insured by the presence of the water of crystallisation of the iron salt. If there is a deficiency of this water, the reaction is retarded or even prevented altogether, and to remedy this, 15—20 c.c. of water per 20 kilos. of the mixture are added. The mass acquires a greenish colour which gradually deepens, and much heat is liberated. The product is shaped into the form of a cone and covered with powdered calcium oxide. Directly the ferrous hydroxide shows a sign of oxidising to the ferric state, the preparation (20 kilos.) is added in small quantities to the ether (10,000 litres). The mixing is effected in a special drum of 10,000 litres capacity. The interior of the drum is provided with 4 stops which carry iron chains, whereby intimate admixture of the materials is insured on rotating the drum; the iron chains are padded to prevent too violent contact with the drum. As a rule, with an occasional rotation of the drum, a contact of 24 hours duration is enough. The ether passes from the drum to a filter and thence to a receiver.—L. E.

Butyric acid from alcohol: Formation of — under the influence of the silent electric discharge. W. Löb. Biochem. Zeits., 1909, 20, 126—135.

DURING the action of the silent discharge on moist methane, moist acetylene (with and without nitrogen), aqueous alcohol, and other substances, the author has observed an odour of butyric acid. In confirmation of this, he has now proved that by the action of the silent discharge on aqueous ethyl alcohol vapour, butyric acid (or rather, its ethyl ester) is formed, this being the only higher fatty acid produced. The author has already shown that the alcohol decomposes primarily into hydrogen and acetaldehyde. The fact that butyric acid is derivable from acetaldehyde through aldol, renders it easily understood that all substances which yield acetaldehyde under the action of the silent discharge, can form more or less butyric acid; acetaldehyde itself is formed from, and decomposes into, methane and carbon monoxide, so that, given the condition requisite for even the transient existence of these two substances, a synthesis of butyric acid is possible. Thus, in the decomposition of moist methane by the silent discharge, $\text{CH}_4 + \text{H}_2\text{O} \rightleftharpoons \text{CO} + 3\text{H}_2$, this condition is realised. With regard to the decomposition of alcohol, it cannot be decided whether the aldehyde first formed yields butyric acid directly, or decomposes into methane and carbon dioxide which then react to form this acid. The fact, however, that in all systems in which, by the action of the silent discharge, the possibility of acetaldehyde-formation exists, butyric acid is also formed, proves the genetic relation of the two reactions. If carbon monoxide and methane constitute the primary materials for the synthesis of butyric acid, the synthesis of this acid, like that of the carbohydrates, may be effected from carbon dioxide and water, the only obstacles being of an experimental kind. This synthesis is shown by the following scheme:



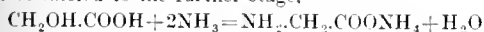
Each of these reactions singly, is practicable. The author also points out that acetylene, derived from methane by removal of hydrogen, may be an intermediate product of the decomposition of alcohol by the silent discharge, the acetylene taking up water to form acetaldehyde. He also discusses the relations connecting the reactions effected electrically, with the fundamental biological reaction, the decomposition of moist carbon dioxide, and points out that when the introduction of nitrogen into simple organic compounds is explained, natural organic chemistry will be derivable from this simplest of biological reactions.—L. E.

Nitrogen; Fixation of — by alcohol under the influence of the silent electric discharge. W. Löb. *Biochem. Zeits.*, 1909, 20, 136—142.

BERTHELOT has previously investigated the fixation of nitrogen by alcohol and other organic substances under the influence of an electric discharge (this J., 1898, 464). The author points out, however, that with regard to alcohol and the other substances examined by himself, the conditions are not those assumed by Berthelot. Thus, as a result of decomposition, a number of substances is formed and this fact has necessitated various preliminary investigations, *e.g.*, the influence of the silent discharge on moist nitrogen and moist nitric oxide (this J., 1908, 945). The author has now examined the influence of the silent discharge on the fixation of nitrogen by alcohol of concentration ranging from 50 to 100 per cent. A special form of apparatus was used, and the discharging tube was cooled by cooling tubes placed in the solutions of salt serving as electrodes. In spite of the fact that the temperature of these solutions did not exceed 20° C., the discharging tube always contained sufficient alcohol vapour. The nitrogen is not fixed as such, but first forms ammonia with the hydrogen which is produced. Hence, the alcohol is decomposed into acetaldehyde and hydrogen. The aldehyde is decomposed into methane and carbon monoxide, with the result that formaldehyde is produced, and, by combination of formaldehyde and ammonia, hexamethylenetetramine is obtained. Formic acid and ammonium formate, and ammonium butyrate (see preceding abstract) are also obtained. The author also considers it probable that an amino-acid can be prepared from the simplest primary substances and has observed indications of its occurrence, but his results do not permit of a definite conclusion on this point. If the reaction



can be carried to the further stage,



by means of ammonia and with the co-operation of oxygen, a direct synthesis of glycocoll from the constituents of atmospheric air would be practicable.—L. E.

Iodine exports from Japan. Brit. & Col. Drug., Sept. 4, 1909. [T.R.]

EXPORTS of iodine from Japan during late years have been as follows:—

	Cwt.	Value.
		£
1902.....	35	1,483
1903.....	263	10,117
1904.....	612	26,880
1905.....	535	26,629
1906.....	196	7,896
1907.....	305	10,182

The fall in exports which took place in 1906 was occasioned by the reduction in price made by the European iodine syndicate, which tried to free the market from Japanese competition. About half Japan's iodine exports come to England.

Solubility of silver iodide in sodium iodide solutions. Krym. See VII.

Ammonium phosphate; its volumetric determination. Wilkie. See VII.

Determining iodides and free iodine. Bugarszky and Horvath. See XXIII., Inorg. Quant.

PATENTS.

Organic substances; Reduction of —. F. Bedford, and C. E. Williams, Sleaford. Eng. Pat. 9112, April 27, 1908.

THE authors have improved the process for reducing organic substances described in Eng. Pat. 2520 of 1907

(this J., 1908, 296) by carrying out the reduction under diminished pressure and immediately distilling off the product of reduction under diminished pressure.—J. C. C.

o-Diorydiphenylethanolmethylamine and process of making same. F. Stolz and F. Flaecher, Höchst on Maine, Germany, Assignor to H. A. Metz and Co., New York. U.S. Pat. 930,703, Aug. 10, 1909.

THE hydrochloride of methylaminoacetocatechol (see Eng. Pat. 26,480 of 1903; this J., 1904, 1043) is dissolved in water, and the solution, slightly acidified, is reduced by means of sodium amalgam or other suitable reducing agent, and the impurities are extracted from the solution by means of ether; the solution is then concentrated, filtered, again extracted with ether, and finally treated with ammonia to precipitate the *o*-dihydroxydiphenylethanolmethylamine. The new product melts at about 208° C., is sparingly soluble in water, alcohol, or ether, stable when dry, optically inactive, and possesses astringent and hæmostatic properties.—T. F. B.

Guaiacol-5-sulphonic acid [$\text{OH} : \text{OCH}_3 : \text{SO}_3\text{H} = 1 : 2 : 5$] and its salts; *Process for preparing* —. F. Hoffmann-La Roche und Co. Ger. Pat. 212,389, April 12, 1908.

ACIDYL derivatives of guaiacol are sulphonated, with or without addition of dehydrating agents; the resulting acetylguaiacol-5-sulphonic acid solution is saponified and neutralised, and the resulting guaiacol-5-sulphonic acid isolated as such or in the form of its salts.—T. F. B.

Bromoacetylsalicylic acids; Process for preparing —. Chem. Fabr. von Heyden A.-G. Ger. Pat. 212,422, May 26, 1907.

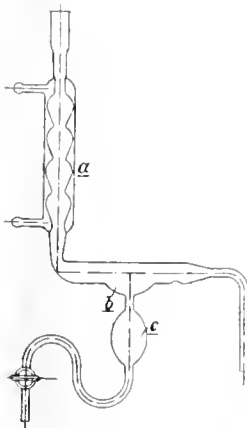
BROMOACIDYL derivatives of salicylic acid are prepared by the action of the chlorides, bromides, or anhydrides of brominated fatty acids on salicylic acid or its salts, preferably in presence of a basic substance, such as dimethylaniline. Tribromoacetylsalicylic acid has a much more powerful physiological action than the corresponding quantity of acetylsalicylic acid. The new compounds are generally of value for treating the complaints for which acetylsalicylic acid is applied.—T. F. B.

Alkylthiosalicylic acids and their alkyl esters; Process for preparing — substituted in the benzene nucleus. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 212,434, Jan. 29, 1907. Addition to Ger. Pat. 203,882, Aug. 23, 1906 (see this J., 1908, 1223).

DERIVATIVES of *o*-diazobenzoic acid (substituted in the benzene nucleus) are treated with a xanthogenate, and the resulting substituted benzoic acid *o*-xanthogenic esters treated with alkylating agents in presence of alkali, when they are converted into substituted alkylthiosalicylic acids or their esters. (See also this J., 1909, 854.)—T. F. B.

Organic liquids; Apparatus for removing water from —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 212,854, April 5, 1908.

THIS apparatus is for use in processes, such as esterification, where water is formed and may return to the apparatus together with the condensed solvent. It consists of a reflux condenser, *a*, connected with a horizontal tube in the lower side of which is a small well, *b*, into which the mixture of condensed water and solvent falls, whence it passes to the separator, *c*; when this is full, the water may be removed by means of the stop-cock, and the solvent returned to the apparatus.—T. F. B.



Products containing iodine; Process for obtaining —, and products obtained thereby. J. Hertkorn, Berlin. Eng. Pat. 17,220, Aug. 15, 1908.

SEE U.S. Pat. 901,709 of 1908; this J., 1908, 1176.—T. F. B.

Cumpher; Process of making —. C. Glaser, Baltimore, Md. Re-issue No. 13,001, Aug. 3, 1909, of U.S. Pat. 864,162, Aug. 27, 1907.

SEE this J., 1907, 1065.—T. F. B.

Tobacco extract; Manufacture of concentrated —. C. F. Gloystein, Henderson, Ky. Re-issue No. 12,994, July 27, 1909, of U.S. Pat. 899,865, Sept. 29, 1908.

SEE this J., 1908, 1080.—T. F. B.

Santalol ester [ester]. J. Callsen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Re-issue No. 13,008, Aug. 17, 1909, of U.S. Pat. 909,541, Jan. 12, 1909.

SEE Ger. Pat. 202,352 of 1907; this J., 1908, 1177.—T. F. B.

Bromoisovaleric ester of the borncols. M. Dohrn, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 930,054, Aug. 3, 1909.

SEE Fr. Pat. 389,327 of 1908; this J., 1908, 999.—T. F. B.

1-Phenyl-2,3-dimethyl-4-sulphamino-5-pyrazolone and its salts; Manufacture of —. E. Scheitlin, Altstetten, Switzerland. U.S. Pat. 930,091, Aug. 3, 1909.

SEE Fr. Pat. 378,486 of 1907; this J., 1907, 1109.—T. F. B.

1-Phenyl-2,3-dimethyl-4-dimethylaminopyrazolone; Method of making —. E. Scheitlin, Altstetten, Switzerland. U.S. Pat. 930,092, Aug. 3, 1909.

SEE Eng. Pat. 13,383 of 1907; this J., 1908, 91.—T. F. B.

Compounds of mercuric salts with hexamethylenetetramine; Process of manufacturing soluble —. A. Busch, Brunswick, Germany. U.S. Pat. 930,836, Aug. 10, 1909.

SEE Ger. Pat. 196,060 of 1907; this J., 1908, 833.—T. F. B.

Cascara sagrada extract free from bitterness and containing no zinc; Manufacture of a —, which forms a clear solution with water. M. Penschnick. Fr. Pat. 400,069, March 2, 1909.

SEE Ger. Pat. 206,467 of 1907; this J., 1909, 161.—T. F. B.

Gelose or extract of marine algae for foods and pharmaceutical preparations. Fr. Pat. 399,432. See XVIII.A.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Silver iodide-gelatin emulsion and plates; Preparation and development of —. R. Jahr. Internat. Congr. Appl. Photography, Dresden, 1909. Chem.-Zeit., 1909, 33, 845.

THE following process is given for the preparation of a fine-grained silver iodide photographic emulsion:—33 grms. of potassium iodide and 15 grms. of gelatin are dissolved in 200 c.c. of water, a solution of 30 grms. of silver nitrate in 200 c.c. of water is added, and ammonia is passed through the solution until the precipitate dissolves. The red emulsion is heated for an hour at 55° C., allowed to set, and washed. After standing 24 hours, it is treated with chrome alum and spread on plates. Its sensitiveness can be increased by heating to 80° C. The plates seem to be better suited for physical than for chemical development.—T. F. B.

Silver subhalides; Action of hydrogen peroxide on —. A. P. H. Trivelli. Internat. Congr. Appl. Photography Dresden, 1909. Chem.-Zeit., 1909, 33, 844.

Pure silver bromide is inactive towards hydrogen peroxide whilst colloidal silver decomposes it into water and oxygen. The absorption compound of silver and silver bromide is converted by hydrogen peroxide into a mixture of silver oxide and bromide. The red photohalide is decolorised, being oxidised to silver oxide and bromide the blue photohalide is converted into the red, and the green into the blue by means of hydrogen peroxide. The double compounds of sodium thiosulphate and silver thiosulphate, obtained by the action of sodium thiosulphate on the photohalides, were analysed, with the result that the green photohalide was found to contain the most silver, and the red the least. It is thus concluded that the photobromides are the subhalides; there is a definite relation between their molecular weights and absorption spectra.—T. F. B.

Dyestuffs; Sensitiveness of — to light. A. F. von Hübl. Wiener Mitt., 1909, 268. Chem. Zeit., 1909, 33, Rep., 436.

DYE STUFFS which alone are tolerably fast to light, become very sensitive to light when present in films prepared from gelatin to which glycerin has been added. This is especially the case with Methylene Blue, Phenosafranine, and "Scarlet"; addition of glycerin has less effect in the case of Crystal Violet and Rose Bengal, and no influence at all on Patent Blue, Fast Red, and Tartrazine. The sensitiveness to light of films coloured with Methylene Blue, is increased 500—1000 times by addition of glycerin (3 c.c. to 10 grms. of gelatin). By addition of certain other substances, *e.g.*, arsenates, the sensitiveness is still further increased, complete bleaching being produced in a few minutes on exposure to sunlight. The bleached films soon recover their original colour when kept in the dark; almost instantaneously when moistened with water. The sensitising action of glycerin is completely destroyed by addition of copper sulphate (1—2 grms. to 10 grms. of gelatin).—A. S.

PATENTS.

Pigment prints; Production of —. W. Triepel, Berlin. Eng. Pat. 7000, Mar. 23, 1909.

A PIECE of pigmented paper, somewhat larger than the silver print to be reproduced, is soaked in water until it lies flat, the silver print, preferably after it has been hardened by alum solution, being likewise thoroughly soaked. The pigmented paper is then impregnated with a solution containing soluble bichromates and ferriocyanides of certain metals, the ferriocyanides and monochromates of which are slightly soluble or insoluble in water. Such metals are particularly iron, and the rare earth metals, such as cerium, didymium, lanthanum, and the like. Or the haloid salts of these metals may be used in conjunction with the bichromates and ferriocyanides of alkali metals. In addition to the above-mentioned salts, other salts of these metals, or of uranium, vanadium, molybdenum, etc., especially such as have a tanning effect on gelatin, may be added to the impregnating bath, and preferably in conjunction with an organic acid, such as acetic acid, and in the presence of a liquid, such as alcohol or glycerol, which increases the absorbing power of the gelatin. The pigmented paper is thoroughly saturated with one of the above impregnating solutions, and brought into contact with the wet silver print for five minutes, after which it is developed in the usual way.—O. R.

Photographic chromated glue images on metal, porcelain, glass, and other impermeable substances; Process for producing —. A. Hans. Ger. Pat. 212,764, May 20, 1908.

SOLUTIONS of glue containing a bichromate and a suitable colouring matter, prepared in the usual manner, are applied by means of a colour spray or atomiser, to the

surface of the metal, glass, etc., to be treated. This surface must be heated to such a temperature that the drops of solution mingle and dry rapidly, so as to produce an even coating, but too high a temperature must be avoided, as it reduces the solubility of the film. After exposing under a negative in the usual manner, the picture is developed by means of water, also applied by an atomiser.—T. F. B.

Film for cinematography; Sensitive —. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 400,385, June 3, 1908.

SEE Eng. Pat. 16,114 of 1908; this J., 1909, 491.—T. F. B.

Pyrophorous substances [flash-lights, etc.]. Eng. Pat. 27,341. See II.

XXII.—EXPLOSIVES, MATCHES, &c.

Cotton; Nitration of —. O. Guttmann. Z. angew. Chem., 1909, 22, 1717.

THE author has made experiments during a period of two years with samples of cotton, from English and German sources, the history of which was known, from their obtaining from the cotton-spinning works to the finished, and in some cases, stored nitrocellulose. Some of the samples of cotton were unbleached, others had been strongly bleached with bleaching powder; and some were highly contaminated with dust, etc. The results obtained confirm those of Piest (this J., 1909, 746), namely that the stronger the degree of bleaching of the cotton, that is, the higher the content of oxycellulose, the more difficult it is to stabilise the nitrocellulose obtained therefrom, and the more soluble is the nitro-derivative in ether-alcohol; and in addition, the lower is the viscosity of the solution.—A. S.

PATENTS.

Gelatin dynamite; Machine for packing —. T. W. Bacchus, Woodbury, N.J., Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 929,815, Aug. 3, 1909.

THE explosive is fed by means of a worm, from a hopper, through a die-plate containing several holes, furnished with nozzles. A carrier, containing empty cartridge cases, mounted on a rotating table, receives the cartridges issuing from the die.—G. W. McD.

Dynamite heater. A. H. Vannauker, Hazleton, Pa. U.S. Pat. 929,902, Aug. 3, 1909.

THE heating apparatus consists essentially of a vessel similar to a water oven. The trays stop short, both of the back and sides of the oven, and are turned up at right angles so as to prevent the cartridges actually coming in contact with the inside of the oven.—G. W. McD.

Nitroglycerin; Compound for eliminating noxious fumes when exploding —. F. P. Bettanin, Bessemer, Mich. U.S. Pat. 930,030, Aug. 3, 1909.

THE explosive consists of dynamite, potassium chlorate, and pine oil.—G. W. McD.

Powder and explosives; Use of silicates, silicic acids, or their derivatives in —. F. Chailly. First Addition, dated, Feb. 20, 1909, to Fr. Pat. 381,311, Aug. 20, 1907 (this J., 1908, 140).

LAIM is made for the use, as ingredients of explosives, of all metals (excluding aluminium) in a finely divided condition, and all minerals and also emery in the same condition. It is said that such additions render explosives less sensitive to moisture and increase their power.

—G. W. McD.

Nitro-explosives; Apparatus for detecting the spontaneous decomposition of —. J. C. E. Bouchaud-Praceig. First Addition, dated May 4, 1908, to Fr. Pat. 388,142, May 22, 1907 (this J., 1908, 961).

THE explosive is contained in a hermetically sealed case. A capillary tube passes through the lid almost to the bottom of the case and is connected, outside, with a tube containing a reagent sensitive to oxides of nitrogen. This tube is closed by an indiarubber ball which expands and contracts according to variations of temperature and pressure. There is thus a certain amount of movement of the air in the case through the tube containing the indicator, and hence any deterioration, and consequent evolution of oxides of nitrogen, is said to be readily detected.—G. W. McD.

Igniting compositions [matches]; Manufacture of —. H. Schmitz, Paris. Eng. Pat. 9992, Apr. 27, 1909.

THIS is a process for rendering yellow phosphorus more effective as an igniting material and consists in adding the phosphorus to a hot solution of potassium perchlorate and continuously stirring the mixture as it cooks. The potassium perchlorate crystallises out and an intimate mixture of the crystals and the phosphorus is obtained. The phosphorus thus treated does not volatilise to any great extent when exposed to air, and the addition of Venice turpentine still further decreases the volatilisation. The mixture may be heated to a temperature of 75 C., without ignition taking place.—W. P. S.

Matches; Igniting composition for —. L. Stange, Aachen, Assignor to The Chemical Industrial Synd., Ltd., London. U.S. Pat. 930,570, Aug. 10, 1909.

SEE Eng. Pat. 16,453 of 1906; this J., 1907, 353.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, &c.

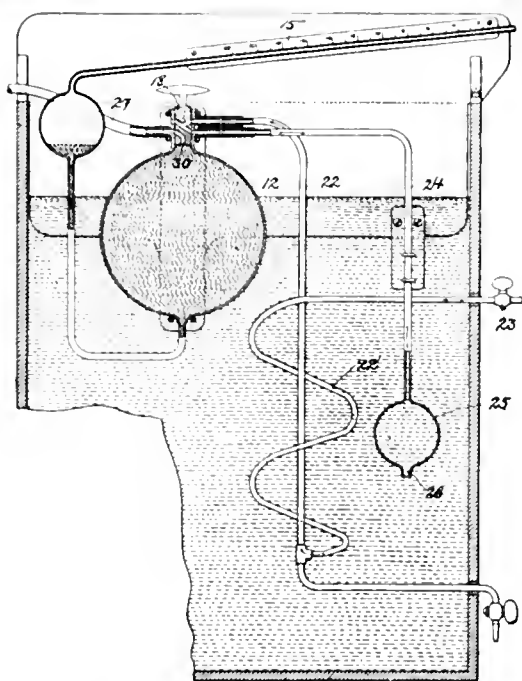
PATENTS.

Calorimeter. C. J. Emerson, Providence, R.I. U.S. Pat. 931,189, Aug. 17, 1909.

THE patent relates to a bomb calorimeter having an electrical ignition device. The bomb is supported on an insulating stand in the calorimeter vessel, and the ignition circuit comprises the calorimeter vessel, a contact-pin passing through a porcelain plug in the base of the bomb, a fuse wire passing through the fuel in the fuel-pan, and the body of the bomb itself.—A. T. L.

Gas; Apparatus for analysing —. H. N. Cheney, and H. L. von R. Nickerson, Boston, Mass. U.S. Pat. 922,086, May 18, 1909.

THE apparatus, which is suitable for the rapid determination of carbon dioxide in combustible gases at frequent intervals, comprises an absorption chamber, 12, charged with potash, connected to an inclined graduated tube, 15, and a sample chamber, 25, open at 26, the two chambers being immersed in water. In carrying out the analysis, the gas enters the sample chamber by way of the cock, 23, pipes, 22¹ and 22, stop-cock, 18, and pipe, 24, whilst a passage, 30, in the stop-cock, 18, permits the escape from the absorption chamber of gases from the previous test. The stop-cock, 18, is now turned through 180° and the sample of gas passes through the passage, 30, in the stop-cock into the absorption chamber and forces the potash into the graduated tube, 15, whilst the gas supply from the cock, 23, passes to waste at 27. The volume of gas analysed depends upon the height to which



the liquid rises in the tube, 15, but the latter is calibrated so as to indicate the percentage of carbon dioxide in the sample tested.—A. T. L.

Industrial gases; Continuous automatic registering apparatus for the analysis of — by absorption. C. Andorff. Ger. Pat. 211,389, Aug. 17, 1907.

A DEFINITE volume of the gaseous mixture to be analysed is sucked into a measuring vessel by an automatic mercury pump, and then forced into an absorption vessel connected with a second mercury pump. The unabsorbed gas is next forced by the second pump into a measuring vessel, whilst simultaneously another portion of the gaseous mixture to be analysed is sucked into the apparatus. —A. S.

INORGANIC—QUANTITATIVE.

Aluminium, chromium, and iron; New quantitative precipitation method for —. E. Schirm. Chem.-Zeit., 1909, 33, 877–878.

WHEN aluminium, chromium, and iron are separated as hydroxides by means of ammonia, the precipitate is very voluminous, cannot be easily washed, shows a great tendency to carry down other substances present in the solution, and frequently passes through the filter in the colloidal condition. By precipitating with a mixture of potassium iodide and iodate (see Stock, this J., 1900, 276), a much denser precipitate is obtained, but the method is not generally applicable. The author has found that by using ammonium nitrite as a precipitant in a boiling solution, the precipitate of hydroxides obtained is of good quality, and the method is as generally applicable as precipitation with ammonia. The solution, containing from 0.1 to 0.2 gm. of the metals, is treated with ammonia so long as no precipitate forms and is then diluted to about 250 c.c. Twenty c.c. of a 6 per cent. solution of ammonium nitrite are next added, and the whole boiled vigorously till the odour of oxides of nitrogen is no longer perceptible. After allowing to stand for $\frac{1}{4}$ – $\frac{1}{2}$ hour on the water-bath, the precipitate is washed with hot water, first by decantation and then on the filter, dried, ignited, and weighed. If the original solution contains more than 1 per cent. of ammonium salts per 250 c.c., then in consequence of hydrolytic

dissociation and the small amount of free acid thus produced, the precipitation is not quite complete. In such cases, after expelling the oxides of nitrogen, the solution is rendered faintly ammoniacal.—A. S.

Zinc, copper, and cobalt; Determination of — by means of ammonia. W. Vaubel. Z. angew. Chem., 1909, 22, 1716–1717.

THE author states that zinc, copper, and cobalt can be precipitated quantitatively with ammonia if the solution be first carefully neutralised with sodium hydroxide or carbonate, and excess of ammonia be avoided. The acid solution containing the salt of the metal is first treated carefully with sodium hydroxide or carbonate until neutral to litmus paper. Then in the case of zinc salts a drop of phenolphthalein solution is added, followed by ammonia until a red colour is produced. The whole is then heated to boiling until precipitation is complete. In the case of cobalt salts, the coloration is somewhat difficult to recognise, but good results can be obtained with care, and a slight excess of ammonia is not injurious. With copper salts, ammonia is added until the deep blue colour of cuprammonium compounds first makes its appearance. On heating, the complex salts are decomposed, and the copper separates in the form of the brown oxide.—A. S.

Sulphur in animal charcoal; Determination of total —. E. Selvatici. Bull. Assoc. Chim. Sucri. et Dist., 1909, 26, 1164.

FOR determining sulphur in animal charcoal, the author recommends the following method, whereby precipitation of barium phosphate with the barium sulphate is avoided:—The sample (0.5–1 gm.) is heated with sodium carbonate and potassium nitrate, at first gently, and then gradually to fusion, and kept in this state for about 15 minutes. After cooling, the material is extracted with boiling water, filtered, and washed until no longer alkaline. The filtrate is treated with hydrochloric acid, heated until all carbon dioxide has been driven off, evaporated to dryness to remove nitric acid, taken up with water, and filtered to remove silica. The filtrate is precipitated with magnesia mixture (55 grms. of crystallised magnesium chloride and 105 grms. of ammonium chloride dissolved in water and made up to 1 litre) and ammonia, the filtrate from this precipitate being acidified with hydrochloric acid and precipitated with barium chloride.—L. E.

Iodides and free iodine; Determination of —. S. Bugarszky and B. Horvath. Z. anorg. Chem., 1909, 63, 184–196.

BROMINE, in aqueous solution, reacts with iodine according to the equation: $I_2 + 5Br_2 + 6H_2O \rightarrow 2HIO_3 + 10HBr$, and the reaction may, under proper conditions, be utilised for the determination of iodine or iodides. A quantity of solution, containing not more than 12 mgrms. of iodine, is taken and, if alkaline, is rendered feebly acid by means of sulphuric acid, so that the acidity is less than $N/100$; 50 c.c. of saturated bromine water are added and then water to 100 c.c. The flask is kept for 1 hour in a boiling water-bath, and the contents are then transferred to a larger flask, and the bromine is boiled off as rapidly as possible (5 minutes vigorous boiling should suffice). After cooling, 1–2 grms. of potassium iodide are added and 5 c.c. of 2N sulphuric or hydrochloric acid, and, after 2–3 minutes, the separated iodine is titrated with thiosulphate, $1/6$ of the iodine found representing that originally present. Chlorides and bromides, even in very large excess, in no way interfere with the accuracy of the method, but if bromine water, made from commercial bromine, be used for the determination, its iodine content must be ascertained by a blank experiment. The method is suitable for the determination of iodine in waters, and previous softening or removal of organic matter is unnecessary. The presence of ammonium salts, nitrates, and nitrites does not affect the results, but if manganese or iron salts be present, the titration with thiosulphate should be performed rapidly.—F. SOBX.

Determining alkali phosphates by direct acidimetry. Pozzi-Escot. See VII.

Ammonium phosphate: its volumetric determination. Wilkie. See VII.

Determining free lime in cements. Brandenburg. See IX.

Analysis of bronzes by electrolysis. Fischer. See X.

ORGANIC—QUANTITATIVE.

Mineral constituents in plants [Sugar beets, etc.]: Determination of —. H. Pellet. Bull. Assoc. Chim. Sucri. et Dist., 1909, 26, 1145—1148.

VUAFLART has shown that in the incineration of vegetable substances, appreciable losses of phosphorus, sulphur, potassium, and chlorine, occur, and has therefore recommended wet methods of analysis (Bull. Assoc. Chim. Sucri. et Dist., 1908, 26, 448—455). The author, however, uses a method for determining phosphoric acid in the sugar beet and many other plants, in which the sample is first carbonised and then extracted; the evaporated extract is added to the residue from the extraction, and on igniting the whole, the normal ash of the sample is obtained and no phosphoric acid is lost. The accuracy of this method is now confirmed by Vuafart. Of course, if the material contains much organic phosphorus, means must be taken to insure that the whole of the phosphorus is converted into phosphates, but beetroot, wheat, and sugarcane, do not contain sufficient organic phosphorus to affect the results obtained by carbonisation and extraction. The same observation applies to sulphur. Vuafart has admitted that ignition with sulphuric acid is preferable to the wet method for the determination of potassium. The author considers that for the determination of this constituent, the method of carbonisation and extraction is quite as applicable as that of ignition with sulphuric acid, and the former method gives satisfactory results for lime and magnesia. Save in very special cases, he will therefore continue to use this method.—L. E.

Separation of combustible gases. De Voldere. See II.

Determining carbon bisulphide in benzol. Weiss. See III.

Brominated derivatives of indigo. Binz and Marx. See IV.

Analysis of calcareous asphaltum and paving mixtures. Prettner. See IX.

Saponification of Carnauba wax. Berg. See XII.

Determining rubber in soft rubber goods. Axelrod. See XIII.

Analysis of rubber goods. Frank and Marckwald. See XIII.

Determining tannin electrolytically. Corridi. See XIV.

French regulations for wine analysis. See XVII.

Determining milk-sugar [lactose] in milk. Oppenheim. See XVIII.

Aconite. Taylor. See XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Carbon dioxide: Absorption of — by charcoal. A. E. M. Geddes. Ann. der Physik, 1909, [4], 29, 797—808. Chem. Zentr., 1909, 2, 592.

COCOANUT charcoal was treated with carbon dioxide of less than 1 atmosphere pressure in a quartz vessel con-

nected with a pressure gauge, at the temperatures, 14°, 31°, and 35° C. respectively, until equilibrium was attained. The quantity of gas absorbed was calculated from the reduction of pressure, the volume of the apparatus being known. Equilibrium was reached from both sides, but the results were not concordant, the whole of the absorbed gas not being evolved again on reducing the pressure. The results obtained at all three temperatures may be represented by the equation: $v = ap^n$, where v is the volume of gas in c.c. absorbed by 1 c.c. of charcoal at the pressure, p , and a and n are constants. The value of n increases (0.498—0.588) and that of a decreases (1.356—0.629) with rising temperature.—A. S.

Radio-active parent substances: Chemistry of the —. D. Strömholm and T. Svedberg. Z. anorg. Chem., 1909, 63, 197—206. (See this J., 1909, 259.)

AN extension of the authors' work to the actinium group of radio-active elements shows that actinium X is isomorphous with barium and lead; it is precipitated with barium salts as oxalate and sulphate, but not with lead salts as sulphide or iodide; it, therefore, undoubtedly belongs to the alkaline-earth group. Actinium itself is isomorphous with lanthanum, and radio-actinium with thorium. The isomorphy of thorium 2 (*loc. cit.*) is uncertain. A quantitative comparison has been made for the three radio-active alkaline-earth metals, thorium X, actinium X, and radium, of the ratios of distribution of their salts between a solid and a liquid solvent (thorium nitrate crystals and the corresponding mother liquor); the same value was obtained for all three elements, and at very different concentrations. Striking analogies are pointed out between the radio-active elements of the thorium, actinium, and radium groups.—F. Sodn.

Fractional distillation: The theory of —. W. K. Lewis. J. Ind. and Eng. Chem., 1909, 1, 522—533.

A MATHEMATICAL article on the fractional distillation of binary mixtures.—A. S.

Trade Report.

Port of London dues. Draft Schedule of maximum rates.

THE following list is extracted from the draft schedule prepared by the Port of London Authority. Unless otherwise stated, the rates are per ton:—Acids: Acetic 3s.; Boric, 2s.; Carbolic, liquid or solid, 8d.; Hydrochloric, 1s.; Nitric, 1s. 6d.; Oxalic, 3s.; Sulphuric, 1s.; Tartaric, 2s.; Alizarin, 1s.; Alkali, 5d.; Alum, alum rock, alumina, 1s.; Alum cake, 6d.; Alumite, 3s.; Ammon. carb., nitrate, and muriate, 1s.; Ammonium sulphate, 6d.; Other ammonium salts, n.o.r., 1s.; Ammoniacal liquor, 1s.; Aniline, salts of, or colours, 3s.; Anthracene, 1s.; Antimony regulus, 1s.; Antimony ore, 8d.; Arsenic, 3s.; Ashes, black, 6d.; Pearl and pot ashes, 1s.; Barium oxide, chloride, nitrate, 6d.; Bark for medicinal purposes, 3s.; Bark for tanners, 1s.; Barytes, 2s.; Bauxite, 6d.; Bleaching powder, 5d.; Boraxite, 1s.; Borax, 3s.; Brimstone or sulphur, 4d.; Calcium carbide, 3s.; Chemicals, n.o.r., 3s.; Chloral hydrate, 3s.; Colloidion, 3s.; Copper sulphate, 2s.; Copperas, green, 1s.; Creosote salts, 6d.; Cutch, 1s.; Disinfecting fluid and powder, 3s.; Divi-divi, 1s.; Dyestuffs, n.o.r., 1s.; Dyes from coal tar, 3s.; Dyewood roots, 1s.; Extracts to be used in medicine or for dyeing purposes, n.o.r., 1s.; Extracts of dyewood and of bark for dyeing purposes and all extracts for tanning (description to be stated), 1s.; Galls, 3s.; Gambia pods, 1s.; Gambier, 1s.; Gelatin, 3s.; Glucose, 1s.; Ghee, 1s. 6d.; Glycerin, 2s.; Gums, n.o.r., 2s.; Indianrubber, 5s.; Iodine, crude, 3s.; prepared, per £1 sterling, 1d.; Indigo, 5s.; Kieselguhr and infusorial earth, 1s.; Lime, acetate, 1s.; Lime, borate, 1s.; Lime, gas or spent, 4d.; Lime, muriate, 1s.; Lime, phosphate, 6d.; Magnesium carbonate, 3s.; Magnesium borate, 1s.;

N.O.R.=not otherwise rated.

Manganese oxide, 6d.; Mercury, 6s. 8d.; Methylated spirits, 2s.; Myrobalans, 1s.; Naphthalene, 1s.; Nitre cake, 4d.; Orchella, 2s.; Paris white, 1s.; Petroleum burning oils and spirit, and petroleum lubricating oils, naphtha, benzoline, &c., 1s.; Phosphorus, 3s.; Potash salts, 1s. 6d. to 2s.; Quinine, sulphate of, 4d. cwt.; Quinine, residuum, 3s.; Rosin, 3d.; Saccharin, 1s. 1b.; Sal ammoniac, 1s.; Saltpetre, 1s.; Sheep dip or wash, 1s.; Sumac, 2s.; Soap of all kinds, 10d.; Soda salts, 6d. to 2s.; Soy, 2s. 6d.; Spirits, brandy, 100 gals., 1s.; Other spirits, 100 gals., 1s.; Spirits, in bottles, 1 doz. qts., 1d.; Starch, 1s.; Stearine, 2s.; Strontia, 1s. 6d.; Tallow, 2s.; Tar, coal, 1s.; Tar, Stockholm, 8d.; Tartar, cream of, 2s.; Tartar, crystals and lees, 1s.; Turmeric, 1s.; Turpentine, 1s.; Vaseline, 2s. 6d.; Verdigris, 3s.; Wax, paraffin, 1s.; Wax, other descriptions, 3s.; Zinc salts, 2s. to 3s.

Oil is classified under three headings, Class I. at 1s. per ton, Class II. at 2s. per ton, and Class III. at 4d. per cwt., and include the following items:—(1) Bone, castor, coconut, copra, corn, cottonseed, creosote, fusel, gas, linseed, naphtha (coal tar), naphtha (wood), palm, palm nut, rapeseed, refuse for soap, rosin, soap, tar (not otherwise rated), turpentine, wood naphtha; (2) aniline, chemical; (3) camphor, coal tar. Oil cans and drums (empty) are chargeable at 1s. 6d. per ton, and oilseed cake at 8d. per ton.

Appended to these tables of maximum port rates is an alphabetical list of articles not separately rated with reference in each case to some entry in the tariff in accordance with which the charge shall be made. The following are examples:—

Chemicals not otherwise rated.—Acetone, albumen, calcium chloride, potassium iodide, and other potash salts. *Medicines not otherwise rated.*—Citric acid, citrate of magnesia, nareotine, nicotine. *Dye-stuffs not otherwise rated.*—Gallic acid. *Drugs not otherwise rated.*—Alcohol, citrate of lime, malt extract, Epsom salts, Venice turpentine.

German chemical imports and exports. For. Off. Ann. Ser., No. 4325.

The following table shows the imports and exports of chemical products into and from Germany during the years 1907-08:—

Foreign trade.	Year.	Import.		Export.	
		tons.	£	tons.	£
Total of chemical and pharmaceutical products.....	1907	1,358,774	15,034,750	2,800,205	28,592,350
	1908	1,413,550	15,101,000	2,801,933	27,300,050
Of which—					
(a) Chemical base stuffs, acids, salts and other combinations of chemical base stuffs not otherwise mentioned ..	1907	880,071	9,382,000	2,019,334	9,825,050
	1908	904,970	9,712,300	2,074,005	9,998,300
(b) Dyes and dyeing materials	1907	66,258	967,200	186,496	11,826,909
	1908	62,626	893,650	171,560	10,696,700
(c) Varnishes, lacquers, cements	1907	2,857	191,850	3,602	209,600
	1908	2,411	160,800	3,853	224,350
(d) Ether, alcohol, volatile oils, perfumes, cosmetics	1907	37,300	2,012,350	9,464	1,136,650
	1908	40,421	1,950,400	8,846	1,021,150
(e) Artificial manures	1907	327,072	1,008,850	539,878	1,325,450
	1908	353,436	1,017,450	503,228	1,257,000
(f) Explosives, ammunition, and combustibles	1907	1,403	88,400	13,741	1,630,550
	1908	1,101	75,750	11,784	2,629,650
(g) Chemical and pharmaceutical products not otherwise mentioned	1907	43,214	1,384,450	27,691	2,861,650
	1908	49,115	1,291,250	28,658	

Books Received.

BULLETIN OF THE IMPERIAL INSTITUTE. Vol. VII., No. 2. Price 1s.

This issue contains the results of investigations as to various African food grains, Nigerian cotton, East African sisal hemp, rubber from Southern India, recent discoveries of graphite in British African Colonies; also notes on the occurrence and utilisation of tungsten ores, on peppermint oil, on the tussur silkworm in India, on cocoa cultivation in German Colonies, &c. (See pp. 978, 981, 993, 998).

TRADE AND COMMERCE OF THE CONSULAR DISTRICT OF FRANKFORT, APRIL, 1908, TO APRIL, 1909. For. Off. Ann. Series, No. 4325. Wyman and Sons, Fetter Lane, E.C. Price 8s.

This book includes a lengthy report on the chemical industry of Germany; it deals with the subject generally, and also under the following special headings:—Alkalis, acids, &c.; Bromine; Kali; Manures; Dyes; Nitrogenous products out of atmospheric nitrogen; Tanning extracts; Pharmaceutical industry.

NEW CUSTOMS TARIFF OF THE UNITED STATES OF AMERICA. [Cd. 4856.] Wyman and Sons, Fetter Lane, E.C. Price 10½d.

This is a copy of the Act of Congress, approved Aug. 5, 1909, entitled "An Act to provide revenue, equalise duties, and encourage the industries of the United States, and for other purposes," to the dutiable list of which have been added, as far as possible, the former rates of duty on the articles specified in the new tariff.

DIE THEORIE DER FAERBUNG DER NATUERLICHEN ERDOELE UND DEREN NOTWENDIGE KONSEQUENZEN. Von M. A. RAKUSIN. Verlag für Fachliteratur Ges.m.b.H. Berlin. 1909. Price M.2.

PAMPHLET containing 29 pages of subject matter, including a bibliography. The text is subdivided as follows:—I. Theoretical and experimental. II. Conclusions: (1). Chemical-geological consequences. (2). Probable nature and constitution of the dark-coloured substance of petroleum. (3). Relations between the polarimetry of petroleum and the microscopy and ultra-microscopy of the same. (4). Relations between the polarimetry of petroleum and the spectroscopy of the same. III. Final considerations.

METAL CORROSION AND PROTECTION. References to Books and Magazine Articles. Reprinted from the Monthly Bulletin, July, 1909. [Carnegie Library of Pittsburgh.] Second Edition. Carnegie Library, Pittsburgh, U.S.A. 1909.

PAMPHLET containing 64 pages of bibliographic references to articles and books on the above subject. The classification is as follows:—I. CORROSION. (i). General and theoretical. (ii). Corrosion by electrolysis. (iii). Corro-

sion by salt-water. (iv). Corrosion by vapours. (v). Boiler corrosion. (vi). Pipe corrosion. (vii). Corrosion of structural work. II. PROTECTION AGAINST CORROSION. (i). General. (ii). Cement and concrete. (iii). Enamels and lacquers. (iv). Galvanising and tinning. (v). Magnetic oxide. (vi). Paint. (vii). Paper.

THE LEAD AND ZINC PIGMENTS. By CLIFFORD DYER HOLLEY, Ph.D. First Edition. John Wiley and Sons, New York, U.S. America. Price \$3.00 net. Chapman and Hall, Limited. London. 1909. Price 12s. 6d.

Svo volume, containing 313 pages of subject matter, with 85 illustrations, and an appendix with 14 tables,

and the alphabetical index. The subject matter is classified according to the following scheme:—I. White lead in ancient times. II. Development of the white lead industry in the United States. III. Brands, production, and prices of white lead. IV. Modern application of the Dutch process in the United States. V. The Carter process. VI. The mild process (Rowley). VII. Matheson process. VIII. The sublimed lead pigments. IX. White lead manufacture in Europe. X. Properties of white lead. XI. Lead poisoning. XII. Manufacture of zinc oxide. XIII. Properties and uses of zinc oxide. XIV. Manufacture of leaded zinc. XV. Zinc-lead white. XVI. The oxides of lead. XVII. The lead chromates. XVIII. Lithopone. XIX. Physical properties of white lead. XX. Practical tests. XXI. Art of grinding white lead, pastes and paints. XXII. Analysis of commercially pure white leads. XXIII. Analysis of the zinc pigments. XXIV. Analysis of white lead and paints in oil. XXV. Estimation of water in white leads and paints. XXVI. Qualitative analysis of combination white leads and pastes. XXVII. Laboratory equipment and manipulation.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 19,990. Leask. Cooling apparatus or apparatus for treating gases with liquids. Sept. 1.
20,140. Sheard. Filtering apparatus.* Sept. 2.
20,244. Farago. Leaching crystalloids from vegetable and other organic substances in presence of sulphurous acid.* Sept. 3.
20,245. Brun. Linseed preparations for steam generators. [Fr. Appl., Sept. 4, 1908. Addition to No. 25,987 of 1906.]* Sept. 3.
20,254. Moore. *See under II.*
20,305. Deroy. *See under XIV.*
20,380. Farago. Concentrating solutions without heating them.* Sept. 6.
20,462. Suzuki. Evaporators.* Sept. 7.
20,715. Petitpierre. Apparatus for raising liquids. Sept. 10.
20,822. Matter. Concentrating apparatus.* Sept. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

- 19,525 (1908). Smith. Continuous kiln. Sept. 8.
24,328 (1908). Clark (Fellner und Ziegler). Supporting inclined rotary drums. Sept. 8.
27,466 (1908). Hallett. Separating air or other gas from liquids. Sept. 8.
2049 (1909). Fawcett, Preston, and Co., and Shield. Evaporating apparatus. Sept. 15.
8876 (1909). Senn and Klüger. *See under IX.*
11,988 (1909). Draper. Apparatus for separating substances of different specific gravities. Sept. 8.
13,859 (1909). Aktiebolaget Separator. Centrifugal separators. Sept. 8.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 19,859. Evans. Smokeless steam fuel. Aug. 30.
19,924. Lumsden. Gas producers. Aug. 31.
19,959. Koppers. Obtaining by-products in dry distillation or gasification of fuel. [Ger. Appl., Sept. 1, 1908.]* Aug. 31.
20,010. Cobbett, de Fazi, and Clausen. Manufacture of filaments for incandescence electric lamps. Sept. 1.
20,158. Tozer. Distilling or carbonising coal and other carbonaceous material.* Sept. 3.
20,237. Simpson. Manufacture and purification of coke. Sept. 3.
20,254. Moore. Retort for making coke and for treating other materials. Sept. 4.
20,304. Fichet and Heurtey. Gas generators. [Fr. Appl., Sept. 23, 1908.]* Sept. 4.
20,309. Glover and West. Distilling coal in vertical retorts. Sept. 4.
22,419. Higgins and Kemp. Motor fuel. Sept. 7.
20,447. Fabry. Recovering the by-products of coal-gas, &c. Sept. 7.
20,492. Duchanoy, Bousquet, and Davicion. Gas producers.* Sept. 7.
20,504. Simonin. Utilisation of the waste of the purification of illuminating gas.* Sept. 7.
20,592. Tully. Retort furnaces for the destructive distillation of coal. Sept. 8.
20,631. Riedel. Extraction of nitrogen and carbonic acid from combustion gases. [Ger. Appl., Sept. 9, 1908.]* Sept. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

- 14,167 (1908). Parker. Apparatus for the destructive distillation of coal. Sept. 15.
18,829 (1908). Rodhe. *See under XXIII.*
26,719 (1908). Fletcher. Apparatus for compressing gas or air for lighting or heating. Sept. 8.
28,462 (1908). Neilson. *See under X.*

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATION.

- 19,959. Koppers. *See under II.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 16,617 and 24,209 (1908). Hood and Salamon. Treatment of mineral and vegetable oils. Sept. 15.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

- 20,029. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of dyestuffs of the safranine series. Sept. 1.
20,127. Soc. Chem. Industry in Basle. Manufacture of orange sulphurised vat dyestuffs of the anthracene series. [Addition to No. 7583 of 1908.]* Sept. 2.
20,649 and 20,650. Chem. Werks formerly Sandoz. Manufacture of substantive disazo dyestuffs. [Ger. Appls., Jan. 2, and July 16, 1909.]* Sept. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

- 2386 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of halogenated indigo. Sept. 8.

2608 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of a monoazo dyestuff especially adapted for making lakes. Sept. 8.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

19,926. Wooster. Treatment of fabrics for use as belting, fire or garden hose, &c.* Aug. 31.

20,305. Deroy. *See under XIV.*

20,312. Imray (Soc. Chem. Ind. in Basle). Obtaining fast grey prints and vat dyeings.* Sept. 4.

20,645. Palmer. Imparting lustre to yarns, fabric, &c.* Sept. 9.

20,728. Bernhardt. Preserving silk-finish and similar effects on textile goods. [Ger. Appl., July 17, 1909.]* Sept. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1594 (1909). Murray. Apparatus for supplying liquid to wool fibre. Sept. 15.

4683 (1909). Ellis (Heberlein et Cie.). Apparatus for mercerising textile fabrics. Sept. 15.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

19,794. Peek. Recovery of ammonia from crude ammoniacal liquors. Aug. 30.

19,920. Carulla. Manufacture of sodium sulphate, hydrogen, and iron oxide. Aug. 31.

20,062. McKechnie and Beasley. Separation of iron and other metallic oxides from solutions, ores, or residues. Sept. 2.

20,289. Moeller. Manufacture and distribution of ozone. Sept. 4.

20,290. Moeller. Production of ozone.* Sept. 4.

20,291. Moeller. Apparatus for bringing ozonised air or ozonised oxygen into contact with liquids. Sept. 4.

20,401. Chem. Fabr. Griesheim-Elektron. Manufacture of sulphuric acid. [Ger. Appl., Sept. 21, 1908.]* Sept. 6.

20,562. Spurge. Apparatus for making ozone. Sept. 8.

20,568. Rollin and Hedworth Barium Co. Manufacture of barium or other compounds.

20,631. Riedel. *See under II.*

20,673. McKechnie and Beasley. Separating iron or other oxides from complex solutions, ores, &c. Sept. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

18,356 (1908). Keogh and Douglas. Manufacture of fusible compounds of aluminium, and recovering aluminium therefrom. Sept. 8.

20,402 (1908). Thom and Pryor. Manufacture of lime and carbonic acid gas. Sept. 15.

3732 (1909). Sinding-Larsen. Manufacture of silicon nitride and metals from metallic silicides. Sept. 15.

11,123 (1909). Friedrich et Cie. Preparation of sodium sulphite and ammonium chloride. Sept. 8.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

20,400. Garros. Apparatus for making ceramic ware, glassware, enamelling metals, &c. [Fr. Appl., Sept. 3, 1908.]* Sept. 6.

COMPLETE SPECIFICATIONS ACCEPTED.

18,482 (1908). Solon and Campbell. Purifying the slip or like material used in making china, earthenware, and like goods. Sept. 15.

20,393 (1908). Royer. Glass melting furnaces or ovens. Sept. 15.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

20,479. De Villartay. Manufacture of bricks, tiles, slabs, &c., from slate waste.* Sept. 7.

20,481. Lironi. Treatment of plastic or clay in making bricks, &c.* Sept. 7.

COMPLETE SPECIFICATIONS ACCEPTED.

18,345 (1908). Lake (Spackman Engineering Co.). Preparation of cementitious materials. Sept. 8.

8876 (1909). Senn and Klüger. Manufacture of porous materials for heat-insulating, filtering, building, &c. Sept. 8.

X.—METALS AND METALLURGY.

APPLICATIONS.

19,829. Bloxam (Treibacher Chem. Werke). Manufacture of pyrophoric alloys. [Addition to No. 8163 of 1909.]* Aug. 30.

19,867. Headson. Metallic compounds or compositions. Aug. 30.

19,889. Butterfield. Treating complex ores of lead, zinc, copper, silver, and gold. Aug. 31.

20,020. Cowper-Coles. Armour plate. Sept. 1.

20,022. Cowper-Coles. Inlaying and ornamenting metallic surfaces. Sept. 1.

20,062. McKechnie and Beasley. *See under VII.*

20,081. Stuart-Bailey. Recovery of copper and like metals. Sept. 2.

20,293. Chenhall. Crucible furnaces.* Sept. 4.

20,471. Cobb. Extraction and separation of gold and silver from their ores. Sept. 7.

20,636. Ruthenburg. Treatment of ores. Sept. 9.

20,673. McKechnie and Beasley. *See under VII.*

20,707. Graf, and Roman Gold and Silver Mines, Ltd. Furnaces for treating ores. Sept. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

9383 (1908). Reynolds. Manufacture of steel and other metallurgical processes. Sept. 8.*

12,212 (1908). Stock. Bessemer converters. Sept. 15.

15,956 (1908). Germain. Separating precious and other metals combined with gangue. Sept. 8.

18,356 (1908). Keogh and Douglas. *See under VII.*

28,462 (1908). Neilson. Purifying and recovering tar from blast furnace, producer, and like gases. Sept. 8.

3732 (1909). Sinding-Larsen. *See under VII.*

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

20,057. Cowper-Coles. Apparatus for electroplating. Sept. 1.

- 20,129. Johnson (Badische Anilin und Soda Fabrik). Production of long, continuous electric arcs. Sept. 2.
 20,192. Girtin. Electrolytic production of salt solutions.* Sept. 3.

COMPLETE SPECIFICATIONS ACCEPTED.

- 26,356 (1908). Bingham. Electric furnaces. Sept. 15.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

- 20,089. Macpherson and Heys. Manufacture of soap. Sept. 2.
 20,202. Bamberg. Hydrolysis. Sept. 3.
 20,646. Brown and Brown. Manufacture of soap. Sept. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

- 16,617 and 24,209 (1908). Hood and Salamon. *See under III.*
 18,031 (1908) and 4956 (1909). Gilbert and Ralph. Machines for cooling and moulding soaps, fats, &c. Sept. 8.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

- 20,038. Simson. Luminous paints or compositions.* Sept. 1.
 20,805. Meurant. Manufacture of oil colours having a magnesium base.* Sept. 11.

(B.)—RESINS, VARNISHES.

COMPLETE SPECIFICATIONS ACCEPTED.

- 18,349 (1908). Reil. Manufacture of a linoleum-like substance. Sept. 8.
 28,526 (1908). Thompson (Germania Linoleumwerke). Manufacture of linoleum and the like. Sept. 15.

(C.)—INDIA-RUBBER.

COMPLETE SPECIFICATION ACCEPTED.

- 18,048 (1908). Ansterweil. Regenerating and devulcanising old indiarubber and extracting caoutchouc from raw material. Sept. 8.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

- 19,804. Deuts. Versuchsanst. f. Lederindustrie, and Arnoldi. Decolourising tannin extracts. [Ger. Appl., Sept. 7, 1908.]* Aug. 30.
 20,025. Beckmann. Manufacture of a glue in powdered form.* Sept. 1.
 20,305. Deroy. Scouring hides and skins, cleaning and scouring cloth, &c., and preparations for extraction by volatile solvents. [Fr. Appl., Sept. 11, 1908.]* Sept. 4.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATION.

- 20,420. Freeman and Freeman. Preventing ill-effects from formation of blue mould on barley during its conversion into malt. Sept. 7.

COMPLETE SPECIFICATION ACCEPTED.

- 4584 (1909). Thompson (Topf und Soehne). Drums for the germination of malt. Sept. 15.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

- 19,858. Sargent. Beverages.* Aug. 30.
 20,215. Evers. Destroying the poisonous materials present in foodstuffs, &c. [Ger. Appl., Sept. 8, 1908.]* Sept. 3.
 20,580. Ingle. Dietetic preparation. Sept. 8.
 20,766. Vasey. Soluble protein or albumen and its production from meat fibre or other insoluble protein matter. Sept. 10.
 20,819. Maconochie and Vasey. Nutritive food. Sept. 11.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

- 20,179. Schilling, and Ges. f. Abwässerklärung. Separating light or floating substances from effluents. Sept. 3.
 20,445. Abt, Diebl, and Bayer. Treatment of effluents.* Sept. 7.
 20,558. Dickson. Treatment of sewage sludge. Sept. 8.

COMPLETE SPECIFICATIONS ACCEPTED.

- 18,199 (1908). Purcell, Ryan, and Polglase. Recovery of the useful constituents of sewage. Sept. 8.
 23,668 (1908). Koch. Apparatus for purifying sewage water. Sept. 15.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

- 19,963. Gernaert. Manufacture of paper. [Belg. Appl., Sept. 1, 1908.]* Aug. 31.
 20,195. Kodak, Ltd. (Reid). Manufacture of acetyl-cellulose. Sept. 3.
 20,489. Langlet. Precipitating ulmic compounds from the black liquors of soda pulp mills. [Swed. Appl., Sept. 24, 1908.]* Sept. 7.
 20,593. Leclaire. Manufacture of viscose and similar compositions. Sept. 8.

COMPLETE SPECIFICATION ACCEPTED.

- 20,616 (1908). Poirier. Paper to be used as substitute for rubber, leather, &c. Sept. 15.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

- 19,805. Hoffmann-La Roche und Co., Barell, and Elger. Manufacture of guaiacol compounds. [Addition to No. 24,072 of 1908.]* Aug. 30.
 19,820. Ulzer and Sommer. Manufacture of radium and substances containing large proportions of radium.* Aug. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

- 23,143 (1908). Newton (Bayer und Co.). Manufacture of aminoacetylprocatechins. Sept. 15.

XXI.—PHOTOGRAPHIC MATERIALS AND
PROCESSES.

APPLICATION.

20,046. Albert. Photographie paper for grained photographs. Sept. 1.

COMPLETE SPECIFICATION ACCEPTED.

18,744 (1908). Dufay. Manufacture of screens for use in colour photography. Sept. 15.

XXII.—EXPLOSIVES. MATCHES, &c.

COMPLETE SPECIFICATION ACCEPTED.

19,334 (1908). Holmes. Explosive compounds. Sept. 8.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

COMPLETE SPECIFICATION ACCEPTED.

18,829 (1908). Rodhe. Apparatus for analysing gas. Sept. 8.

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Meeting held at the University on Wednesday, April 21st, 1909.

DR. JAMES T. CONROY IN THE CHAIR.

THE OCCURRENCE OF MOULDINESS IN PAPER PULP.

BY CLAYTON BEADLE AND HENRY P. STEVENS, M.A., PH.D.

Abstract.

The authors called attention to the occurrence of mould both in paper and in wood fibres prepared for paper making, and gave the features observed and the proportions of furfural and water extract obtained.

BY-PRODUCTS OF COTTON SEED AND THEIR UTILISATION.

BY CLAYTON BEADLE AND HENRY P. STEVENS, M.A., PH.D.

Introduction.—This communication deals with products of cotton seed which hitherto have been regarded as waste materials. The subject matter is treated under two heads:—(A) The utilisation of cotton separated from the seed hulls as a paper-making material; and (B) the utilisation of the hulls themselves as a foodstuff for cattle. Under "A." is given a description of the physical and commercial qualities of the cotton as mechanically separated from the cotton seed hulls of different seeds by the Minck and the De Segundo separating machines (British Patent 12,718, 1906; this J., 1906, 16). Under "B." is discussed generally the feeding qualities and composition of the hulls and their various ingredients, with particular reference to a process of our own for hydrolysing the cellulose and thereby increasing its digestive qualities (British Patent 14,588, 1904).

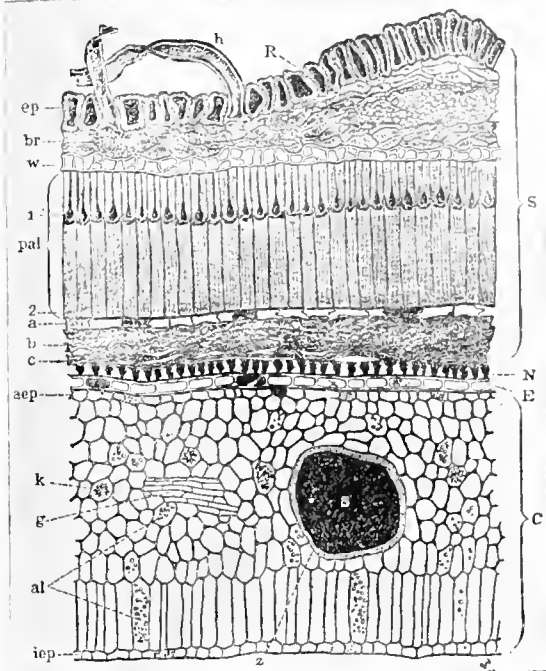
In the United States there are produced per annum a million tons of hulls capable of yielding 100,000 tons of cotton by mechanical separation, and employed usefully in the manufacture of high-grade papers.

Before proceeding under these headings, a brief reference to a section of the cotton seed (Fig. 1, reproduced by permission) will serve to show from what part of the seed the different products referred to later, are derived. Having once made this reference we will, however, refer to these products under the names by which they are commonly known in the crushing mills.

The husk of the seed, or spermoderm (S), when ground, is commonly known as "ground hulls," or "hull meal"; while the kernel, or cotyledon (C), after expression of the oil, is known as "kernel meal" or "decorticated cake." The two when ground together and pressed for oil constitute "undecorticated cake." The latter is the form produced in this country; "decorticated" cake is the form produced in America.

"Cotton-seed hulls" consist of spermoderm (S) and the hairs (h). These hairs are the cotton fibres that have escaped the ginning and delinting; they frequently have trumpet-shaped attachment ends, and being very short, unripe, and immature, are of no use for textile purposes.

When the cotton is removed from the "cotton-seed hulls" by mechanical separation, described later, each fibre is plucked as it were from the epidermis (ep). When a more drastic separation is effected, in addition to the cotton, the epidermal cells (ep) come away as well as the layers of the inner brown coat (a, b, and c). When cotton-seed hulls as a whole are treated chemically, as has been attempted for the manufacture of paper pulp, the bleached



Cotton seed. Cross section. S spermoderm consists of ep epidermis with h hair, br outer brown coat with R raphe, w colourless cells, pal palisade cells, and a, b, and c layers of inner brown coat; N perisperm; E endosperm; C cotyledon with aep outer epidermis and iep inner epidermis, s resin cavity surrounded by z mucilage cells; al aleurone grains; k crystal cells; g procambium bundles. $\times 160$. (Winton).

residue consists of palisade cells (pal) in addition to the cotton fibre. These cells are useless for paper, and their presence, as will be hereafter seen, renders the cotton useless for explosives. When cotton-seed hulls are hydrolysed, the cellulose of the cotton fibre (h) and palisade cells (pal) have both to be acted upon in order to break them down to a digestive meal, but in cases where the cotton is previously removed by mechanical separation, then, of course, only the palisade cells are acted upon.

"Cotton-seed hulls" constitute therefore the residue after the decortication of the seed for the removal of the kernel; this product (see table) in the United States alone is produced to the extent of nearly one million tons per annum, with a possible augmentation to nearly double this quantity if the whole of the seed produced could be crushed and submitted to the decortication process.

The returns of United States crushing mills (1907).

Number of active establishments	786
Quantity of seed produced	4,952,402 tons
Quantity of seed crushed	2,564,873 tons
Per cent. of seed crushed to quantity produced	51.8 per cent.
Hulls produced	926,705 tons
Linters	128,243,639 lbs.

The hulls appear to show a diminishing proportion to the seed crushed. In 1895 the proportion of hulls was about 50 per cent. on seed. In 1901 the ordinary proportion was about 45 per cent. of hulls, and 1905 and 1907 the computed average was 36.2 per cent., the diminution being due no doubt to the more complete separation of the "meats" and increased delinting, and to more complete cleansing of the seed. The amount of cotton fibre wasted in the hulls is also a diminishing quantity. In 1887 about 10 tons of hulls from Upland

seed was shipped to this country for experiment, from this we procured a yield of 25 per cent. of cotton. In 1896 the fibre on ginned Upland cotton-seed averaged about 10 per cent., the amount removed by linters 1.1 per cent., and the hulls produced 50 per cent.; thus the actual amount of cotton left in the hulls was, according to this figure, 17.8 per cent. At the present time, the linters (as above) equal 2.2 per cent. on seed or 6.3 per cent. on hulls, leaving only 12 per cent. to 14 per cent. of cotton in hulls. After allowing for further possible improvements there would remain in any event a final residue

As will be seen, the Brazilian cotton-seed hulls yield a far higher percentage of cotton than the U.S.A., namely 25 per cent. as against a possible 10 or 12 per cent.

Three main products were eventually separated from the cotton-seed hulls, namely husk, cotton and meal, in the following proportions:—Husk, 65 per cent.; meal, 7 per cent.; cotton, 25 per cent.; loss due to dust and moisture, 3 per cent.

The following table gives some idea of the ingredients capable of being separated and their composition by analysis:—

	Moisture.	Ash.	Woody fibre.	Oil (ether extract).	Protein.	Carbo-hydrates.	Food units.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
Separated husk	12.75	2.31	32.35	0.5	3.16	48.93	58
Separated kernel meal containing inner brown coat	10.0	6.1	27.0	7.2	20.6	29.1	99
Gritty meal consisting of fine particles of husk (supermodern)	10.0	2.0	38.0	2.6	2.7	41.8	60
Meal, of chocolate colour, derived from inner brown coat of husk	10.0	6.6	39.0	8.8	10.8	24.8	74
Separated cotton containing dust	7.29	1.52	55.4	3.28	9.7	27.71	48
Separated fibre deprived of dust	7.3	1.5	77.0	2.6	3.5	8.1	23

of not less than 10 per cent. of pure cotton on the weight of the hulls, which, on one million tons of hulls, would be equal to one hundred thousand tons of cotton per annum.

The computed yields of cotton from U.S.A. cotton-seed hulls we summarised as follows:—1887, 25 per cent.; 1896, 18 per cent.; 1907, 13 per cent.; lowest possible minimum, 10 per cent.

During the last 20 years many attempts have been made to use cotton-seed hulls for the manufacture of paper, but without marked success. To completely remove the encrusting matter from the hulls by boiling and bleaching is far too expensive, as was proved by one of us when in 1887 some tons were shipped over and converted into paper. The best results were achieved by boiling in soda to loosen the husk; the cotton was then floated off when agitated in a hollander with a large quantity of water, and an imperfect separation effected before bleaching. This could only be accomplished when raw materials were far more expensive than at present, and before cotton-seed hulls had any market value. Considerable quantities were so treated in this country, special hollanders being equipped for the purpose. Beyond this many processes have been proposed and patented and much money has been wasted, but without yielding any practical results.

Papermaking section.—Dry mechanical separation of cotton from the hulls, as now accomplished by the Minck and de Segundo machines, has put a different complexion on the problem. One form of the Minck mill consists of a fixed vertical cylinder with a fluted lining provided in the centre with a vertical shaft from which project a number of arms or beaters. The agitation produced by these arms, as the material is fed into the top, by some means or other brings about a complete separation of the cotton from the husk, but without reducing the size of the husk particles. The husk being heavy and deprived of its woolly coating, passes to the bottom and discharges through a grating, the cotton is winnowed upwards into a cyclone or other form of "condenser," from whence it is discharged to a baling machine. The other ingredients of the seed if present can be collected at convenient stages by settlement from the air draught. A constant supply of cotton-seed hulls is kept up by mechanical means to each mill, and the separated ingredients automatically removed. The various factors of rate of rotation, diameter of the mill, number and forms of beaters, and rate of speed, which could only be arrived at after much careful study, not only affect the output of the mill, power consumption and the thoroughness of the separation, but they also determine the physical character of the fibre produced; a point of considerable importance to paper-makers.

In November, 1906, from a store containing 2000 tons of cotton-seed hulls from Brazilian seed, were selected bales to represent the average of the bulk. The first trial gave 24.6 per cent. and the second 26.0 per cent. of cotton fibre on the weight of the hulls, the rest being separated husk, with a slight loss for dust and moisture.

The analysis of cotton deprived of dust as now produced agrees fairly closely with published analyses given for raw lint cotton determined in a similar manner.

We have devised a simple method of determining the amount of husk in cotton-seed hulls and other products containing the husk. We convert the cotton fibre into hydrocellulose, dry off in presence of fumes of ammonia and shake in a nest of sieves. The disintegration of the cotton is accomplished without reducing the husk. Not only is a separation effected, but an idea is obtained of the size of the husk particles, points of importance to paper-makers. The following table gives results obtained by this process:—

	Size of husk.	Husk.	Raw Cotton.
		Per cent.	Per cent.
Cotton-seed hulls	Coarse, unbroken.	75	25
Fibrous residue after grinding and sifting to remove loose hulls, ..	Ditto.	58	42
Cotton as originally separated from hulls by mechanical process	Coarse and fine.	11	89
Cotton as separated in 1907....	Very fine.	0.7	99.3
Cotton as separated in 1908....	Ditto.	0.4	99.6

After proving on a small scale the paper-making qualities of the separated fibre and determining how best to treat it, some tons were converted into paper in the best rag mills. After several trials it was found that the cotton could go direct from the bales into the rag boilers and behaved much like rags, but without requiring the preliminary processes of cutting, dusting, etc.; furthermore, the process known as "breaking-in" was dispensed with as the fibres were already short enough.

Full details as to the mode of treatment and physical qualities of the paper* produced have already been published. The points established are, that it is unnecessary to start from staple cotton (i.e. long fibres), as in rags, in order to produce a good strong paper. Furthermore, the strength of the paper depends more upon the hydration of the cotton than upon the length of the fibre. The trumpet-shaped ends of these fibres apparently assist in giving felting qualities, and as has been confirmed in Germany when beaten, these ends become frayed with formation of fibrillae. The paper produced is equal to a good quality "rag" paper and can be made "all cotton," which can hardly be guaranteed with any form of rags which contains also some linens. There is, as can be appreciated by the paper-maker, less consumption of power in beating, as there is no reduction in length of fibre needed as with rags. The function of the beating operation is rather to bruise, brush-out and hydrate.

With rags, the process of "breaking-in," which is here avoided, may absorb nearly as much power as the beating operation proper.

The actual amount of bleached fibre or cellulose contained in the dust-free Brazilian separated cotton, is 80 per cent. to 82 per cent., *i.e.*, the same as lint cotton, with which it agrees in composition. In large scale working we have obtained as high as 75 per cent. yield of paper, but the average is rather lower than this, and can never reach the actual amount of cellulose present, by reason of the loss of some fine fibres during the washing operation. This yield, however, is satisfactory in comparison with rags.

The following table gives the length of cotton fibres obtained from the cotton-seed hulls of Brazilian seed when prepared for different purposes. The results are the mean of 40 measurements in each case.

	mm.
1. Separated to produce "free" working	3.34
2. Separated to produce "wet" working	2.62
3. Separated to produce "wet" working	2.70
4. The foregoing after conversion to half-stuff	1.93
5. The foregoing after conversion into writing paper	0.83
6. Separated to produce "wet" stuff (another consignment) ..	2.27
7. The above beaten to bruise fibres only, <i>i.e.</i> , for strong stuff ..	2.29
8. The above beaten to somewhat reduce length of fibres, <i>i.e.</i> , for fairly thick writing paper	1.65

We have considered so far only the character of fibre separated from United States and Brazilian seed. The hulls from Indian seed, after mechanical separation, gave a fibre which on boiling and bleaching showed a yield only of 38 per cent. to 40 per cent. of bleached cotton; the consumption of soda on the weight of the raw fibre was found to be 7.3 per cent., and the consumption of bleach 14.0 per cent. These figures represent respectively 18 per cent. to 20 per cent. soda and 35 per cent. to 40 per cent. of bleach on bleached product as against the figures of 9 per cent. soda, and 10 per cent. bleach for cotton separated from Brazilian seed. The separated cotton of Indian seed is thus much inferior, in cost of treatment and yield, to that of Brazilian seed.

The raw product Indian separated cotton was found to contain albuminoids, 3.28 per cent.; oil, 5.60 per cent.; ash, 5.67 per cent. Both the ash and oil were high, but on chemical treatment the product yielded a very clean product, although there was considerable difficulty in bleaching, and a high consumption of bleach as compared with the Brazilian separated wool. The average of 40 measurements for length of the raw material showed 1.10 mm. The bleached fibres averaged 1.66 mm.

The figure for length of raw fibre is only about a third of that for Brazilian seed, and that for the bleached fibre only about one-half. The difference in the length of the raw and bleached fibres in the case of the Indian product is due to the fact that many of the very short fibres are washed away, and this can hardly be prevented unless a very fine wire gauze is used on the washing drum. The notoriously dirty condition of Indian seed, is, however, largely the cause of low yield. The mechanical separation of the cotton from the Indian seed is therefore not likely to be as remunerative as that from the Brazilian seed or the United States Upland seed.

Having regard to the freedom of separated Brazilian cotton from husk and the fineness of the husk particles, it has been proved, as was anticipated, suitable for nitration. The actual amount of husk is 0.4 per cent. in the unboiled product; this comes down to about 0.2 per cent. by chemical treatment, breaking up into individual palisade cells when beaten, which nearly all pass through the wire of the wash drum.

The imperfectly separated product which, on chemical treatment, still contains quantities of bleached husk behaves differently from normal cotton when nitrated, but the fibre produced from the properly separated product gives identical results, though it differs structurally from the ripe and mature fibre as used for textile purposes.

Sir Frederic Nathan (this J., 1909, 28, 179), speaking in regard to short fibre from the cotton-seed, inferred that the husk left after chemical treatment produced some non-resistant cellulose, and the final product in consequence gave gum-cotton low in nitrogen, and with a high percentage soluble in ether alcohol. This statement probably refers to the product containing some

5 per cent. of husk cellulose or over. Products containing various proportions from 1 per cent. to 50 per cent. of husk cellulose, as also palisade cells pure and simple, were nitrated by us, and whilst we found the above remarks to hold true of those samples containing residues of the husk, we could not detect any difference between the product as now mechanically separated and afterwards chemically treated, and the ordinary cotton fibre as used for nitration.

Chemically the palisade cells are unsuitable for nitration as we have repeatedly proved. They differ essentially from cotton in consisting of hemi-cellulose. If used in quantity for explosives they produce autoxidation, rendering the explosive unstable. When nitrated alone they give a low yield and behave quite differently from ordinary cotton.

The separated cotton, after boiling with excess of soda under pressure of 8 atmospheres for 8 hours and bleaching, contains from 0.2 per cent. to 0.09 per cent. matter extractable by ether. A sample of this product, only partially purified chemically, was submitted to Dr. Eric Drabble, of the Liverpool Institute of Tropical Research, who made some tests to determine its absorption qualities as a surgical dressing according to methods employed by him.* In water-holding capacity it was found equal to that of defatted "super" cotton wool, superior to non-defatted "super" cotton wool, commercial best cotton wool, and only slightly inferior to defatted "best" cotton wool. The absorption value when measured as rate of rise of water when packed in a tube after 1 hour, is equal to "best" cotton wool, superior to wood wool wadding, wool wool, gauze, but inferior to "super" cotton wool, defatted gauze, and commercial cellulose.

The volumes occupied by 10 grams are as follows:—

Under pressure of—		
50 grams per sq. cm.	87.45 c.c.	Greater bulk than cotton gauze, less than wood wools, cotton wool, and commercial cellulose.
25 grams per sq. cm.	90.63 c.c.	Greater bulk than cotton gauze, less than others.
12½ grams per sq. cm.	95.4 c.c.	Same bulk as cotton gauze, but less than others.
Contraction on saturation at—		
50 grams per sq. cm.	18.4%	Much less than most dressings, only inferior to bleached ramie and surgeons' tow.
25 grams per sq. cm.	16.5%	
12 grams per sq. cm.	15.7%	Less than all except surgeons' tow, defatted cotton gauze, and wood wool.

Dr. Drabble sums up by observing that the material in question came out very satisfactorily in respect of its absorptive capacity, and of its slight contraction when saturated. A further and more purified sample was submitted and the result of tests showed further marked improvements, placing the product still higher.

Cattle-food section.—We have now to consider the utilisation of cotton-seed hulls as a cattle-food. Of recent years, it has in some measure come into use in the United States, where its value has been proved in practice and confirmed by numerous feeding trials made at Experimental Agricultural Stations, particularly when fed with products such as decorticated meal. Its use, however, has not found favour in this country, principally because trade conditions differ here and partly because there are no hulls produced, the whole of the material forming part and parcel of the undecorticated cake.

Decortication, which produces the hulls, has been tried in this country and failed, partly owing to the difficulty of marketing the hulls. In Germany the separated hulls deprived of cotton are ground and used with advantage as a food-stuff.

Cotton-seed hulls, which contain from 12 per cent. to 25 per cent. of cotton by weight, are so inflated by the cotton that they appear to consist chiefly of cotton with an admixture of some hulls, whereas it is exactly the reverse. In this form it is, of course, useless for mixing as a food-stuff.

We have succeeded in converting this fluffy mass into a fine-grained, palatable, sterilised meal, possessing good

* Drabble and Upsher Smith. Quar. Journ. Ind. Comm. Research, Vol. 1, No. 3. Drabble. Quar. Journ. Ind. Comm. Research, Vol. 2, No. 4.

digestive qualities. In the process of conversion the product shrinks to about one-third of its original bulk. The same conversion can be accomplished on hulls from which the cotton has been removed. The process has been employed mostly on Indian cotton-seed hulls where the cotton is too short and too much intermixed with hulls and oil for service in paper-making. The process in question is performed in accordance with British Patent No. 14,588, 1904 (this J., 1905, 853), in specially constructed, steam-jacketed pans provided with stirrers. The material is introduced in charges up to half a ton at a time, together with a small proportion of mineral acid, such as hydrochloric acid, and raised to a critical temperature at which hydrolysis takes place. The reaction is catalytic, inasmuch as the reagent, in so far as it concerns the reaction, never enters into combination, and if need be can be used over and over again. Moreover at a critical temperature the hydrolysis to the condition of hydrocellulose is almost instantaneous. The material is discharged when ready; and for certain purposes is left in bulk whilst still hot until it mellows down to a friable, crisp, brown product, possessing a distinctly sweet taste and smell. The process of maturing can be arrested by cooling the stuff down, in which condition it keeps almost indefinitely. The process is usually pushed to the extent of partial caramelisation. The hydrolysed product has been sold in this condition to makers of compound cakes, &c., or else sold in admixture with decorticated cotton-seed meal. In all about 3000 tons have been prepared and put on the market.

The following is a typical analysis of hydrolysed cotton-seed hulls as prepared in bulk:—

Moisture	10.0
Ash	2.7
Hydrolysed cellulose	29.6
Oil (ether extract)	4.4
Protein N x 6.25	5.2
Carbohydrates	48.1
	100.0
Food units	72.0

Inasmuch as cotton-seed hulls vary enormously in analysis according to sources and thoroughness of separation, so does the hydrolysed product. The composition can be kept constant by blending and the addition of small quantities of undecorticated meal. The analysis, even without taking into consideration the food value, with hydrolysed cellulose always shows up better in food units than the raw material from which the product is derived, due to an increase in the figure for carbohydrates. This we can vouch for by the analyses of 20 products before and after conversion.

A great deal of systematic work has been done in the United States on the feeding value of cotton-seed hulls. In one series* the rations tested range from cotton-seed hulls alone, and 7 lbs. of hulls to 1 lb. of decorticated meal, down to $1\frac{1}{2}$ lb. of hulls to one of meal. In the combination of the two constituents it is as though no protein had been digested from the hulls, whilst they had caused a decreased digestibility of the protein of the meal. But the loss in protein is more than counterbalanced by the increased digestibility of carbohydrates. The gains in nitrogen free extract and crude fibre were sufficient to increase, after bringing up the loss from protein, the digestible dry matter from 0.81 per cent. in the 7 to 1 ration to 8.66 per cent. in the 3 to 1 ration. In the light of these experiments it must be inferred that cotton-seed meal does effect and increase the digestibility of cotton-seed hulls.

As to the value of the manure from cotton-cake-fed beasts, it should be remembered that cotton-seed hulls are poor in fertilising constituents, while cotton-seed meal is very rich in them. The value of the manure therefore rises and falls in the proportion of hulls and meal in the rations. And in the words of the report:—"The obtainable manurial value of the rations is in all cases materially greater than the original cost of the foods, making the rations."

Many still regard cellulose as possessing no nutrient qualities whatever and as being valuable only as a bulking

material. As exemplification of this the food units of food-stuffs are still calculated without any reference to the constituent shown in the analysis as "crude fibre." On the other hand investigators such as Kellner* have proved the value of certain forms of cellulose as a food-stuff. Kellner has shown that chemical straw pulp, *i.e.*, cellulose formed by boiling straw with caustic soda, which removes everything but the fibre, is as valuable a food material to the ox as starch, and a more valuable food-stuff than the original straw from which it was produced. The straw cellulose used by Kellner contained 82.1 per cent. "crude fibre" and only 17.6 per cent. of nitrogen-free extractive matter, yet 63.1 per cent. of the energy of the straw cellulose was taken up by oxen as against 58.97 for starch. The digestibility of the "crude fibre" of many foods has for a long time been known, but Kellner was the first to demonstrate the value on a cellulosic residue. On the other hand, cotton fibre is proved to be practically indigestible.

Wolff justifies the exclusion of the "crude fibre" in food-stuffs in arriving at food value on the score of "compensation." He asserts, that a compensation takes place between the digested portion of the crude fibre and the undigested portion of the nitrogen-free extract, especially in the case of ruminants. That is to say, these two quantities are always nearly equal, so that the amount of the nitrogen-free extract found by analysis is an approximate measure of the digestibility of the total non-nitrogenous matter in the food (crude fibre and extract taken together).

The "crude fibre" as shown by the ordinary method of analysis is almost invariably lowered about 5 per cent. when cotton-seed hulls and most other products are hydrolysed by our process, but results as to feeding qualities and digestibility appear to show that the residue returned as "crude fibre" when calculating food units should be classed for the most part as carbohydrates. In order to arrive at the cause of this, a number of experiments were carried out in which hydrolysed cotton was subjected to the digestive action of the fresh contents of bullocks' intestines, and also to the action of a culture of Omelianski's bacteria, but without result. Further experiments were made with straw pulp, using the fresh intestinal contents of sheep and oxen, also the action of a culture of Omelianski's bacteria on hydrolysed cotton. None of these gave any result. The Omelianski culture which slowly attacks cotton seemed to have little or no effect on wood pulp.

We have to explain how a material such as straw cellulose, soluble in water and but little acted on by weak acids and alkalis at the body temperature, is digested by herbivora to the extent of 95 per cent. or more, and the soluble products absorbed by the system. No organic ferment has yet been isolated from the digestive tract of herbivora capable of dissolving cellulose in the same way as starch, fibrin and other food constituents are dissolved.

The large amounts of marsh gas and hydrogen given off with carbon dioxide by herbivora in the course of 24 hours† would seem to point to a bacterial action similar if not identical with that studied by Omelianski. It would only remain to show that the fatty acids formed are readily digested and form valuable food-stuffs.

With a view of differentiating raw cotton fibre from cotton hydrocellulose and raw husk as against hydrolysed husk (the points really at issue), we fed cotton-seed hulls to mice for a period of two months. In some trials the mice were fed on ordinary hulls and cheese of known albumenoid ratio in comparison with treated hulls and cheese. In others they were fed on ground hulls not

* Untersuchungen ueber den Stoff und Energieumsatz des erwachsenen Rindes.

† Boycott and Damant. A note on the quantity of marsh gas, hydrogen, and carbon dioxide produced in the alimentary canal of goats. *Journal of Physiology*, vol. xxxvi., Nos. 4 and 5, Dec. 31, 1907.

Goats produce 10–30 c.c. of a mixture of marsh gas and hydrogen per kilogram per hour, on an average 5 per cent. of the total carbon dioxide, so that an average goat of 20 kilos, produced 9 litres of the mixed gases in 24 hours. Similarly, cows produce a quantity of methane amounting to 2.8 per cent. of the total carbon dioxide given off in respiration.

hydrolysed and containing no cotton (*i.e.*, spermoderm only) as against the same but hydrolysed.

The mice rejected the untreated hulls and husk, eating only the cheese, so that it became necessary to mix the cheese and these products. From determination of "fibre" in the droppings it was found that the cotton and palisade cells of the untreated products were practically unaffected; the figures for digestibility or absorption being only about 5 per cent. The mice readily nibbled the particles of treated hull even when unbroken, and when cheese was provided, they took the hulls in preference to the cheese.

The average cellulose "digestibility" of the hydrolysed products were found to be between 65 per cent. and 75 per cent. with a low albuminoid ratio, but as the albuminoid ratio was increased by compelling the use of cheese in admixture with the ground treated product, the absorption of cellulose diminished. We did not strictly differentiate between the cotton hydrocellulose and that of the palisade cells, because the two were fed more or less together.

The microscopic examinations of the droppings of the mice fed on untreated hulls, showed that the husk had altered very little either in structure or colour, also the cotton fibres were intact as though no action had taken place. On the other hand, the droppings of the mice fed on the hydrolysed product (after making due allowance for effects of conversion process upon structure) showed the palisade cells reduced out of definite outline, and what remained, instead of being hard and granular, was semigelatinous, losing its physical form on application of slight pressure. The cotton fibre appeared as reduced to small particles, at the same time losing its characteristic structure and appearance as though it had dissolved away. Probably the outer cuticle which constitutes about 15 per cent. of the cell wall of the cotton fibre is all that is seen under the microscope, and is the only portion of cotton hydrocellulose not capable of digestion by mice, and we believe the same may be the case with herbivora. At the same time it is quite conceivable that the so-called cuticle is capable of digestion if sufficiently hydrolysed, but that it would be the last to go.

To test the efficacy of hulls treated by the hydrolysing process when fed to sheep, some careful trials were undertaken by farmers at our request. One year sheep (tegs) require a certain amount of cotton meal or similar material when grass fed to prevent them from scouring. A flock of 50 to 100 sheep were fed for three months in this way on a mixture of equal parts of linseed cake and hulls submitted to our treatment, using $\frac{1}{2}$ lb. of hydrolysed product per sheep per day. It was found that the sheep took the meal better than ordinary cotton-seed kernel meal and developed a great liking for it, so that it was difficult to keep them away from the troughs when filling, which they always licked clean, and that it served the purpose required. The hydrolysed meal was found to be efficacious as a preventive to scouring when sheep are fed on turnips.

With a view of ascertaining the fattening qualities of meal containing hydrolysed hull meal, we conducted food trials on 16 bullocks (shorthorns). These bullocks had been previously fed on 5 lbs. of undecorticated cake per head per diem of a well-known brand, from August 11th to Nov. 7th. They then went into a shed where they were fed on 7 lbs. of the same cake per diem until the commencement of the trials on Dec. 7th. They were then branded on the horns, weighed and divided into two lots of eight, so that the gross weight of beasts and average condition should be as equal as possible in each lot. The average gain per beast per week was noticed for a period of three months. The rations for the two sheds were the same in each case, with the exception that the "crude fibre" contained in the cotton cake (Shed No. 1) was partially hydrolysed. No. 2 being ordinary undecorticated cake. The beasts in No. 1 shed showed a decidedly greater rate of increase in weight. Furthermore, of those fed with undecorticated cake, *i.e.*, not hydrolysed, two of the beasts died, whereas none were affected in health by the hydrolysed meal. This may have been a coincidence, but the fact remains that the evil effects due to the cotton fibre in the undecorticated cake is entirely

absent from the meal in which the fibre is converted into hydrocellulose. Our belief is that the cotton fibre as well as the palisade cells of the shell by conversion into hydrocellulose is as serviceable a foodstuff as sugar and starch, and should rank as "carbohydrates."

We estimate that the crushing mills at present existing in different parts of the world should yield 120 thousand tons of cotton of sufficient length for paper manufacture, and upwards of 1 million tons of hulls free from cotton that might be successfully employed as a digestive meal. If the process of decortication is extended, these will be augmented, especially if decorticating mills are extended in India and other parts of the East, as is now contemplated. Where the hull cotton is too short even for paper, as with some Indian seed, the cotton-seed hulls without separation can be worked up as a meal. The raw separated fibre should in our opinion be worth at least £8 per ton (in fact, has already commanded a higher price), and the meal £2—£3 per ton.

DISCUSSION.

MR. ALFRED SMETHAM considered the cause of the gradual decrease in the amount of hulls that had been produced in the United States was that about five years ago the Americans were pressed to give guarantees as to the percentages of the various food constituents of the meals which they were exporting and which were imported into England, and more particularly as to the oil and albuminoids, and they were reluctant to put the guarantee too high. The result was that, whereas prior to 1900 or 1902 it was no uncommon thing to find the albuminoids in cotton-seed meals and cakes to amount to anywhere from 42 to 51, it was now quite the exception to get anything testing over 42. By grinding the hulls very fine and mixing them with the meal the hulls got covered with the cotton-seed meal, and to the inexperienced eye it was difficult to detect the presence of the hulls, and a great number of samples of decorticated meal were to all intents and purposes re-constructed undecorticated meal. To-day the percentage was either 40 or 41 of albuminoids, and the result was that most cotton-seed meals coming over now give tests varying from 37 to 41. Allowance had to be made for anything below 41, but all that was lost was the value of the carbohydrates and the cost of the freight if they were detected. Large quantities of cotton-seed cake and cotton-seed meal were now being received from different countries. At the present day, for the first time to his knowledge, cotton-seed meals and cotton-seed cakes were commencing to come to this country from China. The Japanese were also beginning to send over cargoes, some in excellent condition, some in a more or less "heated" condition, but he had no doubt that when the shippers and the shipowners get to know more of what is necessary, the trade from these two countries would be very considerable. Another new source of supply, in the main due to the efforts of the British Cotton Growing Association, was the West Coast of Africa. The shipments of the cake, so far, had only been a few thousand tons, but if the attempts now being made to grow the cotton there were successful the cake would be available to the English farmer in very much larger quantities in the near future. Oil cake coming from West Africa was undecorticated, the woody fibre amounting to nearly 30 per cent., of which a very large proportion was in the shape of lint, and some means of decortication on the spot of the hulls, which evidently were of a very woody character, would be most valuable. Again, Bumah cotton cake was now being imported in very large quantities, containing up to 27 per cent. of woody fibre, *i.e.*, the hulls plus the lint. These new supplies should be eminently suitable for the processes which the authors suggested for the utilisation of what had hitherto been the waste fibre. He was afraid that the method of converting the hulls into meal for food compounds would hardly commend itself to the British agriculturist. He would like to have details of the process of separating fibre from the hull, which would permit the estimation of the percentage of lint in any feeding meal. There had been numerous cases where damage had been done to sheep by the consumption of cake containing large

proportions of cotton wool, and therefore the cotton wool should be eliminated, as far as practicable, from all cattle foods.

Mr. H. B. Stocks asked the authors to outline the method mentioned, for hydrolysing the hulls. In what way was the material treated with hydrochloric acid, and how was the acid subsequently neutralised or eliminated?

Mr. J. MORTON asked if any work had been done on separating the cotton and the hulls after they had been made into cake.

Mr. BEADLE thought Mr. Smetham's definition of a reconstructed undecorticated meal a very apt one. He understood that decortication plant had been shipped to Burmah and China, but whether decortication was going on in those countries he did not know. The usual belief in this country was that the ordinary process of decortication as applied in the States was not applicable to the Indian seed, but he was of opinion that certain types of the American "hullery" could be used for this purpose. As far as he could see from the machines he had inspected in operation in France, the plant and process were as available for Indian seed as for American, and the separated products seemed to come up to the usual standard. The hydrolysis of the meal was conducted by incorporating with the hulls a small amount of hydrochloric acid in suitable plant, such as by the employment of a "kettle" with a mechanical stirrer. The temperature was raised by means of a steam jacket to a little below 120° C., at which temperature an aqueous solution of hydrochloric acid volatilised. Just before reaching the temperature at which it was volatilised, the critical temperature at which the hydrocellulose was produced was reached. But in lieu of removal of excess of acid as above, the easiest way of neutralising was to add a small amount of soda ash, in a very fine state of division, so that in the final product contained about 0.5 per cent. of common salt. If the hydrolysed meal were used by mixing it with kernel meal, etc., these latter substances contained sufficient basic constituents to combine with and neutralise any acid of the hydrolysed meal, so that the mixture no longer contained hydrochloric acid. The reaction at the critical temperature was practically instantaneous. The process was worked intermittently, the time taken before discharging being merely that due to heating to the required temperature. Their laboratory method for the estimation of fibre and husks could be applied to such products as hulls and many other mixtures containing husks and cotton. The separation could be made by introducing hydrochloric acid and shaking it in a stoppered bottle whilst heating to about 110° C. If there was a considerable portion of hulls, by mere shaking the cotton would go to the condition of a powder, leaving the hull particles intact. This mass after neutralising with fumes of ammonia and drying off as already explained, could be separated on a nest of sieves, giving one a fairly accurate idea of the size of the hull particles as well as their proportion by weight.

Sydney Section.

Meeting held at Sydney, on Wednesday, July 14, 1909.

ASSISTANT-PROFESSOR J. A. SCHOFIELD IN THE CHAIR.

THE ABSORPTION OF MOISTURE FROM THE ATMOSPHERE BY WOOLS.

BY ALLISTER M. WRIGHT.

Wool is very hygroscopic, and may contain from 8 to 50 per cent. of moisture, according to the conditions of the atmosphere to which it is exposed. This is an important item in the sale of wool, and hence in Great Britain, and on the Continent, the percentage of moisture

contained in it must be officially determined in "wool conditioning" laboratories. The legal amount of moisture allowed in most European countries is 18.25 per cent.

The purpose of this investigation was to determine under what conditions wool absorbs moisture from the atmosphere, and what constituents enable it to absorb relatively large amounts.

It is necessary to distinguish between the true wool fibre, and the incrusting and mechanically adhering matters. The pure fibre consists for the most part of keratine, the characteristic constituent of horn, feathers, &c., and is not of constant chemical composition, but varies in different qualities.

The incrusting and adhering matters consist of: (a) Wool fat or yolk, soluble in hot alcohol; (b) other fatty matter, soluble in ether; (c) suint, which exudes from the body of the animal with the perspiration, and is sometimes known as "wool perspiration," soluble in water; (d) adhering impurities or dirt mechanically mixed with the above, or entangled among the fibres, which is mechanically removed after extracting the fats.

The methods of analysis used are those described by the author (this J., 1909, 28, 104). The water-soluble suint was determined in the portion of the sample remaining after removal of the adhering sand and dirt, as follows:—After drying and weighing, the sample was placed in a Soxhlet extraction thimble and repeatedly extracted with hot water, then dried and weighed, the loss in weight being suint, and the residue pure wool fibre.

The following are the analyses of the greasy and slipe wools of various kinds used in this investigation.

TABLE I.

Greasy wool.

	Half-bred.	Three-quarter bred.	Leicester.	Lincoln.
Moisture	16.90	19.20	17.79	17.18
Wool fat	16.68	12.08	8.94	5.72
Other fatty matter .....	.12	.74	.01	.06
Water soluble suint	10.30	12.72	7.81	2.26
Sand, dirt, lime, etc.	3.62	2.94	5.10	5.32
Pure wool fibre	52.08	51.32	50.45	68.56
	100.00	100.00	100.00	100.00

TABLE II.

Slipe wool.

	Half-bred.	Three-quarter bred.	Leicester.	Lincoln.
Moisture	12.78	12.82	13.37	12.67
Wool fat	6.49	5.76	2.53	3.47
Other fatty matter	2.45	2.29	1.82	2.05
Water soluble suint	2.01	1.60	1.20	1.04
Sand, dirt, lime, etc.	2.66	3.72	1.49	3.85
Pure wool fibre	73.61	73.81	75.59	76.92
	100.00	100.00	100.00	100.00

These analyses show that the slipe wools contain a lower percentage of moisture than the greasy wools; the amounts of wool fat and suint are also considerably less in the slipe wools, which is to be expected, as these matters are removed in the washing of the skins. The increase in fatty matters other than wool fat is probably due to the fat and grease on the underside of the skin rubbing against the woolly side during the process of washing.

In determining the amount of moisture absorbed by greasy and slipe wools, the samples were dried, and after weighing were exposed to the atmosphere of the laboratory for from 24 hours to 408 hours, being weighed at regular intervals; at the same time determinations of the relative humidity, and the amount of moisture in grains per cubic foot present in the atmosphere, were made. The results obtained are presented in the following

tables, the amounts of moisture absorbed being calculated on the dry samples:—

TABLE III.
Greasy wool.

Time in hours.	Percentage of moisture absorbed.	Relative humidity.	Grains of water per cubic ft.
24	24.28	80	2.6
32	29.27	85	5.2
48	27.77	85	4.4
72	26.82	72	3.8
144	28.66	82	3.9
168	26.62	76	3.8
192	27.36	85	3.8
216	25.79	70	2.7
240	24.85	65	4.3

TABLE IV.
Slip wool.

Time in hours.	Percentage of moisture absorbed.	Relative humidity.	Grains of water per cubic ft.
24	16.26	80	2.7
26	16.12	75	4.2
48	16.69	81	4.7
72	16.37	78	3.5
96	16.92	80	4.1
144	20.66	95	4.8
168	19.82	87	4.6
180	17.79	69	4.2
192	18.14	80	2.6
200	19.41	85	5.2
216	19.43	85	4.4
240	18.92	72	3.8
312	19.27	82	3.9
336	18.71	76	3.8
369	19.12	85	3.8
384	17.95	70	2.7
408	17.74	65	4.3

The greasy wool thus absorbs from 24.38 per cent. to 29.27 per cent. moisture, whereas the slip wool absorbs under the same conditions from 16.12 per cent. to 20.66 per cent. The amounts also increase and decrease with the relative humidity of the atmosphere, and it is the relative humidity, rather than the absolute amount of moisture present, which determines the amount of moisture absorbed. The amount of water per cubic foot of air bears but little direct relation to the moisture absorbed.

The amount of moisture absorbed by pure wool fibre free from incrustations and adhering impurities was determined, the results being shown in Table V.

TABLE V.
Pure wool fibre.

Time in hours.	Percentage of moisture absorbed.	Relative humidity.	Grains of water per cubic ft.
24	18.02	72	3.8
96	19.50	82	3.9
120	18.90	76	3.8
144	19.62	85	3.8
168	18.47	70	2.7
192	18.19	65	4.3

Pure wool fibre free from all other matters thus absorbs from 18.03 per cent. to 19.62 per cent. under varying degrees of humidity. The above results show that the pure wool fibre cannot be the only matter in normal wool which causes the absorption of moisture, for in the greasy wool containing from 50 per cent. to 60 per cent. of fibre, it is found that the absorption of moisture is from 24 per cent. to 29 per cent., whereas if the fibre were the only factor we should expect to find a moisture absorption of from 9 per cent. to 12 per cent.; and in slip wool containing from 70 per cent. to 80 per cent. fibre, we find a moisture absorption of from 16 per cent.

to 20 per cent., whereas it should be only from 14 per cent. to 15 per cent. There are thus other factors which determine the amount of moisture absorbed. The relatively high amounts of moisture absorbed by pure wool fibre is probably due to the very large surface area presented to the atmosphere in proportion to the weight of the fibre.

A number of wool fibres each 3 inches long were counted and weighed and the following results calculated:—

13,100 fibres of half-bred wool, each 3 inches long, weigh 1 gram.

12,500 fibres of three-quarter-bred wool, each 3 inches long weigh 1 gram.

9,100 fibres of Leicester wool, each 3 inches long, weigh 1 gram.

7,800 fibres of Lincoln wool, each 3 inches long, weigh 1 gram.

If we take the average diameter of each of the above classes of wool as given in the following table it will be found by calculation that the surface area of one gram of wool is as follows:—

	Diameter.	Surface area of 1 gram.
	inch.	sq. inches.
Half-bred	0.0008	98
Three-quarter-bred ..	0.0010	118
Leicester	0.0016	136
Lincoln	0.0018	132

The surface area is thus an important factor in determining the amount of moisture absorbed by the fibre.

The wool fat was examined, and it was found capable of absorbing up to 17.2 per cent. moisture when spread thinly on a watch glass, but even with the inclusion of this factor it is not possible to account for more than one or two per cent. of the moisture absorbed by the normal wool fibre.

The water-soluble suint, or wool perspiration, was examined, with the result that it was found that very large amounts of moisture were absorbed by this constituent. The following table shows the results obtained:

TABLE VI.
Water soluble suint.

Time in hours.	Percentage of moisture absorbed.	Relative humidity.	Grains of water per cubic ft.
24	60.43	76	3.8
48	66.42	85	3.8
72	65.50	70	2.7
96	63.55	65	4.3
120	64.76	72	3.4
144	66.24	80	3.8

The moisture absorbed thus varies with the relative humidity, and the suint, although present in the proportion of only one or two per cent. in some wools, and up to 12 per cent. in others, is responsible for a relatively large amount of moisture absorbed by the normal wool fibres.

In slip wools this material is largely washed out during the treatment of the skins, and its presence in greasy wools accounts for the increased power of moisture absorption shown by these wools. In determining the absorption of moisture by slip wools it was found that the fatty matter other than wool fat, which is present in slip wool to a greater amount than in greasy wools, had the power of slightly retarding the absorption of moisture. In the following experiments, the natural wool fat was first removed by extraction with hot alcohol, the wool after drying and weighing was exposed to the atmosphere, and the amount of moisture absorbed determined; then the other fatty matter was extracted with ether, and after drying and weighing, was again exposed to the atmosphere under similar conditions of relative humidity, and the moisture absorbed noted. In all cases the wool absorbed more moisture when the foreign fatty matter was removed than in its presence. The results obtained are shown in the following table:—

TABLE VII.

Foreign fatty matter.	Percentage of moisture absorbed in presence of fatty matter.	Percentage of moisture absorbed in absence of fatty matter.
Per cent.		
2.06	10.70	11.07
2.16	9.38	9.92
2.60	9.22	9.08
2.88	9.08	10.18
3.28	9.95	11.13

The fatty matter probably forms a film over the surface of the wool, and being itself impervious to moisture thus retards to a certain extent the moisture absorption by the fibre and the other constituents of the wool. Another point of considerable interest in connection with the foreign fatty matter present in slipe wool is that it is an oxidisable fat, and it is probably this fat which caused the rise in temperature in certain of the bales of wool experimented upon by the Wool Fires Commission,¹ Nos. 6 and 12, which were slipe wools. The reports by Mr. R. J. Friswell and Dr. J. S. Haldane on these experiments refer to this matter.

Mr. Friswell states:² "Another most interesting point is the fact that the oxidation of the grease by air and moisture (to which I attributed the fires on the ss. 'Gothic') is proved by these experiments. . . I have extracted the grease from Nos. 6 and 12, and have found it oxidised and rubber or varnish-like in character."

Dr. J. S. Haldane states: "The results of the tests quoted in your letter are, I think, very instructive. . . They seem to me to point to this: that the rise in temperature of the bales was due to some substance (probably an oil) capable of combining with oxygen at a comparatively low temperature, and so producing heat; that the amount of this substance is very small, since the process practically comes to an end after about a fortnight, and that more or less of this substance was present in all the bales tested."

This fatty matter has been found in greater or smaller amounts in all slipe wools examined, but the amount present, while it is undoubtedly capable of producing heat by oxidation in the presence of air and moisture, is relatively so small that even should oxidation take place the heat generated cannot be very great where the amount of foreign fatty matter is high; of course a very serious danger does exist, as, for instance, in the case of a wool containing only from 6 per cent. to 10 per cent. moisture, but from 34 per cent. to 36 per cent. foreign fatty matter of an oxidisable nature.³

SUMMARY.

The results of this investigation show that the amount of moisture which a wool can absorb from the atmosphere depends on several factors:

1. The relative humidity of the atmosphere, more moisture being absorbed during a period of high relative humidity than when the humidity is low.

2. Pure wool fibre, of which greasy wool contains from 50 per cent. to 70 per cent. and slipe wool about 75 per cent., can absorb from 18 to 20 per cent. of its weight of moisture from the atmosphere, but this amount is not sufficient to account for all the moisture absorbed by the dry normal wool fibre.

3. Natural wool fat, present in greasy wool to the extent of nearly 17 per cent., and in slipe wool to 6½ per cent., is capable of absorbing about 17 per cent. of its weight of atmospheric moisture.

4. Suint, or wool perspiration present in greasy wool to the extent of nearly 13 per cent., and in slipe wool to about 2 per cent., is very hygroscopic, and can absorb from 60 per cent. to 67 per cent. of its weight of moisture when exposed to the atmosphere.

5. Fatty matter other than natural wool fat, present in slipe wools to an amount of from two to six times that found in greasy wools, and picked up by the wool from the greasy underside of the skins during the washing process, has a retarding effect on the amount of moisture absorbed.

By thoroughly washing wool as in the case of slipe wools, not only are the incrusting and adhering matters washed out and so a less weight of the product obtained, but a further deduction in weight has to be allowed for, because the wool is incapable of absorbing the same amount of moisture from the atmosphere which it could absorb in a greasy state, before the natural fat and suint were partially removed; the amount of moisture which slipe wool can absorb from the atmosphere does not reach the legal standard of 18.25 per cent. allowed.

For permission to publish these results, the author desires to express his thanks to the Christchurch Meat Company, Limited, in whose chemical laboratory at their Islington works this investigation was carried out.

DISCUSSION.

Mr. W. H. CHARD said that the wools examined by the author of the paper were cross-bred or coarse wools, which were of more interest in New Zealand than in Australia or Tasmania, where the wool was chiefly fine or merino, only 15 to 18 per cent. being coarse. It was not the custom to slipe the wool in Australia, as in New Zealand. The Australian practice was to sweat the skin while dirty, and to thoroughly scour the wool after it was removed from the skin. In New Zealand the wool was washed while on the skin, and yielded about 75 per cent. of clean wool. The results in the paper, though interesting from a chemical point of view, were not so interesting commercially as applied to Australian wools, which were always washed again, except in the case of a few wools from Queensland, where there were artesian wells. For this reason it was not the custom to take any account of the moisture till the wool was washed, carded and combed. The short wool was washed hard, and sold as scoured, while the long fibre was combed, and sold as top. The moisture in these two was the important thing, and should be about 16 per cent., which was considered a fair thing. If there was more, an allowance was made in the price, and if there was less the price was correspondingly increased. If any chemist could discover a way of taking the burr and other woody matter out of Australian wool, or of taking the wool off the skin without staining it, this would be a matter of great importance there. There was no burr in New Zealand.

Mr. T. STEEL thought the remarks just made quite justified the need for Mr. Wright's investigations, which had thrown very much light on the subject, and he would like to see similar work done for Australian wools. He regretted there was no information supplied as to the composition of the suint.

The CHAIRMAN thought the practice of buying the raw wool without any reference to the moisture contained in it, as explained by Mr. Chard, was rather surprising and might be capable of abuse.

Mr. WRIGHT, who was unable to be present, wrote, in reply, saying that Mr. Chard's remarks scarcely touched upon the conclusions arrived at in his investigations. Practically none of the skins were "sweated" in New Zealand, the wool being removed by a depilatory, mainly sodium sulphide and lime. This treatment did not permanently discolour the skins, which were afterwards worked up clean and almost white for export; nor, if reasonable care was exercised in the use of the depilatory, was the wool stained.

¹ Rept. Comm. on Fires on Wool Ships, Exhibit 40, p. 87.

² Supp. Rept. Comm. on Fires on Wool Ships, p. 6.

³ Rept. Comm. on Fires in Wool Ships, p. 85. This J., 1908, 27, 3.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

English.—*5s.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

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German.—*1 mark* each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Drying cylinders. W. Kerr and T. S. Graham, Dublin.
Eng. Pat. 17,564, Aug. 21, 1908.

THE claim is for a rotating drying drum having a hollow peripheral wall, the annular space being divided into separate chambers by longitudinal ribs or partitions. Each of the chambers so formed is separately connected to the steam-inlet and exhaust chambers in the hollow trunnions by which the drum is supported.—W. H. C.

Tanks for liquids. W. P. Thompson, London. From Maschinenfabrik Augsburg-Nürnberg A. G., Nuremberg, Germany. Eng. Pat. 3788, Feb. 15, 1909.

THE side walls of the tanks are curved or bulged in a vertical plane either inwardly or outwardly, and are connected above and below to angle rings, the lower angle ring being also connected to the bottom of the tank. The walls are stiffened by compression or tension stays arranged around the periphery of the tank.—W. H. C.

Tanks of large diameter. B. E. D. Kilburn, London. From Berlin-Anhaltische Maschinenbau A. G., Berlin. Eng. Pat. 10,971, April 28, 1909.

THE lower portion of the wall, and the outer annular portion of the base, of large sheet metal tanks, such as gas-holder tanks, are strengthened and supported by being enclosed in an exterior reinforced concrete angle ring. The latter is provided with horizontal radial projections which extend beneath the tank and with vertical projections which extend upwards towards the upper edge of the tank. The relative lengths of these projections are so proportioned that the force acting on the horizontal projections is greater than that acting on the vertical projections. The tank is connected to the concrete angle ring and the projections by V-shaped metal pieces which are rivetted to the tank at one end and have the opposite end embedded in the concrete.—W. H. C.

Separating solid impurities and extraneous matter from viscous or gummy solutions. The Calico Printers' Assoc., Ltd., Manchester, and W. Browning and J. J. Barlow, Accrington. Eng. Pat. 12,739, May 29, 1909.

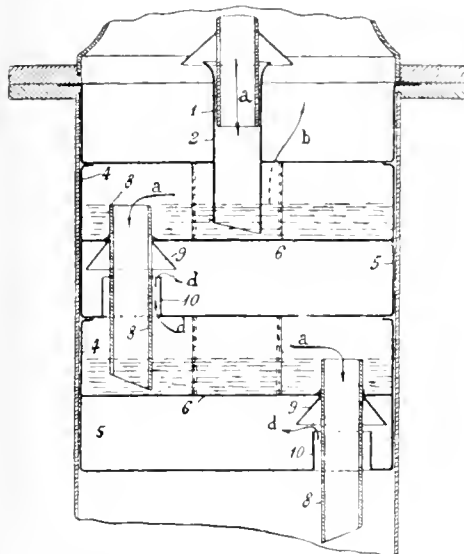
IN order to filter thick solutions, such as those of gum arabic or tragacanth or of Irish or Japanese moss, etc., the solutions are fed into a trough having a semi-cylindrical filter-bottom, formed of layers of suitable filtering material, and provided with a brush which is rotated in close contact with the inner side of the trough. The brush forces the liquid through the filtering medium and leaves the impurities on its inner surface. When the charge is filtered, the impurities are removed by continuing the rotation of the brush and removing the impurities from the latter by a scraper or "doctor." In some cases it is desirable to have two filters arranged one above the other, the upper serving for the preliminary and the lower for the final filtration.—W. H. C.

Separating mixed gases; Apparatus for —. C. J. A. Fiesse, Washington, D.C. U.S. Pat. 933,243, Sept. 7, 1909.

THE mixed gases are blown in puffs through fine orifices, by means of a blower and pulsator, into a downward flowing liquid column. The gases are carried downward and the portion undissolved by the liquid collects in a suitable chamber at the base of the column.—J. W. H.

Stills. Soc. Besnard, Maris, et Antoine. Fr. Pat. 398,847 Jan. 27, 1909.

ACCORDING to the present patent, a rectifying column of special construction is interposed between the condenser



and column of a distilling apparatus of the ordinary type. The liquid to be distilled passes first through the jacket of the condenser where it serves to cool the vapours from the column, and then through the rectifying column (see fig.). The latter consists of vapour chambers, 5, and liquid chambers, 4, alternately superposed. The liquid from the jacket of the condenser enters through the pipe, *a*, 1, 2, into the uppermost liquid chamber, 4, from which it overflows by the pipe, 8, into the second liquid chamber, 4, and so on to the distilling column. The pipes, 8, pass through the intermediate vapour chambers, 5. Any vapour given off in the liquid chambers, 4, passes through the annular space, *d*, into the vapour chamber next above, and any liquid condensed in the vapour chamber is prevented from entering the liquid chamber below by the cone, 9, and the upstanding pipe, 10. The condensed liquid is either re-vaporised in the vapour chamber in which it was condensed, or returns through the annular space surrounding the pipe, 6, into the vapour chamber next below. In this way the liquid flowing to the still serves to cool the vapours rising through the column without coming into direct contact with them. Any liquid condensed in the vapour chambers is gradually re-vaporised without being mixed with the liquid flowing down to the still. The enriched vapours leaving the top of the rectifying column, pass to the condenser, where they are condensed by the inflowing liquid, and the condensed liquid flows from the bottom of the condenser to a receptacle.—W. H. C.

Absorbent material for conservation and manipulation of viscous substances [molasses]. Comp. Ind. des Alcools de l'Ardèche. Fr. Pat. 400,736, June 18, 1908.

THE residue from the saccharification of sawdust by acids, in the manufacture of spirit, is washed and dried until it contains less than 20 per cent. of moisture. This material is then used for absorbing viscous substances, e.g., molasses, to facilitate their storage, manipulation and transport. A mixture of 70 parts of molasses and 30 of sawdust residue is a friable product capable of being packed in bags or pressed into cakes.—J. F. B.

Wood sawdust, etc.; *Treatment of —, for conversion into absorbent materials for viscous substances.* Comp. Ind. des Alcools de l'Ardèche. Fr. Pat. 400,737, June 18, 1908.

SAWDUST or similar material is treated with 2–4 per cent. of its weight of sulphuric acid, suitably diluted with water. The mixture is then heated at a temperature of 75–80° C. until the bulk of the water is evaporated. The acid then begins to act on the wood and this action is regulated to any desired extent by continuing the heating. Generally it is sufficient to continue the treatment until the mass assumes a deep brown colour, but by longer heating or by increasing the temperature, the wood may be converted into a dense form of charcoal. The action is stopped either by cooling or diluting with water, and the absorbent product is washed, if desired, and dried for use.—J. F. B.

Evaporator; Cast-iron — having Field tubes. G. Sanerbreys Maschinenfabr. A.-G., Stassfurt, Germany. Eng. Pat. 28,520, Dec. 31, 1908. Under Int. Conv., Jan. 4, 1908.

SEE Ger. Pat. 207,478 of 1908; this J., 1909, 465.—T. F. B.

Drying and grinding materials; Apparatus for —. G. Suter, Assignor to Soc. Chem. Ind. in Basle, Basle, Switzerland. U.S. Pat. 932,727, Aug. 31, 1909.

SEE Eng. Pat. 9741 of 1907; this J., 1908, 12.—T. F. B.

Drying grains, cement, chemicals, minerals, and other moist materials; Machine for continuously —. J. Black, A. H., H., and A. B. Lennox. Fr. Pat. 398,782, Jan. 6, 1909.

SEE Eng. Pat. 1455 of 1908; this J., 1909, 234.—T. F. B.

Sorting different substances; Process and apparatus for —. C. Seck. Fr. Pat. 398,744, Jan. 23, 1909.

SEE Eng. Pat. 4684 of 1909; this J., 1909, 591.—T. F. B.

ERRATUM. This J., Sept. 30, 1909, page 771, col. 2, line 34 from top, for "Willan" read "Willbur."

II.—FUEL, GAS, AND LIGHT.

Coal dust experiments. Times Eng. Suppl., Sept. 29, 1909. [T.R.]

THE experiments of the Mining Association of Great Britain, which were resumed at Altofts Colliery, near Normanton, on September 23 and 24, were carried out with complete success. They demonstrated both the explosiveness of coal dust by itself and also the utility of a mixture of stone dust and coal dust in limiting the area of an explosion. A space of 367 ft. in the experimental gallery—which is altogether 895 ft. long, part of it being 7½ ft. in diameter and the remainder 6 ft.—was treated with coal dust which was laid on the floor and on wooden shelves. Props were fixed and bars were set in the gallery, exactly as is the case underground. A current of air was then forced through the tunnel by means of a large ventilating fan. A small cannon was fired electrically, for the purpose of raising the dust, and two seconds afterwards a larger cannon was fired in a similar manner. The second flame ignited the dust, and an explosion of terrific force followed. A red flame leaped from the mouth of the gallery and reached to a distance of about 170 ft. beyond the entrance, while a dense cloud of smoke obscured everything. The spectators surveyed the scene from the pit bank, half a mile away, and subsequent examinations showed conclusively the force of the explosion, the woodwork in the gallery having been hurled about in a tumultuous manner. An ordinary corve which had been left inside was blown to pieces, the only recognisable portion of the woodwork being found 320 ft. away, while the metal wheels were thrown a distance of over 400 ft. The Mining Association is preparing a report on the experiments, which will be issued in a few months.

The object of the second day's experiment was to show the value of stone dust as an agent for considerably reducing, if not entirely eliminating, the danger of an

explosion of coal dust. The zone of coal dust in the gallery—which covered the same distance as on the previous day—was bounded by two zones of stone dust, one of then 100 ft. long and the other 125 ft. The explosion, which was created in the same way as on Thursday, was of immense force, but a striking difference was that only a cloud of smoke was discharged from the mouth of the gallery and no flame. Subsequent examination of pieces of gun cotton and cotton wool fixed at short intervals in the gallery showed that the flame from the coal dust had only extended forward for a distance of 39 ft., and backward—with the air current—55 ft. The effect of stone dust was thus conclusively established. The dust was obtained from an ordinary grey bind, ground into rough powder by means of a mortar mill. It was composed chiefly of silica and iron oxides, and it has been suggested that any similar inert matter will have the same effect. It is not necessary, in order to quench the flame, that something generating carbon dioxide should be used. About 15 lb. of coal dust was spread over each lineal yard of gallery.

The system of distributing stone dust in the actual workings of the mine has been adopted at Altofts, and on a road 7 ft. high, 10 ft. wide, and with a perimeter of 24 ft. this has been done at a cost of a penny per yard. The endeavour has been to distribute the dust in such a manner that it would be most easily displaced by the air currents.

Although mining engineers in Yorkshire have now accepted it as a fact that coal dust, in certain circumstances, is a violent explosive, yet there is still some scepticism in parts of South Wales. The result of the second day's experiment was to convince at least one managing director of an important Welsh colliery, but it is reported that in South Wales generally the old idea is still held that gas, and not dust, is the real explosive danger. One result of the experiments is the discovery that 1 lb. of coal dust, when heated to 1650 deg. F., gives off 43 cubic feet of gas. It is therefore suggested that gas may play some part in an explosion of dust, although the firing of the dust in the first instance is the cause of the devastation. Dr. Wheeler the resident chemist at Altofts, has prepared an interesting series of figures with regard to the effect of stone dust. It has been demonstrated that when coal dust is distributed in an atmosphere to the extent of .2 oz. per cubic foot, an explosion may take place, but there is no risk of explosion when a mixture of 90 per cent. of coal dust and 10 per cent. stone dust is diffused in the same proportion. When the quantity of coal dust in the atmosphere is .4 oz. per cubic foot, a mixture of 20 per cent. of stone dust with 80 per cent. coal dust is similarly effective.

An interesting point concerning the use of stone dust in the actual workings of the Altofts colliery is that its greater weight has the effect of removing any coal dust which there may be on any ledge, and so causing it to be either deposited on the floor, where it can easily be removed, or carried forward with the air, either out of the pit by the upcast shaft or to some other resting place, from which it will be again dislodged. The dust is merely thrown at the sides and roof of the colliery roads by two or three lads.

Peat industry of Canada. Engineering, Sept. 17, 1909. [T.R.]

AMONG the many large peat bogs existing in the more populous parts of Canada, are the Mer Bleu Bog, situated about 8 miles from Ottawa, Ontario, with an area of about 5000 acres; the Alfred Bog, situated about 40 miles from Ottawa, with an area of about 6800 acres; the Welland Bog, 6 miles north of the town of Welland, with an area of about 4900 acres; the Newington Bog, about 40 miles from Ottawa, on the New York and Ottawa Railway, with an area of about 3800 acres; the Perth Bog, about 1½ miles north of the town of Perth, with an approximate area of 2800 acres; and the Victoria Road Bog, close to Victoria Station, on the Midland Division of the Grand Trunk Railway, with an area of about 67 acres. These bogs vary considerably in average depth. For instance, in the Mer Bleu Bog there are 1564 acres with an average depth of 2.9 ft., and 347 acres with an average depth of 16 ft.; whereas in the Alfred Bog, which is rather larger

n area, there are 1377 acres with an average depth of 3 ft. 10 in., and 1014 acres with an average depth of 16.5 ft. In some of the bogs the depth in parts exceeds 20 ft. In all the peats taken from the bogs mentioned, the chemical constituents do not vary greatly in samples that are classed as absolutely dry. The volatile matter ranges from about 66 per cent., to over 70 per cent., and the carbon from about 24 to 27½ per cent., while the amount of ash obtained from different samples ranges from about 4 to 13½ per cent., the latter figure being very high, and only being reached in one sample taken from the Perth Bog. The average percentage of ash in the Mer Bleu Bog appears to be considerably higher than in any of the other bogs. On the whole, however, the percentage of ash is not excessive. The percentage of fixed carbon is comparatively regular, being an average of about 25 per cent. The calorific value of the fuel is in some cases as high as 4000 B.Th.U. per pound, and slightly over, but the average value appears to be about 8700 B.Th.U.

The Canadian peat-bogs are formed of vegetation, or the most part identical with that found in European bogs, but consisting chiefly of sphagnum and brynum mosses. None of these bogs are bare, the most open of them being covered in a great part with shrubs. The only rees characteristic of these bogs are the black spruce and the tamarack, though on the margins of most bogs, and in some of the old bogs where drainage is good, cedar, hemlock, balsam, and ash are found.

In Winnipeg the poorest quality of wood now costs from 6 dols. to 8 dols. per cord, and the price of coal is 0½ dols. per ton. The growing scarcity of wood in many parts of the Dominion, and the steady increase in the cost of coal, are bound before very long to bring this question of peat prominently forward. So far, however, very little success has been attained, although plants have been erected which were intended for the manufacture of peat briquettes, and large sums of money have been expended in this direction. The most successful method adopted up to the present time appears to have been that of A. Dobson, of Beaverton. This plant has, however, during the last season produced nothing. The only

easy to carry out this process regularly, as the amount of moisture in the peat varies considerably, and there is great irregularity in the quality of the briquettes made, some being hard and very solid, while others easily fall to pieces and form a large percentage of dust.

The Government of Canada are endeavouring to assist in the exploitation of the peat industry, and have carried on an investigation, the results of which have appeared in a Bulletin of the Department of Mines. The work was carried out by Mr. Erikhyström in 1908. The system adopted in the investigation of certain bogs was to run lines at intervals over the surface about 1000 ft. apart, and drillings were made along each of these lines at intervals of 500 ft., samples of the peat from each drill-hole being collected. In the larger bogs, drillings were made sometimes farther apart than 1000 ft. It is now proposed to establish an experimental plant where peat fuel can be manufactured on a practical scale, and where those interested may learn how to work a bog with the best chance of obtaining satisfactory fuel from it. The extraction of moisture by air-drying is too uncertain ever to be really satisfactory, and this is the method that has been mostly adopted in Canada. Ordinary processes of artificial drying are too expensive, and it is suggested that the only possibility along this line is the employment of vacuum apparatus, although it is not evident how this could be attended with economy. The elimination of water by ordinary mechanical pressure down to below 70 per cent. has been found to be impossible, owing, as pointed out by Ekenberg, to the presence of slimy hydro-cellulose. This hydrocellulose may be destroyed by a process of wet carbonisation; after which the water can be easily pressed out, the resulting briquette fuel having very nearly as low a percentage of moisture as the best air-dried peat.

Gas and coke; Production of — in the United States in 1908. E. W. Parker. Mineral Resources, 1908. [T.R.]

THE quantity and value of gas and coke made in the United States in 1907 and 1908 was as follows:—

Gas.

	1907.		1908.	
	Quantity 1000 c. ft.	Value \$.	Quantity 1000 c. ft.	Value \$.
<i>Coal-gas:</i>				
Made in gas works and by-product coke ovens	58,242,548	36,462,304	56,944,669	37,227,901
Made in retort ovens	20,516,731	3,130,839	16,205,925	2,557,483
<i>Oil and water-gas</i>	102,139,875	90,173,112	110,237,203	96,343,221

plant in operation during the last season was that of Messrs. Milne and McWilliam, at Dorchester, near London, Ontario. In connection with this the surface of the bog is harrowed by means of a common harrow drawn by a horse. The peat is then exposed to the air and sun, and left partially air-dried, after which, by means of a centrifugal pump mounted on an electrically-drawn car, moving on rails laid on the bog, the upper layer is collected and placed in another car, which runs on the same rails. The suction-pipe from the centrifugal pump can, by means of a flexible joint, be swung out at a greater or less distance from the track, by which means a considerable area of ground is covered. Before being placed in the briquetting press the peat is dried; but it has been found not at all

Of the coal gas produced, about 57 per cent. was used for illuminating, about 37 per cent. for fuel purposes, whilst the remainder is "unaccounted for." About 70 per cent. of the oil- and water-gas was used for illuminating, about 23 per cent. for fuel, and the remainder was not accounted for. The number of coal-gas companies reporting production in 1908 was 506, against 516 in 1907; 552 water- and oil-gas companies reported in 1908, against 520 in 1907.

The quantity of coal used at gas works in 1908 amounted to 3,553,920 short tons, at by-product coke plants to 5,699,058 tons, and at beehive plants 33,741,779 tons. The production of coke was as follows:—

	1907.		1908.	
	Quantity short tons.	Value \$.	Quantity short tons.	Value \$.
Gas works	2,510,106	7,667,487	2,051,899	7,041,616
By-product	5,607,899	22,665,157	4,201,226	14,465,429
Beehive	35,171,665	88,873,969	21,832,292	48,018,554

There were 4007 by-product ovens in the United States in 1908, of which 3679 were active; the figures for 1907 were 3892 and 3811 respectively. There were 84,619 active beehive ovens in 1908. The average production amounted to 1142 tons of coke for each retort oven, and 258 tons per beehive oven. The number of coke plants in 1908 was 551, a decrease of one from 1907; of these, 421 were active.

PATENTS.

Peat and the like: Briquetting of carbonised — M. Ekenberg, London. Eng. Pat. 12,010, May 21, 1909.

CARBONISED peat obtained by the wet carbonising process (Eng. Pats. 10,834 and 20,420 of 1903; this J., 1904, 14) and which has been dried thoroughly, does not bind satisfactorily in the briquetting operation as usually carried out. According to the present patent, the dried carbonised material is subjected to pressure at a temperature above 120° C. in a high-pressure briquetting press, or it is heated to 120° C. in a closed dryer and immediately pressed hot in an open-die high-pressure briquetting press.—J. W. H.

Coke ovens; Regenerative and non-regenerative — R. F. F. Fabry, Chesterfield. Eng. Pat. 8920, April 15, 1909.

IN coke ovens heated by an intermittent gas supply (Eng. Pat. 5801 of 1908; this J., 1908, 970), the combustion flues are constructed so that their cross-sectional area gradually increases from the burners to the exit ends. The tapering form of the ordinary coking chamber facilitates the arrangement, the flues being horizontal, and connected with all the burners at their narrow ends and having outlets at their wide ends.—J. W. H.

Coking ovens. S. B. Sheldon, Buffalo, N.Y. U.S. Pat. 933,349, Sept. 7, 1909.

THE oven, rectangular in form, has its upright heating flues arranged in three groups, each group being connected with a separate combustion chamber and regenerator. The area of the flues and the capacities of the combustion chamber and regenerator of the middle group are equal to the combined area of the flues and the combined capacities of the combustion chambers and regenerators of the other groups.—J. W. H.

Coke-oven; Regenerative — L. Bansart. Fr. Pat. 398,843, Jan. 27, 1909.

EACH oven is provided with four regenerator chambers arranged in pairs on each side of the central line of the battery of ovens. Each pair of regenerators, which are placed one above the other, below and parallel to the oven, is worked independently, being connected to the heating flues of that half of the oven immediately above. The air for combustion and the waste gas are passed alternately through each chamber. In this way the alternate heating and cooling of opposite sides of the battery of ovens and the consequent unequal strains on the brickwork are avoided.—W. H. C.

Doors for retorts, coke ovens and other furnaces. F. Shaw, T. M. Percy, and J. K. Entwistle, Wigan. Eng. Pat. 17,647, Aug. 22, 1908.

THE doors of retorts, ovens and other furnaces are formed with channels, so that by means of bridge-pipes, hot gases from the main flues may be made to circulate through them and ensure regular heating of the whole charge in the apparatus.—J. W. H.

Ovens, retorts, etc., for the carbonisation of coal; Process for preventing destruction of the walls of — H. Koppers. Fr. Pat. 400,648, Mar. 10, 1909. Under Int. Conv., Mar. 11, 1908.

THE charge is mixed with a quantity of silica sufficient to combine with the alkali salts contained in the ash, so that these alkali salts are prevented from volatilising and attacking the silica in the walls of the oven or retort. The silica may be used in the form of sand.—A. T. L.

Gas producer plants primarily designed for the recovery of ammonia; Recovery of certain by-products in — W. J. Crossley and T. Rigby, Manchester. Eng. Pat. 17,978, Aug. 27, 1908.

THE patent relates to gas-producer plants of the Mond type or of the type described in Eng. Pat. 24,144 of 1907 (this J., 1907, 957), and to a process for recovering the acetic acid which is present in the gases in considerable quantities when peat and similar fuels are used in the producer. The acetic acid is caused to be held in solution in the sulphate liquors intended for concentration, and recovered from the vapours during concentration in a suitable manner. In the Mond plant, the process is carried out by circulating the liquor from the mechanical gas washer, which contains ammonium acetate, through the acid tower, so that the whole of the acetic acid is collected in the sulphate liquor from this tower. The preferred method of recovering the acetic acid from the vapours given off during the concentration of the sulphate liquor consists in mixing these vapours with the air from the saturating tower and washing the mixture with an alkaline liquor, such as milk of lime or soda, before it reaches the superheater. The alkaline liquor used for this purpose is circulated through a jacket around the gas outlet pipe of the superheater. A recovery of waste heat is effected by this process and the air for the producers which is leaving the saturating tower is saturated at 73° C. saturated at 80° C. after passing through the alkaline washer, so that less steam is required from outside sources.—A. T. L.

Gas producers; Grates of — W. A. Bone, Leeds, and R. V. Wheeler, Altofts, Yorks. Eng. Pat. 10,230 of 1909; date of application, Oct. 29, 1908.

THE invention relates to means for supporting the grate bars in grates of inverted conical form. A series of outwardly projecting studs is fixed to the lower end of the shell of the producer, and the grate bars are provided with holes near the upper end and are hung on the studs and secured by cotter-pins. Alternatively, the bars are passed up through holes in an angle-iron ring fixed to the shell of the producer, and are secured by cotter-pins passing through the bars. The lower ends of the grate-bars rest loosely on a fixed ring.—A. T. L.

Lighting gas [and coke]; Manufacture of — A. L. H. Biennaimé and A. Requier. First Addition, dated June 15, 1908, to Fr. Pat. 394,311, Nov. 22, 1907 (this J., 1909, 197).

THE process described in the principal patent is modified by distilling at a low temperature, and stopping the distillation before all the volatile substances have been liberated, in order to prevent the briquettes from caking or from changing their shape. The escape of volatile products from the briquettes during distillation is facilitated by adding coke, anthracite or non-bituminous coal, sawdust, cut straw, etc., to the fuel before briquetting.—A. T. L.

Liquefied gas for lighting; Manufacture of — from distillation gases. H. Blau. Fr. Pat. 398,839, Jan. 27, 1909. Under Int. Conv., Jan. 31, 1908.

DISTILLATION gases are compressed and cooled to atmospheric temperature, and the hydrocarbons which liquefy under these conditions are collected. The remaining gas is then highly compressed so as to liquefy all but the permanent gases present, and the liquid is stored in steel bottles. The liquid hydrocarbons collected in the first part of the process contain dissolved gases of considerable illuminating power, and to recover these gases, the vessel in which the liquid hydrocarbons are collected is placed in communication with the inlet of the compressor.—A. T. L.

Gas for engines; Plant for the production of — H. Pettibone. Fr. Pat. 398,848, Jan. 27, 1909.

THE plant, which is suitable for use with marine engines, comprises two producers and condensers connected to a single washing and purifying plant. The producers are fed with bituminous coal, anthracite, coke, peat, or

wood, and work with a down-draught, the gas being drawn from the lower ends of the producers and delivered through a pressure-regulating valve to the engine by means of water-jet ejectors arranged at the outlet of the condensers, or by a mechanical exhauster arranged at the outlet of the scrubber. In order that the quality of the gas may not vary, the output of the producers is kept constant, the excess of gas when the engine is not under full load escaping through a branch-pipe between the scrubbers and the pressure-regulator. The valve controlling this branch-pipe is connected up to the engine throttle valve so as to be opened when the throttle valve is closed and *vice versa*. When the fuel column in the producer becomes clogged with clinker and ash, the working is momentarily interrupted and a blast of compressed air from a reservoir is passed up through the fuel, the combustion products escaping by way of the air inlet and a three-way cock to a vent-pipe. The condensers are of the multitubular type, and the air supply for the producers, together with exhaust gases from the engine, is drawn through the casing of the condenser so as to be heated by the gases passing through the tubes. The gas leaving the condensers passes through a washer in which it encounters a series of water-sprays, then through a centrifugal scrubber, and finally through a separator in which the gas is freed from water in suspension by means of baffle-plates.—A. T. L.

Producer working by suction or by pressure. A. Béchevot. Fr. Pat. 400,329, May 29, 1908.

The lower part of the producer chamber is formed by a cylindrical cast-iron shell, supported only at its upper edge, so that it is free to expand. A series of gutters on the outside of this shell serves for the evaporation of water, the annular chamber between the shell and the casing of the producer serving as a vaporising chamber through which the air supply for the producer is passed. The lower edge of the cylindrical shell dips into a water-trough which forms the base of the vaporising chamber. The fuel column is supported by a plate at the base of the producer, and by an inverted conical casting fixed within the lower part of the cast-iron producer chamber. When working by suction, the ash-pit doors and doors of the outer casing of the vaporising chamber can be opened for inspection and for cleaning, without interrupting the working of the producer.—A. T. L.

Producer with gas-discharge conduit at or above the fire-zone. Dresdner Gasmotorenfabr. vorm. M. Hille. Ger. Pat. 212,505, Oct. 6, 1908.

The upper part of, or a little above, the fire-zone, a gas-discharge belt or conduit is formed in the wall of the producer, this conduit being of greater diameter on the side where the gas-discharge pipe is connected, than on the other side.—A. S.

Purifying apparatus. E. Schmiedt, Aschaffenburg, Germany. Eng. Pat. 5768, Mar. 10, 1909.

The apparatus of the type in which the gas enters and passes the purifying material through *louveres* extending over the whole area of the inlet and outlet sides of the purifying chamber, vertical baffle-plates are arranged to project inwards from the ends and downwards from the roof of the purifying chamber, so that when the purifying material shrinks and settles down, the gas is prevented from passing along by the walls and roof of the purifying chamber without passing through the purifying material.—A. T. L.

Purifying gas; Apparatus for —. W. McArthur. Tenino, Wash. U.S. Pat. 933,097, Sept. 7, 1909.

The purifying apparatus is arranged at the base of a holder. The gas is made to bubble through a compartment containing milk of lime ("lime in a semi-liquid state") and then through a compartment, over the first, containing coke, sawdust, and lime.—J. W. H.

Ammonia from coal-gases; Method of recovering —. F. J. Collin, Dortmund, Germany. U.S. Pat. 932,738, Aug. 31, 1909.

The hot gases from the retorts are saturated with steam immediately upon entering the gas main, and are subsequently cooled to recover the ammonia.—W. H. C.

Electric lamps; Method for regenerating blackened carbon filament —. E. A. Krüger, Seehausen, Germany. Eng. Pat. 8283, April 6, 1909. Under Int. Conv., April 6, 1908.

The patent relates to the process in which the lamp is opened, and then heated in an open flame to burn off the carbon from the interior surface of the bulb, and in which a further deposit of carbon is then made upon the filament. The invention consists in introducing a measured quantity of a pure hydrocarbon into the evacuated bulb, after the deposit has been removed from the glass, and then heating the filament electrically so that carbon is deposited on it in the absence of air. The apparatus consists of a main connected to an air pump and provided with branches which are connected to the lamp-bulbs, to reservoirs of liquid hydrocarbon and to bulbs in which the hydrocarbon vapour is measured off. Cocks are arranged so that the lamp-bulbs may be evacuated and then charged with the requisite amount of hydrocarbon from the measuring bulbs.—A. T. L.

Coke oven walls; Method of preserving —. H. Koppers. Essen-Ruhr, Germany. Eng. Pat. 4792, Feb. 26, 1909. Under Int. Conv., March 11, 1908.

SEE Fr. Pat. 400,648 of 1909; preceding.—T. F. B.

Retorts; Vertical —. R. Dempster and Sons, Ltd. Fr. Pat. 400,685, March 11, 1909.

SEE Eng. Pat. 16,405 of 1908; this J., 1909, 647.—T. F. B.

Gas generators. A. Béchevot, Paris. Eng. Pat. 16,333, Aug. 1, 1908.

SEE Fr. Pat. 400,329 of 1908; preceding.—T. F. B.

Gas generator. G. F. Jaubert, Paris. U.S. Pat. 933,077, Sept. 7, 1909.

SEE Eng. Pat. 17,252 of 1907; this J., 1908, 797.—T. F. B.

Methane or mixtures of hydrogen and methane; Manufacture of —. P. Sabatier. Fr. Pat. 400,656, June 15, 1908.

SEE Eng. Pat. 27,045 of 1908; this J., 1909, 876.—T. F. B.

Combustion of gaseous fuels; Process and apparatus for retarding the —. R. F. F. Fabry. Fr. Pat. 400,849, March 15, 1909. Under Int. Conv., March 16, 1908.

SEE Eng. Pat. 5801 of 1908; this J., 1908, 972.—T. F. B.

Apparatus for analysing gas. Eng. Pat. 18,829. See XXIII, Apparatus.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Water in tar; Determination of —. H. Beck. Chem.-Zeit., 1909, 33, 951–952.

The estimation of water in gas tar is usually made by distilling about 1 kilo. of the tar in a metal flask of about 2 litres capacity, until the oil distilling over is free from drops of water. The operation takes 3–4 hours, and there is always danger of the liquid frothing and thus "boiling over." The time is much shortened and the operation simplified if a given quantity of the tar is run slowly into a metal flask containing "heavy oil" heated to 250°–270° C. The rate of flow of the tar into the flask is regulated so that although vaporisation of the water is instantaneous, there is no frothing, and when all the tar has been run in, the temperature of the oil is raised to about

300° C. to drive over all water vapour. Any water remaining in the condenser tube is rinsed into the graduated receiver with a little xylol, and after standing for a short time in a warm place, the volume of water is noted. The method was tested upon known mixtures of dehydrated tar and water and gave very satisfactory results. The operation, with a 50 per cent. mixture, was carried through in about 35 minutes.—F. M.

Bibi-Eibat petroleum: Optical examination of —.
M. Rakusin. J. Russ. Phys.-Chem. Ges., 1909, **41**, 483—500. Chem. Zentr., 1909, **2**, 859—860. (See also this J., 1908, 397.)

From the known data concerning Bibi-Eibat petroleum, the author draws the following conclusions:—(1). The percentage yields of fractions distilling over equal intervals of temperature are, for corresponding kinds of crude oil, inversely proportional to the specific gravities of the oils, and hence also to the depths of the oil-yielding strata. (2). The natural oil is dextro-rotatory, the rotatory power being proportional to the depth of the oil-yielding strata. (3). There is no connection between the formation of petroleum and volcanic activity. (4). The rotatory power of the oil is due to the formation of the latter from compounds containing asymmetric carbon atoms. (5). There is a connection between the paraffin content of a petroleum oil and its age.—A. S.

The value of the imports of various coal-tar products into the United States during the last three years have been as follows:—

	1906. Value \$.	1907. Value \$.	1908. Value \$.
Salicylic acid	2772	1249	1183
Alizarin and colours or dyes, natural or artificial	661,155	782,368	752,386
Aniline salts	806,901	607,758	450,891
Coal-tar colours or dyes, not specially provided for	5,717,932	5,830,651	4,573,217
Coal-tar preparations, not colours or dyes	864,067	911,096	717,556
Benzene, toluene, and other coal-tar products not medi- cinal, colours, or dyes ..	483,416	653,288	549,352

Petroleum production of the world in 1908. D. T. Day.
Mineral Resources, 1908. [T.R.]

The following table gives the amount of petroleum produced in the world during the last five years, in barrels of 42 gallons:—

Country.	1904.	1905.	1906.	1907.	1908.	Percentage of total production.	
	Barrels.	Barrels.	Barrels.	Barrels.	Metric tons.		
United States	117,080,960	134,717,580	126,493,936	166,095,335	179,572,479	23,942,997	63.09
Russia	78,536,655	54,900,270	58,897,311	61,850,734	62,186,447	8,291,526	21.85
Samatra, Java, and Borneo	7,682,014	8,586,804	8,662,572	8,377,099	8,752,822	1,143,243	3.08
Galicja	5,947,383	5,765,317	5,467,907	8,455,841	12,612,295	1,754,022	4.43
Roumania	3,599,026	4,420,987	6,378,184	8,118,207	8,252,157	1,147,127	2.90
India	3,385,468	4,137,098	4,015,803	4,344,162	5,047,038	672,938	1.77
Japan	1,418,767	1,341,157	1,710,768	2,010,639	2,070,929	276,124	0.73
Mexico	—	—	—	1,000,000	3,481,410	464,188	1.22
Canada	552,575	634,095	569,753	788,872	527,987	70,400	0.19
Germany	637,431	560,963	578,610	756,631	1,009,278	141,000	0.35
Peru	345,834	447,880	534,929	741,226	1,011,180	131,824	0.36
Italy	25,476	44,027	53,577	59,875	660,000	8,344	0.03
Other.....	440,000	430,000	430,000	430,000	430,000	4,000	
	219,251,589	215,646,178	213,393,410	262,628,621	284,614,022	38,052,233	100.00

a Estimated.

Tar and ammonia: Production of — in gas works and coke-ovens in the United States. E. W. Parker. Mineral Resources, 1908. [T.R.]

The following table shows the amounts and values of tar and ammonia (calculated as anhydrous ammonia) and ammonium sulphate produced in coal gas works, by-product coke ovens, and oil- and water-gas works in the United States in 1907 and 1908:—

Petroleum in Burma. Od. Paint and Drug Rep., Sept. 13, 1909. [T.R.]

The U.S. Consul at Rangoon reports as follows: The richest oil-bearing tract of Burma lies in the valley of the Irrawaddy, in Upper Burma, in the southern portion of the dry zone. Oil is still obtained from wells dug by native labour, but the principal output is from wells regularly drilled with modern machinery. The output of the

	1907.		1908.	
	Gallons.	Value.	Gallons.	Value.
Tar:		\$		\$
Coal-gas works	49,681,965	1,408,997	48,541,220	1,529,505
Coke-ovens	53,995,795	1,242,530	42,720,609	1,067,613
Oil- and water-gas works	14,414,017	342,041	14,728,033	368,741
Ammonia (anhydrous):	lb.		lb.	
Gas works and coke ovens	20,993,867	1,128,178	15,347,354	853,632
Ammonium sulphate (produced and sold):				
Gas works and coke ovens	48,882,237	1,525,472	44,093,437	1,322,807

The above figures were taken from reports of 488 companies in 1907 and 471 in 1908. The average yields per ton of coal carbonised were:—Tar: 1907, 9.04 galls.; 1908, 10.3 galls. Ammonia: 1907, 4.75 lb.; 1908, 4.7 lb.

hereditary well lessees is purchased by the refining companies at varying prices. A royalty is paid to the Government of Sd. per 100 viss (365 pounds) in the case of early leases, and Sd. per 40 gallons in later ones. A system of pipe lines has been installed. The first section

was about 45 miles in length, connecting the fields at Singu and Yenangyat with Yenangyaung, and pumping stations were installed at Singu and Yenangyat. About the same time another line was constructed to convey the oil from the tank boats to refineries. As both these lines were successful, the construction of a pipe line from Yenangyaung to Rangoon, a distance of 275 miles, was begun early in 1907, and is now completed. There are four pumping stations on this line, each connected with Yenangyaung and Rangoon by telegraph.

Oil is also produced in the districts of Kyankpyu, Akyab and Thayetmyo. Prospecting is continually going on, and there is no doubt that there are many valuable fields as yet undiscovered or undeveloped. From the Cheduba wells, in the Kyankpyu district, a thick dark-coloured oil is obtained, which is used for burning, for covering the bottom of boats, and as varnish. The amount obtained is small and the methods are primitive and wasteful. The oil produced from these wells has a low flash point (below 40° F.), while the specific gravity is 0.8247. At the present time nine companies are engaged in the extraction or refining of petroleum, with a combined capital of £4,540,000. The value of the unrefined oil produced in 1901 was £196,710, and in 1907, £583,579.

The output of the Burma oil fields is all disposed of in Burma or other provinces of India. For the three years from 1903-4 to 1905-6 a considerable amount of oil was exported, principally to the Far East. With the exception of that period the oil dealers have confined themselves to the Indian market. A considerable quantity of high-grade oil is imported into Burma, principally from the United States. In 1907-8 the imports amounted to 2,230,592 gallons, valued at £81,410, of which 2,188,442 gallons, valued at £79,338, were from the United States. Burma's trade in oil with different parts of India, excluding the trade of Rangoon and vicinity, in 1901-2 was 6,542,432 gallons, valued at £531,511, and in 1907-8 it was 69,464,772 gallons, valued at £1,443,280.

Two of the native reserves are of importance—the Twingone, about 300 acres in extent, and the Beme, containing about 160 acres. The number of private wells and well sites in these two reserves is now over 3700. Of this number, however, some 1500 have been temporarily taken over by the Government for non-observance of regulations. At present the best-known and developed field is at Yenangyaung, the average daily output being about 5,000 viss (54,750 lb.). There are newer fields which are producing oil in increasing quantities, notably at Singu and Yenangyat.

There is an increasingly large export trade in the by-products obtained from crude petroleum, such as paraffin wax and mineral oils. These exports were as follows in 1907-8:—Candles, 5,307,512 lb., valued at £97,354, of which 661,000 lb., valued at £12,000, went to the Philippines; wax, 74,205 hundredweight, valued at £109,482, of which £7000 worth went to the United States and 2400 to the Philippines.

PATENT.

cetone; Manufacture of —. A. L. A. Pagès and R. P. T. Duchemin, Paris. U.S. Pat. 933,107, Sept. 7, 1909.

Eng. Pat. 8757 of 1906; this J., 1906, 634.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

PATENTS.

colouring matter suitable for use as a pigment or lake; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 17,546, July 28, 1909. Addition to Eng. Pat. 26,714, Dec. 9, 1908.

4-chloro-6-nitraniline is treated with formaldehyde, somewhat reddish yellow dyestuff is produced, which fast to light, lime, water, and alcohol. It is suitable

for use as a pigment or lake, and possesses properties generally similar to those of the dyestuff described in the principal patent (this J., 1909, 210).—T. F. B.

Disazo dyestuffs. F. Runkel and M. Herzberg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 932,812 and 932,813, Aug. 31, 1909.

CLAIM is made, in the first patent, for the disazo-dyestuff obtained from diazotised *o*-aminophenyl-*o*-tolyl ether, diazotised sulphanilic acid, and 1:8-aminonaphthol-4-sulphonic acid, which dyes wool in blue-black shades fast to washing and milling; and in the second patent for the dyestuff prepared from diazotised *o*-aminophenyl ether, diazotised dichloroaniline, and 1:8-aminonaphthol-3:6-disulphonic acid, which dyes wool in greenish blue-black shades fast to washing and milling.—J. C. C.

Galloguanine series; Production of new dyestuffs of the —. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Feb. 23, 1909, to Fr. Pat. 396,564, Nov. 20, 1908.

In the example given in the chief patent (this J., 1909, 595), nitrosodiethylaniline may be substituted for nitrosodimethylaniline.—J. C. C.

Anthracene series; Production of dyestuffs of the —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 400,653, Mar. 10, 1909. Under Int. Conv., June 4, June 9, and Aug. 28, 1908.

NEW dyestuffs of the anthracene series are obtained by treating aminoanthraquinones or their derivatives, analogues or homologues with agents capable of introducing the benzoyl or a substituted benzoyl group into the amino-group. Example: A mixture of 10 parts of 1-aminoanthraquinone, 100 parts of nitrobenzene, and 20 parts of benzoyl chloride is boiled for half an hour. The benzoylaminoanthraquinone produced crystallises on cooling and is collected and dried. With alkaline hyposulphite (hydrosulphite) a vat is obtained from which cotton is dyed in yellow shades. A list of dyestuffs of this class is given in the patent together with the shades produced on cotton, wool, and silk. The dyestuffs may also be used in printing.—J. C. C.

Black colouring matter for applying to textiles; Production of a —. F. L. P. Bertrand. Fr. Pat. 400,743, June 20, 1908.

THE black colouring matter is obtained by heating a mixture of sulphuric acid, iron sulphide, naphthalene, aniline, and copper nitrate to 100° C. The proportions of the different constituents are varied from 10 to 25 per cent. according to the intensity of the black desired. The colouring matter can be applied cold.—S. H. H.

Dyestuffs by melting phthalic acid with phenols, naphthols, or aromatic bases; Process for preparing —. E. Ziegler. Ger. Pat. 212,796, May 20, 1906.

PHTHALIC acid or anhydride is melted with phenols, naphthols, or aromatic amines, and fatty or aromatic aldehydes, ketones, or substances containing aldehydes or ketones (e.g., essential oils), or aromatic alcohols or nitro-compounds. The aldehydes, etc., may be added to the mixture before or during melting, or the product may be treated with them subsequently. Examples are given in which 1 mol. of phthalic acid, 2 mols. of resorcinol, and 1 mol. of either benzaldehyde, or nitrobenzene, or benzyl alcohol are heated together. The shades of the resulting dyestuffs are said to be quite distinct from those produced from phthalic acid and the phenols or bases alone.—T. F. B.

Vat dyestuff; Process for preparing an orange —. Ges. f. Chem. Industrie in Basel. Ger. Pat. 212,858, Jan. 10, 1908.

By condensing acenaphthenone with acenaphthenequinone, with or without the use of condensing agents, a product is obtained, which is probably identical with the biacenaphthylidene-dione, formed in small quantities when acenaphthene is oxidised or acenaphthenequinone reduced.

It is reduced by alkaline solutions of hydrosulphite, forming violet solutions, in which, when diluted, un mordanted cotton is dyed orange-yellow shades.—T. F. B.

Basic dyestuffs; Manufacture of —, P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 21,585, Oct. 12, 1908. Addition to Eng. Pat. 20,367, Sept. 28, 1908.

SEE Addition of Nov. 23, 1908, to Fr. Pat. 395,793 of 1908; this J., 1909, 595.—T. F. B.

Azo dyestuffs; Manufacture of —, P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,816, Nov. 30, 1908.

SEE Fr. Pat. 396,833 of 1908; this J., 1909, 596.—T. F. B.

Halogenated indigo; Manufacture of —, J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 2386, Feb. 1, 1909.

SEE Fr. Pat. 399,285 of 1909; this J., 1909, 975.—T. F. B.

p-Phenylenediaminesulphonic acid derivatives and monoazo dyestuffs derived therefrom. Badische Anilin und Soda Fabrik. Fr. Pat. 398,969, Jan. 30, 1909. Under Int. Conv., July 8 and Dec. 23, 1908.

SEE Eng. Pat. 25,311 of 1908; this J., 1909, 469.—T. F. B.

Monoazo dyestuff especially adapted for making lakes; Manufacture of a —, A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 2608, Feb. 3, 1909.

SEE Fr. Pat. 399,132 of 1909; this J., 1909, 977.—T. F. B.

Vat dyestuffs, dyeing like indigo; Production of halogenated —, Soc. pour l'Industrie Chimique à Bile. Fourth Addition, dated April 6, 1908, to Fr. Pat. 372,627, Dec. 17, 1906.

SEE Eng. Pat. 8530 of 1908; this J., 1909, 198.—T. F. B.

[Azo] dyestuffs; Process of making —, Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 400,590, Feb. 11, 1909. Under Int. Conv., March 28, 1908.

SEE Ger. Pat. 208,968 of 1908; this J., 1909, 517.—T. F. B.

[Azo] dyestuffs; Process for making —, Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Feb. 11, 1909, to Fr. Pat. 400,590, Feb. 11, 1909. Under Int. Conv., Aug. 29, 1908.

SEE Ger. Pat. 208,968 of 1908; this J., 1909, 517.—T. F. B.

Dyestuffs of the anthracene series; Process for preparing —, Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 401,306, July 17, 1908.

SEE Ger. Pats. 205,149 and 205,551; this J., 1909, 134 and 198.—T. F. B.

Azo dyestuff especially suitable for making lakes; Process for preparing a red —, Wülfing, Dahl, und Co. Fr. Pat. 400,691, March 11, 1909. Under Int. Conv., Feb. 13, 1909.

SEE Eng. Pat. 4859 of 1909; this J., 1909, 975.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

Wool and cotton; Determination of — in mixtures. B. Ruzskowski and E. Schmidt. Chem.-Zeit., 1909, 33, 949—950.

THE chemical methods for the estimation of wool in the presence of cotton are based upon the solvent action which warm caustic soda exerts upon wool. The best method is perhaps the official one in use at the Conditioning

House at Aachen, according to which the material is treated with a volatile solvent to remove fatty matter and then with hydrochloric acid (2 per cent.) to remove filling materials. It is then well rinsed and dried at 110° C. The wool is removed by boiling in a 2 per cent. caustic soda solution and the residual cotton is rinsed, lightly soaped, rinsed again until free from acid, and dried at 110° C. The proportion of wool to cotton is calculated from the dry weights, allowance being made for the facts that cotton itself loses some 3.5 per cent. by boiling with caustic soda, and scoured wool rinsed thoroughly in water loses about 1 per cent. The authors think that such methods as the above have serious drawbacks and have sought to use the nitrogen content of wool as a basis for the analysis. The nitrogen estimation (Kjeldahl) of scoured wool (loose, as yarn, and in the piece) and of woollen yarn dyed in various shades gave results varying between 13.81 and 14.14, with a mean for all analyses of 14.02 per cent. of nitrogen. Analyses of mixed fibres were made simultaneously by this and the Aachen method and the results are in general in close agreement; the nitrogen method in all cases gives a slightly higher percentage of wool than is shown by the other.—F. M.

Wild silks; Hydrolysis of certain —, U. Suzuki, K. Yoshimura, and R. Inouye. J. Coll. Agric., Imp. Univ., Tokyo, 1909, 1, 59—75.

THE authors have investigated three species of Japanese wild silk, viz.: "Sakusan" (*Anthera Pernyi, Guér.*), "Yamamai" (*Anthera Yamamai, Guér.*) and "Kuriwata" (*Caligula Japonica, Moore*). The raw silks were boiled for 2 days with concentrated hydrochloric acid under a reflux condenser and the products of hydrolysis (amino-acids and bases) were investigated. Ordinary *Bombyx* silk was treated in a similar manner for comparison. The principal results are summarised in the table below:—

Species of silk.	"Bombyx" (raw silk).	"Sakusan" (raw silk).	"Yamamai" (raw silk).	"Kuriwata" (raw silk).
Moisture, per cent.	12.90	13.16	11.29	11.71
Dry substance, per cent. . .	87.10	86.84	88.71	88.29
100 parts of dry substance yielded:				
Ash	0.63	2.92	4.73	3.85
Soluble in boiling hydrochloric acid	99.14	92.21	97.07	88.34
Insoluble in boiling hydrochloric acid	0.86	7.79	2.93	11.66
Total nitrogen	18.98	18.87	17.73	16.73
Nitrogen soluble in hydrochloric acid	18.86	16.39	17.26	15.77
Ditto insoluble in hydrochloric acid	0.12	2.48	0.47	0.96
100 parts of the total nitrogen showed:				
Nitrogen soluble in boiling hydrochloric acid	99.34	86.87	97.34	94.26
Ammonia nitrogen	4.57	2.52	3.85	4.08
Nitrogen precipitated by phosphotungstic acid ...	1.78	13.11	19.44	15.54

—J. F. H.

PATENTS.

Cellulose compounds in definite shapes [threads, films, &c.]; Manufacture of —, L. Lederer, Sulzbach, Germany. Eng. Pat. 11,625, May 17, 1909. Under Int. Conv., July 3, 1908.

ARTIFICIAL threads spun from solutions of cellulose and nitro- or acetyl-cellulose differ in their behaviour towards water and dyestuffs. Cellulose threads are readily dyed, but lose in tensile strength by the absorption of water. The cellulose esters on the other hand are not affected by water but do not easily take up dyestuffs. The advantages of the products may be combined by pro-

ducing a mixed thread of nitro- and acetyl-cellulose and then denitrating, the resulting thread being easily dyed and possessing good strength even in the moist condition. The solution for spinning is prepared by dissolving 6 parts of trinitrocellulose and 2 parts of triacetylcellulose in 27 parts of acetone and 16 parts of acetylene tetrachloride. The solution is homogeneous, even though acetylcellulose is not dissolved by acetone alone and nitrocellulose is insoluble in acetylene tetrachloride. Filaments are produced from the mixed solution by precipitation with alcohol. Films may be made in a similar manner, and these, by denitration do not change their external appearance; they take up dyestuffs easily, are quite transparent, and on account of their low degree of inflammability may with advantage replace celluloid films in photography and similar industries.—F. M.

Artificial silk: Coagulation of fibres of —. Pinel Frères.
Fr. Pat. 400,577, June 11, 1908.

THE coagulating liquid described, is particularly applicable for the coagulation of fibres of "viscose" or other alkaline solutions of cellulose. The solutions previously used for the purpose were either neutral or acid solutions of mineral salts; they had the disadvantage, that the salts were apt to crystallise out. According to the present patent, an acid solution containing an organic substance, e.g., glucose, which does not crystallise readily, is used. The following bath is recommended: 30 grms. of glucose, 15 grms. of sulphuric acid of 66° B., and 55 grms. of water.

—S. H. H.

Fibrous materials: Manufacture of —. J. T. Wood.
Assignor to J. W. Wilson, Philadelphia, Pa. U.S. Pat. 931,979, Aug. 24, 1909.

THE fibrous material is treated in a hot bath of zinc chloride, or zinc chloride and oil. The mass, after removal from the bath, is allowed to cool and set, and after heating in a chamber to remove absorbed moisture, is washed with water until free from zinc chloride.—F. M.

Fabrics: Treatment of —. O. Heimann, Erfurt, Germany. Eng. Pat. 2313, Jan. 30, 1909.

THE fabric is led slowly over and under a series of rollers arranged in the top and bottom of a large chamber containing a very moist atmosphere. In order to prevent moisture from condensing and falling on to the material, the ceiling of the chamber is heated. By the time the fabric has travelled through the chamber, the fibres have regained their original elasticity (lost during the process of manufacture) and the material has become suitable for sewing.—P. F. C.

Silk: Degumming, bleaching and dyeing of —. Schmid Frères. Third Addition, dated March 30, 1908, to Fr. Pat. 345,173, July 27, 1904 (this J., 1905, 24; 1906, 475).

THE machine consists of a vat containing a small quantity of the liquor with which the silk is to be treated. Steam pipes placed at the bottom of the vat cause the liquor to froth up, thus filling the upper part of the vat with froth. The sides of the vat are made to admit four separate endless sheets, which pass through the vat out to the opposite side and round again. Where the sheets enter and leave the vat, there is an inclined covering to stain the froth. The silk is placed on the cloths and kept in position while in the vat by passing between horizontal boards. In a modified form of apparatus, no outside coverings are used to retain the froth, the cloth being led directly into the vat. It first enters a small outer compartment, which contains steam pipes and thus serves to produce an abundance of froth; the cloth enters the vat. In a third modification, the cloth is made to enter the vat from above, being slightly inclined downwards over a large distance, to pass through the froth and then out again at a slight upward inclination. In this machine, the silk is treated continuously, being received on the cloth at one side and discharged at the other side.—S. H. H.

Catechin and catechu-tannic acid: Process for preparing a condensation product of — [for silk reeling, &c.]. Fabr. de Couleurs d'Aniline et Extraits ci-dev. J. R. Geigy. Fr. Pat. 401,108, July 7, 1908.

By heating catechin with catechu-tannic acid, either in their natural form (as Gambier extract) or in the same proportions as they occur in Gambier (64:163), for several hours at 100° C. or higher temperatures, brownish red liquid or solid condensation products are produced, which possess great affinity for silk weighted with tin: for example, pure Gambier, after heating for two hours at 110°–115° C., produced an increase of weight of 95 per cent., compared with 14 per cent. with pure Gambier unheated, both being from solutions of 7° B. The products may also be used in tanning.—T. F. B.

Preparing, dyeing, or otherwise treating with liquids, wool, yarn, or other fibrous material; Apparatus for —. J. Rhodes, Bradford. Eng. Pat. 17,083, Aug. 14, 1908.

AN inner vessel, which is divided into several compartments, fits into an outer one, so that there is a space left between the two. The material to be treated, is placed in the compartments of the inner vessel and the necessary liquors are sprayed over it from sprinklers placed above. The flow of the liquor to any portion of the material may be regulated by sliding doors placed beneath the sprinklers, and by baffle-plates (which may be set at any desired angle) arranged in the space between the two vessels.

—F. M.

Vats for dyeing and like purposes. J. Dean, Bradford. Eng. Pat. 6486, Mar. 18, 1909.

IN vats in which the material is dyed in rope form and which are heated by means of steam pipes, the latter have usually to be "guarded" to prevent the goods being damaged by contact therewith. This causes a loss of space and irregularities in the circulation of the dye-liquor. In the improved vat the steam is blown into a channel or trough, formed by a partition which is carried up into the vat at a short distance from the outer wall. The hot liquors are discharged from this over the goods, and flow through a perforated grating which is placed over the recess in the base of the vat, in which the steam injector is placed.—F. M.

Dyeing fabrics in the open width: Apparatus for —. A. Duverger and A. Henrion. First Addition, dated March 10, 1909, to Fr. Pat. 392,693, July 25, 1908 (this J., 1909, 19).

OPEN pipes are placed in the dye-bath, one near the wall at one side of the bath and the other in the middle between the partitions contained in the bath. These pipes contain steam injectors which are placed at the bottom of the dye-bath and force the dye-liquor up the pipes and against baffle-plates at the upper extremities.—S. H. H.

Dyeing of variegated shades on wool. E. P. J. Roussel. Fr. Pat. 400,588, Feb. 10, 1909.

WOOL after bleaching has a different affinity for dyestuffs than it has in the raw state: the unbleached wool is dyed a heavier shade not so pure as that of the bleached variety. By mixing the unbleached and bleached wool in varying proportions throughout a fabric and dyeing the product, gradations of colour can be obtained, the shades varying as desired from a heavy to a bright shade of the same colour.

—S. H. H.

Calico printing. Calico Printers' Association, Ltd., and F. Davis, Manchester. Eng. Pats. 17,713, Aug. 24, 1908, and 2437, Feb. 2, 1909.

THE patents relate to certain novel effects in indigo printing. The material may or may not be previously prepared with glucose, but is printed with a resist containing sulphur and a dyestuff of the sulphide, thioindigo, or indanthrene class. A suitable indigo printing colour (containing alkali) is then applied and the cloth is aged, steamed, washed, and otherwise treated in the usual way. The presence of sulphur prevents the fixation of the indigo upon the parts printed with the resist, but under

the influence of the sulphur and alkali, the dyestuff in the resist is reduced and fixed. The most suitable resist colours are obtained with the sulphide dyestuffs, but Thioindigo Red, Indanthrene Yellow G, (and R), Indanthrene Brown, Algol Dark Green B, and Ciba Violet may be used. For "cover" colours almost all of the vat dyestuffs are suitable.—F. M.

Colour effects on textile fabrics; Process for producing —.

Farbw. vorm. Meister, Lucius und Brüning, Höchst a M., Germany. Eng. Pat. 6876, Mar. 22, 1909. Under Int. Conv., Mar. 27, 1908.

VARIATED, marbled or veined effects in two or more colours have recently been produced upon paper whilst this is still in the web, and paper showing relief colour effects (resembling natural patterns or regularly arranged figures) has also been produced. Hitherto, similar effects have not been produced upon textiles, but it is now found that the effect produced by suitable means (spraying of dyestuff solutions, resists, discharges, dye-components, etc.) upon the paper web, may be transferred to fabrics composed of silk, wool, cotton, jute, or other fibre, by bringing the fabric into intimate contact with the paper whilst this is still in the wet or moist condition. In many cases it is sufficient to pass the combination between pressing rollers, or place, in layers, in a hydraulic press for the necessary length of time. The transference and fixation of the colour may be assisted by moistening or damping, or by the use of heat and steam, etc.—F. M.

Reducing agents [for use in printing]; Production of new —. A. Ashworth, Bury. Eng. Pat. 19,528, Sept. 17, 1908.

NEW and relatively stable reducing agents are manufactured, in paste form, by mixing zinc dust with a concentrated solution of British gum, dextrin, molasses, gum tragacanth, gum arabic, gum sengal, or sugar, with or without the addition of calcium chloride or zinc chloride, and treating the mixture with sulphur dioxide at a suitable temperature. For example, into a well-stirred mixture of 20 lb. of zinc dust, 15 of molasses (or sugar), 2 of water, and 20 of a solution containing 45 per cent. of calcium chloride (or zinc chloride), 27 lb. of sulphur dioxide are introduced, until the zinc dust has disappeared, the temperature being maintained at 40°–50° C.; or, the mixture to be treated with the gas may consist of 20 lb. of zinc dust and 30 of dextrin solution, made by dissolving 15 lb. of dry dextrin in 15 lb. of water, or 15 lb. of 45 per cent. calcium chloride solution. For discharging developed dyes, 90 parts of British gum, 145 of water, and 10 of brown glycerin are boiled together, and 55 parts of sodium chloride solution (60° Tw.) are added, the temperature being thereby reduced to about 130° F.; then 170 parts of the reducing agent and 20 of sodium bisulphite solution (60° Tw.) are added, and the whole strained whilst warm; after printing, the fabric is passed through the ager for several minutes, at about 213° F. The new products have the advantage of reducing indigo and other dyestuffs at the ordinary temperature, and it is not necessary to perform either the steaming or the ageing immediately after the printing, or the clearing immediately after the steaming.—F. SOBN.

Lustrous surface on animal and vegetable fibres; Production of a —. R. Robitschek and I. de Lauverzac. Fr. Pat. 400,575, June 11, 1908.

THE fibre is first immersed in a bath containing 100 grms. of gelatin, 25 grms. of glycerin and 600 grms. of water; this bath renders the fibre capable of taking up the subsequent coating. The treated fibre is then immersed in a bath containing collodion, a solution of nitrocellulose in ether or alcohol, or a cuprammonium solution of cellulose. In order to increase the adherence of the film of collodion, etc., to the fibre, the whole is drawn through an orifice into a vessel which is used for drying the film and to bring it in contact with liquids which coagulate it. The suppleness of the fibre can be further increased by treating it with glycerin, oil, etc. The product is said to appear like a simple fibre, to be very brilliant and pliable, and to take up dyestuffs readily. The process is applicable to separate

fibres or to yarn, and is particularly suitable for silk as it is said to render the latter more brilliant than in its natural state.—S. H. H.

"Black-red style"; Process of making the —. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 400,698, June 17, 1908.

SEE Eng. Pat. 12,811 of 1908; this J., 1909, 472.—T. F. B.

Anhydrous hydrosulphites. Fr. Pat. 400,174. See VII.

Nitrating oils. Fr. Pat. 398,748. See XII.

Tanning hides and skins, and mordanting fibrous materials. Eng. Pat. 17,957. See XIV.

Purifying trade effluent [from wool washing, etc.] Eng. Pat. 17,644. See XVIII B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Sulphuric acid lead chamber construction. F. J. Falding. Eng. and Min. J., 1909, 88, 441–444.

IN the author's opinion previous attempts which have been made to reduce the chamber space in the manufacture of sulphuric acid have been only partially successful, on account of the suction exerted on the gases owing to the "flue" shape of the chambers, tending to draw the gases forward before sufficient time has elapsed for quantitative reaction in the first portion of the system, where the conditions are best. It is claimed that a quantitative reaction can be obtained in one chamber by the author's process. The chamber is built of considerable height in proportion to its width, and the path of the gases is normally downwards, but owing to convection currents, the reacting gases tend to accumulate at the top of the chamber so long as the strongly exothermic reaction goes on, whilst the cooler non-reacting gases travel downwards, probably near the sides of the chamber. With a chamber constructed in correct proportions, it is claimed that the exit gases are free from sulphur dioxide, and only need cooling and drying before passing direct to the Gay-Lussac tower. Besides the saving in ground space effected by such chambers, much less lead is required; for a chamber or chambers of approximately 175,000 cb. ft. capacity, 66·5 short tons of lead are required for the author's system, 110 tons for Meyer's tangential chambers, and 112 tons for horizontal chambers. With a plant erected at Pittsburg, and for which the burners had to be forced, as their normal capacity was insufficient, the following results are said to have been obtained with a chamber of 175,000 cb. ft. capacity:—

	I.	II.
Sulphur burnt in 24 hours.....	25,600 lb.	23,200 lb.
Yield of acid at 60° F. in 24 hours	48 short tons	43·5 short tons
Sulphur dioxide in burner gases.....	7·0 per cent.	8·1 per cent.
Nitrogen dioxide in nitrous vitriol.....	2·2 per cent.	2·19 per cent.
Sodium nitrate (95 per cent.) used	720 lb.	720 lb.
Diff. of temp. at top and bottom of chamber.....	7° F.	8·3° F.
Temp. of gas entering Gay-Lussac tower.....	114° F.	115° F.

—A. S.

Glover tower; Acid-forming capacity of the —, and the power required in sulphuric acid manufacture. T. Meyer. Z. angew. Chem., 1909, 22, 1841–1844.

RASCHIG has lately suggested (this J., 1909, 706) a method of arriving at the acid-production of the Glover tower, and as a result of his investigations has made suggestions for the improvement of the chamber process. The author points out that it has always been possible to determine approximately the yield in the Glover tower, either by determining the sulphur dioxide and trioxide

in the gases entering the tower and leaving it, or by measuring the total yield of acid and the yield of each individual chamber over a given interval of time. The latter method, of course, includes in the make of the Glover tower, any acid which entered it as trioxide. Measurements made in this way, by the author, of two very different installations gave respectively 10.8 and 7.3 per cent. of the total make as the Glover tower's share, whilst the volume of the tower was in the first case 3.0 and in the other 3.8 per cent. of the volume of the chambers. Whilst these figures show a rather less acid-making capacity than Quincke found when using Raschig's method, they are still sufficient to suggest the desirability of assimilating further the conditions in the chambers to those in the Glover tower. The most important of these conditions is the removal by the sprinkling acid of the superfluous heat of reaction, and thus the maintenance in the tower of the most favourable temperature. The author has done something by his system of cooling tubes (this J., 1900, 823) to approach this condition in the chambers; but the ideal way of achieving it would be to use the acid formed in each chamber, starting next the Gay-Lussac tower, as a spray in the chamber in front of it. The practical difficulty in the way of this is the enormous cost of pumping the acid. He quotes the following figures, showing the cost for power in an existing system of chambers:—

Purpose of power.	Kilo-watt hours.	Per cent. of total.	Per 100 kilns of acid of 50° Baumé.		
			Cost, shillings.	Kilo-watt hours.	Cost, pence.
Lifting pyrites and residues	38	0.7	2.61	0.01	0.008
Working mechanical burner	478	8.9	32.80	0.10	0.082
Driving "Frithjof" fan...	434	8.1	29.80	0.09	0.074
Feeding water-spray	123	2.3	8.44	0.03	0.025
Cooling-water distribution	484	9.0	33.20	0.10	0.082
Air-compression for lifting and transporting acid ..	3819	71.0	262.08	0.81	0.667
	5376	100.0	368.93	1.14	0.938

An examination of the work actually done in raising the acid shows that there is an enormous waste of power here, and it is possible that improvements in efficiency may considerably reduce the very high percentage of the total power-cost now demanded by the handling of the acid; but it is clear that either in the method of working above suggested, or in the method suggested by Raschig, where from fourteen to twenty-one times the whole production of acid has to be lifted, the increased cost will be very great, and will need to balance it very greatly increased yield or very great economies in other directions. In the direction indicated, however, the improvements of the future are to be looked for.—J. T. D.

Potassium iodide; The presence of iodate in commercial —. A fallacy. L. W. Andrews. J. Amer. Chem. Soc., 1909, 31, 1035—1039.

THE general belief that commercial potassium iodide frequently contains iodate is erroneous and is not supported by the results of the author's examination of numerous samples of this substance. In no case was the presence of iodate detected. The production of a blue colour when a solution of an iodide is mixed with starch paste and acidified with hydrochloric acid is by no means a definite proof that iodate is present. Most samples of iodide contain minute traces of iron and cuprous iodide which, in the presence of atmospheric oxygen, lead to the liberation of free iodine and the production of the blue coloration. The test should be carried out as follows:—About 50 c.c. of a 10 per cent. solution of the iodide to be tested, are placed in a flask provided with a delivery tube, the outer end of which dips beneath the surface of a solution containing 1 gm. of potassium hydrogen tartrate and a little starch paste. The iodide solution is boiled and the steam allowed to pass through the tartrate

solution until all air has been expelled from both solutions. The flame is now removed from beneath the flask, and a tap or pinch-cock on the delivery tube is closed; when the iodide solution has cooled somewhat, the pinch-cock is again opened, and a portion of the still boiling tartrate solution is allowed to run into the flask. A blue coloration indicates the presence of iodate, iron oxide and cuprous iodide not yielding a reaction under these conditions. The test will detect the presence of 20 parts of iodate per million parts of iodide.—W. P. S.

Cuprous iodide; Solubility of —. M. Kohn. Z. anorg. Chem., 1909, 63, 337—339.

CUPROUS iodide is stated in text-books to be insoluble in a cold solution of potassium bromide. This is incorrect. Potassium bromide solution of 2*N* strength dissolves at 19.5° C. 1.47 grms. per litre, at 24° C. 1.56 grms. per litre. The corresponding figures for 3*N*-solution are 3.41 and 3.59, whilst 4*N*-solution at 22° C. dissolves 7.04 grms. per litre. These solutions slowly change, becoming greenish, yellow, and ultimately brown, whilst free iodine can be detected in the solutions.—J. T. D.

PATENTS.

Sulphurous acid; Recovery of — from solutions. Comp. Ind. des Alcools de l'Ardèche, Paris. Eng. Pat. 9145, April 17, 1909. Under Int. Conv., June 18, 1908.

FOR the rapid recovery of sulphurous acid from solutions containing it, such as those obtained by absorbing the gases given off during the roasting of sulphur or pyrites, these solutions are submitted to a violent mechanical action, for instance, by projection, in the form of a jet, against the vertical wall of a case, provided at its lower part with an opening for the escape of the separated water, and at the upper part with an orifice, through which the liberated sulphur dioxide gas is collected. The operation is repeated until all the acid is recovered. By slightly heating the solution beforehand, the liberation of the sulphur dioxide may be facilitated.—F. SOBX.

Sulphur dioxide; Process of purifying gases containing —. H. Hegeler, Danville, and N. L. Heinz, La Salle, Ill. U.S. Pat. 931,868, Aug. 24, 1909.

THE process consists in mixing hot sulphurous gases from a burner with sufficient cooled burner gases (of about equal sulphur dioxide content) to reduce the temperature below the boiling point of water, subjecting the mixture to the action of water trickling through a filled purifying tower, and drying and filtering the gases.—F. SOBX.

Sulphitometer, or tube for measuring [liquid] sulphur dioxide. P. V. Pacottet. Third Addition, dated Jan. 25, 1909, to Fr. Pat. 365,224, April 13, 1906 (this J., 1906, 928; 1907, 48, 255).

FOR the simplification of the apparatus, the cock controlling the entry of the liquid sulphur dioxide is omitted. Also, since ebouite is attacked by sulphur dioxide, its use is abandoned, and a hard wood impregnated with paraffin takes its place; boxwood, dogwood, quebracho, and algarroba are instanced as being suitable.—F. SOBX.

Sulphur trioxide, or a mixture of sulphur dioxide and oxygen, and anhydrous bases; Direct manufacture of — from metallic sulphates. M. Prud'homme. Fr. Pat. 400,030, May 16, 1908.

NATURAL or artificial sulphates are heated in an electric furnace, with the formation of anhydrous bases, and either sulphur trioxide or a mixture of sulphur dioxide and oxygen, which may be used for sulphuric acid manufacture by the contact process or otherwise. If silica, alumina, or ferric oxide be added to the sulphates, the decomposition of the latter is more complete.—J. R.

Nitric acid; Manufacture of —. Chem. Werke vorm. H. Byk. Fr. Pat. 400,305, Feb. 27, 1909. Under Int. Conv., Sept. 7, 1908.

CALCIUM nitrate, in the solid form or dissolved in the least possible quantity of nitric acid, is treated with sulphuric acid, and the calcium sulphate, which is deposited,

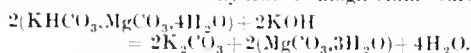
is filtered off and washed with dilute nitric acid, the washings being kept separate and used for dissolving the calcium nitrate in subsequent operations. The concentrations of the sulphuric and nitric acids used are so regulated as finally to yield a product containing as nearly as possible 59 per cent. of nitric acid.—O. R.

Sodium bicarbonate: Manufacture of —, D. Peniakoff. Fr. Pat. 400,241, Feb. 24, 1909. Under Int. Conv., Dec. 28, 1908.

CARBON dioxide is passed into a strong solution of sodium carbonate in the presence of a small quantity of ammonia or ammonium carbonate. The latter acts catalytically, combining with the carbon dioxide to form ammonium bicarbonate, which precipitates sodium bicarbonate and regenerates ammonium carbonate. The latter thus serves as carbon dioxide carrier and greatly accelerates the formation of sodium bicarbonate.—O. R.

Potassium-magnesium carbonate: Process for the decomposition of — for the recovery of potassium carbonate. Salzbergwerke Neu-Stassfurt. Ger. Pat. 211,798, Sept. 13, 1908.

THE solution containing the potassium-magnesium carbonate is treated at atmospheric pressure, or under increased pressure, with the calculated quantity of potassium hydroxide solution to produce normal potassium carbonate and hydrated magnesium carbonate:

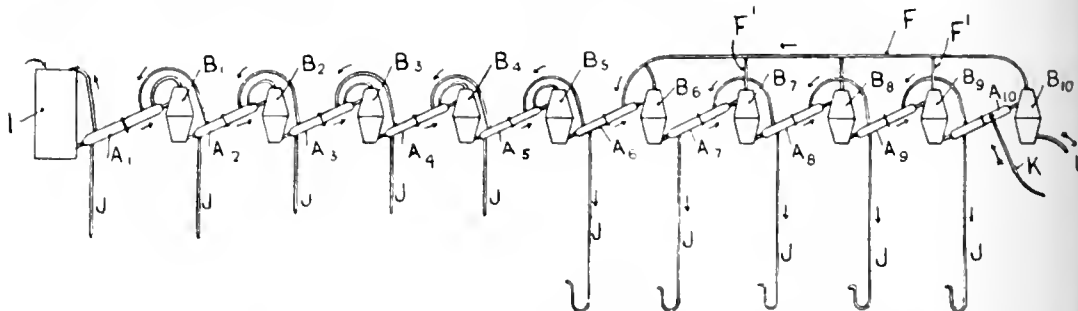


—A. S.

Lime: Apparatus for hydrating —, C. C. Kritzer, Chicago, Ill. U.S. Pat. 932,789, Aug. 31, 1909.

SEVERAL closed hydrating cylinders are so arranged, that the lime is made to travel through them successively, in opposite directions in alternate cylinders, by means of a stirring device. Water is introduced near the end where the lime enters the uppermost cylinder, and means are provided for condensing the steam developed by the slaking, so as to produce a partial vacuum and maintain a draught of air towards the vapour outlet, in a direction opposite to that of the moving lime.—F. SOBY.

[Ammonium nitrate] *Crystals: Apparatus for the manufacture of* —, R. Knowles and P. Malone, Widnes. Eng. Pat. 19,960, Sept. 23, 1908.



THE apparatus consists of a number of jacketed glass tubes, A_1, A_2, A_3 , etc., arranged alternately with separating vessels, B_1, B_2, B_3 , etc. The liquid to be evaporated is fed into the jacketed feed-tank, I, and flows from this vessel through the first jacketed tube, A_1 , and thence into the first separator, B_1 , and so on through the series, being finally discharged in a concentrated state from the pipe, L. In order to economise steam, only a few of the jacketed tubes near the discharge end are supplied with steam from an external source. The steam enters through the pipe, K, into the jacket of the last tube, A_{10} , and passes thence through the jackets as indicated by the arrows. The condensed water is discharged through the pipes, J, provided with steam traps at their lower ends. The steam given off in the glass tubes and separated in the vessels, B_2 , to B_{10} , is conveyed by the pipes, F', into the main, F, by which it is conducted into the jacket

of the vessel, A_6 . Any steam not condensed in this vessel passes on to the jacket of the vessel, A_5 , along with the steam separated in the vessel, B_5 , and so on to the vessel, A_1 , from which any uncondensed steam passes into the jacket of the vessel, I.—W. H. C.

"Sodium sulphite" and ammonium chloride: Preparation of —, Dr. Friedrich und Co., Gloeska, Germany. Eng. Pat. 11,123, May 11, 1909. Under Int. Conv., June 20, 1908.

120 parts of common salt, suspended in 180 parts of water are treated first with a little sulphur dioxide, and then with a mixture of sulphur dioxide and gaseous ammonia in approximately equivalent proportions, the liquid being kept slightly acid up to nearly the end of the reaction, so as to prevent loss of ammonia. Finally the supply of gases is regulated so that the liquid becomes neutral, the proportion of sulphur dioxide being then about 9 to 19 parts by weight to 100 volumes of the neutral liquor. The heat of the reaction causes the deposition of anhydrous "sodium sulphite," which is filtered off, and the mother liquor is cooled to $35-40^\circ\text{C}$. for the separation of the ammonium chloride.—O. R.

Magnesium salts and ammonia: Process of making —, H. B. Hunter, Norfolk, Va. U.S. Pat. 932,130, Aug. 24, 1909.

MAGNESIUM oxide and an ammonium salt are mixed with water, and the temperature gradually raised; ammonia gas is evolved during the first stages of the operation and a mixture of steam and ammonia during the later stages, the latter being condensed to ammonia solution; the magnesium salt remaining in solution is recovered by crystallisation.—F. SOBY.

Magnesium salts from dolomite: Process of extracting —, with the simultaneous production of calcium carbonate. Rheinisch-Westfälische Kalkwerke and E. Fuchs. Fr. Pat. 398,826, Jan. 26, 1909.

CALCINED dolomite is heated with a solution of ammonium chloride, in quantity about equivalent to the lime present, and the magnesia, which under these conditions remains inert, is separated by filtration from the calcium chloride formed. The liberated ammonia is absorbed by cooled calcium chloride solution, and this, at the same time or subsequently, is treated with carbon dioxide, in order that calcium carbonate may be precipitated and ammonium chloride reformed.—F. SOBY.

Boric acid glass: Manufacture of soluble —, W. Ackermann. Fr. Pat. 400,132, Mar. 3, 1909.

A PRODUCT analogous to water-glass (alkali silicate) is obtained by heating a mixture of 3 to 4 mols. of boric anhydride, 1 mol. of anhydrous caustic alkali, and the equivalent quantity of water. The product, which is a viscous liquid, is claimed to be particularly suitable as a flux or for soldering.—O. R.

Hydrosulphites: Manufacture of anhydrous —, Badische Anilin und Soda Fabrik. Fr. Pat. 400,174, Feb. 6, 1909. Under Int. Conv., Dec. 4, 16, and 18, 1908.

HYDRATED solid hydrosulphites are heated in a vacuum desiccator at 100°C . until all the water, free and combined, has been driven off. The resulting anhydrous product is

perfectly stable in air, and may be mixed with: (1), 5 to 10 per cent. of its weight of calcined soda, caustic soda, quicklime, or the like; (2), alcohol or other inert organic liquid and a small quantity of caustic soda or ammonia, to form a paste; (3), molasses or glycerin; (4), an alcoholic solution of caustic soda, or of some inert salt, the mixture being subsequently well stirred for half an hour, and the alcohol finally distilled off.—O. R.

Brine; Process for the purification of natural —. E. Fontenilles et Cie. Fr. Pat. 400,657, June 16, 1908.

THE patent relates to the removal of calcium and magnesium salts before the water is concentrated for the production of sodium chloride. The water is heated to boiling and a quantity of sodium carbonate, or bicarbonate, sufficient to convert the calcium and magnesium sulphates into the corresponding carbonates, is added. The water is well stirred after the addition and the boiling is continued for a short time. The precipitated carbonates are then removed by filtration, and the filtered water is evaporated until the sodium chloride crystallises; the salt crystals contain but a very small amount of sodium sulphate. —W. P. S.

Organic copper salts, formates, acetates, etc.; Process of manufacture of — by means of cuprosocupric oxychloride obtained by the electrolytic process of "La Cuprosa française." A. Buisine and J. A. Cousin. Fr. Pat. 400,678, Mar. 12, 1909.

THE patent is for the manufacture of organic copper salts by the action of the corresponding acids, in hot aqueous solution, on the cuprosocupric oxychloride or copper oxychloride prepared by electrolysis of a solution of alkali chloride, using a copper anode.—F. SODX.

Thiosulphate; Process for the separation of — from solutions containing free alkali. J. Meschorer. Ger. Pat. 211,882, July 26, 1908.

THE solutions are treated with a quantity of fat, fatty acids, or resins, equivalent to their alkali content, and the resulting soap separated from the thiosulphate solution. —A. S.

Sodium nitrite; Process for the manufacture of —. J. Dittrich. Ger. Pat. 212,203, Jan. 14, 1908.

QUICKLIME is slaked with a concentrated solution of sodium nitrate, the pasty mass is well mixed with sawdust, and the mixture fused. After cooling, the product is treated with water, the sodium nitrite solution evaporated to a concentration of 45° B., filtered, and the nitrite recovered by crystallisation.—A. S.

Iron carbonyls; Producing —. L. Mond, London. Eng. Pat. 17,608, Aug. 21, 1908.

IRON carbonyls are produced by subjecting finely-divided iron to the action of carbon monoxide, under considerable pressure and at an elevated temperature. The temperature and pressure to be preferred, depend on the quality and manner of preparation of the iron. A convenient mode of procedure is as follows:—Finely-divided ferrous oxide is introduced into a suitable apparatus, such as a steel tube lined with copper, which is heated to 250°–300° C.; hydrogen is passed through, until reduction is complete, and then the apparatus is allowed to cool to about 150°–170° C., and a current of carbon monoxide is passed slowly through, at a pressure of 100–120 atmos.; the iron carbonyls are condensed by cooling the gas, issuing through the exit valve, to the ordinary temperature or to 0° C. By raising the pressure to 250 atmos., and the temperature to 200° C., a better yield is obtained. —F. SODX.

Non-metallic amorphous bodies; Process of deflocculating —. E. G. Acheson, Stamford, Ontario. U.S. Pat. 931,832, Aug. 24, 1909.

THE process is for disintegrating and deflocculating amorphous bodies by mixing them with a solution or extract

of cow-dung or other analogous material, and then grinding the mass and separating the deflocculated particles.

—F. SODX.

Oxygen from air; Apparatus for separating —. J. E. Johnson, jun., Long Dale, Va. U.S. Pat. 933,462, Sept. 7, 1909.

THE centrifugal separator used is provided internally with several series of coiled tubes, the inner coils communicating with the separator. A central inlet tube connects a source of cooled compressed air with the outermost series of coiled tubes. The separator is rotated by a turbine, driven by vaporisation of the separated nitrogen. Between the turbine and the centrifugal separator are a heat-exchanger and a sleeved connection. Means are provided for separating the incoming from the outflowing fluids, and for separating the liquid oxygen from the liberated nitrogen.—W. C. H.

Salt; Manufacture of —. B. F. McTear, Lea Green. U.S. Pat. 933,572, Sept. 7, 1909.

SEE Eng. Pat. 22,327 of 1906; this J., 1907, 1279.—T. F. B.

Sulphur dioxide; Process for recovering — dissolved in water or similar liquid. Cie. Indus. des Alcools de l'Ardèche. Fr. Pat. 400,735, June 18, 1908.

SEE Eng. Pat. 9145 of 1909; preceding.—T. F. B.

Alkali thiosulphates; Process of making —. Destrée et Cie. Fr. Pat. 401,099, March 22, 1909. Under Int. Conv., May 8, 1908.

SEE Ger. Pat. 208,633 of 1908; this J., 1909, 473.—T. F. B.

Silicon nitride; Process of making —. A. Sinding-Larsen and O. J. Storm. Fr. Pat. 401,256, March 26, 1909. Under Int. Conv., March 27, 1908.

SEE U.S. Pat. 928,476 of 1909; this J., 1909, 942.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Crystallised silicates and their glasses; Relation between the refractive index and the density of some —. E. S. Larsen. Amer. J. Sci., 1909, 28, 263–274.

A STUDY of some silicate glasses and corresponding minerals in the soda-lime felspar series and in the 3-component system, $\text{CaO}-\text{MgO}-\text{SiO}_2$, shows that neither refractive indices nor specific volumes are strictly additive functions. The specific refractivity, calculated from the formula of Gladstone and Dale, $\frac{n-1}{d} = K$, in which n is the refractive index and d is the density, or from that of Lorenz and Lorentz, $\frac{n^2-1}{d(n^2+2)} = K$, is additive for the glasses and nearly so for the felspars, but when crystals are compared with glasses of the same composition, or with other crystals, the values of the specific refractivity may differ by as much as 11 per cent., being usually higher for the glasses. The above formulae appear to hold one as well as the other.—F. SODX.

PATENTS.

Quartz glass; Process for melting and working —. H. Mehner, Friedenau, Germany. U.S. Pat. 931,945, Aug. 24, 1909.

QUARTZ is heated under pressure, until very liquid, by means of one or more electric arcs in a furnace provided with reflecting surfaces, which concentrate the heat-rays on the quartz. The pressure is then reduced to that of the atmosphere, the molten material is allowed to cool somewhat, and the viscous material is worked into shape, a draught being maintained from top to bottom through the furnace.—A. G. L.

Kiln [for burning china, terra cotta, earthenware, and the like]; Continuous —. W. H. Smith, Swinton, Lanes. Eng. Pat. 19,525, Sept. 17, 1908.

IN a muffle kiln heated by gaseous fuel, fire-holes are situated near the bottom of one side of the kiln, and flues,

of the same size as, and exactly opposite to, the gas inlets, are situated in the opposite wall of the kiln, and convey the heated gases through the hollow wall and arch, back to the firehole side, and thence by way of horizontal flues to the chimney. The material to be burnt is placed on a series of trucks, which run on rails laid in the bottom of the kiln. Each truck contains a series of transverse passages under a platform, on which the goods to be fired are placed, these passages corresponding exactly in dimensions and in position with the gas inlets and flues of the kiln, when the truck has assumed its correct position in the latter, and thus serving as flues for the circulation of the heated gases. The heat is greatest in the centre of the kiln and decreases in intensity at each end. In the continuous operation of the kiln, the raw material is placed on trucks, which are moved into the kiln; each truck remains for the required time near the entrance; it is then moved along its own length and again remains in position for a specified time, and so on until it reaches the centre of the kiln, where the firing is completed, after which it proceeds in a similar manner through zones of decreasing intensity, until it emerges sufficiently cooled.—O. R.

Fusible bodies [Seger cones] from silicate mixtures for temperature determinations. Chem. Lab. für Tonind. und Tonind.-Zeit. H. Seger and E. Cramer, Ges.m.b.H. Ger. Pat. 212,496, Sept. 30, 1908.

The irregular melting of fusible bodies, such as Seger cones, used for temperature determinations, is stated to be due to the lead oxide and calcium carbonate used as fluxes in their preparation. According to the present patent, a mixture of potassium oxide and magnesium oxide is used in place of lead oxide and calcium carbonate.—A. S.

Enamelling metal ware; Substitute for tin oxide used for —. R. Weimer, Sheboygan, Wis. U.S. Pat. 932,839, Aug. 31, 1909.

THE substitute for tin oxide consists of a mixture of 70 parts of antimony oxide, 28 of sodium hydroxide, 22 of Chili saltpetre (sodium nitrate), 10 of kaolin, and 10 of barytes (barium sulphate). The mixture is "boiled," roasted, and ground.—A. G. L.

Glass or other furnaces; Means for discharging molten material from —. L. Rembaux, Maustier sur Sambre, Belgium. Eng. Pat. 25,901, Dec. 1, 1908.

SEE FR. Pat. 397,548 of 1908; this J., 1909, 795.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Asbestos deposit in the Urals. Chem. Ind., 1909, 32, 530—531. [T.R.]

IMPORTANT deposits of asbestos are said to have been discovered in the Orenburg Government in the Urals, chiefly at Peyau-Tschin and Ak-Zigit. The deposit at the latter place extends over about 21 sq. miles. The asbestos is found in large veins of serpentine embedded between a silicious schist and porphyry; outcrops of the serpentine occur in places. The veins have in general a length of from 350 to 1400 feet, but occasionally extend to as much as 2100 feet. The asbestos appears an olive-green colour in the rock, but individual fibres are pure white and very soft and woolly; the quality of the asbestos does not diminish with the depth of the deposit. The land on which the deposits occur belongs to the Baschkirs, but has been leased to the Süd-Uralische Asbest-Ges. for 40 years.—A. S.

Portland cement; Free lime in —. A mill study. A. G. Smith. J. Ind. and Eng. Chem., 1909, 1, 668—670.

SAMPLES of finished cement were taken from the four tubemills of a Portland cement factory at intervals of 1 hour during every day (24 hours) of the period June 3 to June 16, 1909. The samples were tested for free lime by White's microscopic test, depending upon the formation of crystals of calcium phenolate (see this J., 1909, 23), and were also

examined as to fineness, setting time, and soundness. The results, given in tabular form, show that the soundness of the cement, as predicted from the observations in the microscopic test, in most cases corresponded well with the results obtained by the boiling test, and the author considers the microscopic test of considerable value as an aid in controlling the manufacture.—A. S.

Magnesium oxide; Influence of the temperature of burning on the rate of hydration of —. E. D. Campbell. J. Ind. and Eng. Chem., 1909, 1, 665—668.

THE magnesite used in the experiments gave the following results on analysis: silica, 1.24; lime, 1.94; alumina and ferric oxide, 1.32; magnesia, 44.40; and loss on ignition, 51.06 per cent. For temperatures up to 1000° C. a Heraeus platinum resistance furnace was used, 16—18 grms. of the finely-ground magnesite in a magnesia crucible were heated to different temperatures, measured by means of a platinum-rhodium thermo-couple embedded in the magnesite, another couple being placed in the annular space between the crucible and the wall of the furnace. The temperature was raised gradually and maintained at the desired point for 1 hour. For temperatures above 1000° C., a specially designed platinum resistance furnace was used, and the magnesite was first burned at a low red heat to completely destroy carbonaceous matter, which would otherwise have injuriously affected the thermo-couple. After burning, the samples were ground to pass a 100-mesh sieve, and their rates of hydration determined. It was found that at 500° C. in one hour, the magnesite was not completely dissociated. At 600° C. magnesium carbonate was completely dissociated in 1 hour, but calcium carbonate was not. Magnesium oxide burnt at 600°, 700°, or 800° C. was practically completely hydrated by immersion in water for 3 days. Between 800 and 900° C. the dissociation of the calcium carbonate was complete. At this temperature, combination took place between acidic and basic oxides, with formation of silicates or aluminates, which on hydration, combined with more water than was necessary for the complete hydration of the basic oxides alone. Magnesium oxide burnt at a temperature of 1000—1100° C. showed a much lower rate of hydration, and this change became more marked with increase of temperature of burning; a sample burnt at 1450° C., or nearly the temperature required for burning Portland cement, combined with only 6.14 per cent. of the water required for complete hydration, after 18 months' immersion in water. The relation thus shown between the rate of hydration and temperature of burning of magnesia explains in some measure the conflicting views as to the injurious effect of magnesia in Portland cement. (See also this J., 1906, 1097.)—A. S.

Cementitious material; Determination of — in mortar and concrete. Framm. Tonind.-Zeit., 1909, 33, 1193—1196.

THE determination of the amount of cement present in concrete falls under three heads, according as samples of the following are available for analysis: (1), The concrete only; (2), the concrete, and either the cement or the filling material used in its manufacture; (3), the concrete and both the cement and the filling material. The determination can in any case only give approximate results. The concrete is dissolved in hydrochloric acid, and the insoluble residue is washed with hot water and extracted with sodium carbonate solution of 5 per cent. strength, which dissolves the soluble silica formed by the decomposition of the cement. The insoluble residue is ignited and weighed, and a separate test for loss on ignition is also made with another sample of the original concrete. The ratio of the weight of the insoluble residue to the weight of matter soluble in acid, after making the requisite allowance for the loss on ignition of the latter, indicates the ratio of filling material to cement in the original concrete, if its ingredients were pure quartz-sand and Portland cement only. If the soluble matter on analysis is found to contain the ordinary ingredients of Portland cement in the same proportions as in normal cement, it may safely be assumed that the

concrete consisted of pure quartz-sand and of pure cement, and that the ratio arrived at in the above estimation is a fairly reliable valuation of the concrete analysed. On the other hand, if the relative amounts of silica, iron and aluminium oxides, lime, magnesia, and sulphuric acid, found in solution, are appreciably different from the proportions corresponding to the composition of Portland cement, the filling material must have contained matter soluble in hydrochloric acid, and the analysis of the concrete only, is useless for estimating its cement content. In the second case, when a sample of the cement used is available, if the composition of the latter is found on analysis to correspond with that of the portion of the concrete which is soluble in acid, the ratio of insoluble residue to soluble matter in the concrete may be taken to represent the ratio of filling material to cement present. When a specimen of the filling material used is available, analyses of average samples are made to determine the amounts of insoluble residue, and of soluble silica and matter soluble in acid, which are present in the filling material. On then analysing the concrete as in case (1), from the amount of insoluble residue obtained, the soluble matter due to the filling material is calculated, and subtracted from the total amount of soluble matter found. The remainder gives the amount of soluble matter, which is taken to be the cement originally present in the concrete, due allowance being made for the losses on ignition, which are determined separately in each case. In the third case, where samples of the concrete and of each of the constituents can be analysed, the composition of the cement should correspond with the figures obtained by difference in the last-mentioned case, and when this is so, the results obtained represent the constitution of the concrete fairly accurately.—O. R.

PATENTS.

Building material; Manufacture of — capable of serving as a substitute for wood or the like. K. Winkler, Zürich, Switzerland. Eng. Pat. 25,637, Nov. 27, 1908. Under Int. Conv., Dec. 6, 1907.

FIBROUS material, such as moss-peat or the like, is comminuted and then kneaded with a 10 per cent. solution of a drying substance, such as calcium sulphide, with, if desired, 2 to 10 per cent. of lead sulphide, or the like, and then strongly heated. It is next mixed in a heated ball mill with a binding material, such as sulphur, resin or asphalt, either alone or with a filling substance such as silica, dolomite, kaolin, basic copper and lead carbonates, etc. After being minutely divided during mixing, the heated material is moulded into suitable forms under a pressure of about 300 atmospheres. If the material is required to withstand the action of water, in addition to the binding material, up to 15 per cent. of resin distillate or the like, with or without drying oils, is added. The strength of the material may also be increased by the use of metallic skeletons.—F. R.

Wood; Art of colouring or transforming —. W. A. Hall, New York. Assignor to American Mahogany Co. U.S. Pats. 933,435 and 933,436, Sept. 7, 1909; and W. A. Hall, U.S. Pat. 933,437, Sept. 7, 1909.

(1). Wood is impregnated throughout with a colouring solution, the constituents of which have varying powers of penetration and capillarity, so that a comparatively large amount of colouring matter is deposited in the outer portions of the wood, and a relatively lesser amount in the inner portions. (2). A colouring solution is forced into and throughout the wood by heavy pressure, after the air has been removed from the pores by placing the wood in a vessel from which the air is exhausted. The surplus colouring solution is drawn from the vessel, and the impregnated wood is subjected to the action of steam in order to diffuse the colour in the wood. It is claimed that the colouring matter is properly diffused throughout the wood and the grain cells are fully developed, so that in the final product the harder heart portions of the wood are of a colour as dark as or darker than the sap portions. (3). Wood is boiled under pressure at temperatures above 220° F. in an alkaline colouring

solution containing saccharine matter, by which process the heart portions of the wood are coloured to darker shades than the sap portions.—W. C. H.

Granulators for molten slag or other substances. W. R. Warren, New York. Eng. Pat. 1236, Jan. 18, 1909.

A GRANULATING house is so arranged that a section of the periphery of a large horizontal cooling table, rotating in the open air passes through it. The molten slag, which is granulated by falling on to a revolving drum, is conveyed away by the table, and becomes sufficiently cool by its passage through the open air to permit of its removal, without agglomeration, by means of a scraper situated where the table re-enters the granulating house.—F. R.

Bricks from clay; Process for moulding — in the dry state. H. Schulte-Steinberg. Fr. Pat. 400,558, Mar. 9, 1909. Under Int. Conv., Aug. 22, 1908.

CLAY is mixed and dried by passage down an inclined rotating cylinder in which it meets hot flue-gases. The dried clay then passes through a chamber, traversed by the flue-gases on their way to the kiln, to the grinding rolls; the ground material is delivered by an elevator to the top of a shoot, from which it falls on to an inclined sieve to which a reciprocating motion is imparted. Any coarse material is returned to the rolls; the fine material falls into a hopper, from which it is automatically fed to a press, in which it is moulded dry and whilst still warm. The moulded bricks are burnt immediately after leaving the press.—A. G. L.

Calcareous stone; Process of colouring and hardening — so as to imitate natural marble and onyx. P. Charbonnier. Fr. Pat. 400,638, Mar. 10, 1909.

To imitate veined and coloured onyx, calcareous stone is first heated to 60°–80° C., and then plunged into cold 10 per cent. hydrochloric or sulphuric acid. The stone is then removed from the acid, again heated, and plunged into a solution of an acid colour in dilute alcohol heated to the same temperature, the veins or cracks produced by the acid treatment absorbing more colour than the rest of the stone. These veins may also be coloured differently by covering the stone around the veins with powdered colours, and then treating with alcohol, so as to cause the colours to permeate the veins. The stone is next hardened by immersion in a solution containing copper sulphate and hydrofluosilicic acid, and is finally polished. To imitate coloured marble free from veins, the procedure is similar, but the acid treatment is omitted; different colours may be applied, one after the other, followed by treatment with cold alcohol. To obtain white "statuary" marble, the stone is simply boiled for 15 minutes in a 20 per cent. solution of sulphuric acid.—A. G. L.

Portland cement; Waterproof — and process of making same. C. McCormick, St. Louis, Mo., Assignor to Meramec Portland Cement and Material Co., Phoenix, Ariz. U.S. Pat. 931,884, Aug. 24, 1909.

CEMENT is rendered waterproof by mixing it in the dry state with a sulphate or sulphates and an alkaline base which will form a colloidal precipitate with the sulphate when the cement is treated with water. A filling material may also be added.—A. G. L.

Cementitious compound; Fixed-colour — and process of producing the same. A. C. Horn, New York. U.S. Pat. 932,280, Aug. 24, 1909.

A CEMENTITIOUS compound having a "fixed colour" is produced by mixing a caustic alkali and a fatty acid with an iron pigment, so as to produce fatty acid salts (stearates) of the alkali and of iron, then adding an additional iron pigment, and mixing with cementitious material. The fatty acid salt of iron and the additional iron pigment should have approximately the same colour, and the specific gravity of the mixture should be greater than that of water.—A. G. L.

Portland cement; Method of making — J. M. Carrère, Assignor to Blanc Stainless Cement Co., Allentown, Pa. U.S. Pat. 932,374, Aug. 24, 1909.

A MIXTURE of calcium oxide or carbonate, a silicious material, and zinc carbonate or other zinc salt, all free from iron, is burnt, and the resulting clinker is powdered. —A. G. L.

Cement; Process for manufacturing — M. Tremblour, Birmingham, Ala., Assignor to Putnam Development Co., New York. U.S. Pat. 932,917, Aug. 31, 1909.

DILUTE sulphuric acid is intimately mixed with molten blast-furnace slag, to which calcium oxide or hydroxide may first be added. —A. G. L.

Tiles, slabs, or other finished products; Manufacture of — of hard material. J. J. Loke, Scheveningen, Holland. Eng. Pat. 23,010, Oct. 29, 1908.

SEE Fr. Pat. 396,468 of 1908; this J., 1909, 602. —T. F. B.

Porous materials [from slab] suitable for heat insulation, filtering, buidling, and like purposes; Manufacture of — H. Senn, Szczakowa, and D. Klüger, Tezelnia, Austria. Eng. Pat. 8876, April 11, 1909.

SEE U.S. Pat. 930,801 of 1909; this J., 1909, 984. —T. F. B.

Porous product and process for obtaining it. H. Senn and D. Klüger. Fr. Pat. 398,963, Jan. 30, 1909.

SEE U.S. Pat. 930,801 of 1909; this J., 1909, 984. —T. F. B.

Stone composition; Artificial — B. Hövermann, Salzwedel, Germany. U.S. Pat. 932,706, Aug. 31, 1909.

SEE Eng. Pat. 15,797 of 1908; this J., 1908, 1206. —T. F. B.

Wood; Process for preserving — W. B. Chisolm. Fr. Pat. 400,885, March 16, 1909.

SEE Eng. Pat. 5908 of 1909; this J., 1909, 984. —T. F. B.

Cementitious materials; Preparation of — W. E. Lake, London. From Henry S. Spackman Engineering Co., Philadelphia. Eng. Pat. 18,345, Sept. 1, 1908. Addition to Eng. Pat. 10,110, May 9, 1908.

SEE Addition of Sept. 1, 1908, to Fr. Pat. 390,194 of 1908; this J., 1909, 244. —T. F. B.

Cement; Preparation of materials by a wet method, particularly for making — F. L. Smidth and Co. Fr. Pat. 398,845, Jan. 27, 1909. Under Int. Conv., Feb. 27, 1908.

SEE Eng. Pat. 2599 of 1909; this J., 1909, 984. —T. F. B.

X.—METALS AND METALLURGY.

Cast-irons; The "growth" [permanent enlargement] of — after repeated heatings. H. F. Rugan and H. C. H. Carpenter. Iron and Steel Inst., Sept., 1909. [Advance copy.]

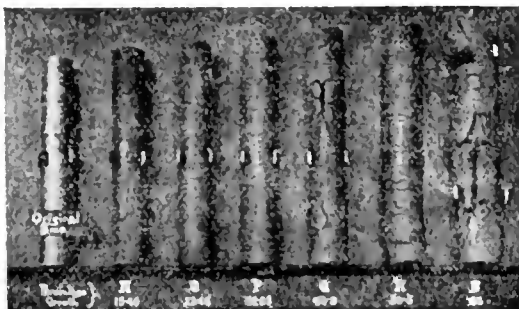


Fig. 1.

ALLOY S



Fig. 2.

THE authors have investigated the causes of the "growth" (permanent increase in volume) of cast-irons such as are used in annealing ovens, furnace grates, etc. In a preliminary experiment it was found that bars of grey iron started growth at about 650° C., and reached their maximum after three hours at 730° C., and that alternate heating and cooling was necessary to the growth, seventeen hours' continuous heating having no greater effect than three hours. For the investigation, bars were accurately machined to 6 in. in length, and 1 in. diameter, being measured by calipers to 0.0001 of an inch. They were heated for four hours at 900° C. in an iron retort, enclosed in a clay muffle; the lid of the retort was well luted on, and carried an iron tube for the thermo-junction. Cooling taking place overnight, the measurements were made in the morning. The first series employed were commercial grey irons used for annealing ovens. After heating 99 times, the increase was 35 to 37 per cent. in volume, and 8 per cent. by weight. The second series (B to I) consisted of cast-irons varying from 4.03 to 0.15 per cent. of carbon, and about 2 per cent. of silicon, with small constant amounts of manganese, sulphur and phosphorus. Samples were cast in both sand and chill moulds, and were white irons giving, after heating for 50—90 times, a permanent shrinkage in volume and weight of not more than 1 per cent. This composition indicates the practical solution of the problem. The third series (J to M) varied from 4.6 to 3.0 per cent. of carbon, 0.5 to 0.79 per cent. of silicon, about 1 per cent. of manganese and low sulphur and phosphorus. J was a grey iron, K and L were white irons with a little graphite, and M a white iron. The first three grew steadily for sixty-eight heats, reaching 11, 7 and 6 per cent. increase respectively. M contracted during ten heats, and then increased in volume, finally reaching 6.2 per cent. after 58 heats. A set of short control pieces of M similarly heated showed that temper-carbon, previously absent, began to be formed at the tenth heat, and increased in quantity during the rest of the heats, showing that, as with graphite, temper-carbon is a factor in promoting growth—that is, increase in volume. The following table gives the fourth series, designed to determine the influence of silicon, with the results of the treatment. In the series N

to S, the alloys Q, R, S containing no combined carbon, the graphite content was nearly constant.

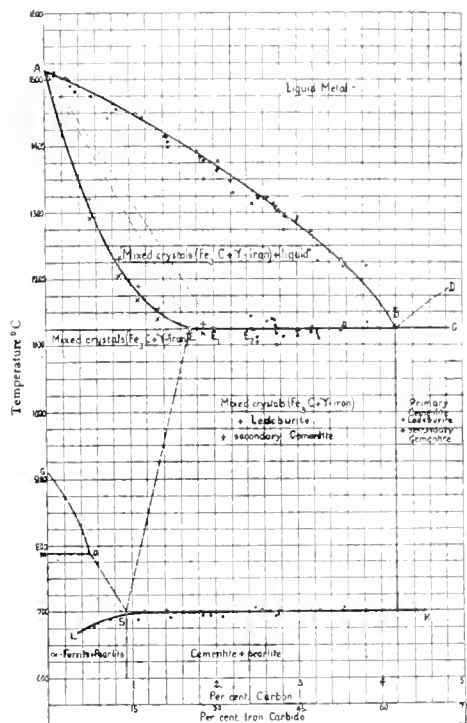
Alloy.	Combined carbon.	Graphite.	Silicon.	Percentage growth on heating.	Percentage increase in weight.	Percentage loss of carbon 25 heats.
N.....	0.64	3.34	1.07	15.40	0.65	3.84
O.....	0.68	3.30	1.79	23.46	1.89	39.7
P.....	0.30	3.49	2.06	32.85	3.62	31.4
Q.....	nil	3.76	4.20	43.9	9.59	26.3
R.....	nil	3.79	4.83	59.5	10.25	14.3
S.....	nil	3.38	6.14	63.0	13.20	nil
T.....	0.17	nil	0.65	-0.025	-0.04	—
U.....	0.18	nil	1.10	0.000	-0.03	—
V.....	0.19	nil	2.71	+ 0.394	-0.02	—

while the silicon content varied from 1.07 to 6.14 per cent. The "growths" are fairly proportional to the silicon content, the greatest being obtained with one of the alloys containing no combined carbon. The alloys, Q, R, and S, were all cracked, and greatly distorted (see Fig. 1). As these alloys were cut at haphazard from the casting, and P and S were near the gate, a duplicate set was cut from the top of a "riser." The rate of growth of these was much slower, although the final increase of volume was about the same. It appears therefore that the dissolved gases play a physical part in the growth; at the same time the increase in weight of the alloys shows that the external gases probably play a physical and a chemical part. This increase in weight can only be explained on the assumption that the ferrous silicide is oxidised by carbon dioxide into ferrous oxide and silica, which greatly overbalances the decrease in weight due to oxidation of carbon, which latter diminishes with increasing silicon content, and was nil at 6 per cent. It is also suggested that some part of the increase is due to oxidation of iron itself. Microscopic examination of control specimens of 3 per cent. carbon content, heated with the other bars and removed after from one to twenty-one heats, showed that the graphite was removed from its original position; the spaces so left showed oxidation, and numerous small holes were formed, the whole structure being revolutionised. The alloys, T, U, V, contained no graphite, and the results of fifteen heats are given in the table. These results show that carbon, in the form of either graphite or temper-carbon, is an important factor, in addition to the silicon-content. The authors now investigated the influence of gases. A bar of alloy S, heated *in vacuo*, gave 1.11 times its own volume of gases consisting of 87.5 per cent. of hydrogen, and 12.5 per cent. of nitrogen. It shrank in volume 0.04 per cent. The same alloy had grown 62 per cent. in volume, and 12.26 per cent. by weight, when heated in the muffle. A similar bar was now heated to 900° C. *in vacuo* till it ceased to evolve any gas; it was then heated in the muffle. After 21 heats it had grown 4.08 per cent.; after 30 heats, 9.7 per cent.; but then grew rapidly, reaching 67.7 per cent. at the fifty-third heat (see Fig. 2). It also had not cracked, and kept its cylindrical form perfectly. On now heating *in vacuo* it evolved gases, consisting of 33 per cent. of carbon dioxide, 14.54 per cent. of carbon monoxide, 42.50 per cent. of hydrogen and 9.96 per cent. of nitrogen. A similar experiment with alloy N showed an increase of 11 per cent. on heating *in vacuo*, which seems to show that the dissolved gases in a close-grained alloy (N) can cause growth because of their difficulty in escaping, as contrasted with (S), an open-grained alloy. The authors conclude that a white cast-iron of about 3 per cent. of carbon and other non-ferrous constituents as low as possible will not "grow;" an alloy of higher carbon content tends to deposit temper-carbon and will ultimately increase in volume, although not to a great extent. The main causes of "growth" are:—1. The disintegration of the material due to the oxidation of the ferrous silicide into ferrous oxide and silica by the furnace gases. 2. In the case of close-grained irons, to the evolution of dissolved gases.—A. H. C.

Iron-carbon alloys; Development of the equilibrium diagram of the —. F. Wüst. Metallurgie, 1909, 6, 512—531.

THE author traces the history of the development of the

iron-carbon diagram, and then communicates some results recently obtained in his own laboratory. For the eutectic



mixture (mixed crystals—cementite) which constitutes pure white cast-iron with 4.2 per cent. of carbon, the name "ledeburite" is proposed. A new diagram (see Fig.) is proposed, which differs from that of Goerens-Benedicks (1907) chiefly in that the point, E, which marks the maximum carbon content of the solid mixed crystals is shifted from 2.0 to 1.7 per cent. of carbon; in the convex shape of the line, AE (pure iron to E); and in the upper limit, LS, of the pearlite + ferrite field, which is made to slope downwards towards the left. The author believes that in molten iron practically all the carbon is present as carbide, and that two forms of graphite are produced on cooling, the first ("Garschaungraphit") from the carbide separating out from the still liquid melt, and the second ("Erstarrungsgraphit") from carbide present in the metal, either during or immediately after solidification. In addition, elementary carbon exists as hardening carbon, formed only after complete solidification has taken place. Graphite can be formed even if no foreign substances (silicon, manganese, etc.) are present. Foreign substances influence the formation of graphite in two ways: Directly, by entering into the constitution of the carbide and accelerating its rate of decomposition (e.g., silicon, nickel, aluminium), or retarding it (e.g., manganese, chromium, tungsten); and indirectly, by altering the solubility of cementite in liquid or solid iron, and consequently altering the quantity of carbide which separates out. The influence of foreign substances on the formation of hardening carbon is due to similar causes. Decom-

position of the carbide in the solidified metal is favoured by prolonging the time of cooling and takes place with absorption of heat. In titanium also, graphite may be present in two forms.—A. G. L.

Pearlite; A new structural form of —. C. Benedicks. *Metallurgie*, 1909, 6, 567–568.

The author describes the occurrence, in a grey pig-iron, of a form of pearlite, in which the well known layers of cementite are broken up into strings of beads, the longer axes of which are at right angles to the original direction of the laminae. With only casual observation these rows may be mistaken for lamellar pearlite, but are quite distinct at high magnifications (1500 diam.). The term, beaded-pearlite, is suggested for this modification, and it is shown to be a transition form between lamellar and granular pearlite. Three microphotographs illustrate its characteristics.—A. H. C.

Steels; Constitution of carbon-tungsten —. T. Swinden. *Iron and Steel Inst.*, Sept., 1909. [Advance proof.]

SAMPLES of three of the steels used in a previous work by the author on carbon-tungsten steels (this J., 1907, 694) were submitted to various heat-treatments and either quenched or air-cooled. The steels contained about 3 per cent. of tungsten and 0.57 per cent., 0.89 per cent., and 1.24 per cent. of carbon respectively. The quenched specimens showed that the constitution of the steels above the "lowering" temperature was preserved down to the lowered A_1 temperature, irrespective of the rate of cooling, while the specimens heated to above the "lowering" temperature, cooled slowly to below the lowered A_1 point, and then quenched, gave the ordinary constituents—ferrite, pearlite, and cementite—found in normal steels. Owing to their small size the air-cooled specimens were cool enough to handle two or three minutes after they had been withdrawn from the furnace, and those heated to 1250° C., *i.e.*, above the "lowering" temperature, all preserved a portion of the martensite, the amount being in proportion to the carbon content of the steel. On the other hand, when heated to 1000° C., *i.e.*, below the "lowering" temperature, and air-cooled, the steels showed no sign of hardening. The change at the lowered A_1 point was more sluggish than at the normal A_1 , and 3 per cent. of tungsten was thus sufficient to produce an air hardening effect. The author is of the opinion that the change that occurs at the "lowering" temperature is the solution of a tungsten compound, probably Fe_3W , and that this compound is reprecipitated at the lowered A_1 , iron carbide immediately separating also. Tests were also made of the resistivity of the heat-treated specimens, the increased resistivity of tungsten steels quenched from above the "lowering" temperature lending support to the author's theory.—O. F. H.

Copper-clad steel—a new metallurgical product. W. Tassin. *J. Ind. and Eng. Chem.*, 1909, 1, 670–673.

THE author states that by a recent process (see Eng. Pats. 8913 and 8913A of 1906; this J., 1907, 532, 696), it has been found possible to successfully weld copper to steel in such a manner that the product will stand the ordinary methods used for working metals. The two metals when welded, have, it is stated, practically the same rate of flow, *i.e.*, on rolling the copper-clad steel, the relative thicknesses of the two metals remain the same. The strength of the copper-clad steel is said to be, under certain conditions, equal to, if not greater than, that of steel. The compound metal resists corrosion just as copper does, except at the ends where both steel and copper are exposed, but even here, after a certain time, corrosion practically ceases. It is believed that after a certain amount of corrosion has taken place, a thin film of copper, mixed with some copper oxide, becomes deposited between the rust and the underlying steel, and that this film so long as it remains unbroken, prevents further corrosion.—A. S.

Iron ores; Arbitration analyses of —. Committee appointed by the "Verein deutscher Eisenhüttenleute." *Chem.-Zeit.*, 1909, 33, 959–960.

COMPARATIVE analyses of carefully sampled iron and manganese ores in 9 works and 6 consulting laboratories showed that large differences, amounting to several per cent. for lime and manganese, are occasionally found between the different analyses. In general, the results of the works laboratories were more concordant than those of the consulting laboratories, although the mean of both series was usually very similar. It is suggested that in many cases it would be best for buyer and seller to have their own analyses made after mutual agreement as to methods of analysis; results which diverge more from each other than 0.5 per cent. for iron, manganese, or silica, and 0.05 per cent. for phosphorus should be entirely disregarded.—A. G. L.

Gold precipitates and bullion; Smelting of — with oil fuel. A. Yates. *J. Chem. Met. and Min. Soc. S. Africa*, 1909, 9, 429–431.

Two Fabre du Faure tilting furnaces are employed at the Redjang Lebong gold and silver mine, Sumatra, for smelting the precipitates obtained in the usual zinc boxes in connection with the cyanide extraction plant. In April, 1908, they were adapted for the use of kerosene oil as fuel, whereas previously a mixture of coke and charcoal had been employed. The furnaces were filled in with firebricks, leaving a space of two inches around the sides and bottom of the retort. Half of an old retort, cut longitudinally, was fixed as a hood over the neck of the retort, resting on the brick in the flue at the back. Just below the retort, and centrally in the furnace, two pieces of 3-in. pipe were built in the brickwork, and in these the "Billow" atomisers, class "F M." of the National Supply Co., Chicago, were placed, their brass shells being protected by a cover of 2-in. piping screwed on them, and projecting 1 in. in front. A 20-gallon oil tank was placed 18 feet above the atomisers, and connected to them by flexible steel tubing. Air was delivered at 40 lb. pressure through a 2-inch main with $\frac{3}{4}$ -inch branches and $\frac{1}{2}$ -inch cocks. The air was heated by having 14 feet of the main coiled in the stack at the junction of the two furnace flues. A 2-inch mica sight hole was fitted in front for observing the behaviour of the atomisers. Each furnace dealt with 1200 lb. of precipitate per day. During May, 1908, one gallon of oil for every 12.47 lb. of roasted precipitate was used; the time occupied was 60 hours as against 140 hours when using coke and charcoal, that is, a smelter and four boys were working 6 days a month instead of 14 days as previously. The author gives the full log return for the months of March and May, that is, before and after the introduction of oil fuel.—A. H. C.

Gold; Adsorption of — by charcoal from aqueous solutions of its compounds. S. Brussow. *Z. Chem. Ind. Kolloide*, 1909, 5, 137–138.

POWDERED bone charcoal, wood charcoal, coke, and retort graphite were used with solutions of gold salts, usually the chloride. The limits of the adsorption were not determined; the gold solution was either shaken with, filtered through, or allowed to stand in contact with, the powdered adsorbent. 0.2 gm. of gold chloride in 100 c.c. of water was completely adsorbed on shaking a few times with 1 gm. of bone charcoal, dried at 110° C. On filtering a solution of gold chloride, containing 0.066 gm. of gold, in 2285 c.c. of water, through a layer of 1 gm. of powdered bone charcoal, the gold was completely adsorbed; gold was adsorbed in a similar manner from solutions of the bromide, iodide, and gold-potassium cyanide. It was also adsorbed in presence of the salts contained in sea-water. Similar results were obtained when the bone-charcoal was replaced by wood-charcoal. Gold adsorbed by charcoal was readily redissolved by treatment with *aqua regia*, chlorine-water, or bromine-water. Coke and retort graphite also adsorbed gold

from its solutions. The chlorine of gold chloride is stated to have remained "almost entirely" in solution in the liquid after adsorption of the gold in the above experiments, but the author states that he did not examine this question quantitatively.—E. F.

Gold-magnesium alloys. R. Vogel. Z. anorg. Chem., 1909, 63, 169—183.

THE author has prepared a large number of alloys of gold and magnesium, and gives a melting point curve on a scale of the percentage of magnesium atoms corresponding to the percentage composition by weight, which latter is also given in the diagram. Three maxima occur, corresponding to the compounds, AuMg, AuMg₂, and AuMg₃. While gold melts at 1064° C., these alloys melt at 1160° C., 796° C., and 830° C. respectively. It is to be noticed that the alloy, AuMg₂, melting at 796° C., is marked by only a very slight rise in the curve. Cooling curves of these alloys showed complete crystallisation at their melting points. The eutectic points occurred at 833° C., 782° C., 774° C., and 576° C. Up to 3 per cent. of magnesium the alloys are yellowish; above that they are of a fairly uniform grey colour. Between 5 and 20 per cent. they are brittle, with a glassy fracture; as the gold increases, the fractures become granular, and the hardness decreases in proportion to the gold present. At ordinary temperatures the alloys are permanent in the air, and only those containing free magnesium (26 to 100 per cent.) are affected superficially by moist air. Alloys containing between 20 and 26 per cent. of magnesium crumble to a brown mass on heating to 600° C., while those with little magnesium are unaffected by heating to a higher temperature. The alloys containing up to 11 per cent. of magnesium are attacked only by *aqua regia*, those with from 11 to 16 per cent. by concentrated nitric acid, and those with a higher magnesium content by dilute acids. In order to prepare the alloys, the magnesium was melted, and gold sheet added as necessary. The union was always accompanied by a very large evolution of heat, in some cases almost to explosiveness. The same characteristic occurs in the alloys of gold with zinc and cadmium, and indeed forms a series in accordance with the periodic system, the heat evolved increasing with falling atomic weight. The miscibility of the gold with magnesium in the solid state, with the formation of mixed crystals, is up to 3 per cent., and with zinc and cadmium up to 5 per cent. Twelve microphotographs illustrate the paper.—A. H. C.

Manganese, aluminium, and copper; Magnetic properties of alloys of —. A. D. Ross and R. C. Gray. Z. anorg. Chem., 1909, 63, 349—352.

COMMENTING on the paper of Heusler and Richarz (this J., 1909, 246), the authors point out that the hysteresis of these alloys varies greatly in samples that have been cooled at different rates after heating to a high temperature: slow cooling gives a material with strong hysteresis, whilst quenching produces a material almost destitute of hysteresis. The temperature from which the alloys are quenched, however, has great influence on the hysteresis: an alloy quenched from 500°, 610°, 660° C., had saturation values for I in the ratio of 4:2:3, whilst their losses from hysteresis were as 3:7:10. In the case of the second sample, cooling to —190° C. increased I by 65 per cent., while the hysteresis loss increased by only 5 per cent. These quenched alloys, free from hysteresis, are unfortunately of little use, for not only is their permeability low, but they are unstable. The effects, on Heusler's alloys, of quenching, and of the temperature of liquid air, are quite different from their effects on copper, manganese, manganese-bronze, and aluminium-bronzes with 5 per cent. and with a high percentage of aluminium, but are closely analogous to the effects on an aluminium bronze of practically the composition, Cu₃Al. The presence of the compound, Cu₃Al, is of great influence in determining the magnetic characters of aluminium-copper alloys, and it is highly probable, as Heusler and Richarz suggest, that the compound, Mn₃Al, may be of analogous importance.—J. T. D.

Aluminium; Use of — as electrical conductor. U. Del Buono. Atti Assoc. Elettrotecn. Ital., 1909, 13, 261—289.

THE author recommends the use of aluminium in place of copper as an electrical conductor in electric furnaces and for conveying high-tension currents, and especially for wires for current-transmission lines. For overhead wires the greatest economy effected by the use of aluminium is in the case of relatively short distances, with the supporting standards from 30—50 m. apart. For longer distances and with iron standards at longer intervals, more standards are required for aluminium than for copper wire, and thus the saving is somewhat less. Aluminium appears to be specially useful for conveying alternating currents to electric furnaces, the loss through eddy currents being 40 per cent. less than when copper is employed. (See also this J., 1897, 73; 1901, 133; 1904, 826).—A. S.

Tin-lead alloys. P. N. Degens. Z. anorg. Chem., 1909, 63, 207—224.

THE author has examined tin-lead alloys by the three methods, thermometric, dilatometric and micrographic. The melting-point curve shows a eutectic temperature of 181° C., which is present in alloys from 0.2 to 88 atoms of lead per cent. The dilatometer confirms the presence of this eutectic. A series of fourteen microphotographs forming a series of varying composition shows the structure of the eutectic at 23.6 atomic percentage of lead, and the existence of mixed-crystals on either side of the eutectic composition.—A. H. C.

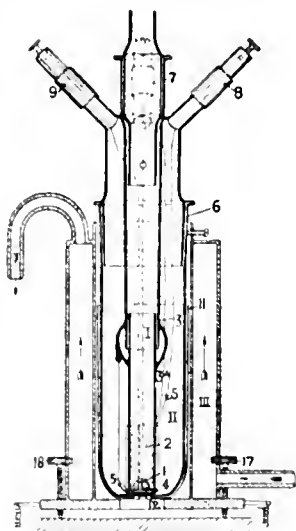
Uranium and vanadium [in ores]; Volumetric determination of —. E. D. Campbell and C. E. Griffin. J. Ind. and Eng. Chem., 1909, 1, 661—665.

THE method proposed is based on the facts that sulphur dioxide has no reducing action on uranyl solutions; and that the titration of vanadium solutions after reduction to the dioxide (V₂O₃) by zinc or aluminium and sulphuric acid requires three times the quantity of permanganate necessary for titration after reduction with sulphur dioxide. The vanadium solution after reduction with aluminium is received in a solution of a ferrie salt to prevent re-oxidation by air. From 0.3 to 0.5 gm. of the ore (e.g., a carnotite ore) is dissolved in 40 c.c. of sulphuric acid (1:5) or in a mixture of nitric and sulphuric acids. After evaporation till most of the acid (the whole of the nitric acid) is expelled, the solution is cooled, diluted, treated with excess of sodium carbonate, and then while boiling, hydrogen peroxide is added, drop by drop, until the iron is entirely in the ferrie condition. The solution is filtered, the precipitate washed with hot water, dissolved in the smallest possible quantity of sulphuric acid (1:1), and the solution treated with excess of sodium carbonate, boiled and filtered. The precipitate is washed, and the combined filtrates and washings are treated with sulphuric acid, so that an excess of 2—5 c.c. of the concentrated acid is present. The vanadium in the solution is reduced by a current of sulphur dioxide, the liquid boiled, and a rapid current of carbon dioxide passed through the boiling solution to expel the excess of sulphur dioxide. The hot solution is then titrated with permanganate of a strength not exceeding N/20. The solution (75 c.c.) is now placed in a 10-in. test-tube, into which a spiral of heavy aluminium wire is next introduced, heated to boiling, and the tube covered and placed in a boiling water bath. When the reduction is complete, as shown by the lavender or greyish colour of the solution, the tube is cooled, the spiral removed and rinsed with 50 c.c. of a solution containing 26 grms. of ferrie alum per litre of water slightly acidulated with sulphuric acid, which is allowed to run into the tube. The solution is now titrated with N/20 permanganate, being heated to 80° C. and a little sulphuric acid added, if necessary, near the end. The number of c.c. of permanganate minus three times the number of c.c. used in the first titration gives the number of c.c. required to oxidise the uranium from the dioxide (UO₂) to the trioxide (UO₃).—A. S.

Molybdenum: Determination of — in molybd. nite.
E. Collett and M. Eckardt. Chem.-Zeit., 1909, 33, 968—969.

THE following method gives accurate results in the analysis of molybdenite: 0.3 gram. of the sample is oxidised by digestion for 2—3 hours with 25 c.c. of fuming nitric acid. The liquid is then treated with 1—2 c.c. of concentrated sulphuric acid, and evaporated until white fumes appear; the residue is taken up with 50 c.c. of water, and the solution filtered whilst warm. The insoluble residue is washed with a little water, then with dilute ammonia, and finally again with water. The united filtrate and washings are treated with an excess of ammonia, iron and aluminium hydroxides are filtered off, the filtrate is evaporated to 150–200 c.c., and treated with hydrogen sulphide. Any precipitated copper sulphide is filtered off, and dilute hydrochloric acid added to the filtrate, which is then boiled. The precipitated molybdenum sulphide is filtered off; the filtrate is evaporated to dryness, ammonium salts are destroyed, and the small quantity of molybdenum usually present in the residue is precipitated as before. The two precipitates are finally ignited with sulphur in a current of hydrogen, and weighed as molybdenum disulphide, MoS_2 . Ignition of molybdenum sulphide or molybdic acid to molybdic anhydride yields low results. The sample used should be very finely powdered, the operation requiring 2—3 hours grinding, in order to ensure complete decomposition by the subsequent treatment with nitric acid.—A. G. L.

Metallographic observations in vacuo at high temperatures.
P. Oberhoffer. Metallurgie, 1909, 6, 554—567.



AN apparatus is described by means of which metals may be microphotographically examined while they are heated to high temperatures *in vacuo*, in order to determine the physical constants of the changes they undergo in special relation to their structure. The method previously employed has been to examine a large number of pieces of the metal or alloy, which have been subjected to various heat treatments usually at wide ranges of temperature, and it has not been possible to determine either the critical point of the change, or the velocity of formation of any special constituent at all accurately. With this apparatus these changes can be watched in one piece of metal. Instead of using a cinematographic outfit, as he intended, the author heated the specimen till a change was in progress, stopped the change by cooling *in situ*, and then photographed it; he then reheated to restart the change, and after an interval recooled and again photographed the stage to which the change had arrived, and so on to its completion. If desired, minute quantities of gases can be introduced into the vacuum, and the behaviour of the polished specimen examined under their influence;

hydrogen and chlorine were both utilised. The piece of metal suitably polished and etched, and in connection with a thermo-electric junction is held at the end of a quartz tube, 3x, (see fig.), around which is wound a platinum electric resistance, 2, for obtaining the necessary temperature. The quartz tube is itself held by a glass tube, 3, which is provided at the top with the necessary electric connections, 8 and 9, and is enclosed in a larger flat bottomed tube, 11, through which the observations are made, and which can be evacuated. A perforated platinum plate, 4, insulates the radiant heat from the quartz tube and the bottom of this outer glass tube. This latter is plated externally with electro-deposited copper, 11, and rests in a brass water cooler, 111., which is held by springs and suitable screws, 17, 18, to the stage of a Le Châtelier microscope. The author has studied with this apparatus the transformation of austenite to sorbite, but although the results are very promising, no definite statements can yet be made. With reference to the formation of temper-carbon it would appear that the eutectic is the main source of this constituent. Although the temperature of its initial formation is unknown, yet once such formation starts it becomes rapidly completed, and a low temperature is now effective in its completion. The presence of hydrogen increases the rapidity of its formation, but the effect on the temperature of its initial formation could not be determined. Thirty-two microphotograms illustrate the paper.—A. H. C.

Metals: Employment of ammonium nitrate in the analysis of —. L. Loviton. Ann. Chim. analyt., 1909, 14, 325.

SOME metals, *e.g.*, copper, zinc, nickel, are readily attacked by fused ammonium nitrate, whilst some others, such as iron, tin, and antimony, are not attacked at all, or only slightly. The author therefore recommends the use of fused ammonium nitrate in the analysis of certain mixtures of metals, *e.g.*, for the determination of iron in mixtures of this metal with copper, brass or nickel. A weighed quantity of the sample (2—4 grms.) is added to fused ammonium nitrate and the whole is heated until the reaction is complete. The mass is extracted with water, and the residual iron dried and weighed. The method is very expeditious and stated to be extremely accurate. (cf. Valentine's Practical Chemistry, 10th Edition, p. 197).—L. E.

Bismuth in New South Wales. Chem. and Drugg., Sept. 18, 1909. [T.R.]

THE quantity of bismuth (metal and ore) recorded as having been exported from New South Wales during 1908 is 8.75 tons, valued at £2,017, as compared with 16.35 tons, valued at £5,268, in 1907. The mines at Jingera, in the Pambula Division, owned by the International Mines, Ltd., were only in operation for a short period in the early part of the year, and the ore raised amounted to 12 tons. From the Kingsgate Mine, in the Glen Innes Division, 4 tons of concentrates, assaying 56 per cent. bismuth, were obtained. The bismuth in this mine is found in association with molybdenite. From 1880 to 1908 the total export has been 512 tons, valued at £121,899, the largest output in any single year being 55 tons 8 cwt. in 1905.

PATENTS.

Armour plate: Manufacture of —. S. O. Cowper-Coles, London. Eng. Pat. 11,142, May 22, 1908.

HARDENED steel balls, short lengths of steel tubing, or fragments of hardened steel or of carborundum are arranged in any suitable pattern, and an alloy of aluminium, with or without the addition of steel wire or ribbon, is cast about them. The plate so formed may be faced to withstand the action of sea water, by previously lining the mould with copper plates or the like, having projecting lugs to ensure perfect union; or zinc-coated iron plates may be used which form a hard superficial alloy with the aluminium.—F. R.

Steel; Process for the manufacture of — G. J. Stock, Darlington, England. U.S. Pat. 933,596, Sept. 7, 1909.

THE process is conducted in two stages, using a Bessemer converter in conjunction with a heat economiser. In the first stage the iron is melted in the converter by forcing fuel through the tuyères while the converter is in an inclined position, the products of combustion being passed through the economiser. The second stage is the ordinary Bessemer "blow," the air blast being preheated by passing through the economiser.—J. W. H.

Steel pieces; Simultaneous cementation and decarbonisation of different portions of — J. de Moya, J. A. Bernardini, and K. B. Greatbath. Fr. Pat. 398,858, April 4, 1908.

THE piece of steel is buried to a depth corresponding to the portion which is to be decarbonised, in a mixture of iron oxide and iron filings or in any other decarbonising composition. The portion intended for cementation is similarly covered completely with wood charcoal or other analogous material, this last being protected on the outside by a layer of some refractory earth well pressed down. The whole is contained within a metal casing, the layers of oxide and charcoal being kept separated by means of metal plates. In this state it is submitted to the necessary temperature in a cementation furnace.—C. A. W.

Blast furnaces; Method of drying the air required for — by calcium chloride, with concomitant automatic regeneration of the drying agent by the fumes of the hot air apparatus. F. A. Danbiné. Fr. Pat. 398,916, Jan. 28, 1909.

THE moist air from the blowing machine is passed through a receptacle containing anhydrous calcium chloride so that it emerges in an almost dry condition. After passage through a recuperating apparatus it is admitted through the tuyères of the blast-furnace in the usual way. In order to regenerate the calcium chloride, when this has become sufficiently charged with moisture, the process is reversed. The inlet through which the air arrives from the blowing machine, and that lying between the blast-furnace and recuperating apparatus, are closed, the chloride receptacle being placed in communication with a chimney. The exhaust gases from the furnace, together with sufficient air for their combustion, are admitted into the recuperating apparatus through separate ports in the base, and there allowed to burn. The hot products of combustion passing into the chloride receptacle carry away the adhering moisture and finally escape up the chimney. It is not necessary to provide a separate chamber for the chloride, which may be placed at the bottom of the recuperating chamber and there renewed as it becomes contaminated with ashes.—C. A. W.

Ores; Method of reducing — G. F. Rendall, New York, Assignor to American Reduction Co., New Jersey. U.S. Pat. 932,175, Aug. 24, 1909.

A REDUCING gas is brought into intimate contact with the ore-charge in a retort, the gas then passing into a chamber above the retort, into which heated air is also forced; the hot gases so produced are used to heat a subsequent charge of ore in a furnace communicating with the retort. The reduced ore from the retort is discharged into a closed receptacle from which the air has been exhausted. This receptacle is then sealed and cooled, after which the ore is mixed with any desired compound, and fused in a bath of molten metal.—A. G. L.

Copper ores; Process of leaching — G. C. Schneider, Freiberg, Assignor to E. Abresch, Neustadt a.d. Haardt, Germany. U.S. Pat. 932,643, Aug. 31, 1909.

COPPER ore (66 kilos.), which may previously be roasted, is treated with a solution consisting of 100 litres of water, 10 kilos. of sodium hydroxide, and 10 litres of glycerin or other organic substance capable of dissolving cupric hydroxide.—A. G. L.

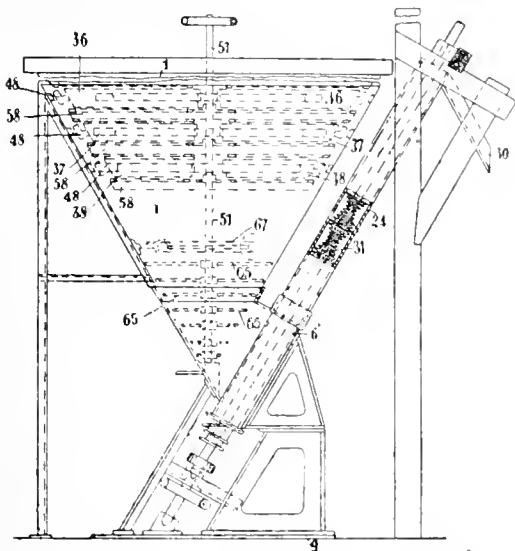
Carbonate ores of copper and zinc; Metallurgical treatment of — V. E. Laurent. Fr. Pat. 398,812, Apr. 2, 1908.

THE pulverised carbonates of copper or zinc are mixed with chloride or sulphate of ammonium and heated in a reverberatory furnace. The ammonium carbonate which passes over is collected in water, the resulting solution being employed in the extraction of a further quantity of copper carbonate or calcined calamine. This second solution of copper or zinc is afterwards mixed with that obtained by the lixiviation of the sulphates or chlorides remaining on the hearth of the furnace after the previous distillation. The zinc or copper is immediately precipitated as oxide or carbonate. The carbonate of copper may then be mixed with an alkali or alkaline-earth acetate and heated to a temperature below 300° C. The resulting acetate of copper is itself decomposed when the temperature attains 300° C., with the production of metallic copper and regeneration of alkali acetate, the latter being separated from the metal by lixiviation.—C. A. W.

[Sulphide] Ores; Process of oxidising — B. E. Eldred, Bronxville, N.Y., Assignor to Combustion Utilities Co., N.Y. U.S. Pat. 932,689, Aug. 31, 1909.

SULPHIDE ores are oxidised by exposure to currents of air diluted with regulated amounts of fully burnt products of combustion, to which combustible gas (carbon monoxide) may also be added.—A. G. L.

Ores or other solid materials; Separation of crushed — from liquids. A. J. Arbuckle and A. Osborne. Fr. Pat. 400,626, March 8, 1909.



THE apparatus, which may be employed for the separation of crushed ores from cyanide solutions, or for analogous purposes, consists essentially of a depositing tank, 1, provided, in its upper part, with one or more layers of filters, 36, 37, 38, each series being composed of eight segmental chambers of decreasing sizes from the top to the bottom layer. The mixture of ore and liquid is fed into the apparatus through an opening, 67, below the lowest series of filters, but above the normal level of deposited solid. Each filter chamber is constructed so as to be readily removable and consists essentially of a segmental frame which serves as a support for the metallic gauze or perforated plate secured at top and bottom by exterior bands. Each of these chambers is provided with a three-way cock, 48, which communicates with the interior between the layers of filtering material. By this means the chambers may be thrown into communication with an aspirating pump, so that a more rapid motion of the liquid through the interstices of the filters is produced, or, conversely, a counter-pressure may be created when it is desired to remove any sediment from

the filtering material. The removal of the solid matter adhering to the filters is effected by means of radial scrapers, 58, which rotate on a vertical shaft, 51, passing down the centre of the apparatus. These scrapers, which are arranged so as to travel between the several layers of filter-chambers, are provided with one or more bands of thin metal which pass over the filtering surface and remove the deposited solid. At the bottom of the apparatus a series of chambers or compartments, 6, is constructed at the side. The sediment is distributed between these compartments by means of radial arms, 65, fixed on the lower part of the shaft, 51. Each compartment forms the lower part of a screw conveyor, 31, enclosed in a tubular casing, 24, and these conveyors provide for the removal of the residual ore at 30.—C. A. W.

Ores of precious metals; Treatment of —. Clancy Metals Process Co. Fr. Pat. 400,770, March 13, 1909.

THE pulverised ore is submitted to the action of a solution containing cyanide, a soluble iodide, and a substance capable of producing nascent oxygen in presence of the mixture, such as a soluble bisulphate, ozone, or nitrogen peroxide. The process is hindered if the solution be too strongly acid, but goes forward in feebly acid solutions. The most suitable proportions of the constituents must be determined by preliminary trials, but in practice the mixture may be composed as follows:—Potassium cyanide, 450 grms.; potassium iodide, 225 grms.; sodium bisulphate, 1350 grms.; lime or soda, 225 grms.; the whole dissolved in 900 kilos. of water and employed in the proportion of two parts of solution to one of ore. The same solution may be used over and over again provided the strength in cyanide and bisulphate be maintained constant. No further addition of iodide is necessary, the iodine being regenerated by the bisulphate added from time to time. Between each operation it is desirable to pass the liquid over zinc shavings in order to extract the dissolved metals. The bisulphate may be replaced by ozone or by nitrogen peroxide, the continuous regeneration of the iodine proceeding in an exactly analogous manner. Refractory ores containing reducing agents (such as iron sulphides) or tellurium may be treated at once by the solution, no preliminary roasting being necessary.—C. A. W.

Suspended matter from liquids containing mineral value; Process of separating —. P. J. A. Maignen, Philadelphia, Pa. U.S. Pat. 932,795, Aug. 31, 1909.

SUSPENDED matter is removed from a liquid containing mineral value (dissolved metals) by adding sodium carbonate and aluminium sulphate in such proportions as not to affect substantially the degree of alkalinity of the liquid. The reagents may be added in the form of solutions.—A. G. L.

Crucible-furnace. W. S. Rockwell, Assignor to W. S. Rockwell Co., New York. U.S. Pat. 932,906, Aug. 31, 1909.

THE furnace consists of a central crucible chamber, open at the top, and two combustion chambers placed on opposite sides of the crucible chamber, each combustion chamber being provided with a burner projecting downwards into the chamber. The crucible chamber is provided with a movable cover, and means are provided for tilting the furnace.—A. G. L.

Alloy; Antifriction —. E. A. Tonedda, Albany, N.Y. U.S. Pat. 933,139, Sept. 7, 1909.

THE alloy contains relatively large proportions of lead and cadmium and a relatively small proportion of magnesium; the proportion of lead is greater than that of cadmium. The alloy of cadmium and lead is said to be hardened by the magnesium.—J. W. H.

Metals; Annealing of —. E. M. D. Hirsch. Fr. Pat. 399,977, May 11, 1908.

THE non-oxidising atmosphere, in which the metal is annealed, is obtained by means of a current of nitrogen. The gas, which may be produced as a by-product in the manufacture of liquid air, is employed in preference to carbon dioxide in the treatment of iron alloys.—C. A. W.

Zinc oxide; Preliminary preparation of — with a view to its metallurgical treatment. H. Pape. Fr. Pat. 400,547, March 9, 1909.

THE metallurgical treatment of the voluminous zinc oxide obtained by condensation is extremely difficult. According to the present patent, the oxide is subjected to a high temperature, exceeding 1000° C., in a reverberatory furnace. After two to three hours' heating, the material is obtained in lumps and solid grains of which the apparent density may be as much as five times greater than that of the original substance. The product having been cooled, and crushed if necessary, may then be smelted for the metal in the usual way.—C. A. W.

Calamines; Method of calcining and simultaneously enriching poor —. J. L. Babé. Fr. Pat. 400,727, March 12, 1909.

AS ordinary reverberatory furnace is employed, provided with an upper and lower hearth, surrounded by a chamber in which the oxide fumes are condensed. The upper hearth or roasting table is charged with a mixture of carbon and calamine which is heated indirectly through the hearth, the temperature being raised to the point necessary for reduction by a current of air drawn through the surrounding chamber. The zinc oxide fumes as they are formed, together with the other products of roasting and combustion, are drawn over a mixture of calamine and zinc oxide on the lower hearth. By the production of zinc carbonate in this way, crude calamine ores may be enriched. Any oxide passing away is condensed in flannel bags in the upper part of the surrounding chamber.—C. A. W.

Volatile chlorides, especially those of heavy metals; Process for obtaining —. F. Prior. Ger. Pat. 212,215, April 13, 1907.

SULPHIDE or oxide ores or compounds of the metals are mixed with suitable chlorides and with a solid carbonaceous fuel, and heated by means of an air-blast to the desired temperature. The process may be applied to the separation of metals which form volatile chlorides from other metals, and also to the separation of metals which form chlorides of different degrees of volatility. For example, auriferous and argentiferous ores may be mixed with fuel and with sodium chloride, and treated in the way described. The volatilised chlorides of gold and silver are preferably passed into a condensing chamber containing metallic iron, on which metallic gold and silver are deposited.—A. S.

Tin contained in the liquors obtained by the treatment of tin-plate scrap with stannic chloride or ferric chloride, or mixtures of the two; Process for recovering the —. J. Perino. Ger. Pat. 212,757, Dec. 25, 1907.

THE liquors, which contain the tin in the form of stannous chloride, are oxidised by means of air, and simultaneously or subsequently heated, whereby a portion of the tin is precipitated as basic chloride, whilst the remainder is converted into stannic chloride: $3\text{SnCl}_2 + \text{O} + \text{H}_2\text{O} = 2\text{Sn}(\text{OH})\text{Cl} + \text{SnCl}_4$. The basic chloride is removed by filtration, dried, and heated to redness in a current of air, whereby, especially in presence of ferric oxide, it is decomposed into tin dioxide and chlorine. The tin dioxide may be reduced to metallic tin, whilst the chlorine may be utilised for the oxidation of the stannous chloride (or ferrous chloride) in a further quantity of the liquor.—A. S.

Iron; Copperising —. W. G. Clark, Geelong, Victoria. U.S. Pat. 932,964, Aug. 31, 1909.

SEE Eng. Pat. 16,820 of 1908; this J., 1909, 986.—T. F. B.

Metallurgic process to produce metals or steels of all qualities. L. H. Baraduc-Muller, Paris. U.S. Pat. 933,357, Sept. 7, 1909.

SEE Fr. Pat. 389,577 of 1907; this J., 1908, 985.—T. F. B.

Furnace for the cementation of articles of iron, steel, and alloys of steel. F. Giolitti, Rome, Assignor to Soc. Anon. Italiana Gio. Ansaldo Armstrong & Co., Genoa. U.S. Pat. 933,642, Sept. 7, 1909.

SEE Fr. Pat. 392,960 of 1908; this J., 1909, 25.—T. F. B.

Iron, soft steel, and cast steel; Cementation of —. E. Jouard. Fr. Pat. 401,105, July 7, 1908.

SEE Eng. Pat. 23,958 of 1908; this J., 1909, 428.—T. F. B.

Metals, especially iron; Process for refining —. J. H. Reid. Fr. Pat. 401,136, March 23, 1909. Under Int. Conv., Sept. 9, 1908.

SEE U.S. Pat. 920,391 of 1909; this J., 1909, 609.—T. F. B.

Blast-furnace dust; Manufacture of coherent bodies from —. W. Schumacher, Osnabrück, Germany. U.S. Pat. 933,270, Sept. 7, 1909.

SEE Eng. Pat. 14,399 of 1908; this J., 1909, 889.—T. F. B.

Precious metals and other metals; Process for separating — which are combined with their gangue or enclosed therein, and apparatus therefor. P. Germain, Paris. Eng. Pat. 15,956, July 27, 1908.

SEE Fr. Pat. 391,032 of 1907; this J., 1908, 1158.—T. F. B.

Tungsten; Process for increasing the ductility of —. Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 17,611, Aug. 21, 1908. Under Int. Conv., Dec. 9, 1907.

SEE Fr. Pat. 393,595 of 1908; this J., 1909, 149.—T. F. B.

Copper and its alloys. H. C. Heide, London. From Titanium Alloy Manufacturing Co., New York. Eng. Pat. 25,035, Nov. 20, 1908.

SEE U.S. Pat. 905,232 of 1908; this J., 1909, 27.—T. F. B.

Copper matte and ore; Process for removing lead and other impurities, such as arsenic and antimony, from —, at the same time obtaining the copper as metal. Usine de Désargementation, Soc. Anon. Fr. Pat. 400,872, March 15, 1909. Under Int. Conv., May 6, 1908.

SEE Eng. Pat. 19,585 of 1908; this J., 1909, 527.—T. F. B.

Zinc ores; Process of treating —. F. T. Snyder, Oak Park, Assignor to Electric Metals Co., Chicago. U.S. Pat. 933,133, Sept. 7, 1909.

SEE Fr. Pat. 369,756 of 1906; this J., 1907, 210.—T. F. B.

Zinc ores, galvanisers' residues, and analogous materials; Apparatus for smelting —. E. H. Hopkins. Fr. Pat. 400,867, March 15, 1909. Under Int. Conv., Nov. 16, 1908.

SEE Eng. Pat. 12,403 of 1908; this J., 1909, 714.—T. F. B.

Solder for aluminium. J. F. Guggenbuhl, Paris. U.S. Pat. 933,433, Sept. 7, 1909.

SEE Eng. Pat. 28,511 of 1907; this J., 1908, 689.—T. F. B.

Ore-separating process. M. Ruthenburg, Lockport, N.Y. U.S. Pat. 933,491, Sept. 7, 1909.

SEE Eng. Pat. 28,191 of 1907; this J., 1909, 26.—T. F. B.

Ores; Process of treating —. A. A. Lockwood and M. R. A. Samuel, London. U.S. Pat. 933,717, Sept. 7, 1909.

SEE Fr. Pat. 398,660 of 1909; this J., 1909, 889.—T. F. B.

Crucible furnaces. Kroeschell Bros. Co. Fr. Pat. 398,805, Jan. 25, 1909.

SEE U.S. Pats. 910,091 and 911,271 of 1909; this J., 1909, 207, 247.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Report of British Association Committee on electro-analysis. See XXIII. Inorg. Quant.

Electrolytic determination of thallium. Morden. See XXIII. Inorg. Quant.

PATENTS.

Batteries; Electric galvanic —. G. Schauli, London. Eng. Pat. 14,609, July 9, 1908.

THE negative element of the battery consists of a number of zinc plates, formed from pressed sheet zinc, which may or may not be corrugated on one side, the sheets being connected together by a cast zinc frame or zinc strips. The positive element consists of plumbago and charcoal or charcoal and manganese dioxide attached to a central carbon rod, and surrounded by a paste or mixture of ammonium chloride, other metallic chlorides or lime salts, and zinc chloride. The electrodes are placed in an electrolyte composed of "amylon," and exciting salts such as platinum ammonium chloride, zinc ammonium chloride, and alum.—B. N.

Conductors; Electric —. P. MacGahan, Pittsburg, Pa., U.S.A. Eng. Pat. 23,007, Oct. 29, 1908. Under Int. Conv., Nov. 8, 1907.

A CORE of suitable metallic conducting material, such as copper, surrounded by a different conducting material, such as aluminium, is drawn through rolls and dies until of the desired shape and size. The conductor is then passed through an electrolytic bath, capable of producing an insulating coating of aluminium oxide on the surface in the form of a thin film.—B. N.

Furnace; Electric —. J. A. Hay, London, Assignor to American Electric Furnace Co., New York. U.S. Pat. 932,469, Aug. 31, 1909.

THE crucible or hearth of the furnace is provided with a passage for limbs of the core and a winding or windings for the primary, the passage being furnished with a metallic shield having a radiation surface, in the form of ribs, of greater length than the axial diameter of the shield itself, the total area of the surface being greater than the normal surface area of the passage.—B. N.

Ozone; Process of producing —. J. F. Place, Glen Ridge, N.J. U.S. Pat. 932,898, Aug. 31, 1909.

COMPRESSED air is passed through a coil immersed in liquid oxygen which is thus evaporated, the air being cooled and liquefied. The vaporised oxygen, mixed with part of the cooled air, is conducted to an ozoniser, and the oxygen lost by evaporation is replenished by that of the liquefied air.—F. SOBY.

Electrodes of magnetic oxide of iron; Process for the production of —. P. Askenasy. Ger. Pat. 212,795, July 7, 1908.

A MIXTURE of finely divided iron and solid oxygen-yielding substances, such as chlorates or perchlorates, with or without the addition of a diluent (e.g., iron oxide) is brought to reaction in any suitable manner in a mould of the shape of the electrode it is desired to produce. The magnetic oxide of iron produced is melted by the heat of the reaction, and solidifies in the desired shape.—A. S.

Arc flames; Process for the production of quietly burning —. Kunheim und Co. Ger. Pat. 212,881, May 8, 1907.

WHEN a current of gas is passed through a conduit in which an arc has been produced, the arc travels along the electrodes in the direction of the gas current. If, however, a force of equal intensity be exerted in the opposite direction, a condition of equilibrium is attained, and the arc flame burns quietly. In such quietly burning arc

flames, the aureole, or decomposition zone, disappears almost entirely. The force opposed to the current of gas may be an electro-dynamic one, or the "driving power" of the hot gases from the arc may be utilised, *e.g.*, by leading the current of gas to be treated downwards through the reaction chamber. According to the present patent the intensity of one or of both of the opposing forces is made to decrease in the direction of its action; this may be effected for example by making the conduit in which the arc is produced of increasing cross-sectional area in the direction of flow of the current of gas. In this way, accidental variations in the intensity of the forces cause merely a displacement, but not destruction of the equilibrium.—A. S.

Electric cells. J. Spiliotopol, Berlin. Eng. Pat. 18,115, Aug. 28, 1908.

SEE Ger. Pat. 205,089 of 1905; this J., 1909, 148. Aluminium may be used as cathode in place of tin.

—T. F. B.

Furnace; Electric ——. J. B. Trillon, Assignor to Soc. Electrochimique du Giffre, St. Jeorre, France. U.S. Pat. 932,835, Aug. 31, 1909.

SEE Fr. Pat. 370,051 of 1906; this J., 1907, 210.—T. F. B.

Electric transformer-furnace. O. Frick, Saltsjöbaden, Sweden, Assignor to The Gröndal Kjellin Co., Ltd., London. U.S. Pat. 933,169, Sept. 7, 1909.

SEE Fr. Pat. 369,267 of 1906; this J., 1907, 157.—T. F. B.

Electric furnaces for treating gas or gaseous mixtures. Salpetersäure Industrie-Ges. Fr. Pat. 400,771, March 13, 1909. Under Int. Conv., May 22, 1908.

SEE Eng. Pat. 8443 of 1909; this J., 1909, 715.—T. F. B.

Gases; Art of treating — electrically. O. Moscicki, Gambach, Switzerland. U.S. Pat. 933,094, Sept. 7, 1909.

SEE Fr. Pat. 380,614 of 1907; this J., 1908, 22.—T. F. B.

Electric arcs of great length; Process for producing ——. Centrals. f. Wissensch.-Techn. Untersuchungen. Fr. Pat. 398,930, Jan. 29, 1909.

SEE Eng. Pat. 2216 of 1909; this J., 1909, 661.—T. F. B.

Electric flame arcs of high tension in series in a high tension circuit; Process for increasing the efficiency of ——. Salpetersäure Industrie-Ges. Fr. Pat. 400,745, March 12, 1909.

SEE Eng. Pat. 6429 of 1909; this J., 1909, 943.—T. F. B.

Regenerating blackened carbon filament electric lamps. Eng. Pat. 8283. See II.

(B.)—ELECTRO-METALLURGY.

Ore analysis; Application of graded potentials to ——. D. F. Calhane and J. C. Woodbury. J. Amer. Chem. Soc., 1909, 31, 1048—1051.

THE following form of procedure was found to be useful for the analysis of ores containing much lead and smaller quantities of silver and copper, together with iron, aluminium, magnesium, and calcium. The actual ore used in the experiments was a carbonate. The electrolytic cell consisted of a platinum crucible weighing 45 grms., in which was placed concentrically a smaller crucible weighing about 16 grms. The smaller crucible was supported by a device made of a thread spool on the end of a wooden rod; contacts of thin copper secured in the lower end of the spool pressed it against the inner walls of the crucible, holding it in place and making electrical connection with the solution. The capacity of the space between the two crucibles was about 30 c.c. Two grms. of the ore were dissolved in nitric acid and any remaining free acid was neutralised. Thirty c.c. of nitric acid of sp. gr. 1.42 were then added, the solution was diluted to a volume of 250 c.c., and 25 c.c. of this solution were placed in the space between the two crucibles. With an E.M.F.

of 1.4 volts the silver was deposited in two hours. After the silver had been rinsed, dried, and weighed, the electrolysis was continued over-night at a pressure of 2 volts, the deposited copper and lead dioxide being then washed, dried, and weighed. The lead peroxide was dried at 160—180° C., the temperature being raised slowly and kept at the higher point for about 1 hour. During the last half hour of the silver deposition, it was necessary to keep the potential carefully at 1.4 volts to avoid resolution of silver by the nitric acid present.—W. P. S.

Steel; Treatment of — in electric furnaces. H. M. Howe. Eng. and Min. J., 1909, 88, 400—406.

THE author compares the results of steel production from pig iron in electric and other furnaces, particularly with reference to the removal of phosphorus and sulphur. In electric furnaces, the current is only utilised for the production of heat, the reactions being brought about in the usual manner by the addition of iron oxide, carbon, ferro-manganese, etc., the chief difference being that in the electric furnace, heat is supplied and may be maintained, without the introduction of oxygen or sulphur. Electric smelting, owing to its high cost, can only compete with the ordinary processes in the final stages of steel making, the molten pig iron being run into electric furnaces for the removal of impurities and for conversion into steel. Electric furnaces may be divided into three groups, *viz.*, arc, resistance, and combined arc and resistance furnaces, illustrations of which are given. In the Héroult and Stassano type of arc furnace, the current enters and leaves the furnace above the bath, and is liable to violent fluctuations owing to occasional short circuits caused by the making and breaking of the arc, especially during the boiling-up stage. In the Giffre and Girod type, in which the current enters above the charge and passes out through the bottom of the furnace, using the bath of metal as the lower electrode, this defect is minimised, at the possible expense of the furnace bottom. Of the resistance furnaces, the Kjellin furnace consists of an annular trough holding the molten metal, in which the current is induced by means of a central core. In the Roebling-Rodenhauser furnace, three cores and coils are used, the steel being heated in a narrow channel passing round the outside of them, and which is in connection with a central bath of the metal; a current also passes through the metal from electrodes buried in the walls. As the heat is generated in the metal, in induction furnaces, the slag, which is only heated by contact, tends to be insufficiently melted, and the rapid rotation of the metal, caused by the action of the current, retards the separation of the slag. In the Kjellin furnace, the narrow channel also renders the removal of slag difficult. On the other hand, there is no local overheating, as is the case in arc furnaces where the arc strikes the metal, and which may cause a certain amount of injury to the steel. Owing to the favourable deoxidising conditions subsequently obtainable in electric furnaces, dephosphorising can be carried on with rapidity by the free addition of iron oxide, but large amounts of phosphorus which require several successive slaggings could be more economically removed in ordinary furnaces. After oxidation of the phosphorus, the phosphatic slag is thickened with lime, or otherwise, and removed. After removal of the phosphorus, deoxidation is mainly accomplished by means of carbon, and when nearly all the iron and manganese oxides have been reduced, the carbon commences to reduce the lime, resulting in the formation of calcium sulphide, which passes into the slag: $C + (FeMn)S + CaO = CaS + FeMn + CO$. Owing to the absence of extraneous fuel, the steel can readily be almost completely desulphurised. A table is given of ten slags of greatly varying basicity, showing that, in the electric furnace, it is unnecessary for desulphurising slags to be strongly basic. Electric furnace steels are said to contain less hydrogen and nitrogen, it being suggested that the absence of the former may be due to the formation of acetylene or other hydrocarbons, owing to the presence of some calcium carbide, but the superiority of electric furnace steel over open-hearth steel is chiefly due to its greater freedom from slag and oxide.—F. R.

PATENTS.

Furnaces; Electric induction. — Röehling'sche Eisen- und Stahlwerke Ges.m.b.H. and W. Rodenhauser, Völklingen on Saar, Germany. Eng. Pat. 18,513, Sept. 3, 1908. Under Int. Conv., Feb. 26, 1908.

THE object of this invention is to reduce the magnetic dispersion which is produced in furnaces where the melting channel forms the secondary, at a relatively great distance from the iron core. The various members of the latter are composed of sheet metal laminae, which are considerably greater in width than the thickness of the assembled laminae, the core thus being of an elongated rectangular form in cross-section. The core comprises two vertical limbs, and two curved yoke-pieces abutting against the extremities of the vertical limbs, in such a way that the laminae of the vertical limbs and yoke pieces are continuous. The vertical limbs are arranged with their wider faces directed towards each other, and at such a distance apart as to afford a wide working hearth, the latter being formed by the union of the two annular channels, forming the secondary of the furnace, surrounding the vertical limbs of the core. The upper semi-circular yoke-piece is arranged in a horizontal plane, in order to give access to the working hearth, the lower yoke-piece being arranged in a plane containing the longitudinal axes of the vertical limbs, so that the latter and the yoke may be made in one piece.—B. N.

Furnaces; Electric induction. — The Gröndal Kjellin Co., Ltd., and J. Hårdén, London. Eng. Pat. 8194, April 5, 1909.

THE secondary of the furnace consists of a melting chamber in the form of an annular channel carrying the charge. This melting chamber or lining is composed of graphite or plumbago and a refractory binding material, such as fireclay, intimately mixed in such proportions, that, when starting the furnace, the primary current will induce currents in the chamber walls sufficiently strong to heat them and melt the charge by conduction. When the charge becomes a continuous conducting mass, the current will then flow through it in preference to the chamber walls. The latter may consist of almost pure graphite, containing only a small percentage of tar, molasses, or the like, when dealing with a charge of high melting point. The portions of the walls adjacent to the surfaces of contact with the charge, are enlarged, in order that these parts may carry a larger portion of the induced current. During the starting of the furnace, a portion only of the primary winding is connected across a source of constant voltage, and means are provided for putting the whole of the primary winding into the circuit when the charge is fused or heated sufficiently to become a continuous electric conducting mass. The inner surface of the melting chamber may be faced with a thin layer of magnesite or other suitable inert material, in order to avoid the introduction of carbon or silicon into the charge.—B. N.

[Pyritic] Smelting-furnace. S. B. Ladd, Washington, D.C. U.S. Pat. 931,775, Aug. 24, 1909.

THE furnace, which is intended for so-called pyritic smelting, consists of an elongated hearth containing molten matte, and provided with tuyères placed above the normal level of the bath. A conduit extends between this hearth and a fore-hearth at the level of the elongated hearth. A current of electricity for heating the matte is passed between an electrode placed in the fore-hearth and a second electrode placed in the elongated hearth. The fore-hearth is provided with a tap-hole, through which molten material is continuously removed.—A. G. L.

Furnace; Electric — for the fusion and reduction of ores. Aktiebolaget Elektrometall. Fr. Pat. 400,244, Feb. 25, 1909. Under Int. Conv., March 10, 1908.

THE ore charge is introduced through a central opening in the upper part of the furnace, which is of such an internal form, that free spaces always exist between the inclined upper surface of the material and the masonry

of the furnace. The electrodes penetrate the material in these free spaces, so that the heat is developed principally in the interior of the mass, and the masonry of the furnace is consequently protected against the elevated temperature existing in the zone of fusion. The material may be charged through an inclined rotating tube, the lower end of which fits into the opening in the top of the furnace. In an alternative form, a blast of air is introduced at the bottom of the inclined tube, in order to burn the escaping gas for the purpose of calcining the material, but in this case a separate hopper must be provided for the introduction of the reducing material, such as carbon. The arrangement is suitable for use with a polyphase current.—B. N.

Oxides and the like; Method of reducing and melting. — O. Frick, Sheffield, England. U.S. Pat. 932,459, Aug. 31, 1909.

THE material to be treated is successively introduced between electrodes in such a manner as to form a continuous conductor of "high-resistant" material. The material is reduced by causing an alternating current to flow through the "high-resistant" conductor; the reduced material falls into an annular crucible and is melted by an electric current induced in the substance within the crucible.—B. N.

Galvanising rods, tubes or the like; Electro-galvanising apparatus specially applicable for. — G. A. Beckett, Seacombe, Cheshire. Eng. Pat. 24,467, Nov. 14, 1908.

THE electrolytic bath is fitted with upper and lower anodes, and with a series of sprocket wheels, the latter being adapted to propel the rods or tubes between, and in proximity to, the anodes, and along an inclined supporting contact rail which forms the negative electrode. After leaving the last wheel, the rods or tubes are raised from the bath by a lifting device, consisting of an endless chain carrying arms which engage with the rods. Brackets fixed to the top of the tank, carry girders, from which the axes of the sprocket wheels are supported by means of suitable brackets. Vertical screws, engaging in the girders, are attached below to the upper anode, so that the height of the latter may be adjusted by turning the screws. The sprocket arms are fixed to a hinged detachable rim, which may be rapidly bolted in position on the periphery of the wheel.—B. N.

Zinc sulphate solutions to be used for the electrolytic separation of zinc; Process for removing iron from — by means of peroxides and zinc oxide. Siemens und Halske Akt.-Ges. Ger. Pat. 213,004, April 12, 1908.

MANGANESE dioxide is used for the oxidation of the iron contained in zinc sulphate solutions, with a view to the subsequent precipitation of the iron with zinc oxide. The manganese dioxide is regenerated during the electrolytic separation of the zinc from the purified solution.

—A. S.

Electroplating apparatus. The Meeker Co. Fr. Pat. 400,600, March 2, 1909.

SEE Eng. Pat. 5087 of 1909; this J., 1909, 716.—T. F. B.

Electric induction furnace. C. Grünwald. Fr. Pat. 400,864, March 15, 1909. Under Int. Conv., May 7, 1908.

SEE Eng. Pat. 3599 of 1909; this J., 1909, 800.—T. F. B.

Electric furnaces. J. H. Reid. Fr. Pat. 401,135, March 23, 1909. Under Int. Conv., Aug. 22, 1908.

SEE U.S. Pat. 917,796 of 1909; this J., 1909, 530.—T. F. B.

Gold and gold alloys; Process for the electrolytic parting of crude — by aid of asymmetric alternating currents. Norddeutsche Affinerie. Fr. Pat. 401,052, March 20, 1909. Under Int. Conv., Sept. 21, 1908.

SEE Ger. Pat. 207,555 of 1908; this J., 1909, 482.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Animal fats; Detection of some — in admixture with other animal fats by Polenske's method. L. Laband, Z. Unters. Nahr. Genussm., 1909, 18, 289—299.

From an experimental examination of Polenske's method of detecting animal fats in admixture with other animal fats by means of the difference between the melting and solidification points (this J., 1907, 1148; 1908, 1119), the author concludes that if the directions are closely followed, concordant figures may be obtained by different workers. The "difference value" obtained with different kinds of beef fat ranged from 13.65 to 14.85, the highest value being thus slightly higher (0.15) than that recorded by Polenske. A sample of fat extracted from salted American beef gave a value of 13.10, and a sample of tallow oil a value of 14.20. The "difference values" of 9 samples of lard of different origin ranged from 19.35 to 20.60, and thus fell within the limits given by Polenske (19—21). A sample of lard containing 10 per cent. of beef tallow gave a difference value of 18.60, but it was not possible to detect the presence of 5 per cent. of beef tallow, the "difference value" of the mixture in that case being 9.65, and thus within the limits for pure lard. The variations of the values given by 100 samples of pure butter fat differed considerably from the figures given by Polenske, the following results being obtained:—Russian butter, 11.50 to 16.80; Dutch butter, 16.00 to 16.65; Danish (imported) butter, 12.80 to 14.50; and Danish butter, 12.05 to 15.50. In the author's opinion the method is only valuable as a test of the purity of butter when it confirms the results of other tests, indicating adulteration. In the case of butter with medium or high saponification and Reichert-Meißl values, a high difference value cannot be regarded as a proof of adulteration.—C. A. M.

Thermal [Mauméné] test of solid fats determined by means of the thermocometer. M. Tortelli. Gaz. chim. ital., 1909, 39, II., 71—100.

THE author describes the use of the thermocometer (this J., 1904, 668) for determining the thermal (Mauméné) value of oils and fats. Tables are given showing the Mauméné values of mixtures of different oils and fats with paraffin oil, and of mixtures of olive oil with other fatty oils; the Mauméné values of animal oils at different temperatures, and of solid fats; and the ratios between the Mauméné values and iodine values of the principal oils and fats. (See also this J., 1909, 250.)—A. S.

Development of fat in the black walnut. McClenahan. See XXIV.

German East African wax. Chem. and Drugg., Sept. 18, 1909. [T.R.]

THE trade in beeswax received its impetus in 1905 from the southernmost coastal district, Lindi. The Tabora district is the chief centre both of production and of trade, and can be depended upon for a regular supply of over 50 tons of wax per annum. The total value of wax exported in 1907 amounted to £73,567, as against £44,405 in 1906. Of this increase £24,328 is accounted for by the lake ports, chiefly Muanza. The following were the quantities exported during the years 1905-6-7:

To	1905.	1906.	1907.
United Kingdom cwt.	14	1	117
Germany (three*) "	6,174	4,746	7,519
Zanzibar "	1,635	439	1,113
*Rest of Africa "	3,322	2,135	4,710

* To Europe via Uganda Railway.

PATENTS.

Fluid or semi-fluid substances [fats, margarine-emulsions, soaps, etc.]; Cooling apparatus for —. E. V. Schou, Southall, Middlesex. Eng. Pat. 1160, Jan. 16, 1909.

THE apparatus consists of two cooling rollers placed parallel and close to each other and rotating in opposite directions. The molten fat to be cooled is delivered into a V-shaped channel fitted above and between the rollers. This channel is constructed of non-conducting material, or its walls may be hollow so that hot water may be passed through them. A slot along the lower part of the channel allows the fat to flow between the rollers, the object being to keep the fat, etc., in a hot and molten state up to the moment when it is delivered on to the rollers, where it is immediately cooled.—W. P. S.

Fat; Process and apparatus for rendering — in an open boiler. G. Hönneke. Ger. Pat. 242,797, Jan. 18, 1908.

THE melting chamber is surrounded by a steam jacket and the latter is in turn surrounded by an annular clarifying chamber. The crude fat is introduced into the lower half of the melting chamber; the heavier impurities settle to the bottom and are withdrawn from time to time through a pipe, whilst the fat rises to the top, and overflows, through a filter, into the annular clarifying chamber.—A. S.

Lubricating compounds; Manufacture of —. J. E. Gill, Franklin, Pa. U.S. Pat. 932,855, Aug. 31, 1909.

A "COMPOUND OF LEAD" is heated with animal oil so as to form a homogeneous liquid; a solid animal fat is added, and, when cold, the mass is mixed with petroleum oil.—W. P. S.

Oils; Process for nitrating vegetable or animal —. F. Gehre. Fr. Pat. 398,748, Jan. 25, 1909.

ANIMAL or vegetable fats and oils, or mixtures of the same with other oils and solvents, may be converted into solid products by treating them with sulphuric acid, then with water, and afterwards with a nitrating mixture of sulphuric and nitric acids. The essential feature of the invention is the preliminary treatment with sulphuric acid and water. The products may be used in the preparation of explosives and in dyeing.—W. P. S.

Soap; Toilet cleaning —. R. Lyon, Englewood, N.J. U.S. Pat. 932,152, Aug. 24, 1909.

SOAP (one part) is incorporated with heavy precipitated chalk (two or more, preferably 3 to 5, parts).—C. A. M.

Wax-extracting apparatus. E. Köpke, Honolulu, Hawaii. U.S. Pat. 931,878, Aug. 24, 1909.

THIS apparatus consists of an open vessel divided into two communicating compartments by means of a partition. Into one of these is introduced the receptacle containing the material to be extracted, and means are provided for keeping it in position. The receptacle has a hood-shaped top provided with a spout, beneath which is a screen covering the material contained in a cage.—C. A. M.

Oil from the pulp of cotton-seed or other oleaginous material; Process and apparatus for extracting —. J. E. Mills and H. B. Battle. Fr. Pat. 398,953, Jan. 30, 1909.

SEE U.S. Pat. 913,751 of 1909; this J., 1909, 373.—T. F. B.

Detergent composition. A. Kayser. Fr. Pat. 401,119, March 23, 1909.

SEE U.S. Pats. 923,850 and 924,792 of 1909; this J., 1909, 802.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

Red lead; Physico-chemical and technical investigation of — J. Milbauer. Chem.-Zeit., 1909, 33, 950—951, 960—961.

CONTINUING his experiments on the formation of red lead from lead oxide (this J., 1909, 612), the author shows that the rapidity of rotation of the reaction tube in which the lead oxide (3.7 grms.) was heated in a current of oxygen for 3 hours at 470° C.) exerted a considerable influence on the reaction. Thus, with 130 revolutions per minute, the product contained 12.3 per cent. of red lead; with 75 revolutions, 18.4 per cent.; with 30 revolutions, 19.4 per cent.; with a stationary tube, 18.7 per cent. It is probable that these results are due to the fact that a high speed of rotation causes the lead oxide to ball together and thus to expose a smaller surface to the gas. Mercier Ann. des Mines, 1871, 19, 212) stated that agitation of the lead oxide is superfluous; in practice the mass is stirred, however, to ensure even heating. All the following experiments were carried out in a stationary tube. It was found that preheating the gas was practically without influence on the reaction. The influence of impurities was then studied: with conditions under which pure lead oxide gave a red product containing 19.1 per cent. of red lead, an addition of 1 per cent. of hydrogen or the oxygen gave 19.6 per cent. (red); 5 per cent. of nitrogen monoxide gave 18.1 (red); steam gave 19.8 (red); nitric acid vapour gave 5.96 (yellowish-brown); moist ammonia gave 2.6 (brown); 0.1 per cent. of sodium hydroxide added to the lead oxide gave 18.5 (intensely ed); 1 per cent. of sodium hydroxide gave 17.5 (intensely ed); 0.1 per cent. of lead nitrate gave 21.8 (fine pink); 0 per cent. of silver nitrate gave 20.8 (red); 10 per cent. of copper nitrate gave 20.6 (red); 0.1 per cent. of bismuth nitrate gave 17.6 (brownish); 10 per cent. of bismuth nitrate gave 17.7 (brownish); 0.1 per cent. of cobaltous nitrate gave 19.5 (brownish); 10 per cent. of cobaltous nitrate gave 10.9 (black); 10 per cent. of zinc nitrate gave 8.5 (pink); 0.1 per cent. of zinc nitrate gave 19.2 (pink); 0.1 per cent. of sodium nitrate gave 20.9 (red); 1 per cent. of sodium carbonate gave 18.0 (bright red); 1 per cent. of silica gave 17.9 (light red); 1 per cent. of barium sulphate gave 15.7 (light red); 1 per cent. of lead sulphate gave 15.5 (light red); 1 per cent. of iron oxide gave 15.7 (light red); 1 per cent. of antimony oxide gave 5.5 (light red); 1 per cent. of aluminium oxide gave 7.2 (light red); 1 per cent. of calcium oxide gave 16.5 (light red); 1 per cent. of arsenious oxide gave 15.5 (light ed); 1 per cent. of lead chloride gave 17.4 (light red); 1 per cent. of tin oxide gave 16.9 (light red); 1 per cent. of ammonium vanadate gave 17.3 (light red); 1 per cent. of ammonium platinochloride gave 21.6 per cent. (light ed); words in parentheses represent the colours of the products. Addition of 50 per cent. of finely divided silica reduced the yield of red lead from 19.1 to 1.5 per cent.; 70 per cent. of finely-divided carborundum to 2 per cent.; 90 per cent. of barium sulphate to 16.0 per cent.; addition of coarse carborundum was without effect. Formation of red lead from lead carbonate proceeds much more rapidly than from lead oxide, a maximum of 89.9 per cent. being attained after 3 hours' heating, which was not increased after 7 hours' heating, at the most favourable temperature of 470° C.—A. G. L.

Lithopone; Analysis of — J. S. Remington and C. Smith. Caoutchouc et Gutta-Percha, 1909, 6, 3259—3262.

THE following methods of analysing lithopone are suggested as being rapid, exact, and applicable to any sample. The sample is first tested for the presence of water-soluble salts of iron, zinc, calcium, and barium. A separate portion is tested for barium carbonate, the percentage of the latter being determined if necessary. For the determination of the barium sulphate and zinc sulphide, 0.5

gram. of the sample is mixed with 25 c.c. of water at 40° C.; 0.5 gram. of bromine is added, the containing flask is covered with a watch-glass, and set aside for one hour, during which it is occasionally agitated. Ten c.c. of concentrated hydrochloric acid are then added, and the excess of bromine is expelled by heat. 25 c.c. of water are next added, and the contents of the flask are boiled and filtered; the residual barium sulphate is washed, dried, ignited and weighed. The filtrate from the preceding operation is precipitated by barium chloride, and the barium sulphate is similarly separated and weighed. From this weight, the percentage of zinc sulphide in the sample is calculated. For the determination of the total zinc, 0.5 gram. of the sample is treated with hydrochloric acid, and the zinc is precipitated as carbonate, from which the total percentage of zinc oxide is obtained. The weight of zinc oxide corresponding to the zinc sulphide previously found, is deducted from the weight of total zinc oxide, the difference giving the percentage of zinc oxide present as such. If barium carbonate was found in the preliminary examination, the corresponding weight of barium sulphate must be deducted from the total weight of barium sulphate (estimated as such). The weight of barium sulphate corresponding to the barium carbonate, must also be added to the weight of the barium sulphate corresponding to the zinc sulphide. If salts of iron, calcium or barium, are present, the zinc must be separated by ammonia and ammonium sulphide. The following table shows the composition of twelve samples of lithopone of average quality, obtained from the English market, the analyses having been carried out by the above methods.

Lithopone sample.	Barium sulphate.	Zinc sulphide.	Zinc oxide.	Barium carbonate.
No.	per cent.	per cent.	per cent.	per cent.
1.....	70.12	29.02	0.73	—
2.....	70.93	26.60	1.66	—
3.....	66.40	29.36	2.70	0.98
4.....	70.60	26.28	1.42	0.17
5.....	70.65	26.52	2.26	0.32
6.....	69.74	26.24	3.36	0.13
7.....	66.70	29.64	1.55	0.36
8.....	75.32	21.54	0.35	0.13
9.....	58.16	37.42	2.14	0.22
10.....	63.28	33.92	2.18	0.31
11.....	80.80	25.68	0.28	0.22
12.....	71.30	25.06	1.30	0.25

—E. C. V-E.

Precipitation of sulphuric acid as barium sulphate. Sacher. See XXIII., Inorg. Quant.

PATENTS.

Oil inks; Processes and apparatus for recovery of ingredients of — M. S. Hopkins and C. R. Barnett, Baltimore, Md. U.S. Pats. 932,470, 932,548, 932,549, and 932,550, Aug. 31, 1909.

THE material, e.g., cloth, containing the oily ink, is washed in a closed chamber with a volatile solvent, such as acetone, the solution is passed through a filter-press to recover the pigment, and the volatile solvent is recovered from the solution of the oily vehicle by distillation. The solution of the oily ink may be mixed with a chemical capable of forming a solution or emulsion with the volatile solvent, and with a reagent capable of producing a precipitate which carries down with it the pigment, before passing into the filter-press. The vessel in which the treatment with the volatile solvent is performed, the filter-press, and the still in which the solvent is expelled, are all connected to a condenser and a vacuum pump, in order to facilitate the recovery of the solvent.—A. S.

Coloration process. B. D. Avis, jun., Wallace, W. Va. U.S. Pat. 933,522, Sept. 7, 1909.

THE surface to be coloured, preferably after being varnished, is coated thinly with mercurous nitrate, and then exposed to ammonia gas.—A. S.

Pigment; Green — and process of making the same.
F. F. Hunt, New Brighton, N.J. U.S. Pat. 932,864,
Aug. 31, 1909.

FRESHLY-PRECIPITATED ferric hydroxide is suspended in water, and treated first with a quantity of acid less than that equivalent to the hydroxide, and then with a ferrocyanide in amount equivalent to that of the acid. The product is a dark green pigment, homogeneous in colour, and free from gritty matter.—A. S.

Painting; Substitute for oil for use in —. N. Silvestrini.
Fr. Pat. 398,813, April 2, 1908.

A SOLUTION of rosin (15 grms.) in 90 per cent. alcohol (30 grms.), to which is added about 40 per cent. (by vol.) of turpentine oil.—A. S.

Fireproof paint; Manufacture of a —. H. Terrisse and C. Collignier. Fr. Pat. 398,956, Jan. 30, 1909.

A MIXTURE of ammonium-magnesium phosphate and suitable pigments is made into a paint with a vehicle prepared by dissolving linoleates or resinates of metals such as calcium, lead, etc., in a suitable solvent. The paint is fireproof owing to the property of ammonium-magnesium phosphate of evolving ammonia at 150° C.—A. S.

Carbon; Process for the preparation of finely-divided amorphous or crystalline —. M. Gollmert. Ger. Pat. 212,202, Nov. 1, 1907.

SUCH mixtures of hydrocarbons with carbon dioxide or carbon monoxide, alone, or diluted with other gases, as cannot be exploded under pressure at the ordinary temperature, are heated to a suitable temperature before ignition. The most suitable temperature and pressure must be determined by experiment. As an example, a mixture of equal parts of ethylene and carbon dioxide cannot be exploded at the ordinary temperature even when under a pressure of 12 atmospheres, but if heated to 400° C., explosion can be effected at a pressure of 6 atmospheres. In order to increase the force of the explosion, a certain quantity of oxygen or air may be added to the gaseous mixture.—A. S.

Soot; Process for the production of — by decomposition of hydrocarbons. J. Machtoff, K. Bosch, F. Closs and T. and C. Boehm. Ger. Pat. 212,345, June 14, 1908.

THE hydrocarbon mixture is introduced, in the form of a spray, into a jacketed decomposition chamber, heated by means of superheated steam or the like. It is rapidly gasified in this chamber and heated to such a degree that it can be ignited by means of an electric spark or by mercury fulminate. Means may be provided whereby the introduction of the hydrocarbon mixture into the decomposition chamber and the production of the electric spark follow one another automatically. Instead of heating the decomposition chamber, a small quantity of a gas such as acetylene, of great explosive force, may be added to the hydrocarbon mixture.—A. S.

Pigments containing naphthanthraquinone and its derivatives. Badische Anilin und Soda Fabrik. Fr. Pat. 400,632, March 9, 1909. Under Int. Conv., Sept. 3, 1908, and Feb. 10, 1909.

SEE Edg. Pat. 18,616 of 1908; this J., 1909, 532.—T. F. B.

Colouring matter for use as a pigment. Eng. Pat. 17,546. See IV.

(B).—RESINS, VARNISHES.

Resinous exudation of Aleppo pine (Pinus halepensis). M. Vèzes. Bull. Soc. Chim., 1909, 5, 931—933.

SAMPLES of the resinous exudation of *Pinus halepensis* (Algeria and S. France) have been examined, and the results compared with those obtained by Tschirch and Schulz (Arch. Pharm., 1907, 245, 156) and by Tsakolotos (Archimedes, 1908, No. 1) who studied resins from Greece, likewise derived from *P. halepensis*. It was found that at least four-fifths of the oil of turpentine extracted from

P. halepensis consist of almost pure *d*-pinene. As a raw material for the production of the latter hydrocarbon or of its derivatives, this oil is thus superior to American oil of turpentine. The American oil often consists of a mixture of dextro- and levo-rotatory oils, having at the most, a specific rotatory power $[\alpha]_D$ —lower than 30° whereas the products from *P. halepensis*, obtained from various samples, gave, on an average, $[\alpha]_D=47^\circ$.—E. C. V.-E.

PATENTS.

Article-coating process [with tung oil]. J. M. Talmadge. Brooklyn, N.Y. U.S. Pat. 933,598, Sept. 7, 1909.

THE article is coated with a film of raw tung oil, alone or mixed with a hydrocarbon, and then heated to at least 212° F. for not more than 30 minutes, whereby the oil is converted into an insoluble form, which is stated to be resistant to water, chemicals, fire, heat, and electricity.—A. S.

Linoxyn and similar products, intended for the manufacture of linoleum; Preparation of —. A. Genth. Fr. Pat. 398,804, Jan. 23, 1909. Under Int. Conv., Feb. 26, 1908.

IT is stated that the superiority of Walton's linoxyn to the linoleum obtained by the rapid process is due to the fact that in the latter process, the linseed oil is oxidized uniformly throughout, whilst Walton's product consists of a colloidal solution of linoleum in boiled oil. According to the present patent, a product equal to Walton's linoleum is obtained from linoleum prepared by the rapid process by intimately mixing it with linseed oil or boiled oil preferably with the aid of heat and with access of oxygen.—A. S.

Resin; Process for purifying —. H. T. Yaryan. Fr. Pat. 400,570, March 10, 1909.

SEE U.S. Pats. 915,401 and 915,402 of 1909; this J., 1909, 431.—T. F. B.

Linoleum-like substance; Process of and apparatus for manufacturing a —. N. Reif, Hanover, Germany. Eng. Pat. 18,349, Sept. 1, 1908.

SEE Fr. Pat. 393,868 of 1908; this J., 1909, 152.—T. F. B.

Oleo-resin of vanilla. U.S. Pat. 931,805. See XX.

(C).—INDIA-RUBBER, &c.

Rubber; Method for studying the process of hot-vulcanisation of —. E. Stern. Z. Elektrochem., 1909, 15, 660—661.

THE method proposed, is one in which vulcanisation is effected by heating together rubber and sulphur in naphthalene solution. It was found that the alteration in the freezing-point of naphthalene brought about by the solution in it of rubber, and by the subsequent heating of the solution, were too small to allow of deductions being made. When vulcanisation was carried out in naphthalene solution, the freezing-point was raised, but here again the changes were too small to allow of the process being followed by this method. By adopting the analytical method the process can be readily followed. In carrying out this method, however, the samples taken at intervals from the heated solution must be run into acetone, and not allowed to cool down and solidify, before extraction with acetone. In the latter case it is found to be impossible to remove all free sulphur by extraction; in the former case extraction is readily effected. The results obtained are shown in the following table, in which columns 1 and 2 refer to a solution of 4.98 grms. of Para rubber and 6 grms. of sulphur in 90 grms. of naphthalene, vulcanised at 150° C., the samples being allowed to solidify before extraction; and columns 3 and 4 to a solution of 5 grms. of Para rubber and 9 grms. of sulphur in 90 grms. of naphthalene, vulcanised at 150° C., the samples being run directly into acetone without cooling.

Time of vulcanisation.	Combined sulphur.	Time of vulcanisation.	Combined sulphur.
minutes.	per cent.	minutes.	per cent.
24	11.3	52	3.33
74	8.7	111	7.67
133	6.5	167	12.58
197	9.7	234	15.73
247	10.4	—	—

—E. W. L.

PATENTS.

Vulcanised rubber; Machine for reducing — to powder.
T. Gare, New Brighton, Eng. Pat. 22,893, Oct. 28, 1908.

The apparatus consists of: (1), a rotary grinding cylinder, having a detachable rasp- or grater-like grinding surface, consisting of a band of "stabbed" steel, the ends of which are drawn down a slit in the periphery of the cylinder and are there gripped by a suitable device; (2), a spiked roller, adjacent to the grinding cylinder, which together with a series of spring- or weight-influenced "presser feet," above and in line with it, forms a set of independent automatic feeds, notably for such articles as disused wheel tyres.—E. W. L.

Chewing gum [from pontianak rubber]; Manufacture of —.
J. D. Darling, Philadelphia, U.S.A. Eng. Pat. 186, Jan. 4, 1909.

A LOW-GRADE rubber, obtained from Borneo and known under the trade name of "pontianak," or "gutta-jelutong," is boiled with a solution containing 25 lb. of sodium hydroxide in 100 galls. of water, until all the impurities present in the rubber have settled to the bottom. The mixture of rubber and resin is then removed from the surface of the solution, washed, and kneaded in a suitable machine at a temperature of 200° to 300° F. until the whole mass has become plastic and ductile. The product thus obtained contains about 3 parts of resin to 1 part of rubber and is suitable for use as a chewing gum. About 5 per cent. of a vegetable wax may be added during the kneading operation.—W. P. S.

Rubber; Solution for and method of extracting resin from —.
C. P. Flora, Watertown, Mass., Assignor to Hood Rubber Co., Boston, Mass. U.S. Pat. 933,638, Sept. 7, 1909.

THE rubber is extracted successively with alcohol, a mixture of benzol and alcohol, and alcohol again.—A. S.

Indianrubber goods; Manufacture of —.
Rütgerswerke-Akt.-Ges., Berlin. Eng. Pat. 16,971, Aug. 12, 1908. Under Int. Conv., Oct. 22, 1907.

SEE Fr. Pat. 393,186 of 1908; this J., 1909, 100.—T. F. B.

Indianrubber or caoutchouc; Process for regenerating and devulcanising old —, and extraction of caoutchouc from raw materials containing caoutchouc.
G. Austerweil, Neuilly, France. Eng. Pat. 18,048, Aug. 27, 1908. Under Int. Conv., May 13, 1908.

SEE Fr. Pat. 388,248 of 1908; this J., 1908, 951.—T. F. B.

Zonite capable of resisting the action of chlorine; Manufacture of —.
M. Wilderman, Ealing. Eng. Pat. 18,269, Aug. 31, 1908.

SEE Fr. Pat. 395,101 of 1908; this J., 1909, 319.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Mangrove swamps of the Philippines; The economic possibilities of the —.
R. F. Bacon and V. Q. Gana. Philippine J. Sci., 1909, 4, A, 205—210.

ALL the species of mangrove trees of the eastern tropics, which are used commercially for tanning purposes, around in the Philippine Islands. Limited areas, amounting

altogether to about 28,000 hectares (70,000 acres), have been mapped out by the Forestry Bureau, which it is estimated will yield about 230,000 tons of bark; the total area occupied by the mangrove swamps is very much greater than this. The best barks (from Mindanao) contain only about 23—25 per cent. of tannin, and cannot compete with East African barks (containing 50 per cent. of tannin), if imported into the United States as raw material. It would be profitable to prepare catechu in the Philippines and ship this to the United States, if the tannin were allowed to enter free of duty, which is not the case at present. Apparently catechu can be prepared very easily from the bark, extraction with cold water, followed by evaporation to dryness *in vacuo* of the extract being all that is necessary.—A. G. L.

Tannin of the bark of Eucalyptus occidentalis (mallet bark).
J. Dekker. Collegium, 1909, 273, 281, 290, and 297.

FROM the results of experiments upon mallet-tannin (see this J., 1909, 665) the author concludes that fractional precipitation from a neutral solution is the only way of obtaining relatively pure tannins. When tannins are acetylated in the ordinary way, water is simultaneously removed; the product does not contain acid groups. In the process of benzoylation in an alkaline liquid, considerable oxidation takes place. Heating the tannin with zinc dust and sodium hydroxide solution gives better results than the ordinary method of fusion with potassium hydroxide.—C. A. M.

Methylotannin; Characteristics of —.
J. Herzig and V. Renner. Monatsh. Chem., 1909, 30, 543—554.

THE authors have prepared methylotannin from pure tannin, and have obtained preparations with the same elementary composition and methoxyl values (37.2 to 37.9) as previously recorded by Herzig and Tscherne (Ber., 1905, 38, 989). The optical activity, however, showed considerable variations, though the preparations still showed almost the same methoxyl values. Thus a compound with $[\alpha]_D = 7.0^\circ$ had a methoxyl value of 37.22, and another with $[\alpha]_D = 16.05^\circ$ had a value of 37.78. In the authors' opinion this variation in the specific rotation is not conclusive proof that methylotannin is not a chemically individual substance. When boiled with an aqueous solution of potassium hydroxide, methylotannin yields triethyl- and diethyl-esters of gallic acid in proportion corresponding to about 86.5 per cent. of the original substance. The mixture of these derivatives is optically inactive. According to the elementary composition and methoxyl values, the triethyl ester predominates, the ratio probably being as 4:2. The other compounds formed in the decomposition were not identified.—C. A. M.

The Leathersellers' Technical College.
Times Eng. Suppl., Sept. 29, 1909.

THE new Leathersellers' Technical College in the Tower Bridge Road, which was opened on October 1st, forms a most important addition to the technical schools of London.

THE buildings and machinery cost £20,000. There is a general laboratory for 40 students, a research laboratory for ten students, a bacteriological laboratory, and a special room for microscopy and microphotographic work. There is also a large museum containing samples of tanning materials from all parts of the world, and of leather and skins, showing the imperfections due to faulty manipulation in tanning or brought about by peculiarities of growth, method of preservation employed, damage by insect pests, branding, and other causes. In the lecture theatre, with accommodation for 100 students, it will be possible by means of a new electroscope projector to show on a screen a view of any specimen of leather, thereby enabling illustrations of grain defects, flaws, or other special features of the sample to be shown without the necessity of photographic reproduction.

ON the ground floor are two experimental tanneries. The adjoining dye house will deal with the product of the tanneries, and also with the re-dressing and dyeing of foreign tanned skins. Adjoining the dye house is

the machine room, provided with machines for scouring, glazing, rolling, and currying. The plant is driven by three powerful electric motors. In the basement is the boiler which provides the steam for the vats and hot water for the dye house, and also supplies the heating apparatus for the building; while on the third floor two spacious drying rooms have been erected for the drying and stoving of the finished leather, a curriers' shop permitting practical demonstrations of the currying of all classes of leather. The library in the entrance hall contains a complete collection of books dealing with the leather and allied industries, as well as the standard works on chemistry, &c.

The curriculum consists of a two years' course, divided into three sections to suit either heavy leather or light leather tanners, or those who only dress and finish tanned leather. The course of instruction in the evening classes extends over three years. The principal of the college is Dr. J. Gordon Parker.

PATENTS.

Waste sulphite liquor; Treatment of — and the manufacture of a new product [tanning material] therefrom. J. Y. Johnson, London. From J. S. Robeson, Au Sable Yorks, N.Y., U.S.A. Eng. Pat. 17,956, Aug. 26, 1908.

THE new product consists of a soluble compound of the sesquioxide of chromium or aluminium with the practically unchanged organic matters of sulphite cellulose liquor, and is prepared by treating the liquor with aluminium or chromium sesquioxide and an acid capable of precipitating mineral matter from such liquor, and removing the precipitate thus formed. After standing some time, the liquor deposits a second precipitate, of sulphur, which is also removed. The solution is then concentrated or evaporated to dryness. The product is stated to be useful as a tanning material.—S. H.

Tanning hides and skins, and mordanting fibrous materials, and the obtaining of improved products thereby. J. Y. Johnson, London. From J. S. Robeson, Au Sable Yorks, N.Y., U.S.A. Eng. Pat. 17,957, Aug. 26, 1908.

THE method consists in treating hides and skins, in successive baths of increased concentration, with a liquor containing a compound of the sesquioxide of aluminium or other base with the practically unchanged organic matters of waste sulphite liquors (see preceding abstract). The tanning can be completed in this liquor, or it can be finished by any of the ordinary tanning processes. The patent also covers the treatment of cotton, wool, and other fibrous materials with the same liquor.—S. H.

Hides, skins and leather; Treatment of —. J. S. Robeson, Au Sable Yorks, N.Y., U.S.A. Eng. Pat. 17,958, Aug. 26, 1908.

THE processes consist of: (1), the treatment of hides or skins with a tanning agent, followed by a bath containing sulphite liquor (see preceding abstracts) and finally bleaching with an acid or other bleaching agent; (2), the tanning of hides or skins by means of sulphite liquors and bleaching with an acid or other material; and (3), tanning the hides or skins in sulphite liquors and subsequently bleaching by the use of sulphuric acid and a salt which reacts with the acid to effect the bleaching.—S. H.

Filling or stuffing material [from gelatin]; Manufacture of —. R. A. Caldwell, New Southgate, and F. Pfeffermer and Pneumatic Syndicate, Ltd., London. Eng. Pat. 11,300, May 12, 1909.

A MIXTURE of gelatin and glycerin, together with zinc oxide or other insoluble powder is heated to about 70° C., and then stirred or beaten into foam with the aid of a current of air, first at the ordinary pressure and later under increased pressure. It is next subjected to the action of a

tanning agent, preferably a solution of pyrogallol rendered viscous by addition of glycerin, gelatin, or the like, and the stirring continued until a product of the required consistence is obtained. The stirrer is electrically driven, so that by means of a watt-meter, it is possible to determine at any moment the power consumed. The air may be mixed with inert gases or with oxygen, and the tanning agent may be mixed with substances which retard its tanning action. The product is suitable for filling hollow tyres, cushions, etc. A. S.

Artificial bathur and process of making the same. L. V. Guillebeau-Chaput, Paris. U.S. Pat. 933,645, Sept. 7, 1909.

SEE Eng. Pat. 6216 of 1907; this J., 1908, 347.—T. F. B.

Condensation product of catechin and catechu-tannic acid [for silk weighting, tanning, etc.] Fr. Pat. 401,108. See V.

XV.—MANURES, &c.

Phosphoric acid; Determination of — in mineral phosphates. G. Jørgensen. Analyst, 1909, 34, 392—393.

THE following method devised by the author is now the official process in Denmark for the analysis of fertilisers and mineral phosphates:—*Reagents*:—(a). *Molybdic solution*.—300 c.c. of a solution of 100 grms. of pure ammonium molybdate in 280 c.c. of ammonia solution (sp. gr. 0.97) are poured into 700 c.c. of nitric acid (sp. gr. 1.21) with vigorous stirring, and the mixture left for 24 hours. (b). *Acid ammonium nitrate solution*, prepared by mixing 90 c.c. of nitric acid (sp. gr. 1.4) with about 1500 c.c. of water, adding 80 c.c. of ammonia solution (sp. gr. 0.91), and diluting the mixture to 2000 c.c. (c). *Magnesia solution* consisting of 50 grms. of pure magnesium chloride ($MgCl_2 \cdot 6H_2O$) and 150 grms. of ammonium chloride in 1000 c.c. of water. *Method*:—Five grms. of the mineral phosphate are gently boiled with 20 c.c. of nitric acid (sp. gr. 1.21), and the solution cooled and made up to 250 c.c., and filtered. To 50 c.c. of the filtrate are added 165 c.c. of the molybdic solution, and the flask immersed in a water-bath at 50° C. for 10 minutes, its contents being meanwhile occasionally stirred. After cooling, the liquid is filtered and the precipitate washed 10 times by decantation with the acid ammonium nitrate solution, about 20 c.c. being used each time. The calcium in the filtrate is determined by adding sulphuric acid and alcohol to the extent of twice the volume of liquid. The washed molybdic precipitate is dissolved in 100 c.c. of 2.5 per cent. ammonia solution, and the filter washed 8 times with about 10 c.c. of the ammonia solution, so that the final volume is about 180 c.c. The beaker is covered with a glass, its contents heated to the boiling point, and (after removal from the flame) treated with 30 to 35 c.c. of the magnesia solution, added drop by drop from a burette, with continual stirring. The beaker is then covered again, and the stirring continued until the precipitate becomes crystalline, after which it is allowed to stand for at least 4 hours, and then collected in a platinum crucible packed with spongy platinum. It is next washed with 2.5 per cent. ammonia solution until free from chlorides, dried, heated gradually over an Argand burner, and finally ignited strongly, cooled, and weighed. The presence of a small amount of silica does not interfere with the results. In the presence of much organic matter a more energetic solvent than nitric acid must be used. The chance of precipitating arsenic or silicic acid is reduced, as the excess of molybdic solution added is smaller than in the case of other methods. It is necessary to avoid too long a boiling before the precipitation, since loss of ammonia will cause the precipitation of the magnesium ammonium phosphate to be incomplete.

For the analysis of artificial manures the quantities of reagents used are as follows:—

	For 50 c.c. of an aqueous extract of an 18 to 20 per cent. superphosphate (1 grm. of material).	For 100 c.c. of a 2 per cent. citric acid extract of 12 to 15 per cent. Thomas phosphate (1 grm. of material).
Molybdc solution	c.c. 75	c.c. 100
Ammonia	100	75
Magnesia	15 to 20	12 to 15

—C. A. M.

Phosphoric compounds: Manurial values of various organic —. K. Asō and T. Yoshida. J. Coll. Agric., Imp. Univ., Tokyo, 1909, 1, 153—161.

HAVING regard to the extended use of vegetable manures, such as green manure, rice-bran, oil-cake, straw, etc., in Japan, the authors have compared the manurial value of various organic and inorganic phosphorus compounds. The soil was a humus loam of a slightly acid reaction, which was exhausted by continuous cultivation without any manures for seven years. The pots having been manured with acidic manures, ammonium sulphate and potassium sulphate; or with basic manures, sodium nitrate and potassium carbonate; equivalent quantities of various phosphoric compounds were added, *viz.*, sodium phosphate, lecithin, phytin, nuclein, aluminium phosphate, ferric phosphate, and tricalcium phosphate. Barley was sown in these pots, its growth noted, and its weight ascertained when harvested; whence it appeared that lecithin produced the best results. Tricalcium phosphate also exerted a very favourable influence. The manurial value of phytin was far less than that of sodium phosphate, but almost equal to that of ferric and aluminium phosphate. As for nuclein, the experiment was made with basic manures only, as it is soluble in alkalis but not in acids; and its manurial value was very small. But while the manurial value of lecithin is far greater than that of phytin or of nuclein, the content of lecithin in plants is generally very small, while that of phytin is much larger. Hence the inferior value of phosphoric acid in vegetable manures

phytin, and as this compound is easily transformed in soils into insoluble ferric and aluminium phosphate, it is recommended to use vegetable manures in a putrefied state to render the phosphoric acid available. In the analysis of manures it is absolutely necessary to pay attention to the different organic phosphorus compounds.—R. C. P.

Phosphoric acid in organic manures; Different forms of —. S. Tsuda. J. Coll. Agric., Imp. Univ., Tokyo, 1909, 1, 167—170.

THE author has determined the amounts of the different forms of phosphoric acid in several organic manures of vegetable and animal origin. To determine the lecithin, 50 grms. of the air-dry sample were extracted with ether and the residue boiled with absolute alcohol. After evaporating the combined extracts to dryness, the residue was fused with potassium nitrate and sodium carbonate, and the fused mass dissolved in nitric acid. The phosphoric acid was then determined by the molybdate method. The residue obtained from the alcoholic extraction was dried and extracted with 500 c.c. of 0.2 per cent. hydrochloric acid at the room temperature. After filtering, the extraction was repeated. To a part of the acid extract, ammonia was first added until the reaction was slightly alkaline, then nitric acid in excess, and the phosphoric acid in the form of inorganic salts was determined by the molybdate method. To determine the phosphoric acid in the form of phytin, another part of the acid extract was evaporated in a large platinum basin and the residue was fused with potassium nitrate and sodium carbonate. After extracting the fused mass with nitric acid, the phosphoric acid was determined. The difference between the total and the inorganic phosphoric acid of the original hydrochloric acid extract is the phosphoric acid in the form of phytin. The residue left after extraction with 0.2 per cent. hydrochloric acid was dried and extracted with 500 c.c. of 5 per cent. hydrochloric acid in the same manner as before, and the phosphoric acid in the solution, in the form of both organic and inorganic compounds, was determined. The last residue was dried and fused with the fusion mixture, dissolved in dilute nitric acid, and the molybdate method applied to determine the phosphoric acid in the form of nuclein. The results obtained are shown in the following table:—

In 100 parts of dry matter.

	Soy bean cake.	Rape seed cake.	Red clover hay (before flowering).	Herring guano.	Bone dust (steamed).	Pressed cake of pupa of silk-worms.	Crab shells.
Total phosphoric acid	1.311	2.251	0.554	4.470	25.060	1.350	3.23
Phosphoric acid extracted by ether and alcohol (as lecithin)	0.114	0.091	0.050	0.310	0.023	0.043	0.023
Phosphoric acid extracted by 0.2 per cent. hydrochloric acid	0.050	0.050	Trace	1.894	5.534	1.039	0.300
Phosphoric acid extracted by 5 per cent. hydrochloric acid	0.040	0.073	0.300	0.860	Trace	Trace	0.151
Phosphoric acid in last residue (as nuclein)	0.120	0.931	0.084	0.648	0.530	Trace	0.200
	0.236	0.204	0.050	0.583	0.112	0.169	0.302

to that in animal manures is explained by these results. The phytin used in the experiments was prepared by extracting rice-bran in succession with ether and 95 per cent. alcohol, drying the residue, and extracting it with 0.2 per cent. hydrochloric acid. From the acid solution the phytin was precipitated with 95 per cent. alcohol, washed with alcohol and ether, and purified by dissolving in 0.2 per cent. hydrochloric acid and reprecipitating with alcohol. It was a white powder containing 45.86 per cent. of phosphoric anhydride. The nuclein was prepared from beer yeast and contained 1.68 per cent. of phosphoric anhydride. The lecithin contained 7.75 per cent. of phosphoric anhydride. A second series of experiments showed that rice-bran and rape-cake exert a better manurial effect after the fat has been extracted, and that the chief manurial value of phosphoric acid in press-cakes is due to phytin. The most essential phosphorus compound in vegetable manures is thus seen to be

These results show distinctively the difference between animal and vegetable manures in the relative amounts of the different forms of phosphoric acid, the former containing it mostly in the form of inorganic compounds and the latter as organic compounds. In vegetable manures phosphoric acid is present principally in the form of phytin, and the amount of nuclein is comparatively small; lecithin is also contained in small quantities, the phosphoric acid in this form being always less than 10 per cent. of the whole. On the other hand, since tricalcium phosphate is the principal ingredient of bones, most of the phosphoric acid of animal manures containing bones is the part soluble in 5 per cent. hydrochloric acid. In crab shells the phosphoric acid is in nearly the same form as in bones; while in the pupa of the silk-worm, *Bombyx mori*, it is present in an inorganic form easily soluble in 0.2 per cent. hydrochloric acid.

—R. C. P.

Herring-guano: Availability of phosphoric acid in various forms in —. R. Mitsuta. J. Coll. Agric., Imp. Univ., Tokyo, 1909, 1, 163—165.

Eleven pots, each containing 2.5 kilos. of a humus-loam soil, were manured with 2 grms. of potassium carbonate and 3 grms. of sodium nitrate, these large doses being necessary to eliminate the effect of the potash and nitrogen of the herring-guano. One pot was used as a control, one was treated with 5 grms. of herring-guano in its original condition, five pots with the same quantity of herring-guano after treatment with different solvents, and one pot with a quantity of sodium phosphate containing an amount of phosphoric acid equal to the total phosphoric acid of the 5 grms. of herring-guano. The results showed that treatment with ether and alcohol had not increased, but decreased the manurial value of the herring-guano, owing to the fact that the material had originally been deprived of most of its oil content, and it was chiefly lecithin, perhaps from lecithalbumin, which had been extracted by the ether and alcohol. The guano was much less effective after extraction with 0.2 per cent. hydrochloric acid than before. Since the content of phytin in herring-guano is very small, the phosphoric acid soluble in dilute acid was probably chiefly calcium phosphate. Nuclein in herring-guano has no immediate manurial value as generally assumed. The principal part of the phosphoric acid serving as phosphatic manure in fish-guano is of inorganic nature, chiefly consisting of calcium phosphate. Lecithin and phosphates soluble in water also exert a certain rôle. There is thus a great difference regarding the manurial value of phosphoric acid in animal and vegetable manures. (See preceding page.)—R. C. P.

Diacyandiamide as a nitrogenous manure. R. Inouye. J. Coll. Agric., Imp. Univ., Tokyo, 1909, 1, 193—196.

Five pots containing 8 kilos. of air-dry soil were each manured with 10 grms. of superphosphate and 5 grms. of potassium carbonate. In addition, equal quantities of nitrogen were applied to each pot, except Pot V., which received no nitrogenous manure. Pot I. served as control, and contained the total nitrogen as ammonium sulphate; Pot II., two-thirds of the total nitrogen as ammonium sulphate and one-third as diacyandiamide; Pot III. received the manure in the same proportion as Pot II., but the diacyandiamide was given as top-dressing later on; in Pot IV. the total nitrogen was applied as diacyandiamide. Experiments with rape and barley showed that early in the growth of the plants, the diacyandiamide exerted an injurious effect, the growth being impeded and the leaves turning a yellowish-white colour and withering. Later on, these adverse symptoms disappeared, and when harvested, the plants in Pots II. and III. excelled the plants in the control pot. The best results were obtained from Pot III., where the diacyandiamide was given as a top-dressing. The conclusion arrived at by the author is as follows:—Diacyandiamide may be injurious to the plants, but if the dose does not surpass a certain limit, it acts rather beneficially upon them; and it is, indeed, a better manure than ammonium sulphate. The plants in Pot IV., which received diacyandiamide as the only nitrogenous manure, were as much injured as those in Pot V., which received no nitrogen. One gram of nitrogen in the form of diacyandiamide for 8 kilos. of soil is injurious to the crops and especially to the young plants, but 0.35 gm. of nitrogen in the same form yields a favourable result. If diacyandiamide is applied as manure, it is better to use it as top-dressing.—R. C. P.

Diacyandiamide; Manuring with —. K. Asō. J. Coll. Agric., Imp. Univ., Tokyo, 1909, 1, 211—222.

Numerous experiments with calcium cyanamide have shown that in many cases this nitrogenous manure is equal or nearly so to sodium nitrate or ammonium sulphate. On acid muck (swamp) soils and on sandy soils, however, less favourable results have been obtained. Acid soils should first be neutralised with lime before "lime-nitrogen" is applied. Further it is advisable to avoid mixing "lime-nitrogen" with superphosphate. In the case of soils not only rich in lime, but also containing much more lime than magnesia, the lime content of the soil would be unduly

increased by the application of "lime-nitrogen," and the results would not be so good. Hence it has been proposed to separate the lime from the cyanamide. When the crude "lime-nitrogen" is treated with warm water, a separation takes place into cyanamide and calcium hydroxide; and the cyanamide readily polymerises to diacyandiamide. Comparative experiments as to the effect of diacyandiamide on the growth of buckwheat, oats, and paddy-rice under varying conditions in flasks, pots, and frames, showed that in water culture, diacyandiamide at a concentration of 0.01 per cent. is a source of nitrogen for plants. In common soil, it acts poisonously when used at the rate of 5 grms. per 10 kilos. of soil, but serves as a favourable nitrogenous manure with reduced quantities. In paddy soil the injury is less than in the soil of common dry land, and when the precaution is taken to perform the planting three weeks after manuring with diacyandiamide, no injury whatever is observed, and the harvest reaches nearly that obtained with the equivalent quantity of ammonium sulphate or of "lime-nitrogen." This renders it very probable that the bacteria in paddy soil convert the injurious diacyandiamide into innocuous compounds (ammonium compounds?) more rapidly than those in common field soil. Furthermore, diacyandiamide acts as a nitrogenous manure more favourably when applied in conjunction with alkaline manures.—R. C. P.

PATENTS.

Fertiliser; Process of making —. J. H. Connor, Nashville, Tenn. U.S. Pat. 931,846, Aug. 24, 1909.

Five parts of powdered phosphate rock or calcium phosphate, 1 part of caustic soda, and 2 parts of quicklime are mixed with water to the consistence of thick mud, and the mass heated strongly until the phosphoric acid becomes "available."—A. S.

Pyrophosphates [for fertilisers]; Process and apparatus for transforming the salts of tribasic phosphoric acid into —. E. Giana. Fr. Pat. 398,792, Jan. 12, 1909. Under Int. Conv., June 30, 1908.

A mixture of sulphate and pyrophosphate is formed by the action of sulphur dioxide, at a high temperature, and in the presence of atmospheric oxygen, on a salt of tribasic phosphoric acid, according to the equation: $2\text{Ca}_3(\text{PO}_4)_2 + 2\text{SO}_2 + \text{O}_2 = 2\text{CaSO}_4 + 2\text{Ca}_2\text{P}_2\text{O}_7$, in which the calcium salt is taken as an example. The operation may be carried out in a furnace which is described, in the lower part of which pyrites is burnt, whilst the upper portion consists of a muffle for the decomposition of the phosphate, above which are channels for the deposition of dust. The product has the following advantages over ordinary superphosphate:—It is dry and pulverulent and does not tend to harden; it is not acid, is readily distributed, and contains more phosphoric anhydride than superphosphate; moreover, there is no danger to the workpeople engaged in its preparation.—F. Sonn.

Calcium phosphates; Process of enriching —. C. Bardy. Fr. Pat. 398,924, Jan. 29, 1909.

In the treatment of phosphatic chalks by the sugar process, the mineral is calcined to convert the calcium carbonate into quicklime, and the latter is dissolved out of the product by means of a sugar solution. According to the present patent, the separation of the calcium sucrate solution from the residual calcium phosphate is effected in a centrifugal machine, instead of by the methods (decantation, filtration, etc.) usually employed. The sucrate solution is then treated with carbon dioxide, and the precipitated calcium carbonate separated from the saccharine solution also in a centrifugal machine.—A. S.

Organic nitrogenous manures; Process for the manufacture of —. H. E. L. Fiévet. Fr. Pat. 400,661, June 16, 1908.

NITROGENOUS organic matter, such as excreta of animals, slaughterhouse residues, etc., is mixed with small quantities of manganese dioxide, or other oxygen-yielding compound, the double sulphate of iron and magnesium, and magnesia, alumina, or tricalcium phosphate. It is

then infected with an alkaline culture of brewers' yeast, and allowed to ferment. The whole of the nitrogen is transformed into ammonia, which is fixed by the double sulphate of iron and magnesium. When the fermentation is completed, the mass is mixed with an absorbent material such as peat, neutralised with sulphuric acid, treated with ozonised air, and then dried in a stove. The yeast culture is composed of 30 grms. of dried brewers' yeast, 2 grms. of urea, 20 grms. of soda crystals, 1 grm. of potassium phosphate, and sufficient urine to make up 1 litre.—A. S.

Superphosphates; Method of and apparatus for removing — from decomposition chambers. K. J. Beskow, Helsingborg, and M. Ekedahl, Limhamn, Sweden. Eng. Pat. 4494, Feb. 23, 1909. Under Int. Conv. March 2, 1908.

SEE Fr. Pat. 399,907 of 1909; this J., 1909, 996.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Beetroot; Optically active non-sugar in the —. A. Blau. Deutsche Zuckerind., 1909, 34, 743—744.

To avoid the error in the analysis of beetroot juice due to the presence of certain optically active non-sugar substances, Herles has proposed boiling the juice with lime (see this J., 1908, 1168). The author shows, however, that though lower polarimetric readings are thus obtained than by the ordinary method, the quantity of optically active non-sugar destroyed by boiling with lime is quite small, and insufficient to account for the differences.

—L. E.

Sugar analysis; Proposals for unification of methods of clarification in —. F. Sachs. Internat. Comm. for uniform methods of sugar analysis, London, 1909; Z. Ver. deut. Zuckerind., 1909, 775—778.

THE author proposes that for determining invert sugar in sugar products (both cane and beet), normal lead acetate should be used for clarifying the solution, as recommended by Schrefeld (see this J., 1908, 1168). The use of unclarified solutions is objected to on the ground that the results may be vitiated by the presence of foreign matter in the copper or copper oxide. In accordance with Browne's recommendation, the author also proposes that Herzfeld's modification of Clerget's method should be used for the analysis of cane products. On the assumption that the volume of the lead precipitate affects the polarisation, Gonnermann has proposed the following method of clarification with a view to avoiding this error:—28.6 grms. ($=26 \times 1.10$) of the sample are dissolved and made up to 100 c.c. This solution is then made up to 110 c.c. either with 2–3 c.c. of alumina cream and 8–7 c.c. of water, or with 10 c.c. of a 3 per cent. solution of basic lead acetate, mixed, filtered, and polarised in a 200-mm. tube. The author points out, however, that the total volume of liquid will be less than 110 c.c. Hence the method does not effect the object in view.—L. E.

Sugar analyses; Basic lead nitrate as a clarifying agent in —. F. Herles. Internat. Comm. for uniform methods of sugar analysis, London, 1909; Z. Ver. deut. Zuckerind., 1909, 782—783. (See this J., 1897, 67.)

THE author's clarifying agent, basic lead nitrate, presents the following advantages:—It decolorises the solution well, and owing to its insolubility, the excess of the clarifying agent, under the conditions in which clarification is executed, does not cause the precipitate formed to partially dissolve, nor does it affect the polarisation reading. The alkali nitrate formed when basic lead nitrate is used (unlike the alkali acetate formed when basic lead acetate is employed) has no influence on the precipitate formed, but, on the contrary, precipitates any lead salt from the solution; again, the alkali nitrate has less influence than the alkali acetate on the polarisation. Solutions clarified with basic lead nitrate can be used directly for inversion, since, not only do they contain very little lead, but on adding hydrochloric acid, no weak

acid of feeble inverting power is liberated, as is the case, when, owing to clarification with basic lead acetate, alkali acetate is present. The clarified solutions filter quickly, yielding filtrates which are clear and remain so for a long time. The author recommends basic lead nitrate as a clarifying agent not only for molasses, osmose water, after-products, etc., but also for raw, first-product sugars.

Sugars; Colour reactions of —. Reactions of Pettenkoffer and Seliwanoff. J. Ville and E. Derrien. Bull. Soc. Chim., 1909, 5, 895—901.

It has been frequently stated that Pettenkoffer's reaction (purple coloration given by sucrose in presence of cholic and sulphuric acids) and Seliwanoff's reaction (red coloration produced by levulose in presence of resorcinol and hydrochloric acid) are due, not to the sugars, but to furfural. The authors find, however, that the colorations given by furfural are not identical spectroscopically with those produced by the sugars. The two reactions mentioned are really due to methyl-4-hydroxy-2-furfural, produced by the hydrolysis of the sugars. Pure methyl-4-hydroxy-2-furfural gives colorations identical both chromoscopically and spectroscopically with those produced by sucrose and levulose in the reactions mentioned.

—E. C. V. E.

Carbohydrates of plant seeds. E. Schulze and C. Godet. Z. physiol. Chem., 1909, 61, 279—351.

THE authors have investigated the nature and proportions of the carbohydrates in the kernels (i.e., dehusked seeds) and husks of a considerable number of seeds. The chief results are as follows:—*Seed kernels.*—No pentose or hexose was found in any of the seed kernels. Sucrose is of wide occurrence; thus, out of 27 kinds of seeds examined, in only two (blue and yellow lupins) was sucrose not found, and perhaps even in these seeds, sucrose is present in quantities too small to be isolated. Water-soluble carbohydrates which yield galactose on hydrolysis, appear to be as widely distributed as sucrose. The only hexoses which are formed by the hydrolysis of the water-soluble carbohydrates (di- and poly-saccharides) of the seed kernel are dextrose, galactose, and levulose; in no instance was mannose detected. The content of water-soluble pentosans is very small; in no case was so much as 1 per cent. found, and in some cases, none. Since there is no doubt that the water-soluble carbohydrates (including amylan, levulin, sinistrin and levosin, which are found in amylaceous seeds and which yield dextrose and levulose on hydrolysis) serve as reserve materials, and that before they are utilised by the growing shoot, they are transformed into dextrose, levulose, and galactose, it appears that the latter are specially adapted to the nutrition of the young plant. The hemicelluloses appear to be of universal occurrence in the kernels of seeds; in seeds that are free from starch and poor in fat, the hemicelluloses are present in considerable quantity in the kernels and in such cases they serve as reserve material. On hydrolysis, the hemicelluloses yield mixtures of hexoses (in many cases galactose and in others, mannose, is formed in considerable quantity) and generally a pentose, e.g., arabinose; the proportion of pentose, however, is much less than that of hexose. The cell walls of the kernels of the seeds examined contain a small quantity of cellulose. *Seed- and fruit-husks.*—These materials contain very little water-soluble carbohydrates, and little or no starch; they consist chiefly of nitrogen-free substances, insoluble in ether, water, and malt extract, and contain a considerable quantity of hemicelluloses. On hydrolysis, the hemicelluloses from various seed- or fruit-husks were found to yield arabinose or xylose, or both, and in many cases, galactose. The residue from the husks left after removal of the hemicelluloses by hydrolysis, was found to contain a substance soluble in 5 per cent. sodium hydroxide and possessing the properties of "wood gum" (xylan); the material left after removing this substance yielded cellulose. The husks also contain lignin in considerable amount, and most of them contain brown-coloured substances of unknown nature.—L. E.

Sugars; Relation of pyridine to the —. C. Nenberg. *Biochem. Zeits.*, 1909, 20, 526—530.

THE view that under natural conditions, carbohydrates are converted into cyclic substances and the latter into the sugars, finds much acceptance. Chemical evidence, however, is scanty, and the author's experiments in this direction have not hitherto led to very satisfactory results. He has already investigated the formation of furfural by the dry distillation of inositol (*Biochem. Zeits.*, 1908, 9, 551). He now finds that on oxidising pyridine with hydrogen peroxide and ferrous or ferric sulphate in sulphuric acid solution, a pentose or pentose derivative is formed, though he has not yet succeeded in isolating such a substance. On heating the reaction-product with sulphuric acid, furfural is formed.—L. E.

Gums; Enzymes in acacia and other —. F. Reimter. *Z. physiol. Chem.*, 1909, 61, 352—392.

THE author has investigated the enzymes of a number of gums, including hard and soft Kordofan gums, a very pure gum presenting the properties of a soft Kordofan gum, and a rather crude Gheziri gum. His experiments on the distribution of the gum enzymes and the behaviour of these enzymes towards poisons and high temperature, lead to the conclusion that very probably at least three enzymes, *viz.*, an oxydase, a peroxydase, and a diastase, are present in gum, though in some gums, all three enzymes may not be present. The diastase appears to be a mixture of at least two enzymes, of which one dissolves starch and converts it into erythro-dextrin, whilst the other forms sugar (*cp.* Fränkel and Hamburg, this J., 1906, 945). *Oxydase*.—The gum oxydase very much resembles Bertrand's laccase (this J., 1894, 1071; 1895, 374) and the author proposes to designate it by this name provisionally. A gum of strong oxidising power was found to contain not more than a very small trace of manganese, and to effect its oxidising action in acid solution, so that Dony-Henault's chief arguments against the existence of oxydases are invalid unless the presence of iron is regarded as responsible for the oxidising action (this J., 1908, 823). Tyrosinase was not found in any of the gums examined. The oxydase-activity was found to vary with different gums, and to be absent in some cases. *Peroxydase*.—This enzyme was present in all the gums examined excepting tragacanth. *Amylase (diastase)*.—The author shows that gum amylase acts on starch paste with the formation of dextrin and maltose, and not of the former only as was supposed by Wiesner and Grafe. According to Wiesner, his "gum ferment" can convert cellulose into gum, and according to Grafe, this enzyme, though incapable of acting on cellulose, converts hemicellulose-like substances and starch into dextrin. The author shows, however, that gum amylase does not attack ungelatinised potato starch, and that it only completely liquefies the gelatinised starch when the concentration of the latter is less than 5 per cent.; subsequent addition of water to the cold starch paste does not alter its behaviour towards the amylase, thus showing that the action of the latter is determined by the degree of hydrolysis of the starch. Again, gum amylase neither liquefies nor saccharifies insoluble gums or plant mucilages, and the author concludes that it is impossible that this enzyme, or the oxydase and peroxydase accompanying it, can convert cellulose or hemicelluloses into gum. Different varieties of gum differ widely in respect of amylase-content, and the proportions of the enzymes of which the amylase consists also vary; gum amylase presents very great similarity to malt diastase. According to Grafe, the saccharification of starch by the gums is caused, not by the enzymes of the latter, but by bacteria, and he found that on filtering the gum solution through a Pukal filter, the filtrate obtained possessed no saccharifying power. Fränkel and Hamburg observed that malt diastase passes through a Pukal filter nearly quantitatively if the enzyme solution is not rich in those colloids which remain in the filter and adsorb the enzyme. A gum solution, however, is very rich in colloids, and the author shows that on passing such a solution through the filter, a large proportion of the colloids is retained, and that the saccharifying part of the amylase may either be completely or almost

completely retained whilst the liquefying part passes through. The author also shows, contrary to Grafe's statement, that ether (recently purified) does not extract an enzyme from gum capable of converting starch paste into erythro-dextrin, since the ethereal extract contains no substance capable of acting on starch paste, and the residual gum saccharifies the paste quite normally; Grafe's result appears to have been due to the use of unpurified ether. The fact that the bark and wood of trees contains amylase (*cp.* Butkewitsch, this J., 1908, 822) easily explains the presence of amylase in gum, and the presence of oxydase and peroxydase in gum is traceable to the same source.—The author shows that the frothing exhibited by a gum solution when shaken, is not due to enzyme action as supposed by Wiesner, since this property is not destroyed or diminished by heating the solution; the property is really due to the viscosity of the solution.—L. E.

Sugars; Decomposition of the —. *Reversion of the synthesis of sugar.* Löb. *See* XXIV.

PATENTS.

Separating solid impurities from gummy solutions. Eng. Pat. 12,739. *See* I.

Absorbent material for viscous substances [molasses]. Fr. Pats. 400,736 and 400,737. *See* I.

XVII.—BREWING, WINES, SPIRITS, &c.

Hops; Chemistry of —. R. Siller. *Z. Unters. Nahr. u. Genussm.*, 1909, 18, 241—271.

THE researches of Hayduck have shown that hops contain three resins, two of which, the soft α - and β -resins, are bitter principles soluble in light petroleum spirit, while the third, or γ -resin, is tasteless and insoluble. He also prepared from the two soft resins crystalline compounds of the corresponding α - and β -hop bitter acids. The author finds that the α -bitter acid can be precipitated quantitatively from a methyl alcohol solution of the mixed resins by lead acetate dissolved in methyl alcohol. As the lead salt of the α -bitter acid is decidedly soluble in excess of the precipitant, it is advisable to use only a 1 per cent. solution of lead acetate. After a recrystallisation from glacial acetic acid, the lead salt contains 36.65 per cent. of lead and is sufficiently pure to yield, after decomposition with dilute sulphuric acid, a well crystallised preparation of the free acid. Based upon this precipitation of the lead salt of the α -acid, the author has elaborated a method for the estimation of the three resins in hops as follows: (1), an ether extract gives the total resins, $\alpha + \beta + \gamma$; (2), a petroleum spirit extract gives the α - and β -resins, the γ -resin being insoluble in petroleum spirit; (3), the α -resin is determined by precipitation as lead salt from a methyl alcohol solution of 1 or 2; (4), the β -resin is determined by difference between 2 and 3; and (5), the γ -resin is determined by difference between 1 and 2. This method is claimed to give results correct to about 0.2 per cent. The α -acid, when pure, proves to be much more resistant to oxidation than it is usually considered to be, being practically unaltered in air at ordinary temperature; on protracted heating it absorbs oxygen and is resinified. The γ -resin appears to be a mixture of two substances differing in their solubility in ether and their carbon content. The α -acid has at least two pairs of doubly linked carbon atoms, as it yields a tetra-bromo addition compound.—R. L. S.

Hops; Determination of moisture in —. J. F. Hoffmann. *Woch. f. Brau.*, 1909, 26, 460—461.

IN a previous paper (this J., 1903, 655) the author described a method for the estimation of moisture in different substances by distilling with turpentine oil at a temperature of above 135° C. He finds that the method then described gives too high values and has consequently modified it by using a mixture of 400 c.c. of turpentine oil and 100 c.c. of toluene in the apparatus described in

this J., 1902, 1088. Figures are given showing that the new method yields results agreeing well with those obtained by drying *in vacuo* over phosphoric anhydride or for four hours in an oven at 80° C.—R. L. S.

Peptolytic ferments; Detection of —. E. Adlerhalden and A. Schittenhelm. *Z. physiol. Chem.*, 1909, 61, 421–425.

The authors criticise the various methods at present used for the investigation of the action of proteolytic and peptolytic ferments upon polypeptides. They suggest the use of a polypeptide yielding a large proportion of a difficultly soluble amino-acid, e.g., tyrosine, leucine, or cystine, the polypeptide itself being freely soluble in water. Glycyl-L-tyrosine is shown to be suitable. They have also prepared a peptone ("Pepton Roche") from silk, which is easily soluble in water, and contains a large proportion of tyrosine groups. It is prepared by the partial hydrolysis of silk, and after purification, is obtained as a snow white powder giving a colourless aqueous solution. For experimental purposes a solution is made of 10–15 per cent. strength, and sodium bicarbonate is added to the slightly acid solution to give a weak alkaline reaction. The solution which must be quite clear, is then added to the test ferment and placed in an incubator. If peptolytic ferments are present, tyrosine separates after a short time, and on cooling may be filtered off and weighed. The silk peptone should also be useful for the cultivation of bacteria. Further researches are in progress to obtain peptones in a similar way from other proteins, in order to obtain general experimental material for researches on peptolytic ferments.—W. N. B.

Alcoholic fermentation in the presence of sulphurous acid. P. Martinand. *Comptes rend.*, 1909, 149, 465–467.

THE fermentation which commences sooner or later in musts and sugar solutions containing considerable quantities of sulphurous acid is due to a micro-organism similar to the *Torula*; this organism has feeble fermentative powers, does not ferment maltose, and does not form ascospores. In one experiment which is described, 5 grms. of sulphurous acid were added to a solution of 180 grms. of sucrose in 1 litre of water; this commenced to ferment at the end of 10 days. At this time about one-half of the added sulphurous acid was present in the free state, the other half being combined, probably with the aldehyde which is produced by the organisms. Twenty-four hours later, all the free acid had disappeared, whilst 4.09 grms. were present in the combined state. The amount of aldehyde now present was 1.14 gm. per litre. An experiment with yeast in a similar sugar solution did not lead to the formation of aldehyde, and, consequently, fermentation did not commence. A portion of the added sulphurous acid becomes oxidised to sulphuric acid and it is only when the sulphurous acid has disappeared, either by oxidation or by combination with the aldehyde produced during the fermentation set up by the above-mentioned organisms, that the yeast cells grow and predominate.—W. P. S.

"*Tanezu*" (*Japanese vinegar ferment*); *The micro-organisms of* —. T. Takahashi. *J. Coll. Agric., Imp. Univ.*, 1909, 1, 103–133.

JAPANESE vinegar is made from various raw materials, e.g. soured "saké," soured "moromi" mash of "saké," specially prepared vinegar mash and "saké-kasu," the pressed residue of "saké" mash. In all cases the use of a previously fermented mash is essential to the proper starting of the fermentation. This mash, which is called "tanezu," is prepared by mixing rice "koji," steamed rice, and water. The author has made a detailed study of the micro-organisms contained in it. He has isolated and characterised 7 varieties of bacteria, 2 of wild yeasts, and 2 of *Aspergillus*. The following bacteria are described: (1) *B. ascendans* Henneberg, var. *Tanezu*, which differs from the normal type in its ability to form acid directly from most of the sugars; this variety belongs to Hoyer's class of quick vinegar bacilli. (2) *B. acetosum* Henneberg, var. *Tanezu*, which may be classed among Hoyer's beer-vinegar bacilli and with *B. rancens* Beijerinck. (3) *B.*

acti Brown, var. *Tanezu* I., which forms reducing sugar from mannitol; it also may be classed with *B. rancens*. (4) *B. acti* Brown, var. *Tanezu* II., which resembles the last, but is characterised by the formation of a rose-red colour at high temperatures. (5) *B. acetosum* Henneberg, var. *Tanezu*, also classed with *B. rancens* Beijerinck, but its property of forming reducing sugar from mannitol assimilates it to *B. acti* Brown. (6) *B. acti* Pasteur, var. *Tanezu*, differing from *B. acetigenum* and *B. asenulans* in many respects, and forming acid direct from sugars. (7) *B. xylinoides*, var. *Tanezu*, which differs from the normal type in the fact that its films do not give the cellulose reaction. The amount of acid produced by these bacteria ranges from 1 to 5 per cent., according to the variety. The products of fermentation in media free from alcohol also differ according to the varieties:—some form methyl alcohol and fusel oil; others form isopropyl alcohol, ethyl alcohol, methyl alcohol and fusel oil, and one forms methyl lactate or butyric acid.—J. F. B.

Alcohol; Industrial — and its possibility as a source of power in the Philippines. A. J. Cox. *Philippine J. Sci.*, 1909, 4, A, 232–236.

THE sources of alcohol available in the Philippine Islands are rice, Indian corn, sugar-cane, the sap of the nipa and other palms, and cassava. At present nearly all the alcohol produced is obtained by the systematic "bleeding" of the nipa palm, followed by fermentation and distillation of the "tuba." The wholesale price of 15 litres of 95 per cent. alcohol from this source is 2.40 pesos (5s.), whilst the estimated price for the product from Indian corn is 2.30 pesos (4s. 9½d.), and for that from cassava 2.60 pesos (5s. 5d.) per 15 litres. As gasoline (sp. gr. 0.699) is at present sold in Manila at 2.38 pesos (4s. 11½d.) per 15 litres, and an engine requires about 1.5 times as much 95 per cent. alcohol as gasoline to develop the same power, it follows that alcohol at any price above 1.60 pesos (3s. 4d.) per 15 litres cannot compete with gasoline, except possibly in remote localities.—A. G. L.

Oxydases; Employment of hydrogen peroxide in experiments on —. Kikkaji and Neuberg. *See XXIV.*

PATENTS.

Malt kilns. R. Roth, Erfurt, Germany. Eng. Pat. 5409 Mar. 5, 1909.

In the kiln described, the hot air from the furnace passes through flues, provided with regulating valves, into the kiln proper, which contains a number of horizontal travelling bands placed one above the other. The heated air is then conducted from the top of this part of the kiln through a number of passages into a preliminary drying chamber. The green malt is fed on to a travelling inclined band, reaching to the top of the preliminary drying chamber, and is partially dried by the currents of hot air. It then falls on to the uppermost of the travelling bands in the kiln proper which delivers it to the next band, and so on, the dried malt finally falling from the lowest band into a discharge shoot. An exit flue for the hot air is provided at the bottom of the preliminary drying chamber, and a ventilating dome fitted with a valve is placed at the top of the kiln. In a second form of kiln described, the hot air is conducted from the kiln proper to the under surface of the travelling band in the preliminary drying chamber. In both kilns, the temperature may also be regulated by means of flues in connection with the outer air.—W. P. S.

Vinasses; Process for treating distillery —. F. and E. D. Verbièse. First Addition, dated Jan. 19, 1909, to Fr. Pat. 396,288, Jan. 21, 1908 (this J., 1909, 619).

In the process of clarification referred to in the principal patent, other bases than lime may be used if desired. A large excess of lime should be avoided, since it redissolves some of the precipitated matters and tends to attack the filtering cloths. For this reason it is proposed to remove the greater part of the excess of lime by the passage of a current of carbon dioxide, preferably the gas developed during fermentation.—J. F. B.

Wine or other alcoholic liquid: Method of preparing a nourishing —, S. Bendle, D. I. Smith, and T. B. H. Thorne. Fr. Pat. 400,471, Feb. 12, 1909. Under Int. Conv., Feb. 25, 1908.

SEE Eng. Pat. 4231 of 1908; this J., 1908, 1171.—T. F. B.

Stills. Fr. Pat. 398,847. See I.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.) FOODS.

Preservatives in cream: The use of —, J. M. Hamill. Report to the Local Gov. Board, 1909, Food Report No. 10, 1—35.

ON several occasions traders have represented to the Board that 0.25 per cent. of boric acid (the limit recommended by the Departmental Committee on Preservatives and Colouring Matters in Food, 1901) is an insufficient quantity for the preservation of cream, and that in the conditions under which the cream trade has to be conducted, no limit of boric acid under 0.5 per cent. would suffice. The Board therefore instructed the author to make inquiries and investigations on the subject, and the results are published in this report. A description is given of the sources of the cream supply, methods of separation of cream, distribution of cream, richness of cream, clotted cream, etc. The results are also given of an experimental inquiry into the effect of different amounts of boric acid and boron compounds on the keeping power of cream at relatively high temperatures

Origin.	South America.	Central America.
	Per cent.	Per cent.
Raw.....	1.08—1.35	1.11—1.68
Roasted.....	1.11—1.48	1.15—1.70

and under conditions approximating to those under which the jug-cream trade is carried on. It was found that 0.2 per cent. and 0.3 per cent. of boric acid were insufficient to preserve cream either at 65° F. or 71° F. for more than 3—4 days; 0.4 per cent. and 0.5 per cent. of boric acid prevented the production of acid, but allowed the production of an unpleasant flavour after 4—7 days, and mould growth after about 6 days both at 65° F. and 71° F. A more effective preservative than boric acid is obtained when the boron preservative contains 7 grms. of alkali (Na_2O) per 100 grms. of boric acid. In the presence of this proportion of alkali, 0.4 per cent. of boric acid is practically as effective as 0.5 per cent. at 65° F., but is slightly less effective at 71° F. Cream may be preserved by either of these proportions for about 4—7 days at temperatures up to 71° F.

The following recommendations are made:—

(1). In the interests of the public health and of the consumer, and also with a view to removing difficulties which traders in cream are experiencing on account of present uncertainties, it appears desirable that effect should be given, subject to (2) below, to the recommendations made by the Departmental Committee on Preservatives, 1901, that the only preservative to be used in cream should be boric acid, borax, or mixtures of these boron preservatives; that a maximum limit of boron preservative calculated as boric acid (H_3BO_3) should be prescribed; and that the presence of boron preservatives should in all cases be declared. These provisions should also apply to clotted cream.

(2). An exception might, however, be made in respect of the use of hydrogen peroxide, the addition of which to cream might be permitted, provided that only traces were allowed to remain in the cream.

(3). It appears desirable that the question of issuing regulations on this matter should receive the Board's consideration and that account should be taken of the following points:—

(a). The declaration of the presence of preservative to the purchaser, whether wholesale or retail, should in all cases be adequate, and the preserved cream as an article of commerce should be differentiated from cream which contains no added preservative.

(b). In the case of boracised cream the maximum amount of boron preservative, calculated as boric acid (H_3BO_3), should be 0.4 per cent. from May to October inclusive, and 0.25 per cent. during the remainder of the year.

(c). Cream in which boron preservatives are permitted, subject to the above limits, should in all cases contain at least 40 per cent. of milk fat.

(4). Having regard to the use of sweetening agents such as saccharin to conceal sourness of cream and to impart an unnatural sweetness, it appears desirable that their presence should be notified to the purchaser.

—W. P. S.

Coffee: Amount of caffeine in —, and loss of caffeine on roasting coffee. K. Lendrich and E. Nottbohm. Z. Unters. Nahr. Genussm., 1909, 18, 299—308.

HEFELMANN (this J., 1908, 1218) found the dry substance of raw unwashed coffee to contain from 0.864 to 1.669 per cent. of caffeine, whilst results recorded by other chemists have differed widely from these figures. The amount of caffeine determined by the authors' method (this J., 1909, 379) in 32 samples of raw coffee varied from 1.05 to 2.83 per cent., and in the roasted beans from 1.09 to 2.95 per cent. Both in the case of the raw and the roasted beans the smallest proportion of caffeine was found in Abyssinian Mocha coffee, and the highest in Cazengo coffee. The proportions, arranged according to the origin of the coffee, were as follows:—

	Asia.	Africa.	Australia.
	Per cent.	Per cent.	Per cent.
Raw.....	1.10—1.65	1.05—2.83	1.35
Roasted.....	1.12—1.68	1.09—2.95	1.42

The samples of Cazengo and Encongo coffee, which contained over 2 per cent. of caffeine, were derived from wild plants in Portuguese Africa. The so-called "wild Congo coffee," with which Cazengo coffee can probably be classed, is produced by *Coffea camphora* (Pierre). The highest value for the caffeine content of this coffee recorded by Siedler (2.36) is exceeded by the Cazengo coffee, with 2.83 per cent. These wild kinds of coffee are regarded as of inferior quality in commerce, and are generally used for blending. Experiments are now being made in Java and Surinam on the cultivation of this coffee. The highest proportions of caffeine found in the samples of cultivated coffee were 1.65 and 1.68 per cent. No sample containing less than 1 per cent. was found, and the authors regard 1 per cent. as the probable lowest limit for commercial samples. Although the percentage of caffeine is probably influenced by the climate and methods of cultivation, it is mentioned as noteworthy that Liberian coffee, which contains the highest proportion among the cultivated kinds, still contains the most when cultivated in other parts of the world. Thus from 1.29 to 1.68 per cent. of caffeine was found in Liberian coffee of different origin. The loss of caffeine on roasting the coffee was found to vary from 1.50 to 8.53 per cent. of the total amount of alkaloid present. Contrary to the experience of Balland (J. Pharm. Chim., 1904, 20, 543) the beans were found to contain a higher percentage of caffeine than the seed-pellicles, whilst the hulls contained a still smaller proportion than the pellicles.—C. A. M.

"Tamari-Shoyu" [soy]; Chemical composition of —, K. Yoshimura. J. Coll. Agric., Imp. Univ., Tokyo, 1909, 1, 89—96.

"TAMARI-SHOYU" is manufactured entirely from soy beans, whereas ordinary "shoyu" is made from equal parts of soy beans and wheat (see this J., 1907, 1062). The mash is made up with soy beans, salt and water

and the "tamari" pressed out after about 20 months. In the following table, the composition of "tamari" is shown comparatively with that of ordinary "shoyu":—

	"Tamari."	"Shoyu."
Specific gravity	1.205	1.197
Water, per cent. by weight	45.68	67.15
Dry substance, per cent. by weight ..	54.32	32.85
Total nitrogen, per cent. by weight ..	2.385	1.240
Protein nitrogen, per cent. by weight ..	0.536	0.037
Ammonia nitrogen, per cent. by weight ..	0.305	0.140
Basic nitrogen, per cent. by weight ..	0.379	0.330
Nitrogen in other forms, per cent. by weight ..	1.165	0.742
The dry substance contains:—		
Organic matter, per cent.	58.04	49.12
Ash, per cent.	41.96	50.88
Sodium chloride, per cent.	16.64	44.94

The destruction of the proteins during the ripening period is not so intense in the case of "tamari" as in that of ordinary "shoyu." The authors have examined the bases of "tamari" more particularly. From 1 litre of "tamari," they isolated 0.3 gm. of putrescine, 0.7 gm. of ornitine, 0.7 gm. of a base, $C_6H_9N_3$, and 4.5 grms. of ammonia. The putrescine is regarded as being derived from the further breaking down of the ornitine, and both these bases are probably formed at the cost of arginine. The base, $C_6H_9N_3$, is probably a putrefaction derivative of histidine. It is known that glycine, the protein of the soy bean, yields arginine, lysine, and histidine on hydrolysis, but none of these bodies were found to have survived in the "tamari."—J. F. B.

"Shoyu" [soy]; *The carbohydrates of* — R. Mitsuda. J. Coll. Agric., Imp. Univ., Tokyo, 1909, 1, 97—101. (See preceding abstract.)

THE sugars present in "shoyu" have been isolated in the form of their osazones. After removing the greater part of the salt from the "shoyu" by evaporation, the liquid was decolorised with animal charcoal and treated directly for the preparation of the osazones. On purification, there were obtained from 400 c.c. of "shoyu," 5 grms. of glucosazone and 0.6 gm. of galactosazone, whilst maltosazone was recognised microscopically, but not isolated. When "shoyu" or "tamari" is exactly neutralised and distilled, traces of furfural are obtained, and this body must be regarded as pre-existent in the "shoyu." The quantities of furfural found did not exceed 0.0002 per cent., and the proportion appeared to be in some relation to the acidity of the "shoyu." When the "shoyu" is distilled without neutralisation, the proportion of furfural obtained is somewhat higher. It would appear that the presence of furfural in "shoyu" is due to the action of the organic acids on the pentosans at the ordinary temperature during the period of ripening. The author has studied the pentosan content of the "moromi" at different stages during the ripening process. The percentage of pentosans in the pressed extract increases in the early stages up to a maximum after 5 months; it subsequently decreases owing to the action of micro-organisms or to that of the organic acids. Compared with the amount of pentosans in the raw material, the quantity which is extracted by the salt water during the ripening process is quite small.—J. F. B.

Detecting some animal fats in admixture with others. Labaud. See XI.

Determining phosphoric acid in organic substances. Schaumann. See XXIII., Org. Quant.

Pure Food Act (1908), New South Wales. Further Regulations. (See this J., 1909, 902 and 999.) Bd. of Tr. J., Sept. 23, 1909. [T.R.]

A "SUPPLEMENT to the Government Gazette of New South Wales" for 28th July, 1909, contains further regulations which have been made under the Act.

These additional regulations relate to drugs, milk, butter, cheese, margarine, and condensed milk, and provide that certain packages of food shall be exempt from the

provisions of Section 14 of the "Pure Food Act" which relates to labelling, and requires that a statement as to the weight, number, measure or volume of the contents shall be attached to packages of food.

The regulations operate partly from the 28th July, 1909, and partly from 1st January, 1910.

PATENTS.

Flour from wheat; Art of milling and conditioning — H. Simon, Ltd., Manchester. From L. M. Thomas, Wilhelmshafen, Germany. Eng. Pat. 9946, May 7, 1908.

THE flour is subjected to the action of a current of air saturated with water vapour and having a temperature of from 30° to 50° C. The flour is led through the mixing apparatus at such a rate that it absorbs at least 0.1 per cent. of its weight of water.—W. P. S.

Flour; Treatment of — [improving its bread-making properties]. A. E. Humphries, Weybridge, Surrey. Eng. Pats. 13,135, June 19, 1908, and 17,279, Aug. 17, 1908.

THE flour is sprayed, preferably during the intermediate stages of the milling process, with water or with solutions of various substances. A preliminary experiment is necessary in order to determine the character of the solution required to be used. For instance, the weight of the flour may be increased by from 1 to 2 per cent. by simply using a water spray. For increasing the gas-making qualities of the flour, a solution containing 13 per cent. of maltose, 8 per cent. of dextrin, and 5 per cent. of malt extract (300° Lintner) may be employed; the solution may also contain a small quantity of ammonium phosphate. To improve the dough, the spray may contain calcium, magnesium, or potassium phosphates; and to restrain fermentation, etc., a solution containing 3 per cent. of potassium hydroxide, or a saturated solution of common salt may be sprayed on to the flour. The amount of spray used should be such that the flour receives from 0.2 to 0.5 per cent. of its weight of salt or salts, except in the case of the alkali spray, when the quantity of alkali added to the flour should not exceed 0.05 per cent.—W.P.S.

Flour; Process for improving [the baking qualities of] — F. Tildesley, A. B. Ritchie, and E. J. Watkins, London. Eng. Pats. 3612, Feb. 13, 1909, and 6178, Mar. 15, 1909.

THE flour is treated in an agitator with air containing sulphur trioxide, sulphur trioxide and chlorine, or with air which has been passed through or over Nordhausen sulphuric acid and one or other of the following acids:—Hydrochloric acid, hydrofluoric acid, hydrobromic acid, hydriodic acid, nitric acid, or nitrous acid.—W. P. S.

Baking-powder. J. H. Kellogg, Battle Creek, Mich. U.S. Pat. 932,138, Aug. 24, 1909.

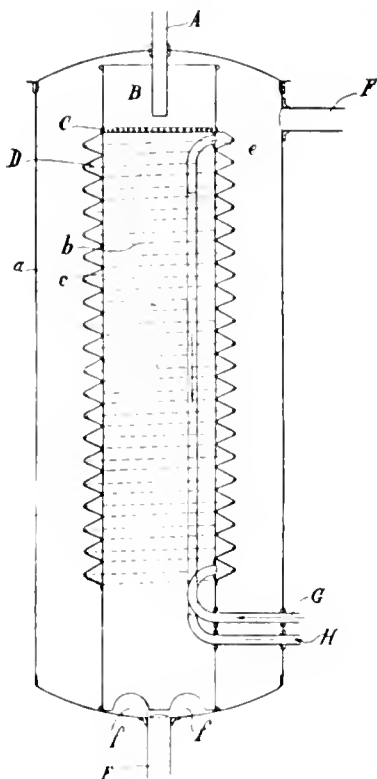
THE baking powder is prepared by impregnating gluten with hydrochloric acid, drying the same, and mixing it with suitable quantities of flour, or starch, and sodium bicarbonate.—W. P. S.

Milk; Process for the manufacture of dried — Swiss Dry Milk Co. Fr. Pat. 398,941, Dec. 23, 1908. Under Int. Conv., April 27, 1908.

THE milk is concentrated under reduced pressure at a temperature of about 40° C. until the greater part of the water has been evaporated. It is then dried completely on a rotating drum heated to a temperature above 100° C.—W. P. S.

Condensation of liquid [milk] in vacuo; Continuous — Swiss Dry Milk Co. Fr. Pat. 400,513, March 8, 1909.

THE liquid, e.g., milk, is fed into the apparatus through the pipe, A, and is distributed from the vessel, B, through the ring of holes, C, on to the exterior surface of the spiral, D. The latter is supported on the exterior surface of the cylinder, b, so as to form a spiral channel, e, through which the heating medium is circulated, entering through the pipe, G, and being discharged through the pipe, H.



The milk flows over the outer surface of the spiral, is condensed or concentrated by the heat and is discharged from the bottom of the outer containing vessel, *a*, through the pipe, *E*; holes, *f*, *f*, being cut in the lower end of the cylinder, *b*, to allow the passage of the condensed milk to the outlet. The vessel, *a*, is connected by the pipe, *F*, to a vacuum pump, by which it is exhausted.—W. H. C.

Milk and other liquid foods, medicines, serums, etc.; Sterilisation of — V. Henri, A. Helbronner, and M. von Recklinghausen. Fr. Pat. 400,602, Mar. 2, 1909.

The liquid to be sterilised is allowed to flow into a funnel-shaped vessel, having corrugated sides, and inclined at an angle to the vertical. This vessel is rotated and the liquid flows, in a thin layer, down the sides to the bottom or stem, from which it is discharged into a receiving chamber. While the liquid is flowing down the sides of the vessel, it is subjected to the action of ultra-violet rays proceeding from a mercury vapour lamp fitted at the top of the vessel. A current of sterilised air or inert gas is passed upwards through the vessel while the operation is proceeding, in order to prevent the liquid from becoming heated.—W. P. S.

Sterilising liquids [foods], etc.; Process and means for — by the action of ultra-violet rays. Soc. Le Ferment. Fr. Pat. 400,760, Mar. 13, 1909.

The liquid is placed in a closed vessel, such as a bottle or other receptacle, and is subjected to the action of ultra-violet rays. The stopper of the bottle, or the bottle itself, is made of quartz, silica, or other substance which offers no obstacle to the passage of the rays, and the latter may be allowed to pass through the stopper, sides, or bottom of the bottle. A number of bottles may be placed on revolving plates situated around a central source of the light, and reflectors may be provided for concentrating the rays.—W. P. S.

Vegetable albumin and animal casein; Process of treating — and the product thereof. F. G. Wiechmann, New York, Assignor to Protal Co. U.S. Pat. 932,527, Aug. 31, 1909.

SEE Fr. Pat. 388,492 of 1908; this J., 1908, 909.—T. F. B.

Cooling apparatus for fluid or semi-fluid substances [margarine emulsions]. Eng. Pat. 1160. See XII.

(B.)—SANITATION; WATER PURIFICATION.

PATENTS.

Trade effluent [from wool washing, etc.]; Method and apparatus for purifying — T. Waite, Bradford, Yorks. Eng. Pat. 17,644, Aug. 22, 1908.

THE effluent is pumped into one or more "seak" tanks where the grease is separated by the addition of sulphuric acid. These tanks are provided with a trumpet-shaped agitator through which air is injected by means of a steam jet. The acid water is run off on to a water-wheel which operates a stirrer in a separate tank; in this tank is a bucket-wheel which delivers automatically a certain proportion of lime solution into the acid water. This then flows into neutralising tanks where a second precipitation takes place; the tank fills up and then the liquid is run off through a siphon into another similar tank where a further clarification is effected. The clarified liquid next passes to another water-wheel which automatically revolves a circular sprinkler situated over a filter bed composed of ashes suitably graded, through which the purified effluent is discharged. (Reference is directed to Eng. Pat. 11,366 of 1901; this J., 1902, 1292.)—J. F. B.

Water purifying and softening plant. H. Boyd, Timperley, Cheshire. Eng. Pat. 17,672, Aug. 22, 1908.

THE apparatus consists of a series of filtering tanks of circular section, each containing a filter which can be readily lifted out for cleaning, any mud or sediment being removed through a cock at the bottom. In combination with these filters there is an arrangement of bucket-wheels for measuring the water to be treated and the chemicals required. The water to be treated is delivered into a series of buckets mounted on a vertical chain, and thus provides the motive power for the measuring of the reagent and the agitation of the chemicals. The reagent and measured water fall together into a spout which conducts them to a mixing tank from which the filters are fed. The filters are connected in series, the top of one to the bottom of the next, the water passing upwards through the filters. The filter-beds are held in conical seatings making a tight joint with the walls of the circular tanks.—J. F. B.

Water; Process for purifying — W. P. Morgan. Fr. Pat. 400,525, Mar. 9, 1909.

THE process relates to the purification of waters containing calcium salts. To every 4.5 litres of the water is added a mixture consisting of aluminium sulphate, 0.256 gm.; kaolin, 0.384 gm.; and starch, 0.640 gm. These reagents may be conveniently made up in the form of tablets; when required for use, a tablet is ground up with a little water and the paste added to the bulk of the water. The coagulum which forms entrains the bacteria, suspended matters, and dissolved organic substances present in the water, and, after the lapse of five minutes, the precipitate is removed by filtering the water through fibrous material. (See also U.S. Pat. 914,887 of 1909; this J., 1909, 438.)—W. P. S.

Effluents; Process for the purification of — by means of finely ground humic coals (e.g., lignites, peat). W. Rothe and Co. Ger. Pat. 212,740, June 10, 1908.

THE effluent is treated with a mixture of humic coal (lignite, peat) and ordinary pit coal, both in a finely-divided condition, together with a salt of a heavy metal. The pit coal does not exert any purifying action, but accelerates the settling of the sludge, and renders the latter better suited for subsequent utilisation as fuel or by carbonisation.—A. S.

(C.)—DISINFECTANTS.

PATENT.

Disinfectants; Manufacture of — H. Schneider. Berlin. Eng. Pat. 2472, Feb. 2, 1909. Under Int. Conv., May 11, 1908. Addition to Eng. Pat. 3789 of 1907, dated Feb. 16, 1906.

SEE Addition of Feb. 3, 1909, to Fr. Pat. 377,141 of 1907; this J., 1909, 1000.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Cellulose esters; Notes on — R. G. Woodbridge. J. Amer. Chem. Soc., 1909, 31, 1067—1071.

THE results of some work on the propionates and formates of cellulose are given. Cellulose tripropionate may be prepared by the action of propionic anhydride upon cellulose in the presence of sulphuric acid or zinc chloride, the latter causing more complete esterification to take place in a shorter time. The properties of cellulose tripropionate are essentially the same as those of the acetate. It may be distinguished from the latter by its solubility in ethyl acetate. On spontaneous evaporation, solutions of the tripropionate yield good films, which are, however, not superior to those which can be obtained from the acetate. Cellulose formate is formed by the action of anhydrous formic acid upon cellulose in the presence of sulphuric acid. It is soluble in formic acid and zinc chloride solution, but insoluble in methyl, ethyl and amyl alcohols, acetone, chloroform, acetylene tetrachloride, ethyl acetate, amyl acetate, aniline, and nitrobenzene. It was not found possible to prepare a fibrous cellulose formate.—W. P. S.

Celluloid; Flameless decomposition of — A. Panzer. Z. angew. Chem., 1909, 22, 1831—1837.

CELLULOID was heated by an electrically heated wire touching its surface, in a vessel from which the air had been removed, till decomposition set in. The current was then switched off, the decomposition allowed to continue, and the products were examined. It was found that 24.8 per cent. of the weight of the celluloid was obtained as gaseous products, and 16.8 per cent. remained behind as charcoal or coke; the remaining 58.4 per cent. of liquid and solid products of distillation could be only partially collected, owing to the difficulty of condensing them. The charcoal was found to be, or to become when very gently heated, pyrophoric. The fires which have from time to time arisen in celluloid factories have very probably been caused by decomposition of the celluloid, followed by ignition of this pyrophoric charcoal. The gases consisted of (by volume) nitric oxide, 51.1; nitrous oxide, 5.5; carbon dioxide, 6.8; carbon monoxide, 30.9; hydrogen, 0.9; nitrogen, 4.8 per cent. The liquid products consisted very largely of camphor and nitric acid, very probably the whole of the camphor contained in the celluloid passing over as Kachler's camphor nitrate, $2C_{10}H_{16}O.N_2O_5$. Possibly the explosions which have occurred during celluloid factory fires are caused by this substance or the products of its decomposition by heat. Further investigation is, however, necessary. (See also this J., 1909, 1001.)—J. T. D.

PATENTS.

Paper, cardboard, etc.; Method of glazing — Armitage and Ibbetson Ltd., W. H. and F. Ibbetson, R. F. Woodburn and E. Norrie, Bradford, Yorks. Eng. Pat. 3883, Feb. 17, 1909.

PAPER or cardboard is coated with a film of gelatin by applying the gelatin or other glazing material in a fluid state to the surface of the paper, and passing the latter between a pair of rollers revolving in close proximity to each other but not actually in contact. One of the rollers supports the paper, whilst the other applies the fluid glaze, which is fed on to it by another roller revolving in a trough. The film is subsequently polished by pressing it in contact with a sheet of glass by means of resilient rollers.—J. F. B.

Papers for decorative purposes; Manufacture of varnished — C. Follot. Fr. Pat. 400,692, March 11, 1909.

PAPER is first coated with a "finish" or size and is then given a coating of coloured lacquer. The varnished paper is subsequently embossed by means of engraved rollers which impress striations or dots on its surface in such a way that various reflections of the light are produced according to the position in which the paper is held. Designs may be embossed or reserved on the paper in addition to the general groundwork of the decoration; also different colours may be printed in design by means of the relief portions of the embossing rolls.

—J. F. B.

Plastic material [from celluloid] for manufacture of combs and moulded articles. L. Desvaux and H. Allaire. Second Addition, dated March 6, 1909, to Fr. Pat. 388,097, March 11, 1908 (this J., 1908, 873, 1982).

ACCORDING to this addition the whole or a portion of the "maisin" claimed in previous specifications for incorporation with celluloid may be replaced by vegetable proteins of the amidine group, e.g., gliadin, gluten-fibrin, mucedin, zein, guaneide, etc., which are soluble in alcohol. For instance a celluloid mixture containing 50 parts of nitrocellulose and 25 parts of camphor may be milled with 50 parts of an amidine previously moistened with alcohol.—J. F. B.

Bamboo pulp and analogous materials; Treatment of — J. S. Turner and A. W. Maxwell. Fr. Pat. 401,035, March 19, 1909. Under Int. Conv., March 20, 1908.

SEE Eng. Pat. 6277 of 1908; this J., 1909, 851.—T. F. B.

Cellulose acetate; Process for producing solutions of — Fürst Guido Donnersmarck'sche Kunstseiden und Acetatwerke. Fr. Pat. 400,652, March 10, 1909.

SEE U.S. Pat. 922,340 of 1909; this J., 1909, 671.—T. F. B.

Treating waste sulphite liquor, and new product [tanning material] therefrom. Eng. Pat. 17,956. See XIV.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Saponin-digitalin group of glucosides; A new member of the — B. Moore, F. W. Baker-Young, and S. C. M. Sowton. Pharm. J., 1909, 80, 364.

THE residue left after expressing the oil from the seeds of *Bassia longifolia* (mowrah seeds), has, in common with digitalis, an irritating action when in contact with a cut surface of the skin. A quantity of the residue was extracted with alcohol, and precipitated with ether. The substance on purifying proved to be a glucoside (carbon 51.9, hydrogen 6.85 per cent.), for it yielded a hexose and "mowrie acid" on hydrolysis. It has a strong coagulating effect on blood corpuscles in saline suspension. "Mowrin," the glucoside, has a stronger effect in this way than the salts of mowrie acid. Both substances are poisonous, and have an effect on the heart resembling that of digitalis.—F. SHDN.

Bismuth iodide; Hydrolytic dissociation of — R. Dubrisay. Comptes rend., 1909, 149, 451—453.

THE hydrolysis of bismuth iodide results in the formation of two distinct compounds; in low concentrations, when the amount does not exceed 0.002 gram-atom of bismuth per litre, a red compound corresponding to the formula, $BiOI$, is formed. Stronger concentrations result in the formation of a black compound having the composition $Bi_2O_3.5HI$. As a continuous curve is obtained when the contents of bismuth and hydriodic acid are represented graphically, it is concluded that two oxy-iodides exist. It is further shown that the dissociation of bismuth iodide increases as the temperature is raised.—W. P. S.

Iodate in commercial potassium iodide. Andrews. See VII.

Chemicals for use in factories: Duty-free admission of certain —. Dutch Bd. of Tr. J., Sept. 23, 1909. [T.R.]

A Dutch Royal Decree, dated the 31st July, 11th August, and 16th August, provides for the duty-free admission, under the conditions prescribed by the Royal Decree of the 11th August, 1908, of the following articles:—

(a) Fat mixed with pyroigneous spirit, for use in chrome-leather tanneries, and "cellangoh" (a solution of nitro-cellulose and camphor in alcohol and ether), for use in shoe factories;

(b) Chloride of ethyl, for use in scent manufactories; and

(c) Acetate of amyl, for use in electric incandescent lamp factories.

PATENTS.

Serum or anti-toxin [swine fever]: New — and method of obtaining same. Pharm. Inst. L. W. Gans, Frankfurt-on-Maine, Germany. Eng. Pat. 5773, March 10, 1909. Under Int. Conv., March 11, 1908.

A PROTECTIVE medium against hog cholera or swine fever is prepared by pressing or extracting the organs of the thoracic and abdominal cavities or the muscles of animals infected with the disease, after the animal has been bled. The virus in the extract is then killed by the addition of suitable germicidal agents, e.g., chloroform or toluene. The inoculating medium thus obtained is injected into animals of a different species, their blood being then prepared as a serum in the usual way.—J. F. B.

Blood: Process for obtaining a therapeutic agent from animal —. S. Bergel. Ger. Pats. 205,025, July 27, 1907, and 212,112 and 212,113, July 24, 1908.

FRESH animal blood obtained under aseptic conditions, from immunised animals, is centrifuged till the red corpuscles have separated completely from the white corpuscles and blood plasma. After removing the red corpuscles, the remaining portion of the blood is coagulated, and the mixture of fibrin with serum and white corpuscles is dried and pulverised at temperatures below 40° C., in some cases after addition of other substances such as yeast powder, collargol (colloidal silver), nucleic acid, silver citrate, zinc perhydrol (zinc peroxide), etc. After drying and pulverising, the product may be sterilised by heating, without destroying its therapeutic properties. After separation of the red corpuscles and coagulation of the residue, the fibrin may be separated from the mixture of blood serum and white corpuscles and the two products worked up separately according to the process described.—A. S.

Prophylactic substance in the tissues of immunised animals: Process for recovering the —. L. Heim. Ger. Pat. 212,709, March 20, 1908.

HITHERTO it has been thought that the prophylactic substances produced in immunised animals are contained in remunerative quantity, only in the serum, but according to the present patent, very active preparations can be obtained from the tissues of the animals. The muscles and interior organs of the animals are dried at a low temperature or by means of a mixture of acetone and ether, then freed from fat by means of acetone, and after removing the solvent, ground to a fine powder and the latter triturated with about ten times its quantity of water. The mixture is subjected to the action of proteolytic enzymes in an incubator nearly to the point at which the solution no longer gives the biuret reaction. It is then filtered and concentrated at a low temperature. The muscles and organs may also be mixed with sand and kieselsol, pressed, and the residue and press-juice treated separately according to the process described above.—A. S.

Vanilla: Oleo-resin of —. E. J. Sheehan, Assignor to San Gabriel Valley Fruit Products Co., New York. U.S. Pat. 931,805, Aug. 24, 1909.

THE product described is an oleo-resinous extract from vanilla beans; it is brownish-amber in colour, has a

gummy consistence, and contains approximately 10 per cent. of vanillin, 41 per cent. of neutral resins of the consistence of soft paraffin, insoluble in aqueous alkali but soluble in ether, and 31 per cent. of organic acids and acid resins; the latter are amber yellow in colour, of pasty consistence, are soluble in aqueous alkali and in alcohol, and on sublimation yield fine white crystals melting at about 73.5° C.—W. P. S.

Phenyl acetate: Antiseptic composition containing —. N. Sulzberger, New York. U.S. Pat. 932,647, Aug. 31, 1909.

A NON-IRRITANT, analgesic and antiseptic preparation for pharmaceutical use is claimed, containing phenyl acetate in admixture with about 3 per cent. of eucalyptus oil and 1 per cent. of peppermint oil. Generally expressed, the invention claims the use of a solution of about 5 per cent. of essential oils in the acetic ester of a phenol.—J. F. B.

Silver and albumose: Preparation of basic compounds of —. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 400,627, March 8, 1909. Under Int. Conv., March 23, 1908.

SOLUTIONS of albumose are mixed with solutions of the double compounds of salts of silver with non-irritant and non-poisonous organic bases, and the mixtures are dried, or the complex compounds precipitated by appropriate means. Compounds of albumose with silver nitrate, carbonate, and phosphate in combination with ethylenediamine and piperazine are described.—J. F. B.

Quinine: Manufacture of a sulphur compound of —. Valentiner und Schwarz. Fr. Pat. 400,631, March 9, 1909.

A COMPOUND having a composition corresponding to the formula, $C_{20}H_{23}N_2OS$, is prepared by heating anhydrous quinine with about 20 per cent. of sulphur at a temperature below the melting point of the base. The mixture begins to fuse at a temperature of 120° C., and after half an hour at 145° C., the reaction is complete. The product is dissolved in dilute hydrochloric acid and purified by precipitation from the filtered solution by the addition of ammonia.—J. F. B.

Emulsions of essences or volatile oils: Process for obtaining — immediately by mixture with water. M. Saporta. Fr. Pat. 400,911, March 17, 1909.

ESSENTIAL oils are mixed with a concentrated solution of "pure black soap" in alcohol; they are then stated to be readily emulsified in water. The following example is given of such an emulsifiable mixture: Soap, two parts, 90 per cent. alcohol, one part, aniseed oil, two parts, peppermint oil, two parts.—T. F. B.

Bacteria: Process for obtaining non-toxic, therapeutic preparations from acid-resisting —. Kalle und Co., Akt.-Ges. Ger. Pat. 212,350, May 17, 1908.

ACID-RESISTING bacteria are extracted for a prolonged period with an aqueous emulsion of lecithin, preferably in presence of a small quantity of hydrogen peroxide, and the liquid separated from the insoluble matter. The preparation obtained from tubercle-bacilli is stated to be of value in the treatment of tuberculosis.—A. S.

Protein substances from pathogenic bacilli: Process for obtaining active —. Kalle und Co. Ger. Pats. 212,830, May 17, 1908, and 212,831, July 14, 1908.

(1). THE bacilli are freed from fat, preferably by a method in which the protein is not coagulated, and are then heated with a solution of a primary or secondary alkylamine, or of a substance (dimethylurea, dimethylbenzamide, etc.) capable of yielding the same, until the greater part of the organic matter has dissolved. The solution is filtered and treated with acetic acid, whereupon a precipitate is obtained consisting of a protein substance, which, whilst relatively non-toxic, possesses great therapeutic value. The process is specially applicable to tubercle bacilli.

(2.) If anthrax bacilli which have first been subjected to the action of nitrous acid, be treated according to the process described, a very active preparation of anthrax toxin is obtained.—A. S.

Organic arsinic acids and their salts; Process for preparing [solutions of] — insoluble in water. P. Wolff. Ger. Pat. 213,394, May 6, 1908.

ORGANIC arsinic acids and their salts which are insoluble in water, are readily dissolved in glycerin, in which form they can be administered internally, either undiluted or diluted with water. A solution of mercuric *p*-aminophenylarsinate in glycerin has a stronger action on trypanosomes than the sodium salt (atoxyl).—T. F. B.

Hydroxyarylarsonoxides; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 213,594, Feb. 5, 1908.

By treating hydroxyarylarsonic acids with weak reducing agents, such as sulphurous acid, hydriodic acid, phenylhydrazine, phosphorus trichloride, or thionyl chloride, the arsinic acid group is reduced to the AsO group. For example, 114 grms. of sodium *p*-aminophenylarsinate are dissolved in 1.6 litres of water, and treated with 20 grms. of potassium iodide and 520 c.c. of dilute sulphuric acid (1 : 5); the solution is saturated with sulphur dioxide at about 18° C., then saturated with salt, and extracted with ether. The extract is freed from acid and the ether distilled off from the phenol-*p*-arsenoxide. If this is warmed with a hydrosulphite in neutral solution, *p*-arsenophenol, $\text{HO.C}_6\text{H}_4.\text{As} : \text{As.C}_6\text{H}_4.\text{OH}$, is produced.—T. F. B.

Trichloroacetylsalicylic acid; Process for preparing —. Chem. Fabr. von Heyden A.-G. Ger. Pat. 213,591, Jan. 16, 1908.

TRICHLOROACETYL SALICYLIC acid is obtained in the form of tasteless, white crystals, melting at 150–152° C., by the action of trichloroacetyl chloride or trichloroacetic anhydride, or a mixture of trichloroacetic acid and phosphorus pentoxide or trichloride, on salicylic acid or its salts, alone, or in presence of condensing agents, such as tertiary bases.—T. F. B.

Aromatic halogenalkyloxy-monocarboxylic acids; Process for preparing —. Chem. Fabr. von Heyden A.-G. Ger. Pat. 213,593, Jan. 22, 1908.

HALOGENALKYLEETHERS of cresols, of the general formula, $\text{CH}_3.\text{C}_6\text{H}_4.\text{ORX}$, where R is an alkyl radical and X a halogen, are oxidised to the corresponding carboxylic acids, without the alkyloxy-group being attacked, by such oxidising agents as convert toluene to benzoic acid (e.g., permanganate, bichromate and sulphuric acid, etc.).—T. F. B.

Camphor; Process for making — in a form easily handled and readily compressed. Chem. Fabr. auf Actien. vorm. E. Schering. Fr. Pat. 398,881, Jan. 27, 1909. Under Int. Conv., Feb. 6, 1908.

SEE Eng. Pat. 1532 of 1909; this J., 1909, 814.—T. F. B.

Aldehydes and ketones [with unsaturated fatty acids]; Process for making compounds of —. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 400,738, June 18, 1908.

SEE Eng. Pat. 13,790 of 1908; this J., 1909, 519.—T. F. B.

Lecithin; Process for extracting — from the seeds of lupins and other podded plants. H. C. Buer. Fr. Pat. 400,878, March 16, 1909.

SEE Ger. Pat. 210,013 of 1908; this J., 1909, 675.—T. F. B.

Sterilisation of milk, medicines, etc. Fr. Pat. 400,602. See XVIII.1.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Images on glass, ceramic, metallic, or other surfaces; Reproduction of —. A. R. Ling, T. Rendle, and E. W. Colbrook. London. Eng. Pat. 17,432, Aug. 19, 1908.

IMAGES which will withstand washing are obtained on ground glass or similar rough surface, by means of a sensitising solution containing invert sugar, honey, or other carbohydrate, a bichromate, and a volatile solvent for the bichromate and carbohydrate. The use of nitrocellulose in the sensitising solution (Eng. Pat. 24,214 of 1907; this J., 1908, 592) is unnecessary with rough surfaces. Suitable solvents are ethyl alcohol, wood spirit, acetone, ether, and ethyl acetate. Glycerin may be used in place of a carbohydrate, in which case acetic acid is used as solvent, and chromic acid as sensitiser. Bichromates of lithium, potassium, ammonium, strontium, calcium, copper, or iron may be used, as also may polychromates. The following is an example of such a sensitising solution:—Lithium bichromate, 2 grms.; honey, invert sugar, or other carbohydrate, 4 grms.; ethyl alcohol or wood spirit, 100 c.c.—T. F. B.

Images on glass, ceramic, metallic, or other surfaces; Reproduction of —. A. R. Ling, T. Rendle, and E. W. Colbrook. London. Eng. Pat. 17,433, Aug. 19, 1908.

IN the process described in Eng. Pat. 24,214 of 1907 (this J., 1908, 592), it is necessary to use a certain amount of water to dissolve the bichromate. It is found that more even films can be obtained by omitting the water, and using a volatile solvent or solvents for the bichromate and the carbohydrate which are miscible with the nitrocellulose solution. Thus, the sensitising solution consists of a bichromate of lithium, calcium, strontium, ammonium, sodium, potassium, copper, or iron, with a carbohydrate or glycerin, a solvent, which may consist of a mixture of ethyl alcohol or wood spirit with ether or ethyl acetate, and a nitrocellulose soluble in the solvent used. The bichromates may be replaced by polychromates or chromic acid; in the latter case, a difficultly oxidisable hygroscopic substance, such as glycerin, is used in place of a carbohydrate. Six examples of sensitising solutions are given.—T. F. B.

Photo-engraving; Preparation of surfaces suitable for —. A. Payne, Whitley Bay. Eng. Pat. 18,775, Sept. 7, 1908. Addition to Eng. Pat. 28,415 of 1907, dated June 22, 1908. (See this J., 1909, 383.)

A COATING of metal is deposited, electrolytically or otherwise, on a prepared plate bearing a "substratum resist," the latter is removed, and the plate is etched by means of a solution which does not affect the metallic coating. Thus, a prepared zinc plate may receive a coating of copper and then be etched by means of dilute nitric acid, or a brass or copper plate may be coated with silver and treated with ferric chloride. The plate prepared with a resist may be first etched and then metal may be deposited subsequently.—T. F. B.

Printing plates and the like; Process for producing —. E. Albert, Munich. Eng. Pat. 25,934, Dec. 1, 1908. Under Int. Conv., Dec. 6, 1907.

A SUITABLE plate, coated first with a resinous substance and then with a film of bichromated gelatin, is exposed under a negative, developed by means of water, and then treated with alcohol thickened by means of tannin or glycerin, or both, which rapidly removes the uncovered portions of the resinous layer. When this solvent action is finished, the plate is immediately washed in water, and finally etched.—T. F. B.

Three-colour screens for photography and process for their manufacture. J. Bamber, London. Eng. Pat. 11,147, May 14, 1909. Addition to Eng. Pat. 3252, Feb. 13, 1908 (see this J., 1908, 1132).

IN order to obviate the necessity of using a light filter for colour photography, the "tacky" substance used to hold the coloured gelatin grains to their support, is suitably coloured to regulate the light passing through it; the grains of gelatin are pressed on to the support, which is coated with the coloured "tacky" substance, so that the latter is partly forced up between the grains, forming a filter for the white rays, whilst that remaining beneath the grains modifies the action of the blue rays passing through the grains. —T. F. B.

Photography of colours by means of a screen and a special support; Process for the —, and its application to phototypic and other processes. E. C. G. Galle. First Addition, dated May 29, 1908, to Fr. Pat. 389,977, July 16, 1907.

INSTEAD of preparing the three-colour screen by superposition, as in the original patent (see Eng. Pat. 15,050 of 1908; this J., 1909, 914), it is prepared by photographing with a Lumière autochrome plate a surface coloured in three sets of areas with violet, orange, and green, or with red, blue, and yellow. —T. F. B.

Cinematograph film; Non-inflammable — and its manufacture. G. Chandon de Briailles. First Addition, dated March 30, 1908, to Fr. Pat. 386,845, April 20, 1907.

THE films described in the principal patent (this J., 1908, 834) may be prepared by means of an apparatus consisting of a cylinder rotating in a vat which contains the gelatin, kept in a liquid condition by a water-bath or similar device. The surface of the cylinder is polished and made of material not affected by gelatin. The gelatin adheres to the cylinder, forming a continuous band, which, when dry, is coated with nitrocellulose and cut by means of a knife supported on a carriage which travels on an endless thread along the surface; suitable gearing regulates the width of the band cut. If the film is to be printed mechanically, its surface is made porous by adding glycerin or other similar substance to the composition; the printing ink may also contain a dyestuff soluble in boiling oil, and also a base which can combine with the chlorine in the chondrine, forming a mordant. —T. F. B.

Cinematograph films; Process of restoring worn —. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 400,739, June 19, 1908.

CINEMATOGRAPH films which have, from continued use, become dull or scratched, are rendered fit for use again by re-polishing them, for instance, by applying a coating of collodion or celluloid to each side of the film by the aid of a suitable solvent and gentle pressure of a roller. —T. F. B.

Photographic film; Non-inflammable —. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 401,228, July 11, 1908.

NON-INFLAMMABLE photographic films are prepared by applying to a polished surface a thin layer of cellulose acetate or other non-inflammable cellulose ester, then a layer of gelatin, and finally a photographic emulsion. The cellulose acetate layer need not be more than one-fifth to one-half the thickness of the entire film. The gelatin may have been treated with formaldehyde, alum, etc. Films prepared in this manner are said to be unaffected in dimensions by the subsequent treatment. —T. F. B.

Photographs on metal, porcelain, glass, or other non-porous substances; Process for obtaining — by the gelatin-chromate process. A. Hans. Fr. Pat. 401,370, March 29, 1909.

SEE Ger. Pat. 212,761 of 1908; this J., 1909, 1066. —T. F. B.

Cellulose compounds in definite shapes [threads, films, &c.] Eng. Pat. 11,625. See V.

XXII. — EXPLOSIVES, MATCHES, &c.

Powder; Determination of nitrogen in gelatinised —. O. Poppenberg and E. Stephan. Z. ges. Schiess- und Sprengstoffw., 1909, 4, 350–351.



THE Schultze-Tiemann method (ferrous chloride and hydrochloric acid) for the determination of nitrogen is not applicable to powders containing nitroglycerin owing to the volatility of this body. The drawbacks of the nitrometer method are, that it takes a very long time to dissolve the gelatinised powder, and that carbon monoxide and carbon dioxide may possibly be produced by the prolonged action of the mixed acids on the cellulose and thus vitiate the results. Further, such substances as are added, either as stabilisers or to reduce muzzle flash, may react with the nitrosyl sulphuric acid to produce oximes and thus give low results. The authors, in order to determine the true nitrogen-content of gelatinised powder, make use of a bomb having gas outlets both at the top and bottom (see figure). One gram. of the explosive is mixed with 1.0–1.5 grms. of copper oxide, and the mixture is placed in a cylindrical iron cup having a stout copper wire projecting from the bottom into the interior. This copper wire serves, when the cup is introduced into the bomb, as the lower terminal for the current, and is connected with the upper insulated terminal by a thin platinum wire, 0.1–0.15 mm. diameter. The mixture surrounds this platinum wire, which is burnt through on the passage of the current. Very small charge densities can be employed, and the authors, working with as low a charging density as 0.06, found no appreciable amounts either of oxides of nitrogen or of ammonia in the products of decomposition. The firing takes place in an atmosphere of carbon dioxide, the gases are swept, by a current of carbon dioxide, through a heated tube filled with copper oxide, and the evolved nitrogen is measured over a solution of caustic potash. It was not found necessary to introduce a reduced copper spiral into the combustion tube. Some comparative results obtained with the different methods are given. —G. W. McD.

Explosion; Circumstances attending an — which occurred in the corning house of the gunpowder factory at Blackbuck, in the county of Lancaster, on July 15th, 1909. Major A. Cooper-Key, H.M. Chief Inspector of Explosives. [Cd. 4864.] (See also this J., 1906, 828.)

ABOUT half a ton of gunpowder was involved in this explosion, and two lives were lost. In the corning house the press-cake is, by means of a wooden hopper, passed between a pair of gun-metal toothed rollers, known as "crackers," which are kept almost in contact with one another by means of a suspended weight, so arranged that in the event of pressure arising between the crackers of sufficient force to lift the weight, they yield, and separate to a distance of about two inches, thus allowing the article causing the pressure to pass through before a dangerous degree of friction is set up. An examination of the debris after the accident brought to light certain indications pointing to the crackers as the seat of the original explosion. When passing the press-cake through the crackers, a piece will sometimes "play" on the rolls, and the workman is accustomed, in such cases, to turn the piece with a strip of copper. When clearing the debris, a piece of metal of this description was found, showing distinct marks of the teeth of the cracker rolls, and it is surmised that, whilst the workman was engaged in clearing the rolls, the piece of copper was dragged from his hand into the crackers, one end being at the same time embedded in the woodwork of the hopper in such a way as to cause sufficient friction to fire the powder. In future strips of ash or sycamore will be used instead of copper for the purpose of clearing the rolls. —G. W. McD.

Explosives used at mines and quarries in 1908. Mines and Quarries Report, 1908, Part II. [T.R.]

THE following table shows the amounts of the various explosives used at mines and quarries during 1908:—

Names of explosives.	Explosives used at			
	Mines under the Coal Mines Regulation Act.	Mines under the Metalliferous Mines Regulation Act.	Quarries under the Quarries Act.	Total Mines and Quarries.
	lb.	lb.	lb.	lb.
Albrite	105,559	—	1,055	106,614
Ammonal	63,171	16,619	146,662	226,452
Ammonite	494,248	510	18,583	513,341
Amvis	54,724	—	—	54,724
Aposbite	6,165	—	—	6,165
Arkite	534,543	—	1,477	536,020
Bellite	360,108	—	33,509	393,617
Bobbinite	1,117,849	—	123	1,117,972
Britonite	244	—	—	244
Cambrite	10,310	—	—	10,310
Carbonite	459,741	—	305	460,046
Celtite	60	—	400	460
Cheddite	47,494	89	202,413	249,996
Cornish Powder	2,705	100	—	2,805
Dragonite	16,005	—	—	16,005
Dynamite	1,850	44,963	12,165	58,978
Excellite	156,214	—	—	156,214
Faversham powder	212,612	—	900	213,512
Fracturite	5,205	—	50	5,255
Gelatine (Blasting)	22,282	484,178	49,994	609,289
Gelatine dynamite	1,757,277	504,444	52,835	2,737,468
Gelignite	100,065	—	53	100,118
Geloxite	13,758,157	541,859	4,436,152	18,736,168
Gunpowder	30,633	—	30	30,663
Kolax	3,024	—	36	3,060
Kynite	—	—	134	134
Matagnite gelatine	72	—	—	72
Minite	722,780	224	34,911	757,915
Monobel	58,038	—	355	58,393
Negro powder	20,635	—	—	20,635
Normanite	82,870	—	3,630	86,500
Oaklite	48,236	—	685	48,921
Permonite	40,213	—	2,765	42,978
Pexite	8,086	—	300	8,386
Ripping ammonal	412,841	2,370	3,715	418,926
Rippite	475,322	—	10,484	486,006
Roburite	315	—	—	315
Russelite	1,285	—	—	1,285
St. Helens	1,780,888	—	12,689	1,793,577
Saxonite	410	460	3,937	4,807
Steelite	200,777	—	791	201,568
Stowite	17,563	—	2,305	19,868
Tonite	395,356	—	5,745	401,101
Tutol	—	96,840	—	96,840
Westalite	—	—	—	—
Not stated	—	—	—	—
Total of permitted explosives	7,998,662	—	—	—
Total other than permitted explosives	15,587,470	—	—	—
Total	23,586,132	1,692,656	5,514,935	30,793,723

* Explosives other than permitted explosives allowed under Section 6 of the Coal Mines Regulation Act, 1896.

PATENTS.

Explosive compounds. J. E. Holmes. Haliburton, Ont., Canada. Eng. Pat. 19,334, Sept. 15, 1908. Under Int. Conv., Dec. 28, 1907.

THE explosive consists of equal parts of finely-divided potassium chlorate and sugar, with the addition of 1 per cent. of sulphur.—G. W. McD.

Nitrocellulose; Process of dehydrating — G. W. Gentieu, Peoria, Ill. U.S. Pat. 931,749, Aug. 24, 1909.

THE bulk of the water is removed from the nitrocellulose, whilst in the form of pulp, by means of centrifugal force. The mass is then sprayed with alcohol, the rotation of the machine being meanwhile continued until the remainder

of the water has been expelled, after which the speed is reduced to such an extent that the final product shall retain the right proportion of alcohol.—C. A. M.

Charges for projectiles; Process for the preparation of — Dynamit Act.-Ges. vorm. A. Nobel und Co. Ger. Pat. 212,169, April 17, 1907.

It is stated that by cooling to about 0° C., the shell or other receptacle into which fused trinitrotoluene (or other suitable nitro-hydrocarbon) is introduced, the density of the solid explosive is increased to about 1.6.—A. S.

Fireworks; Manufacture of — Berthier et Cie. Fr. Pat. 398,859, April 4, 1908.

CLAIM is made for a composition consisting of 1 part of magnesium powder, 2 parts of barium nitrate, and half a part of an inert substance.—A. S.

Explosive. C. Clément and J. Langhard, Assignors to G. Grobet, Vallorbe, Switzerland. U.S. Pat. 933,060, Sept. 7, 1909.

SEE Fr. Pat. 351,793 of 1905; this J., 1905, 903.—T. F. B.

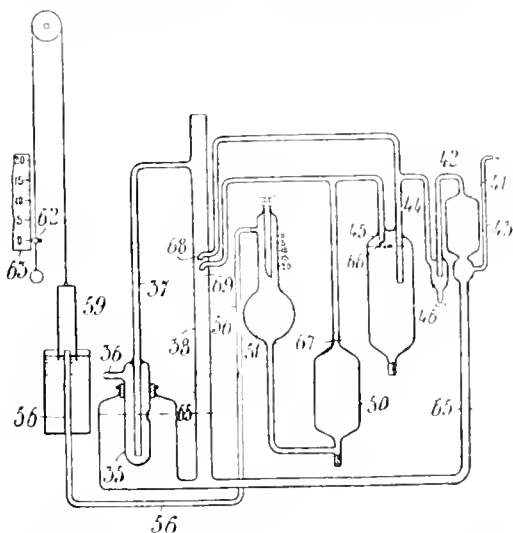
Nitrating oils. Fr. Pat. 398,748. See XII.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

PATENTS.

Gas; Apparatus for analysing — O. Rodhe, Stockholm, Sweden. Eng. Pat. 18,829, Sept. 8, 1908.



THE lower part of the apparatus (see Fig.) is filled with mercury to the level, 65. The tube, 36, is connected to a supply of compressed air and 43 to the supply of gas to be analysed. The absorption pipette, 45, is filled with the absorbing liquid to the level, 66. The tube, 42, is closed by a liquid seal in 46. The bulb, 50, and the lower tube of bulb, 51, are filled with liquid to the level, 67. If compressed air is now admitted at 36, the mercury rises in tubes, 37, 38, and 65, until tubes, 68, 69, and 43, are sealed. The known volume of gas in bulb, 41, will, as the pressure increases, be forced over through the tube, 44, into the absorption pipette, 45, and any unabsorbed gas will collect in the upper part of this pipette, force the liquid in bulb, 50, into bulb, 51, and consequently force the air in 51 through the tube, 56, into the measuring bell, 59, where the volume is automatically recorded by the pencil, 62, on the rotating drum, 63. As soon as the whole of the gas has been forced over from the bulb, 41, into the absorption pipette, the level of the mercury in 35 has reached the opening of the

tube 37, the compressed air passes up this tube, and the conditions are automatically reduced to atmospheric pressure once more—the mercury falling in all the tubes to the original level, 65; a fresh quantity of gas is thus drawn in through the tube, 43, into the bulb, 41, ready for another determination, the bell, 59, sinking again to its original position.—G. W. McD.

Pyrometer. C. E. Foster, Rochester, N.Y. U.S. Pat. 933,543, Sept. 7, 1909.

The pyrometer consists essentially of a casing having an aperture at one end, which is exposed to the body of which the temperature is to be measured. Inside the casing are fixed a device sensitive to heat and an optical condensing device, which has one of its conjugate foci at the aperture and the other at the device sensitive to heat, the latter being protected from rays proceeding through the aperture directly from the hot body. Means are provided for measuring the effect produced on the device sensitive to heat by the rays concentrated thereon by the optical condensing device.—A. S.

Dropping pipette. Bachfeld and Co. Ger. Pat. 211,977, Jan. 6, 1909.

The tube of the pipette ends below in a short piece of glass rod with roughened surface, immediately above which is a capillary opening in the side of the tube. It is stated that by this arrangement, drops of equal size are delivered from the pipette.—A. S.

Testing fluids; Method and apparatus for —. H. B. Bishop, Assignor to General Chemical Co., New York. U.S. Pat. 933,015, Aug. 31, 1909.

SEE FR. Pat. 394,107 of 1908; this J., 1909, 222.—T. F. B.

INORGANIC—QUALITATIVE.

Isolate in commercial potassium iodide. Andrews. See VII.

INORGANIC—QUANTITATIVE.

Sulphuric acid; Precipitation of — as barium sulphate in solutions containing chlorides. I. F. Sacher. Chem.-Zeit., 1909, 33, 941—942.

RUPPIN (Chem.-Zeit., 1909, 398) concluded that sulphuric acid was not quantitatively precipitated as barium sulphate in a solution containing chlorides of alkali or alkaline-earth metals. The author, in reply, cites experiments to show that the deficiencies observed by Ruppinn were due to the solubility of the barium sulphate in potassium chloride solution. He has found that barium sulphate is also soluble in aqueous solutions of ammonium chloride, sodium chloride, calcium chloride, sodium chlorate, potassium chlorate, potassium bromide, and sodium nitrate. The solubility increases with the temperature and the concentration of the salt solution. It is increased by the presence of free hydrochloric acid, but reduced by bases. The most suitable conditions for the precipitation are the addition of a relatively large excess (about 3 times the theoretical amount) of 3 per cent. barium chloride solution to a very dilute solution of the sulphate, rendered very slightly acid with hydrochloric acid (about 1 c.c. of $N/5$ hydrochloric acid per 100 c.c.). The precipitation is made with both liquids at the boiling point, and the precipitate allowed to stand for at least 14 hours before filtration. When the proportion of hydrochloric acid was considerably greater and the excess of barium chloride was less, the results were too low. For the precipitation of sulphuric acid from potassium sulphate in the absence of potassium chloride, the addition of the hydrochloric acid was of little consequence, and so large an excess of barium chloride was unnecessary. The rate of the change of amorphous barium sulphate into the crystalline form depends upon the condition of the solution. In strongly acid liquids the change takes place in a few moments; it

is also brought about by heat. The speed of formation of the crystalline condition is accelerated with increase in the amount of the precipitant. If the precipitation be made in the cold in a neutral or slightly alkaline solution, the barium sulphate remains longer in the amorphous state. The presence of colloids such as albumin and gelatin also retards the formation of the crystalline form. These facts have a bearing on the technical manufacture of permanent white (*blanc fixe*). The product with the best covering power and in the finest state of division is obtained by precipitating the barium sulphate from a dilute solution of barium chloride at the ordinary temperature. The same remarks apply to the precipitation of other substances, such as calcium carbonate, calcium oxalate, magnesium ammonium phosphate, various lead salts, the sulphides of heavy metals, and numerous antimony compounds.—C. A. M.

Lead and bismuth; Quantitative separation of —. J. C. Galletly and G. G. Henderson. Analyst, 1909, 34, 389—391.

STAHLER and Scharfenberg (this J., 1906, 41), and Salkowski (*ibid.*), described methods of separating bismuth from other heavy metals in the form of phosphates. Lead and bismuth are quantitatively precipitated together as phosphates, and the authors have tried various methods of separating the mixed phosphates by digestion with dilute nitric acid, as suggested by Staehler and Scharfenberg. They find that, although it is possible in certain cases, to obtain satisfactory results in this way, the variations under similar conditions are so great as to render the process unreliable. They were also unable to obtain good results with the persulphate method of Dittrich and Reise (this J., 1905, 691), the electrolytic method of Balachowsky (this J., 1900, 855) and the electrolytic method of Holland and Bertiaux (this J., 1904, 839). With Clarke's method of separation, however, (this J., 1900, 26), the results were accurate. It is suggested as an improvement that the bismuth should be precipitated as phosphate, instead of with ammonium carbonate as described in the original method.—C. A. M.

Thiocyanic acid; Volumetric determination of — by means of potassium permanganate. K. Schröder. Z. offentl. Chem., 1909, 15, 321—336.

As the result of numerous experiments the author finds that thiocyanic acid cannot be accurately determined by direct titration with potassium permanganate solution, the results being too low. The reaction is approximately quantitative according to the equation: $\text{HCN} + \text{O}_2 = \text{SO}_2 + \text{HCN}$, when $N/10$ solutions are employed and when the manganese is precipitated by sodium carbonate, redissolved in hydrochloric acid, and again titrated. With more dilute solutions it is necessary to exclude atmospheric oxygen to obtain fairly accurate results. The thiocyanic acid (thiocyanate) may, however, be correctly determined by adding a definite volume of the thiocyanate solution to a known excess of warmed potassium permanganate solution acidified with sulphuric acid and phosphoric acid, decomposing the excess of permanganate by the addition of an excess of either standardised oxalic acid solution or hydrogen peroxide, and titrating the latter with permanganate.—W. P. S.

Silver; Iodometric determination of — based upon the reducing action of potassium arsenite. R. S. Bosworth. Amer. J. Sci., 1909, 28, 287—290.

SILVER, either in solution or in the form of the precipitated chloride, may be rapidly determined by adding an excess of standard potassium arsenite solution, boiling in the presence of ammonia or other alkali, until the silver salt is completely reduced, according to the equation: $2\text{Ag}_2\text{O} + \text{As}_2\text{O}_3 = \text{As}_2\text{O}_5 + 4\text{Ag}$, and then titrating the excess of arsenite with iodine, after acidifying and adding excess of sodium bicarbonate in the usual way; filtration from the reduced silver is not necessary.—F. SODS.

Cerium; Simplification of Mosander's method for the separation of — from the other cerite earths. O. Hauser and F. Wirth. *Z. anal. Chem.*, 1909, **48**, 679—692.

THE authors find that chlorine has no effect on an aqueous suspension of the peroxide formed when cerium, in the cerous state, is oxidised by hydrogen peroxide, in the presence of alkali; whereas lanthanum, neodymium, and praseodymium in like circumstances, are dissolved. The following process, based on these facts, is given for the separation of cerium from these elements. A slight excess of ammonia is added to the solution, containing 50—100 grms. of the oxides, and a 3 per cent. solution of hydrogen peroxide, free from phosphoric acid, is added in small portions, until the yellow colour of the hydroxide is no further deepened, any large excess of the reagent being avoided. A brisk current of chlorine is then led through the suspension, which is vigorously stirred, preferably by a mechanical arrangement; lanthanum is quickly dissolved, and ultimately the didymium earths also go into solution, but no trace of cerium is dissolved, if a harmful excess of hydrogen peroxide has been avoided. In order to get rid of any didymium yet present, however, the washed precipitate is dissolved in hot dilute nitric acid, a little hydrogen peroxide is added, and the above process is repeated.—F. SODN.

Electro-analysis; Report of the British Association Committee on —. *Electrician*, 1909, **63**, 919.

(1). EXPERIMENTS on the electro-deposition of mercury upon cathodes of gold, silver, platinum, and mercury, show that the use of mercury furnishes the only really satisfactory method of deposition (see also this J., 1909, 493), and a new electrolysing vessel of quartz has been designed for this purpose. It consists of a small quartz beaker, capable of holding about 80 c.c. of solution, with a siphon fused into it about 0.5 cm. from the bottom, contact being made by a piece of iridium wire, fused into the bottom of the beaker. The solution to be electrolysed is placed above the mercury, and the spiral anode rotated at 500—750 turns per min. The mercury is deposited in 20—30 minutes, and then, by pouring in water, the siphon is made to act, the addition of water being continued, until the ammeter indicates zero; the water is then replaced by 90 per cent. alcohol, and this by absolute alcohol, and finally the mercury is washed twice with dry ether and the surface is dried by blowing air over it for about 10 minutes. (2). Sand's apparatus for the electro-deposition of metals by graded potential (this J., 1907, 490; 1908, 963) has been modified in several particulars, in order to make it more portable and readily set up. (3). Experiments to ascertain the cause of discrepancies which have been observed in the deposition of lead as peroxide, have shown that lead peroxide is liable to take up water, and it is recommended, that deposition should take place at 90°—95° C., when the deposit, after drying with alcohol and ether, contains only about 1/3 per cent. of water.—F. SODN.

Thallium; Electrolytic determination of —. G. W. Morden. *J. Amer. Chem. Soc.*, 1909, **31**, 1045—1048.

THALLIUM is readily deposited by the action of an electric current, but the chief difficulty in the electrolytic determination is the prevention of oxidation of the deposited metal. The author has made a number of experiments in which the separated thallium was covered with a coating of zinc, but there was an uncertainty in obtaining a good, non-porous coating of the latter metal. It was found, however, that trustworthy results could be obtained by the formation of a dilute zinc amalgam by electrolysis of a zinc sulphate solution in the ordinary mercury cup and the use of the zinc amalgam thus obtained as the cathode for the deposition of the thallium. The usual method of procedure with the mercury cathode was followed. Experiments made to ascertain the minimum quantity of zinc necessary to prevent oxidation of the thallium, showed that with as small a quantity as 0.0007 gm. of zinc present, the wash water was free from

thallium when the amalgam contained 0.1142 gm. of the latter metal. Good results were also obtained with a cadmium-thallium amalgam.—W. P. S.

Determining cementitious material in mortar and concrete. Framm. *See* IX.

Arbitration analyses of iron ores. *See* X.

Determining vanadium and uranium [in ores]. Campbell and Griffin. *See* X.

Determining molybdenum in molybdenite. Collett and Eckardt. *See* X.

Employment of ammonium nitrate in the analysis of metals. Loviton. *See* X.

Graded potentials for ore analysis. Calhane and Woodbury. *See* XI B.

Analysis of lithopone. Remington and Smith. *See* XIII. 1.

Determining phosphoric acid in mineral phosphates. Jørgensen. *See* XV.

Analysis of lead arsenate for water-soluble impurities. Griffin. *See* XVIII C.

ORGANIC—QUALITATIVE.

Detecting some animal fats in admixture with others. Laband. *See* XII.

Colour reactions of sugars. Reactions of Peltenkoffer and Seliwanoff. Ville and Berrien. *See* XVI.

ORGANIC—QUANTITATIVE.

Phosphoric acid; Determination of — in organic substances. H. Schaumann. *Z. anal. Chem.*, 1909, **48**, 612—617.

A WEIGHED quantity of the substance, such as excreta, animal organs, or foods, containing not more than 0.1 gm. of phosphoric acid, is placed in a flask of from 250 to 500 c.c. capacity, and heated with from 10 to 25 c.c. of a mixture of equal parts of concentrated sulphuric and nitric acids. Should the solution remain dark in colour after continued heating, a little more nitric acid is added and the mixture is again heated until a colourless or faintly yellow solution is obtained, and most of the nitric acid is expelled. After cooling, about 30 c.c. of water are added, the solution is boiled, filtered if necessary, and transferred to a flask of about 500 c.c. capacity into which 50 c.c. of 50 per cent. ammonium nitrate solution have been previously introduced. Forty c.c. of 10 per cent. ammonium molybdate solution are then added, and the mixture is kept at a temperature of from 50° to 60° C. for 18 hours. The precipitate is now collected on an asbestos filter, washed with water until free from acidity, and then dissolved in a known volume (say 10 c.c.) of N/2 sodium hydroxide, the solution being collected in the precipitation flask. The filter is washed with about 100 c.c. of water, the washings being also collected in the flask, and the contents of the latter are next boiled until all ammonia has been removed. After the addition of a few drops of phenolphthalein solution, the solution is titrated with N/2 hydrochloric acid until the coloration disappears, N/2 sodium hydroxide is then run in until the red coloration reappears, the solution is boiled for 2 minutes, and finally titrated with N/2 hydrochloric acid. The difference between the total quantities of N/2 sodium hydroxide and N/2 hydrochloric acid used corresponds with the amount of phosphoric acid present. Each c.c. of N/2 sodium hydroxide is equivalent to 0.001268 gm. of phosphoric acid (P₂O₅) or 0.0005536 gm. of phosphorus.—W. P. S.

- Determining water in tar.* Beck. See III.
- Determining wool and cotton in mixtures.* Ruszowski and Schmidt. See V.
- Different forms of phosphoric acid in organic manures.* Tsuda. See XV.
- Optically active non-sugar in the lactrod.* Blau. See XVI.
- Basic lead nitrate as clarifying agent in sugar analyses.* Herles. See XVI.
- Unification of methods of clarification in sugar analysis.* Sachs. See XVI.
- Determining moisture in hops.* Hoffmann. See XVII.
- Determining nitrogen in gelatinised powder.* Poppenberg and Stephan. See XXII.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

- Silkworm; Presence of an enzyme in the —, which produces ammonia from amino-compounds.* T. Takeuchi and R. Inouye. J. Coll. Agric., Imp. Univ., Tokyo, 1909, 1, 15—20.

THE juice expressed from crushed silkworms, especially from the moths, contains an enzyme which is capable of splitting certain amino-compounds with the production of ammonia. The authors have isolated an active preparation by precipitation with alcohol and have examined its action on various amino-compounds at a temperature of 28° C. The enzyme only acts when the medium is made faintly alkaline; it exerts a very pronounced action on asparagine and acts more feebly on urea, biuret, leucine, and glycocoll; certain other amino-compounds, e.g., tyrosine, guanidine, etc., are not attacked. Asparagine apparently yields succinic acid as a cleavage product together with ammonia.—J. E. B.

- Fat in the black walnut (*Juglans nigra*); Development of —.* F. M. McClenahan. J. Amer. Chem. Soc., 1909, 31, 1093—1097.

THE results of observations on the development of the black walnut are given. Starch, sugar, and tannin were found to be absent from the kernel at all periods of its development, but tannin was markedly present in the hull and tissue of the kernel capsule. When the kernel was entirely liquid, there was a pronounced pressure in the capsule. The first formation of the jelly-like kernel was on the interior surface of the capsule; this gradually changed to a white solid, whilst the jelly-like formation retreated towards the centre of the chamber, replacing in turn the liquid and finally itself being replaced by the solid kernel. The fat increased out of all proportion to the increase or decrease of the other constituents. From these observations it is evident that the fat in the walnut is not formed from starch, sugar, or tannin within the capsule of the kernel, nor is it formed from the decomposition products of the crude fibre, proteins, and pentosans. The author suggests that it is possible that the tannin in the tissue of the kernel may afford material from the decomposition products of which the fat is built up. These decomposition products enter the capsule by osmosis, as there is no fluid circulation between the capsule and other parts of the nut.—W. P. S.

- Sugars; Decomposition of the —.* I. Provisional communication. *Reversion of the synthesis of sugar.* W. Löb. Biochem. Zeits., 1909, 20, 516—522. (See this J., 1909, 617.)

PREVIOUS experiments have supported von Baeyer's theory of the rôle of formaldehyde in the synthesis of

sugar, and have led the author to the conclusion that the same compound, or rather a tautomeric, active form of it, plays a special part in the decomposition of sugar that occurs in physiological combustion and fermentation. Granting that formaldehyde can occur in an intermediate labile form, it must be admitted that the latter can undergo (1), synthesis to carbohydrates or other substances; and, (2), rearrangement to stable formaldehyde. In reference to the synthesis of a hexose from formaldehyde in presence of hydroxyl ions, a reaction which the author regards as reversible, the phase of this reaction represented by the equation, $C_6H_{10}O_5 + (H_2O) = C_6H_{12}O_6$, is discussed. If this is the course of the action, its reversible nature shows that in the decomposition of sugar the opposed course is of importance. The author has found that dextrose may be converted into pentose and formaldehyde by inversion of the synthesis of sugar from formaldehyde with lead hydroxide at 70° C. according to the method of Lobry de Bruyn and van Ekenstein. Thus, if a 4 per cent. solution of dextrose is allowed to stand, at 70° C., with 0.8 per cent. of freshly precipitated and well washed lead hydroxide, pentose and formaldehyde, besides polyhydroxy-acids and formic acid (and probably polyhydric alcohols), are formed. Again, by the action of sodium hydroxide on dextrose, both at ordinary and slightly higher temperatures, pentose and formaldehyde are obtained; the accompanying reactions are more complicated than in the previous case; an alkalinity corresponding to that of the blood, is sufficient, at incubator temperatures, to effect the decomposition into pentose and formaldehyde, and, in the light of this result, the author discusses the physiological combustion of sugar. In conclusion, he considers that the sugar suffers a kind of dissociation which, on the one hand, leads to decomposition by oxidation processes, and, on the other, gives opportunity to new syntheses of the cleavage-products in various directions. This dissociation and the subsequent synthesis, cause the inter-conversion of the sugars, the occurrence of the different sugars in nature, and the formation of a series of reaction-products of anaerobic respiration or intramolecular oxidation to which a part of the phenomena of fermentation belongs.—L. E.

- Oxydases; Employment of hydrogen peroxide in experiments on —.* T. Kikkoji and C. Neuberg. Biochem. Zeits., 1909, 20, 523—525.

IN experiments on the action of "tyrosinases," addition of hydrogen peroxide or of hydrogen peroxide and ferrous sulphate, is often made. In presence of iron salts, however, hydrogen peroxide acts on a large number of the aromatic compounds used in experiments on oxydases, yielding dark colorations, or brown or black precipitates, which are not identical with the "melanins." In most experiments on tyrosinases at the present time, however, the dark coloured products are not examined chemically. Hence, the possibility of their formation by other than true enzyme actions, or by chemical and fermentative actions superposed, must be considered. Since, also, many enzyme solutions contain iron, caution must be observed in the use of hydrogen peroxide in oxydase actions. The views concerning these actions require modification in the light of the experiments of Euler and Bolin (Z. physiol. Chem., 1908, 57, 80). The authors describe the colorations or precipitates obtained from various compounds by the action of hydrogen peroxide and iron (ferrous or ferric) salts, and give a method whereby the product from phenol may be obtained in quantity.—L. E.

Trade Report.

- The Tariff Commission on Chemicals.* Chem. and Drugg., Sept. 18, 1909.

THE latest memorandum by the Tariff Commission analyses the course of the export trades in leading manufactures of the United Kingdom, Germany and the United

States in order to illustrate (a) the comparative growth of the export trade in the principal manufactures under the tariff systems of the three countries; (b) the magnitude and growth of the trade of these countries with groups of protected countries; (c) the growth of German trade in manufactures with the central European group of countries with which Germany has special commercial treaties; and (d) the extent and growth of the trade of each country with the British Empire since the adoption of Colonial preferences. The memorandum is published by P. N. King and Son, 2 and 4, Great Smith Street, Westminster, S.W., at 3d. As regards chemicals the Commission says the export from Germany has made far greater advance than that of the United Kingdom or the United States. The increases in the last twelve years have been: Germany, £11,250,000; United Kingdom, £5,500,000; and the United States, £2,250,000. German exports, which were £2,000,000 larger than those of the United Kingdom in 1895, are now £7,750,000 larger. The United Kingdom trade with protected markets has remained practically stationary, while the German trade has nearly doubled. The facts as stated are set forth in a series of tables.

£30,822,211. or, after deduction of drawbacks and repayments, to £29,158,057, which is £41,943, or 0.14 per cent., less than the Budget estimate for the year, and £3,423,937, or 10.5 per cent., less than the net yield for 1907-8.

The largest items in the total Customs receipts during the last two financial years were as follows:—

Gross produce of Customs Duties (excluding duties collected in the Isle of Man).

	Year ended 31st March.	
	1908.	1909.
Spirits—	£	£
Rum	2,402,031	2,320,212
Braandy	1,187,030	1,157,623
Geneva and other sorts	545,150	475,866
Sugar, refined and unrefined	6,460,497	3,065,646
Tea	5,820,906	6,065,067
Tobacco and snuff	15,264,420	15,384,733
Wine	1,180,069	1,122,876

Books Received.

MINES AND QUARRIES. GENERAL REPORT AND STATISTICS FOR 1908. PART II. LABOUR. [Cd. 4877.] Wyman and Sons, Fetter Lane, E.C. Price 10d.

This volume contains an account of the number of persons employed in mines and quarries in 1908, and also of accidents and prosecutions. Also a list of "permitted" explosives, a table showing the amount of explosives used in mines and quarries in 1908, and various other miscellaneous details. (See also under Class XXII.)

MINUTES OF EVIDENCE TAKEN BY THE ROYAL COMMISSION ON WHISKY AND OTHER POTABLE SPIRITS, WITH APPENDICES. Vol. II. [Cd. 4797.] Wyman and Sons, Fetter Lane, E.C. Price 2s. 6d.

This volume contains a list of the witnesses examined, 203 foolscap pages of minutes of evidence, and 13 appendices, containing analyses of whiskies, brandies, and rums, and other matters.

INDEX AND DIGEST OF EVIDENCE TAKEN BEFORE THE ROYAL COMMISSION ON WHISKY AND OTHER POTABLE SPIRITS. [Cd. 4876.] Wyman and Sons, Fetter Lane, E.C. Price 7d.

IMPORTS AND EXPORTS AT PRICES OF 1900. TABLES SHOWING FOR EACH OF THE YEARS 1900—1908 THE ESTIMATED VALUE OF THE IMPORTS AND EXPORTS OF THE UNITED KINGDOM AT THE PRICES PREVAILING IN 1900, WITH AN INTRODUCTORY MEMORANDUM. [Cd. 4867.] Price 2½d.

This return, which has been prepared in the Commercial, Labour and Statistical Department of the Board of Trade, is issued in continuation and extension of that issued last year [Cd. 4115, 1908], in which a detailed comparison was made, in respect of each year since 1900, between the values of the various groups of imports and exports as actually declared and the estimated values of such groups based on the average values obtaining in 1900. The object of this series of returns is to eliminate as far as possible the effect of the fluctuation of prices, and so secure a basis for a closer comparison between the volume of imports and exports in each year.

FIFTY-THIRD REPORT OF THE COMMISSIONERS OF HIS MAJESTY'S CUSTOMS (FOR THE YEAR ENDED 31st MARCH, 1909). [Cd. 4862.] Price 4d.

ACCORDING to this report, the gross Imperial Customs revenue collected in the year 1908-9 amounted to

QUANTITATIVE CHEMICAL ANALYSIS ADAPTED FOR USE IN LABORATORIES OF COLLEGES AND SCHOOLS. By F. CLOWES, D.Sc., Lond., and J. B. COLEMAN, A.R.C.Sc., Dublin. Eighth edition. J. and A. Churchill, 7, Great Marlborough Street, London. 1909. Price 10s. 6d. net.

Svo volume containing 543 pages of subject matter, an index to separations, and a general index. The work is subdivided as follows:—PART I. General processes. (i.) The chemical balance, weights, and weighing. (ii.) Determination of specific gravity, melting point, and boiling point. (iii.) Mechanical preparation of solids. Drying, solution, evaporation, filtration, etc. PART II. (iv.) Simple gravimetric estimations. PART III. Volumetric analysis. (v.) Measurement of liquids. Calibration and use of graduated vessels. Indicators. Standard solutions. (vi.) Alkalimetry and acidimetry. (vii.) Oxidation and reduction processes. (viii.) Unclassified estimations. PART IV. General quantitative analysis. (ix.) Technical analysis, including analysis of alloys, minerals, soda-ash, salt-cake, glass, iron and steel, coal and coke, and fertilisers; also dry assay for lead, silver, gold, and tin. (x.) Water analysis. (xi.) Food analysis. Valuation of tanning materials. Soap analysis. (xii.) Examination of oils, fats, and waxes. PART V. (xiii.) and (xiv.) Organic analysis and molecular weights. PART VI. Volumetric estimation of gases. PART VII. Tables for reference, including results of typical analyses, specific gravities of solutions of alcohol and acids and alkalis, constants of oils, fats, and waxes, English and metric weights and measures, logarithms, etc. PART VIII. Preparation of gases. Use of compressed gases. Distillation of water, etc.

AMERICAN MEDICINAL BARKS. ALICE HENKEL. U.S. Dept. of Agric., Bureau of Plant Industry, Bulletin No. 139, Washington, June 3, 1909.

This bulletin of 51 pages forms the second instalment on the subject of American medicinal plants, the first one having dealt with root drugs. Thirty-five drugs, derived from barks, are described and illustrated, and briefer information concerning closely related species is included. The barks described are white pine (*Pinus strobus*), tamarack (*Larix laricina*), aspen (*Populus tremuloides*), white willow (*Salix alba*), bayberry (*Myrica ripens*), bitter-nut (*Juglans cinerea*), ironwood (*Ostrya virginiana*), sweet birch (*Betula lenta*), tag-alder (*Alnus rugosa*), white oak (*Quercus alba*), slippery elm (*Ulmus pubescens*), magnolia (*Magnolia acuminata*, *M. tripetala*, and *M. glauca*), tulip-poplar (*Liriodendron tulipifera*), sassafras (*Sassafras sassafras*), spicebush (*Benzoin benzoim*), witch-hazel (*Hamamelis virginiana*), blackberry (*Rubus villosus*, *R. nigrobaccus*, and *R. cuneifolius*), American mountain ash (*Sorbus americana*), wild cherry (*Prunus serotina*), prickly ash (*Xanthoxylum americanum* and *X. clavaherculis*), wafer-ash (*Ptelea trifoliata*), black alder (*Ilex*

verticillata), wahoo (*Euonymus atropurpurea*), false bittersweet (*Celastrus scandens*), horse-chestnut (*Aesculus hippocastanum*), cascade sagrada (*Rhamnus purshiana*), cotton (*Gossypium hirsutum*), dogwood (*Cornus florida*), moose-wood (*Dirca palustris*), white ash (*Fraxinus americana*), fringe tree (*Chionanthus virginica*), bitter-sweet (*Solanum dulcamara*), hutton-bush (*Chapmanthus occidentalis*), cramp-bark tree (*Viburnum opulus*), and black haw (*Viburnum prunifolium*).

*New Books.

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Beckurts, Prof. Dr. H., unter Mitwirkg. v. Assistenten Drs. H. *Frerichs* u. Priv.-Doz. H. *Emde*: Jahresbericht über die Fortschritte in der Untersuchung der Nahrungs-u. Genussmittel. 18. Jahrg. 1908. (205 S.) gr. 8°. Göttingen, Vandenhoeck & Ruprecht. 1909. M. 6.

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Nr. 1. *Landolt*, H.: Ueber die Erhaltung der Masse bei chemischen Umsetzungen. Zusammenfassung der u. d. T.: "Untersuchungen üb. die fragl. Aenderg. des Gesamtgewichtes chemisch sich umsetz. Körper" in den Sitzungsberichten der k. preuss. Akademie der Wissenschaften, 1893, 301; 1906, 266; 1908, 354; sowie in der Zeitschrift f. physikal. Chemie. Bd. 12. S. 1—55, 599—61. 581 erschienenen drei Abhandlgn. (VIII., 47 S.) 1909. M. 1.80; f. Mitglieder der deutschen Bunsen-Gesellschaft M. 1.

Nr. 2. *Foerster*, F.: Beiträge zur Kenntnis des elektrochemischen Verhaltens des Eisens. (83 S.) 1909. M. 3.20; f. Mitglieder der deutschen Bunsen-Gesellschaft M. 1.60.

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*Dissertations.

(Prices vary, ranging from two to three shillings.)

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Lumpp, H.: Ueber Oxyphenanthrene u. deren Abkömmlinge. Stuttgart. 1909. (66 S.) 8°.

Prochnow, A.: Beiträge zur Untersuchung des Kakaos und seiner Präparate. Braunschweig. 1909. (70 S.) 8°.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works and dissertations in foregoing list can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

20,871. Southern. *See under VII.*

20,880. Leask. Apparatus for cooling water or treating gases with liquids. Sept. 13.

21,050. Hatschek. Apparatus for filtering through layers of finely-divided material. Sept. 15.

21,293. Held. *See under XVII.*

21,369. Cambridge Scientific Instrument Co., and Whipple. Radiation pyrometers. Sept. 18.

21,418. Tattersall. Apparatus for evaporating and cooling liquids.* Sept. 20.

21,582. Pritchard, and United Alkali Co., Ltd. Apparatus for utilising heat from liquors discharged from stills, etc. Sept. 21.

21,660. Maschinenfabr. F. Weigel Nachfolger, and Spielvogel. Filter-press.* Sept. 22.

21,862. Pedersen. Centrifugal separators. Sept. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

19,668 (1908). Hommel, and Metals Extraction Corporation. Liquid distributors for absorbing towers. Sept. 22.

20,244 (1908). Carr. Apparatus for controlling or deflecting the flow of flue gases, especially for use with CO₂ recorders. Sept. 29.

21,095 (1908). Kirchberg. Reverberatory furnace. Sept. 29.

21,474 (1908). Wöhl and Tarbutt. Filtering apparatus for use in washing slimes, &c. Sept. 22.

23,001 (1908). Challis. Filtration. Sept. 22.

3250 (1909). Vallery. Saturating device for liquids. Sept. 29.

12,056 (1909). Fate. Means for indicating loss of vacuum in vacuum chambers. Sept. 29.

12,958 (1909). Seaver. Apparatus for separating finely divided materials. Sept. 22.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

20,906. Sheppard. Manufacture of fuel blocks. Sept. 13.

20,975. Fritz. Purifying fuel and increasing its heating power. Sept. 14.

21,003. Graf and Smyth. Gas for lighting, heating, and power. Sept. 14.

21,010. Otto und Co. Recovery of by-products from gases derived from combustibles. [Ger. Appl., Oct. 7, 1908.]* Sept. 14.

21,674. Betts. Process for utilising coal.* Sept. 22.

21,942 and 21,947. Werber. Manufacture of mantles for incandescent gas lighting. [Austrian Appl., March 20 and June 5, 1909.]* Sept. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

17,603 (1908). Glasgow. Manufacture of water-gas. Sept. 29.

18,672 (1908). Kaysser. Protecting iron walls of gas-holders from the cyanogen compounds entering the water of the seal. Sept. 22.

19,264 (1908). Act.-Ges. f. Kohlendestillation. Regenerative coke ovens. Sept. 22.

24,332 (1908). Thom and Pryor. Retort furnaces for making gas, etc. Sept. 22.

8940 (1909). Hill and Westwood. Apparatus for making a combustible heating and illuminating gas. Sept. 29.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

21,007. Pichon and Truchelut. Utilising chlorides of carbon for rendering benzine, turpentine, chloroform, alcohol, ether, &c., non-inflammable.* Sept. 14.

21,153. Fabri. Deodorisation and treatment of mineral and like oils. Sept. 16.

21,789. Fabri. Deodorising mineral oil from shale for burning purposes. Sept. 24.

COMPLETE SPECIFICATION ACCEPTED.

13,252 (1908). Heinemann. *See under XVI.*

IV.—COLOURING MATTERS AND DYE STUFFS.

APPLICATIONS.

20,905. Newton (Bayer und Co.). Manufacture of a dyestuff of the oxazine series and its leuco-derivative. Sept. 13.

21,578. Johnson (Kalle und Co.). Manufacture of sulphur-containing matters for vat dyeing. Sept. 21.

21,579. Johnson (Kalle und Co.). Manufacture of reduction products of acenaphthenequinone and of leuco-compounds of vat dyestuffs. Sept. 21.

21,580. Johnson (Kalle und Co.). Manufacture of new compounds and colouring matters. Sept. 21.

21,581. Johnson (Kalle und Co.). Manufacture of brominated colouring matters of the thioindigo group.* Sept. 21.

COMPLETE SPECIFICATIONS ACCEPTED.

25,551 (1908). Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs of the anthracene series. Sept. 22.

657 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Sept. 22.

6831 (1909). Newton (Bayer und Co.). Manufacture of 1,8-diaminonaphthalene-4-sulphonic acid. Sept. 22.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

21,024. Kemp. Dyeing and washing machines. Sept. 14.

21,203. Turnbull and Turnbull. Dyeing and washing machines. Sept. 16.

21,535. Lundeborg. Pressed fabric and its manufacture. Sept. 21.

21,714. Owens. *See under XI*X.

COMPLETE SPECIFICATIONS ACCEPTED.

20,743 (1908). Kur. Dyeing and sizing, or dyeing and starching in one operation, yarns or fabrics of vegetable fibres. Sept. 29.

24,810 (1908). Newton (Bayer und Co.). Process of dyeing and printing. Sept. 29.

26,460 (1908). Newton (Bayer und Co.). Dyeing with oxyanthraquinone dyestuffs. Sept. 29.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

20,871. Southern. Calcining limestone and other inorganic substances. Sept. 13.

20,893. Imray (Meister, Lucius, und Brüning). Manufacture of concentrated formic acid from formates. Sept. 13.

20,907. Nydegger, and Wedekind und Co. Manufacture of pure ammonium nitrate. Sept. 13.

21,032. Cons. f. Elektrochem. Industrie. Production of hydrogen. [Ger. Appl., Nov. 9, 1908.]* Sept. 14.

21,884. Gill. Manufacture of ferric oxide. [Addition to No. 5618 of 1909.] Sept. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

19,402 (1908). Hurford. Obtaining nitrogen from atmospheric air. Sept. 22.

22,824 (1908). Soc. d'Electro-Chimie, and Hulin. *See under XI*.

27,302 (1908). Carulla. Manufacture of ammonium salts and iron oxide from ferrous liquors. Sept. 22.

15,997 (1909). Serpek. Manufacture of ammonia from aluminium nitride. Sept. 22.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

21,063. Davies. *See under IX*

21,123. Lewis. *See under IX*.

COMPLETE SPECIFICATIONS ACCEPTED.

2294 and 2295 (1909). Salamon, Grace, and Exploration Co. Preparation of china clay. Sept. 29.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

21,063. Davies. Kilns for burning bricks and pottery. Sept. 15.

21,123. Lewis. Kilns for making bricks or other clay or ceramic goods. Sept. 15.

• 21,670. Sinclair. Cement. [U.S. Appl. Sept. 22, 1908.]* Sept. 22.

X.—METALS AND METALLURGY.

APPLICATIONS.

21,419. Hodgkinson. Carburising iron or mild steel in iron alloys. Sept. 20.

21,497. Batchelor and Batchelor. Recovery of tin and iron from tinplate scrap.* Sept. 21.

21,584. Isherwood. Treatment of refractory zinc-lead ores. Sept. 21.

21,612. Ruthenburg. Metallurgical and like furnaces. Sept. 22.

21,676. Webb and Webb. Treatment of iron or steel. Sept. 22.

21,718. Diehl. Process for winning metals. Sept. 23.

21,768. Zohrab and Evans. Treatment of refractory ores, iron sands, and other small or waste ores.* Sept. 23.

21,923. Vautin. Wet separation of copper from its ores or compounds. Sept. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

12,962 (1908). Lockwood and Samuel. Treatment of ores. Sept. 29.

19,667 (1908). Hommel, and Metals Extraction Corporation. Furnaces for volatile metals. Sept. 22.

22,337 (1908). Von Schütz. Detinning tin plate waste, &c., by means of chlorine. Sept. 29.

24,007 (1908). Johnson (Chem. Fabr. Griesheim Elektron). Preparation of iron or steel for casting. Sept. 29.

27,025 (1908). Frölich. Process of obtaining cement copper. Sept. 29.

2849 (1909). Pyrotrass Soc. Anon. Granulating slag. Sept. 22.

2938 (1909). Sebillot and Maucclair. Apparatus for recovering metalliferous fumes obtained in roasting or smelting ores. Sept. 29.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

COMPLETE SPECIFICATIONS ACCEPTED.

22,824 (1908). Soc. d'Electro-Chimie, and Hulin. Apparatus for the electrolytic production of sodium and the like. Sept. 29.

605 (1909). Siemens Bros. and Co. (Siemens und Halske A.-G.). Electrolysis of aqueous saline solutions. Sept. 22.

4553 (1909). Aktiebolaget Elektrometall. Electric furnace. Sept. 29.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

21,457. Bauer. Preparation of soft soap.* Sept. 20.

21,742. Kobe. Manufacture of cleansing preparations. [Ger. Appl., Nov. 26, 1908.]* Sept. 23.

COMPLETE SPECIFICATIONS ACCEPTED.

19,511 (1908). Lake (Comp. Luz Stearica). Treatment of the nut of the bieuyba. Sept. 22.

26,857 (1908). Jacekels. Manufacture of soap. Sept. 29.

691 (1909). Egeberg. Apparatus for purifying oil. Sept. 29.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATION.

21,163. Wakefield and Rathbone. Sanitary paint. Sept. 16.

COMPLETE SPECIFICATION ACCEPTED.

12,498 (1909). Dalby and Benson. Paint and like compositions. Sept. 22.

(C.)—INDIA-RUBBER.

COMPLETE SPECIFICATION ACCEPTED.

20,303 (1908). Gare. Manufacture of sheet rubber and rubber articles. Sept. 29.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

21,202. Eberle. Process of bating hides. [Ger. Appl., Nov. 16, 1908.]* Sept. 16.

21,836. Dickson. Leather and process for preparing same. Sept. 24.

COMPLETE SPECIFICATION ACCEPTED.

4488 (1909). Lehmann. Treating hides and skins to remove grease, fat, oil, and lime, and for disinfecting. Sept. 22.

XV.—MANURES, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

11,924 (1909). Johnson and Austin. Manufacture of manure. Sept. 22.

17,116 (1909). Pickering and Voss. Fungicides. Sept. 29.

XVI.—SUGAR, STARCH, GUM, &c.

COMPLETE SPECIFICATION ACCEPTED.

13,252 (1908). Heinemann. Conversion of carbohydrates into hydrocarbons. Sept. 29.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

21,173. Löblov. Manufacture in the form of grain of pure or mixed cultures of bacteria producing lactic fermentation.* Sept. 16.

21,293. Held. Iron vats, casks, &c., for brewers' use.* Sept. 17.

21,685. Boake, Roberts, and Co., Ltd., and Berry. Bleaching and fumigating hops. Sept. 23.

21,788. Fabri. Obtaining a greater proportion of ethyl alcohol from maize. Sept. 24.

COMPLETE SPECIFICATION ACCEPTED.

19,212 (1908). Schwensen and Lazarus. Process of saccharifying malt. Sept. 22.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATION.

21,753. Blenkinsop. Treatment of flour. Sept. 23.

COMPLETE SPECIFICATION ACCEPTED.

19,246 (1908). Evans. Manufacture of feeding cake. Sept. 22.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

21,184. Riedel. Removing iron from water and regenerating the purifying material. [Ger. Appl., Dec. 10, 1908.]* Sept. 16.

21,855. Edgeworth. Bacteriological treatment of sewage. Sept. 25.

21,929. Bevan. Furnaces for destroying injurious gases, &c. Sept. 25.

COMPLETE SPECIFICATION ACCEPTED.

6935 (1909). Payne and Staynes. Purification of water. Sept. 22.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

20,911. Kuess. Manufacture of pulp for making paper, &c. [Fr. Appl., Sept. 15, 1908.]* Sept. 13.

21,473. Deiss. Manufacture of cellulose.* Sept. 20.

21,714. Owens. Bleaching wood pulp or other vegetable fibres. Sept. 23.

COMPLETE SPECIFICATIONS ACCEPTED.

22,420 (1908). Lövinsohn. Manufacture of transfer papers. Sept. 29.

17,15 (1909). Galay and Galay. Air-proof and water-proof paper and films. Sept. 29.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

21,007. Pichon and Truchelut. *See under III.*

21,173. Löblov. *See under XVII.*

21,174. Löblov. Enriching bacteria cultures. [Ger. Appl., May 29, 1909.]* Sept. 16.

21,948. Wetter (Blank). Manufacture of formaldehyde.* Sept. 25.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

20,891. Vigers. Preparation of paper for photographic purposes. Sept. 13.

21,281. Sury and Bastyns. Photographic printing in colours with the bichromate gelatin process.* Sept. 17.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

21,265. Middleton. Safety explosives. Sept. 17.

21,266. Middleton. Explosives. Sept. 17.

21,272. Hale. Manufacture of explosives. Sept. 17.

21,305. Hale. Manufacture of explosives. Sept. 17.

21,931. Johnson (Chem. Fabr. Griesheim-Elektron). Igniting compositions for matches, &c.* Sept. 25.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Rotary drums; Supporting inclined.—W. Clark, London. From Fellner und Ziegler and A. B. Helbig, Frankfurt-on-Maine, Germany. Eng. Pat. 24,328, Nov. 12, 1908.

THE brackets of the rollers supporting the weight of rotary drum furnaces or kilns are mounted so as to be capable of rotation in two directions. Each bracket as a whole can rotate on its foundation (parallel to the axis of the drum) and is connected by rods with the other brackets to ensure similar angular position. Under the pressure of the drum, each roller can also move about an axis passing approximately through the point of contact of the drum and the roller. In this way the drum may be made, during continuous rotation, to take its bearing at the middle of the faces of the supporting rollers.—J. W. H.

Centrifugal machines. J. B. Allott and A. M. Philips, Nottingham. Eng. Pat. 25,435, Nov. 25, 1908.

THE basket of a centrifugal machine is provided with a door or doors in its bottom by means of which the contents may be removed. The door is hinged on the side near the axis of the machine and may be opened by means of a vertical rod having a spring catch. The parts are arranged so that the centrifugal force produced while the machine is in action tends to keep the door closed.

—J. W. H.

Separating air and other gaseous fluid from liquids; Means for.—J. Hallett, London. Eng. Pat. 27,466, Dec. 17, 1908.

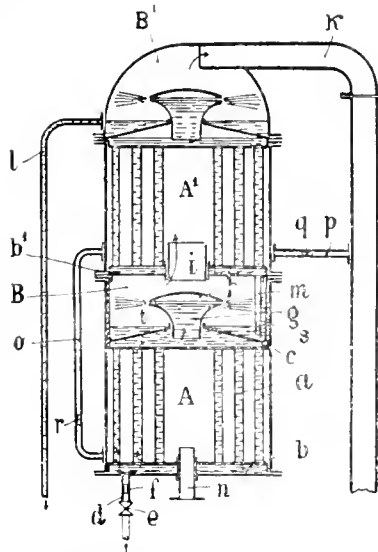
THE apparatus is intended for separating air from a liquid flowing through pipes. It consists of an enlargement in the pipe, provided with a central baffle-plate to direct the gases into a casing above, in which the separated gases accumulate. The separated gases are released from this casing by means of a piston valve and float carried by a balanced lever. The whole of the mechanism is balanced so that the construction may be substantial without affecting its practical sensitiveness.—J. W. H.

Evaporating apparatus. Fawcett, Preston and Co., Ltd., and H. Shield, Liverpool. Eng. Pat. 2049, Jan. 28, 1909.

THE claim is for the provision of T-shaped flanged expansion joints in the heating belt of the evaporator.—W. H. C.

Concentration of liquids; Apparatus for the continuous.—W. Wiegand. Fr. Pat. 400,860, March 15, 1909. Under Int. Conv., March 17, 1908.

THE liquid to be concentrated is introduced through the tube, *d*, provided with a valve, *e*, and a constriction, *f*, into the chamber, *b*, of the lower vessel, *A*. It passes up the tubes, *a*, into the chamber, *c*, being heated by steam introduced through the pipe, *n*, into the space surrounding the tubes, *a*. From the chamber, *c*, the boiling liquid passes up the trumpet-shaped pipe, *g*, and is discharged in a state of spray through the narrow orifice, *t*, between the upper end of *g*, and the cover, *h*, into the separating chamber, *B*, where the vapour and liquid are separated. The vapour passes up the pipe, *i*, into the steam space of the upper vessel, *A'*, which is similar to the lower vessel, *A*, and the liquid rises up the pipe, *m*, provided with the contraction, *s*, into the chamber, *b'*. The vapour separated in the upper separating chamber, *B'*, passes through the pipe, *K*, to the condenser, the concentrated liquid being discharged through the overflow pipe, *l*. Any water



condensed in the steam space of the lower vessel, *A*, passes up the pipe, *o*, provided with a constriction, *r*, into the steam space of the upper vessel, *A'*, from which it is discharged along with any water condensed in *A'*, through the pipe, *p*, provided with the constriction, *q*, into the pipe, *K*, leading to the condenser. The constrictions mentioned serve to regulate the flow of the liquids. Several chambers may, if desired, be combined together.

—W. H. C.

Still. A. Estève. Fr. Pat. 400,839, March 4, 1909.

THE apparatus consists of a condenser and a rectifying column mounted above a tubular boiler of special construction. The latter consists of an annular vessel having a number of interior cross-tubes similar to those of a vertical boiler, which expose a large surface of the liquid to the action of the heat. The boiler and rectifying column are enclosed in an outer casing spaced away from the boiler and column in order to reduce the loss of heat by radiation. The boiler is heated by burners fed with heavy petroleum under pressure.—W. H. C.

Regenerative reverberatory furnaces. O. Friedrich. Fr. Pat. 400,924, March 17, 1909.

THE claim is for a method for reducing the time necessary for repairing the air and gas conduits between the regenerators and the furnace, which are rapidly attacked and require frequent renewal. Those portions of the conduits which are most liable to deterioration are constructed independently, so that the damaged portion may be removed and replaced bodily by spare sections, without the necessity of pulling down and rebuilding the damaged portions brick by brick.—W. H. C.

Dryer for pulverulent and other materials. A. Besson. Fr. Pat. 400,947, March 18, 1909.

THE apparatus consists of a metallic chamber through which the materials are carried on superposed endless belts and are dried by the hot gases from a furnace placed below. The hot, moisture-laden air is withdrawn from the upper part of the chamber by a fan, and passed through

a condenser chamber situated above the dryer proper, from which, after it has deposited the moisture, it is returned to the ash-pit of the furnace.—W. H. C.

Recovery of alcohol and ether lost in the air during the manufacture of powder, artificial silk, or in other processes in which alcohol and ether are employed either together or separately. Apparatus and process for the —, C. Cépelle-Fontaine. Fr. Pat. 401,182. July 9, 1909.

The air containing the vapours of alcohol or ether is withdrawn from the working place by a fan and is discharged into the base of a column, divided by horizontal partitions into sections, each of which is provided with a bubbling weir or hood and an overflow pipe. The air passes up the column and bubbles through an acid or other suitable absorbing liquid, which flows down the column from an overhead supply tank. The liquid flows from the bottom of the column through a cooler, where its temperature is reduced, to a well from which it is pumped back into the overhead tank. The column is provided with thermometers, as it is necessary for the successful recovery of the vapours to maintain the column and washing liquid at a suitably low temperature.—W. H. C.

Solvents insoluble in water; Process for separating volatile — from the dissolved substance, which is also insoluble in water, by distillation. O. Wilhelm. Ger. Pat. 213,246, April 19, 1904.

This process is applicable to the separation of the solvent from solutions of rubber, wax, etc., which are liable to decomposition by direct heat, and which are, therefore, difficult to free from the last traces of solvent. It is only suitable for those substances which are insoluble in water and not volatile in steam. The solution is poured on the surface of water, when it can be distilled by heating the water, the last traces of solvent being readily removed.—T. F. B.

Reaction between a liquid and a gas; Apparatus for ensuring by intimate contact —. C. Boudon. Fr. Pat. 401,202, March 25, 1909.

THE claim is for the method of packing a tower shown in the figures: Fig. 1, being an elevation partly sectional;

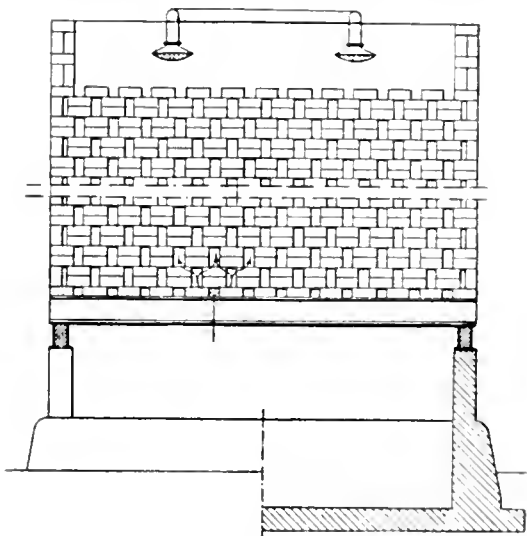


FIG. 1.

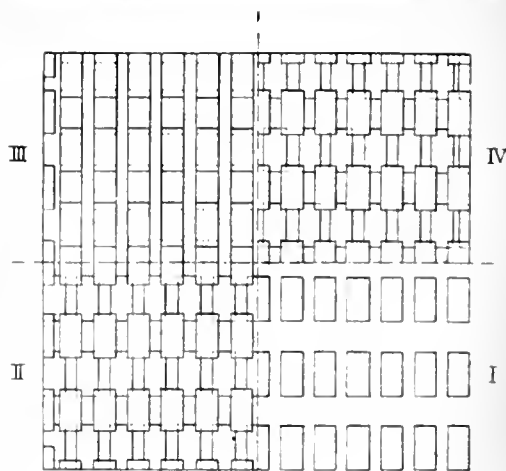


FIG. 2.

and Fig. 2, a sectional plan of the apparatus, showing the relative positions of four superposed rows of the packing material.—W. H. C.

Crystallisation vessels; Special floor for —. H. Mecher. Ger. Pat. 212,589, Aug. 11, 1908.

THE floor of the crystallisation vessel is provided with a series of radial or tangential guide-plates arranged one over the other in a manner similar to the folds of a fan. The solution is circulated in the vessel by one of the usual methods, and the guide-plates cause the motion to be horizontal, or nearly so, over the floor of the vessel.—A. S.

II.—FUEL, GAS, AND LIGHT.

Refractory metals from their chlorides; Preparation at high temperatures of some —. [Metallised filaments for electric lamps.] J. N. Pring and W. Fielding. Chem. Soc. Trans., 1909, 95, 1497—1506.

ATTEMPTS have been made to prepare electric lamp filaments of carbon coated with a refractory metal by "flashing" carbon filaments (heating them by means of a current) in an atmosphere of the chloride of the refractory metal alone or mixed with hydrogen, etc. The authors' experiments were made with a view to determine the conditions necessary for causing the separation of tungsten, molybdenum, chromium, silicon, and boron from the respective chlorides, by means of a heated carbon rod; to study the extent to which the elements react with the carbon at different temperatures; and to ascertain the photometric properties of the coated rods. The carbon rods used were 5 mm. in diam. and 7—9 cm. long. With boron trichloride and excess of hydrogen, at atmospheric pressure, a slight non-adherent deposit of boron was obtained at 1500° C. At 1750° C. a smooth skin deposit of boron carbide was produced, which at 1950° C. was more adherent and assumed a nodular form, whilst at 2150° C. large non-adherent crystals were observed. At 2200° C. a sooty deposit of the carbide and of free boron was produced on the bulb in which the carbon rod was mounted. Above 2000° C. boron appears to exert a catalytic effect in converting carbon into graphite. With silicon tetrachloride alone, no considerable deposit could be obtained. In presence of excess of hydrogen, a skin deposit of silicon was obtained at 1700° C., and crystals of free silicon at higher temperatures; at 1925° C. the deposit consisted wholly of silicon carbide. With benzene vapour in place of, or mixed with, the hydrogen, deposits of silicon carbide mixed with carbon were obtained. With tungsten hexachloride vapour alone, at a pressure of 10 mm., deposition of the metal began at 1000° C. At all temperatures tried (1200° C. to 2050° C.), the deposits were of a silver-white colour, adherent, and

smooth. Between 1000° and 1500° C., the deposit consisted of the metal, being comparatively soft and unable to mark glass; at higher temperatures the deposit consisted of carbide, scratching glass easily. With molybdenum tetrachloride and pentachloride under similar conditions to those employed with tungsten hexachloride, deposits of metallic molybdenum were obtained at temperatures below 1330° C., and of carbide at higher temperatures. When the deposition of tungsten and molybdenum was effected in presence of 1–2 ccs. of water vapour, the bulb being otherwise vacuous, the deposits were always free from carbon, but were less adherent than those obtained in absence of water vapour. No satisfactory deposits could be obtained from chromium oxychloride vapour.

The photometric efficiency of the coated rods was measured approximately in comparison with that of a carbon rod of the same size. The carbon rods were 5.5 cm. long and 4 mm. diam., and the deposits were in most cases 0.25 mm. thick (0.75 mm. in the case of silicon). The measurements were made with a photometer of the Lummer-Brodheim type, and the results were expressed in terms of the standardised lamp.

	Carbon rod.	Tungsten deposit.	Molybdenum deposit.	Boron deposit.
Luminous intensity with 332 watts, temp. 1600° C.....	1.01	3.00	2.97	—
Luminous intensity, with 465 watts, temp. 1775° C.....	3.40	6.06	6.27	1.16

With a rod coated with silicon carbide (diam. 5.5 mm.) the value was as low as 0.91. With the boron and silicon deposits, the luminosity was not sufficiently high for measurement with the lower amount of power.—A. T. L.

PATENTS.

Coking process. L. L. Summers, Chicago, Ill. U.S. Pat. 935,175, Sept. 28, 1909.

THE fuel is passed continuously through a horizontal retort and the gases distilled from the freshly charged fuel are caused to pass transversely through the hotter portions of the fuel column.—A. T. L.

Compression of gas or air for lighting or heating purposes; Apparatus for the —. E. Fletcher, Tottenham. Eng. Pat. 26,719, Dec. 9, 1908.

THE apparatus consists of a double-acting, reciprocating air-pump without valves. In the middle of the cylinder two ports are arranged: one communicates with the low-pressure gas supply and the other with the reservoir of compressed gas. The piston is longer than the stroke of the pump and has two sets of ports, which at the ends of the stroke coincide with those in the cylinder walls, so that the compressed gas is released from one end of the cylinder and flows to the reservoir, and the gas from the supply enters the other end of the cylinder and destroys the partial vacuum produced there.—J. W. H.

Gas-generator. J. Darling, Chicora, Pa., Assignor to The Smokeless Heat and Power Co., Cleveland, Ohio. U.S. Pat. 933,828, Sept. 14, 1909.

THE claims are for a gas-generator comprising vertical furnace walls, with two series of horizontal retorts arranged one above the other and extending across the furnace chamber, the lower retorts being connected by pipes to the retorts above them. The ends of the retorts are rectangular and the vertical sides are provided with ribs which abut against the ribs of the adjacent retorts, so as to space the retorts apart and permit of a vertical joint being made between them with mortar.—A. T. L.

Gas-producer. H. I. Lea, Pittsburg, Pa., Assignor to The Westinghouse Machine Co. U.S. Pat. 934,446, Sept. 21, 1909.

THE producer, which works with a down-draught, comprises a truncated conical producer chamber arranged above an ash chamber of inverted truncated conical form. A ring of gas outlet ports is formed at the widest part of the producer, leading to an annular gas-collecting chamber. The ash-pit is water-sealed.—A. T. L.

Water-gas; Process of making —. C. E. White, Philadelphia, Pa. U.S. Pat. 935,344, Sept. 28, 1909.

A COLUMN of refractory material is heated in an electric furnace, and steam or steam and hydrocarbons, is passed through the heated mass. The heating current passes transversely through the column between a series of electrodes arranged at the two sides. The column is heated to different temperatures at different points, by varying the current density, and the steam is passed through the whole column while the hydrocarbon is passed through only a part of it.—A. T. L.

Gas-generating apparatus. J. H. Stringham, Jersey City, N.J., Assignor to The Westinghouse Machine Co. U.S. Pat. 935,429, Sept. 28, 1909.

THE invention relates to a gas producer having a water-jacketed casing forming a steam generator. The jacket can be heated independently of the producer fire by means of a gas burner beneath it, the combustion products from this burner passing up through vertical heating tubes in the jacket. The blast-pipe for the producer chamber is perforated and is supplied with air from a number of valved branch pipes, so that the blast to different portions of the pipe can be independently controlled.—A. T. L.

Tar and other substances from blast furnace, producer and other gases; Purification of and recovery of —. W. C. Neilson, Coatbridge, Lanark. Eng. Pat. 28,462, Dec. 31, 1908.

PRODUCER or other gases are treated with vaporised cresote oil or other solvent for tar, before being passed through tar-trapping devices. Under ordinary circumstances, in purifying producer or furnace gases at 45° C., 1 part of oil to 7000 parts of gas (by weight) will reduce the viscosity of the tar sufficiently.—J. W. H.

Gas-washing apparatus. O. H. Ensign, Madison, Wis. U.S. Pat. 933,966, Sept. 14, 1909.

THE apparatus comprises a cylindrical chamber containing a bell or holder with perforated walls sealed at the lower edge. The gas is admitted to the interior of the bell and is cleaned by passing through the walls. The bell is continuously rotated, and washed by a water-spray playing on its outer surface.—A. T. L.

Natural gas; Apparatus for recovering light oils from —. J. L. Gray, Elizabeth, N.J. U.S. Pat. 933,976, Sept. 14, 1909.

THE apparatus comprises a compressor which forces the gas through a separator, a condenser, a second separator, and finally through a relief valve which maintains a steady pressure within the system. The oil collected in the second separator passes to a closed trap, having its discharge valve controlled by the liquid, and the upper part of this trap is connected to the gas main between the separator and the relief valve.—A. T. L.

Gas-scrubbing apparatus. J. J. Nix, Los Angeles, Cal. U.S. Pat. 934,205, Sept. 14, 1909.

THE apparatus consists of an annular vertical cylindrical casing, divided by radial partitions into a number of compartments. Gas is admitted to one of the compartments through its outer wall and is led downwards through a pipe bent at right-angles and open at its lower end. This pipe is fitted with a water-spray pipe at the top of the vertical limb. The gas passes from each compartment to the next by a similar pipe bent at right-angles and fitted with a sprayer, the last compartment being connected to the gas outlet. Each compartment

is fitted with a water overflow pipe which maintains the water-level slightly below the open ends of the bent pipes, but a second overflow at a higher level is fitted to the inlet compartment so that the inlet pipe may be sealed when desired.—A. T. L.

Gas purifier. H. I. Lea, Pittsburg, Pa., Assignor to The Westinghouse Machine Co. U.S. Pat. 934,448, Sept. 21, 1909.

THE apparatus comprises a wet scrubber, a water-seal box, and a drying chamber, all arranged within a single casing. The gas enters through a down-pipe which extends below the water level in the water-seal box at the base of the apparatus, then passes up through a scrubbing column against a counter-current of water. The gas is then led down through a water-sealed pipe and finally passes up through a drying column to the gas outlet.

—A. T. L.

Gas-purifying apparatus. H. I. Lea, Pittsburg, Pa., Assignor to The Westinghouse Machine Co. U.S. Pat. 934,679, Sept. 21, 1909.

THE apparatus comprises a dust-collecting chamber of inverted conical form arranged beneath a multitubular boiler having vertical heating tubes, the boiler being surmounted by a gas-collecting chamber provided with a gas-outlet and also with a stack-pipe. The dust-collecting chamber is fitted with a fuel grate beneath the boiler, and an air inlet is provided beneath the grate. The gas-inlet to the dust-collecting chamber is provided with a vertical baffle-plate to direct the gas downwards.

—A. T. L.

Incandescence lamps; Manufacture of filaments for —. Cie. Franç. de la Lampe Canello. First Addition, dated July 9, 1908, to Fr. Pat. 361,602, July 3, 1905 (this J., 1906, 976).

THE process described in the principal patent is simplified by incorporating a solution of cellulose with the solution or mixture of substances from which the filament is to be formed, and then forming threads from this mixture, instead of impregnating a cotton or other thread. An oxygen or sulphur compound of osmium, tungsten or molybdenum is added to the mixture of rare earths, and the threads formed as described, after being dried and heated in a reducing gas, are decarbonised by the passage of a current, with the formation of carbon monoxide, dioxide or bisulphide. The filaments are finished by heating them in hydrogen.—A. T. L.

Incandescent electric lamps; Manufacture of filaments for —. Soc. Franç. d'Incandescence par le Gaz (Système Auer). Fr. Pat. 401,307, July 18, 1908.

FILAMENTS formed from a mixture of oxides of metals or of metalloids with lampblack and a binding agent, are heated to redness in a reducing atmosphere to render them conducting, and are then decarbonised by heating electrically in gases containing oxygen or sulphur to combine with the carbon. The filaments are then "metallised" by heating to a high temperature in an atmosphere containing hydrogen and ammonia. The ammonia may be formed in the vessel in which the "metallising" process is carried out by passing sparks through a mixture of nitrogen and hydrogen in this vessel, or by decomposing an ammonium salt therein. The decarbonising and "metallising" processes may be carried out simultaneously by mixing the decarbonising gases with the hydrogen and ammonia. When the filaments are of vanadium, titanium or other metals which combine with nitrogen, the small quantity of air not removed from the lamp bulbs by the vacuum pump is absorbed by the filament itself, or by an auxiliary filament used for this purpose, or by charcoal, or a metal such as calcium or magnesium, thus leaving in the bulbs only gases of the argon group.—A. T. L.

Coke ovens; Regenerative —. Act. Ges. f. Kohlen-destillation and L. Holbeck, Gelsenkirchen-Bulmke, Westphalia. Eng. Pat. 19,264, Sept. 14, 1908.

SEE Fr. Pat. 394,077 of 1908; this J., 1909, 237.—T. F. B.

Gas-holders; Method of protecting the iron walls of — from the destructive influence of the cyanogen compounds entering the water of the seal from the gas. O. Kaysser, Dortmund, Germany. Eng. Pat. 18,672, Sept. 5, 1908.

SEE Fr. Pat. 393,661 of 1908; this J., 1909, 132.—T. F. B.

Gas and air; Process for the manufacture of a mixture of — for illuminating purposes. F. W. Wolff, Assignor to Selas-Ges. m.b.H., Berlin. U.S. Pat. 935,444, Sept. 28, 1909.

SEE Eng. Pat. 25,596 of 1905; this J., 1907, 41.—T. F. B.

Liquids and gases; Apparatus for effecting intimate contact of —. [Gas washers, &c.]. S. Hersey, London, and E. W. Blake, Croydon, Assignors to Kirkham, Hulett, and Chandler, Ltd., London. U.S. Pat. 935,501, Sept. 28, 1909.

SEE Eng. Pat. 28,387 of 1907; this J., 1909, 83.—T. F. B.

Filling and emptying gas-burettes. Ger. Pat. 212,338. See XXIII. Apparatus.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Aniline; Action of potassium hydroxide on —. A. Bacoescu. Ber., 1909, 42, 2938—2940.

WHEN aniline is mixed with 12 parts of powdered potassium hydroxide and kept for 3 hours, most of the aniline is converted into a mixture of azobenzene and *o*-hydroxyazobenzene. Azobenzene itself when heated on the water-bath with potassium hydroxide yields traces of *o*-hydroxyazobenzene. Hydrazobenzene similarly gives azobenzene and traces of *o*-hydroxyazobenzene. The formation of *o*-hydroxyazobenzene in these reactions is probably due to the direct action of the alkali on azobenzene, but the other transformations are probably effected through the oxygen of the air.—J. C. C.

Paraffin crystals; Acicular — and their importance for the Scottish sweating process. E. Pyhälä. Seventh Int. Congr. Appl. Chem., London, 1909. Petroleum, 1909, 4, 1392—1394.

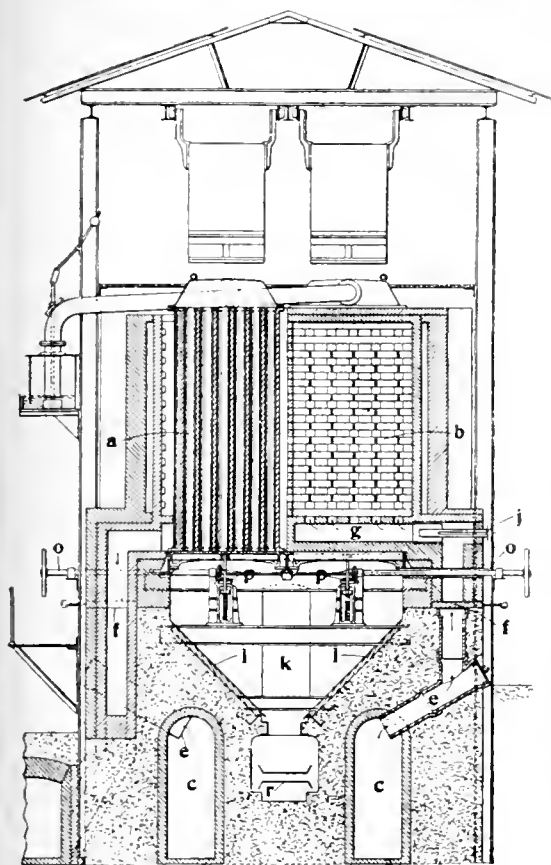
ACCORDING to the author, the acicular form of crystallised paraffin wax yields far better results than the tabular or foliaceous type of crystals, when the cakes are refined by the dry sweating process in the Henderson apparatus. The crystals, which are 15—20 mm. long and 0.5—1 mm. thick, spring from the upper and lower surfaces of the cake; and on the application of heat, the solidified oils located between the crystals, melt and drain away readily. On the other hand, the tabular crystals retard the escape of the melted oil, and delay the extraction, sometimes for several weeks, the residual mass being still more or less impure.—C. S.

Toxicity of aniline derivatives. Hildebrandt. See XX.

PATENTS.

Coal; Apparatus for the destructive distillation of —. T. Parker, Wednesfield. Eng. Pat. 14,167, July 3, 1908.

THE apparatus, which is shown in transverse section in the figure, comprises two series of batteries, *a*, of vertical retorts extending throughout its length, with chambers, *b*, for the heating gases between successive batteries of retorts. Producer gas is distributed from two longitudinal gas-chambers, *c*, by means of conduits, *e*, provided with shut-off valves, *f*, leading to mixing chambers, *g*, beneath the chambers, *b*. Air is admitted to the mixing chambers by valves, *j*, consisting of slotted pipes which may project to any desired extent into the mixing chamber, so as to expose more or less of the length of the slots. The combustion gases pass through the open brickwork of the walls of the chambers, *b*, and circulate around the retorts, passing finally to the chimney. The coke from the retorts is allowed to fall on to the inclined



walls, *l*, of a central discharge chamber, *k*, so as to be broken up before reaching the conveyor, *z*. The mechanism for operating the doors at the lower ends of the retorts is carried within the chamber, *k*, and is arranged to be operated by shafts, *o*, from the two sides of the setting.

—A. T. L.

Mineral oils ; Treatment of — J. J. Hood and A. G. Salamon, London, Eng. Pats. 16,617, Aug. 6, 1908, and 24,209, Nov. 11, 1908.

DARK-COLOURED oils are treated with or filtered through finely-divided alumina, magnesia, bauxite, or magnesite in order to decolorise them. The filtering material is previously ignited at a temperature below redness and after use can be regenerated by being washed with petroleum spirit and again ignited. Certain kinds of magnesite and bauxite are first treated with acids or alkalis before use. Thick, viscous oils are diluted with petroleum spirit of low boiling point, and after treatment the light petroleum is distilled off.—W. H. C.

Sulphuric acid and oils ; Process for the recovery of — from waste acid. G. Stolzenwald, Ger. Pat. 212,000, Aug. 6, 1907.

THE waste acid, *e.g.*, that from the refining of petroleum oils, is passed upwards through a series of vertical retort-tubes, wider in their lower than in their upper parts, and is heated gradually in these retorts to a temperature at which resinous and tarry matters are carbonised. In the lower cooler parts of the retorts, the oils, *etc.*, are volatilised, whilst in the upper, strongly heated portions, the tar, *etc.*, is decomposed, together with a small quantity of the sulphuric acid. The vapours, together with some entrained charcoal, leave the retorts through a discharge pipe at the top. From this discharge pipe, a pipe passes vertically downwards into a vessel, where it dips into a liquid seal. The condensed sulphuric acid and the charcoal pass down this pipe, and are separated by settling.

The oil vapours and any sulphur dioxide are led to a condenser, where the oils condense, whilst the sulphur dioxide may be subsequently converted into sulphuric acid.—A. S.

Recovery of useful constituents of sewage. Eng. Pat. 18,199. See XVIII.B.

Distillation of wood, with direct utilisation of the charcoal for metallurgical purposes. Fr. Pat. 401,226. See X.

IV.—COLOURING MATTERS AND DYESTUFFS.

Amines ; Diazotisation of weakly basic, sparingly soluble, primary —, and some reactions connected therewith. O. N. Witt. Ber., 1909, 42, 2953—2961.

THE diazotisation of weakly basic amines, such as dinitraniline or 2:6-dichloro-*p*-nitraniline, can be very readily effected when the base is dissolved in concentrated nitric acid (sp. gr. 1.48). The nitrous acid is produced from the nitric acid by adding the calculated amount of potassium pyrosulphite (metabisulphite). The process is best carried out by grinding together the base and pyrosulphite and adding the mixture gradually to the cooled nitric acid, the quantity of which may be 2—3 times that of the base employed. The resulting diazo-solution is very stable ; when required for use it is best diluted with powdered ice. The diazo-compound of dichloronitraniline combines with β -naphthol in strongly acid solution, yielding an insoluble scarlet red azo-compound. Dichloronitraniline itself, when treated with concentrated nitric acid, is converted slowly into dichloro-*p*-nitrophenylamine, which yields readily soluble metallic salts, except in the case of the thorium salt, which is insoluble ; it is suggested that this latter salt might be used for the analytical estimation of thorium.—J. C. C.

Amino- and hydroxy-compounds ; Action of sulphites on aromatic —. 7th Communication. Application of the sulphite reaction to some ana-(1.5)-derivatives of naphthalene. H. T. Bucherer and A. Uhlmann. J. prakt. Chem., 1909, 80, 201—241.

1:5-NAPHTHYLENEDIAMINE-2-SULPHONIC acid is prepared by heating purified 1:5-naphthylenediamine sulphate with 6 parts of fuming sulphuric acid containing 5 per cent. of sulphur trioxide for 1½ hours at 100°—110° C. The mixture is cooled, mixed with 1 part of fuming acid containing 25 per cent. of sulphur trioxide and again warmed. The sulphonic acid separates on pouring the mass into water. On boiling this acid for 12 hours with sodium bisulphite solution (36° B.), treating the product first with sodium hydroxide and then with hydrochloric acid, 1:5-aminonaphthol-2-sulphonic acid is obtained. 5-Acetylamino-1-naphthylamine-8-sulphonic acid, prepared by reducing Nietzki and Zübelen's nitroacetylnaphthionic acid with zinc dust and hydrochloric acid at a temperature not exceeding 30° C., on saponification and treatment of the resulting diamino-acid with sodium bisulphite, yields 1:5-aminonaphthol-8-sulphonic acid. The constitution of this acid is confirmed by its yielding 1:5-aminonaphthol when heated with 20 per cent. hydrochloric acid. With tetrazotised benzidine in alkaline solution it yields a dyestuff giving blue violet shades on cotton which, when diazotised and developed on the fibre with β -naphthol, become dirty reddish-violet. When combined with the same tetrazo-compound in acid solution, a dyestuff is obtained which gives deep blue shades on cotton ; on diazotisation and development with β -naphthol, clear brown shades are produced. When 5-acetylamino-1-naphthylamine-8-sulphonic acid is heated on the water-bath for 20 hours with sodium bisulphite solution (38° B.), 1:5-aminonaphthol-4-sulphonic acid is produced, which is separated from the diamino-acid and the isomeric acid by fractional precipitation. When further treated with bisulphite the acid yields the corresponding dihydroxynaphthalenesulphonic acid. This, when heated in a sealed tube with ammonia, yields first the aminonaphthol-

sulphonic acid just described and finally the diamino-acid. By sulphonating 1:5-dihydroxynaphthalene it seems probable that a mixture of 1:5-dihydroxynaphthalene-2- and -5-sulphonic acids are produced. When 1:5-amino-naphthol-7-sulphonic acid ("M" acid) is treated with bisulphite, it is converted into 1:5-dihydroxynaphthalene-7-sulphonic acid.—J. C. C.

Aniline Black; Constitution of —. H. T. Bucherer. Ber., 1909, 42, 2931–2933.

THE author cannot accept Willstätter and Dorogi's formula (this J., 1909, 635) for Aniline Black and points out that an indamine formula for Emeraldine, the red imine and Aniline Black which are all very stable towards acids, is not reconcilable with the fact that indamines are extremely susceptible to the action of acids. The azine constitution is at least equally probable in the case of the dyestuffs of the Aniline Black group.—J. C. C.

o-Azothioanisol and o-thiodianisidine. K. Brand. Ber., 1909, 42, 3463–3468.

THE compounds mentioned in the title have been prepared by the following series of reactions. *o*-Nitrothiophenol, $\text{SH}\cdot\text{C}_6\text{H}_4\cdot\text{NO}_2$, is obtained by boiling an alcoholic solution of *o*-dinitrodiphenyl disulphide with a mixture of sodium hydrosulphide and hydroxide or a suitable amount of sodium sulphide, disulphide, or polysulphide. The solution of the sodium salt of *o*-nitrothiophenol is heated with potassium methyl sulphate for some hours on the water-bath or, better, is diluted with water and treated with dimethyl sulphate. A quantitative yield of *o*-nitrothioanisol, m.p. 85° – 87°C , is obtained. On electrolytic reduction by Elbs's method, this is converted into *o*-azothioanisol, m.p. 156 – 158°C , which can be reduced to *o*-hydrazothioanisol, m.p. 104°C , by means of sodium or ammonium hydrosulphide. The latter is more conveniently prepared, however, from *o*-nitrothioanisol by reduction with zinc dust and sodium hydroxide. On treatment with hydrochloric acid for several hours in the cold, this is transformed into *o*-thiodianisidine, m.p. 110 – 112°C , the tetrazo-compound of which gives with salicylic acid an orange yellow, and with H-acid a blue dyestuff both of which dye cotton direct. The diacetyl compound melts at 245° – 247°C .—J. C. C.

PATENTS.

1:8-Diaminonaphthalen-4-sulphonic acid; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 6831, March 22, 1909.

1:8-NAPHTHYLENEDIAMINE acid sulphate, or a mixture of sulphuric acid and 1:8-naphthylenediamine capable of forming the acid sulphate, is heated, preferably *in vacuo*, to temperatures above 100°C (e.g., to 155°C for about 10 hours); the product is dissolved in dilute sodium carbonate solution, filtered, and the filtrate acidified, when 1:8-naphthylenediamine-4-sulphonic acid separates out.—T. F. B.

Azo dyestuffs. L. Hesse, O. Günther, and A. Zart. Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 933,446, 933,447, 933,448, and 933,562, Sept. 7, 1909.

(1). CLAIM is made for the azo dyestuff prepared by combining diazotised aniline-*o*-sulphonic acid with cresidine, diazotising the resulting aminoazo-compound and combining it with 5-hydroxy-1:2-phenylnaphthiminazole-7-sulphonic acid. The sodium salt is a dark powder giving a blue solution with concentrated sulphuric acid and dyeing cotton in blue shades. (2). An azo dyestuff is prepared by combining diazotised 1-naphthylamine-2:4-disulphonic acid with *p*-xylydine, diazotising the resulting aminoazo-compound and combining it with 2-phenylamino-5-naphthol-7-sulphonic acid. The sodium salt is a dark powder giving a blue-green solution with concentrated sulphuric acid and dyeing cotton in violet shades. (3). Diazotised aniline-*o*-sulphonic acid is combined with *p*-xylydine, the resulting aminoazo-compound is diazotised and combined with 2-amino-5-naphthol-1:

7-disulphonic acid. The sodium salt of the product is a dark green powder giving a greenish-blue solution with concentrated sulphuric acid and dyeing cotton in bluish-red shades. (4). An azo dyestuff is prepared by combining diazotised *m*-xylydine-*o*-sulphonic acid with *p*-xylydine, diazotising the resulting aminoazo-compound and combining it with 2-phenylamino-5-naphthol-7-sulphonic acid. The product in the form of the sodium salt is a dark green powder giving a blue solution with concentrated sulphuric acid and dyeing cotton in reddish-violet shades.—J. C. C.

Anthracene series; Process for preparing grey vat dyestuffs of the —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 213,501, Oct. 1, 1908.

α -*ANTHRACENES* are nitrated and the nitro-compounds reduced; the resulting compounds dye cotton fast grey shades from the vat.—T. F. B.

Sulphur [sulphide] dyestuffs; Brown and olive —. K. Gly, Berlin, and P. Dieterle, Lyons, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pats. 934,302 and 931,303, Sept. 14, 1909.

WHEN *o*- or *p*-aminophenol is heated with *m*-toluylenediamine and sulphur, sulphide dyestuffs are obtained which dye cotton fast brown and olive shades respectively from alkali sulphide solutions, without mordants. The dyestuffs from one mol. of *o*-aminophenol and two of *m*-toluylenediamine, and from two mols. of *p*-aminophenol and one of *m*-toluylenediamine are described.—T. F. B.

Azo dyestuff dyeing chromed wool; Process for the production of an —. Act.-Ges. f. Anilinfabr. Fr. Pat. 401,092, March 22, 1909.

o-CHLORO-*p*-NITRANILINE is diazotised and combined with salicylic acid in alkaline solution. The resulting azo dyestuff gives fast brick-red shades on chromed wool.—J. C. C.

Monoazo dyestuffs; Process for the production of yellow —. Act.-Ges. f. Anilinfabr. Fr. Pat. 401,133, March 23, 1909.

THE disulphonic acid of *p*- or *o*-toluidine is diazotised and combined in alkaline solution with phenylmethylpyrazolone. The azo dyestuff obtained gives clear yellow shades on wool, which are very fast to light.—J. C. C.

Dyestuffs; Manufacture of new —. Farbwerke vorm. Meister, Lucius, und Brüning. Second Addition, dated Feb. 11, 1909, to Fr. Pat. 400,590, Feb. 11, 1909. Under Int. Conv., Nov. 6, 1908. (See Eng. Pat. 3758, this J., 1909, 975, and Ger. Pat. 208,968, this J., 1909, 517.)

INSTEAD of the diamines mentioned in the principal patent and the first addition, their sulphonic acids may advantageously be employed. An example is given describing the combination of diazotised *p*-nitrobenzoyl-*p*-phenylene-diaminesulphonic acid with *p*-nitrobenzoyl-2:5:7-aminonaphtholsulphonic acid in alkaline solution. The resulting dyestuff gives bluish-red shades on cotton which are unchanged by diazotisation and development with β -naphthol on the fibre.—J. C. C.

3-Oxy-(1)-thionaphthene; Process for preparing halogen-substituted —. Badische Anilin und Soda Fabrik. Ger. Pat. 212,942, Oct. 23, 1906.

3-OXY-(1)-THIONAPHTHENE and its homologues or derivatives are converted into halogen-substitution products by treatment with chlorine or bromine or substances which produce chlorine or bromine (excepting alkali hypochlorites or hypobromites). Mono- or di-halogen derivatives can be produced, the halogen being attached to the nucleus containing sulphur.—T. F. B.

Dyestuffs soluble in fats, oils, and resins; Process for preparing —. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 213,172, Nov. 29, 1908. Addition to Ger. Pat. 198,278, Jan. 6, 1907.

THE dyestuffs soluble in fats, oils, etc., prepared according to the original patent (this J., 1908, 801), are rendered much more intense and brilliant by mixing them with basic dyestuffs soluble in fats. These basic dyestuffs may be added to the other dyestuffs at a suitable stage of the process, or both dyestuffs may be rendered fat-soluble by one process. Also the alkali salts of alizarin may be precipitated by means of basic dyestuffs, and the resulting product mixed or melted with the alkaline-earth, earth, or heavy metal salts of fatty or resin acids, with or without addition of free fatty or resin acid.

—T. F. B.

Azoxy dyestuffs dyeing cotton direct; Process for preparing —. L. Cassella and Co. Ger. Pat. 213,278, March 12, 1908.

DIAZOTISED *p*-nitraniline or one of its derivatives is combined in acid solution with 2,5-aminonaphthol-7-sulphonic acid; on reducing this azo dyestuff by means of alkaline reducing agents, direct cotton azoxy dyestuffs are obtained, which, when developed on the fibre, produce very fast, deep red shades; in this respect they differ from the dyestuffs obtained by performing the combination in alkaline solution, the shades of these not being improved by development.—T. F. B.

Vat dyestuffs; Process for preparing halogenated red —. Ges. f. Chem. Ind. in Basel. Ger. Pat. 213,504, June 5, 1908. Addition to Ger. Pat. 196,349, April 27, 1907. (See this J., 1908, 557.)

THE condensation product of acenaphthenequinone and 3-oxy-(1)-thionaphthene is treated with halogens or substances developing halogens, at the ordinary temperature, in presence of concentrated sulphuric acid. (See also Ger. Pat. 198,510; this J., 1908, 801.)—T. F. B.

Vat dyestuffs; Process for preparing halogenated —. Ges. f. Chem. Ind. in Basel. Ger. Pat. 213,505, May 12, 1908.

HALOGEN-SUBSTITUTED isatin derivatives of the naphthalene series are condensed with 3-oxy-(1)-thionaphthene and its derivatives. These products form vats from which cotton is dyed various shades of brown-violet, violet-grey, grey, and violet-black.—T. F. B.

Dyestuffs containing sulphur; Preparation of leuco-compounds of —. Kalle and Co. A.-G. Ger. Pat. 213,714, March 29, 1908.

WHEN diindole is condensed with 3-oxy-(1)-thionaphthene or its 2-carboxylic acid or another of its benzene-substitution products, preferably in presence of an alkali carbonate, leuco compounds of indigo analogues containing sulphur are produced. These compounds are soluble in alkali hydroxides to yellow solutions, from which red dyestuffs are precipitated in contact with air, and which serve for the production of red dyeings on fibres.—T. F. B.

Vat dyestuffs of the anthracene series; Manufacture of —. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 25,551, Nov. 26, 1908.

SEE Ger. Pat. 208,969 of 1908; this J., 1909, 650.—T. F. B.

Azo dyestuffs. J. Jansen and W. Neelmeier, Leverkusen. Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 933,841 and 933,842, Sept. 14, 1909.

SEE Ger. Pat. 210,597 and Fr. Pat. 396,381 of 1908; this J., 1909, 698 and 595.—T. F. B.

Vat [anthracene] dyestuff. J. Démet, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 935,590, Sept. 28, 1909.

SEE Fr. Pat. 400,653 of 1909; this J., 1909, 1029.—T. F. B.

Pyrazolone dyes and process of making them. P. Julius and E. Fussenegger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 935,370, Sept. 28, 1909.

SEE Fr. Pat. 398,602 of 1909; this J., 1909, 832.—T. F. B.

Izo dyestuff. P. Julius and E. Fussenegger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 935,371, Sept. 28, 1909.

SEE Fr. Pat. 398,602 of 1909; this J., 1909, 832.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Silks; Proximate composition [and constitution] of various —. I. Monoamino acids from Niët ngô tsâm (China) silk. E. Abderhalden and G. A. Brossa. II. Monoamino acids from Indian tussah silk. E. Abderhalden and W. Spack. VII. Monoamino acids from the gum of Canton silk. E. Abderhalden and Worms. Z. physiol. Chem., 1909, 62, 129–132, 142–144.

THE authors have examined the products of hydrolysis from the cocoons of Niët ngô tsâm silk, and obtained a residue of melanine products equal to 1 per cent. The determination of tyrosine and the remaining monoamino acids was carried out in the usual way, and the yields obtained from 100 grms. of dry ash-free substance, were: glycocoll, 24 grms.; alanine, 18.5 grms.; tyrosine, 7.8 grms.; with small proportions of glutamic acid, aspartic acid, leucine, serine, proline, and phenylalanine. From Indian tussah silk an average yield of gum equal to 16 per cent. was obtained. The residue left by hydrolysis of the degummed silk was 16 per cent., which was reduced to 6 per cent. by a more drastic treatment. The yield of ultimate products calculated per 100 grms. of dry ash-free substance was: glycocoll, 9.5 grms.; alanine, 24 grms.; the remaining amino-acids being similar to above. The gum obtained from Canton silk gave by hydrolysis with (1), 25 per cent. sulphuric acid, (2) fuming hydrochloric acid, a residue equal to 1 per cent. In the determination of the ultimate products, it was found essential to have a good vacuum (0.1 to 0.2 mm.) for distilling the esters. By this means a fraction containing aspartic and glutamic acids was obtained. The results obtained show clearly that the gum is quite different in composition from silk fibroin or gelatin.—W. N. B.

Mordanting of wool with iron salts. R. Möhlau. Ver. Deutscher Chemiker, Sept., 1909. Chem.-Zeit., 1909, 33, 1020.

WHEN wool which has been mordanted with iron salts is exposed to light, it assumes a grey or brownish-yellow tone. A process of oxidation apparently takes place, which, however, is dependent upon the presence of light, since in an atmosphere of oxygen or ozone, and in the dark, no change occurs. The mordanted wool becomes yellow upon placing it in a slightly alkaline solution of hydrogen peroxide, indicating that the iron is oxidised from the ferro- to the ferro-ferri form. The shades obtained upon this "oxidised" mordant are richer and darker than those with the original one.—F. M.

Mordants on wool; Fixation of "Schwefel" —. R. Möhlau. Ver. Deutscher Chemiker, Sept., 1909. Chem.-Zeit., 1909, 33, 1020.

SAMPLES of wool were mordanted with salts of the following nineteen metals: cerium, thorium, zirconium, ytterbium, beryllium, aluminium, nickel, cobalt, uranium, chromium, copper, zinc, cadmium, manganese, antimony, lead, tin, thallium, and iron. Solutions of the sulphates were employed, as preliminary trials showed that from such solutions the oxide of the metal was generally absorbed by the wool. The mordanting baths were maintained at constant volume and contained (1), 5 per cent. and

alkali. The materials to be bleached remain in this peroxide-soap bath for about 12 hours and are then squeezed and rinsed.—F. M.

Mercerising under tension; Machine for —. P. Hahn. Fr. Pat. 401,004, Mar. 12, 1909.

THE pieces pass between rollers to which a heavy pressure is applied, and then into the caustic liquor. After impregnation, longitudinal shrinkage is prevented by passing the pieces between a series of squeezing rollers (the peripheral speed of each pair of which is slightly greater than that of the preceding pair) and lateral shrinkage is avoided by interposing a number of screw-threaded expanding rollers. The squeezing bowls and expanding rollers are supplied with toothed wheels, which gear one into the other and thus transmit the power from a main cog-wheel.—F. M.

Dyeing machine for wool in the form of sliver, hanks, or on bobbins. H. Maly. Fr. Pat. 401,290, Mar. 27, 1909.

THE machine comprises a vessel to contain the dye-liquors and a dye-vat, connected together by pipes supplied with three-way valves, and a rotary pump and steam injector. The material to be dyed is arranged on perforated tubes, fitting into hollow discs which are supported upon the perforated, hollow central spindle of the dye-vat. The dye-liquor is forced, by means of the pump, alternately over the material and through the spindle, the circulation being assisted by the use of the steam injector, which also ensures the temperature of the liquors being maintained at 100° C., or more.—F. M.

Dyeing half-wool or half-silk goods with sulphide dyestuffs; Process for reserving the wool or silk in —. Farbwerk Mülheim vorm. A. Leonhardt und Co. Ger. Pat. 212,951, Sept. 12, 1908.

WHEN "protamol" (Färber Zeit., 1908, 266) is added to the sulphide dye-bath, the wool or silk in half-wool or half-silk goods remains undyed: the temperature of the dye-bath is preferably 30°–40° C.—T. F. B.

Waterproofing fibrous materials. A. O. Tate, Toronto, Canada. U.S. Pat. 933,861, Sept. 14, 1909.

THE material is heated with a substance of a soapy nature in order to render the interior fibres non-capillary. It is then immersed in an electrolytic bath and "palmate of aluminium" is deposited on one or both of its sides.—S. H. H.

Artificial lace fabric and the like; Method of producing —. M. Ratignier and H. Pervilliac, Lyons, France. U.S. Pat. 934,214, Sept. 14, 1909.

SEE Eng. Pat. 13,518 of 1907; this J., 1907, 1196.—T. F. B.

Wool fibre; Apparatus for supplying liquid to —. W. J. Murray, Bristol, Pa., U.S.A. Eng. Pat. 1594, Jan. 22, 1909.

SEE U.S. Pat. 927,998 of 1909; this J., 1909, 881.—T. F. B.

Mercerising textile fabrics; Apparatus for —. R. E. Ellis, London. From Heberlein et Cie., St. Gall, Switzerland. Eng. Pat. 4683, Feb. 25, 1909.

SEE Fr. Pat. 399,904 of 1909; this J., 1909, 935.—T. F. B.

Dyeing yarn; Apparatus for —. J. Kershaw and J. T. Cole, Menston. U.S. Pat. 934,543, Sept. 21, 1909.

SEE Eng. Pat. 16,329 of 1908; this J., 1909, 979.—T. F. B.

Fibrous material; Preserving composition for —. K. H. Wolman and B. Diamond, Idaweiche, Germany. Assignors to M. Barschall, Nice-Cimiez, France. U.S. Pat. 934,871, Sept. 21, 1909.

SEE Eng. Pat. 19,241 of 1906; this J., 1907, 529.—T. F. B.

Sizing textile materials; Method of —. J. Boyeux, Villeurbanne, France. U.S. Pat. 934,034, Sept. 14, 1909.

SEE Eng. Pat. 233 of 1907; this J., 1908, 158.—T. F. B.

Emulsifying and saponifying fatty substances to render them suitable for the manufacture of soaps and cleansing articles. Fr. Pat. 400,792. See X14.

Decolorising product of sodium hydrosulphite and zinc dust. Fr. Pat. 401,000. See VII.

Recovery of alcohol and ether lost in the air during the manufacture of artificial silk. Fr. Pat. 401,182. See I.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Sodium chloride; Boiling point of —. F. Emich. Ges. Deutscher Naturforscher u. Aerzte, Sept. 1909. Chem.-Zeit., 1909, 33, 1015.

WHEN sodium chloride is introduced into an iridium flask which is heated to a temperature of about 2000° C., the rate of vaporisation is so rapid as to be almost explosive. The temperature at which vaporisation commences has now been determined by gradually raising the temperature of an electrically heated iridium plate, until the sample of salt swells up and disappears. This temperature (optically determined) corresponds with the melting point of platinum, i.e., about 1750° C.—F. M.

Sodium hypochlorite; Electrolytic preparation of —. W. Oglöblin. J. Russ. Phys.-Chem. Ges., 1909, 41, 670–679. Chem. Zentr., 1909, 2, 1177–1178.

FROM results obtained with an apparatus of the Keller type for the electrolytic production of sodium hypochlorite from common salt, the author draws the following conclusions. In a given period of time, with constant temperature, E.M.F., and current-strength, the yield of sodium hypochlorite is higher the greater the concentration of the salt solution. The yield is also increased by keeping the quantity of electrolyte small, having as few interruptions in working as possible, and using a high current-strength and low temperature. Electrolytically prepared sodium hypochlorite solution suffers less decomposition on exposure to light and air than a bleaching powder solution of equivalent concentration.—A. S.

Copper sulphate; Influence of temperature on the decomposition of — in a current of dry air. W. Wanjukow. J. Russ. Phys.-Chem. Ges., 1909, 41, 688–717. Chem. Zentr., 1909, 2, 1124.

CRYSTALLISED copper sulphate was heated in a porcelain boat in a porcelain tube contained in a Heraeus furnace, a current of dry air being passed through the tube, and the temperature measured just above the boat by means of a thermo-couple. The results obtained were as follows:—The formation of the hydrate, $\text{CuSO}_4 \cdot 3\text{H}_2\text{O}$, is complete at 30° C. Between 93° and 98° C. the hydrate, $\text{CuSO}_4 \cdot \text{H}_2\text{O}$, is formed, and above 98° C. formation of the anhydrous salt commences, being complete at 232° C. The anhydrous salt is stable up to 341° C., but above this temperature evolution of sulphur dioxide begins. Between 341° and 621° C. there is formed a brown oxy-salt, $8\text{CuO} \cdot 3\text{SO}_3$, which gives a blue hydrate with boiling water. Between 621° and 670° C. both sulphur dioxide and sulphur trioxide are evolved, and an orange-coloured oxy-salt, $2\text{CuO} \cdot \text{SO}_3$, is formed, which also yields a blue hydrate. This orange-coloured salt begins to decompose at 704° C., but decomposition is still not complete at 850° C.—A. S.

Alcohol for use in preparing sodium hydrosulphite; French denaturation tax on —. Board of Trade J., Sept. 30, 1909. [T.R.]

IN virtue of a Ministerial Decision, dated July 8th, 1909, sodium hydrosulphite in powder shall pay, in addition to the Customs duty applicable to "salts of soda not specially mentioned," the denaturation tax on the alcohol used in

its preparation on the basis of 4 centilitres of alcohol per kilo. of the salt. (Hitherto the denaturation tax has been payable on the basis of 50 centilitres of alcohol per kilo.)

Sulphur industry of Italy. U.S. Cons. Rep., Sept., 1909. [T.R.]

The following figures show the amount of raw sulphur produced and exported in Italy and Sicily from 1905 to 1908:—

Year.	Tons.	
	Production.	Exportation.
1905.....	568,927	384,428
1906.....	499,814	336,339
1907.....	426,972	297,378
1908.....	443,720	330,093

The production of sulphur in Sicily itself, which produced nearly all the sulphur mined in Italy, is shown by the following figures:—

	1903.	1907.	1908.
	Tons.	Tons.	Tons.
Production of Sicily.....	522,274	399,672	413,580
Exports to:—			
Italy proper.....	46,974	57,743	60,134
France.....	79,727	59,868	96,448
Other European countries.....	180,194	188,283	171,955
United States.....	157,259	4,073	12,484
Other countries.....	27,747	31,984	31,052
Totals.....	491,901	341,951	375,073
Stock unsold.....	363,495	396,445	618,459
Average price per ton.....	778.	748.	758.

Graphite production in the United States. U.S. Geol. Survey, 1908. [T.R.]

NOTWITHSTANDING the steady increase in the use of graphite in the manufacture of lubricants, rust-resisting paints, etc., there was a decline in the output of this mineral in 1908. During the year in question domestic graphite was produced by only sixteen firms, to the amount of 2,587 tons, compared with 29,277 tons in 1907. The great decrease is due principally to the fact that the Georgia firms, which in 1907 produced a large number of tons of graphite for use in fertilisers, suspended operations during 1908. As, however, the value of this material is only about \$1.25 per ton the falling off in the value of the total graphite production of the United States from \$296,970 in 1907 to \$208,090 in 1908 is not commensurate with the decrease in the tonnage.

The manufacture of artificial graphite on a commercial scale is conducted at Niagara Falls, using electric power generated at the Falls. At present the output of artificial graphite is greater than the production of natural crystalline graphite in the United States. In 1908 the production of artificial graphite amounted to 7,385,541 pounds, valued at \$502,667, as compared with 6,590,000 pounds, valued at \$481,239, in 1907. Pure amorphous carbon appears to be converted into graphite only very slowly in the electric furnace at atmospheric pressures. The conversion appears to take place on a commercial scale only when certain amounts of impurities, usually silicious, aluminous, or ferruginous, are present. These need not form more than 3 per cent. of the total mass. Anthracite coal, with a small amount of finely distributed ash, has yielded the best results commercially; an anthracite, with 5.78 per cent. of ash, has yielded a graphite with only 0.03 per cent. of ash. The earlier productions of artificial graphite were not as soft and unctuous as much of the natural graphite, but in 1906 a process of manufacturing graphite of this type was devised which has since been used in increasing quantities for lubricating purposes. This so-called "defoliated graphite" is said to be produced by adding small quantities of gallotannic acid and ammonia to oil or water mixed with very fine graphite. The latter, it is claimed, will

then remain in suspension almost indefinitely and can thus be fed through ordinary oil cups.

In spite of the development of the manufactured or artificial graphite by the electric furnace, the demand for the natural product has increased very largely in recent years because of the increased need for lubricants and the development of electric machinery which calls for graphite products.

Sicilian sulphur and the direct application of sulphur ore in the manufacture of sulphuric acid. G. A. Bruhn Chem. Ind., 1909, 32, 560—565.

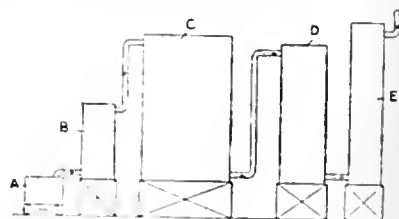
THE author considers it doubtful whether the proposals of the Italian parliamentary commission will suffice to put the Sicilian sulphur industry again in a satisfactory position (see this J., 1908, 684; 1909, 937). Much more promising is the proposed use of the sulphur ore directly as a raw material for the manufacture of sulphuric acid, as recommended by Oddo (this J., 1908, 222, 560). In mining the sulphur ore a large proportion (20 per cent.) of "small" (*sterro*) is produced, which is much richer than the main bulk of the ore, containing, on the average, at least 40 per cent., frequently 50 per cent., and in some cases as much as 80 per cent. of sulphur. Under present conditions this "sterro" with a content of 40 per cent. of sulphur, could be delivered at Sicilian ports at a cost of 11 lire (8s. 9½d.) per ton or 27.5 centesimi (2.64d.) per unit of sulphur. The selling price of Spanish pyrites (47 per cent. of sulphur) may be taken as 15 lire (12s.) per ton f.o.b. Seville, or 32 centesimi (3.07d.) per unit of sulphur. This leaves a margin for profit, etc., of only 4.5 centesimi (0.43d.) per unit of sulphur for the Sicilian sulphur ore, but the position would be much more favourable if "sterro" with a higher content of sulphur than 40 per cent. were put on the market, and the Italian Government were to give facilities for the cheap transport of the ore on land. Taking the 1907 figures as a basis, the annual production of Sicilian crude sulphur ore is 2,590,000 metric tons, of which 500,000 tons consist of "sterro," containing 200,000 tons of sulphur, an amount sufficient for the production of one-fifth of the total world's consumption of sulphuric acid. These 500,000 tons of "sterro," if treated by the ordinary methods, yield 80,000 tons of fused sulphur, so that if they were utilised as raw material for sulphuric acid manufacture, the annual production of sulphur, as such, in Sicily would be reduced from 400,000 to 320,000 tons, as against a demand for 350,000 tons, leaving a quantity of 30,000 tons to be obtained from the large accumulated stocks of Sicilian sulphur.

In the author's opinion, the problem of the utilisation of sulphur ore as a raw material for the manufacture of sulphuric acid would be best solved by the installation of new works in Sicily itself or near Sicily. This has already been done in one case, a large company having been formed for the manufacture at Messina of sulphuric, tartaric, and citric acids, etc.—A. S.

Determination of phosphoric acid. Grete. See XXIII. Inorganic Quantitative.

PATENTS.

Sulphuric acid; Apparatus for making — [by the chamber process]. F. J. Falding, New York. U.S. Pat. 932,771, Aug. 31, 1909.



THE apparatus comprises a source of sulphur dioxide, A (see Fig.), Glover tower, B, lead chamber, C, cooling means, D, for the reaction products, and a Gay-Lussac

tower. E. Relative zones of reaction and inaction are secured in the chamber by constructing this with its vertical axis in the proportion of about 3 to 2 over any horizontal axis. (See also Falding, this J., 1909, 1032.) —F. SODX.

Lime and carbonic acid gas; Manufacture of —, T. M. Thom, Cheshunt, and H. Pryor, Saffron Walden. Eng. Pat. 20,102, Sept. 24, 1908.

LIMESTONE is heated in closed retorts arranged vertically around a central combustion chamber, beneath which is a furnace; holes are provided in the walls of the combustion chamber for the passage of the products of combustion, and the whole apparatus is enclosed in a casing which excludes air from the retorts. Superheated steam is admitted to the retorts at their lower ends, and this decomposes the limestone and carries the carbon dioxide through outlets at the top of each retort, leading to a collecting gas main running round the top of the casing. The retorts have closely fitting mouthpieces above and below, at which they are charged and discharged respectively. Perfect combustion and the fullest use of heat from the waste gases is obtained by a system of primary and secondary air and waste gas flues. It is claimed that carbonic acid gas is obtained with this apparatus in a pure state. —F. SODX.

Calcium silicide; Process of producing —, T. L. Willson and M. M. Haff, Ottawa, Canada. U.S. Pat. 934,379, Sept. 14, 1909.

CALCIUM silicide is prepared by heating together calcium carbide and silica, with or without carbon, in the electric arc. The production of other alkaline-earth silicides is also claimed. —F. SODX.

Potassium nitrate and sodium nitrite; Process for the simultaneous manufacture of —, Soc. "Le Nitrogène." Fr. Pat. 400,958, Mar. 18, 1909. Under Int. Conv., Mar. 24, 1908.

For the separation of the mixture of nitrate and nitrite formed by the absorption of oxides of nitrogen, from mixtures of these with air, by milk of lime, the neutral solution is treated with potassium and sodium sulphates or carbonates, in such quantities that the potassium salt is equivalent to the nitrate and the sodium salt to the nitrite present; after separation of the precipitated calcium sulphate or carbonate, the potassium nitrate and sodium nitrite are obtained from the solution by successive crystallisations. The potassium and sodium salts may also be added before absorption of the oxides of nitrogen by the lime; or, the same end may be reached by using for the absorption a mixture of sodium and potassium hydroxides, or such of their salts as are decomposed by nitrous and nitric acids, in the proportion in which nitrite and nitrate respectively are subsequently produced. —F. SODX.

Decolorising product, composed of solid anhydrous sodium hydrosulphite and zinc dust. Badische Anilin und Soda Fabrik. Fr. Pat. 401,000, Mar. 5, 1909. Under Int. Conv., Jan. 30, 1909.

CLAIM is made for a decolorising product, which is composed of solid anhydrous sodium hydrosulphite and zinc dust, and for its industrial applications. The new product, prepared, for example, by intimately mixing 100 kilos. of solid anhydrous sodium hydrosulphite (90 per cent.) with 10 kilos. of zinc dust, is said to keep better when wet than sodium hydrosulphite and to be more active; it ends itself specially to the bleaching of straw, leather, lue, and feathers. —F. SODX.

Stannic chloride; Process of manufacture of —, Soc. Industrielle de Produits Chimiques. Fr. Pat. 401,125, Mar. 23, 1909.

IRON, or material containing it, is treated with dry commercial chlorine, in the presence of some suitable liquid, on which chlorine has no action, such, for instance, as stannic chloride itself. A current of chlorine is passed into the mixture, which is contained in a distillation apparatus, provided if necessary with an agitator, and the

reaction is started by raising the temperature to 50°–110° C.; the stannic chloride produced is distilled off, and the last traces are carried over by a current of air, when chlorination is finished. It is claimed for the process, that local heating and consequent partial oxidation of the tin by impurities in the chlorine are avoided. —F. SODX.

Compounds containing active oxygen; Process for the preparation of —, E. Merck, Ger. Pat. 213,457, Sept. 6, 1907.

SALTS of alkali peroxide-hydrates, especially alkali peroxide-sulphates and alkali peroxide-carbonates, are obtained by the interaction of alkali bisulphates or bicarbonates with alkaline-earth peroxides or peroxide-hydrates. For example, sodium peroxide-carbonate is obtained by the interaction of sodium bicarbonate and barium peroxide-hydrate: $\text{Ba}(\text{OH})_2 \cdot 2\text{NaHCO}_3 \rightarrow \text{BaCO}_3 + \text{Na}_2\text{C}_2\text{O}_4 + 3\text{H}_2\text{O}$. —A. S.

Barium sulphate; Process of bleaching natural —, Soc. Générale d'Etudes et d'Organisations Industrielles, Commerciales, et Financières. Fr. Pat. 401,325, Mar. 22, 1909.

NATURAL barium sulphate is treated with an acid sulphate capable of interacting to form soluble salts with the impurities present; after extraction with water, pure white barium sulphate, which is claimed as a new product, is obtained. For example, 100 kilos. of potassium bisulphate are melted, and a little strong sulphuric acid and 150 kilos. of the finely powdered barium sulphate are added; the temperature is raised, and heating continued, until the reaction is complete, and then water is added to the cooled mass and the barium sulphate separated, the acid sulphate being recovered. —F. SODX.

Hydrogen gas; Mixture for manufacturing —, G. F. Brindley, San Francisco, Cal., and P. M. Bennie, Niagara Falls, N.Y. U.S. Pat. 934,036, Sept. 14, 1909.

THE mixture consists of finely-divided aluminium and molten sodium hydroxide, free from water, the proportion of the latter being between 1 and 3 mols. to 1 mol. of aluminium. Silicon and zinc may also be added. —F. SODX.

Sulphur and other substances; Apparatus for the continuous sublimation of —, E. F. J. Bert. Fr. Pat. 401,923, July 2, 1908.

THE apparatus, which is described chiefly with reference to sulphur, comprises a hopper, from which the crude material is automatically fed into a vessel, heated by waste heat, in which it is melted, the impurities being deposited and removed, and the liquid sulphur rising through a filtering device immersed in the liquid; the nearly pure sulphur passes then to a number of tubular retorts of fairly thin steel or iron, the surface of which may be suitably protected; these are heated in one common furnace, and the sulphur vapour passes from them to the collecting chambers through condensers cooled by water, the temperature of the chambers being thus kept suitably low. It is claimed for this apparatus, that a much increased yield with a given expenditure of fuel is obtained, and the loss of time and heat due to frequent cleaning of the retorts is avoided. —F. SODX.

Electrolysis of alkali chlorides; Apparatus for the —, J. Billitzer, Vienna. U.S. Pat. 934,385, Sept. 14, 1909. SEE Fr. Pat. 376,329 of 1907; this J., 1907, 1015. —T. F. B.

Chlorine compounds of lime; Manufacture of —, H. Schultze, Griesheim, Assignor to Chem. Fabr. Griesheim Elektron, Frankfurt, Germany. U.S. Pat. 934,467, Sept. 21, 1909.

SEE Fr. Pat. 376,846 of 1907; this J., 1907, 1047. —T. F. B.

Alkali hydrosulphites; Process of making —, B. Deutecom, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 935,001, Sept. 28, 1909.

SEE Ger. Pat. 203,910 of 1908; this J., 1909, 90. —T. F. B.

Magnesium carbonate; Method of producing ——. G. Sisson, Newcastle on Tyne. U.S. Pat. 935,418, Sept. 28, 1909.

SEE Eng. Pat. 24,134 of 1906; this J., 1908, 84.—T. F. B.

Nitrogen from atmospheric air; Process for obtaining free ——. O. P. Hurford, Chicago. Eng. Pat. 19,402, Sept. 15, 1908.

SEE Fr. Pat. 394,557 of 1908; this J., 1909, 243.—T. F. B.

Chlorine; Separating and concentrating ——. K. Goldschmidt and F. Spitzer, Assignors to T. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 934,400, Sept. 14, 1909.

SEE Ger. Pat. 206,104 of 1907; this J., 1909, 243.—T. F. B.

Electrolysis of alkali chlorides, sulphates, etc. Fr. Pat. 400,787. See XI.4.

Recovering sulphuric acid and oils. Ger. Pat. 212,000, See III.

VIII.—GLASS, POTTERY, AND ENAMELS.

Alundum; Manufacture of ——. Mining World, Oct. 2, 1909. [T.R.]

THE abrasive known as "alundum" is manufactured at Niagara Falls. Crude bauxite is calcined in a rotary calciner 60 ft. long, heated by two gas producers; the machine is continuous and will calcine 40 tons of bauxite per day. The ore after calcination is ready for the electric furnaces. These consist of conical pots which stand on cars and are heated by vertical electrodes, which are gradually raised as the molten bauxite fills the furnace. In the furnace room 2000 electric horsepower are used. The dimensions of the furnaces are calculated so that the fusion shall not extend to the water-cooled shell. During the fusion iron is reduced from the bauxite as a result of the reducing action of the electrodes. This iron, containing 5 to 12 per cent. silicon, is sold to the steel makers in masses or "pigs" each weighing about 3 tons. After the completion of the fusion, the furnace is taken under an electric crane, which removes the solidified mass and places it on the cooling floor until it is cool enough to handle. The mass is then broken up and fed to a crusher, after which the alundum passes through a reel which removes all the fine dust, which is re-fused. The product which has gone over the reel is passed over a sorting belt, where the material not up to the standard is picked out. The resulting product in fragments about the size of a man's fist is then subjected to the various operations necessary for use in the alundum wheels.

One of the recent applications of alundum is as a refractory material. The substance melts at 2300° C., and has a very low coefficient of expansion. It is, moreover, very inert, and tests made in the basic open-hearth furnaces show that it is not appreciably affected by slags in these processes. The lining of a Deville furnace does not show deterioration after repeated burns at 1800° C.

PATENTS.

"Slip" or like material employed in the manufacture of china, earthenware, and like goods; Means for purifying the ——. G. C. Solon and A. J. Campbell, Stoke-on-Trent. Eng. Pat. 18,482, Sept. 3, 1908.

THE apparatus, which is arranged preferably below the bottom sieve of the slip-sifting machine, consists of a series of movable frames each carrying a number of electro-magnets; the frames are supported in such a way that the magnets become energised by suitable contact devices when the frames are immediately under the sieve. The cores of the magnets project upwards through holes in the frames somewhat larger than themselves, and the finely-divided slip is made to pass through these holes, thus coming into very intimate contact with the magnets which retain metallic particles. Periodically, the frames are pushed forward by a device connected with an eccen-

tric, and, as each is removed out of position under the sieve, it is automatically demagnetised, and is then picked up by an endless chain and made to pass through a water trough, where the accumulated metallic particles are washed away from the magnets, the latter being then carried by the chain into operative position again; the magnet cores are thus always in effective condition for attracting the maximum amount of metallic particles present in the slip. The invention may be used for removing these impurities from slip or any other potters' materials, either dry or wet.—F. SONS.

Glass melting furnaces or ovens. C. Royer, Gisors, France. Eng. Pat. 20,393, Sept. 28, 1908.

SEE Fr. Pat. 390,102 of 1908; this J., 1908, 1021.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Plaster of Paris; Examination of ——. O. Frey, Tonind. Zeit., 1909, 33, 1229—1230.

COMMERCIAL plaster of Paris may contain the following constituents, which can be determined by analysis: (1), Calcium sulphate semi-hydrate, $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$; (2), soluble anhydrite, CaSO_4 ; (3), "flooring-plaster," CaSO_4 ; (4), dead-burnt plaster, CaSO_4 ; (5), raw gypsum, $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$; (6), natural anhydrite, CaSO_4 ; (7), impurities other than calcium sulphate. To determine the amount of semi-hydrate (1), 5 grms. of the plaster are made into a thin paste with water, allowed to stand for half an hour, and dried at 60° to 70° C. until the weight remains constant. The increase in weight is due to the amount of water required for the complete hydration of the semi-hydrate and of the soluble anhydrite present. If y be the weight of semi-hydrate, z the weight of soluble anhydrite, and a the increase in weight after complete hydration, $y = 5.37(a - 0.26z)$. To determine z , the amount of soluble anhydrite present, another 5 grms. are allowed to stand over water in a well-fitting bell-jar for 7 days, at the end of which all the soluble anhydrite will have been converted into semi-hydrate. After drying at 70° C. to constant weight, and calling the increase in weight, b , the amount of soluble anhydrite, z , is given by the equation, $z = b \times 15.11$. "Flooring plaster" is that portion of the gypsum which has been heated to a red heat, and which is intermediate between normal and dead-burnt plaster. Taking the same quantities of plaster and of water as for the determination of semi-hydrate, the paste is allowed to remain in air saturated with aqueous vapour for 7 days, at the end of which it is dried as before. If e be the amount of "flooring-plaster" present, c the total increase in weight, and a the increase in weight due to the hydration of the semi-hydrate, $e = (c - a) \cdot 3.78$. To determine the remaining "inactive" constituents of the plaster, the total amount of calcium sulphate present is first determined by dissolving in hydrochloric acid and precipitating as barium sulphate. To the weight of calcium sulphate found in this way, is added the amount of combined water contained in the original plaster (which is separately determined by finding the loss of weight on ignition), and their sum, G , less the sum of the active constituents, (1), (2), and (3), already determined, represents the weight of inactive gypsum present, $t + r$, where t is the sum of the weights of dead-burnt plaster and natural anhydrite, and r the amount of raw gypsum. The latter is calculated from the equation $r = (t - y \cdot 0.062) \cdot 4.78$, in which r is the loss on ignition of 5 grms. of the plaster, and y is the weight of semi-hydrate present. The amount of foreign matter is finally determined by difference.—O. R.

PATENTS.

Artificial stones; Manufacture of ——. H. M. J. Soufflet. Fr. Pat. 401,261, July 15, 1908.

NATURAL or artificial corundum or emery, melted bauxite or alumina, are introduced into an agglomerate formed of cement, porphyry and granite, for the production of paving stones, etc.—B. N.

Cement clinker; Process of making —, and apparatus therefor. C. Ellis, White Plains, N.Y., Assignor to Pitte Street Patents Co., New Jersey. U.S. Pat. 934,056, Sept. 14, 1909.

THE apparatus consists of communicating superposed rotary cylinders, the flame and gases heating the lower cylinder being able to pass by a conduit to the upper one. In the upper cylinder, which is adapted for calcination, the raw cement material is deprived of carbon dioxide, and it is then removed and ground by appropriate means, and made to enter the lower cylinder, where it is burnt to clinker.—F. SODX.

X.—METALS AND METALLURGY.

Iron; Corrosion of — in the earth (gas and water mains) by stray currents from tramway lines. F. Haler and P. Krassa. Z. Elektrochem., 1909, 15, 705—712.

A CONTINUATION of the investigations of Haber and Goldschmidt (this J., 1906, 186) and discussion of the conditions affecting corrosion. A large number of observations and experimental results are given, but no conclusions are yet drawn from them. The authors are of opinion that the access of atmospheric oxygen to underground junctions of different metals has much to do with the possibility of corrosion; and they still consider that as long as positive currents flowing from mains do not exceed 0.75 milliampère per sq. dm. the danger of electrolytic corrosion is but slight.—J. T. D.

Iron; Corrosive power on —, of alternating and of frequently reversed continuous currents. F. Bergius and P. Krassa. Z. Elektrochem., 1909, 15, 712—717.

CAST iron, in water, is practically unaffected by alternating currents of a frequency of 15 to 50. Continuous currents, reversed every 1 to 4 hours, produced no corrosion greater than that produced when the current was not reversed. Much greater corrosion occurs while the current is passing than when no current flows, and the amount of it depends very much on the condition of the surface. The "skin" on a casting affords protection against electrolytic as well as against chemical corrosion.—J. T. D.

Copper-ore; Obtainment and treatment of — at the Oss-Mazzurana works in Predazzo, S. Tyrol. F. Oss-Mazzurana and R. Hesse. Metallurgie, 1909, 6, 569—596.

THE Oss-Mazzurana copper mine with its associated works for the production of copper sulphate is situated on Mt. Mulât near Predazzo in the South Tyrol. The authors discuss the geological and mineralogical formation of the mountain, which latter includes copper pyrites, pyrites, tourmaline, scheelite, and magnetite. The copper ore contains about 4.6 per cent. of copper, 15.2 per cent. of sulphur, 3.6 per cent. of iron oxide, 1.5 per cent. of tungstic acid, and 2 grains of gold and 35 grains of silver per ton; the pure copper pyrites contains 34 per cent. of copper, and the scheelite 79 per cent. of tungstic acid, and 4 oz. of silver and 0.2 oz. of gold per ton. A detailed scheme of "dressing," including the most recent methods of crushing and grading the ore, is described, whereby scheelite containing 70 per cent. of tungstic acid and a concentrate containing 20 per cent. of copper are obtained. The ore is roasted in a cylindrical iron drum, heated by three oil-injectors, the air supply to which can be perfectly controlled. A thermoelectric junction of iron and constantin inserted in an iron tube in the drum is connected with a recording pyrograph, and also with an alarm set at the maximum temperature desired. The operation needs very close supervision to ensure the whole of the copper being finally obtained as copper sulphate. With poor concentrates the temperature is maintained at about 450°—480° C. for some hours to form directly the copper sulphate. The temperature is then raised to 560° C., when the ferrous sulphate produced is decomposed into ferric oxide, without affecting the copper salt. With rich concentrates the temperature is from the start

rapidly raised to about 600° C. in order to obtain copper oxide, which is of importance for the removal of iron at a later stage. It is found that when a temperature of 420° C. is reached, the injectors can be stopped, the combustion of the sulphur being sufficient to raise the temperature of the mass to between 500° and 610° C. Considerable economy of oil is thus effected. The roasted mass is lixiviated with dilute sulphuric acid, and treated with copper oxide in a current of air to convert the ferrous sulphate into copper sulphate and ferric oxide. After the solution has been filtered, and concentrated, crystallised copper sulphate of a very high grade of purity is obtained.—A. H. C.

Alloys; Alteration of the physical properties of — by mechanical and thermal treatment. E. Pannain. Atti R. Accad. dei Lincei, Roma, 1909, [5], 18, 1., 700—701. Chem. Zentr., 1909, 2, 900—901.

THE author's experiments were made with coinage alloys, viz., bronze containing about 4 per cent. of tin, and a silver-copper alloy containing 16.5 per cent. of copper. The structural alterations of these alloys during mechanical and thermal treatment have been previously described (see this J., 1909, 246, 838). It has now been found that the specific gravity of the bronze (8.76965 at 16° C.) increases during its manufacture into coins, rising to 8.94623 after stamping. The greatest increase (0.1618) was caused by the rolling after the first heating; stamping only increased the specific gravity by 0.00006. The specific gravity (at 18° C.) of the silver alloy rose from 9.99932 to 10.21636 during the entire process, the first rolling causing an increase of 0.20038. It is stated that during the heating, the alloys regain their original ductility, without the compactness caused by rolling being impaired.—A. S.

Tantalum and niobium; Determination of —, and their separation from silica in minerals, steel, and alloys. W. E. von John. Chem. News, 1909, 100, 154.

FOR the determination of tantalum and niobium in minerals, these are decomposed by fusion with potassium bisulphate; the cooled melt is boiled with water, and the insoluble matter washed, first with hot water, then with hot yellow ammonium sulphide, then with hot water and dilute sulphuric acid, and finally with hot water again; the residue, consisting of silica and tantalum and niobium acids, is ignited and weighed. This residue is next fused with sodium hydroxide, and the melt dissolved in cold dilute sodium hydroxide solution, the insoluble sodium tantalate and niobate being separated from the soluble sodium silicate by filtering through a Gooch crucible and washing with dilute sodium hydroxide; the residue is washed with lukewarm water, until no precipitate is obtained with dilute sulphuric acid, and the tantalum and niobium are precipitated from the somewhat cloudy washings by boiling for a few minutes with dilute sulphuric acid; the precipitate is ignited and weighed. This residue is then fused with potassium hydroxide, the melt is dissolved in water, and again precipitated by boiling with dilute sulphuric acid; the precipitate is filtered off and dissolved in hydrofluoric acid, and, after the addition of some potassium fluoride, the solution is boiled for a few minutes, then diluted and boiled again. The tantalum is thus separated as potassium tantalum oxyfluoride; this is washed with cold water, until no reddish precipitate is obtained with tincture of galls, concentrated sulphuric acid is added, and the hydrofluoric acid is driven off by gentle heating; tantalum acid and potassium bisulphate are thus formed, and the latter is extracted with water, the residue being ignited and weighed. For the determination of tantalum in steel or alloys, containing up to 45 per cent. of tantalum, the turnings are dissolved in hydrochloric acid, the solution is evaporated to dryness, and the residue treated with dilute sulphuric acid; silica, carbonaceous matter, and tantalum remain insoluble, and the mixture is washed, ignited, and weighed; it is then fused with sodium hydroxide and treated as above described. Alloys containing more than 45 per cent. of tantalum are ignited, and then treated as in the

case of steel, or, in presence of tin, as described for minerals. The above methods are said to be rapid and well suited for use in commercial analysis.—F. SOPH.

Elmore's ore-extraction process. R. Glatzel. *Erzbergbau*, 1909, 285. *Chem.-Zeit.*, 1909, 33, Reps. 512.

THE method depends upon the selective attraction of certain minerals for oil. A mineral becomes coated with oil if the difference in surface tension between water and mineral on the one hand and oil and mineral on the other is greater than the tension between oil and water. A viscous mineral oil is used. The following minerals become coated with oil:—Gold, cinnabar, nickeline, galena, mispickel, argentite, rammsbergite, pyromorphite, cassiterite, smaltite, ulmannite, cerussite, bismuthite, cobaltite, scheelite, goetschite, cuprite, pyratgryrite, bornonite, chalcocite, chalcopyrite, pyrites, hornite, freibergite, molybdenite, marcasite, fahl ore, magnetic pyrites, antimonite, tin pyrites, zinc blende, malachite, graphite, and sulphur. The following do not become coated: Magnetic iron ore, hematite, limonite, spathic iron ore, psilomelane, pyrolusite, yellow zinc blende, calamine, wolframite, quartz, heavy spar, fluor spar, calc spar, ankerite, dolomite, and felspar. It is possible that the applicability of the process could be further extended by using saline solutions in place of water.—A. S.

"Cork Metal." F. J. Willott. *Chem. News*, 1909, 100, 162.

AT one of the recent aeronautical exhibitions, samples of a metal were shown under the name of "cork metal," which was said to be 40 per cent. lighter than aluminium, and to have numerous other properties which should make it a rival of the latter. In appearance the metal resembles very strongly the alloys known as magnalium. The surface presents a lustreless whitish grey colour, both sheets and bars showing the scorings and scratches so frequently found on badly rolled or drawn aluminium. Careful analysis gave the following result:—Aluminium, 0.04; iron, 0.017; zinc, 0.48; sodium, 0.21; magnesium, 99.30 per cent.

Refractory metals from their chlorides. Pring and Fielding. *See H.*

PATENTS.

Metallurgical [zinc] condenser. W. M. Johnson, La Harpe, Kans., Assignor to The Continuous Zinc Furnace Co., Hartford, Conn. U.S. Pat. 933,843, Sept. 14, 1909.

A ZINC furnace is connected with a condenser having means for cooling and a series of baffle-walls upon which are arranged carbon resistances for the purpose of independent heating.—F. R.

Converters. Comp. Générale des Aciers. Fr. Pat. 400,820, March 15, 1909.

THE converter is of the improved Bessemer type, but several modifications have been introduced. The hearth of the furnace is rectangular in section, and two superimposed rows of tuyères are provided; these are completely independent, the top row supplying a current of air, which can be increased or cut off at will, above the surface of the molten metal. The manner of working is arranged as follows:—In order to bring the interior lining and the mouths of the tuyères to the requisite temperature, the converter is charged with a sufficient amount of burning combustible, and, its mouth being covered with a grating, is inverted. The mouth is then connected with a tuyère, and a current of air is passed up through the grating, the products of combustion passing away through the ordinary air holes used as tuyères in the subsequent operation. When the interior has been raised to a white heat, the fire is drawn and the apparatus charged with the requisite amount of molten metal. In the first phase of blowing, the air is led along the surface of the iron from the lower row of tuyères only, so that an intimate contact of air and metal is obtained. When the first phase is completed, that is, when the metal becomes so hot that the carbon commences to oxidise, the pressure of the blast proceeding from the lower holes is diminished by opening one or more

of the upper ones. In this way the temperature of the converter is maintained within the desired limits. It is finally claimed that, by giving to the hearth a rectangular section with rounded corners, there is a noticeable decrease in the consumption and pressure of the air employed, as well as in the loss of metal through the projection of cinders.—C. A. W.

Solder for platinum. D. de Benedetti. Fr. Pat. 400,827, June 25, 1908.

THE solders, which are intended mainly for use in the manufacture of jewellery, are composed of platinum and gold, or of platinum, gold, and fine silver. The gold, which should be preferably the "green" metal of 75 per cent. fineness, is weighed out, and if necessary alloyed with the required amount of silver. A sheet of this alloy is then used as a wrapping for the platinum in the form of spangles, the proportions of metal taken being calculated according to the required composition. The whole, after being rolled into a ball, is covered with borax and heated in the oxyhydrogen flame. The product is rolled out and the operation repeated two to three times. As examples, the compositions, platinum 60, gold 35, fine silver 5 parts; and platinum 25, gold 50, and fine silver 25 parts, may be cited.—C. A. W.

Nickel; Production of pure —. Soc. Electro-Métallurgique Française. Fr. Pat. 400,910, June 27, 1908.

THE method consists in casting, as a preliminary operation, a nickel alloy containing nickel, iron, carbon, and silicon in varying proportions according to the ore and the composition of the reducing agent employed. The molten alloy is then deprived of most of its iron, either by heating in a Bessemer furnace or by simple pulverisation in a jet of air, a treatment in a reverberatory furnace completing the operation. The product, which is composed mainly of metallic nickel, metallic iron, and the respective oxides, is subsequently re-smelted in an electric furnace, when the oxide of iron passes into the slag, the nickel remaining behind as a bath of metal. In order to obtain the latter free from iron, carbon, and silicon, it is necessary that a small quantity of nickel oxide be present in the slag.—C. A. W.

Wood; Process and apparatus for the distillation of —, with recovery of by-products and direct utilisation of the charcoal for metallurgical purposes. Soc. des Hauts Fourneaux, Forges, et Acieries du Chili. Fr. Pat. 401,226, July 11, 1908.

THE patent relates to the use of wood as fuel for blast-furnaces. Instead of carbonising the wood in a separate plant, the blast-furnace is made sufficiently high for the upper part to serve as a chamber for the slow carbonisation of the wood which is fed in with the ore at the top of the furnace. The by-products are recovered from the furnace-gases in the usual manner.—A. T. L.

Porosity in ingots; Method and apparatus for preventing —. Soc. Anon. Electro-Métallurgique (Procédés P. Grod). Fr. Pat. 401,300, July 16, 1908.

UNDER the ordinary conditions of casting, there is a tendency for the ingot to solidify too rapidly at the head, so that, by reason of the imperfect escape of the upgoing gases through the pasty mass, an unsound and porous metal is obtained. It is therefore proposed to retard the solidification at the top by heating the ingot electrically, either by the direct Joule effect or by the radiations from an arc. In practice, the ingot mould is covered at the top with a small movable metal frame lined with some refractory material, which should be a bad conductor of electricity. The whole is surmounted by a cover provided with a hole in the centre through which passes an electrode. This electrode is suspended, by an insulating hook, below an electric transformer, which can itself be moved vertically when desired. The transformer is connected by conducting cables with the electrode and with the bottom of the ingot mould, which thus forms the second pole. The upper electrode being brought into contact with the head of the ingot, a high-tension current is passed into the transformer, where its voltage is diminished. The arc,

having been started, is maintained by raising the upper electrode to a suitable height, the heat produced being concentrated at the required point by means of the cover on the top of the mould.—C. A. W.

Bessemer converters. G. J. Stock, Darlington. Eng. Pat. 12,212, June 5, 1908.

SEE U.S. Pat. 933,596 of 1909; this J., 1909, 1043.—T. F. B.

Slag; Process and apparatus for granulating —. "Pyrotrass," Soc. Anon. pour la Fabr. du Trass Artific. et ses Appl. Indus., Paris. Eng. Pat. 2849, Feb. 5, 1909. Under Int. Conv., Feb. 13, 1908.

SEE Fr. Pat. 387,218 of 1908; this J., 1908, 816.—T. F. B.

Silicon nitride and metals from metallic silicides; Process of manufacturing —. A. Sinding-Larsen, Christiania. Eng. Pat. 3732, Feb. 15, 1909. Under Int. Conv., Feb. 17, 1908.

SEE U.S. Pat. 928,476 of 1909; this J., 1909, 942.—T. F. B.

Copper; Apparatus for refining —. F. L. Antisell, New York, Assignor to W. S. Higgins, Perth Amboy, N.J. Re-issue No. 13,020, Sept. 14, 1909, of U.S. Pat. 875,641, Dec. 31, 1907.

SEE this J., 1908, 168.—T. F. B.

Ores; Method of reducing —. K. A. F. Hiorth, Christiania. U.S. Pat. 934,170, Sept. 14, 1909.

SEE Fr. Pat. 387,284 of 1908; this J., 1908, 818.—T. F. B.

Alloy for armour-plates and other uses. E. Schneider, Le Creusot, France. U.S. Pat. 934,697, Sept. 21, 1909.

SEE Fr. Pat. 379,188 of 1906; this J., 1907, 1202.—T. F. B.

Smelting furnace. C. and J. Debus, Höchst on Maine, Germany. U.S. Pat. 934,892, Sept. 21, 1909.

SEE Eng. Pat. 5506 of 1908; this J., 1908, 1069.—T. F. B.

Cast iron or articles cast from iron; Process for reducing the amount of carbon in —. W. Rübel, Vienna. U.S. Pat. 935,234, Sept. 28, 1909.

SEE Fr. Pat. 391,429 of 1908; this J., 1908, 1157.—T. F. B.

Metallic compounds; Wet method of separating —. J. H. Thwaites, Peterborough. U.S. Pat. 935,337, Sept. 28, 1909.

SEE Fr. Pat. 393,502 of 1908; this J., 1909, 203.—T. F. B.

Tinware; Method and apparatus for cleansing articles of refuse — and for the recovery of solder therefrom. J. W. Evans, Middlesbrough. U.S. Pat. 935,477, Sept. 28, 1909.

SEE Eng. Pat. 26,383 of 1907; this J., 1909, 26.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Mercurous sulphate for standard cells [and crystallised calomel]. C. J. J. Fox. Brit. Assoc., Winnipeg, 1909. Chem. News, 1909, 100, 150—151.

PURE well-crystallised mercurous sulphate may be prepared from the commercially pure substance by heating it for one or two days with a little pure mercury and dilute sulphuric acid at 120°—150° C. in a closed vessel which is occasionally agitated, the acid being preferably filtered off and renewed during the process of heating. The product is ground in a mortar with one or two successive quantities of dilute sulphuric acid, and then several times with a saturated solution of cadmium sulphate, filtering through a Büchner funnel after each washing. A white crystalline preparation is thus obtained, which is free from nitrate and basic salt and in every way suited for use in standard cells. Calomel may be prepared

in a crystalline form by heating mercury and hydrochloric acid together in a similar manner, though for a longer period.—F. SODY.

Hydrogen peroxide; Influence of — on the properties of platinum. K. Bornemann. Z. Elektrochem., 1909, 15, 673—677.

THE author finds an explanation of the facts that both cathodic and anodic polarisation of platinum have been observed by different authors to render it inactive, in the action on the platinum of hydrogen peroxide, for when a freshly-ignited platinum electrode is dipped into hydrogen peroxide solution, the catalytic decomposition of the peroxide and evolution of oxygen rapidly lessen and cease, though only a negligible quantity of peroxide has been decomposed. This electrode, if now submitted to anodic polarisation in a weak hydrogen peroxide solution, shows a sharp "knick" in the curve connecting voltage and current at 1.23 volts; but if it be now either ignited, or submitted to anodic polarisation in water (weak acid) without hydrogen peroxide, the curve is continuous. The same destruction of the "knick"-producing property is effected to a limited extent by immersing the electrode in oxidising agents such as potassium permanganate; and it is therefore concluded that the property is due to the formation on the platinum of an oxide containing oxygen held similarly to the oxygen in hydrogen peroxide—an "antozonoid" oxide, to use Schönbein's nomenclature. This oxide must be without catalytic activity, and when decomposed by oxidation leaves a lower oxide, the catalytic effect of which is very slight.—J. T. D.

Cadmium arc; New method of producing a —. T. M. Lowry. Brit. Assoc., Winnipeg, 1909. Chem. News, 1909, 100, 161.

IN order to produce a cadmium spectrum of sufficient intensity for polarimetric work, advantage is taken of the favourable properties of the silver-cadmium alloys. On account of their isomerism, the two metals form an excellent series of alloys which are characterised by good mechanical properties and very high melting points. (An alloy with 60 per cent. of cadmium melts as high as 700° C.). In striking contrast to the behaviour of the pure metal the alloy gives a steady arc which can be kept true to centre by rotating the electrodes in opposite directions. The spectrum shows the silver as well as the cadmium lines, but these are so far separated that even with a low resolving power the slit of a spectroscope can be opened to its full width without any overlapping of the brilliant "blocks" of light which take the place of the usual "lines."

Refractory metals from their chlorides [Metalised filaments for electric lamps]. Pring and Fielding. See II.

Electrolytic preparation of sodium hypochlorite. Ogloblin. See VII.

Electrochemical reduction of condensation products of aldehydes with amines. Brand. See XX.

PATENTS.

Electric furnaces. C. Bingham, London. Eng. Pat. 26,356, Dec. 5, 1908.

IN order to renew the upper electrode without interrupting the working of the furnace, in furnaces in which the lower electrode is fixed and the upper one is suspended and lowered as required, two or more carriages are arranged to run on a joist over the furnace, with duplicate electrodes suspended therefrom. When required, the new electrode is connected by flexible connections to the same electric supply as that being used and lowered alongside the worn electrode, which is then withdrawn, the flow of current having been gradually transferred from one electrode to the other without interruption of the discharge.—F. R.

Furnace; Electric —. T. F. Baily, Alliance, Ohio. U.S. Pat. 933,815, Sept. 14, 1909.

THE furnace consists of an oven composed of heat-resisting bricks, of low electrical conductivity, arranged in tiers,

having strips of asbestos between each tier. Spaced electrodes are located at opposite ends of the furnace, and a granular resistance body placed on the floor of the furnace connects the electrodes. Midway between the electrodes the area of cross-section of the resistance body is reduced and means are provided for placing an object to be heated, immediately over but not in contact with the resistance body, at this point.—F. R.

Chlorides, sulphates or other alkali salts; Electrolysis of — C. Marie. Fr. Pat. 400,787, June 23, 1908.

The invention relates to the electrolysis of alkali salts, such as chlorides, sulphates, etc., depolarisation of the anode being brought about by means of hydrogen, which is produced at the cathode or which may be formed in any other suitable manner. The hydrogen, or other gaseous reducing agent, is conveyed under a convenient pressure to the anode, the latter being composed preferably of platinum, platinised carbon, or other convenient material.—B. N.

Accumulators and electrolytic apparatus. J. H. Russenberger. Fr. Pat. 401,355, March 27, 1909.

Thin separating membranes are arranged between and in contact with the different electrodes. Collodion is preferably employed as a separating medium, either directly as a coating on the electrodes, or as a layer on an appropriate surface, and the electrodes are thin so as to obtain a large surface area with a minimum of weight. Viscose, "cellite," etc., may be employed in place of collodion, and may be mineralised or not by means of gelatinous silica.—B. N.

Carbon electrodes for electro-analytical purposes; Process of making durable — G. Adolph, Ammendorf, and A. Pietzsch, Assignors to Chem. Fabr. Buckau, Magdeburg, Germany. U.S. Pat. 934,988, Sept. 28, 1909.

SEE Fr. Pat. 377,026 of 1907; this J., 1907, 1054.—T. F. B.

Making water-gas. U.S. Pat. 935,344. See II.

Incandescence lamp filaments. Addition to Fr. Pat. 361,602. See II.

Incandescent electric lamp filaments. Fr. Pat. 401,307. See II.

Making pure unctuous graphite. U.S. Pat. 933,944. See VII.

Producing calcium silicide. U.S. Pat. 934,379. See VII.

(B.)—ELECTRO-METALLURGY.

Iron; Sulphur-content of electrolytic — A. Pfaff. Z. Elektrochem., 1909, 15, 703—705.

A. MÜLLER (this J., 1909, 371) who examined samples of electrolytic iron prepared by a modification of Burgess and Hambuechen's process, found in the metal as first deposited, 0.0099 per cent. of sulphur, ten times the amount which those authors found. As this result did not accord with those of H. Lee (Dissertation, Dresden, 1906), who found no sulphur in any of the samples of electrolytic iron which he prepared, the author has carefully gone over the ground again. His best results were obtained when the electrolyte was a slightly acid concentrated solution of ferrous sulphate, and a high current density (2 amp. per sq. dm.) and temperature (70° C.) were used, the electrolyte being stirred by a current of indifferent gas. The anodes were wrapped in parchment-paper, and the electrolyte was not renewed. The following table shows the results:—

No.	Electrolyte.	Per cent. of sulphur.
1	Ferrous sulphate, weakly acid, 6 per cent.	0.00037
2	Do. do.	0.00023
3	Do. do.	0.00065
4	Do. do.	0.00018
5	Do. do.	0.00065
6	Burgess and Hambuechen's, prepared by Lee	0.00018
7	Ferrous ammonium sulphate, 2 per cent.	0.00265
8	Do. do.	0.00082

In experiments 5 and 7 the precipitates of barium sulphate contained iron, and the results are certainly too high; omitting these, it is safe to say that the amount of sulphur never reaches 0.001 per cent., and is usually far below that. Müller's results, then, though they may be true in the case of the irons prepared and examined by him, have no general application to electrolytic irons.—J. T. D.

Silicomanganese and silicon-spiegel; Preparation and properties of commercial — J. Escard. L'Électricien, 1909, 37, 293.

Four compounds of manganese and silicon have been prepared, viz., SiMn_2 , SiMn , Si_2Mn_3 , and Si_3Mn (see this J., 1896, 141; 1903, 168, 214; 1905, 1235; 1907, 98, 154). Commercial silicomanganese varies in composition and properties. It usually contains from 60 to 70 per cent. of manganese and 20—25 per cent. of silicon, with varying proportions of carbon, iron, and aluminium; products containing 75 and 80 per cent. of manganese can, however, be obtained. A sample which broke easily under the hammer and showed an irregular brilliant fracture, contained 71.5 per cent. of manganese, 23 of silicon, 2.5 of iron, and small proportions of calcium and carbon. It is prepared technically by the reduction of rhodonite, a mixture of quartz and pyrolusite, or a mixture of rhodonite and pyrolusite in an electric furnace. The charges used and electrical energy consumed in preparing 1 ton of commercial silicomanganese: (1), from rhodonite (45.6 per cent. of silica and 38.3 of manganese oxide); (2), from pyrolusite (50 per cent. of manganese) and quartz; and (3), from a mixture of rhodonite and pyrolusite, are shown in the following table:—

	(1).	(2).	(3).
	kilos.	kilos.	kilos.
Rhodonite	2900	—	1000
Pyrolusite	—	1580	1000
Quartz	—	380	—
Coke	420	680	625
Carbon for electrodes	80	65	65
Elect. energy	7100 kilo-watt-hrs.	6300 kilo-watt-hrs.	6200 kilo-watt-hrs.
Cost	£13 2s.	—	£12 14s.

Silicon-spiegel is an alloy containing from 60—65 per cent. of iron, 20—25 of manganese, 10—12 of silicon, and 2—3 of carbon. By reduction of 1 ton of acid Bessemer slag in an electric furnace with 200 kilos. of coke, and a consumption of 25 kilos. of carbon for electrodes, and 2400 kilowatt-hours, 400 kilos. of an alloy containing 25 per cent. of silicon and 35 per cent. of manganese can be obtained, together with a slag rich in silica (see U.S. Pat. 712,925; this J., 1902, 1541). A relatively pure alloy, known as electro-silico-spiegel, containing 22—25 per cent. of silicon, 38 of manganese, and 1 of carbon, is now produced in large quantities by the reduction of a mixture of ferrosilicon, silica, and manganese ore by means of carbon in an electric furnace.—A. S.

PATENTS.

Steel; Manufacture of — W. R. Walker, New York. U.S. Pat. 934,247, Sept. 14, 1909.

MOLTEN iron is first treated in an acid-lined Bessemer converter until the silicon has been substantially eliminated and the carbon reduced to about 0.3 per cent.; it is then transferred to a basic-lined electric furnace, having a non-oxidising atmosphere, for the removal of the phosphorus.—F. R.

Nickel and nickel-copper alloys; Manufacture of — D. H. Browne, Ontario, Canada, Assignor to The Canadian Copper Co., Cleveland, Ohio. U.S. Pat. 934,278, Sept. 14, 1909.

SULPHUR compounds of nickel or of nickel and copper, are reduced to metal by fusion in an electric furnace in the presence of lime. Part of the sulphur is evolved as sulphur dioxide, the remainder combining with the lime to form calcium sulphide.—F. R.

Hollow metallic bodies; Manufacture of — by deposition of several superimposed bodies on a mandrel and subsequent removal of the latter. Fabrik Elektrischer Zünder Ges.m.b.H. Fr. Pat. 400,999, March 4, 1909.

THE present invention may be applied to the manufacture of small metallic cases, primarily composed of some such metal as zinc but lined internally with a thin protective coating of nickel. The metallic layers are precipitated on mandrels of steel or brass which have previously received a thin coating of silver iodide obtained by thinly silver plating and then treating with iodine. The various metals may then be electrolytically precipitated in the required order by transferring the frame holding the mandrels from one solution to another. In order to enable the finished article to be removed more readily from the mandrel, the latter may be polarised anodically.—C. A. W.

Metallisation of non-metallic articles. The Newell Manufacturing Co. Fr. Pat. 401,137, March 23, 1909.

THE invention is intended for application more especially to the manufacture of artificial flowers from the natural blossoms, but other non-metallic articles, such as silk, may be metallised in a similar manner. As an example, a rosebud is taken, and the stem replaced by a double-pointed hat-pin inserted in the calyx nearly up to the top of the flower. The latter is then hardened by immersion in a solution of 200 grms. of shellac in 1 litre of alcohol. After drying for half an hour, it is again immersed and finally covered with bronze powder, which may be dusted over the blossom from a brush. After further drying, it is submitted to a process of electro-plating in an acid copper solution, the pin serving as cathode. The metallised blossom is washed in hot water, dried in hot air, and freed from vegetable material by heating over a Bunsen burner. Finally the surface is cleansed by a three hours' soaking in dilute hydrochloric acid (1 in 4), followed by immersion successively in potassium carbonate solution, and in a mixture of nitric acid (3 parts) and sulphuric acid (1 part). The connection between flower and stem having been rendered rigid by a plaster moulding, the blossom may be tinted to any shade desired by means of lacquer.—C. A. W.

Zinc; Electrolytic winning of — from solutions of zinc sulphate. V. Engelhardt and M. Huth, Charlottenburg, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 935,250, Sept. 28, 1909.

EE Fr. Pat. 375,140 of 1907; this J., 1907, 880.—T. F. B.

Electric furnace. A. Reynolds, London. U.S. Pat. 935,548, Sept. 28, 1909.

EE Eng. Pat. 3914 of 1907; this J., 1908, 289.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Refractive power of fats; Influence of halogens on the —. W. Storp. Mitt. a. d. Gebiete des Militärsanitätswesens. 1909, Hft. 41, Tl. 3, 84—97. Chem. Zentr., 1909, 2, 1012—1013.

BROMINATED fats were prepared by adding 5 grms. of bromine dissolved in 100 c.c. of glacial acetic acid to 0.5 gm. of the fat dissolved in 15 c.c. of chloroform. The excess free bromine was removed by means of sodium sulphite, and the chloroform solution of the brominated fat was neutralised by means of sodium bicarbonate. The refractive powers of the brominated fats were greater than those of the original fats, in proportion to the amount of bromine fixed. Since the dispersive power was increased concurrently with the refractive power, the author employed red light (an electric incandescent lamp with bulb of red glass) for determining the latter. If for given fat the limiting values for the refractive power of a bromine derivative be determined, then these values may be used in the same way as the iodine values as a measure of the purity of the fat. For this purpose the bromination must always be carried out under strictly

defined conditions, otherwise concordant results cannot be obtained. The method is simpler than the determination of the iodine value, and it can be applied to fats, waxes, and paraffin wax. For an increase of 100 ss in the iodine value of a fat, the refractive power of the brominated fat increases by 9.2 butyrefractometer scale divisions. The limiting values for the refractive power of brominated butter and lard are 57—72 and 74—94, the corresponding iodine values of the original fats being 26—44 and 46—70 respectively.—A. S.

Fats and oils; Theory of the hydrolysis of —. 111. J. Kellner. Chem.-Zeit., 1909, 33, 993.

THE author, experimenting on the same lines as described (this J., 1909, 531), states that the course of hydrolysis in Kretitz's method of saponifying fats by means of lime is quadrimolecular, as in the case of saponification with alkalis. Thus in two experiments the amounts of glycerol found in the partially saponified fat were 7.80 and 4.31 per cent. as compared with 8.04 and 4.31 per cent. theoretically required for a quadrimolecular hydrolysis. In neither case was the presence of mono- or diglycerides indicated. In the experiments on the hydrolysis of fats with hydrochloric acid, expressed palm-kernel oil, with an acid value of 13.4, was boiled for several hours with an equal volume of hydrochloric acid of sp. gr. 1.150. After 8 hours the acid value of the thoroughly-washed fat was found to be 156.2, whilst the saponification value exceeded 260 (in some cases 270), and was thus higher than that obtained in the saponification of the fat with alkali. Absorption of hydrochloric acid had apparently taken place, since after saponification with alkali the fat again showed saponification values of 258 to 260. The presence of mono- and diglycerides was indicated and the author therefore concludes that the hydrolysis of fats with hydrochloric acid is uni- and bimolecular. The curve for the hydrolysis coincides fairly closely with that observed in Twitchell's method. The loss of glycerol of 9.08 per cent. observed by Eisenstein and Rosauer in the hydrolysis of pressed tallow in an autoclave is considered by the author in the light of his experiments to be largely due to the formation of mono- and diglycerides. (See also this J., 1898, 1107; 1899, 1031; 1904, 905; 1906, 856; 1907, 24, 263, 623; 1908, 693).—C. A. M.

China bean oil in Australia; Denaturation of —. Board of Trade J., Sept. 30, 1909. [T.R.]

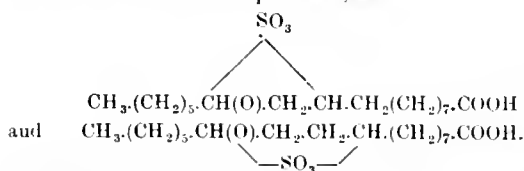
A CUSTOMS By-Law (No. 58), dated 5th August, amends with effect from 15th July, 1909, the method of denaturation of China oil entered for delivery free of Customs duty in Australia, which is to be as defined in this J., 1909, 250, when the oil is for use other than for soap making.

When for use in the manufacture of soap, the oil, when opened, must (a) at once be mixed with soap stock. (Prior to such mixing the Collector of Customs shall be satisfied that mixture with such stock will constitute effectual denaturation of the oil), or (b) be denatured by the addition to each 100 gallons of the oil of 5 per cent. of castor oil, and of 5 per cent. of molten tallow.

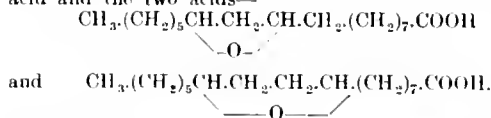
Ricinoleic acid; Derivatives of —. R. F. Chonow-ky. Ber., 1909, 42, 3339—3356.

THE ricinoleic acid used in the author's experiments was prepared by "salting out" stearic and palmitic soaps from castor oil soap solution with sodium chloride, then converting the ricinoleic soap into the lead salt, which was treated with ether, and finally converted into the barium salt, the latter being freed from impurities by extraction with ether. On treating this ricinoleic acid with hydriodic acid in the presence of phosphorus and iodine, there was obtained a thick yellow oil, consisting of di-iodostearic acid, $C_{18}H_{31}I_2O_2$, and not iodo-stearic acid, as stated by Claus and Hassenkamp. In the author's opinion the product obtained by them was a mixture of di-iodostearic acid and unchanged ricinoleic acid. When reduced with zinc in acetic acid solution, this di-iodostearic acid yielded only stearic acid (m.p. 70°—71° C.). This supports the statement of Goldschmid and Kasansky that ricinoleic acid contains the

alcoholic hydroxyl group attached to the twelfth carbon atom, whilst the double linkage occurs between the ninth and tenth carbon atoms. It may thus be assumed that in the reduction with hydriodic acid two isomeric di-iodostearic acids are produced, one of which contains the halogen atoms attached to the ninth and twelfth, and the other to the tenth and twelfth carbon atoms. When boiled with alcoholic potassium hydroxide, the di-iodostearic acid yielded a light brown oily fatty acid, $C_{18}H_{32}O_2$, isomeric with linolic acid, which thickened on exposure to the air. It did not yield the ordinary linolic tetrabromide when brominated, but a dark-coloured thick fluid tetrabromide. Moreover, oxidation with alkaline permanganate produced, not tetrahydroxystearic acid, but only a brown resin-like mass, containing azelaic acid, &c. The interaction of zinc oxide and the di-iodostearic acid yielded a product which could be separated, by treatment of the barium salts with ether, into an impure hydroxyoleic acid, $C_{18}H_{34}O_3$ (m.pt., 108° — 114° C.), and a more soluble portion containing an acid with two double linkages. By the action of moist, freshly-precipitated silver oxide upon the di-iodostearic acid, there was produced a dihydroxystearic acid with the hydroxyl groups attached to the tenth and twelfth carbon atoms, together with a small quantity of an oily product consisting, in the main, of an acid resembling linolic acid. On treating ricinoleic acid with sulphuric acid (65° B.) at 0° C., and pouring the product of the reaction into ice-cold water, about 30 per cent. of solid fatty acids could be separated from the oily layer after saponification and the addition of acid. By treatment with ether these could be separated into a sparingly soluble portion melting at 108° to 109° C. (and containing a small amount of a substance melting at 115° — 116° C.), and a soluble portion melting at 73° — 74° C. Analysis showed that these substances were two isomeric glycidic acids contaminated with a little dihydroxystearic acid. The tendency of ricinoleic acid to form glycidic rather than dihydroxy acids may be explained as follows:—The sulphuric acid can form two isomeric sulpho-acids, viz. :—



When these are boiled with water and saponified with potassium hydroxide they are decomposed into sulphuric acid and the two acids—



The first of these reacts with other substances more readily than the second. It forms a diacetyl compound, and is partially converted by the action of potassium hydroxide into the dihydroxystearic acid with the same constitutional formula as that produced by the action of moist silver oxide upon the di-iodostearic acid. This acid differs both in its structure and in its physical and chemical properties from the isomeric dihydroxystearic acids obtained from oleic, iso-oleic and elaidic acids.

—C. A. M.

Tallow in beeswax; Detection of — A. Ostrogovich and S. Petrisor. Bulet. Soc. Stiinte din Bucuresti, 1909, 18, 127—130. Chem. Zentr., 1909, 2, 1170.

FROM 6 to 7 grms. of zinc chloride are melted in a porcelain crucible, and then 1 gm. of the wax is added. The crucible is covered with a lid, the under side of which has been wetted with 2—3 drops of a solution of 0.3 gm. of phloroglucinol in 100 c.c. of concentrated sulphuric acid. The covered crucible is heated for 35—40 seconds, and then the under side of the lid examined. If the sample of wax contained tallow, the acrolein formed will have

developed with the phloroglucinol reagent a reddish violet colour, which is intensified on addition of a few drops of alcohol (see Barbet and Jandrier, also Istrati this J., 1898, 954). With pure wax, only a faint brown coloration is produced. Very small quantities of acrolein produce only a yellow coloration.—A. S.

PATENTS.

Fatty substances; Process for emulsifying and saponifying — to render them suitable for the manufacture of soaps, etc., and more particularly the cleansing of textile material in general. E. Lasbordes, Fr. Pat. 400,792, Feb. 8, 1909.

THE object of the process is to emulsify fatty substance such as suet, copra, oils, etc., and consists in mixing them at a temperature of about 60° C. with either (1) 10 per cent. of their weight of the mucilaginous matters obtained from linseed, or of gum, starch, etc.; (2) 10 per cent. of soap (3) 3 per cent. of gelatin dissolved in water; (4) from 1 to 5 per cent. of potassium hydroxide, sodium hydroxide or ammonia.—W. P. S.

Fats, butter, and the like; Process and apparatus for sterilising — by means of ultra-violet rays. Soc. L. Ferment. Fr. Pat. 400,921, Mar. 17, 1909.

THE fat, etc., is spread in a thin layer on the surface of a endless band or on a drum. The movement of the band or drum carries the layer of fat past a number of lamps which emit ultra-violet rays. These lamps are provided with a reflector. The fat is removed from the band or drum by means of a scraper after it has passed the lamps and the band or drum may be heated or cooled as desired.—W. P. S.

Soap, fats, and the like; Machines for cooling and moulding. W. Gilbert, London, and S. J. Ralph, Peterborough. Eng. Pats. 18,031, Aug. 27, 1908, and 4950 Mar. 1, 1909.

THE machine consists of a number of vertical moulds which are carried on a table or frame fitted in a cylindrical cooling tank. A measuring device is arranged between the supply vessel and the moulds, and means are provided for rotating the cooling tank, step by step, so that the moulds travel from the measuring device to a number of discharge ramps, the number of moulds being such that the machine may be in practically continuous operation. Provision is made for supplying water to the cooling tank and for circulating it in the tank. The measuring device consists of a drum divided transversely into measuring compartments and in cross-section is formed with two pockets one of which is being filled, while the other is discharging into the mould; it may be heated by a steam jacket. The moulds are provided with discharge valves which are operated by the movement of the ramps. A porous pad may be fitted round the end of each ram, brine being supplied to this pad in order to wipe out the mould at each discharge operation. The machine may be connected with a discharging mechanism consisting of a receiving box which has one side fixed and the other side pivoted on receiving the bars of soap, the movable side is tilted by means of cams so as to bring the end of the bars into contact with a conveyor band which removes them from the box, the latter being then returned to position by means of a counter-weight.—W. P. S.

Nut of the bicnyba; Process of treating the — for obtaining industrial products [candle material]. W. E. Laks London. From Companhia Luz Stearica, Rio de Janeiro. Eng. Pat. 19,511, Sept. 16, 1908.

SEE Fr. Pat. 394,362 of 1908; this J., 1909, 251.—T. F. F.

Separating volatile solvents from dissolved substances. Ger. Pat. 213,246. See I.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

Paints; Production of mineral — in the United States.
U.S. Geol. Survey, 1908. [T.R.]

The following is an abstract of the report on the production of mineral pigments and paints in the United States in 1908. The mineral paints are arranged in this report in three groups:—(1) natural mineral products which, after mechanical treatment, such as cleaning and grinding, are either used directly as pigments or are first roasted to give certain desired colours; (2) chemical products made directly from ores of valuable metals, and (3) chemical products that pass through several metallurgical and chemical processes in their preparation from the original ores.

Natural mineral paints.—In 1908 the total production of the natural pigments—ochre, amber, sienna, metallic paints, mortar colours, slate and shale—reported to the Survey amounted to 49,853 short tons, valued at \$536,544, as compared with 48,546 short tons, valued at \$530,486 in 1907. The following table shows the production of these mineral pigments in 1907 and 1908:

	1907.		1908.	
	Tons.	Value.	Tons.	Value.
		\$		\$
Ochre	16,971	164,742	17,019	156,360
Amber and sienna	730	19,309	2,756	70,996
Metallic paint	16,225	195,176	16,224	182,007
Mortar colours	10,490	110,719	9,026	86,967
Slate and shale, ground ..	4,130	40,540	4,828	40,220

The imports of ochre in 1908 were as follows:—Crude, 584,129 pounds, valued at \$4,954; dry, 8,663,537 pounds, valued at \$69,815; ground in oil, 6,094 pounds, valued at \$307; total, 9,253,760 pounds, valued at \$75,076. The imports of amber in 1908 were as follows:—Dry, 2,391,153 pounds, valued at \$19,461; ground in oil, 15,556 pounds, valued at \$803; total, 2,406,709 pounds, valued at \$20,264. Imports of sienna in 1908 were as follows:—Dry, 1,756,237 pounds, valued at \$28,407; ground in oil, 7,621 pounds, valued at \$458; total, 1,763,894 pounds, valued at \$28,865.

Metallic paint and mortar colours.—Metallic paint and mortar colours are red and brown iron oxides, produced either by grinding the impure mineral found in the natural state, or by roasting impure iron carbonate. The production of metallic paint and mortar colours in 1908 as reported to the survey, amounted to 25,250 short tons, valued at \$268,968, a slight decrease in quantity from the 1907 production of 26,715 short tons, but a large decrease in value as compared with \$305,895, the total value for 1907.

Slate and shale.—Slate and shale were ground for use as pigments in 1908 principally in Pennsylvania and New Jersey. The following table gives the production of slate and shale ground for pigment from 1905 to 1908, inclusive:—

	Tons.	Value.
		\$
1905	5,181	44,108
1906	5,481	40,540
1907	5,130	40,540
1908	4,828	40,220

Paint ore deposits.—The paint ore deposits near Lehigh Gap, Pa., have been extensively developed during the past year or two. The deposits are situated in the southern part of Carbon County, Pa., seven miles below Mauch Chunk, and extend in a general east-west direction for about 20 miles. The paint bed is a sedimentary

formation of Devonian age lying between the Oriskany and Hamilton formations. It has been traced west to Germans, five miles west of Lehigh River, and eastward to Little Gap. The area in which the deposit lies is a narrow strip from one-half mile to two miles wide. The paint ore in this vicinity consists principally of carbonate of iron. The bed varies in thickness, being in some places one and one-half to two feet thick; rarely it is found as thick as four feet; in many places its thickness is but a few inches, and in others it cannot be found.

The following is an average analysis of the crude ore:—Iron, 33.00 per cent.; manganese, 0.01 per cent.; silica, 25.00 per cent.; carbon dioxide, 25.00 per cent. There are in addition small quantities of magnesia, sulphur, and phosphorus present. The specific gravity of the ore varies from 3.2 to nearly 4. The treatment of the ore in this region consists of calcining and grinding to a fine powder, in which state it is sold dry to be mixed with oil. At the mills the ore is broken up with sledges into six-inch pieces and is ready for calcination. This was formerly carried on in stone kilns, but these are being replaced by more modern steel-jacketed kilns. Certain typical kilns are of brick construction with sheet-steel sheathing twenty-five feet high and ten feet in diameter. There are two fireplaces, one on each side, making the width of the kiln at the bottom eighteen feet. Cord wood is used as fuel and the average temperature obtained is 500° F. The run lasts twenty-four hours and every twelve hours ten tons of calcined ore is drawn off at the bottom, a corresponding quantity of raw ore being charged at the top. The calcined material is very compact and of a dark reddish-brown colour. It is of the same composition as the finished product, the rest of the process consisting simply of grinding. The loss during calcination is from 20 to 25 per cent. The product is ground to buckwheat size by gyratory crushers, after which it is ground very fine by three thirty-six-inch horizontal buhr mills and three vertical mills. More of this metallic paint is used for freight cars than for any other purpose. It is recommended that seven pounds of paint be mixed with one gallon of boiled linseed oil; the mixture will be sufficient for one coat over an area of 500 square feet. It is used also for painting structural steel, tin roofing, tanks, boats, and as a filling in oilcloth and linoleum.

Pigments made direct from ores.—The pigments made direct from ores or valuable metals are zinc oxide, leaded zinc oxide, zinc lead, sublimed white lead, and sublimed blue lead. The ores utilised in making these pigments are the franklinite ores of New Jersey, the sphalerite and galena ores of the Mississippi Valley (mined in the Plattville district of Wisconsin and the Joplin district of Missouri, Kansas, and Oklahoma), and the sulphide, carbonate, and silicate ores of zinc and lead produced in Colorado and New Mexico.

The production of zinc oxide in 1908 as reported to the Survey was 56,292 short tons, valued at \$5,072,460, as compared with 71,784 short tons, valued at \$6,490,660, in 1907.

The production of zinc lead, including leaded zinc oxide, in 1908 was 8,430 short tons, valued at \$778,200, as compared with 13,086 short tons, valued at \$1,286,440, in 1907.

In 1908 there were produced in the United States, 9,100 short tons of sublimed white lead, valued at \$973,700, an average value of \$107 per ton; in 1907 the production amounted to 8700 short tons, valued at \$1,026,600, an average value of \$118 per ton.

There were 1311 short tons of sublimed blue lead produced in 1908, valued at \$121,923, as compared with 1211 short tons, valued at \$135,632, in 1907. The average value per ton in 1907 was \$112; in 1908 it was \$93.

The imports of zinc oxide in 1908 were as follows:—Dry, 4,635,101 pounds, valued at \$262,876; in oil, 210,166 pounds, valued at \$10,798; total, 4,845,267 pounds, valued at \$279,674.

Chemically manufactured pigments.—Under this heading are grouped the lead pigments made from pig lead and lead compounds, and such minor pigments as lithopone and Venetian red. Much of the material now sold as Venetian red, however, instead of being precipitated from ferrous sulphate and calcium hydroxide, is made by

calcining a mixture of ferrous sulphate and *terra alba* and also by grinding natural red iron oxide with a white base, such as ground oyster shells.

The production of basic carbonate (corroded) white lead, as reported to the Survey, in 1908 was 132,588 short tons, valued at \$15,891,001. Of this total 101,109 short tons were sold in oil, valued at \$12,552,771, and 31,479 short tons were reported sold dry, valued at \$3,338,830. The sales for 1908 represented a net gain over those for 1907 of 5337 short tons in quantity, but a net decrease of \$556,723 in value, showing a general decrease from the average value \$129.25 per ton in 1907 to \$119.85 per ton in 1908.

The production of red lead fell from 20,078 short tons, valued at \$2,802,454, in 1905 to 16,720 short tons, valued at \$2,065,202, in 1908. The average value per ton decreased from \$139.57 in 1907 to \$123.52 in 1908.

In 1908 15,542 short tons of litharge were produced, valued at \$1,887,506, as compared with 20,838 short tons, valued at \$2,854,987, in 1907. This represents a fall from the average value per ton, \$137, in 1907 to \$121.45 in 1908.

Orange mineral likewise showed a reduction in output, there being 397 short tons produced in 1908, valued at \$65,498, as compared with 669 short tons, valued at \$129,410, in 1907.

The production of lithopone in 1908 was reported as 8292 short tons, valued at \$639,483, as compared with 10,275 short tons, valued at \$750,350, in 1907. In the case of lithopone the value per ton apparently increased from \$73.03 in 1907 to \$77.12 in 1908, or \$4.09.

The production of Venetian red in 1908 amounted to 8825 short tons, valued at \$159,650, as compared with 7566 short tons, valued at \$134,167 in 1907. The average value per ton apparently increased from \$17.73 in 1907 to \$18.09 in 1908.

The following table gives the quantity and value of the imports of corroded white lead, red lead, litharge, orange mineral, and Venetian red in 1908:—

	Pounds.	Value.
		\$
Corroded white lead	540,311	30,452
Red lead	645,073	28,153
Litharge	96,184	3,327
Orange mineral	489,407	26,445
Venetian red	3,113,858	25,745

PATENTS.

Barium sulphate; Process of bleaching natural — Fr. Pat. 401,325. See VII.

Dyestuffs soluble in fats, oils, and resins. Ger. Pat. 213,172. See IV.

(B.)—RESINS, VARNISHES.

Turpentine oil and its substitutes. J. Marcusson. Chem.-Zeit., 1909, 33, 966—967; 978—979; and 985—987.

THE author discusses different methods which have been published for the detection of petroleum, pine oil, rosin spirit, carbon tetrachloride, regenerated turpentine, etc., in oil of turpentine. Determinations of the refractive index and specific gravity of the fractions obtained on distilling a sample of oil of turpentine afford useful data for detecting the presence of petroleum, benzene, xylene, and naphtha in the sample. Whilst the sulphuric acid test (this J., 1905, 562) is useful in some cases, it is not altogether reliable. Carbon tetrachloride may be detected by testing the sample for chlorine, and regenerated turpentine (the turpentine recovered in the manufacture of synthetic camphor) is characterised by its high boiling point; genuine oil of turpentine distils at from 155° to 175° C., about 80 per cent. coming over below 165° C., whilst regenerated turpentine only begins to distil at a temperature of 170° C.

Burton's nitric acid test for petroleum.—The author describes a modification of Burton's nitric acid test for the detection and determination of petroleum in oil of turpen-

time. It consists in adding 10 c.c. of the sample to 30 c.c. of fuming nitric acid previously cooled to —10° C. and contained in a bulb-tube the neck of which is graduated. The addition is made drop by drop so that the temperature of the mixture does not exceed —10° C. After the lapse of 30 minutes, concentrated nitric acid cooled to —10° C. is added so as to bring the undissolved portion of the oil into the neck of the bulb, and its volume is read off. The acid layer is then separated, diluted with 150 c.c. of water, the mixture is heated on a water-bath, cooled, and shaken out with ether. The ethereal solution is washed first with water, then with caustic potash, and evaporated. The residue obtained is weighed and its weight divided by 1.15 to give its volume in c.c. This volume added to that read off directly in the graduated tube, gives the quantity (by volume) of petroleum in the 10 c.c. of the sample.—W. P. S.

Japan; Duty on concentrated — in Australia. Board of Trade J., Sept. 30, 1909. [T.R.]

A STATUTORY RULE (No. 94 of 1909) provides, with effect from July 22 last, that the following shall be the standard according to which duty shall be charged on the under-mentioned "japan" on importation into the Australian Commonwealth: Concentrated japan of a consistency that by the addition of an equal weight of turpentine produces a japan of ordinary consistency—one gallon of the concentrated japan to be deemed equal to two gallons of the japan of ordinary consistency.

The rates of duty leviable on japan are 2s. per gallon under the British Preferential Tariff, and 2s. 6d. per gallon under the General Tariff.

PATENT.

Rosin; Process for the purification of — H. T. Yaryan, Toledo, Ohio. U.S. Pat. 934,257, Sept. 14, 1909.

THE rosin is dissolved in a liquid hydrocarbon and the solution is agitated after the addition of cold water; the mixture is then allowed to separate into various layers which are separated from each other.—W. P. S.

(C.)—INDIA-RUBBER, &c.

Rubber content of Lactuca viminea, Presl. V. Guafé and K. Linsbauer. Z. landw. Vers.-Wesen Oesterr., 1909, 12, 126—141. Chem. Zentr., 1909, 2, 1059.

Lactuca viminea, a biennial plant of the order *Compositae*, which is found in Austria, yields a latex which contains an amount of rubber corresponding to about 0.5 per cent. of pure caoutchouc on the weight of the dry substance of the plant. It thus yields more rubber than *Hevea brasiliensis*, from which, according to Alexander and Bing (*Tropenpflanzer*, 12, 57), only about 0.3 per cent. is obtainable. In searching for new rubber-yielding plants, it would appear desirable to pay greater attention to plants of the order *Compositae*, to which, besides *L. viminea*, the Mexican guayule plant also belongs. For the determination of the caoutchouc content of *L. viminea*, the plant, at the period of its maximum growth, was dried, extracted with petroleum ether, the extract treated with 10 per cent. alcoholic caustic potash to remove saponifiable matter, and then extracted with carbon bisulphide. From the evaporation residue of the carbon bisulphide extract, the resin was removed by means of acetone, and then the pure caoutchouc was determined by Harries and Weber's method, and Fendler and Kuhn's modification of Budde's method.—A. S.

PATENTS.

Rubber. D. Sandmann, Berlin. U.S. Pat. 935,414, Sept. 28, 1909.

SEE Fr. Pat. 377,528 of 1907; this J., 1907, 1058.—T. F. B.

Separating volatile solvents from dissolved substances. Ger. Pat. 213,246. See I.

Paper to be used as a substitute for india-rubber. Eng. Pat. 20,616. See XIX.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Zeuthen's method [of washing hide powder]; Examination of —. J. Paessler. *Collegium*, 1909, 305—312.

THE author considers that the method of washing chromed hide powder proposed by Zeuthen (*Collegium* 1908, 366) is quicker and more convenient than the official method. In order to obtain the same analytical results by the official method and by Zeuthen's method, he proposes to modify the latter so that the same amount of dry hide powder (6.5 grms.) is used in each case. To wash this quantity of dry chromed hide powder by Zeuthen's method, larger filter-bells (3 by 8.5 cm.) are employed. Comparative results of non-tannin determinations are given by the official method, and by Zeuthen's method with 20 c.c. and with 35 c.c. of water in the wet powder. The results by the two methods differ on the average by 0.4 per cent., Zeuthen's method giving the lower values for non-tannins. Further results with the use of only 20 c.c. of water in the wet powder by both methods show a very small average difference. Certain tanning materials, however, show differences up to 1 per cent., the official method giving sometimes the higher and sometimes the lower results. The author also gives 3 analyses to show that his dry chromed powder gives the same results by Zeuthen's method whether it be 2½ years, 2 years, or only a few days old.—H. G. B.

Azelaic acid as a product of oxidation of keratin. T. Lissizin. *Z. physiol. Chem.*, 1909, 62, 226—228.

THE author has investigated the products of oxidation of keratin (horn shavings) by potassium permanganate. The most favourable conditions were, 1 part by weight of potassium permanganate, to 8—9 parts of keratin, the process being as follows:—300 grms. of horn shavings were treated with 35 grms. of potassium permanganate dissolved in 6 litres of water. The mixture was shaken for 4 to 6 days by a shaking machine until the solution was quite colourless. It was then filtered, acidified with dilute sulphuric acid, and after concentration, extracted with ether. The residue left on evaporation of the ether, was purified by recrystallisation, and was identified as azelaic acid. In order to decide the question whether the azelaic acid was formed by oxidation of fatty bodies or of other substances accompanying the keratin, the author carried out experiments on fat-free and purified horn shavings. The yield obtained was lower, but he concludes that azelaic acid is in effect a new oxidation product of keratin.—W. N. B.

Gelatinous substances; Formation of oxalic acid from —. W. Sadikow. *J. Russ. Phys.-Chem. Ges.*, 1909, 41, 641—651. *Chem. Zentr.*, 1909, 2, 1126.

By the action of nitric acid of sp. gr. 1.4 on thioglutan (see this J., 1907, 105), more or less oxalic acid is formed, according to the conditions. Glutin gives oxalic acid only if the oxidation is effected in presence of calcium salts which prevent decomposition of the oxalic acid by the nitric acid. Tendocollagen also yields oxalic acid on oxidation with nitric acid. On fusion with caustic potash at 240° C. for 6 hours, glutin yielded 39.17 per cent. of oxalic acid, reckoned on the carbon of the glutin. Whilst carbohydrates yield hydrogen on fusion with caustic potash, proteid adhesive substances yield oxalic acid and ammonia.—A. S.

PATENTS.

Decolorising product composed of sodium hydrosulphite and zinc dust. Fr. Pat. 401,000. See VII.

Paper to be used as a substitute for leather. Eng. Pat. 20,616. See XIX.

XV.—MANURES, &c.

Calcium phosphate; Manurial experiments with precipitated —. H. C. Söderbaum. *Z. Landw. Vers.-Wes.*, 1908, 506; *Biedermann's Zentrabl.*, 1909, 38, 585—587.

EXPERIMENTS have been made in Stockholm for some years with electrolytically precipitated calcium phosphate to test its manurial value towards oats and peas in comparison with superphosphate. One commercial preparation consisted mainly of tricalcium phosphate containing 34.3 per cent. of total, and 5.6 per cent. of citrate-soluble phosphoric acid; a second showed 39.9 per cent. of total, and 33.5 per cent. of citrate-soluble phosphoric acid, and was mainly dicalcium phosphate. The action of the dicalcium phosphate was as great and as continuous as that of superphosphate, and the assimilative power of the phosphoric acid was not lowered by the addition of large quantities of calcium carbonate. The tricalcium phosphate was much less valuable as a manure, and its activity was very markedly decreased on the addition of increasing quantities of chalk.—E. F. A.

Silver cyanamide [and determination of cyanamide in commercial products]. H. R. Ellis. *Chem. News*, 1909, 100, 154—155.

THE author criticises Perotti's method for the determination of cyanamide (this J., 1905, 1129) and recommends the following process:—20 c.c. of a solution of the substance, of about *N*/10 strength, are added to about 40 c.c. of *N*/10 silver nitrate and 10 c.c. of *N*/1 nitric acid; the silver cyanide thus precipitated, is filtered off and washed, the filtrate and washings being received in 20 c.c. of *N*/1 ammonium hydroxide, and the solution is warmed; silver cyanamide is precipitated, and, after washing, it is treated on the filter with nitric acid (1:5), the residue is washed, and the silver determined by Volhard's method in the filtrate and washings. The silver cyanide precipitate is also dissolved in nitric acid and the silver determined by *N*/50 ammonium thiocyanate. From the weight of silver in each case the percentage of cyanide and cyanamide can be calculated. This process is applicable to the analysis of commercial sodium cyanamide. In the case of "nitrolim," 1—2 grms. of the very finely powdered substance is shaken with water and filtered, and washed until no precipitate is given with ammoniacal silver nitrate; the volume is made up to 500 c.c., and 20 c.c. of this solution are added to an excess of *N*/10 silver nitrate (about 30 c.c.) and 20 c.c. of *N*/1 ammonium hydroxide; the precipitated silver cyanamide is washed with warm water and the silver determined as above, any silver sulphide or chloride remaining on the filter paper, undissolved by the nitric acid. Silver cyanamide, when rapidly heated, explodes violently; the decomposition is represented by the equation: $2\text{Ag}_2\text{CN}_2 = 4\text{Ag} + \text{C}_2\text{N}_2 + \text{N}_2$.—F. SONN.

Cape Colony: Proposed regulations under Fertilisers Act, 1907. Board of Trade J., Oct. 14, 1909. [T.R.]

THE Government of Cape Colony have approved of the issue of certain additional regulations under the Fertilisers Act No. 20 of 1907, with effect from 1st January next.

These regulations are briefly as follows:—1. The registered brand will have to be legibly marked on the receptacle containing the fertiliser. 2. Brands or names of fertilisers which contain a numerical indication of the proportion of any constituent of the fertiliser as an integral portion of the brand will not be accepted for registration unless amended in that respect. 3. The practice of using a figure to represent any constituent of a fertiliser in any advertisement, invoice, or label is forbidden, unless such figure is accompanied by the name of the constituent so represented, and further the constituent so alluded to must be expressed in the manner set forth in the regulations. 4. In the case of superphosphates (excepting double or basic superphosphates) these will, in future, be

graded according to their percentage of phosphoric oxide as under, and the grade will have to be distinctly marked on the receptacle:

Under 12 per cent.	Below strength.
12 per cent. to 13 per cent.	Low grade.
Above 13 per cent. to 15 per cent.	Medium grade.
Above 15 per cent. to 17 per cent.	Medium high grade.
Above 17 per cent.	High grade.

The above marking will, in addition, be required to be accompanied by a figure indicating the minimum percentage contained in the particular consignment, *e.g.*, "medium grade" comprises a range of about 13 per cent. to 15 per cent. It would, therefore, be necessary to mark a receptacle "medium grade 13 per cent.," or 14 per cent., or 15 per cent., according to what the minimum percentage actually was. This is the only instance in which a numeral may be used unaccompanied by the name of the constituent referred to and special provision has been made in the regulations accordingly. The use of the term "guano" is forbidden to be applied to any substance other than the nitrogenous excreta of birds or bats and fish or whale fertiliser. In the case of the last three mentioned it must be preceded by the term "bat," "fish," or "whale" respectively; used by itself it will signify only the nitrogenous excreta of birds. So-called phosphatic guanos (*e.g.*, those from which the nitrogen has disappeared), may not be sold as "guano," but as "guano phosphate." 5. The sale of bone-meal or bone-dust which is not sufficiently fine to permit 80 per cent. thereof to pass through a sieve of 8 meshes to the linear inch is forbidden. 6. The sale of basic slag, Thomas phosphate, or Thomas slag, which is not sufficiently fine to admit of 75 per cent. thereof passing through a standard wire sieve of 100 meshes to the linear inch is also forbidden.

Determination of phosphoric acid. Crete. See XXIII. Inorganic Quantitative.

PATENT.

Artificial nitrate for use as manure; Process of manufacture of —. A. Montbaron and A. Ducommun-Müller. Fr. Pat. 400,895, March 16, 1909. Under Int. Conv., Feb. 27, 1909.

AMMONIACAL liquor, extracted from peat, is fermented, and nitric acid, lime, and impure salt are added; nitrification is then brought about by a further fermentation, and the product is crystallised for use as a manure. As an example, for 1 ton of product, 320 kilos. of the ammoniacal liquor, 300 of lime, 300 of impure salt, and 80 of nitric acid are said to give good results.—F. SOBY.

XVI.—SUGAR, STARCH, GUM, &c.

PATENTS.

Crystalloids from parts of plants and other organised substances [sugar from beetroots]; Process for effecting the fixation of —. Soc. Egyetemes Kísérletező Intezet, Vegyészeti, Orvosi és Gyógyszerészeti Laboratorium Részvénytársaság. Fr. Pat. 400,964, March 13, 1909.

SULPHUROUS acid, or other acid, is employed as a catalytic agent in the extraction of crystalloids from organic substances, for instance, in the extraction of sugar from beetroots. The extraction is carried out at the ordinary temperature, and the extraction battery is so arranged that the weak sugar solution containing sulphurous acid is allowed to act on a fresh charge of beetroots which absorbs the acid from the sugar solution. The extracted beetroots are treated with water and the acid solution obtained is employed as an extractive solution for a fresh charge. It is only necessary to add a little sulphurous acid from time to time to replace the portion which is unavoidably lost.

—W. P. S.

Juice extraction by diffusion; Continuous —. K. Philipp. Magdeburg, Germany. U.S. Pat. 934,349, Sept. 14, 1909.

See Fr. Pat. 378,175 of 1907; this J., 1907, 1155.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Nitrogen content of barley; Relation between the — and the extract yielded by the malt. J. Fries. Z. ges. Brauw., 1909, 32, 500–503.

THE nitrogen in a hundred samples of barley of 1908 harvest was determined and calculated into terms of protein. The values so obtained were plotted against the extract yield of the corresponding malts. Six different kinds of mid-European barleys were examined and in each the extract was found to decrease fairly regularly with the increase in protein; exceptions were usually to be accounted for by differences in the kilning of the malt. Co-ordinating the average protein content of the six kinds of barley and the average extract yielded by their malts, the author claims that they vary in almost exactly inverse ratio.—R. L. S.

Alcoholic fermentation; Decomposition of sugar by —. E. Buchner. Ges. Deutscher Naturforscher u. Aerzte, Sept., 1909. Chem.-Zeit., 1909, 33, 1001.

EXPERIMENTS made by the author in conjunction with J. Meisenheimer show that, under normal conditions, lactic acid is neither formed from sugar, nor fermented, by the action of living yeast, a pure culture of Race 792 being employed. These results are in accord with those obtained from the study of cell-free fermentation by expressed yeast-juice and with Sclater's conclusion (this J., 1906, 227) that lactic acid is not an intermediate product in the fermentation of sugar. The author has investigated the behaviour towards yeast and yeast-juice of methylglyoxal, glyceraldehyde, and dihydroxyacetone. Whilst the first of these compounds undergoes virtually no fermentation, glyceraldehyde is slowly and dihydroxyacetone fairly rapidly fermented. A two per cent. solution of dihydroxyacetone yields besides alcohol, as much carbon dioxide in 5 days as is given by a dextrose solution of the same concentration. It remains to be ascertained whether dihydroxyacetone is actually formed during alcoholic fermentation. (See also this J., 1909, 494).

—T. H. P.

Molasses washes; Fermentation of —. L. Neustadt and B. Ehrenfreund. Chem.-Zeit., 1909, 33, 1056–1057.

IN attempting to determine the residual sugar in fermented [beet] molasses washes by polarimetric examination, the authors found that these washes were invariably dextro-rotatory (0.1°–0.2° in 200 mm. tube at 20° C.). Polarimetric tests at frequent intervals during the fermentation of a molasses wash showed that the dextro-rotation first falls gradually to *nil*, when there is a period of increasing levo-rotation, followed by a fall and a further rise, after which the levo-rotation falls gradually to *nil*; in the final stage there is a slight dextro-rotation which, at the end, remains constant at about 0.2°. The detailed results are shown in the following table:—

Time.	Density.	Polarisation.	Time.	Density.	Polarisation.
hrs. mins.	° Balling.		hrs. mins.	° Balling.	
1 45	13.7	+2.6	8 0	9.1	—1.4°
2 0	13.6	+2.0	9 0	8.3	—1.1°
2 15	13.4	+1.7	10 0	7.6	—0.9°
2 30	13.3	+1.5	11 0	7.0	—0.7°
2 45	13.1	+1.0	12 0	6.6	—0.5°
3 0	12.9	+0.7	1 0	6.2	—0.3°
3 15	12.8	+0.4	2 0	6.0	—0.1°
3 30	12.6	+0.2	3 0	5.9	0
3 45	12.4	0	4 0	5.8	+0.1°
4 0	12.2	—0.3	5 0	5.7	+0.2°
4 15	12.0	—0.6	6 0	5.6	+0.4°
1 30	11.8	—0.8	7 0	5.5	+0.5°
1 45	11.6	—0.9	8 0	5.4	+0.6°
5 0	11.4	—1.1	9 0	5.3	+0.3°
5 15	11.2	—1.4	10 0	5.3	+0.2°
5 45	11.0	—1.3	11 0	5.3	+0.2°
6 15	10.6	—1.2	1 0	5.3	+0.2°
7 0	10.0	—1.5	—	—	—

The results are interpreted as follows:—From the beginning until the density falls to 11.2° Balling, sucrose is inverted and mainly dextrose is fermented; at the latter point the inversion of the sucrose is complete and the fermentation of the levulose becomes noticeable. The increase of lavo-rotation between 10.6° and 9.1° Balling is due to the hydrolysis of raffinose into levulose and melibiose; the further hydrolysis of melibiose into dextrose and galactose has practically no effect on the rotation. At 5.4° Balling the fermentation of the levulose is complete, and the final stage of the process consists in the fermentation of galactose, which proceeds very slowly. The authors consider that the final degree of attenuation of the fermented wash can be judged with sufficient accuracy by means of polarimetric examination.—A. S.

French alcohol statistics for 1908. Z. Spiritusind., 1909, 32, 453.

ACCORDING to the official statistics the production of spirit (reckoned as absolute alcohol) in France was 55,862,040 galls. in 1908, as compared with 55,350,970 galls. in 1907. The consumption of tax-free alcohol for industrial and scientific purposes in the two years is shown in the following table:—

	1908.	1907.
	galls.	galls.
For lighting and heating, etc.....	9,744,883	8,831,072
" preparation of varnishes	265,309	294,626
" polishes	24,585	26,192
" plastic substances	468,813	377,097
" fur industry	5282	6537
" preparation of tinctures and colours	25,245	13,910
" rennet	3456	3918
" collodion	7902	16,508
" chloroform	4270	2223
" chloral	10,785	3412
" tannin	20,910	11,225
" chem. and pharm. prods.	153,476	228,904
" scientific purposes	12,920	28,657
" preparation of ether and explosives	3,044,995	3,226,050
" vinegar	1,053,421	1,062,577
Totals	14,846,252	14,132,908

In 1900 the consumption of tax-free alcohol was 6,068,773 gallons, and in 1892, 3,470,251 gallons.—A. S.

Cider apples; Use of an oxidising lime solution [bleaching powder] for washing:—rapid defecation of the must, and pure fermentation. H. Alliot and G. Gimel. Comptes rend., 1909, 149, 532—534.

CIDER apples should be washed with water containing 28 to 42 grains of bleaching powder per gallon (40—60 grms. per hectolitre) in order to clean the fruit and destroy bacteria, pathological and others, with which they may be contaminated. Juice of fruit treated in this way defecates well and clarifies quickly; the pectinous substances always separate as a brown head. Bleaching powder has a stimulating influence on *Saccharomyces mali*, but retards the activity of bacteria, thus assisting very materially the use of pure races of selected yeasts. Analytically the cider prepared from apples washed with bleaching powder contains slightly more chlorides.

—R. L. S.

PATENTS.

Malt; Drums for the germination of — W. P. Thompson, London. From J. A. Topf und Soehne, Erfurt, Germany. Eng. Pat. 4584, Feb. 24, 1909.

The apparatus described consists of a horizontal drum which is divided by transverse partitions into a number of separate compartments. Each of the compartments is provided with an air pipe and a water pipe, these pipes passing through a central chamber in the drum and being connected with main air and water pipes fitted to either end of the drum, respectively. The compartments are thus aerated and moistened independently of each other and can contain malt in different stages of germination.—W. P. S.

Mashing process. C. Zimmer, Barcelona, Spain. U.S. Pat. 934,783, Sept. 21, 1909.

SEE Fr. Pat. 370,728 of 1906; this J., 1907, 270.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Flours; Examination of — on the basis of their content of catalase. P. Liechti. Chem.-Zeit., 1909, 33, 1057.

ACCORDING to the author the quality of a flour can be satisfactorily judged from its capacity of liberating oxygen from hydrogen peroxide, which depends on its content of catalase. In the grain the catalase is present in the husk (bran) and the embryo, that is, in those portions which are, as far as possible, removed in the preparation of bread-making flours. Some experimental results obtained are given in the following table, the figures representing the pressure of the oxygen evolved in cm. of mercury.

Commercial mark.	Source.		
	Mill A.	Mill B.	Mill C.
Baking flour No. 1	1.2	1.3	0.9
" No. 2	1.7	1.7	1.2
" No. 3	2.3	3.1	2.0
" No. 4	3.3	4.8	3.2
" No. 5	10.6	8.6	6.0
" No. 6	23.2	22.2	23.2
Fodder flour	over 30	over 30	29.0

—A. S.

Panary fermentation. Relation between the extent of fermentation and the starch degradation. M. P. Neumann and K. Mohs. Z. ges. Getreidewesen, 1909, 1, 89; Biedermann's Zentrabl., 1909, 38, 633—635.

THE author discusses the rôle played by carbohydrates in panary fermentation and states that the diastatic activity of the flour is sufficient not only to produce the sugared in fermentation, but such a quantity, that after two hours, an amount of sugar is found in the dough equal to that originally present.—E. F. A.

Casein in cow's milk; Volumetric method for the determination of — E. B. Hart. J. Biol. Chem., 1909, 6, 445—451.

CASEIN which has been precipitated from milk by the action of acids, is capable, after the removal of the excess of acid by long-continued washing, of combining with a definite proportional quantity of alkali to yield a compound which is neutral to phenolphthalein. The method proposed is based on these facts. Preliminary experiments with casein prepared by Hammarsten's method from mixed milks and from the milk of typical breeds of cows showed that each 0.1 c.c. of N/10 alkali solution is equivalent to 0.0108 grm. of casein, this being the mean of twenty determinations, the results of which varied between 0.0102 and 0.0113 grm. 10.5 c.c. of the milk are placed in an Erlenmeyer flask, 75 c.c. of cold water are added, and from 1 to 1.5 c.c. of 10 per cent. acetic acid. The flask is given a vigorous rotary motion and the precipitate is then collected on a filter. As the casein accumulates on the filter, the mass is loosened by means of a jet of cold water, so that retardation of the filtration does not take place. The particles of casein adhering to the sides of the flask need not be removed, but they must be thoroughly washed, the precipitate and filter being also washed with at least 300 c.c. of water to insure removal of all acid. If the temperature has been kept below 20° C., and the right amount of acid used for the precipitation, the filtrate will be perfectly clear. The precipitate, together with the filter, is now returned to the flask, about 80 c.c. of

water free from carbon dioxide are added, then a few drops of phenolphthalein and 10 c.c. of *N*/10 potassium hydroxide solution. The flask is closed with a rubber stopper and shaken until all the particles of casein have dissolved. When solution has taken place, the stopper is rinsed with water and the solution is immediately titrated with *N*/10 acid until the red coloration disappears. It is imperative that a control determination be made parallel with the determination proper. The quantity found in the control determination (0.2—0.3 c.c.) is added to the number of c.c. of acid used in the titration and the difference between the corrected acid reading and the 10 c.c. of alkali used gives directly the percentage quantity of casein in the milk.—W. P. S.

Casein; Hydrolysis of —, and detection of the mono-aminoacids formed thereby. R. Engeland. Ber., 1909, 42, 2962—2969.

WHILST it is easy to identify leucine, tyrosine, and glutamic acid, this is not the case with the other easily soluble monoaminoacids produced by the hydrolysis of casein and other proteins. The method proposed by the author consists in the exhaustive methylation of these aminoacids by means of methyl iodide and a solution of potassium hydroxide in methyl alcohol, whereby they are converted into betaines, which can be easily identified by the varying solubility of their double salts with mercury, platinum, or gold chlorides. By applying this method to the products of hydrolysis of casein with hydrochloric acid of sp. gr. 1.19, after separating glutamic acid, tyrosine, and leucine in the usual manner, the author identified *l*-pyrrolidine-carboxylic acid in the form of *N*-methylglycine acid, aminovaleric acid as trimethylaminovaleric acid, glycocoll as betaine, and alanine as homobetaine.—A. S.

Proteins; The leucine fraction of —. P. A. Levene and D. Van Slyke. J. Biol. Chem. 1909, 6, 391—418.

THIS paper deals more particularly with the separation of *l*-leucine and *d*-isoleucine from *d*-valine. The authors find that leucine and isoleucine are precipitated quantitatively as the normal lead salt, $\text{Pb}(\text{C}_6\text{H}_{12}\text{O}_2\text{N})_2$, when lead acetate solution containing 1 gram.-mol. per litre, in quantity slightly more than equivalent to the leucine and isoleucine present, is added to a hot ammoniacal solution of the substances. The valine is recovered from the filtrate of the lead-leucine precipitate by precipitating the excess of lead with hydrogen sulphide, and evaporating the filtrate from the lead sulphide to dryness. The valine is then extracted from the residue with a mixture of alcohol and ether (3:1). The relative proportions of the leucine isomerides may be determined polarimetrically by the optical rotation of their mixture in 20 per cent. hydrochloric acid; and the isomerides may be separated by Ehrlich's method of extracting their copper salts with methyl alcohol. Isoleucine preparations from casein and edestine showed, after repeated purification by means of the copper and lead salts, specific rotations of $[\alpha]_D = +37.35^\circ$ and $+37.44^\circ$. The value $[\alpha]_D = +37.4^\circ$ doubtless more nearly expresses the rotation of pure natural isoleucine than does $[\alpha]_D = +36.8^\circ$, the value found by Ehrlich, who had less complete means of purifying the substance. Fischer and Warburg found the specific rotation of *l*-leucine to be $[\alpha]_D = +15.6^\circ$.—W. P. S.

Casein and edestine; The leucine fraction in —. P. A. Levene and D. D. Van Slyke. J. Biol. Chem., 1909, 6, 419—430.

THE authors have investigated the leucine fraction obtained from casein and edestine (from flax-seed), the process described in the preceding abstract being employed after the baryta method had been used for the separation of the esterified substances. In the case of casein, the leucine fraction, amounting to 16.04 per cent., was found to consist of leucine, 7.92; isoleucine, 1.43; and valine, 6.69 per cent. The leucine fraction of edestine amounted to 13.7 per cent. and consisted of leucine and isoleucine, 8.1; and valine, 5.6 per cent. These figures are considerably higher than those obtained by other workers, and the authors consider that the figures for the leucine fraction in most protein hydrolyses hitherto published are in need of revision.—W. P. S.

Eggs; The cholesterol-content of — as a basis for the valuation of pastry. H. Cappenberg. Chem.-Zeit., 1909, 33, 985.

THE average egg contains about 0.36 per cent. of cholesterol and a determination of this constituent affords a means of ascertaining the quantity of egg-substance in articles of food such as pastry, etc. A quantity of 500 grms. of the sample is extracted with ether, the solution is filtered, and the ether is evaporated. The residue obtained is saponified, the soap solution is evaporated to dryness and this residue is also extracted with ether. The ether extract is filtered, evaporated, the residue is dissolved in hot methyl alcohol, the solution is filtered while hot, and, after the addition of 20 per cent. of water, it is evaporated until crystallisation commences. The mixture is then cooled to a temperature of 0°C ., the crystals of cholesterol are collected on a filter, washed first with 50 per cent. methyl alcohol, then with hot water, dried for 3 hours at 100°C ., and weighed.—W. P. S.

PATENTS.

Flour; Milling of —. [Preventing evaporation of water]. H. Simon, Ltd., Manchester. From L. M. Thomas, Strassburg, Germany. Eng. Pat. 11,904, June 1, 1908.

TO prevent evaporation of water from wheaten flour during the milling operations, air saturated with water vapour is admitted to the milling machinery; the moistened air may be introduced into the whole of the rooms of the mill if desired. The air is saturated by bubbling it through water or by spraying water or injecting steam into it. The temperature of the air may be raised above the normal and it is advantageous to heat the air passing from the rollers before it enters the filter dust collectors.

—W. P. S.

Centrifugal [cream] separators. Aktiebolaget Separator, Stockholm. Eng. Pat. 13,859, June 12, 1909. Under Int. Conv., June 25, 1908.

IN cream separators, owing to the air currents produced by the revolving bowl, there is a tendency for the froth formed to flow from the collecting vessels into the machine casing. To obviate this a series of radial wings is placed between the bowl and the skimmed milk cover or collecting vessel, whereby a permanent air current is produced from the casing to the collecting vessel.—J. W. H.

Cream; Colloidal — and process of making the same. L. M. Rousseau. First Addition, dated July 10, 1908, to Fr. Pat. 392,253, Sept. 20, 1907 (this J., 1908, 1218).

A CREAM which may be "whipped" is obtained by mixing colloidal, homogenised cream, prepared as described in the original specification, with a suitable proportion of colloidal cream which has not been homogenised. The homogenised cream must be completely cooled before mixing. A cheese may be obtained by treating colloidal cream with rennet.—W. P. S.

Arachis nuts [earth-nuts]; Treatment of — to render them suitable for use in baking and pastry-making. H. Siveke. Fr. Pat. 401,166, Mar. 24, 1909.

THE arachis nuts are roasted, decorticated, then finely divided, and treated with sweet almond oil. The resulting product may be used in place of almonds in pastry-making, etc.—W. P. S.

Milk for infants; Method of making —. P. Bergell, Assignor to J. A. Wülling, Berlin. U.S. Pat. 934,133, Sept. 14, 1909.

SEE Fr. Pat. 393,347 of 1908; this J., 1909, 104.—T. F. B.

Sterilising fats, butter, or the like. Fr. Pat. 400,921. See XII.

(B.)—SANITATION; WATER PURIFICATION.

PATENTS.

Sewage; Method or process for the recovery of the useful constituents of —. M. F. Purcell and J. H. Ryan. Dublin, and C. J. Polglase, Falmouth. Eng. Pat. 18,199, Aug. 31, 1908.

THE process relates to the recovery of ammonia, gas, heavy oils, etc., and consists in submitting the sewage-sludge to destructive distillation. The sludge is pressed to remove superfluous moisture and the cake, with or without the addition of lime or sodium hydroxide, is introduced into a retort similar to those used in the distillation of shale. Coal or other fuel is introduced along with the first charge, the subsequent charges being introduced continuously, so as to be self-firing. When the charge is alight, steam, either wet, dry, or superheated, is injected under pressure and the products of distillation are conducted to a tank containing water. The ammonia is absorbed by the water, the oils form a layer on the surface of the water, and the combustible gases are then conducted to a gasometer or other receptacle. Means are provided for withdrawing the oils and ammonia solution from the tank, the latter solution being afterwards treated with sulphuric acid and the ammonium sulphate recovered by crystallisation. The retort residue is withdrawn as required, and may be used for making cement, or for other purposes. (Reference is directed to Eng. Pats. 629 of 1885, 14,253 of 1890, 1567 of 1892, 3272 of 1895, 23,562 of 1898, 21,921 of 1899, and 15,720 of 1900; this J., 1900, 67; 1901, 830.)—W. P. S.

Sewage water; Apparatus for purifying —. P. Koch, Villingen, Germany. Eng. Pat. 23,668, Nov. 5, 1908.

THE apparatus consists essentially of a settling tank and an oxidising or filtering tank. The former is cylindrical in shape and is provided with an inner cylinder the walls of which are perforated in parts. The sewage is introduced into the inner cylinder and flows through the perforations into the space between the two cylinders. Sedimentation takes place here and the lighter components of the sewage rise to the surface and quickly decompose, an outlet being provided for the gases which are formed. The liquid portion of the sewage then flows from the top of the tank through a pipe, and is distributed over the surface of a filter-bed composed of "the oxidising material," consisting of gravel and charcoal, arranged in the second tank. A ventilating space is provided below this filter and air is supplied through a perforated pipe, through holes in the side of the tank, and through perforations at the bottom of the tank. One or more of these oxidising tanks may be employed in connection with the settling tank. The apparatus as described and arranged, is claimed.—W. P. S.

Sewage, etc.; Apparatus for dissolving and nitrifying the solid matters in —. C. Didelon and A. Braut. Fr. Pat. 400,981, June 29, 1908.

THE apparatus consists of two tanks, one closed and the other open to the air. The sewage is introduced into the top of the closed chamber, which is divided into two compartments by means of a perforated partition, the crude sewage falling into one of the compartments. When anaërobic fermentation has taken place and the solid matters have been dissolved, the liquid portion of the sewage, passing through the perforated partition, is conducted through a pipe into the lower part of the second chamber. This is also divided into two parts by a vertical partition reaching nearly to the top. The sewage rises in one of the compartments, passes through a bed of slag or cinders contained in the space between two horizontal perforated partition-plates, and flows over the vertical partition into the second compartment, where it is spread over the surface of peat beds with which the compartment is filled. An outlet for the liquid is provided at the bottom of the second chamber.—W. P. S.

Liquids; Process for sterilising — by means of ultra-violet rays. Soc. Le Ferment. Fr. Pat. 491,204, Mar. 25, 1909.

THE liquid is circulated through a closed vessel containing one or more mercury vapour lamps, the latter being so fixed that they are immersed in the liquid. Taps on the inlet and outlet pipes enable the velocity of the current of liquid to be controlled, and the outlet pipe may deliver the treated liquid into sterilised receptacles.—W. P. S.

(C.)—DISINFECTANTS.

PATENTS.

Sulphur; Process of treating finely-divided — for giving it the property of mixing readily with water. P. Ducancel and H. Gouthière et Cie. Fr. Pat. 401,067, July 6, 1908.

FINELY-DIVIDED commercial sulphur is incorporated with barium, strontium, or calcium saccharate, and thereby gains the property of mixing readily with water. The product may be employed for the treatment of vine-mildew.—F. SODX.

Disinfectant. H. Schneider, Wilmersdorf, Germany. U.S. Pat. 934,844, Sept. 21, 1909.

SEE Eng. Pat. 3789 of 1907; this J., 1907, 712.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

PATENT.

Paper to be used as a substitute for india-rubber, leather, and the like. F. Poirier, Paris. Eng. Pat. 20,616, Sept. 30, 1908.

THE bark of the two varieties of Japanese paper mulberry called "kazokodzou" and "gampi" is scraped, beaten to fine particles, boiled in water, washed, dried, sifted, and boiled in "clear lye." It is then mixed with a glutinous mass composed of: glycerin, 10; rice-powder, 2; glue or size, 2; camphor oil, 1; water, 3; ochre, 1; and Chinese ink, 1 per cent. A paper is made from the paste thus obtained and is afterwards coated on both sides with the glutinous mixture mentioned above. The product can be used in many cases as a substitute for india-rubber, canvas, etc. It is impermeable to water.

—S. H. H.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Cinchona alkaloids; Iodine derivatives of —. T. Kózniewski. Anz. Akad. Wiss. Krakau, 1909, 734—746. Chem. Zentr., 1909, 2, 989—990.

BY the action of a solution of iodine in carbon bisulphide on alcoholic solutions of cinchonine and quinidine, the author has prepared di-iodo-derivatives of the bases, analogous to those previously obtained from strychnine and brucine (see this J., 1909, 38). The cinchonine compound, $C_{19}H_{22}N_2O_{12}$, forms orange-yellow microscopic prisms melting with decomposition at 147° — 149° C. The quinidine compound, $C_{26}H_{34}N_2O_{12}$, melts at 157° — 159° C. with decomposition. These di-iodo-compounds are insoluble in petroleum spirit (ligroïne); almost insoluble in ether, benzene, and carbon bisulphide; somewhat more soluble in acetone, absolute alcohol, ethyl acetate, amyl alcohol, and chloroform. By the action of a solution of potassium hydroxide in methyl alcohol, the di-iodo-compounds lose the whole of their iodine, the alkaloids being regenerated. Di-iodocinchonine when heated with a large quantity of alcohol under a reflux condenser is dissolved, with decomposition. Di-iodoquinidine can be recrystallised from warm 90 per cent. alcohol, but on repeating the operation, the iodine content gradually falls unless a solution of iodine in carbon bisulphide be added. The hydrogen iodide and methyl iodide addition-compounds

of di-iodocinchonine and the methyl iodide and ethyl iodide compounds of di-iodoquinidine were also prepared. The author also succeeded in obtaining di-iodo-compounds from papaverine, golden-yellow needles, m. pt. 126—127° C.; berberine, small dark yellow needles; and thebaine, red prisms; further an iodine derivative of narcaine. No corresponding derivatives of morphine, codeine, aconitine, codeine, and veratrine could be prepared, and it is concluded that only those alkaloids the molecules of which contain a quinoline or isoquinoline nucleus are capable of yielding additive di-iodo-compounds.

—A. S.

Strychnine, brucine, and other alkaloids: Bromination of — J. Buraczewski and M. Dziurzynski. *Anz. Akad. Wiss. Krakau*, 1909, 632—641. *Chem. Zentr.*, 1909, 2, 988—989.

ON adding a solution of bromine in carbon disulphide to a cold saturated solution of strychnine in alcohol, a yellow coloration is first produced, and later, a yellow precipitate. The latter, when dried at 80° C., has the composition of a dibromo-derivative of strychnine, $C_{21}H_{22}N_2O_2Br_2$, but is not identical with Beckurt's dibromostrychnine (Ber., 18, 1237). It decomposes on heating, without melting, and is insoluble in cold water, and nearly so in the common organic solvents; it is decolorised when boiled with ethyl or methyl alcohol. The alcoholic filtrate from the dibromo-derivative, when treated with alkalis, yields a precipitate of a monobromostrychnine, not identical with the earlier known α -monobromostrychnine. The new monobromoderivative forms white, silky, fibrous crystals, melting at 250° C.; it is easily soluble in alcohol, and in acids, with formation of salts. On further bromination it yields products having the composition of tri- and tetra-bromoderivatives of strychnine. When a solution of bromine is added to an alcoholic solution of brucine, there are formed first a white gelatinous precipitate, which gradually dissolves on further addition of bromine, and then a dark yellow precipitate; with a large excess of bromine, this yellow precipitate is not produced, but the solution becomes dark reddish-violet after standing for a few days. The gelatinous precipitate is a monobromobrucine, $C_{23}H_{25}BrN_2O_4$, not identical with that isolated by Laurent. When washed with alcohol and ether, it yields a white pulverulent substance almost insoluble in cold water and the common organic solvents. It dissolves in mineral acids with production of a cherry-red coloration. The yellow precipitate consists of a brucine tribromide, $C_{23}H_{25}N_2O_4Br_3$; when boiled with water it dissolves, forming a red solution, just as Beckurt's brucine tribromide does, but unlike the latter, it is not hygroscopic.

—A. S.

Brucine: A base isomeric with — G. Mosser. *Ges. Deutscher Naturforscher u. Aerzte*, Sept., 1909, Z. Allgem. österr. Apoth.-Ver., 1909, 47, 417—419.

WHEN cyanogen bromide is allowed to act upon brucine dissolved in chloroform, two substances are formed, one of which is soluble, the other insoluble in chloroform. The soluble substance is the hydrobromide of a base isomeric with brucine, and described as *allobrucine*, $C_{23}H_{26}N_2O_4$. The free base crystallises from alcohol and water in long crystals, containing 5 molecules of water. Allobrucine containing water of crystallisation melts at 69.5° C., then becomes solid on further heating, and again melts at 182° C. The anhydrous form becomes transparent at 126—128° C., and melts at 182° C. When boiled with water or dilute alcohol, allobrucine is more or less converted into brucine. It has $[\alpha]_D^{20} = -112.2^\circ$ to -113° in chloroform. The methiodide, $C_{23}H_{26}N_2O_4I$, melts at 265° C., and contains 11 molecules of water of crystallisation. The peroxide, $C_{23}H_{26}N_2O_6 \cdot 5H_2O$, m. pt. 182° C., is formed when allobrucine is warmed with hydrogen peroxide solution. If the peroxide is heated to 110° C., it loses oxygen and passes into allobrucine oxide, $C_{23}H_{26}N_2O_5 \cdot H_2O$, which also melts at 182° C. Brucine peroxide can be made in the same way. It crystallises with 4 molecules of water, of which two are lost on drying the substance in a vacuum. The air-dried crystals melt at 124° C., whilst the substance after drying in a vacuum melts at 191°—196° C. Sodium

ethoxide converts allobrucine into allobrucinic acid, $C_{23}H_{28}N_2O_5 \cdot 7H_2O$, which melts at 165°—166° C. This substance is not decomposed by boiling water, but is easily converted into brucine by the action of dilute acids.

—F. SUDS.

Pseudocodeine. L. Knorr, H. Butler, and H. Hörlein. *Annalen*, 1909, 368, 305—323.

PSEUDOCODEINE (this J., 1907, 66) was made by boiling α -chlorocodeide with water and acetic acid; it melts at 180°—181° C. When phosphorus pentachloride acts upon pseudocodeine, a mixture of α -chlorocodeide and pseudo-chlorocodeide is produced. The latter is an oily substance, which gives a crystalline methiodide, melting at 185—186° C., and with $[\alpha]_D^{20} = -227.4^\circ$ to -229° at 15° C. When pseudocodeine is treated with phosphorus tribromide, the same bromocodeide is produced as that obtained from codeine. ϵ -Methylmorphinethine (*loc. cit.*) crystallises from ether, and melts at 129°—130° C. It has $[\alpha]_D^{20} = -120.1^\circ$ at 15° C. in alcohol. This substance is not affected by boiling with potassium hydroxide solution. When the methiodide of ϵ -methylmorphinethine is heated under pressure with alcohol and potassium hydroxide, morphenol and trimethylamine are produced. If ϵ -methylmorphinethine is heated to 180° C. with acetic anhydride, methylacetyl-morphol and ethanoldimethylamine are produced.—F. SUDS.

Odoriferous plants and essential oils. Roure-Bertrand fils. *Chem. Zentr.*, 1909, 2, 1055—1056.

THE analytical characters of three samples of essential oil of *Schinus molle* L. of different origin are shown in the following table. Nos. 1 and 2 were from Algiers, the former being distilled from the twigs, leaves, woody parts, and fruits of the plant, and the latter from the leaves alone; No. 3 was prepared in the same way as No. 1 from plants cultivated in Grasse.

	No. 1.	No. 2.	No. 3.
Sp. gr. at 15° C.	0.8634	0.8658	0.8696
Rotatory power at 15° C.	+59° 54'	+65° 20'	+46° 13'
Solubility in 90 per cent. alcohol	1:5	1:3	turbid at 1:10
Acid value	0	0.7	2.1
Saponification value.....	5.5	4.1	10.3
Percentage of esters, as lunalyt acetate	1.9	1.2	2.8
Saponification value of acetylated oil	29.4	40.4	43.4

The oils contained pinene and phellandrene, and probably also sesquiterpenes. The Grasse oil was richest in pinene. A sample of Grasse peppermint oil examined yielded no crystals even at -17° C. From a specimen of 1907 oil having the acid value, 0.2, and containing 10.6 per cent. of combined menthol and 6.4 per cent. of menthone, there were isolated: isovaleric aldehyde, isoamyl alcohol, *l*-pinene, a hydrocarbon melting at 165°—167° C., *i*-cineol, secondary *l*-menthol, and *l*-menthone (b. pt. 208° C.; $[\alpha]_D^{20} = -26.50^\circ$).—A. S.

Pinene: Conversion of — into *sobrerol*. G. G. Henderson and W. J. S. Eastburn. *Chem. Soc. Trans.* 1909, 95, 1465—1466.

BY oxidation with aqueous mercuric acetate in the cold, Henderson and Agnew (this J., 1909, 258) obtained optically inactive *sobrerol* from a pinene which was itself almost optically inactive. Analogous experiments with two specimens of *d*-pinene from Burmese and American oil of turpentine respectively, and one of *l*-pinene from French oil of turpentine showed that in each case the *sobrerol* produced was inactive.

It is suggested that the production of *sobrerol* by oxidation with mercuric acetate may be used as a test for pinene. Tests in this manner with fractions of Russian and Swedish oil of turpentine indicated that there is a small proportion of pinene in the former, but none, or only traces, in the latter.—A. S.

Camphor; *Rapidity of volatilisation of* —. C. H. La Wall. Amer. Drugg., 1909, 55, 107—108.

LUMP camphor, exposed in a large, dust-free cupboard, lost 1.56 per cent. of its weight in 24 hours; 8.74 per cent. in 4 days; 23.46 per cent. in 14 days; 43.34 per cent. in 28 days; and 61.95 per cent. in 45 days. Powdered camphor, similarly exposed, lost 8.8 per cent. in 24 hours; 33.3 per cent. in 4 days; 83.7 per cent. in 14 days; and 99.9 per cent. in 20 days. Liniment of camphor (camphorated oil) containing the official percentage, 20 per cent. of camphor, after being exposed in an uncorked bottle at an almost constant temperature of 40° C. for 14 days, contained 19.75 per cent. of camphor; and after one month, 19.21 per cent. Another portion similarly exposed at ordinary room temperature lost less than 0.25 per cent. of camphor in a month. Spirit of camphor, when exposed in uncorked bottles gains in its camphor content, the volatilisation of the alcohol being more rapid than that of the camphor. A sample of this spirit containing 10 grms. of camphor in 100 c.c., gave 11.47 grms. in that volume after 14 days exposure, and 12.04 grms. after one month.—J. O. B.

α-Eucaine [methyl ester of benzoylmethyltetramethyl-γ-hydroxypiperidinecarboxylic acid] and *β-eucaine* [benzoylmethylacetonealkamine hydrochloride]; *Distinctive reaction for* —. *Distinction between cocaine and its substitutes*. U. Saporetti. Boll. Chim. Farm., 1909, 48, 479—482. Chem. Zentr., 1909, 2, 1015.

CONTRARY to the statement of Caudussio (this J., 1908, 1130), the author finds that with a solution of iodine in potassium iodide, *α*- and *β*-eucaine yield immediately a chestnut-brown or a dark rusty brown precipitate. With bromine water, *β*-eucaine gives a yellow precipitate which is partially dissolved on warming, and is converted into a white precipitate on boiling; *α*-eucaine gives a yellow precipitate which dissolves completely on heating; cocaine, novocaine (*p*-amino benzoyldiethylaminoethanol hydrochloride), stovaine (hydrochloride of the benzoyl ether of dimethylaminopentanol), alypine (benzoyl tetramethyldiaminoethyl dimethylethanol hydrochloride), and nirvanine (diethyl glycol-*p*-amino-*o*-hydroxybenzoic acid methyl ester hydrochloride) behave in the same way as *α*-eucaine. With a solution of potassium iodide (1:10), cocaine, *α*-eucaine, nirvanine, and stovaine yield a white precipitate, which partially dissolves on boiling; *β*-eucaine, novocaine, and alypine do not give a precipitate. With mercuric chloride solution, *α*-eucaine, novocaine, nirvanine, and alypine give a precipitate which dissolves on heating; *β*-eucaine, cocaine, and stovaine give no reaction. With sodium hydroxide solution, *α*-eucaine, stovaine, alypine, and nirvanine give a white precipitate, insoluble in excess of the reagent, even on boiling. Potassium permanganate solution is not decolorised by *β*-eucaine; with the other substances mentioned, violet-blue precipitates are first produced, which later become brown, whilst the solution is gradually decolorised.—A. S.

Astrolin [antipyrine-methylethylglycollate]. E. Winzheimer. Pharm. Zeit., 1909, 54, 660—661.

ASTROLIN is the commercial name of antipyrine methylethylglycollate, $C_8H_{10}O_3 \cdot C_7H_7O_2N_2$, m.pt. 64°—65.5° C. It is a colourless, non-hygroscopic powder, with a slight odour and a pleasant acid taste; soluble in 0.6 part of water at 20° C., in 0.5 part of absolute alcohol, in about 75 parts of ether, and sparingly soluble in light petroleum spirit. Its aqueous solution should be clear and give an acid reaction with litmus, but almost neutral with Congo red. It gives a blood-red colour with ferric chloride; with sodium nitrite a green colour is produced without the addition of acetic acid, and the mixture soon deposits green crystals. One gm. of astrolin should require 6.53 c.c. of *N*/2 sodium hydroxide solution before giving a red colour with phenolphthalein, this being equivalent to 0.3856 gm. of methylethylglycollic acid. The liquid after this titration should yield 0.61 to 0.62 gm. of antipyrine when extracted with 3 successive 15 c.c. of chloroform. The aqueous solution left after extracting the antipyrine with chloroform should give a yellow

colour with ferric chloride. On liberating the methylethylglycollic acid by means of an excess of sulphuric acid, adding sodium sulphate, and extracting with ether, the residue obtained on evaporating the ether should consist of colourless crystals, melting at 71—72° C. after drying over sulphuric acid. The aqueous solution of these gives a bulky colourless crystalline precipitate with zinc acetate.—J. O. B.

Condensation products of aldehydes with amines; *Electrochemical reduction of* —. K. Brand. Ber., 1909, 42, 3460—3462.

By the electrochemical reduction of benzylidenedianiline and its analogues in moderately alkaline solution, with a lead cathode, good yields of the corresponding secondary amines can be obtained. In the author's experiments, the cell used consisted of a glass beaker in which was an earthenware jar, which formed the anode chamber and was surrounded by a cylindrical perforated cathode of sheet lead; the anode consisted of a piece of sheet lead. A saturated solution of sodium carbonate was placed in the earthenware jar, whilst in the outer compartment was placed a hot solution of 18 grms. of benzylidenedianiline and 15 grms. of sodium acetate in 200 c.c. of alcohol and 30 c.c. of water. Electrolysis was effected at 80° C. with an E.M.F. of 6—8 volts, the current-density being 1.5—2 amperes per 100 sq. cm. From the reaction-product, the alcohol was distilled off, the residual oil boiled with 10 per cent. hydrochloric acid, the acid solution filtered from insoluble resinous matter, and benzyldianiline recovered from the filtrate either by crystallisation as the hydrochloride or by adding caustic soda and distilling. The hydrochloride melts at 214°—216° C.; the free base melts at 37°—38° C. and boils at 306°—307° C. at 759 mm. *p*-Methoxybenzyldianiline was prepared in a similar manner from *p*-methoxybenzylidenedianiline.—A. S.

Aniline derivatives; *Toxicity of certain* —. Hildebrandt. Int. Med. Congr., Aug.-Sept., 1909, Chem.-Zeit., 1909, 33, 997.

THE toxicity of the toluidines varies with the position of the methyl group. Thus *o*-toluidine causes the separation in the urine of the colouring matter of the blood, whilst dimethyl-*o*-toluidine, which is the most poisonous of all, not only has an action upon the blood, but also causes fatty degeneration of the inner organs, such as the liver. The introduction of one atom of bromine into the *p*-position does not affect the toxicity, but if two atoms of bromine are introduced into the complex, the toxic action of the compound upon the blood is entirely prevented, whilst its effect in producing fatty degeneration is reduced, though not altogether checked. Dibromodimethyl-*o*-toluidine is more poisonous than tribromoaniline. It thus appears that a most important factor in the toxicity of aniline derivatives is the presence of the methyl group in the *o*-position.—C. A. M.

Hydrazine hydrate; *Action of calcium oxide on* —. A. Staehler. Ber., 1909, 42, 3018—3019.

THE method usually employed for the preparation of anhydrous hydrazine consists in distilling hydrazine hydrate with barium oxide. On attempting to use calcium oxide in place of barium oxide, it was found that a vigorous reaction takes place on adding the calcium oxide to hydrazine hydrate. On subsequently distilling, pure anhydrous hydrazine comes over at first, and then, later, hydrazine contaminated by ammonia.—A. S.

Nitromethane; *Preparation of* —. W. Steinkopf and G. Kirchhoff. Ber., 1909, 42, 3438—3440.

THE method used now by the authors in place of the one previously described (this J., 1909, 259) consists in using as the reaction-mixture, 500 grms. of chloroacetic acid dissolved in 1 litre of water, 280—300 grms. of calcined sodium carbonate, and 300 grms. of sodium nitrite dissolved in 500 grms. of water. Only a portion of the reaction-mixture is heated at first, and when the nitromethane begins to distil over, the remainder is added drop by drop whilst distillation is proceeding. By making

the process continuous, 2 kilos. or more of chloroacetic acid can easily be converted into nitromethane in one day. For this purpose the distillation flask carries a tap-funnel for holding the reaction-mixture and is provided with a tube reaching nearly to the bottom, which can be connected with a water-pump in order to remove the spent reaction mixture as desired.—A. S.

Solubility of sparingly soluble acids; Influence of various sodium salts on the —, J. C. Philip and F. B. Garner. Chem. Soc. Trans., 1909, 95, 1466—1473.

IN a previous paper (see this J., 1905, 818) it was shown that the solubility of a sparingly soluble acid is markedly increased in presence of the sodium salt of a weak acid, the influence of the salt being greater, the weaker the acid from which it was derived. Further experiments have now been made with benzoic acid (0.0277), salicylic acid (0.0161), *m*-nitrobenzoic acid (0.0205), *o*-chlorobenzoic acid (0.0136), 3,5-dinitrobenzoic acid (0.0062), and 2,4-dinitrophenol (0.0027), in presence of the sodium salts of acetic, formic, monochloroacetic, and succinic acids, and potassium formate. The figures given in parentheses represent the concentrations of the saturated aqueous solutions of the acids at 25° C. in grm.-mols. per litre. The results obtained confirm the statement made above, and show also that if, of two sparingly soluble acids, the weaker is also the more soluble, then the solubility of the stronger acid is increased to a greater degree than that of the weaker one by the presence of a sodium salt. If the difference in solubility of two such acids in water be not too great, then the curves representing the solubility in presence of different quantities of a sodium salt will intersect. For example, in water benzoic acid is more soluble than salicylic acid, but in sodium formate solutions of a greater concentration than 0.06 *N*, salicylic acid is more soluble than benzoic acid.—A. S.

Anhydrides of aromatic sulphonic acids. H. Meyer. Ges. Deutscher Naturforscher u. Aerzte, Sept., 1909. Chem.-Zeit., 1909, 33, 1936—1937.

THE production of aromatic acyl chlorides by the action of phosphorus pentachloride on the alkali salts of sulphonic acids has in some cases failed. The author has found that in all such cases, where the alkali salts are attacked either not at all or only with difficulty, the free sulphonic acids readily interact with phosphorus pentachloride. A similar condition of things has been observed with respect to the interaction of aromatic sulphonic acids and thionyl chloride. In general, a sulphonic acid that reacts readily with thionyl chloride yields the corresponding acyl chloride, whilst an alkali sulphonate yields the anhydride of the sulphonic acid, more or less contaminated by the acyl chloride. Sulphonic acids, which in the form of their alkali salts, react only with difficulty with thionyl chloride, yield when used in the free state, the corresponding anhydrides, usually immediately and in a pure condition. The anhydrides can be converted into the acyl chlorides by further treatment with phosphorus pentachloride or thionyl chloride. The anhydrides of aromatic sulphonic acids are colourless and odourless, well crystallised compounds, of considerable stability against water and weak alkalis, and soluble with difficulty in organic solvents. Incidentally the author points out that the efficacy of aluminium chloride as a condensing agent is increased by addition of some ferric chloride.—A. S.

Mercurous sulphate for standard cells [and crystallised cadomil]. Fox. See XI.A.

Determining arsenic in organic compounds. Little and others. See XXIII. Org. Quant.

PATENTS.

Aminoacyldipyrrocatechins; Manufacture of — and of intermediate products for use therein. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,143, Oct. 30, 1908.

THE *N*-phthaliminoacyldipyrrocatecholdialkyl ethers, described in Ger. Pat. 209,962 of 1908 (this J., 1909, 675), are

converted by saponification into the corresponding aminoacyldipyrrocatechols. The preparation of α - and β -*N*-aminopropionylcatechols is described.—T. F. B.

Tubercle or murrain bacilli; Process for obtaining active preparations from —. Kalle und Co. Ger. Pat. 213,393, July 10, 1908.

TUBERCLE or murrain bacilli are cultivated for about six weeks on bouillon, then separated from the culture liquid by filtration, dried, and triturated with a few drops of glycerin and a few c.c. of a solution of sodium chloride and phenol to a very fine emulsion. The latter is mixed with the filtered culture liquid, and allowed to stand for some time, with frequent agitation. After again filtering, the solution is said to contain nearly the whole of the active constituents of the bacilli and their transformation products.—A. S.

*Alkyl derivatives of substituted *p*-aminophenols; Process for preparing —.* Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 213,592, Nov. 30, 1907. Addition to Ger. Pat. 211,869, Oct. 12, 1906. (See Fr. Pat. 382,367 of 1907; this J., 1908, 246).

SUBSTITUTION products of *p*-aminophenol (substituted in the benzene nucleus) are condensed with aromatic aldehydes, and the products are reduced by means of zinc and alkali. *p*-Benzylamino-*m*-chlorophenol and *p*-benzylamino-*m*-cresol are described. The products are suitable for photographic and other purposes.—T. F. B.

Convallaria majalis; Process for obtaining from — a stable preparation containing the therapeutically active constituents of the drug in their original proportions, and free from inactive and injurious substances. Knoll und Co. Ger. Pat. 213,630, Aug. 25, 1908.

THE alcoholic extract of *Convallaria majalis* (lily of the valley), if desired, after concentration *in vacuo*, is treated with ether so long as a precipitate is produced, then filtered, concentrated *in vacuo*, and after addition of lactose or other suitable substance, dried so as to obtain a yellow powder, which dissolves easily in dilute alkalis, but is not completely soluble in water and dilute acids.—A. S.

Silver compounds containing organically combined silver; Process for preparing stable, soluble —. A. Busch. Ger. Pat. 213,712, March 3, 1908. Addition to Ger. Pat. 193,740, Dec. 13, 1906.

HEXAMETHYLENETETRAMINE-SILVER nitrate or carbonate is dissolved in a solution of a peptone or of a mixture of an albumose and a peptone, and the double silver compound precipitated as in the original patent (this J., 1908, 645. See also Ger. Pat. 209,345; this J., 1909, 626).—T. F. B.

Indole; Process for preparing —. R. A. Weerman. Ger. Pat. 213,713, July 18, 1908.

IF the amide of *o*-nitrocinnamic acid is heated with an alkali hypochlorite and an alcohol (preferably methyl alcohol), it is converted into the alkyl ester of *o*-nitrostyrylaminoformic acid, $\text{NO}_2\text{C}_6\text{H}_4\text{CH}:\text{CH}.\text{NH}.\text{COOR}$. This is reduced to the corresponding amino-compound, preferably by means of iron powder and dilute acetic acid, and the reduction product is treated with alkali, when ammonia and the alcohol are eliminated, and indole is formed.—T. F. B.

Salicylosalicylic acid; Process for preparing a crystallised —. C. F. Boehringer und Soehne. Ger. Pat. 214,044, April 9, 1908. Addition to Ger. Pat. 211,403, May 24, 1907.

THE crystalline salicylosalicylic acid described in the principal patent (Eng. Pat. 11,457 of 1908; this J., 1909, 382) is readily obtained by the action of salicylic acid on the products obtained by treating salicylic acid with acid condensing agents, such as phosphorus trichloride, pentoxide, or pentachloride, or thionyl chloride.—T. F. B.

Albumose; Process for the preparation of —. P. Runge.
Ger. Pat. 214,209, Sept. 26, 1908.

CASEIN is hydrolysed in the usual manner with a solution of an alkali, an alkaline-earth, or an alkali sulphide, and the alkaline albumose solution is treated with one of the higher fatty acids, preferably palmitic, stearic, oleic, or linolic acid. The resulting mixture of albumose and soap is dried, and the soap removed by extraction with alcohol or other suitable solvent.—A. S.

Ethoxyphenylamidomethane sulphonate. R. Lepetit, Assignor to Lepetit, Dollfus, and Gansser, Milan, Italy.
U.S. Pat. 934,554, Sept. 21, 1909.

SEE Eng. Pat. 21,389 of 1908; this J., 1909, 490.—T. F. B.

Chlor-acetic acid; Process of obtaining —. G. Imbert, Nuremberg, Germany. U.S. Pat. 935,606, Sept. 28, 1909.

SEE Eng. Pat. 5013 of 1907; this J., 1907, 637.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Screens for use in colour photography; Manufacture of —. L. Dufay, Chantilly, France. Eng. Pat. 18,744, Sept. 7, 1908. Addition to Eng. Pat. 11,698 of 1908, dated June 4, 1907. Under Int. Conv., May 26, 1908.

SCREENS similar to those described in the principal patent (this J., 1909, 383) are obtained by mechanically applying a greasy resist to a fraction (two-thirds for a three-colour screen) of the surface of a gelatin film, dyeing the part uncovered, and covering the whole with a varnish, the resinous base of which is insoluble in a solvent of the greasy resist, and the solvent of which does not dissolve the resist. The greasy material is now removed, together with the varnish which covers it, thus leaving one-third of the surface coloured and coated with varnish. The process is repeated for the second coloration (or all but the last, if there be more than three), and the free spaces are coloured with the last colour, when the varnish is removed. When these screens are used for making coloured prints, they may be reduced in intensity, if necessary, by removing a portion of the thickness of the layer, either by mechanical or by chemical means.—T. F. B.

Photographic developers. W. F. C. Kelly and J. A. Bentham, London. U.S. Pats. 935,115 and 935,156, Sept. 28, 1909.

SEE Eng. Pat. 3164 of 1905; this J., 1906, 560.—T. F. B.

Aralkyl derivatives of substituted p-aminophenols. Ger. Pat. 213,592. See XX.

XXII.—EXPLOSIVES, MATCHES, &c.

Silver cyanamide. Ellis. See XV.

PATENTS.

Explosive. O. F. von Schroetter, Kruppamühle, Germany. U.S. Pat. 934,020, Sept. 14, 1909.

SEE Eng. Pat. 8156 of 1907; this J., 1907, 893.—T. F. B.

Explosives; Device for detecting decomposition of —. E. Bouchaud-Praceiq, Paris. U.S. Pat. 934,509, Sept. 21, 1909.

SEE Addition of May 4, 1908, to Fr. Pat. 388,142 of 1907; this J., 1909, 1007.—T. F. B.

Recovery of alcohol and ether lost in the air during the manufacture of powder. Fr. Pat. 401,182. See I.

Recovery of solvents of nitrocellulose. Fr. Pat. 401,262. See V.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

PATENT.

Gas-burettes for gas analysis; Device for filling and emptying —. C. Hohmann, Ger. Pat. 212,338, July 29, 1907.

A GAS-ANALYSIS apparatus in which, by means of a connected series of siphons and overflows, with mercury seals, the use of cocks and of movable levelling vessels is dispensed with.—A. S.

INORGANIC—QUANTITATIVE.

Phosphoric acid; Determination of — in acid solution by means of alkaline molybdate solution and glue. A. Grete, Ber., 1909, 42, 3106—3115.

THE volumetric method described by the author in 1888 (this J., 1888, 771) has been thoroughly tested in practice, over 100,000 analyses having been performed with it; and since 20 determinations can be carried through in one hour, with results equal in accuracy to those obtained by the gravimetric process, a description of the modified manner in which it is performed is now given. Instead of the nitric acid solution of molybdic acid, a solution rendered faintly ammoniacal is used; this is quite stable, and does not attack rubber tubing. The solutions used are prepared as follows:—(No. 1). 500—600 c.c. of glue solution (see under No. 2) and 1 litre of nitric acid are mixed, with constant agitation with a concentrated solution of 400 grms. of molybdic acid in ammonia solution till the precipitate produced no longer re-dissolves; after standing for one day, with frequent agitation, the solution is filtered, rendered faintly ammoniacal, and standardised against a solution of monopotassium phosphate so that 1 c.c. is equivalent to 0.0025 gm. of phosphoric anhydride. (No. 2). 1 kilo. of fish glue is dissolved in water to which 250 c.c. of nitric acid have been added, and boiled for $\frac{1}{2}$ hour; after cooling, the solution is made strongly ammoniacal, any phosphoric acid present precipitated with magnesia mixture, and after addition of about 50 c.c. of ammonium carbonate solution, the whole is diluted to 10 litres; when required for use, the necessary quantity of the solution is filtered and acidulated with nitric acid. (No. 3). 10 kilos. of ammonium nitrate and 8.5 litres of nitric acid are dissolved in about 25 litres of water, the solution is made up to 50 litres, and standardised so that 10 c.c. are equivalent to 64.8 c.c. of $N/4$ baryta. The solution of the phosphate to be titrated must be as free as possible from hydrochloric acid and from organic matter. It is first neutralised with ammonia in presence of methyl orange and then rendered faintly acid with nitric acid. Solutions containing less than about 4 per cent. of phosphoric anhydride should be mixed with 25 c.c. of a phosphoric acid solution of known concentration before carrying out the determination. A measured quantity of the faintly acid phosphate solution (25 c.c., containing 0.5 gm. of substance) is treated with 100 c.c. of the acid ammonium nitrate solution (No. 3), heated to boiling, and the molybdic acid solution (No. 1) run in slowly from a burette until a precipitate is produced, which on boiling the solution and shaking, rapidly settles. The titration, boiling and allowing to settle are continued until only a faint reaction is observed. Then 5—6 c.c. of the glue solution (No. 2) are added, the mixture boiled and allowed to settle, and the titration continued as before, only 3 drops of the molybdic acid solution being introduced each time. When after repeatedly boiling and allowing to settle in this way, the 3 drops of molybdic acid solution produce no precipitate, the volume consumed is read off, 2.6 c.c. are deducted (0.1 c.c. for the final 3 drops and 2.5 c.c. for the 100 c.c. of acid ammonium nitrate solution used), and the remainder divided by 2 gives the percentage of phosphoric anhydride in 0.5 gm. of the original substance.—A. S.

Diazotisation of weakly basic, sparingly soluble, primary amines, and some reactions connected therewith. Witt. See IV.

Examination of plaster of Paris. Frey. See IX.

Determination of tantalum and niobium, and their separation from silica in minerals, steel, and alloys. Von John. See X.

ORGANIC—QUALITATIVE.

Detecting tallow in butter. Ostrogovich and Petrisor. See XII.

Distinctive reaction for α - and β -cucaine. Distinction between cocaine and its substitutes. Saporetto. See XX.

ORGANIC—QUANTITATIVE.

Arsenic in organic compounds; Determination of —. H. F. V. Little, E. Cahen, and G. T. Morgan. Chem. Soc. Trans., 1909, 95, 1477—1482.

THE process found most satisfactory by the authors is a combination of Pringsheim's method of oxidation with sodium peroxide (this J., 1901, 504) and Gooch and Browning's volumetric method (Amer. J. Science, 1890, [iii.], 11, 66). 0.2—0.3 gm. of the finely-powdered substance is mixed in a nickel crucible with 10—15 grms. of sodium carbonate and sodium peroxide in equal proportions, a portion of these reagents being spread over the mixture. After heating gently for about 15 mins., the fusion is completed by heating to dull redness for 5 mins. The contents of the crucible are extracted with water and raised into a 450 c.c. conical flask, treated with 25—31 c.c. of sulphuric acid (1:1), and the volume reduced to 100 c.c. by boiling. One gm. of potassium iodide is now added and the liquid further concentrated to 40 c.c. After removing the last traces of iodine by means of a few drops of dilute sulphurous acid, the green solution is diluted with hot water and saturated with hydrogen sulphide. The arsenious sulphide is collected, washed, dissolved in 20 c.c. of N/2 sodium hydroxide and treated with 30 c.c. of hydrogen peroxide (20 vols.), the excess of the latter being destroyed by heating. A few drops of phenolphthalein are now added, followed by 11 c.c. of sulphuric acid (1:1) and 1 gm. of potassium iodide. The solution is concentrated to 40 c.c., decolorised with a few drops of dilute sulphurous acid, diluted with cold water, neutralised with 2N-sodium hydroxide, and slightly acidulated with sulphuric acid. An 11 per cent. solution of sodium phosphate (compare Washburn, J. Amer. Chem. Soc., 1908, 30, 31) is then added, and the arsenic solution titrated with iodine and starch in the usual way. The volume of sodium phosphate solution added should be about equal to that of N/10 iodine required in the titration. Compounds containing little or no oxygen require a proportionately larger quantity of sodium peroxide for oxidation. When the arsenic compound contains iodine, sodium iodate is formed on oxidation, and sufficient sulphurous acid must be added to the acidified extract to reduce this salt to iodide. The results are given of determinations by this method the arsenic in atoxyl (sodium *p*-aminophenylarsinate), hexamethyltriaminotriphenylarsine, dicamphorylarsinic acid, *p*-tolylarsinic acid, sodium tetraiodoacetylarsinate, triaminotriphenylarsine oxide, phenyltriaminotriphenylarsine, toluene-*p*-sulphonyl-*p*-aminophenylarsinic acid, *bis*-2-aminotolyl-5-arsinic acid, *bis*-*p*-acetylaminophenylarsinic acid, monosodium 4-hydroxy-2'-benzenazotoluene-5'-arsinate, and sodium 2-hydroxytolyl-5-arsinate.—A. S.

Phosphorus in organic substances; Determination of — by means of the bomb calorimeter. P. Lemoult. Comptes rend., 1909, 149, 511—513.

THE phosphorus in such substances as triethylphosphine, aniline phosphite, &c., may be determined by burning the substance in a bomb calorimeter provided that the substance be placed in a porcelain capsule coated on its interior with a layer of fused potassium nitrate; the nitrate ensures complete oxidation of the phosphorus and carbon. If plain capsules be used, a black deposit

containing phosphorus is usually found on the walls of the capsule. The phosphoric acid formed by the combustion dissolves in the water placed at the bottom of the bomb, and its quantity is then determined by precipitation as ammonium-magnesium phosphate.—W. P. S.

Tarpetin oil and its substitutes. Marcusson. See XIII.B.

Two-bath chrome tannages and their analytical control. Bennett. See XIV.

Examination of Zenthen's method [of washing hide powder]. Paessler. See XIV.

Silver cyanamide [and determination of cyanamide in commercial products]. Ellis. See XV.

Volumetric determination of casein in milk. Hart. See XVIII.A.

Cholesterol content of eggs as basis for valuation of pastry. Cappenberg. See XVIII.A.

Books Received.

METALLOGRAPHIE. Ein ausführliches Lehr- und Handbuch der Konstitution und der physikalischen, chemischen und technischen Eigenschaften der Metalle und metallischen Legierungen. von Dr. W. GUERTLER. Erster Band: DIE KONSTITUTION. Heft I. Verlag von Gebrüder Bornträger, Berlin, S.W.11, Grossbeeren-Strasse 9. 1909. Price 4 M. 20 Pf.

LARGE 8vo volume, containing 80 pages of subject-matter, with 23 illustrations and 2 tables. The matter is classified as follows:—I. Introduction, with definition of metallography; the history of the latter. Alloys and their limits; etc. II. Constitution as dependent on temperature. III. Solid solutions and compounds. IV. Diagrams as to condition and composition.

DIE METHODEN ZUR HERSTELLUNG KOLLOIDER LÖSUNGEN ANORGANISCHER STOFFE. Ein Hand- und Hilfsbuch für die Chemie und Industrie der Kolloide. von Dr. THE SVEBERG. Theodor Steinkopff's Verlag. Dresden. 1909. Price M. 16; (bound), M. 18.

8vo volume, containing 499 pages of subject-matter, with 60 illustrations, numerous lesser tables, and three large tables. There are indexes both of names of authors, and of subjects. The subject-matter receives the following arrangement in groups and chapters:—I. METHODS OF CONDENSATION. (i.), Reduction; (ii.), Oxidation; (iii.), Hydrolysis, etc. II. METHODS OF DISPERSION. (i.), Mechanico-chemical, including (a), The washing-out methods, and (b), The peptising methods. III. METHODS OF ELECTRIC DISPERSION.

THE MANUFACTURE OF LEATHER. By HUGH GARNER BENNETT, M.Sc., Demonstrator and Assistant Lecturer in the Leather Industries Department of the University of Leeds. Constable and Constable, Ltd., London. 1908. Price 16s. net.

8vo volume, containing 408 pages of subject-matter, with 109 illustrations, numerous tables, and an alphabetical index of subjects. The subject-matter is classified according to the following scheme:—I. Historical, and introductory outline. II. The nature of skin. III. Fermentation. IV. Hides and skins. V. Water. VI. Soaking. VII. Unhairing. VIII. De-liming. IX. Tanning. X. Vegetable tanning materials. XI. Analysis of tanning materials. XII. Preparation of the tanning liquors. XIII. The principles of vegetable tanning. XIV. The tannage of sole leather. XV. The tannage of belting, harness, and upper leather, etc. XVI. Tannage of moroccos and light leathers. XVII. Tannage of chrome leather. XVIII. Alum and combination tannages. XIX. Fat, oil and aldehyde tannages. XX. The drying of leather. XXI. The finishing of sole leather. XXII. The currying and finishing of dressing leather. XXIII.

Leather dyeing. XXIV. The finishing of light leathers. XXV. Finishing of chrome leather. XXVI. Finishing of the alum- and combination-tanned leathers. XXVII. Finishing of fat- and oil-tanned leathers. XXVIII. Janned and enamelled leathers. XXIX. The dressing of wool rugs. XXX. The analysis of leather.

SYSTEMATIC QUALITATIVE ANALYSIS FOR STUDENTS OF INORGANIC CHEMISTRY. By R. M. CAVEN, D.Sc., Lecturer, etc., in Chemistry, University College, Nottingham. Blackie and Son, Limited, 50, Old Bailey, London, E.C. Also Glasgow, Dublin, and Bombay, 1909. Price 3s. 6d. net.

SMALL 8vo volume, containing 238 pages of subject-matter, one chart, and an enclosed analytical scheme covering two large sheets. The system adopted is as follows:—I. METHODS OF ANALYSIS. (a), Preliminary examination by dry reactions. (b), Systematic examination for basic and acidic radicles. II. REACTIONS OF THE METALLIC RADICLES. III. THE PROCESS OF ANALYSIS. (a), Preliminary examination by dry reactions. (b), Examination for acidic radicles which give volatile products with acids, and for ammonia. (c), Systematic examination for basic radicles in solution. (d), Examination for acidic radicles in solution.

PRACTICAL CHEMISTRY FOR PUBLIC SCHOOLS. By A. BERESFORD RYLEY, M.A. (Oxon.). J. and A. Churchill, 7, Great Marlborough Street, London. 1909. Price 4s. 6d. net.

8vo volume, containing 156 pages of subject-matter, interleaved with blank pages for notes, etc.; also a few illustrations. The arrangement of the text is as follows:—I. Introduction, with general physical and chemical reactions and tests, etc. II. Non-metallic elements. III. Acidimetry and alkalimetry. IV. Compounds of nitrogen. V. Equivalent and atomic weights, etc. VI. Proof of laws of constant and multiple proportions. VII. Sulphur, its allotropic forms, and its compounds. VIII. Phosphorus; allotropic forms, etc. Phosphine. Orthophosphoric acid. IX. Carbon; allotropic forms. Compounds. Coal gas. Flame. Causes modifying luminosity of flame. X. Halogen elements, and their compounds. XI. Simple qualitative analysis.

CHEMISTRY. Part II. Inorganic and Organic. (Catechism series.) New edition. Revised and enlarged. E. and S. Livingstone, 15, Teviot Place, Edinburgh. Price 1s. net.

SMALL 8vo volume, containing 73 pages of matter arranged in catechism form, followed by an alphabetical index.

Lo ZINCO. Di Prof. R. MUO-BOY. U. Hoepli, Milan, Italy. 1909. Price, Lire 3-50.

SMALL 8vo volume, containing 219 pages of subject-matter, with 10 illustrations and 4 inset plates. The subject-matter is classified as follows:—PART I. (1). Historical. (2). Properties of zinc. (3). Zinc ores. (4). Analysis of ores. (5). Determination of zinc in its ores. (6). Geological. PART II. (1). Metallurgy of zinc. (2). Calcination of calamine. (3). Roasting of blende. (4). Grinding of zinc ores. (5). Mechanical concentration of zinc ores. (6). Reduction of zinc ores. (7). Production of zinc by electrolysis. (8). Accessory operations to the metallurgy of zinc. (9). Thermo-electric treatment of zinc ores. (10). Alloys of zinc. (11). Analysis of zinc alloys. PART III. Zinc mining. PART IV. (1). Applications of zinc and its compounds. (2). Sheet zinc. PART V. (1). Economic conditions. (2). Production in recent years. Appendix. Manufacture of zinc white.

METALLOGRAFIA APPLICATA AI PRODOTTI SIDERURGICI. Di U. SAVOIA. U. Hoepli, Milan, Italy. 1909. Price, Lire 3-50.

SMALL 8vo volume containing 205 pages of subject-matter, with 94 illustrations, 85 of which are microphotographs. The text is divided as follows:—I. Historical. II. Preparation of specimens. III. The microscope. IV. Metallographic examination. V. Iron and its alloys. VI. Constituents of iron-carbon alloys. VII. Equilibrium-

diagram of iron-carbon alloys. VIII. Micro-structure of irons. IX. Micro-structure of steels. X. Carbon steels. XI. Ternary steels. XII. Quaternary steels. XIII. Cast iron. XIV. Malleable cast iron. XV. Study of a steel tempered only in one part. Bibliographies are appended to nearly all of the chapters.

CENSUS OF PRODUCTION (1907). Preliminary Tables, summarising the Results of the Returns received under the Census of Production Act, 1906. Part I. Wyman and Sons, Fetter Lane, E.C. [Cd. 4896.] Price 4d.

This return contains particulars relating to (1) Mines under the Coal Mines Regulation Acts (including coke and shale oil works in connection with mines); (2) Cotton factories; (3) Woollen and worsted factories; (4) Tin-plate factories; (5) Iron and steel factories (smelting, foundry, and rolling).

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 21,999. Ramsay and others. *See under X.*
- 22,163. Hodgkinson. Apparatus for evaporating brine or other solutions. [Comprised in No. 26,068 of 1908.] Sept. 29.
- 22,604. Gilmore. Drying apparatus. [U.S. Appl., Oct. 5, 1908.]* Oct. 4.
- 22,728. Ogle. Separating materials of different specific gravity. Oct. 5.
- 22,764. Armour. Electrical pyrometers. Oct. 6.
- 22,859. Barnes and others. Kilns. Oct. 7.
- 23,038. Töpfer. *See under XVIII.A.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 20,921 (1908). Nobel and Bessonoff. Regenerating and utilising the latent heat of vaporisation of liquids. Oct. 13.
- 21,176 (1908). Bowden. Heat-insulation of pipes. Oct. 6.
- 22,738 (1908). Diederichs. *See under V.*

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 22,219. Bedford and Williams. Catalytic synthesis of methane. Sept. 29.
- 22,290. Richards and Pringle. Apparatus for distilling coal and recovering the products. Sept. 30.
- 22,514. Wyld and Green. *See under VII.*
- 22,609. Sanders. Production of fuel. Oct. 4.
- 22,628. Schramm. *See under XIII.A.*
- 22,703. Bloxam (Sparlicht Ges.). Mantles for incandescent gas lamps.* Oct. 5.

COMPLETE SPECIFICATIONS ACCEPTED.

- 6966 (1908). Moore and Crombie. Plant for treating fuel and recovering and separating by-products. Oct. 13.
- 20,920 (1908). Burkholder. Purifying gases generated by dry distillation and obtaining by-products. Oct. 13.
- 174 (1909). Mayer and Fehlmann. Removing carbon bisulphide from gases, especially coal gas. Oct. 6.

- 3171 (1909). Lubeck and Payet. Catalytic material for automatic ignition of illuminating gas. Oct. 6.
6163 (1909). Morris. Manufacture of artificial fuel. Oct. 13.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

- 22,398. Newton (Bayer and Co.). Production of salts of *m*-aminobenzaldehyde; also the anhydro-compound of *o*-aminobenzaldehyde. Oct. 1.

COMPLETE SPECIFICATIONS ACCEPTED.

- 8768 (1909). Finlay. Manufacture of paraffin wax for candles and other purposes. Oct. 6.

IV. COLOURING MATTERS AND DYE STUFFS.

APPLICATIONS.

- 22,200. Kalle and Co. Manufacture of pure nitro-*o*-oxyazo dyestuffs. [Ger. Appl., Jan. 2, 1909.]* Sept. 29.
22,555. Newton (Bayer and Co.). Manufacture of new dyes. Oct. 4.
22,714. Johnson (Badische Anilin und Soda Fabrik). Manufacture of halogen derivatives of the indigo series. Oct. 5.

COMPLETE SPECIFICATIONS ACCEPTED.

- 24,600 (1908). Newton (Bayer and Co.). Manufacture of an azo dyestuff. Oct. 13.
1816 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. Oct. 13.
2373 (1909). Newton (Bayer and Co.). Manufacture of anthracene derivatives. Oct. 6.
6728 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of yellow monoazo dyestuffs. Oct. 6.
10,187 (1909). Cassella and Co. Manufacture of red chromable dyestuffs. Oct. 6.
11,354 (1909). Act.-Ges. f. Anilinfabr. Manufacture of blue substantive dyestuffs. Oct. 13.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

- 21,952. Hahn. Skein-yarn mercersing machine.* Sept. 27.
22,111. Ketcheson. Treatment of fibrous or cellulose materials.* Sept. 28.
22,129. Blake and Blake. Treating fabrics for producing wall, roof, and similar coatings. Sept. 28.
22,343. Scott. Printing on cotton or other fabrics.* Oct. 1.
22,413. Ellis (Le Crinoid). Alkaline precipitating baths for cellulose threads. Oct. 1.
22,615. Mayo. Extraction of grease and similar matter from, and treating wool, skins, textiles, &c. Oct. 4.
22,986. Platt, and Times Coloured Spinning Co., Ltd. Apparatus for dyeing and similarly treating textile material.* Oct. 8.

COMPLETE SPECIFICATIONS ACCEPTED.

- 16,429 (1908). Gantt. Bleaching and otherwise treating fabrics with liquids. Oct. 13.
20,173 (1908). Raw and Orr. Treatment of ramie, china grass, and other fibrous substances. Oct. 6.
20,316 (1908). Draper. Manufacture of artificial fibres and the like from cellulose. Oct. 6.

- 24,191 (1908). Ellis (Le Crinoid Soc. Anon.). Manufacture of artificial hair or silky threads. Oct. 13.
21,621 (1908). Balmie and Ashton. Machines for dyeing, bleaching, and washing textile fabrics, &c. Oct. 13.
22,738 (1908). Diederichs. Apparatus for treating textile materials and for mixing liquids with chemicals, &c. Oct. 6.
5575 (1909). Maly. Dyeing woollen yarn on bobbins. Oct. 13.
5859 (1909). Vandatte and Lagye. Electrically removing grease and yolk from wool. Oct. 13.
14,760 (1909). Farjas and Jaboin. Radiferous fibres. Oct. 13.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

- 22,019. Justice (Cons. f. Elektrochem. Ind.). Production of hydrogen peroxide.* Sept. 27.
22,034. Jaubert. Preparation of oxygen. [Fr. Appl., Nov. 26, 1908.]* Sept. 27.
22,037. Pauling. Production of nitrous gases.* Sept. 27.
22,163. Hodgkinson. *See under I.*
22,316. Soc. l'Air Liquide. Separation of rare gases from the atmosphere. [Fr. Appl., Oct. 3, 1908.]* Sept. 30.
22,384. Wetter (Vogel). Antimony compounds.* Oct. 1.
22,514. Wyld and Green. Utilising sulphuretted oxide of gas-works in making sulphuric acid. Oct. 4.
22,585. Hewitt. *See under VIII.*
22,672. Messel. Manufacture of sulphur dioxide, sulphuric anhydride, and sulphuric acid. Oct. 5.
23,107. Jänecke. Continuous production of liquid air and its separation into its constituents.* Oct. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

- 20,787 (1908). Lévy. *See under XI.*
21,479 (1908) and 7849 (1909). Clark (Dellwik-Fleischer Wassergas-Ges.). Production of hydrogen. Oct. 6.
2192 (1909). Schillot and Mauchaire. Apparatus for making dilute sulphuric acid. Oct. 13.
25,23 (1909). Johnson (Chem. Fabr. Griesheim-Elektron). Removing carbon monoxide from gases and replacing it by hydrogen. Oct. 6.
3188 (1909). Johnson (Chem. Fabr. Griesheim-Elektron). Preparation of pure hydrogen. Oct. 6.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

- 22,041. Sievert. Manufacture of hollow glass bodies. [Ger. Appl., Jan. 23, 1909.]* Sept. 27.
22,585. Hewitt. Drying and burning or calcining slip, slurry, chalk, clay, limestone, &c. Oct. 4.
22,603. Hopper. Enamelling.* Oct. 4.
22,870. Goodwin. Frit kilns. Oct. 7.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

- 22,118. Cowper-Coles. Manufacture of bricks for furnaces. Sept. 28.
22,585. Hewitt. *See under VIII.*
22,839. Platten and Thompson. Manufacture of artificial stone, marble, granite, &c. Oct. 6.

COMPLETE SPECIFICATIONS ACCEPTED.

- 9147 (1909). Cie. Indus. des Alcools de l'Ardèche. Manufacture of absorbent products from sawdust or similar material. Oct. 13.
9381 (1909). Haddan (Meramec Portland Cement and Material Co.). Manufacture of waterproof Portland cement. Oct. 13.

X.—METALS AND METALLURGY.

APPLICATIONS.

- 21,999. Ramsay and others. Preventing corrosion of iron and steel water mains, tanks, &c. Sept. 27.
 22,047. Gebhard and Gebhard. Flux for soldering aluminium and its alloys. Sept. 28.
 22,088. Wheatley. Red-coloured alloy. Sept. 28.
 22,140. Robertson (Robertson). Extraction of tin and like metals from ores and slags. Sept. 29.
 22,201. Talbot. Manufacture of iron and steel. Sept. 29.
 22,394. Talbot. Converters or vessels for refining iron and steel. Oct. 1.
 22,426. Kelly. Manufacture of alloys. Oct. 1.
 22,445. South Staffordshire Mond Gas Co., and Parker. Oxidation of iron and steel surfaces. Oct. 2.
 22,472. London Electron Works Co., and Kardos. Detinning scrap tin or like materials. Oct. 2.
 22,743. Coslett Anti-Rust Synd., Ltd., and Coslett. Treating iron or steel to prevent oxidation or rusting. Oct. 5.
 22,812. Reynolds. Manufacture of steel. Oct. 6.
 22,902. Dichl and Faber. Winning iron low in sulphur. Oct. 7.
 22,928. Richardson. Manufacture of steel. Oct. 7.
 23,108. Ramen and Beskow. Roasting ores.* Oct. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

- 13,366 (1908). Whitcombe and Cox. Apparatus for separating or grading metals, ores, &c., in wet recovery processes. Oct. 6.
 26,851 (1908). Schumacher. Process of briquetting ores. Oct. 6.
 28,260 (1908). Kostileff. Casting steel ingots. Oct. 6.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

- 22,374. Cowper-Coles. Electrodeposition of metals. Oct. 1.
 22,715. Johnson (Badische Anilin und Soda Fabrik). Electrodes and their use in producing stable electric arcs. Oct. 5.
 22,827. Podszus. Electric vapourising apparatus. [Ger. Appl., Oct. 7, 1908.]* Oct. 6.

COMPLETE SPECIFICATION ACCEPTED.

- 20,787 (1908). Lévy. Electrolytic decomposition of sodium and other chlorides in manufacture of caustic soda, &c. Oct. 6.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

- 22,401. Barringer. Clarifying oils. Oct. 1.
 23,013. Böhme and Wolf. Production of a solid hydrocarbon soap. [Ger. Appl., May 13, 1909.]* Oct. 8.
 23,111. Weyner. Cosmetic soap.* Oct. 9.

COMPLETE SPECIFICATION ACCEPTED.

- 23,210 (1909). Prusz. Cleansing compound. Oct. 6.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(A).—PIGMENTS, PAINTS.

APPLICATIONS.

- 22,628. Schramm. Manufacture of lamp-black. Oct. 5.
 23,010. Newton (Bayer and Co.). Preserving preparations. [Addition to No. 10,973 of 1909.] Oct. 8.

(B).—RESINS, VARNISHES.

APPLICATION.

- 22,118. Freymuth. Treatment of lac. Sept. 29.

COMPLETE SPECIFICATION ACCEPTED.

- 20,529 (1908) and 6917 (1909). Johnson. Purifying or refining gums, resins, and balsams. Oct. 6.

(C).—INDIA-RUBBER.

APPLICATIONS.

- 22,222. Van Oosterzee. Regenerating old rubber. [Belg. Appl., Sept. 30, 1908.]* Sept. 29.
 22,606 and 22,607. Scholz. Obtaining pure caoutchouc, gutta, balata, &c.* Oct. 4.
 23,110. Meyer. Devulcanising and reclaiming rubber waste.* Oct. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

- 20,302 (1908). Gare. Manufacture of rubber articles. Oct. 6.
 23,264 (1908). Marks (Schaar). Manufacture of an elastic composition. Oct. 6.
 23,627 and 26,643 (1908). Hutchinson and Milne. Reclaiming and re-manufacturing vulcanised rubber. Oct. 13.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

- 22,004. Ostberg. Manufacture of a substitute for leather-board.* Sept. 27.
 22,588. Miller. Treatment of leather. Oct. 4.
 22,615. Mayo. *See under V.*

COMPLETE SPECIFICATION ACCEPTED.

- 1865 (1909). Lehmann. Preparation of colourless glue. Oct. 13.

XV.—MANURES, &c.

COMPLETE SPECIFICATION ACCEPTED.

- 15,093 (1909). Thompson (Van der Kolk). *See under XVI.*

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATIONS.

- 22,455. Fielding. Production of dextrin. British gums, &c. Oct. 2.
 22,655. Moore. Treatment of cassava and the like.* Oct. 5.

COMPLETE SPECIFICATIONS ACCEPTED.

- 18,493 (1908). Mertens and Co., and others. Making insoluble in water the root substances of various kinds of amorphophallus. Oct. 13.
 20,484 (1908). Hervey. Manufacture of dextrin, gum, starch, &c. Oct. 6.
 20,529 (1908). Johnson. *See under XIVB.*
 15,093 (1909). Thompson (Van der Kolk). Utilising waste substances in sugar cane plantations and manufacture of manure. Oct. 13.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

- 22,092. Le Petit. Manufacture of fermenting liquids. Sept. 28.
 22,093. Le Petit. Manufacture of temperance beer. Sept. 28.
 22,259. Kuhn. Manufacture of beverages. Sept. 30.
 23,012. Pearson. Treatment of spirit to remove deleterious oils. Oct. 8.

COMPLETE SPECIFICATION ACCEPTED.

- 21,068 (1908). Slavicek. Continuous distillation and rectification of alcoholic liquids. Oct. 6.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

- 22,431. Chitty and Jago. Treatment of wheat for flour-milling purposes. Oct. 2.
 22,591. Parker. Non-alcoholic beverages. Oct. 4.
 22,787. Brunn. Production of a substitute for eggs. Oct. 6.
 22,850. Samuelson and Backhouse. Manufacture of flour. Oct. 7.
 22,877. Loring. Ageing and improving dry or moist flours. Oct. 7.
 23,038. Töpfer. Condensing or drying milk or other mixtures of liquids and solids.* Oct. 8.
 23,039. Boul (Electric Meat Curing Co.). Processes of preserving. Oct. 8.

COMPLETE SPECIFICATION ACCEPTED.

- 26,155 (1908). Chavassien. Dissolution and coagulation of proteids and application of the products. Oct. 13.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

- 22,193. Thresh. Apparatus for purifying water.* Sept. 29.
 22,864. Adams. Sewage purification plant. Oct. 7.

COMPLETE SPECIFICATION ACCEPTED.

- 24,430 (1908). Candy. Purification of potable waters. Oct. 13.

(C.)—DISINFECTANTS.

APPLICATIONS.

- 22,742. Potter. Treatment of sawdust for disinfecting or like purposes. Oct. 6.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

- 22,009. Pearson and Stoneham. Manufacture of millboard and similar material. Sept. 27.
 22,111. Ketcheson. *See under V.*
 22,763. Milne. Machines for imparting a linen-like finish to paper. Oct. 6.

COMPLETE SPECIFICATIONS ACCEPTED.

- 493 (1909). Richardson. Production of a loading agent or sizing ingredient. Oct. 6.
 15,855 (1909). Bloxam (Chem. Fabr. Griesheim Elektron). Manufacture of celluloid-like products. Oct. 6.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

- 23,011. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Oct. 8.

COMPLETE SPECIFICATION ACCEPTED.

- 4246 (1909). Imray (Meister, Lucius, und Brüning). Manufacture of arsonoarylglycollic acids and arsonoarylthioglycollic acids. Oct. 6.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATION.

- 21,097 (1908). Christensen. Manufacture of colour screens or plates for photography. Oct. 13.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATION.

- 22,095. Steele (Steele). Safety explosive. Sept. 28.

London Section.

Meeting held at Burlington House, on Monday, May 3rd, 1909.

DR. J. LEWKOWITSCH IN THE CHAIR.

A MACHINE FOR THE MECHANICAL TESTING OF INDIA-RUBBER.

BY CLAYTON BEADLE AND HENRY P. STEVENS, M.A., PH.D.

Some four or five years ago, in attempting to test the tensile strength of india-rubber goods, with a view to supplementing chemical analyses by physical tests, it was found that there was no machine to be had suitable for the purpose. Rubber samples are frequently so small and irregular in shape that it is difficult to cut strips of uniform size and thickness, and when they contain a small proportion of mineral matter they are liable to be crushed in the jaws and to tear at a point just inside one or other of the grips. Eventually it was found that tearing in the jaws could be overcome by cutting test pieces in the form of rings and stretching between smooth hooks. Stévant used rubber in the form of large rings for his physical experiments, but we believe that we were the first to use rings for tensile strength determinations.*

Recently Messrs. Schopper have brought out a testing machine for rubber on the swinging arm principle adopted in their other testing machines. They also use a fairly large ring-shaped test piece which they stretch over rotating pulleys so as to equalise the strain. This machine has already been described in detail†; its cost is high; and the published results‡ for a series of test rings cut from the same sheet of rubber show greater variations than similar tests made with our machine.

* Chem. News, July 26th, 1907, p. 41.

† See India Rubber Journal, May 17, 1909, pp. 565 and 566; also Lectures on India-rubber, 1908, p. 289.

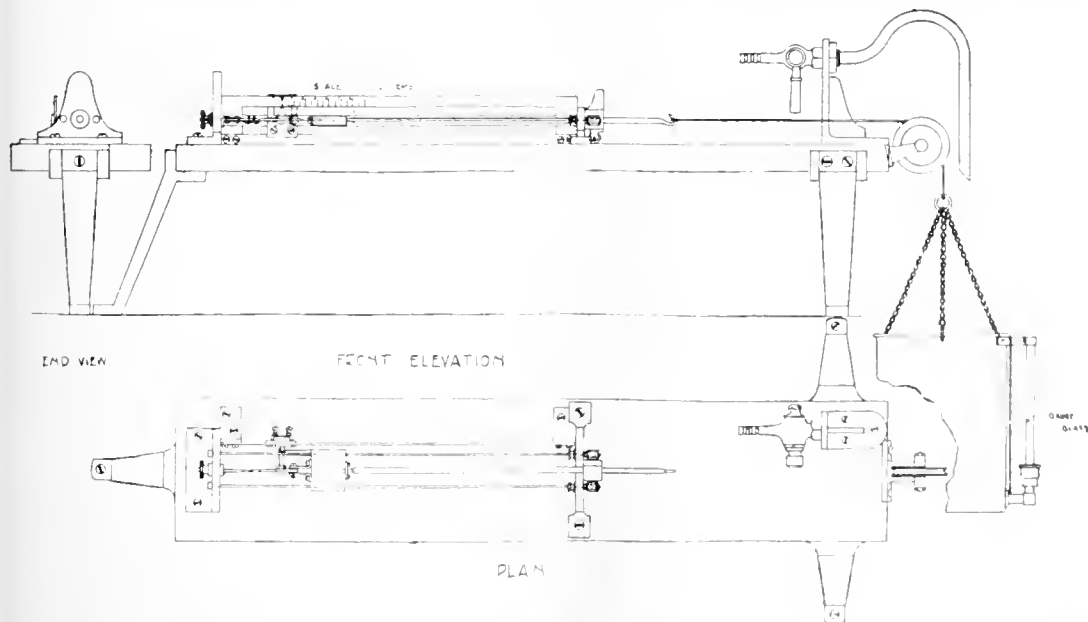
‡ Beiträge zur Frage der mechanischen Prüfung von Weichgummi. Mitt. Kgl. Materialprüfungs amtes.

The testing machine designed by us consists of a smooth iron hook fixed to a stationary block, a second hook being fixed to a sliding block moving horizontally. To the latter a cord is attached passing over a pulley and carrying a light metal vessel. A pipe from a cistern with water at a constant level delivers a stream of water into the vessel, the supply being automatically cut off when the test ring breaks; the vessel and its contents are then weighed, giving the grams weight required to rupture the ring. The water is delivered into the vessel so that the tension increases at a uniform rate, say, 1000 grams per minute. After making the necessary allowance for any variation in the thickness of the ring from the 1 mm. standard, the result divided by 5 would give the tensile strength in terms of 1 sq. mm. sectional area. The elongation is measured by noting the position of a pointer or indicator attached to the sliding block which moves over the scale. By an automatic arrangement shown in the plan the hook attached to the movable block drops at the moment of rupture and releases the indicator, which remains at the point of total elongation. The plan shows details of the machine as constructed by Messrs. Baird and Tatlock, but if preferred it could be arranged vertically, the movable block sliding downwards, when the pulley would not be required. The figures given later were obtained with a machine of the horizontal type.

The test pieces are vulcanised in the form of sheets about 1 mm. thick. From these discs 10 mm. in diameter are punched, and the thickness of each disc is measured where necessary with an ordinary micrometer screw gauge with friction head set once for all so as to work with the same pressure. By a simple device a hole 5 mm. in diameter is punched in the middle of each disc, thus producing a ring which when stretched is equivalent to a strip with a sectional area of 5 sq. mm.

If desired the ring can be punched from the sheet in one operation. An appliance for this purpose is shown in the diagram.

If the article it is desired to test is not in the form of a thin sheet, as, for instance, a solid tyre, thin sections can be cut with a little practice from which the rings are punched. By cutting sections in different directions, as, for instance, parallel and at right angles to the base



About one-sixth size.

of the tyre, valuable information may be obtained on the structure of the rubber. This is one of the great advantages attaching to the use of small rings.

If the bucket is made to weigh 500 grams and the elongation is taken before the water is run in, we have the elongation produced by a strain equivalent to 100 grams per sq. mm. sectional area of sample, a useful figure. Further, measurements of the elongation can be made under any particular strain by running into or taking out from the bucket definite amounts of water. In place of the bucket a light aluminium pan can be used, and the test piece stretched under varying loads produced by adding or removing weights from the pan.

In this way it will be seen that the machine can be used for a variety of mechanical tests and for plotting hysteresis loops as well as for tensile strength determinations. This machine has been in constant use for three or four years in testing commercial samples as well as vulcanised plantation rubbers, and the number of tests made now amount to well over one thousand.

As illustrating the foregoing some results of tensile strength determinations are given.

(1) Solid rubber tyres (cab tyres).

Details of test on thin sheets about 1 mm. thick cut in cross section of tyre.

Rings 5 mm. internal diameter and 10 mm. external diameter giving a test piece equivalent to a sectional area of approximately 5 sq. mm.

Tensile strength of rings in grams weight for each ring.	Thickness of ring.	Tensile strength in grams per sq. mm.	Elongation at rupture, original length = 1.
3960	1.23	644	4.6
3670	1.25	588	4.2
3400	1.18	576	4.4
3060	1.01	595	4.6
3800	1.25	608	4.2
3470	1.05	661	4.6
3580	1.23	582	4.4
3450	1.08	638	4.4
3680	1.18	624	4.2
3280	1.12	586	4.4
Mean 3535	1.16	610	4.4

(2) Unvulcanised plantation rubber.

Sheet 1 mm. thick :—

Tensile strength in grams per sq. mm.	Elongation at rupture, original length = 1.
204	2.2
226	2.3
230	2.4
208	2.2
206	2.3
228	2.4
210	2.8
250	2.4
Mean 216	2.3

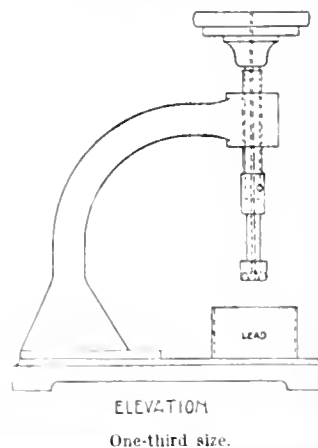
As a rule, however, the thickness of each individual ring is not determined, but is measured up in batches of five. The average breaking strain per sq. mm. is then calculated for each batch of five, thus obtaining two results. If the mean of the two be taken, the average of the whole series is obtained, which at the same time provides a check on the accuracy of the results. If the mean of the two batches of five rings differs by more than 2 per cent. from the mean of either batch the results are rejected and a fresh series of tests made.

(3) Sheet of vulcanised plantation rubber.

The following table shows the details of such a series. The elongation produced by a load of 500 grams on the ring is also given, that is a load of 100 grams per 1 sq. mm. section. This figure is obtained by reading off the elongation after hanging on the water pan (which is adjusted to weigh 500 grams) before turning on the water.

Tensile strength in grams weight for each ring.	Mean thickness of each batch of 5 rings.	Mean tensile strength in grams per sq. mm.	Elongation at rupture, original length = 1.	Elongation with a strain of 100 grams per sq. mm.
3780	1.120	625	7.0	1.4
3630			6.6	1.4
3310			6.2	1.6
3350			6.2	1.6
3400			6.8	1.6
3400	1.104	644	6.4	1.6
3205			6.2	1.6
3795			7.0	1.4
3650			6.8	1.6
3730			6.8	1.6
Mean 3528	1.112	635	6.60	1.54

Rubber Washer Punch.



Journal and Patent Literature.

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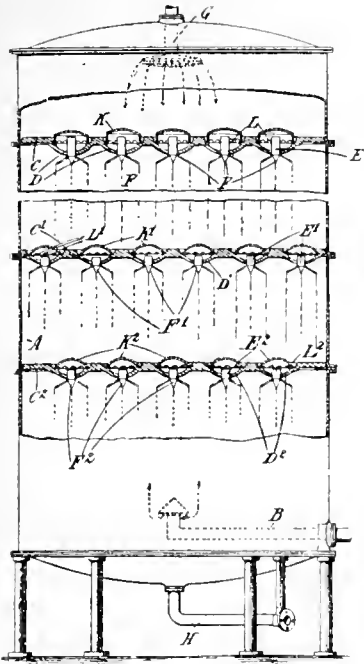
I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Liquid distributors for absorbing towers. W. Hommel and The Metals Extraction Corporation Ltd., London. Eng. Pat. 19,668, Sept. 18, 1908.

THE plates, C, C¹, C², which extend across the tower, A, are provided with saucer-shaped depressions, D, D¹, D².

Short vertical pipes, E, E¹, E², having their lower ends slit and splayed out into fingers, F, F¹, F², are passed through the depressions. The absorbing liquid enters the top of the tower through the pipe, G, is distributed over the plate, overflows through the vertical pipes, drips from the extremities of the fingers, and is finally discharged from the bottom of the tower through the pipe, H. The gas enters through the pipe, B, passes upwards through the



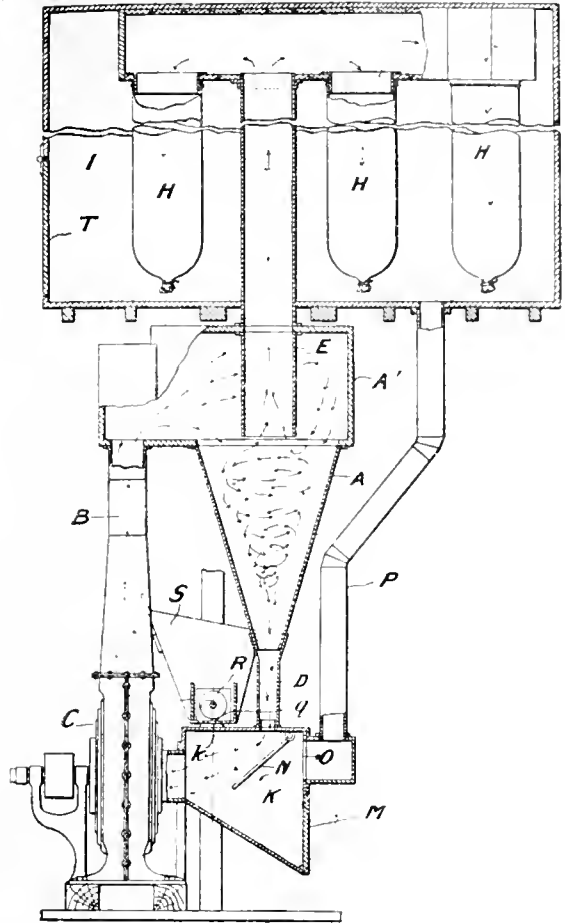
vertical pipes, and is thus brought into intimate contact either with the falling spray of liquid or with the film covering the pipes. If the whole of the gas is to be absorbed in the tower, or the residual portion taken off below the top plate, the vertical pipes are made rather longer and are covered with caps, K, serrated at their lower edges, L, which are sealed by the liquid contained in the caps so that the liquid but not the gas can pass through. The other plates of the tower, and in the case in which a portion of the gas is allowed to escape above the top plate, that plate also, are provided with shallow caps, K¹, K², having serrations, L¹, L², which allow liquid to enter and gas to escape.—W. H. C.

Filtering apparatus for use in connection with the washing of slimes and for similar purposes. J. F. Webb and P. Tarbutt, London. Eng. Pat. 21,474, Oct. 10, 1908.

THE filter consists of a flat box having one of its faces perforated and covered with filter-cloth. The box is attached to a machine by which it is lowered, with the perforated face downward, into a tank containing the slimes or other material to be filtered. The interior of the box is connected to a vacuum pump and the liquid is sucked through, leaving a cake of solid matter adhering to the outer surface of the perforated face of the box. When the cake is of sufficient thickness, the operator starts the machinery which raises the box, inverts it and tilts the inverted surface at an angle. Water is then sprayed on to the surface to wash the deposit, and the washings are sucked through into the box by the vacuum which is still maintained. When the deposit is sufficiently washed, both the water spray and the vacuum are shut off and the washed deposit is removed. The box is then lowered into the tank again by the machinery.—W. H. C.

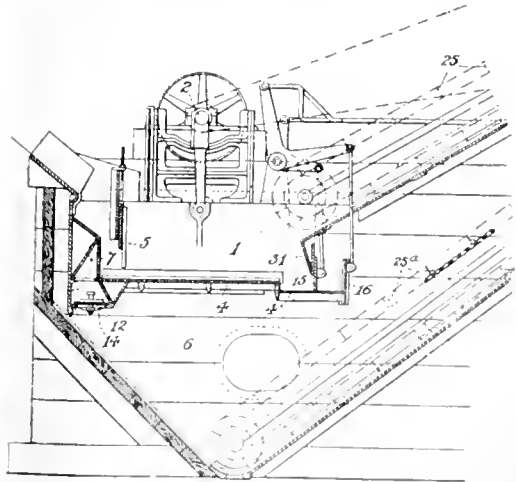
Separating finely-divided materials. J. M. Seaver, Boston, Mass., U.S.A. Eng. Pat. 12,958, June 2, 1909.

FINE materials to be separated are fed into the chamber, K, through the openings, k, q, from the hopper, S, by the worm, R. They pass into the "cyclone," C, and the lighter particles are carried forward by the air current up the pipe, B, to the box, A¹. The finest particles pass with the air up the pipe, E, into the box, F, and thence into the bags, H, where they are arrested, while the air passes on. The coarser particles return by the shoots, A, and D, into the chamber, K. When the apparatus is first started, the bores of the bags, H, allow some dust to pass through



with the air. The doors, T, and M, are therefore kept closed at first and the air passes back from I, by the pipe, P, to K. As soon as the bags, H, are partially filled and they no longer allow the dust to pass, the doors, I, and M, are opened and the air enters at M and leaves at T. When the door, M, is closed, the flap, N, is opened by the air current from O.—W. H. C.

Separating substances of different specific gravities; Apparatus for —. J. M. Draper, Glasgow. Eng. Pat. 11,988, May 21, 1909.



THE apparatus is an improvement upon the jiggging machine described in Eng. Pats. 15,285 and 20,894 of 1906 (this J., 1907, 11, 12). In the machine illustrated (see Fig.), the box, 1, is reciprocated vertically in the tank, 6, by means of the driving shaft, 2; the pulsating water current so produced, causes the material on the perforated bottom, 4, to become stratified into layers of different specific gravity. To prevent the finest particles passing through the perforations at the point of entry and before stratification has taken place, that part of the box near the dam, 5, which first receives the material, is modified as shown, so that on the upward stroke the valve, 14, closes and the water does not pass through the perforations; on the downward stroke the water passing through the valve and the perforated plates, 7, and 12, forms a horizontal current impelling the material under the dam, 5, and a vertical current tending to stratify the material. Stratification proceeds as the material moves over the perforated bottom, 4; the lower layer passing under the gate, 15, and falling over the sill, 16, is removed by the scraper conveyor, 25a, and the upper layer rising over the sill, 31, is removed by a similar scraper conveyor, 25. The sills and gates are connected with external levers by which adjustment may be made.—J. W. H.

Transferring apparatus for fluids under high pressure. J. A. Hoff, Assignor to The Standard Carbonic Co., Cincinnati, Ohio. U.S. Pat. 927,798, July 13, 1909.

THE apparatus consists of a tube for holding one charge of compressed gas for such purposes as inflating motor-car tyres, and means for discharging and re-charging this tube. The tube carries a screwed plug having two small holes, one of which is central. Covering the central hole on the underside of the plug is a disc of thin metal which seals the tube when the plug is screwed down on its seating, the latter also having a central hole. The discharging apparatus is an arrangement for piercing the metal disc by a needle while the mouth of the tube is connected to the tyre or vessel to be charged. The re-charging device is a means for screwing the plug on its seating, after the gas has been allowed to enter the tube through the lateral hole in the plug, the central hole having had its thin metal disc renewed.—J. W. H.

Pulverisation, dispersion, and mixing of liquids; Process and apparatus for the —. Pages, Camus et Cie. and P. Bardy. First Addition, dated July 20, 1908, to Fr. Pat. 396,476, Jan. 27, 1908 (this J., 1909, 591).

VARIOUS forms of jets are described, all of which have the orifice from which the atomised liquid issues, partially closed by a disc or plug which can be regulated so as to give an annular opening of varying width. The object of blocking up the centre of the opening is to prevent the recombination of the different streams of atomised liquid.—W. H. C.

Hydraulic press for extracting the juices or water from pulps or other materials. X. M. Roux. Fr. Pat. 401,495, July 24, 1908.



THE material to be pressed is contained in the flexible impermeable pockets, *b²*, the sides, *d*, of which are formed of metallic gauze. Two such pockets are placed in the box or frame, *a*, the upper and lower faces of which consist of perforated plates, the other sides being solid plates. The whole is clamped together and water is forced by a pump through the openings, *a²*, *a³*, into the space between the pockets. The material is pressed towards the perforated plates through which the liquid

portion passes. The amount of pressure exerted by the water upon the material is proportional to the resistance offered by it.—W. H. C.

Distilling apparatus. H. L. F. Mariolle. Fr. Pat. 401,587, July 30, 1908.

THE claim is for a combination of stills, condensers, extractors, liquid reservoirs and an air pump in such a way that a series of successive distillations or extractions with recovery of the solvent can be carried out in the same group of apparatus. The operations can be carried out either *in vacuo*, or under atmospheric or increased pressure, and in the case of liquids whose vapours form explosive mixtures with air, the whole of the latter is abstracted and replaced by the vapour of the solvent.—W. H. C.

Centrifugal separator for removing solids or liquids from air or gases. K. Michaelis. Fr. Pat. 401,693, April 6, 1909.

THE gas is passed into one end of the hollow shaft of a centrifugal machine provided with conical baffle-plates and flows through perforations in the shaft, which has a cross partition near its central point, into the spaces between the baffle-plates. The solid and liquid particles glide along the surfaces of the plates and are discharged at the periphery of the drum into the surrounding casing. The cleaned gas leaves the apparatus, flows back into the hollow shaft beyond the partition, and is discharged from the end of the same.—W. H. C.

Chemical reactions; Process for carrying out — [under pressure]. F. Wolfson. Ger. Pat. 214,885, Jan. 18, 1908.

THE reacting substances are mixed to form a stiff mass, with or without addition of an inert material. The mass is coated with paraffin wax, or the latter may be added previously, and then rendered electrically conductive by rubbing graphite over its surface, after which it is coated electrolytically with a deposit of copper or other metal, of a thickness capable of resisting the pressure developed by the chemical reaction. The coated mass is then heated to bring about the reaction, and after cooling, the metal casing may be removed or opened by filing, &c., or by the action of acid.—A. S.

Latent heat of vaporisation of liquids; Process for the regeneration and utilisation of the —. E. Nobel and S. Bessonoff, St. Petersburg. Eng. Pat. 20,921, Oct. 3, 1908.

SEE Fr. Pat. 395,108 of 1908; this J., 1909, 357.—T. F. B.

Reverberatory furnace with separate dust chambers and regenerating chambers arranged in pairs. E. Kirehberg, Dortmund, Germany. Eng. Pat. 21,095, Oct. 6, 1908. Under Int. Conv., Oct. 7, 1907.

SEE Fr. Pat. 388,154 of 1908; this J., 1908, 889.—T. F. B.

Saturating device for liquids. C. E. Vallery, Besancon, France. Eng. Pat. 5250, March 4, 1909.

SEE Fr. Pat. 397,752 of 1909; this J., 1909, 898.—T. F. B.

Absorbent products from sawdust or similar material; Manufacture of —. Comp. Indus. des Alcools de l'Ardèche, Paris. Eng. Pat. 9147, April 17, 1909. Under Int. Conv., June 18, 1908.

SEE Fr. Pat. 400,737 of 1908; this J., 1909, 1024.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Coal mines; Dust in —. J. Virgin. Eng. and Min. J., 1909, 88, 734.

THE author has experimented with common salt and calcium chloride for the damping of coal dust in mines. Half a ton of dry powdered salt was sprinkled on the roof walls and floor of an 8 ft. wide level, for a distance of 500 ft. In 24 hours the coal dust was damp and

remained so for more than a month. Calcium chloride was found to be still more efficient but also more expensive.

—F. R.

Liquid fuel and its economic aspects. Introductory Lecture, Sir John Cass Technical Inst., Oct. 11, 1909. By J. S. S. Brame.

THE use of liquid fuel for power purposes has within recent years attracted much attention in this country. It is only within comparatively recent times that great advances have been made in its utilisation in internal combustion engines, a use which has had far-reaching results.

As a fuel for steam raising, oils of high calorific value, cheapness, and high flash point are demanded, whilst for internal combustion engines, oils of high volatility are generally requisite in order that they may readily form explosive mixtures with air in the cylinder. For external combustion of oil-fuels, some spraying or "atomising" device is now almost universally adopted, some systems depending on steam injection, others on air, and another type, which is rapidly finding extended use especially for marine purposes, on the spraying action obtained through the oil being forced under pressure through suitable small orifices in the burner. To obtain complete and smokeless combustion great attention has to be paid to the furnace arrangements, and early troubles largely arose from lack of proper attention to this point. Smokeless combustion can now be ensured. Briefly, the advantages of liquid fuel over coal may be summarised as: superior evaporative power to that of coal in the ratio of 1·6 to 1, ease of handling, facility it affords for stowing on ships in situations where coal could not possibly be stored, less space required than for coal, one ton of oil requiring only some 38 cubic feet, whilst coal requires some 43 cubic feet per ton. There are also numerous other minor advantages.

The total oil supplies of the world, taking the figures for 1907, amounted to 34,569,500 tons, which in terms of coal, since it has such superior calorific value, would be equivalent to 51,854,250 tons of coal, or only one-fifth of the coal output of this country alone. Only a portion of the crude petroleum is suitable for fuel. Liquid fuel therefore cannot compete with coal, and is not a fuel for general use, but for employment in special cases.

For use in internal combustion engines the lighter petroleum distillates are almost universally employed. Our annual importation of petrol has now reached the total of some 33,500,000 gallons. By the introduction of the spray carburettor a heavier grade of petrol can now be utilised, a factor of considerable economic importance as regards supplies. Further, since the calorific value of petrols of varying gravity is practically the same per unit weight (20,000 British Thermal Units) it follows that, as they are bought by volume, the heavier grades are more economical. One important point with all engines using petroleum oils is that high compressions are out of the question, since at little over 4·5 atmospheres there is a risk of premature ignition, hence the efficiencies obtained are low. As petrol substitutes, the claims of benzol and alcohol must be considered. Benzol is produced in very large quantities from both gas and coke-oven tar, and its present price is low, about 6½d. per gallon. The calorific value per unit weight is 18,540 British Thermal Units, but per unit volume, owing to its higher gravity, it has a higher value than many petrols. In practice benzol gives most excellent results without any special alteration of the carburettor designed for petrol. A 10 h.p. 6 cylinder Napier having covered 22·65 miles per gallon of benzol as against 18·14 miles on petrol. Slight trouble may be anticipated in very cold weather, but usually there is no difficulty in starting the engine if a little petrol is first put through the carburettor. Alcohol, the only fuel which we can actually manufacture from materials derived from other sources than coal, peat, or petroleum, is of special interest. The importance of alcohol and the great aid which its production on a large scale would give to agriculture, has led to the possibilities of its use being carefully studied by Commissions in Germany, France, and America. For motor use it has many

advantages over petrol or benzine: it is far less inflammable, and if a fire does arise, it can more easily be extinguished. Its combustion leaves no evil-smelling products: engines run more quietly on alcohol, and it will stand higher compressions in the cylinder, thereby giving such greater efficiency that the effect of its low calorific value is almost counterbalanced. For equal weights the calorific value of petrol to alcohol is 20,000 to 11,000 British Thermal Units, a ratio of 1·8 to 1, but if considered by volume, the ratio is reduced to 1·6 to 1. Since the thermal efficiency of alcohol is greater than petrol in the ratio of 3 to 2, it is evident that volume for volume the same power can be obtained from alcohol as from petrol. At present the cost of alcohol is prohibitive, and although in seasons when a heavy yield of raw material—chiefly potatoes—is obtained, the cost of production is comparatively low, yet with charges such as are necessarily imposed through Revenue supervision, quite independent of duty, it is unlikely that it can for many years reach the position of a commercial fuel. As pointed out by Lewes, for use in submarines, alcohol would be an ideal fuel on account of its great safety.

Vertical retorts; The Glover and West — at St. Helens. H. G. Colman. J. Gas Lighting, 1909, 108, 42. (See this J., 1909, 829).

THE results of two additional tests are given below:—

	I.	II.
Kind of coal	Silkstone	Arley Mine
Locality	Yorkshire	Wigan
Percentage of ash in coal	5·95	3·58
Percentage of moisture in coal ..	1·64	1·39
Yield of gas in cub. ft. per ton. .	12,435	12,145
Average illuminating power, in candles	16·19	15·22
Calorific power in B. Th. U. gross	584·9	576·2
Calorific power in B. Th. U. net ..	522·0	516·3
Average composition of the gas—		
Carbon dioxide	1·10	1·15
Unsaturated hydrocarbons ..	2·70	2·45
Oxygen	0·20	0·15
Carbon monoxide	7·30	7·30
Methane	32·30	33·90
Hydrogen	53·75	51·65
Nitrogen	2·40	3·25
Yield of coke in cwt., per ton, moist	15·3	15·8
Yield of coke in cwt., per ton, dry	13·3	13·9
Percentage of ash in coke	9·1	5·87
Percentage of moisture in coke ..	12·5	12·05
Fuel used in gas generator, as percentage of dry coke	13·4	12·2
Yield of tar in gallons per ton ..	12·4	10·74
Sp. gr. of tar	1·084	1·075
Quality of tar	Much thinner than that from the same coal carbonised in horizontal or inclined retorts	Comparatively thin.
Composition of tar—		
Percentage by weight of light oils distilling up to 170° C. .	6·7	5·8
Percentage of middle oils distilling from 170°—270° C. .	21·7	23·1
Percentage of heavy oils distilling from 270°—350° C. .	22·5	27·8
Percentage of pitch remaining at 350° C.	48·5	42·7
Percentage of naphthalene ..	6·9	6·7
Percentage of free carbon ..	3·6	3·8
Yield of ammonia equal to lb. ammonium sulphate per ton ..	20·1	24·2
Yield of cyanogen as Na ₂ Fe(CN) ₆ ·10H ₂ O, lb. per ton	5·67	5·64
Total sulphur in gas after purification with oxide only, grains per 100 cub. ft.	27	30·2
Naphthalene in purified gas, grains per 100 cub. ft.	3·3	3·3

—W. H. C.

Determining carbon monoxide in mine gas. Weiskopf. See XXIII. Inorg. Quant.

PATENTS.

Peat; Apparatus for producing fuel and gas from — W. L. Shepard, Elmwood, Conn., Assignor to H. J. Wickham, Manchester, Conn. U.S. Pat. 936,049, Oct. 5, 1909.

THE apparatus consists of one or more retorts, each of which is formed of a shell provided with a lining of fire-resisting material. The upper end of each retort is closed with a loosely fitting cover, and a door, carrying a burner for heating the interior of the retort before the introduction of the peat, is hinged to the lower end. Gas passes through outlet pipes leading from the upper portions of the retorts to a hydraulic main, and valves are provided whereby each retort can be isolated from the main. A washer is connected with the main, and superheaters are connected with the washer by pipes in which valves are placed so that either superheater can be utilised without using the other. The superheaters are connected by pipes with a gas storage tank.—W. C. H.

Peat; Direct and rapid conversion of — into small charcoal. X. M. Roux. Fr. Pat. 401,419, July 22, 1908.

THE object of the invention is to obtain peat charcoal in the form of small pieces similar to ordinary wood charcoal. The raw peat is pressed to remove about three-fourths of the moisture present, and is then disintegrated and pressed into briquettes of the desired size and shape. These briquettes are carbonised in closed retorts at a temperature varying from 250° to 350° C. without further drying. Thus, the carbonisation results in the production of gas, tar, and ammoniacal liquor, collected in the usual way, and also in the formation of a carbonaceous residue consisting of small pieces of carbon, similar to wood charcoal obtained in wood retorts. The whole process can be carried through in half-an-hour.—A. T. L.

Coke oven. Soc. Anon. d'Ougrée-Marihaye. Fr. Pat. 401,451, March 31, 1909. Under Int. Conv., June 2, 1908.

THE oven comprises a series of coking chambers *a* (see Fig. 2), with hollow dividing walls, *b*, forming heating flues.

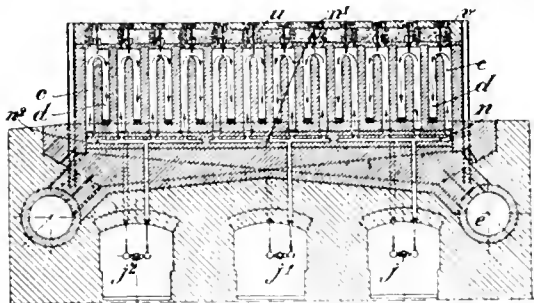


Fig. 1.

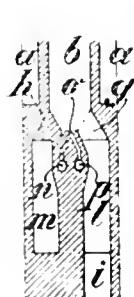


Fig. 2.

towards the main flues, as shown in Fig. 2, in order that the velocity of the gases may be uniform. The gas

supply is distributed by mains, *j*, *j*¹, *j*², and pipes, *n*, *n*¹, *n*². When the currents are reversed in the regenerators, the heating gases pass in the direction opposite to that indicated in Fig. 1, the gas being distributed to another set of burner orifices, *o*, from the pipes, *p*, *p*¹, *p*². The walls of the flues, *c*, *d*, are constructed of special bricks so that the walls separating the flues, *c*, *d*, from the chambers, *a*, are thinner than the walls separating the flues, *c*, *d*, from one another, but these latter walls are of a material of greater conductivity.—A. T. L.

Vertical [gas] retorts; Charging of — R. Dempster and Sons, Ltd., and H. J. Toogood, Elland, Yorks. Eng. Pat. 19,437, Sept. 16, 1908.

THE patent relates to the charging of vertical gas retorts in such a manner as to facilitate the escape of gas during that stage of the distillation when the charge becomes more or less plastic. The unscreened coal is delivered in a relatively thin stream down one side (or around the sides) of the retort, the differing velocities and slipping tendencies of the "slack" and "nuts" causing a column of the latter to form on the opposite side (or in the centre) of the retort.—W. E. F. P.

Water-gas; Manufacture of — A. G. Glasgow, Richmond, Va., U.S.A. Eng. Pat. 17,603, Aug. 21, 1908.

IN water-gas plant comprising generators blown alternately with air and with steam, and steam-operated blowing engines, pumps, exhausters, etc., the exhaust steam from the engines is collected in a main provided with a relief valve, and is used for the steam-blow in the generators, which are connected by valved branch-pipes with the exhaust-steam main.—A. T. L.

Gases [water-gas]; Treatment of — for removing carbon monoxide therefrom and replacing it by hydrogen. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 2523, Feb. 2, 1909.

WATER-GAS heated to about 500° C. is passed together with steam through a reaction chamber containing lime or calcium hydroxide. The following reaction takes place: $\text{Ca(OH)}_2 + \text{CO} = \text{CaCO}_3 + \text{H}_2$, with evolution of heat, and the reaction chamber is cooled so that the temperature does not exceed 500° C., or the temperature at which calcium carbonate commences to dissociate. The reaction may be accelerated by the addition of a metal, for example, 5 per cent. of iron powder, in the reaction chamber.—A. T. L.

Gas producers; Rotary grate for — Gütchoffnungshütte, Aktienverein für Bergbau und Hüttenbetrieb, Oberhausen, Germany. Eng. Pat. 14,947, June 26, 1909. Under Int. Conv., Sept. 30, 1908.

THE invention relates to a rotary grate in which the two concentrically arranged parts rotate in opposite directions. The inner part is cylindrical or conical, and carries a circular step-grate mounted eccentrically to the axis of rotation, while the outer part consists of an annular dish. The inner portion is made to rotate more quickly than the outer part, in order to crush the clinker and loosen the charge in the gasifying zone of the producer.—W. E. F. P.

Gas-producers; Apparatus for regulating the supply of steam to — in order to maintain uniformity in the gas produced. L. P. C. Roche, Fr. Pat. 401,530, April 2, 1909.

THE patent relates to gas-producers of the suction type. An annular boiler in the upper part of the producer is employed, and this boiler is provided with heating flues and is capable of generating more steam than is required. The quantity of steam generated is regulated by supplying more or less cold feed-water, the water-level in the boiler being kept constant by an overflow pipe. In order to keep the water-supply constant at the desired rate of feed, the supply is taken from a constant-level tank by means of a down-pipe terminating in a small orifice.—A. T. L.

Gas-producer. A. Fichet and R. Heurtey. Fr. Pat. 401,535, July 27, 1908.

THE producer comprises a cylindrical metal casing, of which the lower part only is lined with refractory material. The fuel column rests directly upon the hearth of the producer. The producer is worked with a blast of hot or cold air, introduced through water-cooled tuyères; the clinker and ash are fused in the lower part of the producer, fluxes being used if necessary, and the fused mass is run off through suitable outlets. A central conical hood in the upper unlined part of the producer throws the descending fuel column outwards, and forms a gas-collecting chamber in the interior of the producer, the gas-outlet pipes being connected to this chamber.—A. T. L.

Gas scrubbers or purifiers. R. V. Farnham, Wemyss Bay, Renfrewshire. Eng. Pat. 28,233, Dec. 28, 1908.

THE apparatus described, which is for use with a suction gas plant, consists of a suitably mounted water wheel or turbine, carrying a series of flat radial blades feathered at their outer ends. The operation of the wheel produces a fine spray of water, through which the gas is made to pass on issuing from the generator.—W. E. F. P.

Controlling or deflecting the flow of flue gases or the like, specially applicable for use in connection with CO₂ recorders. A. E. Carr, Liverpool. Eng. Pat. 20,244, Sept. 26, 1908.

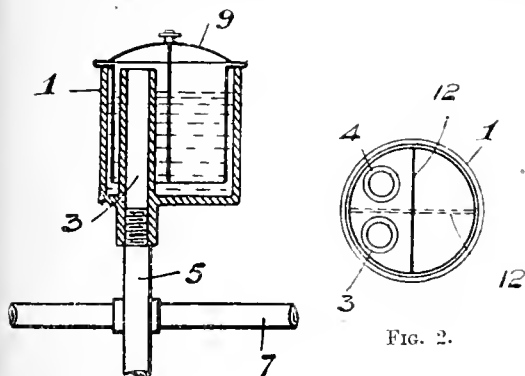


FIG. 1.

A PIPE, 5, extends upwards from the boiler flue into the vessel, 1, as indicated at 3, and the pipe, 7, leading to the carbon dioxide recorder has a branch, 4, which also extends upwards into the vessel, 1. This vessel is filled with liquid and is provided with a cover, 9, which dips into the liquid and forms a seal; the cover is provided with a midfeather, 12. When the cover is in the position shown in section in Fig. 1, and in plan at 12, in Fig. 2, the gases pass from the boiler flue to the main, 7. When it is desired to cut off the connection between the main, 7, and the flue, the cover, 9, is lifted, turned through a right angle and replaced with the midfeather in the position shown by the dotted line in Fig. 2. The cover, 9, may be made longer and be provided with a filter through which the gases are compelled to pass. The filtering material is contained in a cartridge which fits into the filter so as to be easily replaceable.—W. H. C.

Calcium carbide cartridges. A. Barnett, London. Eng. Pats. 19,939, Sept. 22, 1908; 24,679, Nov. 17, 1908; and 2301, Jan. 30, 1909.

CRUSHED carbide is mixed with fine sawdust, and hard wax, linseed oil, and resin, pitch, or other binding material are added; the mixture, heated if necessary, is compressed into a block of suitable size and shape for the carbide chamber of an ordinary acetylene lamp. The block, which may be provided with a central hole, is wrapped in oil paper, tinfoil, or the like, and packed in an outer tin or cardboard box made to fit into the lamp chamber, so as to be removed bodily after use, all mess being thus avoided. Or, the box may be dispensed with, and the cartridge wrapped in paper and then in an outer covering

of capsule metal, tinfoil, or lead foil, so as to be air-tight, and a space may be left between the block and the casing to prevent bursting of the cartridge during use. The ingredients may be mixed in the following proportions:—100 parts of carbide, 18 of sawdust, 10 of hard wax, 2 of linseed oil, and 6 of resin or other binding material; or, 100 of carbide, 10 of hard wax, 2 of linseed oil, and 6 of binding material; or, 100 of carbide, 18 of sawdust, and 10 of resin.—F. SOBN.

Electrical incandescent refractory metal filaments; Process for the prevention of the disintegration of — in a vacuum. Glühlampenwerk Anker, Berlin. Eng. Pat. 19,847, Sept. 22, 1908. Under Int. Conv., Oct. 3, 1907.

PHOSPHORETTED or arseniuretted hydrogen is introduced into the exhausted lamp bulb by placing suitable reagents on the leading-in wires or in the tube through which the lamp is exhausted. These reagents are (1), 1 part of phosphorus and 2 parts of phospham, PN_2H ; (2), 1 part of phosphorus, 1 part of solid phosphoretted hydrogen, P_4H_2 , and 1 part of phospham; (3), 2 parts of solid arseniuretted hydrogen, As_2H_2 , and 1 part of phospham.—A. T. L.

Gas; Apparatus for the manufacture of —. W. H. Morgan and J. Densley, Weston-super-Mare, Assignors to Walls, Ltd., Birmingham. U.S. Pat. 936,144, Oct. 5, 1909.

SEE Eng. Pat. 10,558 of 1908; this J., 1908, 1051.—T. F. B.

Gas and air; Mechanism for the production of a constant mixture of —. F. H. Wolff, Assignor to Selas Ges.m.b.H., Berlin. U.S. Pat. 937,016, Oct. 12, 1909.

SEE Eng. Pat. 25,596 of 1905; this J., 1907, 41.—T. F. B.

Coal gas, water gas, and oil gas, or mixtures of these gases; Process and apparatus for making —. W. H. Morgan, J. Densley, H. Gray, H. J. Walduck, and G. Geering. Fr. Pat. 401,641, April 3, 1909. Under Int. Conv., May 15, 1908.

SEE Eng. Pat. 10,558 of 1908; this J., 1908, 1051.—T. F. B.

Gases generated by dry distillation; Process of purifying —, and of obtaining by-products therefrom. K. Burkheiser, Aix-la-Chapelle, Germany. Eng. Pat. 20,920, Oct. 3, 1908. Under Int. Conv., Oct. 14, 1907.

SEE Fr. Pat. 394,926 of 1908; this J., 1909, 359.—T. F. B.

Carbon bisulphide from gases, particularly coal-gas; Method of removing —. M. Mayer and A. Fehlmann, Karlsruhe, Germany. Eng. Pat. 174, Jan. 4, 1909.

SEE U.S. Pat. 926,273 of 1909; this J., 1909, 830.—T. F. B.

Illuminating gas; Catalytic material for the automatic ignition of — and process and apparatus for producing same. Soc. C. Lubeck, and M. Payet, Paris. Eng. Pat. 3171, Feb. 9, 1909. Under Int. Conv., March 5, 1908.

SEE Fr. Pat. 397,746 of 1908; this J., 1909, 830.—T. F. B.

Incandescent gas mantles; Manufacture of —. A. Simonini, Atlantic City, N.J., Assignor to Welsbach Light Co. U.S. Pat. 936,177, Oct. 5, 1909.

SEE Eng. Pat. 10,233 of 1908; this J., 1908, 932.—T. F. B.

Filaments for electric incandescent lamps; Process of making —. W. von Bolton, Charlottenburg, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 936,403, Oct. 12, 1909.

SEE Eng. Pat. 4814 of 1907; this J., 1907, 519.—T. F. B.

Electric lamps; Method of regenerating blackened carbon-filament —. Electricische Dauer-glühlampen Ges. m.b.H. Fr. Pat. 401,669, April 5, 1909. Under Int. Conv., April 7, 1908.

SEE Eng. Pat. 8283 of 1909; this J., 1909, 1027.—A. T. L.

Retort furnaces for the manufacture of gas. Eng. Pat. 24,332. See VII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Methyl alcohol: Purification of — in counter-current rectifying column apparatus. P. Pikoš, Z. angew. Chem., 1909, 22, 2036—2037.

IN apparatus for the rectification of wood spirit, copper is the material almost invariably used for the rectifying columns, condensers, etc., and the still itself, if of wrought iron, is provided with a copper lining. The author, as the result of long practical experience and numerous experiments, states that under the catalytic influence of the copper, considerable quantities of methyl alcohol are lost by oxidation to acetaldehyde, methylal, and formaldehyde. There is always a small quantity of air in the apparatus at the beginning, and further quantities are almost invariably sucked in at intervals during the process, owing to variations of pressure. Although the greater portion of the aldehyde produced escapes, some passes back into the spirit, and can be detected in the form of aldehyde-ammonia, by addition of caustic soda and allowing to stand; frequently also the so-called aldehyde-resin is deposited in the still. The losses are greatest when an alkaline reagent has been added to the crude spirit: the liberated ammonia combines with the aldehyde produced, forming aldehyde-ammonia, which by its strong solvent action, cleans the surface of the copper tubes, vessels, etc., and thus renders the metal more active. Considerable losses of methyl alcohol may also occur in the subsequent operations of treatment of the rectified spirit with sulphuric acid, and oxidation with 5 per cent. permanganate solution, unless great care be exercised. The author recommends that apparatus for the rectification of wood spirit be constructed of aluminium or an aluminium alloy free from copper; or copper with a thick coating of tin, or copper or iron with linings of earthenware or stoneware might be employed, with connecting pipes, etc., of earthenware. Where copper apparatus is used, special care should be taken to prevent sucking-in of air during the process, owing to variations of pressure; and in any case it would appear advisable to effect the rectification in an apparatus working under vacuum.

—A. S.

Petroleum oils: Grozny — rich in paraffin wax. K. Charitschoff, Chem. Rev. Fett-u. Harz-Ind., 1909, 16, 247—248.

It has long been known that the petroleum oils from the western part of the Grozny oil-fields differed considerably from oils from other parts of the fields, and especially in containing a high proportion of paraffin wax. Further investigations have shown that these particular oils only occur in a wedge-shaped patch of the western district, whilst the oils produced to the north and south of this area are intermediate between those rich in, and those free from paraffin wax. The proportion of paraffin wax shows great variations. In determining it the author employed a modification of Zalozecky's method, in which the sample was first freed from asphaltum by treatment with excess of sulphuric acid, so that the paraffin wax subsequently separated was pure and of a pale yellow colour. Heavy petroleum oil containing paraffin wax was first discovered in 1905, in MacGarvey's borings. It had a sp. gr. of 0.906 to 0.919, and on distillation yielded the following fractions:—Up to 110° C. 12.12; 110—150° C. 0.75; 152°—273° C. 22 (with sp. gr. 0.8048, and flashing point 40° C.); and residue 66.25 per cent. (with sp. gr. 0.9246 and flashing point, 120° C.). On treatment of the residue with sulphuric acid in excess, a final residue of 36.9 per cent. was obtained, and this contained 8.38 per cent. of paraffin wax (2.35 per cent. on the crude oil). When distilled in a current of steam the residue yielded the following fractions:—From 200°—250° C. 10 per cent. (with sp. gr. 0.840 and flashing point 80° C.); 250°—275° C. 12.6 per cent. (with sp. gr. 0.856 and flashing point 100° C.); 275°—295° C. 13.8 per cent. (with sp. gr. 0.875 and flashing

point 130° C.); 295—325° C. 5.8 per cent. (with sp. gr. 0.889 and flashing point 160° C.); 325°—360° C. 1.3 per cent. (sp. gr. 0.891); and residue, 54.3 per cent. (sp. gr. 0.940). The first three fractions were very fluid, the fourth viscous, and the fifth semi-solid. The residue was hard, brittle, and of an asphaltic character.—C. A. M.

Mineral oil: Refining — by the dry process. F. Schulz, Petroleum, 1909, 5, 86—90.

THE author finds that all the organic acids present in petroleum distillate can be completely eliminated by agitation with dry calcium hydroxide, the treatment also removing the acids left after the treatment with concentrated sulphuric acid. About 1½ to 2 per cent. of calcium hydroxide is used, after the acid treatment, agitation being continued for about 15 minutes. In practice it will be advisable to pass the entire contents of the agitator through a filter-press, without previous subsidence, and then put the still somewhat cloudy filtrate through an ordinary filter. In the case of highly viscous oils, the use of a centrifuge is suggested for separating the lime sludge from the clarified oil. The lime treatment is said to have no injurious influence on the charring of the wick, or on the colour of the finished oil.—C. S.

Mineral oils in Spain; Tariff classification of —. Board of Trade J., Oct. 28, 1909. [T.R.]

A ROYAL ORDER, dated the 11th October, contains the following provisions:—

1. Note 3 to the Tariff is to be altered in the sense that lubricating oils included under Tariff No. 23 must contain less than 10 per cent. by volume of tar.

2. Those oils are to be dutiable under Tariff No. 20 which leave, on distillation at 300° C., residues to the amount of more than 80 per cent., or emit inflammable vapours below 150° C.; which, treated with concentrated sulphuric acid, rise more than 3° C. in temperature; which contain more than 10 per cent. by volume of tar, or leave a solid residuum greater than 3 per cent. of the distilled liquid.

3. Oils which do not satisfy the foregoing conditions, and are not included under Tariff Nos. 21 or 22, are to be dutiable as lubricating oils under Tariff No. 23.

Nos. 20—23 of the Spanish Tariff are as follows:—

Petroleum and mineral oils, which leave, on distillation at 300° C., residues to the amount of:—

No.		Duty.
		Pes. Cts.
20	More than 80 per cent.	100 kilos. 30 00
21	From 20 to 80 per cent. inclusive	" 25 00
22	Less than 20 per cent.	" 37 00
23	Oleomaphtha, mineral lubricating oils, vaseline, and mixtures of these products with animal or vegetable oils or fats	" 40 00

NOTE.—25.15 pesetas = £1 sterling.

Fats: Detection of — in vaseline. A. Ferraro, L'Union pharm., 1909, 50, 400.

A REAGENT is prepared by adding ammonia, drop by drop, to a saturated aqueous solution of acid fuchsine, until the colour disappears. Twenty grms. of vaseline are intimately mixed in a porcelain capsule, with 4 or 5 grms. of the reagent. In presence of animal or vegetable fats, a more less intense rose tint will be evident.—J. O. B.

PATENTS.

Nitrobenzene: Process of making —. Saccharin-Fabr. A.-G. vorm. Fahlberg, List, und Co. Fr. Pat. 401,679, April 5, 1909.

IN the preparation of nitrobenzene from benzene, sulphuric acid, and an alkali nitrate, the sulphuric acid should be slowly added to a mixture of benzene and alkali nitrate in such a manner that a layer of a solution of alkali bisulphate is formed on the surface of the mixture as rapidly

and at as low a temperature as possible; in this way the nitration proceeds regularly. For example, 115 kilos. of sodium nitrate and 35 kilos. of benzene are heated to 60°–80° C. in a vessel provided with a stirrer: 150 kilos. of 90–96 per cent. sulphuric acid are slowly added, with stirring, when the temperature will rise to about 100° C. A further quantity of 65 kilos. of benzene is now added gradually, agitation being continued until the mixture can separate readily into two layers. The product is now heated for a short time and the nitrobenzene separated and purified in the usual manner. The yield is said to amount to 148 kilos. of pure nitrobenzene. The aqueous residue deposits sodium bisulphate on cooling, and the mother liquor, which contains a small quantity of nitric acid, may be added to the sulphuric acid for a subsequent nitration.—T. F. B.

Tar, pitch, asphaltum, and analogous substances; Process for purifying — by extraction with solvents, with simultaneous recovery of pure carbon. Chem. Fabr. Lindenhof C. Weyl und Co. Ger. Pat. 213,507, July 31, 1908.

It has been proposed to treat tar, pitch, asphaltum, etc., with hydrocarbons and carbon bisulphide to facilitate the separation of the carbon; the separation is, however, incomplete, since aniline, pyridine, and other bases extract further quantities of bituminous constituents from the solid residue. Extraction with aniline and pyridine is costly, so it is proposed to use phenols or phenolic constituents of tars for the purpose. The extraction may be performed by the phenol alone, or it may be preceded by an extraction with hydrocarbons. By filtration of the mixture of tar or other substance with phenol, and washing with a further quantity of phenol and then with alkali and water, a pure carbon is said to be obtained. The phenol is separated from the extract by treatment with alkali and precipitation of the solution with carbon dioxide. The bituminous extract obtained has a considerably higher softening-point than that produced by extraction with hydrocarbon alone.—T. F. B.

Paraffin wax for candles or other purposes; Manufacture of —. R. H. F. Finlay, Belfast. Eng. Pat. 8768, April 13, 1909.

THE stearine commonly added to paraffin wax to increase its strength and prevent crystallisation in the moulds is partially or completely replaced by a small quantity of a soap or soaps. These may be salts either of alkali metals or of other inorganic bases with fatty or allied acids.—C. A. M.

Sulphuric acid and oils; Process for the recovery of — from waste acid of all kinds. G. Stolzenwald. Ger. Pat. 213,589, May 23, 1908. Addition to Ger. Pat. 212,000, Aug. 6, 1907.

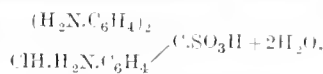
IF the waste acid contains much tarry or resinous matter, it is diluted with water, and heated in covered lead pans, the vapours being passed to a condenser to recover volatile oils. When most of the volatile oils have distilled over, the residual acid is run into a settling vessel and allowed to cool, when the greater part of the resinous and tarry matters rises to the surface and forms a solid cake. After removing this, the acid is treated in the apparatus described in the main patent (this J., 1909, 1081).—A. S.

Improving tar oil [for preserving wood, etc.]. Ger. Pat. 213,715. See IX.

IV.—COLOURING MATTERS AND DYESTUFFS.

Rosaniline hydrochloride and Crystal Violet; Decomposition of the leucosulphonic acids of — in aqueous solution. J. H. Kastle. Amer. Chem. J., 1909, 42, 293–300.

ACCORDING to Hantzsch and Osswald (this J., 1900, 236), the compound obtained by the action of sulphur dioxide on pararosaniline hydrochloride has the constitution,



and these workers gave it the name pararosaniline hydrochloride leucosulphonic acid; it is partially decomposed by a current of carbon dioxide even in the cold, pararosaniline hydrochloride being regenerated. The author has now investigated the nature of the decomposition of the leucosulphonic acids of rosaniline hydrochloride and Crystal Violet in aqueous solution. Dilute solutions (about 0.1 per cent.) of rosaniline hydrochloride and Crystal Violet were decolorised with sulphur dioxide. On evaporation, the decolorised solutions yield the original dyestuffs, and on boiling for a long time, they become permanently coloured; if, however, they are only boiled for a short time so that all the sulphur dioxide is not removed, the colours appear and persist in the hot solutions but disappear on cooling; the changes may be repeated several times on the same solution by alternate heating and cooling. The author has also shown that the decomposition of the leucosulphonic acids of the dyestuffs of the pararosaniline type in aqueous solution is a reversible process, and that atmospheric air does not cause the above-mentioned changes of colour. As to whether the change is one of simple or of hydrolytic dissociation remains to be decided; the author inclines to the latter view.—L. E.

Ethylene derivatives containing nitrogen. G. Busignies. Comptes rend., 1909, 149, 348–350.

By the action of the Grignard reagent on amino- or alkylamino ketones the author has prepared a number of ethylene bases. The following were obtained by using, on the one hand, methyl, ethyl and isoamyl iodides and benzyl chloride and, on the other hand, dimethylaminobenzophenone, Michler's ketone, and tetraethyldiaminobenzophenone: *p*-dimethylaminodiphenylethylene, m.pt. 47° C.; *p*-dimethylaminodiphenylpropylene, m.pt. 91° C.; *pp*-tetramethyldiaminodiphenylethylene, m.pt. 115° C.; *pp*-tetramethyldiaminodiphenylpropylene, m.pt. 99° C.; isoamylidenetetramethyldiaminodiphenylmethane, m.pt. 61° C.; *pp*-tetraethyldiaminodiphenylethylene, m.pt. 102° C.; and *pp*-tetraethyldiaminodiphenylpropylene, m.pt. 56° C. These ethylene derivatives combine with 2 atoms of hydrogen to give the corresponding saturated compounds.—J. C. C.

Leuco bases and dyestuffs derived from diphenylethylene; New series of —. P. Lemoult. Comptes rend., 1909, 149, 606–608. (See also Fr. Pat. 382,187; this J., 1908, 936).

THE substances described by Busignies (preceding abstract) are true leuco-bases for on oxidation in acid solution (best with sodium nitrite) they give the following colours: tetramethyldiaminodiphenylethylene, green; tetraethyldiaminodiphenylethylene, green; tetramethyldiaminodiphenylpropylene, blue; tetraethyldiaminodiphenylpropylene, blue; tetramethyldiaminodiphenylphenylethylene, greenish blue, and tetraethyldiaminodiphenylphenylethylene, blue green. These colours can be fixed on tannin-mordanted cotton when sodium nitrite is added to the bath containing the fibre and leuco-base.—J. C. C.

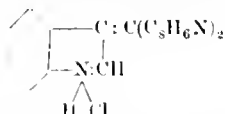
Hydroxyazo-derivatives obtained from aminomethylene-catechol. E. Mameli. Gaz. chim. ital., 1909, 39, II., 314–321.

By combining the diazo-derivative of aminomethylene-catechol, $\text{CH}_2\text{O}_2 : \text{C}_6\text{H}_3.\text{NH}_2[\text{CH}_2\text{O}_2 : \text{NH}_2 \quad 1:2:5]$, with phenols or their derivatives, hydroxyazo-compounds are obtained, which act as acid dyestuffs. They are specially suitable for dyeing wool and silk in a bath containing sulphuric acid and sodium sulphate; and in a lesser degree for dyeing artificial silk in a bath containing acetic acid. They also dye cotton mordanted with tannin and tartar emetic in a bath containing acetic acid. The shades produced are fast to washing and light, especially on wool and silk. The dyestuffs from phenol, *o*- and *p*-resol, *α*- and *β*-naphthol, and salicylic acid were prepared. Of these,

the products from phenol and α -naphthol possessed the greatest colouring power, the latter dyeing wool dark red in an acid bath.—A. S.

Tri-indylmethane dyestuffs. A new class of dyestuff of biochemical importance. A. Ellinger and C. Flamand. *Z. physiol. Chem.*, 1909, **62**, 276—286.

ELLINGER found in 1906 (*Ber.*, **39**, 2519) that when β -indolaldehyde is heated with moderately concentrated acids a red dyestuff is obtained. The authors have investigated this more fully, and find that the dyestuff prepared by the use of 50 per cent. sulphuric acid dyes wool and silk from alcoholic acetic acid solution in red-brown shades inclining to violet. As this reaction is accompanied by the formation of formic acid and sulphur dioxide, it seemed likely that the dyestuff had been formed by condensation of indolaldehyde with indole and subsequent oxidation and salt formation, and that it consisted of a tri-indylmethane derivative. This was proved by its synthesis from indole, chloroform and alcoholic potash. The dye-base has therefore the formula, $\text{HO} \cdot \text{C}(\text{C}_6\text{H}_5\text{N})_3$, and the salt the formula,



On heating the dyestuff with water under pressure, it is decomposed into indole and indolaldehyde. The authors think it probable that uroscine and "seatole red" may belong to this new series.—J. C. C.

ERRATUM.—This Journal, 1909, page 1082, col. 1, line 30 from top, for "85°—87° C." read "64°—65° C."

PATENTS.

Azo dyestuff. M. Kahn and A. Ossenbeck, Assignors to Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. U.S. Pat. 935,031, Sept. 28, 1909.

THE azo dyestuffs obtainable from dinitro-orthoamino-m-cresol and 2-arylamino-5-naphthol-7-sulphonic acids are dark powders, soluble in water with a violet colour, and dye wool in violet shades which are converted into fast black shades by chroming.—F. M.

Azo dyestuffs. P. Volkmann, Assignor to Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. U.S. Pat. 935,829 and 935,830, Oct. 5, 1909.

DIAZOTISED toluidines or toluidinesulphonic acids are combined with 1-sulphoaryl-3-methyl-5-pyrazolones. The dyestuffs from *p*-toluidine and 2-toluidine-5-sulphonic acid are especially claimed. All the products are soluble in water, and dye wool yellow shades.—T. F. B.

Azo dyestuff. M. Kahn, Assignor to Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. U.S. Pat. 936,456, Oct. 12, 1909.

CLAIM is made for the dyestuff obtained from diazotised *p*-aminochrysoidine and 1:8-aminonaphthol-4:6-disulphonic acid. It forms a dark powder giving a blue solution with concentrated sulphuric acid and dyeing cotton in blue shades which when developed with diazotised *p*-nitraniline are changed to black.—J. C. C.

Tetrazo dyestuff; Orange to red —. A. Schedler, Assignor to Soc. Chem. Ind. in Basel, Switzerland. U.S. Pat. 936,367, Oct. 12, 1909.

CLAIM is made for the tetrazo dyestuffs obtained by combination of one molecule of the tetrazo derivative of a diamine of the general formula, $\text{NH}_2 \cdot \text{R}' \cdot \text{X} \cdot \text{R} \cdot \text{NH}_2$, with two molecules of a component one of which is a molecule of an aminoaryl-5-pyrazolone derivative. The products are brownish-yellow to brown powders dyeing unmodanted cotton in orange-yellow to orange-red shades which, when further diazotised and developed with β -naphthol, yield orange to red tints fast to washing.—J. C. C.

Mongazo dyestuffs; Production of new —. Act.-Ges. f. Anilinfabr. Fr. Pat. 401,006, March 15, 1909.

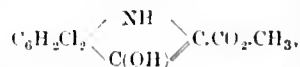
THE new dyestuffs are obtained by combining diazo-compounds with 3-amino-4- and -2-cresols ($\text{CH}_3 : \text{OH} : \text{NH}_2 = 1:4:3$ and $1:2:3$) in acid solution. They dye unmodanted wool from an acid bath and are specially suitable for subsequent chroming. They can also be used as intermediate products for the production of polyazo dyestuffs. The azo-dyestuff prepared from diazotised *p*-nitraniline and 3-amino-4-cresol is a red powder with a green, metallic lustre. When *p*-chlor-anilinesulphonic acid is used instead of *p*-nitraniline, the resulting dyestuff forms a red powder with a green metallic lustre; it dyes wool in brown shades which change to brownish-red on chroming. The dyestuff obtained by combining diazotised sulphanilic acid with 3-amino-2-cresol is a red powder; it dyes wool in brownish-orange shades which become brown on chroming.—J. C. C.

Yellow dyestuff; Production of a —. L. Cassella and Co. Fr. Pat. 401,379, July 21, 1908.

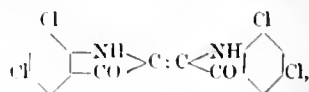
By condensing dinitrostilbenedisulphonic acid with formaldehyde in the presence of sodium hydroxide, a dyestuff is produced which dyes cotton direct in yellow shades fast to washing, light, and chlorine.—J. C. C.

Halogenated indigos and intermediate products serving for their manufacture; Production of —. Badische Anilin und Soda Fabrik. Fr. Pat. 401,506, April 1, 1909. Under Int. Conv., Dec. 12, 1908, and March 9, 1909.

NEITHER the halogen derivatives of phenylglycine nor of phenylglycine-*o*-carboxylic acid can be transformed into halogenated derivatives of indigo, because the halogens are eliminated in the necessary operations. It is now found, however, that the acid or neutral esters of halogenated phenylglycine-*o*-carboxylic acids can be transformed into the corresponding halogenated indigos without loss of halogen. Example 1: Dichloroanthranilic acid (m. p. 222°—224° C.) is treated with formaldehyde and the product converted into *o*-cyanomethyldichloroanthranilic acid by digestion with potassium cyanide. On hydrolysis of this nitrile, 4:6-dichlorophenylglycine-2-carboxylic acid, identical with the acid produced by chlorinating phenylglycinecarboxylic acid, is obtained. Example 2: Dibromoanthranilic acid, m. pt. 245°—248° C., is prepared in a similar way from dibromoanthranilic acid, m. pt. 225° C. Example 3: By the same process tetrachloroanthranilic acid is converted into tetrachlorophenylglycine-*o*-carboxylic acid, m. pt. 198° C. Example 4: By the same series of operations anthranilodiacetic acid, $\text{CO}_2\text{H} \cdot \text{C}_6\text{H}_4 \cdot \text{N}(\text{CH}_2\text{CO}_2\text{H})_2$, identical with the acid obtained from anthranilic acid and chloroacetic acid, is prepared either from *o*-cyanomethylantranilic acid or phenylglycine-*o*-carboxylic acid. Example 5: By chlorinating dimethylphenylglycine-*o*-carboxylate in benzene solution, dimethyldichlorophenylglycine-*o*-carboxylate is produced. Example 6: The same ester, m. pt. 78° C., is obtained by methylating 4:6-dichlorophenylglycine-2-carboxylic acid. Example 7: On treating the ester described in the preceding example with sodium in toluene solution, methyl 5:7-dichloroindoxylcarboxylate,



m. pt. 195° C., is produced, and on heating this with dilute aqueous sodium hydroxide, 5:7:5':7'-tetrachloroindigo



is obtained. This is a blue powder which dyes cotton and wool in bright blue shades. Example 8: Methyl 7-chloro-5-bromoindoxylcarboxylate is prepared by treating methyl 4-bromo-6-chlorophenylglycine-2-carboxylate with sodium methoxide, and on treatment with aqueous sodium hydroxide it yields 7:7'-dichloro-5:5'-dibromoindigo which dyes cotton in bright greenish-blue shades.—J. C. C.

Azo dyestuff; Manufacture of a new —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,600, Nov. 16, 1908.

SEE Fr. Pat. 396,381 of 1908; this J., 1909, 565.—T. F. B.

Azo dyestuffs; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 657, Jan. 11, 1909.

SEE U.S. Pat. 935,031 of 1909; preceding.—T. F. B.

Anthracene derivatives; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2373, Feb. 1, 1909. Addition to Eng. Pat. 1822, Jan. 27, 1908.

SEE Addition of Jan. 29, 1909, to Fr. Pat. 386,599 of 1908; this J., 1909, 976.—T. F. B.

Gallocyanine dyestuffs and process of making same. W. Lommel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 936,247 and 936,248, Oct. 5, 1909.

SEE Addition of Feb. 23, 1909, to Fr. Pat. 396,564 of 1908; this J., 1909, 1029.—T. F. B.

Azo dyestuffs. J. Jansen and W. Neelmeier, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 936,321, Oct. 12, 1909.

SEE Fr. Pat. 396,833 of 1908; this J., 1909, 596.—T. F. B.

Monoazo dyestuffs; Manufacture of yellow —. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 6728, March 29, 1909.

SEE Fr. Pat. 401,133 of 1909; this J., 1909, 1082.—T. F. B.

Chromable [azo] dyestuffs; Manufacture of red —. L. Cassella und Co., Frankfurt on Maine, Germany. Eng. Pat. 10,187, April 29, 1909. Under Int. Conv., May 26, 1908. Addition to Eng. Pat. 8154 of 1909, dated April 7, 1908.

SEE Addition of May 26, 1908, to Fr. Pat. 398,980 of 1908; this J., 1909, 976.—T. F. B.

Dyestuffs; Process for producing chrome —. L. Cassella und Co. Fr. Pat. 401,548, July 29, 1908.

SEE Eng. Pat. 16,743 of 1908; this J., 1909, 879.—T. F. B.

Azo dyestuff; Process of making a red —. E. Ulrichs, Elberfeld, Assignor to Wülfig, Dahl, und Co., A.-G., Barmen, Germany. U.S. Pat. 936,260, Oct. 5, 1909.

SEE Eng. Pat. 4859 of 1909; this J., 1909, 975.—T. F. B.

Azo dyestuff. O. Schmidt, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 936,951, Oct. 12, 1909.

SEE Eng. Pat. 25,311 of 1908; this J., 1909, 469.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

Nigrisin; The production of — and similar dyestuffs on the fibre. J. Brandt, Sealed Note No. 1027, dated Mar. 16, 1898, and Report thereon by R. Federmann. Bull. Soc. Ind. Mulhouse, 1909, 79, 251—254.

NIGRISIN is produced when aqueous or alcoholic solutions of nitrosodimethylaniline hydrochloride are boiled. Upon printing a thickened solution of this salt upon cotton and then steaming, a yellow shade is obtained but no decomposition of the nitroso compound takes place, whereas in the presence of an organic acid a grey (similar in shade to that given by Nigrisin upon un mordanted cotton) is produced on steaming. By replacing the organic acid by tannin steaming, fixing with tartar emetic and washing, a deep rich grey is obtained. Level shades are obtained by dyeing in a weak bath of nitrosodimethylaniline salt and tannin, drying in the hot flue, steaming, and fixing with tartar emetic; by reduction the nitroso compound is converted into dimethylparaphenyl-

caediamine, so that by printing with suitable reducing pastes, white and colour discharge effects upon a grey ground are obtained.—F. M.

PATENTS.

Artificial fibres from cellulose; Manufacture of —. W. P. Dreaper, Felixstowe. Eng. Pat. 20,316, Sept. 28, 1908.

SOLUTIONS of cellulose in the ordinary cuprammonium solution will give good filaments when squirted into concentrated alkaline solutions to which have been added organic substances which materially increase the viscosity of the solutions. For example a 10 per cent. solution of glucose containing 10 per cent. of sodium hydroxide may be used for spinning with a 10—12 per cent. solution of cellulose. The temperature of the precipitating bath may be raised even up to 70° C. Where such a bath is used, the cellulose or hydrocellulose is dissolved in aqueous solutions containing either zinc chloride or copper carbonate dissolved in ammonia.—P. F. C.

Cellulose and albuminoid bodies [Artificial silk]; Process of strengthening —. X. Eschaliar. Fourth Addition, dated March 31, 1909, to Fr. Pat. 374,724, April 24, 1906 (this J., 1907, 821).

THE reagents used for the "sthenosage" of artificial silk, etc., may be dissolved in other media than water, e.g. acetone, alcohol, glycerin, etc. The use of acetone is particularly advantageous, since it dispenses with the usual process of dehydration. The dry silk is introduced into a bath composed of 150—200 parts of acetone, 5—20 parts of 40 per cent. formaldehyde and 0.5—0.15 part of sulphuric acid of 66° B. or hydrochloric acid of 23° B. These quantities are sufficient for treating 10 parts of silk. The whole is boiled for 3—5 hours under a reflux condenser, the silk being completely immersed. The silk is then washed with water and dried. When required for dyeing, the silk is subsequently steeped in an alkaline solution of a hypochlorite, containing 30—50 grms. of sodium hydroxide and 3—5 litres of available chlorine per litre. Other acids may be used, if desired, instead of the mineral acids.—J. F. B.

Artificial threads; Preparation of stable solutions for obtaining —. P. Friedrich. First Addition, dated Mar. 23, 1909, to Fr. Pat. 400,321, Feb. 13, 1909. Under Int. Conv., Mar. 30, 1908.

ACCORDING to the principal patent (see Eng. Pat. 4104 of 1909; this J., 1909, 934), carbohydrates or gums were added to the solutions of cellulose. Solutions having the same properties can be more directly obtained by preparing the cellulose solutions from those plants which contain both carbohydrates and cellulose. The outside layers of the rice plant, for example, give good results if they are first treated with alkalis and then bleached and washed before being dissolved in a cuprammonium solution.—P. F. C.

Colloidal solutions of ammoniacal cupric hydroxide for the manufacture of threads and filaments of cellulose; Preparation of —. Soc. Anon. Le Crinoid. Fr. Pat. 401,741, Aug. 6, 1908.

As described in Fr. Pat. 362,986 of 1906 (this J., 1906, 808) colloidal ammoniacal cupric hydroxide can be separated from the other constituents of a cuprammonium solution by dialysis, and it is this substance which has the property of dissolving cellulose. It is found that when all the cupric hydroxide in a cuprammonium solution is in the colloidal state, approximately two parts of cellulose can be dissolved by each part of cupric hydroxide in solution. These colloidal solutions can be prepared in two ways:—(A). By treating solutions of copper salts with ammonia and caustic alkalis, the solutions being of such concentrations that the cuprammonium solution contains no more than 15 grms. of cupric oxide per litre. (B). By the joint action of air and ammonia on metallic copper in the cold and subsequent dialysis of the product. Pure cellulose is dissolved in liquor A to which has been added enough of liquor B to make the mixed solutions sufficiently concentrated to dissolve the amount of cellulose required for the filament to be made.—P. F. C.

Kier for scouring fabrics open width under pressure and having lateral circulation. Soc. Anon. de Teinture et Impression de Saint-Julien. Fr. Pat. 401,690, Apr. 6, 1909.

This apparatus comprises a rectangular vat which is provided with two perforated vertical sheet iron partitions arranged near to opposite walls. Between each partition and its neighbouring wall, steam coils are disposed to maintain the temperature of the scouring liquor. The vat is placed in connection with a pump by means of pipes which are so arranged that the liquor has to circulate laterally through the fabric, the latter being plaited down inside the vat, and through the perforations in the partitions. A tubular apparatus for heating the scouring liquor without diluting it is also included in the system. The apparatus is provided with devices for removing the lid of the kier and with an arrangement for keeping the material in position during the scouring operation.—P. F. C.

Bleaching of textile materials by emulsified stearine. E. Lasbordes. First Addition, dated Mar. 25, 1909, to Fr. Pat. 399,514, Feb. 8, 1909 (this J., 1909, 979).

In the bleaching process described in the principal patent, the effective agent is the stearine which, especially when it has an acid reaction, is able of itself to produce a good white. The best result is obtained if the material is exposed to air for a time after being withdrawn from the bleaching bath.—P. F. C.

Dyeing and sizing, or dyeing and starching, in one operation, yarns or fabrics made of vegetable fibres. E. F. Kur, Bournemouth. Eng. Pat. 20,743, Oct. 2, 1908.

AN alkaline size is prepared by mixing 30 lb. of farina or other sizing material with 30 galls. of cold water and next adding not less than 2 galls. of caustic soda lye of 44° Tw., the mixture being then stirred till transparent and of a pasty consistence. Ten galls. of the alkaline sizing are mixed with a boiling solution of 9 lb. of dyestuff in 20 galls. of water. This solution may then be applied to piece goods on a padding machine and to warp yarns in the sow-box of a sizing machine.—P. F. C.

Silk: Treatment of materials containing —. T. Boettger, Hackensack, and F. Vom Eyser, Rochelle Park, N.J. U.S. Pat. 935,292, Sept. 28, 1909.

THE treatment consists in subjecting the material to the action of a hot, dilute, slightly alkaline solution of Turkey Red oil and then dyeing without previous washing.—F. M.

Loading agent or sizing ingredient [for textiles]: Production of a —. J. H. Richardson, Manchester. Eng. Pat. 493, Jan. 8, 1909.

CHINA clay is dried at 212–220° F., then very finely powdered and is finally screened.—P. F. C.

Wool: Electrical process for removing the grease and yolk from — and apparatus therefor. R. Vandatte and B. Lagye, Antwerp. Eng. Pat. 5859, March 11, 1909. SEE Fr. Pat. 399,875 of 1909; this J., 1909, 934.—T. F. B.

Textile materials: Apparatus for treating — and for mixing liquids with chemicals, dyeing materials, oils, and the like. R. Diederichs, Cologne, Germany. Eng. Pat. 22,738, Oct. 26, 1908. Addition to Eng. Pat. 8821, April 22, 1908.

SEE Addition of Oct. 26, 1908, to Fr. Pat. 390,105 of 1908; this J., 1909, 471.—T. F. B.

Dyeing and printing [with dianthraquinonylamines]: Process of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,810, Nov. 18, 1908.

SEE Ger. Pat. 208,845 of 1908; this J., 1909, 519.—T. F. B.

Dyeing with oxyanthraquinone dyestuffs. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 26,460, Dec. 7, 1908.

SEE Fr. Pat. 397,659 of 1908; this J., 1909, 792.—T. F. B.

Dyeing woollen yarn on bobbins: Method of, and apparatus for —. H. Maly, Bedburg, Germany. Eng. Pat. 5575, March 8, 1909.

SEE Fr. Pat. 401,290 of 1909; this J., 1909, 1085.—T. F. B.

Dyeings with sulphide dyestuffs: Production of fast — in iron apparatus. L. Cassella und Co. Fr. Pat. 401,589, July 30, 1908.

SEE Eng. Pat. 17,267 of 1908; this J., 1909, 701.—T. F. B.

Printing on felt and the like: Process of —. R. J. C. Mitchell, Lincoln. U.S. Pat. 935,675, Oct. 5, 1909.

SEE Eng. Pat. 20,747 of 1907; this J., 1908, 683.—T. F. B.

Zinc formaldehyde sulphocylate: Process of preparing —. F. Rademacher, Prague-Karolinenthal, Austria-Hungary. U.S. Pat. 935,815, Oct. 5, 1909.

SEE Eng. Pat. 4761 of 1908; this J., 1908, 1058.—T. F. B.

Vegetable fibres: Method and means for protecting from decomposition and putrefaction —. A. Gadd and G. Dillberg, Ovedsgård, Sweden. U.S. Pat. 936,113, Oct. 5, 1909.

SEE Eng. Pat. 16,757 of 1907; this J., 1908, 499.—T. F. B.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Hydrocyanic acid: Formation of — from ammonia and wood charcoal and from di- and trimethylamine. G. A. Voerkelius. Chem.-Zeit., 1909, 33, 1025–1026, 1078–1081, 1090–1092.

IN Buch's process (see Eng. Pat. 7171 of 1895; this J., 1896, 114) for the utilisation of the nitrogen contained in the vinasse from beetroot molasses, the latter is first subjected to destructive distillation at about 640° C., and the distillation gases, which contain steam, carbon dioxide and monoxide, hydrogen, methane, nitrogen, ammonia, and methylamines, are heated to 800°–1000° C. in a superheater. The resulting gaseous mixture contains about 7 per cent. by vol. of hydrocyanic acid, 7 of ammonia, 8 of methane, 12 of hydrogen, 18 of carbon monoxide, 24 of carbon dioxide, and 24 of nitrogen. In order to gain an insight into the reactions taking place in the superheater, the author has studied the behaviour of ammonia in presence of wood charcoal at temperatures between 700° and 1000° C., and the effect of heating di- and trimethylamine to temperatures of from 600° to 1000° C. It was found that at temperatures above 700° C. when a mixture of ammonia and hydrogen is led over wood charcoal, the gaseous mixture produced contains hydrocyanic acid, ammonia, nitrogen, and hydrogen, but no methane. The ratio of ammonia to hydrocyanic acid varies. The yield of hydrocyanic acid and the proportion of undecomposed ammonia both rise with increasing dilution of the ammonia and with increase of the velocity with which it is passed over the charcoal; dilution with coal gas is better than dilution with hydrogen in regard to yield of hydrocyanic acid. The best yield of hydrocyanic acid is obtained at about 1000° C. The activity of the charcoal gradually decreases. The experiments as to the effect of heat on tri- and di-methylamine, showed that at 800°–1000° C. the former is decomposed almost quantitatively into hydrocyanic acid and methane; below 800° C. the formation of hydrocyanic acid is less, and it ceases altogether at 600° C., at which temperature trimethylamine probably forms tetramethylhydrazine, according to the equation: $2N(CH_3)_3 - H_2 = (CH_3)_2N.N(CH_3)_2 + 2CH_4$. Dimethylamine decomposes quantitatively into hydrocyanic acid, methane, and hydrogen at 820°–1120° C., but when mixed with more than 50 per cent. of hydrogen, a portion also decomposes in accordance with the equation: $NH(CH_3)_2 + 2H_2 = NH_3 + 2CH_4$. The amount decomposed in this manner increases with the proportion of hydrogen present, until with 97 per cent. of hydrogen, hydrocyanic acid is no longer produced. The results of the investigation show that in order to obtain the maximum yield of hydrocyanic

acid in Bueh's process, the destructive distillation of the vinasse should be conducted so as to yield as much trimethylamine as possible: the hot gases should be removed from the superheater as quickly as possible; and the filling material of the superheater should consist of glazed stone or stone coated with carbon, in order to diminish the catalytic decomposition of the hydrocyanic acid. (See also this J., 1896, 449, 543; 1897, 440.)—A. S.

Electrolysis in the alkali and bleaching powder industry. B. Lepsius. Ber., 1909, 42, 2892—2916.

THOUGH the groundwork of the electrolytic decomposition of common salt was laid by Davy and by Faraday, its application on the industrial scale was not practicable till the development of the dynamo made cheap electric energy possible. The earliest attempts were made at the Griesheim works near Frankfurt; and after many failures Stroof and the Brothers Lang succeeded there in working out a practicable process. The cells were vertical, the cathodes of iron, and the anodes of carbon. The anode cells, within the cathode cells, were made of cement, salt, and hydrochloric acid, and became during use very porous through the dissolution of the finely-divided salt they contained. They were furnished with lids, through which passed tubes to carry off the chlorine. The cathode cells, 6 to 12 in an iron trough, separated by iron partitions, were provided with pipes at the bottom to run off the alkaline solution, and with tubes to carry away the hydrogen to gas-holders or compression plant. As the electrolysis proceeded, the sodium hydroxide formed shared more and more in the current, so that not only was there considerable waste of energy, but the anodic oxygen destroyed the carbon anodes, and the carbon dioxide formed diluted the chlorine, and reacted on the lime in the bleach chambers. Accordingly, anodes of magnetic oxide of iron were substituted, made by casting ferric oxide fused at the temperature of the electric arc. The oxygen now, at the bath-temperature (70° – 80° C.) formed chlorate, which crystallised out and was from time to time removed. When the alkalinity of the cathode liquor had reached the desired amount, the current was stopped, the liquor run off and evaporated, whilst fresh chloride solution was run into the cathode cells. When the concentration of the liquor reached 50 per cent., practically all the undecomposed salt separated, and was returned to the process. The Griesheim Company worked at first with 400 h.p.; in 1892 this was doubled, and soon after another work of 2000 h.p. was erected. They also erected works at Bitterfeld in Saxony (where the local lignite furnished a cheap source of power) of 3500 h.p., at Lamotte in France, and at Flix near Barcelona, where the Elbro furnished the power. The Badische Anilin- und Soda-Fabrik, the Allgemeine Elektrizitäts-Ges., and others, also erected plants to work the Griesheim process, which to-day employs about 33,000 h.p., corresponding to a yearly output of about 50,000 tons of caustic soda and 120,000 tons of bleaching powder. The process of Castner, Kellner, and Solvay began on an industrial scale in 1897. In the Castner process, the bath is divided into three by two partitions which dip into a layer of mercury on the bottom. The outer sections contain salt solution and carbon anodes, and are provided with tubes to carry off the chlorine; the middle section contains water and iron cathodes. Mechanism tilts the bath at regular intervals, so that the mercury occupies the bottom of two sections, and each half of it is alternately in the anode- and the cathode-cell. The sodium produced in the anode-cell, where the mercury is cathode, amalgamates with the mercury, and when this becomes anode in the cathode-cell the sodium is converted into hydroxide, with evolution of hydrogen at the cathode. To avoid the possible oxidation of the mercury through water-decomposition in the middle cell, due to lack of sodium ions caused by recombination of sodium and chlorine in the anode cell, which always occurs to some extent, Kellner connects the iron cathode directly with the mercury by an outside wire, so that this cell works independently of the main current. This process, or the Solvay process, in which the cell is fixed, but a constant stream of mercury passes through it, is worked in Germany at Osternienburg (1500 h.p.) and at Gersthof; in England at Oldbury and Runcorn [and Wallsend]; in Belgium at Jemappes; in Russia at Liubimow; in Austria at Golling;

in Bosnia, and at Niagara Falls. The process has the advantages of working without diaphragms, of yielding a very pure product, and of attaining a high concentration in the alkaline liquor, so that the cost of evaporation is reduced; but it needs a higher E.M.F. than the other process (4.3 volts against 3.5), presents greater technical difficulties in the working of the apparatus, and involves considerable outlay for mercury. It also requires more ground-space than the vertical cell process. The third type of process is the Austrian "bell-process," worked at Aussig, and also at Greppin and Stassfurt in Germany. Here the horizontal carbon anode, pierced with holes for the escape of chlorine, is placed in a non-conducting bell-jar, outside of which is the iron cathode. Through the neck of the jar pass tubes, for the exit of chlorine and the supply of electrolyte. The greater density of the alkali solution keeps it separate from the anode-liquid, and a slow stream of fresh electrolyte continually enters the bell, whilst an overflow of alkali-solution leaves the outer circumference of the cell. This method also needs high E.M.F., as the electrodes are so far apart, and requires considerable ground-space; but it has the advantages of avoiding diaphragms and movable apparatus.

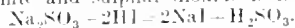
In estimating the influence of electrolytic processes on the industry, it is to be remembered that the ammonia-soda process, which from the point of view of the production of soda presents many advantages over the Leblanc process, was not able to supplant that process entirely; the old process was still needed to supply the world's chlorine, and the sodium sulphate produced at the same time was used directly in glass-making. None of the proposals from time to time made to recover the chlorine in the ammonia-soda process have proved successful, but the electrolytic production of chlorine at once affected the Leblanc industry, which has steadily declined since, and is still declining. The early electrolytic processes worked with potassium chloride, and the world's production of potassium hydroxide (chiefly used in soapmaking) is now nearly all the result of electrolysis. Electrolytic chlorine is by no means all used in the manufacture of bleach: large quantities are used in making organic derivatives—chloroform, chloral, carbon tetrachloride, chloroacetic acid, chloro- and dichlorobenzene, etc., and liquid chlorine itself is largely sold, not only in iron cylinders, but even in large tank wagons. Moreover, the Griesheim process affords potassium chlorate, the yield of which can be greatly increased by appropriately altering the conditions. The other product of electrolysis is hydrogen: this was for long allowed to go to waste, but is now to a large extent collected and compressed, for use in autogenous soldering and welding, and for dirigible balloons. Electric energy is also largely used, apart from the alkali industry, in the production of bromine, iodine and iodoform, phosphorus, potassium chromate and permanganate, calcium carbide, sodium, calcium, magnesium, aluminium, and so forth.—J. T. D.

Alkali [sodium] nitrates and nitrites; Formation and decomposition of mixed crystals of —. G. Bruni and D. Meneghini. Z. anorg. Chem., 1909, 64, 193—199.

THE cooling and freezing-point curves for fused mixtures of sodium nitrate and nitrite have been studied, and show the formation of two series of mixed crystals of these salts, containing 0—29.5 and 35—100 per cent. of sodium nitrate respectively. It has been found, by comparing the heats of solution of mixtures prepared by fusion with those of corresponding mechanical mixtures of the salts, that the mixed crystals are almost completely broken up into their components on cooling, unless this be very rapidly effected. The presence of moisture increases the instability of the mixed crystal.—F. SODN.

Sodium sulphite; Detection of — in the presence of sodium sulphate and sodium thiosulphate. F. E. Weston. Chem. News, 1909, 100, 176.

IF to a solution of a sulphite there be added iodine in insufficient quantity to convert the whole of the sulphite into sulphate, the hydriodic acid produced reacts with the residual sulphite and sulphur dioxide is liberated—



The sulphur dioxide may be detected by its odour in strong solutions, or in weak solutions by the addition, drop by drop, of dilute potassium bichromate solution, which will be immediately reduced to a basic chromium salt and become pale green. The best method of applying the test is to add *N*/10 iodine solution to a 5 per cent. solution of the salt under examination. If decolorisation takes place the presence of a sulphite or thiosulphate or of both is indicated, whilst if the solution, after the addition of a faint trace of iodine in excess, is acid, it is probable that a sulphite is present. Another portion of the original solution is now treated with half the quantity of iodine used in the first test, and the solution examined for sulphur dioxide as described above. If no green coloration is obtained in the bichromate test a thiosulphate is present. Sulphates may be detected with barium chloride in the usual way, and the presence of a sulphite does not interfere with the confirmatory tests for thiosulphates.—C. A. M.

Calcium chloride: Solutions of lime and silica in fused —.
K. Arndt and W. Löwenstein. Z. Elektrochem., 1909, 15, 784—790.

At temperatures from 850° to 950° C., a saturated solution of lime in calcium chloride contains 13.8 per cent. of lime, or 100 grms. of calcium chloride dissolve 16.2 grms. of lime. Saturated solutions of silica in calcium chloride contain at 800°, 850°, 900°, and 950° C. respectively 2.5, 3.8, 5.4, and 7.6 per cent. of silica. The silica, however, with the oxygen of the air, decomposes the calcium chloride, so that whether silica alone, or a mixture of silica and lime, or calcium metasilicate be added to the fused calcium chloride, calcium orthosilicate, Ca_2SiO_4 , is ultimately formed. The specific electrical conductivity of fused calcium chloride at the four temperatures above mentioned is 2.40, 2.27, 2.40, 2.51; the conductivity is lowered by dissolved lime, still more by equivalent quantities of calcium orthosilicate. The density of the fused chloride at 800°, 850°, and 900° C. is 2.048, 2.026, and 2.002 respectively; it is increased by 0.009 for each 1 per cent. of lime, by 0.012 for each 1 per cent. of calcium orthosilicate, and by 0.036 for each 1 per cent. of silica dissolved.—J. T. D.

Alumina with silica, lime, and magnesia: Binary systems of —. E. S. Shepherd, G. A. Rankin, and F. E. Wright. Amer. J. Science, 1909, 28, 293—333.

IN addition to experiments with the lime-silica series of minerals (this J., 1907, 95), an investigation has now been made of the alumina-silica, alumina-lime and alumina-magnesia series. In the alumina-silica series only one compound, $\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$, was found to be stable in contact with the melt, the optical properties agreeing with those of the mineral sillimanite. The two other minerals, cyanite and andalusite, which have the same composition, slowly change into sillimanite at temperatures above 1300° C. There are four definite compounds of lime and alumina, $5\text{CaO} \cdot 3\text{Al}_2\text{O}_3$, m.pt. 1387° C.; $\text{CaO} \cdot \text{Al}_2\text{O}_3$, m.pt. 1587° C.; and two with no definite melting point, $3\text{CaO} \cdot \text{Al}_2\text{O}_3$ and $3\text{CaO} \cdot 5\text{Al}_2\text{O}_3$, but which are completely melted at 1550° and 1725° C. respectively. It is considered probable that only the compound, $3\text{CaO} \cdot \text{Al}_2\text{O}_3$, occurs in Portland cement. There is only one compound of magnesia and alumina, $\text{MgO} \cdot \text{Al}_2\text{O}_3$, similar to the lime-alumina compound. The temperature range of the lime-magnesia system is too high for satisfactory investigation, but it is considered to be an eutectic series with no compounds and little if any solid solution. A detailed description is given of the optical character of the various products, together with a number of tables and curves.—F. R.

Aluminium hydroxide: Solubility of — in aluminium sulphate solutions, and artificial preparation of "aluman."
R. Kremann and K. Hüttinger. Jahrb. d. K. K. Geolog. Reichsanstalt, 1909, 58, 637—658. Chem. Zentr., 1909, 2, 1200—1201.

The authors have determined the solubility of freshly-precipitated aluminium hydroxide in solutions of aluminium sulphate at different concentrations at 20°, 40°, and 60° C.

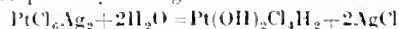
respectively. The solubility-curves at the different temperatures are of similar form, each consisting of three distinct portions (*ab*, *bc*, *cd*). Along the first portion (*ab*) with rising concentration of aluminium sulphate, the solubility of aluminium hydroxide increases rapidly; along the second portion (*bc*) of the curve, the solubility increases more slowly to a maximum at *c*, corresponding to a concentration of 32 per cent. of aluminium sulphate at 20° C., 28 per cent. at 40° C., and 38 per cent. at 60° C. Along the final portion (*cd*) of the curve, with further increase of the concentration of aluminium sulphate, the solubility of the aluminium hydroxide diminishes. The solid phases corresponding to the different portions of the curve are aluminium sulphate, $\text{Al}_2(\text{SO}_4)_3 \cdot 16\text{H}_2\text{O}$, for the portion *cd*; "aluman," $\text{Al}_2\text{O}_3 \cdot 2\text{SO}_3 \cdot 12\text{H}_2\text{O}$, for the middle portion, *bc*, and probably a still more basic compound for the portion, *ab*.—A. S.

Lead silicates. S. Hilpert and P. Weiler. Ber., 1909, 42, 2969—2977.

THERMAL investigation of mixtures of lead oxide and silica melted together in various proportions was undertaken. The difficulties were considerable, in consequence of the low heat-conducting power of the melts. The existence of a eutectic was demonstrated, containing 24 mols. of silica to 76 mols. of lead oxide, and it was shown that a metasilicate, but no orthosilicate, exists. In all probability another silicate, richer in silica than the metasilicate, also exists. Crystallised metasilicate has a sp. gr. of 6.36, the amorphous form a sp. gr. of 5.93. The refractive indices of the glasses formed on cooling mixtures rich in lead are very high; that of the mixture corresponding in composition to the orthosilicate is 2.07. The colour of this glass is dark-yellow; as the proportion of silica in the mixtures increases, their colour becomes lighter. These glasses are not suitable for optical uses, however, as their polished surfaces are not permanent. All the mixtures richer in lead than the metasilicate are easily decomposed by mineral acids or acetic acid; as the proportion of silica increases, they are more difficult to decompose. They are all very sensitive towards reducing gases; even at 240° C. hydrogen reduces them to metallic lead with considerable speed.—J. T. D.

Silver tetrachloroplatinate: Decomposition of —, by water, and preparation of fulminating platinum. J. Jacobsen. Comptes rend., 1909, 149, 574—577.

HEXACHLOROPLATINIC acid was prepared by passing chlorine through concentrated hydrochloric acid containing platinum black in suspension, and this was treated with silver nitrate in the cold. The silver hexachloroplatinate so formed was decomposed by hot water on the water-bath, and the tetrachloroplatinic acid obtained, treated again with silver nitrate. The silver salt formed was then decomposed by boiling with water for some hours.



The yield of dichloroplatinic acid was 80—90 per cent. of the theoretical. The solution, treated with excess of ammonia, gives a precipitate which, both when suspended in the solution, and when washed and dried, strongly resembles ferric hydroxide in appearance. When heated, it first darkens, then detonates with great violence, producing platinum black, nitrogen, oxygen, and water vapour. Its composition corresponds with the formula, $(\text{OH})_2\text{Pt}(\text{NH}_3)\text{Pt}(\text{OH})_2$. A substance similar in formula and in characters is obtained if pyridine be substituted for ammonia.—J. T. D.

Platinum trioxide. L. Wöhler and F. Martin. Ber., 1909, 42, 3326—3333.

HYDRATED platinum dioxide was dissolved in 2*N*-solution of potassium hydroxide, and the solution electrolysed at a temperature of 0° C. The anode became covered with a brilliant golden-yellow film, which gradually sealed off and floated in the liquid. This substance, collected and washed with ice-cold water, gave on analysis figures corresponding with the formula, $3\text{PtO}_4 \cdot \text{K}_2\text{O}$. The alkali could not be washed out with water, but could be easily

neutralised by weak acids, even by acetic acid. The moist trioxide so obtained kept the form of the original substance, but became red-brown. It began to lose oxygen, rapidly at first, but at a diminishing rate, so that after three weeks it contained 16.5 per cent. ($\text{PtO}_3 = 19.77$, $\text{PtO}_2 = 14.1$ per cent.) and probably consisted then of a solid solution of the trioxide in the hydrated dioxide. Weak sulphuric and nitric acids hardly affect platinum trioxide; 2N-hydrochloric acid very slowly acts on it, concentrated acid very rapidly, with evolution of chlorine; most reducing agents reduce it to platinum black. Gentle warming converts it sharply into hydrated dioxide, which is in turn decomposed at a higher temperature. It liberates iodine from potassium iodide, but is very stable towards alcohol, acetic acid, and many other oxidisable organic substances. Hydrogen peroxide removes from the alkaline product of electrolysis some of its alkali, but there is no evolution of oxygen. Many observations of former authors on the behaviour of platinum are shown to be due to the formation of this new oxide.—J. T. D.

Titanium tetrachloride; *Reduction of —, by hydrogen*. H. Goerges and A. Stähler. Ber., 1909, 42, 3200—3218.

THE reaction, $2\text{TiCl}_4 + \text{H}_2 = 2\text{TiCl}_3 + 2\text{HCl}$, goes on with much greater speed as the temperature is raised; at 1200°C . it is almost complete; it can be completed at lower temperatures (900° — 1000°) if the trichloride is withdrawn by cooling. Accordingly, the authors have prepared trichloride in quantity by passing a mixture of tetrachloride vapour and hydrogen into the annular space between an inner quartz tube, heated by a platinum resistance inside it, and an outer glass tube kept cool. The hydrochloric acid formed, and any undecomposed tetrachloride are condensed in water at the far end of the apparatus, whilst the trichloride is condensed on the walls of the glass tube. It is a fine red-violet powder, rapidly decomposing in damp air. It tends even at the ordinary temperature to decompose according to the equation, $2\text{TiCl}_3 = \text{TiCl}_4 + \text{TiCl}_2$; and when heated, according to Friedel and Gherin's directions, in a stream of hydrogen, it yields a black powder consisting of titanium dichloride. The properties of this depend notably on the temperature of its preparation; some specimens are spontaneously inflammable, others not. Solutions of titanium dichloride gradually turn violet on boiling in the air, becoming converted into compounds of trivalent titanium. Nitric acid renders them first violet then colourless (trivalent and quadrivalent titanium). Titanium tetrachloride turns them violet ($\text{TiCl}_4 + \text{TiCl}_3 = 2\text{TiCl}_3$). Ammonium hydroxide, carbonate, or sulphide produces a black-brown precipitate, which presently gives off hydrogen in abundance. When titanium dichloride, produced at a high temperature, is dissolved in hydrochloric acid, there is often a distinct evolution of hydrogen, suggesting that the chloride has been in part reduced to metal.—J. T. D.

Nitrogen and hydrogen with metals; *New compounds of —*. [Tricalciumamide.] F. W. Dufert and R. Miklausz. Monats. Chem., 1909, 30, 649—654.

PURE calcium nitride absorbs hydrogen at about 700°C ., forming an addition compound which is probably tricalciumamide, $\text{Ca}_3(\text{NH}_2)_2$. This substance is remarkably sensitive to light, changing from yellow to dark grey, but it regains its original colour when heated in a current of nitrogen; it is decomposed by water with the liberation of ammonia and hydrogen. Magnesium nitride forms no such addition compound, but lithium nitride absorbs hydrogen readily on heating, giving a product which appears to be analogous with the calcium compound and undergoes a corresponding change of colour, from white to red.—F. SODN.

Rare gases [argon, etc.]; *Apparatus for the preparation of — from gaseous mixtures, using a nitrogen [high-tension] arc*. F. Henrich. Z. Elektrochem., 1909, 15, 749—751.

THE process is intended for the separation of "noble" gases from the nitrogen and methane accompanying them in gaseous mixtures obtained from hot springs, etc. The gases are mixed with oxygen and subjected to a high-

tension electric arc. The apparatus consists of a vertical tube, about 30 cm. long and 3.5 cm. in diameter, which is provided near the apex with platinum terminals connected with a large induction coil. This tube is in communication at the top with a reservoir containing a 5 per cent. solution of sodium hydroxide, which during the process is allowed to flow down the inner wall of the tube (previously cleaned with nitric acid), so as to form a mantle around the arc flame, thus absorbing the oxides of nitrogen produced and cooling the tube; the alkali forms a seal in the lower part of the tube, and the excess flows into a levelling tube and thence to another vessel, from which it is returned periodically to the reservoir. The whole apparatus, which is controlled by a series of taps at appropriate points, is first filled with the alkali, and the gas, mixed with twice its volume of oxygen, is admitted to the tube, the pressure being arranged slightly above the normal; by means of an alternating current at 110 volts and 4 ampères, a steady yellow nitrogen arc is then obtained, and more gas is let in from time to time, as absorption proceeds, without interrupting the process; when the yellow colour has disappeared from the flame, a current from about 4 accumulators is made to replace the alternating current, and a disruptive discharge is continued for some time; finally, the gas is withdrawn from the apparatus and freed from the excess of oxygen in the usual way.—F. SODN.

Specific heats of silicates and platinum. White. See VIII.

Reducing reactions with phosphorous and hypophosphorous acids [and determination of these acids]. Sieverts. See XXIII. Inorg. Quant.

Irregularities in volumetric determination of uranic after previous distillation. [Presence of pyrrole in ammonia]. Brandt. See XXIII. Inorg. Quant.

Separating silica from silicon and carbon. Brütcke. See XXIII. Inorg. Quant.

PATENTS.

Sodium and other chlorides; *Electrolytic decomposition of — in the manufacture of caustic soda and other useful products*. R. J. Lévy, Twickenham. Eng. Pat. 20,787, Oct. 2, 1908.

THE chlorine resulting from the electrolytic decomposition is caused to react with oxygen compounds of metals, for which chlorine has a greater affinity than oxygen, as, e.g., by passing it in a dry condition over heated quicklime, whereby, it is stated, there is produced a metallic chloride and oxygen, or a gaseous mixture containing oxygen. The process may also be applied to the electrolytic decomposition of calcium chloride for the production of metallic calcium, the liberated chlorine being converted into calcium chloride, which is again utilised in the process.—B. N.

Retort furnaces for the manufacture of gas [carbon dioxide, coal gas, etc.], and for other purposes. T. M. Thom. Cheshunt, Herts., and H. Pryor, Safron Walden, Essex. Eng. Pat. 24,332, Nov. 12, 1908.

THE patent relates to an apparatus for the manufacture of lime, carbonic acid gas, illuminating gas, etc., in which vertical retorts are arranged, in an enclosed space, around a central combustion chamber provided with lateral openings which communicate with the retort space. For convenience in discharging, the lower end of each retort is curved outwards, the upper end being provided with an outlet pipe (fitted with a stop valve) leading to a circular gas main situated above the retort chamber. In the manufacture of carbonic acid gas from limestone, suitable provision is made for the passage of superheated steam through the retorts, in order to facilitate the escape of the gas.—W. E. F. P.

Limekiln. R. Buder, Gray Summit, Miss. U.S. Pat. 931,180, Aug. 17, 1909.

THE kiln, which is designed to secure regular burning of the material, comprises a body, preferably of square section, and furnaces opening into it on opposite sides.

At the side of each furnace and independent of it, horizontal channels lead into the kiln at opposite corners, in a tangential direction, that is, parallel to the adjacent side. Air is forced through these channels, in order to produce a whirling draught in the lower portion of the kiln, and conduce to uniformity of temperature by preventing the gases following a restricted path through the material. By means of a blower, which supplies also the tangential channels, an upward suction is maintained through the furnaces and ash-pits, and gases generated by fuel which has dropped into the ash-pit are thus utilised.—F. SOUX.

Lime; Process of purifying and reconditioning spent and waste — J. G. Jones. Fr. Pat. 401,803, April 7, 1909.

SPENT or waste lime is first submitted to a mechanical purification, preferably by centrifugal means, and then the semi-liquid material is filtered by means of a press, in order to form the lime into a dense solid cake. The cakes are dried and crushed, preferably to pass a 25 mm. screen, and the carbon dioxide is expelled by calcination in a rotary kiln. The kiln gases are used for heating the air required for drying, or are themselves employed for this purpose.—F. SOUX.

Ammonium salts and iron oxide from ferrous liquors; Manufacture of — F. J. R. Carulla, Derby. Eng. Pat. 27,302, Dec. 16, 1908.

IN the manufacture of ammonium salts by the addition of ammonia to ferrous liquors (ferrous chloride or sulphate), the necessary dilution of the ferrous liquor before precipitation, is effected with the weak solution of ammonium salt produced by washing a previous batch of iron oxide. The salt contained in this wash water is thus utilised, without the expense of evaporating or distilling it, or allowing it to run to waste, as at present done.—F. SOUX.

Ammonia from aluminium nitride; Process for producing — O. Serpek, Niedermorschweiler, Germany. Eng. Pat. 15,997, July 8, 1909. Under Int. Conv., July 15, 1908.

ALUMINIUM nitride is completely decomposed by treatment with a mixture of an alkali aluminate and water, which reacts like a solution of alkali. 100 parts of nitride, 120 of potassium aluminato, and 200 of water are suitable proportions, and, in carrying out the process, it is best to operate so that the nitride is first decomposed with an alkaline lye and then boiled; ammonia is given off and a solution of aluminate formed which is used for treating a fresh portion of nitride, the heating being done preferably under pressure. All the nitrogen is recovered as ammonia in 1–1½ hours.—F. SOUX.

Sodium peroxide; Method of treating — D. E. Parker, Niagara Falls, N.Y. U.S. Pat. 935,542, Sept. 28, 1909.

SODIUM peroxide, or other alkali peroxide, is purified by melting in an open vessel, by contact with electrodes and a resistance material through which a current is passed. Such a temperature is maintained, that carbon dioxide is liberated without any decomposition of the peroxide itself taking place.—F. SOUX.

Lithium compounds; Manufacture of pure — E. Zell, Gottenborg, Sweden, Assignor to General Electric Co., New York. U.S. Pat. 935,880, Oct. 5, 1909.

A LITHIUM ore is heated in the presence of carbon in an atmosphere of acetylene to form volatile lithium hydrogen carbide which is decomposed by water into lithium hydroxide and acetylene, the latter being collected and used for the treatment of fresh quantities of lithium ore.—W. C. H.

Hydrogen sulphide generator. E. L. Ross, Everett, Wash. U.S. Pat. 936,168, Oct. 5, 1909.

THE apparatus consists of a receptacle for a liquid, open at the top, and on the bottom of which is a support with arms. A bell-jar rests on the arms within the receptacle, and is prevented from moving upwards by wires, which hold the shoulders of the bell-jar, and are fastened to the

top of the receptacle. A perforated basket is arranged inside the bell-jar, and rests solely on the upper face of the support, so that the bottom of the basket is above the lower edge of the bell-jar.—W. C. H.

Lead hydride; Use of magnesium for the preparation of metallic hydrides, particularly — M. M. J. Bouffort. Fr. Pat. 401,473, April 1, 1909.

LEAD hydride is prepared by immersing magnesium in a solution of lead acetate or basic lead acetate, in the cold, when the metal becomes covered with a thick spongy layer which possesses all the properties of the hydride prepared electrolytically, and can be used for similar purposes, such as the manufacture of accumulator plates or as a source of nascent hydrogen.—F. SOUX.

Hydrosulphites; Process for the preparation of anhydrous — Chem. Fabr. Von Heyden Akt.-Ges. Ger. Pat. 213,586, July 25, 1908.

IT has been found that dry hydrosulphites containing water of crystallisation are so resistant to decomposition, compared with the moist salts, that they can be completely dehydrated by heating at 80°–110° C., preferably at about 100° C., in a vacuum or in a current of inert gas, provided that they are maintained in a "dust-dry" condition during the process.—A. S.

Hypochlorite solutions; Process for the electrolytic production of — E. A. F. Düring. Ger. Pat. 213,588, Nov. 12, 1908.

THE essential feature of the process consists in adding continuously water or a salt solution to the alkaline cathode liquid and a concentrated solution of salt to the anode liquid, which itself also consists of a concentrated solution of salt, so that the alkali and chlorine are forced to travel from the cathode and anode respectively to a middle space or layer, from which the alkali hypochlorite solution, which must be kept faintly alkaline, is continuously removed. The process may be worked with or without diaphragms, and chlorine may be removed from the anode and pumped into the middle layer in the former case; when working without diaphragms, care must be taken that the hypochlorite solution is withdrawn continuously without disturbing the three separate layers of liquid, viz., the anode, cathode, and intermediate solutions. It is stated that with suitable precautions, and with carbon anodes and iron or carbon cathodes, an almost theoretical current-yield can be attained, with production of a hypochlorite solution containing up to about 80 grms. of available chlorine per litre.—A. S.

Alkali hypochlorite solutions; Process for the electrolytic preparation of stable — Elektrizitäts-Akt.-Ges. vorm. Schueckert und Co. Ger. Pat. 213,590, Nov. 17, 1908.

IT is the practice to add caustic alkali to electrolytically prepared alkali hypochlorite solutions, in order to improve their stability. According to the present patent, a caustic alkali solution is added continuously to the electrolyte, in the preparation of the hypochlorite, in quantity sufficient to maintain a faintly acid or neutral reaction. It is claimed that in this way, not only is less alkali required, but as the electrolyte at no part of the process contains any considerable quantity of free hypochlorous acid, the yield of hypochlorite is increased, and solutions of a higher concentration of available chlorine are obtained.—A. S.

Hydrogen; Process of producing — G. M. Clark, London. From Dellwik-Fleischer Wassergas-Ges., Frankfurt on Main, Germany. Eng. Pats. 21,479, Oct. 10, 1908, and 7849, April 1, 1909.

SEE Fr. Pat. 395,132 of 1908; this J., 1909, 310. In Eng. Pat. 7849 of 1909, the use of iron pyrites, roasted to expel all sulphur and volatile metals, is claimed.—T. F. B.

Hydrogen; Preparation of pure — G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 3188, Feb. 9, 1909.

ALUMINIUM in a divided form such as filings, dust, chips, or factory waste, is mixed with a small quantity of a

compound of a metal such as mercury, platinum, or gold, which is electro-negative to aluminium, and with a small quantity of an alkali or acid, or a borate, phosphate or other soluble substance. This mixture can be stored in the dry condition, and when added gradually to water it yields 1.2 cb. m. of hydrogen per kilo. The alkali, etc., serves to generate sufficient hydrogen to reduce the mercury or other compound, which then forms an electro-chemical couple with aluminium and decomposes water until the aluminium is used up. A suitable mixture consists of 1 part of mercuric oxide, 1 part of powdered caustic soda, and 98 parts of aluminium.—A. T. L.

Air; Liquefaction of — and separation into its constituents. Soc. L'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des procédés G. Claude). Fr. Pat. 401,496, July 24, 1908.

The invention relates to a means for accomplishing the liquefaction of air and the separation of oxygen and nitrogen in a single cycle of operations. Compressed air, after passing through heat interchangers, cooled by the escaping

reduced to a minimum by providing a removable bottom to the vertical cylindrical resistance furnace and arranging the calorimeter immediately below it. The crucible was suspended by a fine platinum wire, and when required the furnace bottom was swung aside and a heavy charge of electricity passed through the supporting wire, which fused and permitted the crucible to fall directly into the water. Preliminary determinations made with an empty crucible, counteracted the small errors due to the splashing of some of the water, etc. The calorimeter was completely enclosed by a water-jacket and a temperature rise of as much as 23° C. was successfully employed, the wide range increasing the accuracy of reading the thermoelements which were employed for all temperature determinations. It is claimed that a final accuracy of better than 0.5 per cent. is obtained. Specific heats of silicates show a considerable increase with rise of temperature up to 700° C., followed by a tendency to diminish at higher temperatures. The values of the true specific heats of the substances experimented with are given in the following table:—

Temp. °C.	Platinum.	Wollastonite.	Pseudo-wollastonite.	Orthoclase.	Diopside.	Orthoclase glass.	Soft glass.
500.....	0.0356	0.251	0.250	0.257	0.262	0.264	0.298
700.....	0.0368	0.263	—	—	0.272	—	0.324
800.....	—	—	—	0.272	—	0.282	—
900.....	0.0380	0.262	—	—	0.281	—	0.340
1100.....	0.0390	0.261	0.259	0.279	0.286	0.297	0.335
1300.....	0.0400	—	0.257	—	0.278	—	0.333
1500.....	0.0407	—	—	—	—	—	0.332

—F. R.

gases, is allowed to expand, doing external work. From the expansion engine, the air is sent to a group of closed tubes, immersed in liquid oxygen, in which it accumulates until liquefied by its own pressure, preferably collecting as a more volatile and a less volatile fraction (this J., 1905, 969), which are used as reflux liquids in the upper and lower portions respectively of a rectifying column surmounting the liquid oxygen boiler. The gaseous oxygen from the lower part of this column is led away through a heat interchanger and thence to be utilised, and the more or less pure and extremely cold nitrogen, escaping from the top of the column, is made to pass around the tubes in the liquefier, before helping to cool the entering compressed air in another heat interchanger. The whole of the liquid required in the cycle is thus produced in the system itself.

—F. SODN.

Oxygen; Process for the production of —, e.g., for use in internal combustion engines for submarines and torpedoes. P. Wienand. Ger. Pat. 213,686, Aug. 4, 1906.

A MIXTURE of an alkali peroxide and an alkali perchlorate, which melts at a much lower temperature than either of its components, is melted and heated to a temperature below that at which oxygen is evolved. It is then transferred to the place at which it is desired to produce the oxygen and is heated more strongly in presence of water; or the oxygen of the perchlorate and of the peroxide respectively may be liberated in two stages, first by heating strongly and then by treatment with water. The water is preferably used in the form of a solution of alkali hydroxide of high boiling point.—A. S.

Recovering sulphuric acid and oils from waste acid. Ger. Pat. 213,589. See III.

VIII.—GLASS, POTTERY, AND ENAMELS.

Silicates and platinum; Specific heats of —. W. P. White. Amer. J. Science, 1909, 28, 334—346.

THE paper describes the beginning of an investigation into the thermal properties of silicates. The method employed for determining the specific heats up to 1500° C., was to drop the crucible containing the heated substance into a water calorimeter at room temperature. The error due to loss of heat occurring during the passage of the heated body from the furnace to the water was

Alumina; Effects of — on glass. R. L. Frank. Trans. Amer. Ceram. Soc., 1909, 11, 99—102.

MANUFACTURERS who insist on their sand being scrupulously washed, thereby lose one of the most valuable ingredients of their raw materials. The loam which is removed contains alumina, which, in quantities of 3 to 4 per cent., vastly improves the qualities of glass. It acts as a vehicle for forming combinations between silica and lime, or soda, taking the part of either acid or base. It facilitates the making of a homogeneous body, as the glass is not so susceptible to the reducing action of the fire, or to the formation of cords and strings, or production of a laminated condition. In glass made in moulds, or in a machine, alumina increases the surface tension, so that the glass will have less tendency to take the imperfections of the moulds, while it renders the glass sufficiently pliable to be forced into any desired shape. It reduces the co-efficient of expansion, and increases the tenacity, which is valuable in the manufacture of bottles. It also exerts a favourable influence in the annealing process. It has one drawback, in that it does not mix well with cullet, so that care must be taken not to have too large a proportion of cullet in the mixing.

—H. H. S.

Clay press; Can water from the — be re-used? T. Gray. Trans. Amer. Ceram. Soc., 1909, 11, 365—368.

A DISCUSSION on this question elicited varying opinions. The author stated that "a large saving could be made by re-using this water, and perhaps the bacteria thus preserved would present a simpler means for developing plasticity than by the artificial process in which tannin or straw is used." On the other hand, the re-used water gradually becomes richer in soluble salts and finally these salts may be simply re-distributed evenly through the clay. A great deal depends on the composition of the water, and of the soluble salts in the clay. If the water is a hard, limy one, it is of no use for washing clay saturated with the same impurity. Where, on the other hand, the salts in the clay consist of easily soluble chlorides and nitrates and some sulphates, there is no likelihood of the wash-water becoming saturated.—H. H. S.

Clays; Effect of preliminary heat treatment upon —.
A. V. Bleiminger. Trans. Amer. Ceram. Soc., 1909, 11, 392—406.

PLASTIC clays often crack during the drying process. Weathering overcomes this difficulty to a great extent, but the author finds that heating the clay from 200°—350° C. causes it to show a greatly decreased shrinkage on drying. If exposed to the action of water for long periods, the clay would doubtless resume its original plasticity, but in a few hours the recovery is only partial. The loss in plasticity at increasing temperatures is not abrupt but gradual. The decrease in shrinkage proceeds hand in hand with a decrease in the amount of water required to form the clay into a plastic mass, but no simple mathematical relation exists between the two factors. It does not follow that the more plastic a clay is originally, the more it is affected, as regards drying, by the heating treatment; different clays require different temperatures. With none of the heated clays did any cracking appear during drying.—H. H. S.

Marly clay as fluxing material for easily fired bodies.
E. Berdel. Sprechsaal, 1909, 42, 581—583, 595—597.

THE author has examined the fluxing effect on ceramic bodies of easily fusible clays with a relatively large content of lime (marls). As fluxes, they have the advantages that they are plastic, have a fine grain, and can be easily ground and mixed in a body. The marl used consisted of 34.8 per cent. of clay substance, 27.5 per cent. of quartz, 5.2 per cent. of feldspathic material, and 32.5 per cent. of calcium carbonate; it melted at about Seger cone 1. From mixtures of 40 parts of this, and 60 parts of various kaolins and clays, tiles were made, and fired at different temperatures, and the contractions and porosities measured. On the whole it appeared that calcareous, easily fusible clays were a useful means of bringing about sintering, at comparatively low temperatures, of stoneware and other highly plastic clays, and where a tile clay, such as the above, cannot be obtained, a potters' or brick clay can be substituted. Generally speaking the marly clay produced more effect than loam, which also tends to give a speckled surface, unsuitable for some kinds of plain ware. The best result obtained was a stoneware body composed of equal parts of Hämmerbach (Westerwald) clay and washed marly clay, which burned dense at Seger cone 1—2, retained its shape well, and had a lustrous, conchoidal fracture. The composition of the mixture in percentages was:—clay substance 43.0, quartz 36.85, feldspar 4.35, and calcium carbonate 16.25. As an extension of the use of such a low-fired body to stoneware manufacture, suitable glazes of the following formulae may be used, and fired at Seger cone 1—2. I. $0.25\text{K}_2\text{O}$, $0.25\text{Na}_2\text{O}$, 0.30CaO , 0.20BaO ; $0.4\text{Al}_2\text{O}_3$; 3.2SiO_2 , $6.5\text{B}_2\text{O}_3$. II. $0.15\text{Na}_2\text{O}$, $0.20\text{K}_2\text{O}$, 0.20CaO , 0.45PbO ; $0.28\text{Al}_2\text{O}_3$; 2.5SiO_2 , $0.3\text{B}_2\text{O}_3$. III. $0.15\text{K}_2\text{O}$, 0.20CaO , 0.65PbO ; $0.2\text{Al}_2\text{O}_3$; 1.8SiO_2 . The warm, dark yellow colour of the glazed and unglazed ware is quite suitable for many purposes, but all three glazes are suitable also for producing deep coloured glazes. The boron-free glaze III. is well adapted for matt effects, especially if the content of lime is increased, or rutile or magnesite is introduced. A suitable white engobe, similar in rational composition to the body, except that the amount of fluxing material (feldspar) is increased, is compounded of 400 parts of Zettlitz kaolin, 100 parts of feldspar, 340 parts of quartz, and 160 parts of whiting, and coloured engobes can be produced from this by the addition of the requisite colouring oxides. Almost all the earthenware underglaze colours are bright and permanent with glaze II. given above. The low temperature, Seger cone 014, of the biscuit-firing is a great advantage of the whole scheme, and the pieces become so hard on drying that simple objects can even be painted before firing.—W. C. H.

Sulphur problem [pottery]; Method of overcoming the —.
H. B. Wells. Trans. Amer. Ceram. Soc., 1909, 11, 93—98.

THE presence of sulphur in a clay may cause discoloration and distortion in burning. To overcome this, the author experimented on the commercial scale, and in ordinary

down-draught kilns, with a clay containing 1.82 per cent. of sulphur, in the form of pebbles of pyrites. The sulphide, FeS_2 , oxidises in two stages, the first atom of sulphur at 400° C., and the second at 900° C., and the principle of the method followed was to shut off heat at the first stage so that the oxidation of the sulphur could take place slowly and regularly. The kiln was brought up to the ignition point of the sulphide, when the fires were allowed to die out, the fire-boxes were closed up, and the openings in the top of the kiln were uncovered, whilst the gases were shut off from the stack entirely. The heat advanced slowly and gradually from the outer courses towards the centre. Shortly before evolution of sulphurous gases ceased, the top was closed, the damper opened to the stack, the fire started, and the burning carried out to the end in the usual manner. The result was uniform burning throughout the kiln.—H. H. S.

Porcelains of potash and soda felspar; Comparison of —.
A. S. Watts. Trans. Amer. Ceram. Soc., 1909, 11, 179—184.

IT has been said that soda spar, or albite, cannot be used for the manufacture of white ware, owing to the fact that it imparts a dull, wooden ring to the ware, whereas with the potash spar, a clear glass ring is obtained. To test this, trials were made in a body of composition 0.16KNaO ; 0.08CaO ; $1.0\text{Al}_2\text{O}_3$, 4.5SiO_2 . The bodies were made up into bell-shaped cups, and the difference in tone was very marked. Under physical tests, however, such as resistance to electric current and to sudden changes of temperatures, no difference could be observed. As soda spar is cheaper than felspar, its substitution is worth a trial where the ring of the ware is immaterial. Care must be exercised that grinding is carried to the same degree as with the potash spar, otherwise the economy obtained from its lower fusing point and its lower cost will be largely lost.—H. H. S.

Porcelains; Crystalline structure in —. A. S. Watts. Trans. Amer. Ceram. Soc., 1909, 11, 185—201.

THE author summarises his views as follows. Of all the ingredients in porcelain, the felspar is the first to act. At cone 9, a hard spar binds together the other ingredients to a conglomerate mass. As the temperature rises, the spar becomes more active, dissolving first the clay substance and then the flint particles, till at cone 10, there is evidence of crystallisation of sillimanite. At cone 13, a hard felspar is completely fluid, permitting such complete crystallisation as conditions and other ingredients will allow. A soft felspar may make a difference of two cones in the maturing temperature, an equal amount of dissolving action being obtained. The addition of another flux causes the matrix to become more active as a solvent. Whiting and marble are more powerful in this respect than plaster. Soda felspar produces the greatest change, giving the matrix a dissolving power that is remarkable. Soda-spar porcelain contains clusters of segregated bubbles, which is also a peculiarity of bodies containing fritted material. In this case, the matrix is sufficiently fluid to let bubbles move more freely, and the segregation occurs accordingly. Cornish stone acts more like a frit than a spar, though its fluxing action is not equal to that of a frit of the same composition. It is advantageous to frit spar and lime together rather than to frit spar alone. Turning to the clay ingredients of porcelain, ball clays are notably less soluble in fused spar than china clays, though ball clay porcelain displays a finer texture. Crystalline development is greater in the china clay porcelain. A bibliography is given of previous papers on this subject.

—H. H. S.

Porcelain; The coefficient of linear expansion of —.
A. S. Watts. Trans. Amer. Ceram. Soc., 1909, 11, 84—87.

A LONG straight unglazed porcelain tube was immersed in oil heated by an electric resistance coil. The expansion of the tube caused a lever to move, and was read off by means of a mirror and telescope. The average of six determinations furnished the coefficient, 0.00005357 for temperatures between 19° and 243° C.—H. H. S.

Chromium-tin pinks; A study of — R. C. Purdy and G. H. Brown. Trans. Amer. Ceram. Soc., 1909, 11, 228—261.

THE authors investigated the effect, on the pink colour, of chromium in varying amounts, introduced as the green oxide, as lead chromate, and as potassium bichromate; also, the effect of calcium in varying amounts, introduced as carbonate. Analyses of nine stains already in commercial use showed that lead oxide was present in five, and sodium and potassium oxides in four; also that, taking the equivalent of tin oxide as unity, the chromium trioxide varied from 0.0091—0.0155, the lime from 0.744—3.6, and the silica, though generally about unity, varied in extreme cases, from 0.437 to 3.33 equivalents. In the present experiments all the stains contained one equivalent each of tin oxide and silica; the stains were not melted, but merely calcined; they were not washed nor re-calcined. The same glaze was used throughout, viz.:—PbO, 0.22; CaO, 0.60; KNaO, 0.18; Al₂O₃, 0.16; SnO₂, 0.1; SiO₂, 2.1; B₂O₃, 0.475; and Cr₂O₃ varying. Of this, 0.625, CaO; 0.375, KNaO; 0.23, Al₂O₃; 0.72, SiO₂; 0.989, B₂O₃, was fritted. The authors conclude that the source of the chromium does affect the tint obtained. The group containing the trioxide showed the largest number of stains having a pink colour, similar to those found on the market. The pinks made with lead chromate were lighter than those made with the trioxide and potassium bichromate. The bichromate group showed a tendency to dark brown colours when high in chromium, and when water was added the pink was lost and the stains turned yellowish-brown, probably owing to formation of chromic acid. Only the merest trace of chromium is necessary to develop the pink colour. With the trioxide and bichromate, the limits are 0.0001 to 0.0375 equivalent, but the amount of lead chromate may be as high as 0.15. With regard to calcium, the stain can carry at least three equivalents, the fusibility being the only limiting factor. The greater the proportion of lime, up to 25 per cent., the higher the temperature the colour will bear. Decrease of lime tends to change the pink into greyish-brown. The authors deny that the composition of the glaze is more important than that of the stain. It is only necessary that the glaze should be relatively low in lead and alkalis, and high in calcium. In the discussion, fluorspar and gypsum were said to produce better reds than whiting, and boric acid was said to improve the stains, using high boric acid with high lime content, and low boric acid with low lime content.—H. H. S.

Melting points of glaze and glass silicates of the porcelain type as used in the ceramic industry; Method for determining — M. Barrett. Trans. Amer. Ceram. Soc., 1909, 11, 80—83.

THE author postulates at the outset that the materials used are in the finest state of subdivision, and that the glazes are subjected during fusion to a sufficiently prolonged heat. He finds that one equivalent of calcium oxide is equal in fluxing value to $\frac{1}{2}$ equiv. of potassium oxide (K₂O), $\frac{1}{2}$ equiv. of sodium oxide, $\frac{1}{2}$ equiv. of zinc oxide, and 1.0 equiv. of barium oxide, and he accordingly calculates all bases into their fluxing equivalents of calcium oxide (CaO). It is then found that the glaze, 10SiO₂, 1Al₂O₃, 6 $\frac{1}{2}$ RO, melts at 1200° C., and that 1 equiv. of silica neutralises $\frac{2}{3}$ equiv. RO in point of fusibility, so that 11SiO₂, Al₂O₃, 6 $\frac{1}{2}$ RO, and 9SiO₂, Al₂O₃, 6 $\frac{1}{2}$ RO, would also melt at 1200° C. Also, by deducting $\frac{1}{2}$ equiv. of RO, the melting point is raised 5° C., so that, say, 10SiO₂, Al₂O₃, 6RO, would melt at 1215° C. To elucidate the method of calculation, an example is given. Having thus found the melting point of a glaze, the correct firing temperature should be 90° C. above it, to develop the glaze properly. This method refers to glazes of the usual type. Those in which bases predominate, so that silica is used as a flux, do not conform to the method outlined.—H. H. S.

Matt glazes. F. H. Rhead. Trans. Amer. Ceram. Soc., 1909, 11, 157—174.

FIVE series of trials were made to produce a matt glaze with a broken surface, maturing at cone 1. In the first

series, the best results were obtained from the formula:—K₂O, 0.135; CaO, 0.376; ZnO, 0.082; Al₂O₃, 0.208; SiO₂, 0.958; CuO, 0.032; Fe₂O₃, 0.0026; PbO, 0.162—0.405; BaO, 0.0—0.053. The second series, made to study the effect of underglaze stains, was based on the glaze with formula:—PbO, 0.621; K₂O, 0.184; BaO, 0.195; Al₂O₃, 0.246; SiO₂, 1.28; and all the results were good. The variations in the next series, based on PbO, 0.737; K₂O, 0.120; BaO, 0.144; Al₂O₃, 0.157; SiO₂, 0.85; were only those in colours, and the results were beautifully matt with striking flaking effects. Series four was a study in double dips of glazes in the first series. A soft biscuit was used that the glazes might dry almost immediately. The lower glaze was the heaviest, being two-thirds of the total glaze thickness. In the last series, very handsome water line effects were obtained by use of a formula:—PbO, 0.492; CaO, 0.254; K₂O, 0.087; ZnO, 0.167; Al₂O₃, 0.30; SiO₂, 0.948. With regard to the separation in matt glazes, the flakes decrease in size with increase of silica, with decrease of alumina and of lime. Barium oxide is more potent than lime in producing flakes. No good matt effects were obtained without zinc oxide. Surface cracking is generally mechanical in origin, being due to the cracking of the drying glaze, healing over at the joints, or, to the thickness of the glaze. In some cases it is due to chemical causes, such as alumina making the glaze too hard, or barium carbonate giving off its carbon dioxide slowly and at a high temperature.—H. H. S.

Opalescence in highly acid glazes; A study on the production of — J. D. Whitmer. Trans. Amer. Ceram. Soc., 1909, 11, 262—295.

OPALESCENCE appears to be due to the refraction of light by particles of undissolved matter suspended in the glaze matrix. Purdy had previously laid down the rule that opalescence can be produced in a glaze by supersaturating it with silica at high oxygen ratios, at least 1:4; that 0.20 equivalent of alumina is also requisite, and that the higher the boric acid, the better the opalescent effect. The author made a series of experiments, keeping the alumina constant, varying the lime at the expense of the lead, varying the oxygen ratio from 3.0 to 6.5, and the molecular ratio of B₂O₃ to SiO₂ from 1:2.0 to 1:6.5. No good opalescence was developed, and no decided conclusions reached, but a few points were noted. The actual composition of the floating matter in the matrix seems immaterial, but it should be finely sub-divided or opacity will be produced instead of opalescence. The glaze coating should be as thick as possible. The best oxygen ratio was from 5.5 to 6.5, the best silica-borate ratio was between 3 and 4. The lime is high enough at 0.5 equivalent. The best temperature range is from cones 1 to 5. The author then turns to the subject of boric acid and crazing. To lessen crazing, it is better to increase the oxygen ratio or the firing temperature, than to alter the proportion of boric acid.

—H. H. S.

Glazes; A peculiar property of some — A. E. Mayer. Trans. Amer. Ceram. Soc., 1909, 11, 369—374.

A "ROPEY" glaze mixture is one that settles quickly to the bottom of the tub; the grains interlock, forming a very dense mass that can hardly be dug out with the fingers. The defects of such a glaze are apparent in dipping a piece of flat ware, as the glaze rolls in pools round the edge instead of being thrown off. The author found that this viscosity was accompanied by alkalinity, and the greater the alkalinity the more viscous the glaze. The remedies are both physical and chemical. In the former class are those substances which thicken the slop so that the glaze will not sink. Amongst these are syrup, milk, blood, gum, dextrin. The chemical remedies depend on the neutralisation of the alkali, which seems to be present as sodium silicate. Boric acid, weak mineral acids, acetic acid are used, but the author recommends one-half per cent. of magnesium sulphate. He states that this amount of sulphate will not give rise to "seumming."—H. H. S.

Enamels; The allowable limit of variation in —. J. B. Shaw. Trans. Amer. Ceram. Soc., 1909, 11, 103—152.

THE paper refers to enamel on sheet steel. The objects of the investigation were to find an enamel that would adhere to the steel without crazing or peeling, to find the relation between undercoat and subsequent coats, to produce an enamel that resists dilute acetic acid, contains no lead, and has a pleasing appearance. The furnace was heated to 1040°C . The time of burning of the ware was from four to ten minutes, the ground coat requiring more severe treatment than subsequent coats. The general conclusion is stated in the following formulae:—Ground coat, K_2O , 0.15—0.75; Na_2O , 0—0.6; CaO , 0.14—0.64; CuO , 0—0.06; Al_2O_3 , 0.1—0.5; SiO_2 , 1.1—1.7; B_2O_3 , 0.2—0.5; cover enamel, K_2O , 0.0—0.6; Na_2O , 0—0.65; CaO , 0.2—0.6; Al_2O_3 , 0—0.5; SiO_2 , 1.0—1.8; B_2O_3 , from 0.2 upwards. Potassium and sodium oxides may be interchanged without marked result, but potassium oxide gives a more brilliant surface. Lime is the most active component in affecting refractoriness. Enamels without any lime are too soft for practical use. Alumina increases the opacity, brilliancy and hardness; it also increases the refractoriness and viscosity. Silica renders the enamel acid-resisting and prevents crazing. Boric acid causes peeling, more so than silica, and it also affects the brilliancy of the enamel more than silica. A low proportion of boric acid produces matt enamels. Cobalt oxide increases the stability of the enamel in burning, and its toughness. It also intensifies the whiteness of the enamel. The substitution of calcium carbonate for fluorspar makes no difference in the finished product, but it renders the raw enamel more difficult to frit. Cryolite in place of felspar softens the enamel markedly and produces opacity. It also tends to crazing. The best results are given by mixing equal amounts of cryolite and felspar. Tin oxide produces opacity, but may be replaced by zinc oxide plus antimony trioxide. To produce good opacity 0.13 equivalent of tin or its substitute is required.—H. H. S.

Enamelled sheet-steel wares; Notes on the testing of —. E. Orton. Trans. Amer. Ceram. Soc., 1909, 11, 320—341.

THE author appeals for standard methods of testing enamelled ware. The Hooper solubility test is the only one which attempts to classify ware. The method is to boil the ware in 10 per cent. acetic acid solution until all the liquid has evaporated, and note whether the glaze has suffered damage. If it has not, it is again boiled with 20 per cent., or stronger, solutions of acid until the glaze has been attacked, and the enamel is classified accordingly as having resisted acid of a stated strength. Other chemical tests relate to the solubility of the enamel in water and in dilute mineral acids, and its ability to withstand acid gases. The physical tests deal with the ability of the enamel to withstand bending without cracking, and impacts without shattering. The former is determined by measuring what amount of deflection under pressure the enamel will undergo without cracking, and the latter by counting the number of blows of equal force on one spot necessary to shatter it. No correlation can be shown between the chemical resisting properties and the physical strength of enamels now on the market. In judging a ware, it must be remembered that the chemical qualities of an enamel are of different degrees of importance in different wares. For table ware, culinary ware, or chemical utensils, solubility is the worst possible fault, whereas for advertising signs or automobile tags the physical qualities are more important. Enamels for electric heating devices must be tested for conductivity. Coloured enamels are generally better than white ones for this purpose. Possibly the small amount of cobalt silicate formed in a blue enamel, makes it a better insulator than the white glazes which contain suspended oxides or salts.—H. H. S.

Lead silicates. Hilpert and Weiller. See VII.

Binary systems of alumina with silica, lime, and magnesia. Shepherd and others. See VII.

Determining the physical properties of clays. Sokoloff. See IX.

PATENTS.

Glass heating and drawing furnace. U. Houze, Grand Rapids, Mich. U.S. Pat. 935,789, Oct. 5, 1909.

A MELTING tank, with side openings for lading, a heating pot, and a drawing pot are arranged in series. Molten glass passes along a trough, with a spout, from the tank to the heating pot and this communicates above and below a partition with the drawing pot. The latter has a movable flat top, provided with a central opening and movable cover, and also has an opening at the side opposite to the heating pot. Above the heating pot is a dome, provided with openings to admit heat above the level of the glass in the pot. The pots are spaced apart from, and surrounded by masonry, which also encloses the dome, and the wall in front of the drawing pot and of the dome can be removed without disturbing the rest of the masonry.—W. C. H.

Glass; Electric furnace for the continuous manufacture of —. M. Sauvageon. Fr. Pat. 401,744, Aug. 7, 1908.

MELTED glass is a conductor of electricity, but it has a high resistance. If, then, a current of electricity be passed through a bath of molten glass, the resistance offered will cause heat to be generated, so that more glass-material may be melted. The furnace contains a bed filled with molten glass on which the material floats, and this bed is furnished with a channel to draw off the refined glass.—H. H. S.

China clay; Preparation of —. A. G. Salamon, London, C. J. Grace, Steyning, Sussex, and The Exploration Co., Ltd., London. Eng. Pats. 2294 and 2295, Jan. 30, 1909.

A LARGE proportion of the china clay from Cornwall and Devonshire is known as "bleaching clay," and its selling value depends largely on its freedom from colour. It is proposed to remove any colouring matter by subjecting the clay emulsion to the action of oxalic acid, either in hot or cold solution, or of sulphurous acid or one of its compounds. The oxalic acid or sulphurous acid should afterwards be washed out when the clay goes through the filter-press. This process is also applicable to "potter's clay," provided that it does not contain an undue proportion of mica containing colouring matter, in which case the stain would become visible on firing.—H. H. S.

Enamelling furnaces; Means for charging and discharging —. Wanderer Werke vorm. Winkhofer und Jaenicke, Akt.-Ges., Chemnitz, Germany. Eng. Pat. 7839, April 1, 1909. Under Int. Conv., April 3, 1908.

To prevent loss of heat, enamelling furnaces may be charged and discharged by means of trolleys running on rail tracks between the furnaces and work-shops. For this purpose a transferring or traversing carriage is used, movable on a track in front of a bank of furnaces out of which rail-tracks extend. The present invention consists in providing the carriage with a number of rail-tracks, so that immediately after running a trolley out of the furnace on to one of the tracks, another trolley can be run into the furnace off another track.—H. H. S.

Enamelling in one stage; Process of —. P. Woog and M. Delage. Fr. Pat. 401,543, July 29, 1908.

AN oxyhydrogen or acetylene flame is directed on to the spot where the enamel is required, while the finely-ground enamel is also projected on to the same spot. The process is specially adapted to such shapes and sizes of ware as cannot be introduced into a kiln.—H. H. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Clays; Determination of the physical properties of —. Sokoloff. Tonind.-Zeit., 1909, 33, 1256—1260, 1286—1289, 1295—1298.

WHEREAS the chemical composition is of the greatest importance in the case of high-grade clay intended for porcelain, stoneware, and the like, it is the physical properties which determine the value of low-grade clay suitable for bricks, tiles, and common building purposes. These are, amongst others, the water-absorbing power, contraction on drying, plasticity, and burning temperature. The author determined the plasticity of different samples of clay by moulding small pyramids of definite size and shape, and measuring the time these pyramids retained their shape, when placed under gently running water. He mixed clay and quartz-sand in various definite proportions, and representing the quartz content and the life of each sample graphically, obtained unbroken curves for each specimen of clay. Each diagram contained two critical points, between which the curvature reached its maximum, these points being taken by the author to be an index of the plasticity, and to indicate the greatest amount of "thinning" material that could be added to the clay in practical use. The relative porosity was determined by burning samples of the clay, and boiling the burnt samples in distilled water until saturated, carefully wiping with filter paper, and reweighing the samples so treated in closed glass tubes. The "water-penetrability" was determined by subjecting cylindrical slabs of burnt clay to a certain head of water and measuring the rate of leakage through the plates. Regular curves were obtained for this property, also for clays with graduated admixtures of "thinning" material, and the author draws attention to the remarkable fact that the penetrability of burnt clay decreases with the repeated subjection of the same sample to water pressure. The author concludes that the most important points to be settled in connection with clays are: (1), The determination of the standard amounts of "thinning" materials of various degrees of fineness, that can be added without detriment to the plasticity; (2), the determination of the effect of different degrees, and of different duration, of burning, on the density of the burnt material; (3), the study of the effect of repeated burning on one and the same mass of material under varying conditions; (4), the exact determination of the water-penetrability of pottery and roofing-tile clays, and of other ceramic materials.—O. R.

Silica; Studies in the uses of finely-divided —. S. W. Parr, T. R. Ernest, and W. S. Williams. J. Ind. and Eng. Chem., 1909, 1, 692—694.

A DESCRIPTION is given of attempts to prepare artificial stone from the finely-divided silica which occurs in extensive deposits in Southern Illinois. (The material consists of minute, transparent particles of silica, 0.2 to 50 mm. diam., of crystalline structure, loosely cemented together by a small amount of clay; it contains 0.15 per cent. of moisture, 98 of silica, 0.2 of magnesia, and 1.21 of alumina.) When formed into bricks with lime in the proportion of 80 of silica to 20 of lime, and subjected to a steam pressure of 150 lb. per sq. in. for 10 hours, a product with a tensile strength of 278 lb. per sq. in. was obtained. To examine the effect of heat on the product, a number of bricks were heated, and test-samples withdrawn at different temperatures, and their tensile strengths determined, the following results being obtained:—20° C., 278 lb. per sq. in.; 300° C., 45; 400° C., 0; 500° C., 101; 600° C., 131; 700° C., 124; 750° C., 27; 800° C., 71; 850° C., 186; 1190° C., 260; and 1390° C., 26 lb. per sq. in. By addition of asbestos to the lime-silica mixture, the tensile strength of the product was increased up to a maximum of 377 lb. per sq. in. with 12 per cent. of asbestos. The lime-silica mixture is as plastic as Georgia kaolin, and a vase prepared with it, by moulding, and then hardened by steam-pressure, had a good clear white colour. It is suggested that an architectural building material, to

be used in a similar manner to terra-cotta, could be prepared very advantageously from this finely-divided silica.—A. S.

Portland cement; Lime in —. H. Trachler. Tonind.-Zeit., 1909, 33, 1334—1340.

THE author investigated a number of Portland cements containing high percentages of lime, which had been perfectly clinkered at high temperatures, and had satisfied all the required standard tests for setting, tensile and crushing strengths, and constancy of volume. He found that all these cements began to weaken after six months' keeping under water, a fact which could only be explained by the separation of free lime, present in a state of solid solution. The author draws attention to the two types of Portland cement formulae, taking Schott's formula, $x(2\frac{1}{2}\text{CaO}, \text{SiO}_2) + y(2\frac{1}{2}\text{CaO}, \text{R}_2\text{O}_3)$, as an example of the "bicalcium silicate" type, and Newberry's formula, $x(3\text{CaO}, \text{SiO}_2) + y(2\text{CaO}, \text{R}_2\text{O}_3)$, as typical of the tricalcium silicate type. Taking x in either formula to equal 1, 2, 3, etc., up to 10, y being unity, and calculating the percentages of lime, silica, and iron-and-aluminium oxides (R_2O_3), thus found, a table is obtained by comparison with which, the actual analysis of a cement indicates the excess of lime, i.e., the lime present in the form of solid solution. Corrections have to be made for the magnesia, sulphuric anhydride, and alkalis present, which are calculated as magnesium silicate, calcium sulphate, and sodium silicate respectively, and the magnesium silicate is taken as being capable of binding one molecule of lime in an artificial olivine, having the composition $\text{MgO}, \text{CaO}, \text{SiO}_2$. The author's experiments led him to doubt the existence of tricalcium silicate in Portland cement, and to conclude definitely that a high percentage of lime, in addition to increasing the difficulty and cost of making satisfactory clinker, is invariably injurious to the cement in the course of time.—O. R.

Portland cement; Action of calcium sulphate and calcium chloride on —. Spieglberg. Tonind.-Zeit., 1909, 33, 1289—1290.

THE effects which calcium sulphate and calcium chloride exercise on cement, vary with the composition and properties of the latter. Calcium chloride is most pronounced in its action in those cases where small quantities of calcium sulphate suffice to produce volume changes in the cement. In all cases, however, the author concludes that calcium chloride influences the expansion due to calcium sulphate beneficially; even when the proportion of the latter is unduly increased by adding gypsum to cement, the addition of calcium chloride causes the cement to set to constant volume; the cement at the same time increases in both tensile and crushing strength, more especially the latter.—O. R.

Portland cement; The chemical analysis of —. R. Grimm. Tonind.-Zeit., 1909, 33, 1277—1280.

THE author draws attention to the great divergence in the results of the chemical analysis of Portland cement furnished by different laboratories; in one case under consideration a carefully prepared and thoroughly average sample was divided into six parts: one part was retained and analysed by the laboratory belonging to the manufacturers of the cement, and the remaining five samples were analysed by five different public laboratories in Germany, France, Switzerland, and Spain. There was practically no agreement between the results. The amount of ferric oxide contained (which had led to the rejection of the cement in the first instance), was given as 3.16 per cent. in one of the analyses and as 4.54 per cent. in another, the difference of 1.38 in 100 parts of cement representing a divergence of 43.5 per cent. on the amount of ferric oxide itself. The figures for the other constituents showed even greater discrepancies, and the hydraulic modulus found varied between 1.94 and 2.08. The author briefly reviews the various analytical processes in use at the above, and at other cement laboratories, and recommends that standard methods of chemical analysis should be agreed upon for Portland cement, as has been done in the case of other chemical industries.—O. R.

Portland cement trade of Germany. Board of Trade J., Oct. 28, 1909. [T.R.]

FOREIGN competition in the importation of Portland cement into Germany, as well as the increased production in the country has, during 1909, been remarkable. Exports from Belgium to Germany during the first seven months of the present year amounted to 1,562,685 cwt., as against 1,178,571 cwt. during the corresponding period of last year. Imports into Germany from all sources during the period referred to amounted to 2,528,847 cwt. in 1907, as against 2,022,729 cwt. in 1908. The exports during the first seven months of the present year amounted to 6,646,427 cwt., as against 5,822,141 cwt. during the similar period of 1908. This increase has been due mainly to the demands of Chile, which in the period mentioned took 681,941 cwt., as against 210,253 cwt. in the first seven months of last year. Much larger quantities have also been exported this year from Germany to China, the Dutch East Indies, Brazil, Finland, Norway, and Austria-Hungary.

Sand-lime brick. U.S. Geol. Survey, 1908. [T.R.]

THE sand-lime brick industry in the United States began in 1901. The value of the production in 1903 was \$155,040. In 1907, the maximum of \$1,225,769 was reached, and there was a decrease in 1908 to \$961,226. The number of plants reporting increased from 16 in 1903 to 94 in 1907, with a decrease in 1908 to 87.

Binary systems of alumina with silica, lime, and magnesia. Shepherd and others. See VII.

PATENTS.

Wood ; Process of preserving — J. M. Nelson, jun., Sherwood, Md. U.S. Pat. 937,008, Oct. 12, 1909.

TIMBER is heated in a suitable bath to a temperature above 100° C., in order to expel a portion of the contained gas and moisture. It is then immersed in a cool preservative solution. Owing to the contraction of the contained gas and moisture by the reduction in temperature, the preservative is readily absorbed. The impregnated timber is again heated above 100° C. and finally cooled in air. —F. R.

Wood ; Process of impregnating — by sudden changes of pressure and exhaustion. M. Boucherie. Fr. Pat. 401,746, Aug. 7, 1908.

THE injection of antiseptic or colouring liquids into wood is retarded by gases and by the residue of the sap. The inventor obviates these difficulties by subjecting the wood in a closed vessel to sudden changes of pressure and to suction, by which means the gas is removed. —H. H. S.

Tar oils [for preserving wood, etc.] ; Process for improving — Gewerkschaft des Steinkohlen-Bergwerkes "Lothringen." Ger. Pat. 213,715, Jan. 15, 1909.

FOR use in preserving wood, etc., tar oils should not have a disagreeable odour, should be of a brownish colour, and as viscous as is consistent with ease of application. These conditions are said to be fulfilled if the tar oil is heated to 200°–300° C. with about 2 per cent. of carbon tetrachloride and a small quantity of hydrochloric acid, and then a portion removed by heating or by treatment with steam. If the proportion of carbon tetrachloride is increased, the hydrochloric acid may be omitted, and no distillation is necessary. —T. F. B.

Cement ; Waterproof — and method of making the same. J. F. Schoellkopf, Assignor to Schoellkopf, Hartford, and Hanna Co., Buffalo, N.Y. U.S. Pat. 930,697, Aug. 10, 1909.

Two parts of quicklime and one part of powdered rosin or colophony are mixed with water and well stirred. Baryta may be used in place of lime. About two per cent. of the resulting mixture added to Portland or similar cement is stated to give a product which is waterproof when set. —J. W. H.

Cement product ; Vitrified — and process of making same. H. C. Todd, Oak Park, and C. Mayr, Chicago Ill., Assignors to Chicago Fireproof Covering Co. U.S. Pat. 935,616, Sept. 28, 1909.

ARTICLES of great hardness are made by shaping them out of a mixture of hydraulic cement and water, with or without the addition of a porous or fibrous "filler," and when set, drying them and impregnating them with a solution of a colloid soluble silicate. —F. R.

Cement ; Manufacture of — M. Trembour, Harzburg, Germany, Assignor to Putnam Development Co., New York. U.S. Pat. 935,617, Sept. 28, 1909.

MOLTEN blast-furnace slag is broken up into small particles, and an acid solution, alone or containing a small quantity of a dissolved coating material, is added, or a finely-divided material is introduced, which forms a deposit around the separated globules of slag. —F. R.

Cement ; Manufacture of — from slag in blast-furnaces. Soc. J. et A. Pavin de Lafarge. Fr. Pat. 401,493, Apr. 1, 1909.

ACEMENT, approximately of the formula, $\text{SiO}_2 \cdot \text{Al}_2\text{O}_3 \cdot 3\text{CaO}$, is made by adding the required quantities of alumina and chalk to the charge of a blast-furnace. —H. H. S.

Wood ; Liquor for impregnating — K. H. Wolman, Idaweiche, Germany, Assignor to M. Barsehall, New York. U.S. Pat. 935,070, Oct. 5, 1909.

SEE Fr. Pat. 353,181 of 1905 ; this J., 1905, 971. —T. F. B.

Portland cement ; Waterproof — and process of making same. H. J. Haddan, London, From Meramec Portland Cement Co., St. Louis, U.S.A. Eng. Pat. 9381, April 20, 1909.

SEE U.S. Pat. 931,884 of 1909 ; this J., 1909, 1037. —T. F. B.

X.—METALS AND METALLURGY.

Mineral output of British India in 1908. Indian Tr. J., Sept. 23, 1908. [T.R.]

Coal.—The coal industry in India has now assumed very important proportions. The output in 1908 amounted to 12,149,020 tons, as compared with 10,526,468 in 1907. Of the total, 11,559,911 tons were raised in Bengal.

Mica.—There was an increase in the output of mica of 1,289 cwt. As in 1907, Hazaribagh increased its output, while that of Madras again fell, the decrease being 4,516 cwt. There was a great falling off in the demand towards the end of 1908, and several of the smaller mines closed down.

Manganese ore.—The figures for 1907 were 642,082 tons, while last year they reached only 494,942 tons. Of this decrease, 113,375 tons is due to the Central Provinces, which made such strides in the previous year ; while Madras has a decrease of 36,108 tons. In the Bombay Presidency the output has risen from 19,689 tons in 1907 to 22,032 tons in 1908.

Limestone again showed a considerable increase, while the output of salt diminished. The copper mines in the Central Provinces have now reached the producing stage, but the quantity returned for 1908 was only 10 tons. Tin in Burma was only half the quantity returned in 1907, and the chromite worked in Baluchistan dropped to 1,000 tons for the year.

Mineral output of Japan in 1908. Board of Trade J., Oct. 28, 1908. [T.R.]

THE following particulars of the output of minerals in Japan during 1908, as compared with the preceding year, are taken from a return issued by the Japanese Department of Agriculture and Commerce :—

			1907.		1908.	
			Quantity.	Value.	Quantity.	Value.
			£		£	
Gold	Momme	783,409	391,704	959,441	179,721	
Silver	"	25,492,269	422,330	32,846,767	447,645	
Copper	Kin	66,971,314	3,369,996	68,998,195	2,283,215	
Lead	"	5,132,091	56,864	4,850,591	40,512	
Bismuth	"			1,376	798	
Tin	"	53,950	5,018	42,885	3,508	
Antimony, refined	"	270,026	11,074	229,978	4,299	
" crude	"	142,534	3,310	160,354	1,069	
Mercury	"	760	95	1,349	174	
Zinc ore	Kwan	5,245,405	32,154	4,879,860	39,878	
Cast-iron	"	11,852,442	208,959	11,201,874	173,673	
" Kera	"	235,959	2,541	182,872	1,650	
Wrought-iron	"	289,496	8,164	24,954	961	
Steel	"	1,473,576	43,809	695,826	20,810	
Iron pyrites	"	14,977,623	20,295	9,031,153	17,146	
Chrome iron ore	"			697,440	1,362	
Manganese ore	Kin	34,309,809	14,410	18,550,574	15,057	
Tungsten ore	Kwan	—	—	310	49	
Molybdenite	"			20,527	120	
Arsenic	Kin	12,485	87	33,063	253	
Phosphate ore	Kwan	458,900	740	197,293	736	
Graphite	Kin	171,984	1,047	295,813	1,726	
Coal, bituminous	Metric tons	13,578,846	5,939,387	14,526,604	6,287,514	
" anthracite	"	185,885	45,635	241,034	59,596	
Coke	"	39,238	11,104	57,725	15,268	
Peat	"	70,873	10,992	82,957	14,490	
Petroleum	Koku	1,513,994	521,874	1,641,321	652,038	
Asphalt	Kwan	155,800	1,091	641,110	5,129	
Sulphur	Kin	55,548,626	78,879	55,699,100	74,810	
Total value	Yen	—	£11,201,567	—	£10,634,238	

Momme=0.12057 oz. Troy.

Kin=1.3228 lb.

Kwan=8.2673 lb.

Koku=39.7033 galls.

Melting iron in a foundry cupola. H. McCormack. Electrochem. and Met. Ind., 1909, 7, 391—393.

THE author has calculated the amount of heat developed in the melting of an ordinary charge of iron in a foundry cupola, and determined the manner in which the heat is distributed and utilised during the operation. The charge consisted of 240 kilos. of coke, 727 of scrap iron, 363.5 of pig iron, and 70 of limestone; and after the melting, which occupied 67 minutes, 119.5 kilos. of slag, 53 of coke, and 1070 of clean castings were obtained. The average temperature of the molten metal was 1900° C., that of the escaping gases being 800° C. The calculated amount of heat developed was 1,386,383 calories, the amount utilised being apportioned as follows:—

	Per cent. of the total.
Melting and superheating iron	28.14
Heating gases, and loss as carbon monoxide	49.00
Formation and heating of slag	5.60
Heating cupola	13.60
Heating unburned coke	2.90
Loss by radiation and convection	0.58
Unaccounted for	0.18
	100.00

The smallness of the amount remaining unaccounted for is regarded as due to counter-balancing errors, the methods employed not being accurate to this degree. The re-melted iron was found to have gained in silicon, combined carbon, and phosphorus, and to have lost in sulphur, manganese, and graphitic carbon. This effect, which is not in harmony with the experience of Turner, Hoffman, and others, is ascribed by the author to the presence of the slag.—W. E. F. P.

Steel; Slag enclosures in —. W. Rosenhain. Int. Assoc. Testing Materials, 1909. Engineering, Sept. 24, 1909, 409—410.

ATTENTION is called to the importance of further and closer study of the influence exerted upon the strength and safety of steel by the presence within its mass of non-metallic substances, commonly known as "slag enclosures." Their presence is readily seen on microscopic examination. The duplex nature of some of these is

usually explained by the statement that they consist of sulphide of manganese embedded in silicate of manganese, but the author has observed instances of duplex enclosures in which neither of the constituents was really soluble in acids. In wrought iron, containing practically no manganese, there was always a large amount of non-metallic matter and this sometimes showed a well-marked duplex structure. In this case, although sulphide of iron might be present, it seemed probable that the constituents were two different silicates, or possibly oxides, of iron. Stead had suggested that in the case of steel these enclosures were due to the introduction of oxygen either during melting or in the teeming process; this oxygen reacted with the manganese and silicon to form silicates, while the sulphur already in the steels combined with the manganese in the manner shown by Arnold. The obvious remedies were to protect the steel from oxygen during teeming, and to allow it to rest sufficiently long after the addition of manganese to allow the sulphide to rise to the surface, this period of time is probably much longer than usually anticipated. The author points out that the incomplete separation of slag from the metal in the furnace or converter, the violent boiling probably producing admixture of slag and the time taken for settling being much longer than generally thought, the contact of the metal with the tapping hole, the gutter, the ladle lining and the stopper were all sources of contamination by silicious substances. In steel the enclosures were generally found embedded in the ferrite bands, but when they were in the harder pearlite, they were in contact with a material which could not adapt itself to them. Guillet mentions some ship's plates which were accepted and delivered on the usual specified tensile test. On being worked up they developed cracks, and impact tests gave invariably bad results. It was shown that the cracks started from slag enclosures, and the plates would probably have been rejected if impact tests had been made at the works. Stead in a discussion which followed the paper confirmed the remarks which stood in his name, and said that he strongly recommended casting all steel without allowing air to impinge upon it. It was barbaric to cast through air after the extreme care which was given during the process of manufacture. The Congress recommended the appointment of a committee to investigate the influence of slag enclosures upon the quality of the metal.—A. H. C

Spring steel; Heat treatment of — L. H. Fry. Int. Assoc. Testing Materials, 1909. Engineering, 1909, Sept. 17, 369—370.

Using a basic open-hearth spring steel commonly used in America for locomotive carrying-springs, the author has investigated the effect of annealing, the comparative effect of quenching in water and in oil, and the effect of reheating to various temperatures after complete cooling in water and in oil. Ten test-pieces 1 in. in diameter and 14 in. long were cut from the same bar of steel having the following composition: carbon 1.01 per cent.; manganese 0.38 per cent.; phosphorus 0.032 per cent.; sulphur 0.032 per cent.; and silicon 0.13 per cent. The critical point was found to be 1360° F. (740° C.). As the result of experience it was found advisable to anneal the steel from 40° F. to 50° F. (4°—10° C.) above the critical temperature, and to harden the steel from 50° F. to 100° F. (10°—38° C.) above the critical temperature, the exact temperature being determined by the size of the work and the effectiveness of the cooling bath. The author decided to employ the following temperatures: for annealing, 1400° F. (760° C.), for quenching in oil 1450° F. (790° C.), and for quenching in water, 1425° F. (775° C.). The modes of quenching, and the heats to which the temper was drawn were the only variable operations. To anneal the test-pieces they were heated in a lead bath at the above temperature for two hours, and were then allowed to cool with the furnace for fourteen hours. The oil for hardening was at a temperature of 80° F. (27° C.); the water was pure running water at 60° F. (16° C.). Either an oil bath which could be heated by gas to 600° F. (315° C.) or for higher temperatures a lead bath was used for tempering the test-pieces. For testing, the specimens were placed on supports 12 in. apart, and the loads were applied in the middle. It was found by the author that the steel used, when thoroughly annealed as described had an elastic limit of 78,500 lb. (35 tons) per sq. in. or about half the elastic limit obtained when given a "spring temper" or equal to about one-third of the elastic limit of the same steel when quenched in water and drawn to 750° F. (400° C.). The highest elastic limit when quenched in oil at 1450° F. (790° C.) was 187,400 lb. (83.7 tons) per sq. in. and this was obtained when the temper was not drawn after quenching. The higher the temperature of tempering the lower the elastic limit fell. Thus:—Drawing to 400° F. (205° C.) gave 177,600 lb. (79 tons) per sq. in.; drawing to 500° F. (260° C.) gave 160,400 lb. (71.6 tons) per sq. in.; drawing to 560° F. (292° C.), gave 137,500 lb. (61 tons) per sq. in. When the steel was quenched at 1425° F. (775° C.) in water, and not tempered, it was brittle and broke at 212,000 lb. (94.6 tons) modulus of rupture, the elastic limit being the same as the modulus of rupture, the deflection of the breaking point being 0.171 in. Tempering to 500° F. (260° C.) gave an elastic limit of 219,800 lb. (98.5 tons) still equal to the modulus of rupture; tempering to 750° F. (400° C.) gave the highest elastic limit viz. 240,800 lb. (107.5 tons) with a still higher modulus of rupture of 389,000 lb. (174 tons); at 900° F. (482° C.) the elastic limit fell slightly, while on tempering at 1050° F. (565° C.), the elastic limit fell to 180,700 lb. (80.7 tons) and the test piece did not break under a deflection of 1.1 in. The modulus of elasticity was found to be practically constant, and independent of the heat treatment; it was however, difficult to determine accurately, and values varying from 27,150,000 to 30,420,000 were obtained. The author concluded that steel with 1 per cent. of carbon when quenched in water from above its critical temperature, was usually too hard and brittle to be used for making springs or tools.—A. H. C.

Titanium; Influence of —, on steel, especially on steel rails. E. von Maltitz. Stahl u. Eisen, 1900, 29, 1593—1602.

The addition to steel in the ladle, after ferro-manganese or ferro-silicon, of half to one per cent. of ferro-titanium (containing 10—15 per cent. of titanium) greatly improves the quality of the steel. It probably does this by combining with the last traces of oxygen, and also with any

nitrogen in the steel, and, by thus lessening the amount of gas present in the metal, making it more compact and homogeneous. Photographs are given of ordinary Bessemer rails and of "titanium-steel" rails laid down and used under similar conditions, and figures showing the wear, which prove that the "titanium-steel" rails are from three to six times as durable as the others. The increased cost of production is probably 7 or 8 shillings per ton. The tensile strength of this steel is stated to be from 60 to 75 per cent. higher than that of ordinary Bessemer steel.—J. T. D.

Sparks as indicators of the different kinds of steels. M. Bermann. Int. Assoc. Testing Materials, 1909. Engineering, 1909, Sept. 17, 370.

In grinding metals the size of the spark depends upon the size of the grain forming the emery wheel, the speed of cutting, the nature of the metal, and the pressure with which the wheel bears against the metal. The initial temperature of the sparks is influenced principally by the cutting power and cutting speed of the emery wheel, and in a minor degree by the nature of the material ground. The influence of the emery wheel, however, far outweighs that of the quality of the steel. The author states that the spark test is so sensitive that it will give very clear indication of a difference of 0.01 per cent. of carbon in a steel. If bars had been wrongly arranged in store rooms, when tested with a revolving emery wheel the spark-ray would give precise information of the quality of the metal forming the bar; for instance, pointed branching lines denoted carbon steel (Siemens-Martin); leafy ends of the branching lines showed Siemens-Martin steel of high carbon percentage; spark pictures, with a "blossom-branch-like" appearance, indicated ordinary tool steel. The spark-test could be used in the course of the Siemens-Martin process, to test the bath and for the inspection of the finished material, as a guide in the hardening of tools, in inspecting wire for the manufacture of springs, and in the forge to distinguish good iron from that which was difficult to weld.

—A. H. C.

Iron alloys; Some physical characteristics of — C. F. Burgess and J. Aston. Electrochem. and Met. Ind., 1909, 7, 436—438.

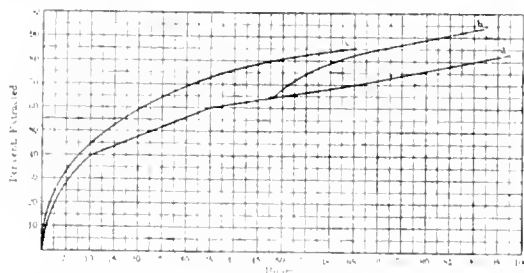
The authors have studied qualitatively the mechanical properties of alloys of a large number of elements with electrolytic iron (see this J., 1904, 667) of 99.97 per cent. purity, the alloys being practically free from carbon. The alloys were prepared in ingots of about 1 lb. weight by heating the components together in a covered graphite crucible, lined with magnesia, in an electric resistance furnace. The results, which are given in tabular form, showed that qualitatively the characters of the various alloys in regard to forging did not differ greatly from those of similar commercial alloys (i.e., containing carbon). Chromium, manganese, molybdenum, nickel and tungsten promoted self-hardening properties even in absence of carbon, and many of the alloys of electrolytic iron with these five metals would make satisfactory lathe tools either in their air-hardened condition or after quenching. Alloys of electrolytic iron with combinations of two or more of the metals mentioned were generally so hard, that test-bars could only be obtained by grinding, but by choosing a suitable temperature and taking the precautions found necessary in the working of high-speed steels, nearly all of them could be forged.—A. S.

Alloys of electrolytic iron with arsenic and bismuth. C. F. Burgess and J. Aston. Trans. Amer. Electrochem. Soc., 1909, 15, 369—389.

The pure iron used in the investigations was electrolytically refined from Swedish iron bars. After two refinings the pure iron content was 99.971 per cent. (See this J., 1904, 667.) This material was melted with the alloying metal in a dense electrically-shrunk magnesia crucible, with a magnesia cover; this crucible was placed in a graphite crucible and the whole embedded in granu-

to the tube mills, mixing them with the ordinary pulp, until they are so fine that they float off with the tailings. In this system concentration is used as an aid to fine grinding. The ground pulp from the stamps containing about 10 of solution to 1 of ore, goes to a "Dorr" classifier A (see fig.), the overflow from which, consisting of particles all passing 150-mesh, is condensed in the pulp thickener, B, to 4 to 1. The coarser part of the pulp goes to the tube mill or regrinder (D). It contains the sands from which the metal has not yet been completely liberated, the pyrites, and coarser particles of silver sulphides and gold. The overflow of the classifier having been properly thickened in B is concentrated on the slime tables (C). The concentrates from these tables instead of being sold are returned to the pump (F) which receives the discharge of the tube mill (D) and returns them to the classifier again. The concentrates are thereby kept in circulation, till they are fine enough to float off the slime tables into the tailings with which they are led to the pulp thickener (E), where they are rendered fit for treatment with cyanide. These concentrates are now so fine, that they behave just like the metals in the ordinary pulp. Extraction is complete in 24 hours or even less; there is no reprecipitation and the cyanide consumption is in proportion to the metallic contents of the ore. The additional cost of this regrinding is insignificant when compared to that of disposing of the concentrates to the smelter or subjecting them to a special treatment.—A. H. C.

Oxidation and cyanidation. H. A. Megraw. Eng. and Min. J., 1909, 88, 645-646.



OXIDATION plays a most important part in the reactions of cyanidation. As far as the extraction of gold is concerned, it is the general opinion that air itself is the best and cheapest oxidising agent, although chemical oxidising reagents have been used with some success. With silver, however, no really satisfactory result has been obtained. The volume of silver in a commercially treatable ore is so great, compared with a gold ore of equal value, and the reactions so much more involved, that a longer time of treatment has come to be considered necessary. In the treatment of a silver-gold ore by different chemical oxidisers, Caldecott has shown that barium peroxide gave the best result, in the case of gold, with an extraction of 89.7 per cent. in six hours using 0.1 per cent. of the oxidising agent. In the case of silver, oxygen under 100 lb. pressure gave the best result, with an extraction of 79.4 per cent. in six hours. The diagram shows the results of experiments made on slimes in circular, flat bottom tanks, air being introduced from a compressor through a number of jets fixed in the bottom of the tank. Curve *a* shows the result of treatment by agitation and oxidation by free air alone, *b* shows the result of circulation with a centrifugal pump after 48 hours' treatment by free air agitation, and *c* shows the result of the use of the centrifugal pump alone, during the entire time of treatment. As the result of many experiments the author concludes that the use of chemical oxidisers is inadvisable owing to the expense, and because the introduction of other and useless chemicals further complicates the already complex reactions. The author has devised a method of deriving oxygen from water electrolytically, and adding it in a fine stream to the slime pulp under treatment by means of a small pipe leading from the oxygen tank into the suction of the centrifugal pump

used for circulation. Although the cost would be small the author is unable to make any comparison between the cost of his method, and that of the somewhat similar suggestion of Mosher (Min. and Sci. Press, May 15, 1909) in which the use of ozone from air is recommended.

—A. H. C.

Silver and its alloys: Solubility of — in mixtures of acids. E. Panmain. Gazz. chim. ital., 1909, 39, 11, 234-239.

IN the manufacture of silver coins the coating of copper oxide produced by the repeated annealings to which the metal is subjected, is removed by treatment with dilute sulphuric acid of 2°-3° B. heated to about 100° C. In this operation some silver is always dissolved along with the copper. Moreover Carey Lea (Z. anorg. Chem., 1893, 3, 180) has stated that pure silver, if finely-divided, is slightly soluble in dilute sulphuric acid. On the other hand the generally accepted view is that silver is soluble in concentrated, but insoluble in dilute sulphuric acid, and technical processes for the separation of silver from gold on the one hand and from base metals on the other have been founded on this view. The author's experiments on the subject have shown that silver whether pure or in the form of an alloy (Italian coinage metal) containing 16.5 per cent. of copper is not dissolved by pure sulphuric acid of a concentration below 60° B. In presence of impurities in the acid, however, silver is dissolved even by dilute sulphuric acid. In the technical separation of silver from gold, it would be preferable to use a mixture of sulphuric and nitric acids, which would dissolve the silver at a lower temperature than sulphuric acid alone, and with a consumption of nitric acid of about one-half that required when pure nitric acid is employed. In the removal of the coating of copper oxide from silver-copper alloys, such as silver coinage alloys, and in the separation of base metals from silver, pure dilute sulphuric acid should be employed; even in presence of the impurities contained in the commercial acid, or in tap water, some silver is dissolved.—A. S.

Copper-slags: Metal losses in —. L. T. Wright. Trans. Amer. Inst. Min. Eng., 1909, 817-820.

THE copper content of a well-settled slag is not reduced by holding the slag in a molten condition nor can fine-grinding and elutriation of the solid slag be made to give a product containing more copper than the average. Also, the ratio of the silver and gold to the copper is not the same in the slag as in the matte, the proportion of silver being less and of gold much less. For these reasons the author considers the copper is present in thoroughly settled slags in a state of solution and not in the form of "prills" of matte. For every increase of 1 per cent. of copper in 15-45 per cent. mattes, the copper in the accompanying slags increases on an average 0.005 per cent., and, other things being equal, a difference of 1 per cent. of silica in the slag makes a difference of about 0.01 per cent. in its copper content. The silver and gold in copper-slugs may be almost entirely removed by keeping them while molten in contact with matte poor in precious metals, although the percentage of copper may remain unaltered. O. F. H.

Copper: Comparison of the properties of — containing nickel and arsenic respectively. W. Stahl. Metallurgie, 1906, 6, 610-612.

SMALL percentages of nickel increase the tensile strength of copper without decreasing the elongation and contraction of area at fracture. The molten metal, however, more readily absorbs gases, and special precautions are necessary to avoid this. Small percentages of arsenic increase the tensile strength, malleability, and ductility, and when sufficient arsenic is present, the molten metal does not absorb gases. The presence of arsenic counteracts the harmful effect of bismuth as an impurity, and

in conjunction with nickel, increases the hardness of the copper. The strength, etc., of the two classes of metal are as follows:—

	Copper containing a few tenths per cent. of nickel.	Copper containing 0.30—0.35 per cent. of arsenic.
Tensile strength (kilos. per sq. mm.)	22—23	22.0—23.4
Elongation (per cent.)	39.5—46.0	33.0—44.0
Contraction of area (per cent.)	50.5—67.0	47.0—62.0

The tensile strength increases or decreases with the percentage of arsenic outside the limits given, but the elongation and contraction cannot be markedly increased by decreasing the percentage of arsenic. Copper containing nickel retains its properties unchanged when subjected to considerable fluctuations of temperature and of stress, but it is doubtful whether this is the case with copper containing arsenic (compare Friedrichs, *Metallurgie*, 1905, 487; 1908, 532). The author concludes that copper containing nickel is more suited to modern requirements.

—A. T. L.

Bismuth; Influence of — on wire-bar copper. H. N. Lawrie. *Trans. Amer. Inst. Min. Eng.*, 1909, 857—866.

BISMUTH varying in amount from 0.005 per cent. to 0.4 per cent. was added to the purest wire-bar copper melted in graphite crucibles. Samples were withdrawn and cast into bars when the copper was judged to be at "tough-pitch." These bars were subjected to tensile and rolling tests. It was found that some of the bars containing bismuth had a fine-grained fracture, while others gave a columnar fracture, this difference being due probably to a difference of "pitch" at the time of pouring. The alloy containing 0.2 per cent. of bismuth had a very fine-grained, "tough-pitch" fracture and gave a tensile strength of 3500 lb. per sq. in. greater than the best pure copper bars cast in these experiments. The author considers that, if cast at "tough-pitch," an alloy of copper with 0.18 per cent. of bismuth is stronger than pure copper. With regard to the effect on the rolling properties, it was found that the limiting quantity of bismuth which can be present without appreciably lowering the malleability and ductility of the copper is less than 0.005 per cent., whether the metal is to be rolled hot or cold. If this limit be exceeded, the ductility of the copper is so lowered as to interfere with the process of wire-drawing.—O. F. H.

Copper and brass; Notes on some probable causes of the corrosion of —. E. L. Rhead. *Inst. of Metals*, Oct., 1909. [Advance proof.]

THE author has experimented upon copper and brass with various corroding liquids, including dilute solutions of ferric chloride, hydrochloric acid, and common salt, the last being used alone and also in conjunction with carbonic acid gas, ammonium nitrite, and hydrogen peroxide. The ammonium nitrite and carbonic acid gas were introduced to show the possible effects resulting from the use of sea water contaminated by sewage, while the hydrogen peroxide was used to produce an effect similar to that of dissolved oxygen. Plates of hard and soft copper, and of brass, were submitted to the action of dilute ferric chloride solution for from 20 to 48 hours, note being taken of the amount of metal dissolved in each case. In most instances the loss on the hard copper was greater than that on the soft; but whereas, in the latter case, the corrosion of the surfaces was fairly uniform, in the former the action was found to have proceeded unevenly and in more or less distinct bands parallel to the direction of the rolling of the plates. The brass plates, which were polished on one side, became enriched in copper round the end edges, on the polished side, and in scratched or tool-marked places. Further experiments upon hard, soft, and polished copper, with the other corroding liquids enumerated, indicated that hard copper shows greater susceptibility to attack than

the soft metal; and the presence of carbonic acid gas was found to promote the corroding action in every case. In an experiment upon a strip of hard brass, which was softened at one end and then bent into Ω -form, the two limbs were placed in a solution containing 10 per cent. of hydrochloric acid and 5 per cent. of copper chloride. After 12 hours, it was found that while the softened limb was scarcely affected, the other had become seriously corroded, especially on the inner side, the corrosion being most marked in parallel lines running across the strip in the direction of the rolling. In the light of these results, it would seem that corrosion of this kind might be due to the unequal hardness resulting from unequal pressures during the cold rolling of the metal, the harder portions being electro-positive to the softer, and consequently dissolving more readily. This may facilitate the explanation of some of the more rapid cases of corrosion met with in practice; for example, that of the tubes of surface condensers. The roughness caused by the action thus set up may form the points from which the liberation of the gases contained in the condensing water takes place, and any tendency to concentrate the evolution of gas would also tend to localise the corrosion.—W. E. F. P.

Copper-zinc alloys: a study of volume changes. T. Turner and M. T. Murray. *Inst. of Metals*, Oct., 1909. [Advance proof.]

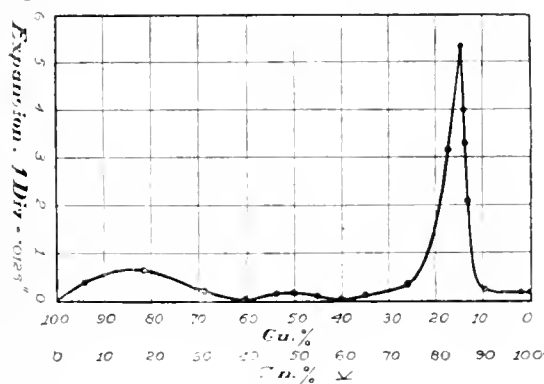


Fig. 1.

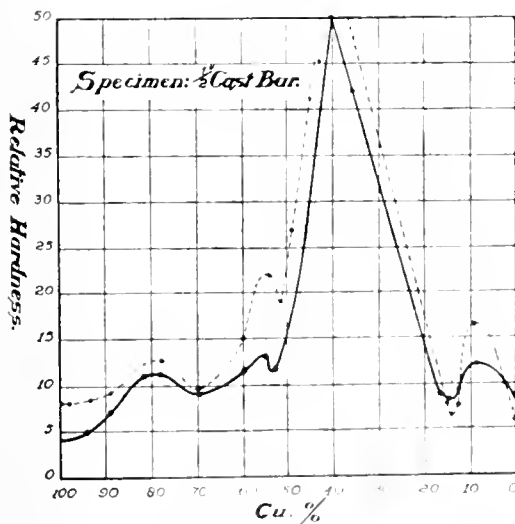


Fig. 2.—Continuous line Shore scleroscope.
Broken line Brinell test.

The extensometer designed and previously described by Turner (this J., 1906, 538) was used to obtain shrinkage curves of the alloys of the copper-zinc series, the test bars being 12 in. long and $\frac{1}{2}$ in. square section. A cooling

curve of each alloy was taken simultaneously with the shrinkage curve by means of a thermo-couple inserted in the test bar, and the micro-structures of the cast bars were examined. Many of the alloys gave an expansion during solidification, particularly those between the compositions 9 per cent. and 26 per cent. of copper (see Fig. 1). The maximum expansion in the series is at the composition 14.76 per cent. of copper, and other maxima occur at about 80 per cent. of copper and at about 50 per cent. of copper. The alloys containing 60 per cent. and 40 per cent. of copper give no expansion, and the equilibrium diagram shows that at these compositions the solidus and liquidus curves coincide. On the other hand, the maximum expansions during solidification are observed where the solidus and liquidus are most widely separated. The solid solutions, δ and ϵ , both expand considerably during solidification, and the change of δ to ϵ is considered to be the cause of the greater part of the very pronounced maximum expansion at 14.76 per cent. of copper. The hardness of the alloys was tested by the Shore scleroscope and by the Brinell test, similar results being obtained by each method (see Fig. 2). A very well marked maximum hardness was found at 40 per cent. of copper, this alloy being harder than mild steel. The authors are of the opinion that the existence of the compound, Cu_2Zn_3 (39.36 per cent. of copper), is well established. Curves showing the total shrinkage of $\frac{1}{2}$ in. bars and $\frac{1}{4}$ in. bars of these alloys are also given. From these curves it is seen that there is a well-defined maximum total shrinkage at 40 per cent. of copper, and a minimum at about 20 per cent. of copper. In the case of the $\frac{1}{2}$ in. bars there is also a maximum at 65 per cent. of copper which is absent in the curve for the $\frac{1}{4}$ in. bars. The fact that alloys containing about 65 per cent. of copper shrink less in thin sections than in thick may account in some cases for the failure of brass castings.

—O. F. H.

Alloys: The constitution and properties of the aluminium-copper-tin — C. A. Edwards and J. H. Andrew. Inst. of Metals, Oct., 1909. [Advance proof.]

BEFORE the constitution of a ternary alloy, ABC, can be studied, it is necessary to know that of the binary alloys, AB, BC, AC. The constitution of the three series, aluminium-copper, aluminium-tin, copper-tin, having been investigated, and there being a desire to substitute aluminium for tin in brasses, and other industrial alloys, the authors have studied the effect of a third metal on the transformations of such complicated alloys as aluminium-copper, and copper-tin. An equilateral triangle can graphically represent a triple alloy, each corner being one of the metals, while any point within it represents a mixture of the three metals, and perpendicular lines to the sides from this point are proportional to the percentage of the metal located at the opposite corner. A solid right-triangular prism can illustrate temperature and concentration, by letting the axis of the prism represent temperature. The boundary lines of the different phases were determined by casting the alloys in chill, annealing at the desired temperature for such time as considered necessary and then quenching, finally examining the alloy by the microscope. The authors illustrate the paper with twenty-four microphotographs, and by means of five triangular diagrams give the constitution of the alloys for the liquid state, the first and second periods of solidification, and at the ordinary temperature. It is shown that (1), no ternary compound is deposited from the liquid alloys; (2), no ternary eutectic is formed; (3), while the inversion of the compound, Cu_3Al , in the series copper-aluminium takes six weeks at 540° C. (Curry), in the presence of tin the inversion takes place in five hours; (4), the alloy containing 10 per cent. of tin and 9 per cent. of aluminium has the same structure at 900° C. as at 500° C., but at intermediate temperatures quite different structures are obtained. From a practical point of view, it is pointed out that alloys possessing useful mechanical properties are confined to very limited areas. All the others are very brittle, and in the far greater number the tin does not mix to form homogeneous alloys; no advantage is to be gained by adding tin to those alloys containing the compound, Cu_2Al .

The most important alloys of copper-tin are those containing 9—14 per cent. of tin. One containing 10 per cent. of tin has a breaking strain of 20.6 tons per sq. in. and an elongation on 2 in. of 40 per cent. Under the same conditions an alloy containing 7.5 per cent. of aluminium and 92.5 per cent. of copper breaks at 21.3 tons per sq. in. with an elongation of 71 per cent. From the results obtained the authors consider that an alloy containing 6.5 per cent. of aluminium and 5.5 per cent. of tin will have the same properties as an alloy of 10 per cent. of tin and 90 per cent. of copper. Such an alloy would be cheaper than the copper-tin, and have a lower specific gravity, and the authors are hopeful of being able to obtain definite figures for a plastic metal capable of being moulded between 232° C. and 540° C. — A. H. C.

Zinc: The technical assay of — H. W. Greenwood and F. J. Briscoe. Inst. of Metals, Oct., 1909. [Advance proof.]

WITH a view to determining their relative value for technical purposes, the methods in general use for the estimation of zinc have been examined and compared by the authors. Only volumetric and gravimetric determinations are considered, electrolytic processes being generally regarded as too troublesome for technical work. Of the volumetric processes, the authors prefer Schaffner's method (titration with alkali sulphide) as being of the widest application and affording the highest degree of accuracy. This method was found to give the best results with the assay solution at a temperature between 60° and 80° C., the volume being 150 to 170 c.c. and containing excess of ammonia. The indicator employed was ferric hydroxide (formed in the assay solution by the addition of 1 drop of a strong solution of ferric chloride), and corrections for the excess volume of liquid and for the excess of sulphide required to blacken the indicator were applied. The ferrocyanide method is recognised as being very rapid and fairly accurate, but in the authors' opinion, its value is greatly impaired by the unsatisfactory end point of the titration when a uranium indicator is employed. Ammonium tetramolybdate is stated to be nearly twice as delicate an indicator as the uranium salt, and its use is recommended for this purpose. Walker's volumetric method, which consists in precipitating the metal as zinc-ammonium phosphate, dissolving the precipitate in excess of standard acid and titrating with standard alkali, is regarded as being of limited application only, the results being seriously affected in the presence of lime and magnesia. Of the gravimetric methods, precipitation as carbonate, with subsequent ignition to oxide, gave consistently high results, due to the practical impossibility of washing the precipitate free from sodium carbonate. The addition of excess of mercuric chloride before the precipitation of small quantities of zinc as sulphide was found of advantage in many cases, the mercuric sulphide being subsequently expelled by ignition. Traces of zinc were satisfactorily detected by the calcium zincate method, consisting in the addition of an excess of milk of lime to the solution, boiling well and filtering. The precipitated calcium carbonate then contains the zinc as calcium zincate, and the metal may be separated (as sulphide) by dissolving the precipitate in acetic acid, adding excess of ammonium acetate and saturating with sulphuretted hydrogen. For the estimation of zinc in alloys, precipitation as zinc-ammonium phosphate, with subsequent ignition to the pyrophosphate, was found to give very accurate results, and this method is regarded as the most satisfactory gravimetric process for the determination of zinc. In the analysis of zinc-aluminium alloys, an indirect process was adopted in which the proportions of the metals were calculated from the amount of hydrogen evolved by the action of a known weight of the alloy upon hydrochloric acid. The results were very satisfactory when the proportions of the metals were nearly equal, but less concordant when the alloy was comparatively poor in zinc. — W. E. F. P.

Spelter: Production of pure — J. S. G. Primrose. Inst. of Metals, Oct., 1909. [Advance proof.]

It is said that in one operation, zinc of 99.7 to 99.9 per cent. purity can be obtained from galvanisers "dross,"

"ashes," and "hards," by passing the volatilised products from the retorts, through fume filters. The flow of the gases is retarded in proportion to their respective densities, the lead fume being condensed within the filter, while the lighter zinc fume passes through to the condenser. Tests made on a refractory lead-zinc "middlings" from Broken Hill, containing about 48 per cent. of zinc and 13.75 per cent. of lead, yielded 5 tons of high grade spelter from 15 tons of the middlings. The first and second tappings only contained 0.68 and 0.85 per cent. of lead respectively. Curves are given showing the production and prices of zinc from 1875 to date, together with tabulated details of the various tests.—F. R.

Galvanised and other zinc-coated metals: Testing of —. W. H. Walker. Amer. Soc. for Testing Materials, 1909. Electrochem. and Met. Ind., 1909, 7, 440—442.

THE coatings produced by the hot-galvanising, wet-galvanising (electrolytic), and sherardising processes (see this J., 1909, 399) each present different characteristics, and the Preece copper sulphate test is not of much value for judging the efficacy of the respective coatings. For the detection of pin-holes and cracks, immersion in a concentrated solution of caustic soda at 100° C. is recommended, when evolution of hydrogen will take place at any spots where unprotected iron is present (see also this J., 1909, 605). A coating of electrolytically deposited zinc is less porous and of better quality, the lower the current density at the cathode during the deposition. By heating in a concentrated solution of caustic soda in presence of metallic iron, the pure zinc in galvanised iron is dissolved, but not the zinc-iron alloy, and the weight of zinc per unit area can thus be determined. For determining resistance to corrosion of galvanised iron, a piece of the metal of known area is immersed in dilute standardised acid and the rate of evolution of hydrogen observed: this should indicate the relative durability of the coating, the rate of evolution from inferior products reaching a maximum in a few minutes, whilst with better products, a much longer time is required. With respect to galvanised iron wire for fences, it is stated that heavier coatings of zinc are needed than those generally provided, and it is suggested that by mechanically working the coated wire in dies or grooved rollers, the crystalline character of the zinc might be destroyed and the flexibility and ductility of the coating improved.—A. S.

Tin; A new infectious disease of —: the "forcing disease" [*Forcierkrankheit*]. E. Cohen. Chem. Weekblad, 1909, 6, 625—640. Chem. Zentr., 1909, 2, 1207.

THE phenomenon described by Hasslinger (this J., 1908, 1116) as "a new form of tin pest," is quite distinct from the effect generally known as "tin pest" (see this J., 1908, 1155); it is due to strong mechanical actions on the metal, and may be produced artificially both by chemical and mechanical means. If a mixture of potassium chlorate and hydrochloric acid be allowed to act for one minute at the ordinary temperature on tinplate, the so-called *Moiré métallique* is produced. If the treated spot be now rinsed with water, dried with a soft cloth, and then pressed against pure tin foil and the whole heated to 184° C., the effect observed by Hasslinger is produced: the tin foil becomes dull, and is capable of infecting other samples of tin. Further, if a bright piece of tinplate be struck carefully in an oblique direction with a hammer so that the bright surface layer is removed, then the dull spots so produced are also capable of infecting other samples of tin. Apparently "forced tin" (rolled tin, tinplate, tin foil) is to be regarded as a metastable system. At the ordinary temperature the change to the stable form proceeds with extreme slowness, but by rise of temperature or by infection with the stable modification, the velocity of the change is considerably increased.—A. S.

Bag house; The — and its recent applications. W. C. Ebaugh. J. Ind. and Eng. Chem., 1909, 1, 686—689.

IN an article furnished with numerous references, the author describes the modern bag-house of a lead smelting works, in which the fume from the lead blast-furnace

is forced through a large number of long narrow wooden bags in order to recover the solid matter present. This method has been in use for a long time in the case of zinc and lead furnaces, but until recently was not practicable for fumes from copper furnaces and roasters. Rhoades and Sprague, however, found that by addition of zinc oxide, produced for example in auxiliary furnaces from zinc "middlings," the small proportion of sulphur trioxide present in fumes from copper blast-furnaces, reverberatory furnaces, and converters, could be neutralised, and the bag-house method could then be used with advantage. — A. S.

Solders: Surface appearance of —. C. O. Bannister and H. J. Tabor. Inst. of Metals, Oct., 1909. [Advance proof.]

AS the sale of solder is influenced by its appearance, investigations were made into the conditions which affect the surface, which latter should be smooth, even, white, and with a furrow running along the centre. It was found that the addition of 2 per cent. of antimony to tinman's solder gave a bright, clear smooth surface, superior in appearance to the alloy containing only lead and tin, but larger amounts of antimony produced a rough, spotted, frosty or pimply surface. The presence of copper up to 0.5 per cent. gave good surfaces, which however, had a tendency to blister; larger quantities gave dull, flat, crystalline surfaces. Zinc, even in extremely minute quantities was highly detrimental, as little as 0.01 per cent. causing the whole of the surface to become minutely crystalline. Bismuth up to 1 per cent. appeared to have no effect. Silver up to 0.2 per cent. gave a good smooth surface, with an opalescent effect, which on increasing the percentage of silver, developed into a very white crystalline surface. The condition of the pouring largely affects the surface appearance, the best results being obtained when the alloy is poured at a moderate temperature into a mould of poor conducting material, such as marble, and allowed to solidify gradually.—F. R.

Soldering; Chemistry of preparations for use in —. A. Lippmann. Z. angew. Chem., 1909, 22, 2042—2044.

EXAMINATION of a large number of defective soldered joints in electric wires and cables has shown that the prejudice against acid soldering preparations is not justified by facts, preparations of zinc chloride being found superior in every way to those containing ammonium chloride. The latter have a much more marked deleterious after-effect than even free hydrochloric acid, and the gradual addition of ammonia, drop by drop, to a preparation of ammonium chloride was found to lead to worse results in proportion to the amount added; neutralisation with sodium hydroxide rendered the preparation useless.—F. SODN.

Titanium; Metallic —. H. Kaiser. Dissertation, Munich. Stahl und Eisen, 1909, 20, 1663—1664.

REFERENCE is made to the earlier workers, including Moissan who with a high current-density current in an electric furnace obtained titanium containing 4.8 to 15.3 per cent. of carbon, along with the nitride and blue oxide. The author prepared pure potassium titanofluoride, and reduced this with sodium, extracting the mass with water and alcohol. A product was finally obtained containing 85.6 per cent. of titanium, 3.27 of iron, 2.67 of hydrogen, 0.42 of carbon, and 7.99 of oxygen. Allowing for this oxygen as titanous oxide, the product contained 61.61 per cent. of metallic titanium. Experiments were also carried out with commercial potassium titanofluoride. The pure product had a specific gravity of 3.988; it absorbed 19.12 per cent. of nitrogen at about 1250° C. (TiN requires 22.58 per cent.). Employing the aluminium method of Wöhler, a product was obtained containing 33.72 per cent. of titanium, 45.17 of aluminium, and 1.31 of silicon, approximating to Al_3Ti_2 , with a specific gravity of 3.348. This material was compressed under great pressure, saturated with hydrogen, and electrically fused in a vacuum vessel, distilling off the aluminium. Its melting point was between 2200° C.

and 2400° C. The pure fused titanium was silver-white in colour, and contained 97.41 per cent. of titanium, 1.56 of hydrogen, and 0.30 of carbon. At 1360° C. it absorbed 23.31 per cent. of nitrogen. Its specific gravity was 5.174, specific heat 0.1418, and heat of combustion 2031 cal.—A. H. C.

Colloidal thorium. E. Wedekind and H. Baumhauer. *Z. Chem. Ind. Kolloide*, 1909, 5, 191—193.

ZIRCONIUM is already known in the colloidal condition; the authors found that titanium shows very little tendency to become colloidal, but thorium assumes the colloidal condition very readily. Metallic thorium, prepared by the authors in a very finely-divided form, was ground very finely with cold dilute acetic acid in a glass mortar with roughened surface. On washing with cold water a portion of the metal passed through the filter in the colloidal condition at a certain stage of the process. The filtrate was rather intensely coloured and grey and opalescent by reflected light; when sufficiently diluted it was brownish by transmitted light. The hydrosol is fairly stable, but less so than that of zirconium: it is readily coagulated by alkaline reagents, but stable towards dilute mineral acids and acetic acid. It is coagulated by freezing. In an electric field the thorium particles in the dialysed hydrosol wander to the cathode. Under the ultramicroscope bright and almost colourless particles in rapid motion were observed. It was found that 0.0235 grm. of colloidal thorium, as hydrosol, was as radio-active as 0.111 grm. of metallic thorium suspended in water. The radio-activity of thorium hydrosol is less than that of a solution of the same amount of thorium as nitrate. The corresponding thorium gel was dried at a low temperature in a high vacuum and analysed by the method used by Wedekind and Lewis for zirconium: it contained only 20.5 per cent. of metallic thorium and 78 per cent. of thorium oxide.—E. F.

Testing enamelled sheet steel wares. Orton. See VIII.

Specific heats of silicates and platinum. White. See VIII.

PATENTS.

Steel and other metallurgical processes; [Crucibles for] manufacture of —. A. Reynolds, London, Eng. Pat. 9383, May 30, 1908.

IN processes in which the material of the crucible (fireclay or the like) enters into the reactions, the lid of the crucible is provided with rods of the same or similar material which dip into the charge.—O. F. H.

Iron; Method of refining —. P. Sejournet, Paris. Assignor to Soc. Electro-Metallurgique Française, Froges, France. U.S. Pat. 928,551, July 20, 1909.

LOW-CARBON steel is melted in an electric furnace and then cooled until partly solidified. The contained iron oxide and carbon segregate on cooling and then react with each other, with evolution of carbon monoxide. The temperature is maintained at the necessary point until the carbon is practically eliminated, and if desired, the excess of oxide is removed by the addition of a non-carburised de-oxidiser, such as metallic aluminium. The refined metal is reheated under non-carburising conditions and cast into moulds.—F. R.

Iron ore; Method of treating —. J. T. Jones, Iron Mountain, Mich., Assignor to Jones Step-Process Co., Duluth, Minn. U.S. Pat. 930,764, Aug. 10, 1909.

THE ore mixed with coal is passed through a non-oxidising atmosphere of gradually increasing temperature, by which the ore is first reduced and then very highly heated, without, however, melting the slag constituents. The "sponge" produced is allowed to cool or treated at once in a balling or other furnace. A rotary kiln is suggested as a suitable apparatus for carrying out the process. It is stated that the final high temperature employed renders the spongy mass less liable to oxidation on exposure to the air.—J. W. H.

Nickel-steel scrap; Recovery of —. R. H. Watson, Monhall, Pa. U.S. Pat. 934,864, Sept. 21, 1909.

NICKEL-STEEL scrap is melted in an open-hearth furnace with the necessary amount of carbonaceous material. The excess of carbon is then reduced and a steel of substantially the same composition as the scrap, produced.—F. R.

Metal; Permanent magnetic —. S. E. Gertler, Assignor to C. F. Splittdorf, New York. U.S. Pat. 936,530, Oct. 12, 1909.

THE metal comprises a tungsten-steel containing less than 5 per cent. of aluminium. It may contain a variety of elements but the composition is: tungsten, 5.25 per cent.; carbon, 0.65; silicon, 0.15; manganese, 0.25; chromium, 0.20; sulphur and phosphorus, 0.02 or less; and aluminium, 2.50 per cent., with the remainder iron, is instanced.—C. A. W.

Bessemer converter. G. J. Stock, Darlington, England. U.S. Pat. 935,615, Sept. 28, 1909.

THE converter, which is rotatable about both horizontal and vertical axes, is adapted for either melting a charge or converting it, the tuyères being provided with means for supplying both fuel and air. An economiser, which can be moved into or out of connection with the converter, enables the waste heat generated during the melting operation to be used for heating the blast required for the converting.—F. R.

Blast-furnaces and converters; Method of operating —. J. Gayley, New York. U.S. Pat. 935,628, Sept. 28, 1909.

IN order to obtain uniform working in blast-furnaces and converters, the air for the blast is passed through refrigerating chambers to reduce it to a uniform temperature and render its content of moisture low and uniform. These conditions are maintained by means of protected conduits for the passage of the air to the blowing engines.—F. R.

Blast-furnace. E. B. Cook, Pottstown, Pa. U.S. Pat. 936,308, Oct. 12, 1909.

PART of the upper portion of the lining of a blast-furnace is protected by a series of small separated plates of high-carbon steel, held in place by tangs of metal fitted between the brickwork, and anchored, if desired, in a concrete backing.—F. R.

Ores; Apparatus for concentrating —. G. L. Whitcombe, Johannesburg, and A. K. Cox, London. Eng. Pat. 13,366, June 23, 1908.

THE concentrator consists essentially of two concentrically arranged cylindrical vessels connected by a helical partition. The water containing the fine ore in suspension is led under pressure into the annular space, and is discharged tangentially at the bottom into a turbine, which rotates a screw conveyor within the inner vessel. The bottom of the larger vessel is fitted with a series of graduated slots through which the concentrates fall; the lighter material passes up through the inner vessel, assisted by the screw conveyor, and is discharged at the top. Means are provided for automatically clearing the slots and for removing "float" gold if present.—F. R.

Aluminium; Methods of making fusible compounds of — and recovering aluminium therefrom. L. C. Keogh and C. A. Douglas, Ottawa, Canada. Eng. Pat. 18,356, Sept. 1, 1908.

ANHYDROUS aluminium sulphate, preferably mixed with carbon, is added to a molten mass consisting of one or more of the sulphides or haloid salts of alkali or alkaline-earth metals. The fused mass containing aluminium sulphide which results, constitutes an easily decomposed electrolyte from which the aluminium can be recovered. (Reference is directed to Eng. Pats. 97 and 362 of 1883; 2002 of 1890; 20,604 of 1893; 23,707 of 1895; 8072 and 11,555 of 1896; 26,046 of 1897; 16,555 of 1899;

and 964 of 1903; this J., 1883, 382, 478; 1891, 553; 1894, 947; 1896, 544, 658; 1897, 445; 1898, 159; 1899, 1030; 1903, 805.)—O. F. H.

Furnaces for volatile metals. W. Hommel, and The Metals Extraction Corporation, Ltd., London, Eng. Pat. 19,667, Sept. 18, 1908.

IN order to volatilise the zinc or other metal, the ore is mixed with fuel and fed on to the grate of a blowing hearth, which is in connection with a furnace chamber. The blowing hearth consists of a rectangular trough having a horizontal grate rotatable on hollow trunnions, which latter are cooled by the air blast which passes through them. A vertical wall extends laterally across the furnace behind which the ore to be treated collects and becomes pre-heated. Free passages are left both at the top and bottom of the wall, the upper one permitting the gases and fumes to escape to the flue, while the lower space allows the ore behind the wall to be raked forward on to the grate of the blowing hearth as required.—F. R.

Furnace; Metallurgical —. R. Hübner, New York. U.S. Pat. 934,532, Sept. 21, 1909.

THE furnace consists of a series of horizontal heating flues and ore chambers placed above each other alternately. The heating flues are provided with gas and air burners and with dampers between them and a common flue, for modifying the flow of the products of combustion through the furnace.—J. W. H.

Furnaces for reducing ores. G. Gröndal, Djursholm, Sweden, Assignor to American Gröndal, Kjellin Co., New York. U.S. Pat. 936,124, Oct. 5, 1909.

THE furnace consists of two or more parallel tubular furnaces, through which the ore is conveyed, and a series of regenerative chambers. The entrance ends of the furnaces are connected with a gas main and with a supply of air under pressure. Means are provided for controlling the flow of gas and air to and from the regenerative chambers.—F. R.

Furnace for smelting ores. W. Kemp, Tucson, Ariz., Assignor to the Kemp Hydro-Carbon Furnace Co., New York. U.S. Pat. 936,781, Oct. 12, 1909.

THE furnace consists of a flat-bottomed smelting chamber, having water-jacketed walls which extend laterally inwards at the top and from which rises a water-jacketed charging shaft of smaller diameter. The chamber is provided with openings inclined inwards and downwards, into which burners project. The walls of the smelting chamber slope outwards and decrease in thickness from the bottom upwards to the burner apertures.—F. R.

Charges of smelting furnaces and the like; Means for calculating the amount of constituents of the —. R. Marshall, London, Eng. Pat. 23,981, Nov. 9, 1908.

THE claim is for a circular slide rule for calculating furnace charges.—O. F. H.

Copper; Process for obtaining cement —. O. Fröhlich, Berlin, Eng. Pat. 27,025, Dec. 12, 1908. Under Int. Conv., Jan. 28, 1908.

IN the precipitation of copper from solutions of its salts by means of metallic iron, it has been almost invariably found impossible to obtain a metal of greater than 90 per cent. purity, and this only by stirring the liquid and raising its temperature to about 60°–90° C. It is now claimed that, if the circulation of the liquid be increased to such a degree that at least the whole of the solution passes round in a second and a half, the metal is precipitated almost free from iron. The necessary circulation may be obtained by means of an endless screw, which revolves within a tube, the whole being placed vertically within the precipitation vat. Using a chloride liquor, and raising the temperature to about 80°–90° C., the time of circulation being one second, it is found that, at 60° C., almost the entire layer of copper falls to the bottom of the vat. Subsequently, no further copper adheres to the iron, with the exception of a thin layer which may contain a

small amount of black iron oxide. The final purification of the precipitated metal is achieved by washing or by a system of magnetic separation.—C. A. W.

Copper; Recovery of — from cuprous residues. D. Crispo, Antwerp, Belgium. U.S. Pat. 936,762, Oct. 12, 1909.

RESIDUES containing metallic copper, are treated with dilute sulphuric acid and manganese dioxide, with the addition of sufficient iron persulphate to act as a contact agent and accelerate the solution of the copper.—F. R.

Coating metals; Apparatus for —. H. M. Huxley, Assignor to American Steel and Wire Co., Worcester, Mass. U.S. Pat. 928,385, July 20, 1909.

WHERE a large body of metal has to be maintained in the molten condition, such as in the galvanising of wire, sheets, etc., in place of the iron vessels commonly used, which are acted upon by the zinc, resulting in contamination of the metal besides damage to the vessel, graphite or plumbago vessels are employed, but as these are affected by direct exposure to the fire, they are floated on a bath of molten lead contained in an iron outer vessel. It is not necessary for the graphite inner vessel to have great strength, as the buoyant nature of the molten lead bath evenly supports the weight of the zinc or other coating metal. To avoid loss from oxidation, the surface of the metal is covered with floating plates of graphite or other material, which is lighter than the metal and unaffected by it.—F. R.

Depositing metals; Process of —. C. H. Zieme, Assignor to G. L. Patterson, W. R. Kinnear, and C. W. Johnson, New Castle, Pa. U.S. Pat. 934,704, Sept. 21, 1909.

THE surfaces to be coated are covered with a fabric containing "carbonising material" loaded with the metal to be deposited in a partially oxidised form, e.g., zinc dust, and then subjected to heat sufficient "to carbonise the carbonising material and deposit the metal mingled therewith."—J. W. H.

Sherardising [Coating metals with zinc]; Plant for —. W. C. Robinson, Pittsburg, Pa. U.S. Pat. 935,058, Sept. 28, 1909.

IN a plant for sherardizing, the retort is supported on a pivoted cradle which permits the contents of the retort to be discharged into a pit, where the articles coated are separated from the treating material, the latter being automatically conveyed to the charging bin.—F. R.

Metals; Method of plating —. W. Griffith, Pittsburg, Pa. U.S. Pat. 936,713, Oct. 12, 1909.

THE surface of iron, steel, or other metal, having been cleaned, is given a coating of a convenient alkali solution. This is then covered with one or more layers of a suitable alloy of lower fusing point, when, finally, a metal that will unite with the last-named alloy is applied in a molten condition.—C. A. W.

Antifriction alloy. E. A. Touceda, Albany, N.Y. U.S. Pat. 934,637, Sept. 21, 1909.

THE alloy consists of a relatively large proportion of cadmium and a relatively small proportion of magnesium. It is stated to be hardened and toughened by the magnesium which forms substantially 3½ per cent. of the whole.—J. W. H.

[Copper-titanium] alloy, and process for its production. A. J. Rossi, Assignor to Titanium Alloy Manufacturing Co., New York. U.S. Pat. 935,863, Oct. 5, 1909.

ALLOYS are produced by melting copper, or an alloy of copper and titanium, with another metal previously alloyed with titanium or mechanically mixed with it.—F. R.

Metal; Composite —. J. G. Mellen, New York. U.S. Pat. 936,339, Oct. 12, 1909.

THE alloy is composed of aluminium, magnesium, and phosphor-copper. A metal of the composition: alu-

minium, 79 parts; magnesium, 11; copper, 9.998; phosphorus, 0.002 part is instanced, and is stated to be characterised by great lightness, hardness, and strength.

—C. A. W.

Alloys of high magnesium content; Employment of — in the manufacture of ordinary industrial articles. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 401,648, April 3, 1909.

THE claim relates to the production of alloys, containing high proportions of magnesium in combination with one or more foreign metals, preferably of low specific gravities ranging from 1.75 to 2.2. As an example calcium or aluminium may be employed. The proportion of magnesium is never allowed to exceed 99.5 or to go below 80 per cent. It is stated that, taking into account their low specific gravities, these alloys possess unusually high degrees of resistance, ductility, and malleability. The tendency to oxidise in air, moreover, is not much greater than that of copper or tin, the thin film of oxide produced forming a protective coating over the surface of the alloy.

—C. A. W.

Alloy of copper, zinc, tin, and mercury. P. M. Séguay. Fr. Pat. 401,750, Aug. 7, 1908.

THE metals copper, zinc, and tin are melted in the same crucible in the order given, a certain quantity of the zinc being held back. Complete fusion having been attained, the requisite amount of mercury is amalgamated with the residual zinc, weighted with moistened graphite and dropped into the bath. The bath being stirred energetically, the coating of graphite falls off, when the mercury ascends from the bottom and is said to become perfectly incorporated. The alloy: copper, 75 parts; zinc, 31.5; tin, 5; and mercury, 3 parts, is instanced and is stated to be of considerable tenacity and to be readily workable in the lathe.—C. A. W.

Zinc; Process of treating —. S. Frank, Frankfort-on-the-Maine, Germany. U.S. Pat. 935,900, Oct. 5, 1909.

METALLIC zinc is produced having the physical properties of brass and with a fine crystalline structure, by causing it to flow at a temperature between 30° and 80° C., through the aperture of a die, on being subjected to a pressure of not less than 6000 kilos. per sq. cm. (85,320 lb. per sq. in.).

—P. R.

Zinc ores; Continuous treatment of — by the method of precipitation, using cast iron as reacting metal. Imbert Process Co. Fr. Pat. 401,667, Aug. 3, 1908.

THE pulverised zinc blende, or analogous ore, mixed with the necessary fluxes, is continuously brought into contact with a stream of molten iron. The reaction is carried on in an apparatus which may be caused to oscillate slowly and which comprises two or more chambers, one of which is arranged as a gas furnace of the Siemens-Martin type. In this last the cast iron is melted and at the same time superheated to a degree some way above the fusion point. The fusion chamber communicates, through the partition, with one or more reaction chambers, by channels lying along the floor below the level of the molten iron. The procedure is as follows: the iron having been superheated to the requisite temperature, the apparatus is given the necessary inclination so that the molten metal flows into the reaction chamber, where it comes into contact with the ore mixture introduced at the same time in either a solid or molten condition. The heat necessary for the ensuing reaction is supplied by the molten iron, the zinc produced being conveyed to condensers through flues which, to prevent premature condensation, are built in the separating partitions. The iron sulphides and slags which are formed at the same time float on the surface of the metal and gradually pass away through an overflow, being finally removed from the chamber through a siphon. In this way contact of the metal with the exterior atmosphere is avoided. The reaction having been completed, the apparatus is inclined in the opposite direction so that the molten iron flows back into the fusion chamber, where it recovers the heat lost in the preceding operations. Subsequently, the procedure is repeated as before. In order

to avoid as far as possible losses of heat by radiation, the waste gases from the furnace may be made to pass round the reaction chamber and condenser flues.—C. A. W.

[On reduction] Metallurgical process. O. B. Dawson, El Paso, Tex., Assignor to American Reduction and Refining Co., New York. U.S. Pat. 936,095, Oct. 5, 1909.

ORES of metals, which do not form carbides, are heated to incandescence but not to such a temperature as to cause fusion or volatilisation, and the contained metal reduced by means of water-gas or carbon monoxide in the absence of air and flux. After the metal has been reduced, granular carbon is introduced and the temperature raised to the melting point of the metal.—F. R.

Ore; Process for smelting —. J. P. Welch, Assignor to J. J. Sinder, Salt Lake City, Utah. U.S. Pat. 937,031, Oct. 12, 1909.

THE ore, in a constantly falling and flowing mass, is brought into contact with fused silica, or similar mineral, in a revolving furnace. At the same time the whole is subjected to the heat of an impinging stream of burning carbon, or hydrocarbon, with an excess of oxygen. The ore should have been previously calcined and may itself be employed, in the reaction, in a molten condition.—C. A. W.

Slags; Process of deacidising —. O. Thallner, Assignor to the Firm of Bismarckhütte, Bismarckhütte, Germany. U.S. Pat. 936,382, Oct. 12, 1909.

AN excess of metallic aluminium is forced under the surface of a bath of molten steel, so that when the steel has been completely deoxidised, free aluminium will rise to the surface and act on the ferruginous slag from below.—F. R.

Precious metals; Process of extracting — from ores. J. Kitzee, Philadelphia, Pa. U.S. Pat. 936,545, Oct. 12, 1909.

THE ore is subjected to the solvent action of a chlorinated water which may, for example, be the anodic product arising from the electrolysis of a chloride. The resulting solution is afterwards brought into contact with a gaseous compound of nitrogen, produced with the aid of the electric arc. The process may be simplified by previously saturating the preliminary chlorine solution with the gaseous product, containing an unstable oxide of nitrogen, obtained as above.—C. A. W.

Ores; Process of amalgamating and separating of metallic —. R. Luckenbach, Colwyn, Pa., Assignor to Berindum Extraction Co., Arizona. U.S. Pat. 937,033, Oct. 12, 1909.

THE pulverised ore is projected by streams of liquid over a series of electrified bodies of mercury, held on a number of trays supported within the apparatus alternately on opposite sides, so that the fluid takes a tortuous course as it passes down the vessel. The channels running from floor to floor are given a rounded form, by hollowing the sides of the apparatus at these points. The mercury then is supported on those portions of the path to which the heavier material is projected by the centrifugal force developed at each turn. The lighter material, not falling on the mercury surfaces, is swept away by streams of liquid projected into each chamber, the movement being facilitated by the slight downward inclination given to each floor.—C. A. W.

Metals; Extraction of — from their ores. C. A. Stevens. Fr. Pat. 401,443, March 31, 1909.

THE general principle of the method is, briefly, to smelt an intimate mixture of the ore with an alkali or an alkaline-earth in conjunction with some carboniferous material. The apparatus consists of a long narrow vertical chamber provided at the top with a hopper, which can be closed when necessary, and at the bottom with a vat of water, from which it is separated by means of a movable floor. The vessel is provided on its two longest sides with combustion chambers. The products of combustion from

these are passed up the two sides of the reaction chamber and are finally carried away through chimneys situated on the two remaining sides. In this way, the reaction chamber is heated on all sides by the hot gases and a relatively high temperature can be produced within it. During the reaction, water is made to run slowly through the vat, so that the reduced metal, as it condenses in the liquid, gives rise to a cloud of steam which, passing up the furnace, is decomposed into carbon monoxide and hydrogen. In a similar manner there is a great evolution of heat as the water vapour comes into contact with the quicklime produced in the early stages of the reduction. As the temperature rises, the alkali hydroxides and carbonates may even be reduced to metallic potassium and sodium, and these metals will then effect the removal of sulphur, selenium, tellurium, and arsenic from the ore.—C. A. W.

Ores and the like; Treatment of —. A. A. Lockwood and M. R. A. Samuel, London. Eng. Pat. 12,962, June 17, 1908.

SEE Fr. Pat. 398,660 of 1909; this J., 1909, 889.—T. F. B.

Briquetting ores; Process for —. W. Schumacher, Osnabrück, Germany. Eng. Pat. 26,851, Dec. 10, 1908.

SEE Fr. Pat. 397,316 of 1908; this J., 1909, 798.—T. F. B.

Casting of metals. J. F. Monnot, New York. Eng. Pat. 20,788, Oct. 2, 1908.

SEE Fr. Pat. 397,231 of 1908; this J., 1909, 799.—T. F. B.

Refining tin-plate waste and the like by means of chlorine; Process for —. H. von Schütz, Wetzlar, Prussia. Eng. Pat. 22,337, Oct. 21, 1908. Under Int. Conv., Nov. 15, 1907.

SEE Fr. Pat. 395,999 of 1908; this J., 1909, 480.—T. F. B.

Iron or steel; Preparation of — for casting. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt on Maine, Germany. Eng. Pat. 24,007, Nov. 9, 1908.

SEE Fr. Pat. 396,009 of 1908; this J., 1909, 480.—T. F. B.

Armour-plates and other articles of steel and alloys of steel; Manufacture of —. F. Giolitti, Rome, Assignor to Soc. Anon. Italiana Gio. Ansaldo Armstrong & Co., Genoa, Italy. U.S. Pat. 936,315, Oct. 12, 1909.

SEE Fr. Pat. 393,355 of 1908; this J., 1909, 145.—T. F. B.

Iron; Extraction of — direct from ore. W. S. Simpson and H. Oviatt. First Addition, dated March 26, 1909, to Fr. Pat. 399,901, Feb. 5, 1909.

SEE U.S. Pat. 918,381 of 1909; this J., 1909, 527.—T. F. B.

Steel; Manufacture of — direct from ore. W. S. Simpson and H. Oviatt. First Addition, dated March 26, 1909, to Fr. Pat. 399,902, Feb. 5, 1909.

SEE U.S. Pat. 918,382 of 1909; this J., 1909, 527.—T. F. B.

Silver from its ores; Processes for extracting —. J. C. Pryor, Trout Mills, Canada. Eng. Pat. 25,804, Nov. 30, 1908.

SEE U.S. Pat. 918,908 of 1909; this J., 1909, 528.—T. F. B.

Metalliferous fumes obtained in roasting or smelting ores; Apparatus for the recovery of —. A. M. G. Sébillot and L. Mauchaire, Paris. Eng. Pat. 2938, Feb. 6, 1909. Under Int. Conv., Feb. 7, 1908.

SEE Fr. Pat. 387,011 of 1908; this J., 1908, 815.—T. F. B.

Metals; Process and products for depositing — on metallic or other conducting surfaces. A. Rosenberg. Fr. Pat. 401,463, March 31, 1909. Under Int. Conv., April 1, 1908.

SEE Eng. Pat. 7227 of 1908; this J., 1909, 530.—T. F. B.

Zinc from ores and zinc residues; Method of extracting —. Metals Extraction Corporation, Ltd. Fr. Pat. 401,557, March 2, 1909.

SEE Eng. Pat. 27,020 of 1907; this J., 1909, 127.—T. F. B.

Manufacture of cement from slag in blast-furnaces. Fr. Pat. 401,493. See IX.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Electrical furnaces; Working limit in — due to the "pinch" phenomenon. C. Hering. Trans. Amer. Electrochem. Soc., 1909, 15, 255—277.

Is that class of electric furnaces in which the resistor is a fluid, an effect called the "pinch" phenomenon, noticed by the author two years ago, sets a limit to the increase of current and therefore of temperature available. When a current, either direct or alternating, passes through a liquid conductor, the conductor tends to contract in cross-section. The action is due to electro-magnetic forces, and when high current-densities are used, is sufficient to rupture the circuit. Northrup has explained that it is due to the mutual attraction of the current elements in the conductor, and has examined the phenomenon mathematically. For conductors of circular cross-section he derives the formula:—

$$P = \frac{C^2}{44,479,100S}$$

where P is the pressure in lb. per sq. cm. at the centre of the conductor, acting axially; C is the current in amperes, and S is the cross-section in sq. cm. This attracting force acts on the material itself which carries the current. The phenomenon is not of a simple nature, since unknown quantities such as viscosity, change of density at high temperatures, etc., enter into it. Mechanical obstructions such as floating masses or particles may so constrict the cross-section as to raise the current density to the critical point, bringing about the "pinch" phenomenon. The "pinching" force depends only on the current and the shape and size of the cross-section of the conductor; it is independent of the voltage, resistance, watts, heat, temperature, length of channel, etc., except as these affect the current and cross-section of the conductor. The resistance to "pinching" depends upon the density of the liquid and upon the depth of the axis of the contracted column. The contraction which takes place involves also the viscosity of the liquid, the presence of floating masses, etc. From the Northrup formula it will be seen that there are two levels of the liquid conductor where the hydrostatic and the electro-magnetic pressures are equal. The upper level is a stable one, since, in the event of a slight displacement, the hydrostatic pressure will restore the liquid to its former level. The lower level will be unstable, and a mechanical reduction of level will determine the rupture of the liquid conductor. The rupturing phenomenon takes place at high current-densities, and need not be feared in low current-density furnaces. If rupture does occur, a frozen charge usually results and the furnace must be dismantled, unless by opening the circuit the rupture heals. The critical current determines the maximum temperature that can be reached in a given furnace. It is greater the deeper the channel, the higher the density, the less the viscosity, the smoother and more regular the channel, and the more free the surface is maintained from floating masses.—J. W. H.

Electrode losses; [Electric] furnace —. C. A. Hansen. Trans. Amer. Electrochem. Soc., 1909, 15, 279—293.

The author has investigated the losses in the electrodes of electric furnaces and compared the efficiencies of carbon and graphite electrodes. Usually, to ensure good electrical connections, these electrodes are water-

cooled at the cable contacts. There are two main losses, that due to the flow of heat from the hot to the cold end of the electrode, and that due to electrical conduction, the C²R loss. The heat conductivities of carbon and graphite are as 1 to 18 (Fitzgerald), and their electrical resistances about 3.8 to 1 (Lincoln). From these figures it would be expected that graphite would be the more efficient when the difference between the C²R losses exceeded the difference between the heat conductivity losses. Experiments were made in a resistance furnace for the experimental manufacture of titanium carbide, using electrodes 8 in. by 8 in. cross-section. In another set of tests, when a furnace with a wider end wall and with more carborundum packing, necessitating longer electrodes, was used, no increase in total electrode loss took place—the efficiency had been raised by increasing the length of electrode embedded in the end wall. Other experiments were made in a smaller furnace with idle electrodes in the side walls, using cracked arc lamp carbons as the charge. One of each pair of terminals was a graphite electrode, the other being of carbon. The idle side terminals were used for direct comparison of heat conduction. Knowing the physical changes in some carbons with rise of temperature, data from which the maximum temperature could be determined were obtained. Motor brush carbons were also embedded in the charge for this purpose. Three distinct temperature approximations could be made by measuring: (1) hardness by the Shore scleroscope; (2) electrical resistance; (3) density, by weighing in benzol. The results show that the carbon electrodes were graphitised at the tips in the course of the run, and that the change from carbon to graphite is a gradual one. Carbon is more efficient than graphite for current densities under 200 amps. per sq. in. In furnaces taking 500 kilowatts the electrode losses may amount to 15 per cent. of the total load, and in short furnaces the losses may be greater. The ratio of heat conductivity of graphite and carbon, under the conditions of the tests, is about 8 to 1, the relation 18 to 1 being probably brought down by the partial graphitisation of the carbon.—J. W. H.

Electrolysis in alkali and bleaching powder. Lepsius. See VII.

Platinum trioxide. Wöhler and Martin. See VII.

PATENTS.

Batteries; Primary —. W. A. F. Bleeck, South Brisbane, Australia. Eng. Pat. 15,194, June 29, 1909.

THE cell consists of a zinc rod in a porous pot, surrounded by a perforated cylinder of carbon in an outer containing vessel. The exciting liquid is a solution of sodium hydroxide with the addition of a little gum arabic, to reduce the rate of diffusion. The depolarising fluid consists approximately of 20 oz. of commercial hydrochloric acid (1 to 3) in which is dissolved 1 oz. of ferrous sulphate or nickel sulphate, or any mixture of the two, and to which 8 oz. of commercial chromic acid are subsequently added. (See also Eng. Pat. 5297 of 1908; this J., 1908, 1025).—F. R.

Storage-battery plates; Process of preparing —. W. Morrison, Assignor to D. P. Perry, Chicago, Ill. U.S. Pat. 935,316, Sept. 28, 1909.

A LEAD plate or grid is filled with paste in any suitable manner, then dried, and afterwards dipped in a solution containing glycerin and sulphuric acid. The plate is again dried, and subsequently treated with a solution containing water, formaldehyde, formic acid and sulphuric acid.—B. N.

Accumulators; Alkaline —. Nya Ackkumulator Aktiebolaget Jungner. Fr. Pat. 401,453, March 31, 1909.

It is found that, in an alkaline accumulator, the expensive positive support of nickel, or nickel alloy, may be readily replaced by one of iron. In fact, it is stated that the active material, provided it be insoluble in the alkaline electrolyte, has the property of rendering the surface of the iron passive so that the metal is rendered inactive

towards an oxidising electrolysis at the anode. The surface of the iron must be well polished and absolutely free from rust; it is found, moreover, that the best results are obtained when the metal has been alloyed with silicon, manganese, chromium, tungsten, or some other analogous element. The active material may consist of three parts of nickelous hydroxide intimately mixed with one part of graphite. In this case, during the subsequent electrolysis, the oxygen evolved will at once produce the necessary protective coating. In the preliminary fixation of the active material around the support it is necessary to employ, as moulding liquid, some non-electrolyte such as paraffin oil. The metallic iron should also receive a coating of the oil, in order to prevent the formation of surface rust.—C. A. W.

Electrode; Iron —. M. Roloff, Hagen, Germany. U.S. Pat. 934,839, Sept. 21, 1909.

THE active material for the negative pole plates of alkaline accumulators consists of magnetic oxide of iron, derived from forge scale by magnetic means, in order to separate it from the non-magnetic ingredients of the scale.—B. N.

Graphite articles (electrodes, etc.) and process of making the same. A. M. Williamson, Assignor to Internat. Acheson Graphite Co., Niagara Falls, N.Y. U.S. Pat. 935,180, Sept. 28, 1909.

THE claim is for a carbon article formed by moulding powdered carbon and a carbonaceous binder, expelling volatile constituents by heat, and impregnating with a material yielding a carbonaceous residue, the whole being then "graphitised." Such articles are said to be less porous and to have a higher electrical conductivity than those prepared from unimpregnated carbons.—F. SONS.

Electrolysis of aqueous solutions; Apparatus for the —. M. Huth, Charlottenburg, Assignor to Siemens und Halske A.-G., Berlin, Germany. U.S. Pat. 935,109, Sept. 28, 1909.

FOR the electrolysis of zinc sulphate solutions, or solutions of other sulphates, the anode consists of massive artificially prepared manganese peroxide, free from constituents susceptible to the action of the electrolyte, and coated with ceresin. The anodes are prepared from a mixture of pure manganese nitrate and a binding agent, the mixture being pressed into moulds and heated.—B. N.

Electrolytic apparatus. J. L. Roberts, New York. U.S. Pat. 936,039, Oct. 5, 1909.

A METHOD of making porous diaphragms is claimed consisting of forming the diaphragm of woody material and then partially carbonising it. The carbonising is carried out by enclosing the article in a rigid holder of the same size and shape and then subjecting it to heat.—J. W. H.

Air and other gases; Apparatus for electrically treating —. J. H. Bridge, Philadelphia, Pa. U.S. Pat. 935,457, Sept. 28, 1909.

THE ozoniser comprises a tubular electrode, enclosed in a second tubular electrode, the former having a number of perforations through which air or other gas may be passed in line streams from one side of the electrode to the other. A number of electric discharges originate around the perforations, so that the gas in passing from one side of the electrode to the other is surrounded by the electric discharges.—B. N.

Electric discharges; Production of — with great energy consumption. Elektrochemische Werke Ges.m.b.H. Addition, dated March 31, 1909, to Fr. Pat. 389,112, April 10, 1908 (this J., 1908, 986).

It has been found that, for the production of voltaic arcs between concentric annular electrodes, it is not necessary to employ the very high pressures, ranging to several thousands of volts, described in the original specification. On the contrary, provided high current intensities of more than fifty amperes are employed, the pressure may be reduced to some hundreds of volts,

the minimum voltage varying, of course, with the distance between the electrodes. It is moreover proposed to modify the system, by giving to the interior electrode the form of a rod arranged perpendicularly to the plane of the annular electrode, and at some distance from it. In this way the arc is obtained in the shape of a cone, while, by the use of a third electrode on the opposite face of the cylindrical furnace, a bi-conical flame is produced. The arrangement of the apparatus is necessarily somewhat modified. Employing a furnace with three electrodes, the air is admitted through tangential tuyères at the ends, while the reaction products are aspirated through openings surrounding the annular electrode in the centre.—C. A. W.

Electric furnace. W. A. Smith, Assignor to the International Acheson Graphite Co., Niagara Falls, N.Y. U.S. Pat. 935,937, Oct. 5, 1909.

THE inner walls of the furnace (of the type used in making carborundum) are made permeable to gases. Movable heat-retaining walls are placed near the permeable walls and by the admission of air into the space between them, the gases, given off from the charge under treatment, are burnt.—J. W. H.

Electric-furnace terminal. E. C. Speiden, Assignor to the International Acheson Graphite Co., Niagara Falls, N.Y. U.S. Pat. 935,939, Oct. 5, 1909.

THE terminal is built up of strips or rods of graphite and a filling of granular electrically conductive material (subdivided graphite) of low heat conductivity. The length of the strips of graphite is in the direction of the current flow and one or more of the strips are divided transversely.—J. W. H.

Electrolysis of aqueous saline solutions. Siemens Bros. and Co., Ltd., London. From Siemens und Halske A.-G., Berlin. Eng. Pat. 605, Jan. 9, 1909.

SEE U.S. Pat. 935,109 of 1909; preceding.—T. F. B.

Electric furnace; Rotary ——. A. H. Imbert. Fr. Pat. 401,666, Aug. 3, 1908.

SEE Eng. Pat. 17,281 of 1908; this J., 1909, 207.—T. F. B.

Carrying out chemical reactions [under pressure]. Ger. Pat. 214,885. See I.

Preventing disintegration of refractory metal filaments. Eng. Pat. 19,847. See II.

Electrolytic decomposition of sodium and other chlorides. Eng. Pat. 20,787. See VII.

Preparing lead hydride. Fr. Pat. 401,473. See VII.

Electrolytic production of hypochlorite solutions. Ger. Pat. 213,588. See VII.

Electrolytic preparation of alkali hypochlorite solutions. Ger. Pat. 213,590. See VII.

Electric furnace for the continuous manufacture of glass. Fr. Pat. 401,744. See VIII.

(B).—ELECTRO-METALLURGY.

Platinum; The electrolytic deposition of ——. W. J. McCaughey. Trans. Amer. Electrochem. Soc., 1909, 15, 523—527.

IN order to ensure an adherent deposit of platinum it was found essential that the metal upon which the deposition takes place, should have no tendency to dissolve in the electrolyte. For the preparation of platinum-plated bottles, the bottles were first coated with gold by means of an alkaline cyanide solution. The deposit, though soft, was adherent and formed an excellent basis for building up a harder deposit of platinum. Using a hot solution of potassium chloroplatinate the electrolyte near the cathode became alkaline and a

dark cloud of finely-divided platinum formed. By rotating the cathode or by stirring the electrolyte, the formation of a cloud was delayed and a firmer deposit obtained. Experiments were made with other electrolytes. The deposit from cyanide solutions was very good, but after a time the formation of complex cyanides prevented further deposition. A satisfactory electrolyte was made by adding 10 grms. of citric acid and 2 grms. of potassium chloroplatinate to 100 c.c. of water. By continued use, the solution lost its efficiency; the addition of a little hydrochloric acid restored the solution by neutralising the liberated alkali. By substituting for potassium chloroplatinate ammonium platonic chloride, the addition of hydrochloric acid was found to be unnecessary. With low current density, bright non-adherent coatings were obtained, while high current density gave hard steely deposits. Uneven current distribution produced both kinds of deposits. Satisfactory deposits were obtained at a current density of 1 ampère per sq. ft. for the bottles and 1.8 amps. per sq. ft. for the covers, but to prevent hard crusty deposits the covers were placed in the bath for a very short time, about one minute, a thick deposit being obtained by successive treatments with fresh solutions.—J. W. H.

PATENTS.

Magnesium; Production of ——. F. von Kügelgen, Holcombs Rock, Va., and G. O. Seward, East Orange, N.J., Assignors to the Virginia Laboratory Co., New York. U.S. Pat. 935,796, Oct. 5, 1909.

By electrolysis of a magnesium salt, such as fused magnesium chloride, using a less electro-positive metal, such as aluminium, as the cathode, an alloy of magnesium is obtained. In a second operation, by using this alloy as the anode with a suitable molten electrolyte, the magnesium is dissolved out of the alloy and deposited at the cathode.—J. W. H.

Electroplating objects; Mechanical arrangement for ——. W. Pfannhauser, Leipzig, Germany. U.S. Pat. 936,472, Oct. 12, 1909.

THE material to be coated with metal is drawn, by means of several pairs of small rollers connected to one pole of the electric circuit, between larger pairs of rollers, disposed alternately with respect to the pairs of small rollers, and on to which the electrolyte is delivered. The electrolyte collects in a trough below, in which the lower rollers rotate, so that the liquid is applied to both sides of the material. The larger rollers are connected to the other pole of the circuit.—B. N.

Films or flakes [electrolytically]; Process of making metallic ——. T. A. Edison, Llewellyn Park, Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 936,525, Oct. 12, 1909.

FILMS or flakes of cobalt, nickel, or cobalt-nickel are prepared by electrolytically depositing a layer or film of a soluble metal, such as copper, on a suitable cathode, and afterwards depositing on the film the cobalt, nickel, or cobalt-nickel; or the soluble metal and the cobalt or nickel may be deposited in successive and alternating layers. The composite sheet is separated from the cathode, cut up into bodies of the shape and size desired, and the copper finally dissolved in order to free the flakes of the other metal.—B. N.

Sodium and the like; Electrolytic production of ——. Soc. d'Electro-Chimie, Paris, and P. L. Hulin, Grenoble. Eng. Pat. 22,824, Oct. 27, 1908. Under Int. Conv., Nov. 2, 1907.

SEE Fr. Pat. 393,706 of 1907; this J., 1909, 149.—T. F. B.

Electric furnace [for smelting ores, etc.]. Aktiebolaget Elektrometall, Stockholm. Eng. Pat. 4553, Feb. 24, 1909. Under Int. Conv., March 10, 1908.

SEE Fr. Pat. 400,244 of 1909; this J., 1909, 1047.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Nuts yielding Borneo tallow. C. Beadle and H. P. Stevens. Chem. News, 1909, 100, 173.

BORNEO tallow can be extracted from the nuts of the following plants:—*Shorea stenoptera*, *S. aptera*, *Hopsea aspera*, *Isopsea borneensis*, *S. compressa*, *S. gysbertiana*, *S. Scapherrima*, *S. Martiniana*, and *S. fulcifera*. Samples of the nuts of three of these plants from Kew Gardens contained the following amounts of fat:—*Isopsea borneensis*, 58.0; *S. stenoptera*, 64.6; and *S. aptera*, 49.9 per cent., whilst the quantities yielded by them on expression were 48 to 52, 55 to 60, and 41 to 45 per cent., respectively. The pressed residues had the following approximate composition:—Moisture, 10; fat, 10; albuminoids, 10—18; ash, 2; indigestible matter, 10—27; and carbohydrates (by difference) 27 to 58 per cent. A specimen of Borneo tallow extracted from the nuts of *S. gysbertiana* gave analytical values in close agreement with those found by Lewkowitsch. It is stated that 2500 tons of Borneo tallow were exported from Sarawak during the first nine months of 1908, and that with systematic treatment, 10 times the quantity now collected could be obtained.—C. A. M.

Hare seeds (Gynandropsis pentaphylla); [Oil from —.] D. Hooper. Ann. Rept. Indian Museum, Industrial Section 1908-9, 10.

THESE seeds, of a common plant, yield to ether about 25 per cent. of a thick greenish, drying oil, having an acid value of 6.4; saponification value, 194.6, and iodine value, 119.5.—E. W. L.

Litsae zeylanica; Fat from seeds of —. D. Hooper. Ann. Rept. Indian Museum, Industrial Section, 1908-9, 10.

THE tree grows on the Nilgiri Hills, S. India. The seeds yield 61 per cent. of a cream-coloured fat melting at 40° C., and having sp. gr. (at 40° C.), 0.9317; acid value, 10.0; saponification value, 244.7; iodine value, 46.5; fatty acids, 91.3 per cent.; m.pt. of fatty acids 40° C. The fatty acids consists largely of lauric acid and would be useful if obtainable in sufficient quantity. Oil from other species of *Litsae* is said to be used for candle-making in China and Java.—E. W. L.

Oils; Animal — from India. D. Hooper. Ann. Rept. Indian Museum, Industrial Section, 1908-9, 10—11.

(1). *Gangetic dolphin (Platanista gangetica) oil*—Susu or Sehu—used locally as an embrocation and illuminant, has the following characteristics:—sp. gr. (15° C.), 0.921; acid value, 21.36; saponification value, 198.8; iodine value, 106.9; Reichert-Meissl value, 0.71; fatty acids, 94.0 per cent.; fatty acids: m.pt. 25.5° C.; acid value, 205; iodine value, 116.5. The solid fats consist chiefly of palmitin; no spermaceti is present.

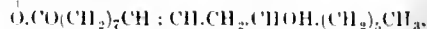
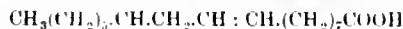
(2). *Fish liver-oils.*—(1). White sting ray (*Trigon microps*); (2). Saw-fish (*Cristis perotteti*); (3). Spotted shark (*Stegostoma tigrinum*); (4). *Rhamphobatis ancylotomus*. The characteristics of these oils are given in the following table:—

	1.	2.	3.	4.
Sp. gr. at 40° C.	0.914	0.900	0.910	0.909
M. pt.	22° C.	27° C.	26.5° C.	25.5° C.
Acid value	0.98	1.0	1.16	1.13
Saponification value	194.0	187.1	185.4	187.4
Iodine value	124.7	92.9	123.2	118.5
Reichert-Meissl value	0.26	0.28	0.21	0.23
Fatty acids, per cent. ...	93.2	94.7	94.2	94.6
M. pt. of fatty acids	37.5° C.	39° C.	39° C.	39° C.
Acid value of fatty acids	203.4	192.2	189.9	190.4

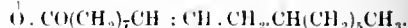
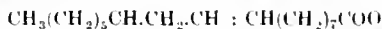
—E. W. L.

Sulphoricinoleic acid and its derivatives. A. Grün and H. Wetterkamp. Z. Farben-Ind., 1909, 8, 279—282.

THE authors' recent experiments on the hydrolytic decomposition of sulphoricinoleic acid confirm their previous conclusions (this J., 1908, 1212). The acid ester, $C_{17}H_{32}(OH)COOC_{17}H_{32}COOH$, which is produced in the first stage of the decomposition, undergoes intramolecular condensation on continuing to heat the aqueous solution, and forms a neutral ester, the lactide of ricinoleic acid. The acid ester, ricinoleic ricinoleate,

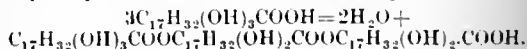


was prepared by heating an aqueous solution of sulphoricinoleic acid for 15 hours on the water-bath, extracting the liquid with ether, evaporating the ethereal extract, and drying the residue. It was a yellow, very fluid oil, with a pleasant odour. It was only soluble with difficulty in water, and was also less soluble in alcohol than ricinoleic acid and its sulphonated derivative. When saponified with alcoholic potassium hydroxide solution, it yielded pure potassium ricinoleate. Hence the transformation of sulphoricinoleic acid into ricinoleic ricinoleate takes place without the formation of by-products. The further condensation of this compound into the lactide of ricinoleic acid was not quantitative, even after several hours' boiling. The product consisted of a mixture of the neutral and the acid esters in the proportion of about 2:1. The neutral compound was separated by precipitation with absolute alcohol from an ethereal solution, and purified by repeating this treatment several times. When dried over phosphorus pentoxide it was a neutral, transparent, very viscous fluid, of a yellowish-brown colour. The following constitutional formula is given for it:—



The hydrolytic decomposition of sulphoricinoleic acid followed an analogous course. Hydroxystearic acids give similar condensation products. Sulphodihydroxystearic acid, $C_{18}H_{32}S_2O_{10}$, was prepared by treating dihydroxystearic acid (m. pt. 70° C.) with chlorosulphonic acid. It was a light yellow liquid, which was soluble in organic solvents, and in water, yielding a clear solution. On heating this aqueous solution the sulphuric acid was split off, also with the formation of an acid ester, and finally of the neutral lactide of dihydroxystearic acid. This formation of an anhydride also occurred on simply heating dihydroxystearic acid, the substance first changing to a caoutchouc-like mass and then becoming viscous. Trihydroxystearic acid (m. pt. 110° C.), which is obtained by oxidising ricinoleic acid with potassium permanganate, forms a brown viscous sulphonated derivative.

$CH_3\cdot (CH_2)_5\cdot CH(OSO_3H)\cdot CH_2\cdot (CHOSO_3H)_2\cdot (CH_2)_7\cdot COOH$, on treatment with chlorosulphonic acid. When freshly prepared this compound is soluble in water. On heating the solution, the sulphuric acid is split off quantitatively, whilst the organic components interact to form a fluid product, apparently by condensation of the three trihydroxystearic acid mols. as in the equation:—



Analogous compounds have been found by Bougault and Bourdier (this J., 1909, 29, 802) in conifer waxes.—C. A. M.

Determining fat in pork-butchers' products and in other substances containing water. Perrier. See XVIII.

Fats; Detection of — in vaseline. A. Ferraro. See III.

PATENTS.

Fat; Process and apparatus for extracting — from oily residues. B. Groverman und Co. Fr. Pat. 401,517, Apr. 2, 1909.

THE material to be extracted is introduced into a vessel provided with a perforated false bottom, the holes in

which have a wider diameter at the bottom than at the top. The vessel is closed by means of a cover which can be screwed down; it is provided with a pipe at the top for the introduction of steam, and with another at the bottom for the removal of the extracted oil.—C. A. M.

Solvents for fats and essential oils; Manufacture of new —. Soc. Laroche et Juillard. Fr. Pat. 401,704, Aug. 4, 1908.

FATTY and essential oils are mixed with one of the ordinary solvents (e.g. carbon tetrachloride or petroleum spirit), and the solution treated with concentrated sulphuric acid, with precautions to prevent too great a rise of temperature. The layer containing the sulphonated product is allowed to separate, washed with water, and neutralised with ammonia or caustic soda. The resulting ammonium or alkali salt, which is soluble in, or forms an emulsion with water, may be used as a cleansing agent and in dyeing, varnish making, perfumery, etc.—C. A. M.

Soap; Manufacture of —. J. E. Jaeckels, Tottenham. Eng. Pat. 26,857, Dec. 10, 1908.

A HOT mixture of clarified tallow and cottonseed oil is treated with caustic soda solution of about 22° B., and the resulting mass cooled, broken up, and boiled with water until of the required consistence. It is then incorporated with powdered or granular pumice stone, and scent, glycerin and colouring matter added if desired. An addition of melted rosin may also be made to the fluid tallow prior to the treatment with caustic soda.—C. A. M.

Oil; Apparatus for purifying —. O. F. Egeberg, Christiania. Eng. Pat. 691, Jan. 11, 1909.

SEE Fr. Pat. 398,411 of 1909; this J., 1909, 894.—T. F. B.

Manufacture of paraffin wax for candles, etc. Eng. Pat. 8768. See III.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

Paint tests. U.S. Geological Survey Report.

INVESTIGATIONS in regard to protective coatings for structural materials have recently been made on an extensive scale in different parts of the United States, mostly with co-operation of the American Society for Testing Materials. Severe outdoor tests have been carried out by the Paint Manufacturers' Association at Atlantic City, N.J., where fences, coated with different paints, were exposed for one year to moist sea air, to sudden and considerable changes of temperature, and to the abrasive action of wind-blown sand. Of the "prime" white pigments, white lead (basic carbonate) when used alone showed good colour and covering power, but weathered badly, dusting-off and checking being very noticeable; when used, in large proportions, in appropriate combination with other pigments, however, it gave excellent results. Sublimed white lead (basic sulphate) showed good colour, gloss, and covering power, but some checking and considerable dusting-off took place. Zinc oxide showed fair to good covering power, good colour and gloss, but checking was noticeable. Zinc-lead white showed good colour and gloss, and fair covering power, but dusting-off occurred. With respect to "inert pigments," such as gypsum, whiting, barytes, *blanc fixe*, asbestos (magnesium silicate) and silica, it was found that their use, in moderate quantities, is necessary for the production of a satisfactory mixed paint. Special care is needed in the use of gypsum, owing to its solubility and tendency to leach through the coating of dried linseed oil. Mixed white paints containing large proportions of lithopone failed completely under the severe conditions described above. Paints tinted yellow or gray by addition of ochre, umber, bone-black, lamp-

black, or Venetian red to white paints, showed less checking and dusting-off than the corresponding white paints. With regard to colours, Para red gave better results on a lithopone or white lead base, especially on the latter, than on a base of sublimed white lead or zinc white. Of the blues, the best results were obtained with those on a base of sublimed white lead or zinc white, whilst those on a white lead base failed completely. Chrome green gave good results in the tests, but bronze green faded somewhat and "mildewed" in places, probably owing to separation of carbon. The general conclusion drawn from the Atlantic City tests is that a mixture containing more than one pigment, either with or without a small percentage of "inert pigments," makes a paint that is far superior to one manufactured from one pigment alone. This is in accord with the view that the voids in a paint film are reduced to a minimum and the imperviousness is increased to a maximum by using three pigments, the particles of which have different average sizes, for the preparation of the paint. (See also this J., 1909, 403—408.) For experiments on paints for the protection of iron and steel, see Cushman, this J., 1909, 605.—A. S.

PATENT.

Grinding colours; Machine for —. E. Richter. Ger. Pat. 211,968, April 22, 1908.

THE machine is constructed with the view of permitting the wet grinding of the colours to be effected immediately after the dry grinding. It has two pairs of rollers arranged one above the other. The bearings of the upper pair of rollers are fixed to a carriage which can be moved sideways in its supporting frame; the upper rollers can thus be disposed immediately above the feed-hopper for the lower pair of rollers, or, if it be desired to pass the ground colours between the upper rollers again, the carriage is moved so that the rollers no longer discharge into the feed-hopper. One of the upper pair of rollers is connected in any suitable manner with the driving shaft of the lower pair of rollers.—A. S.

(B.)—RESINS, VARNISHES.

Hungarian fir resin. Angustin. Ges. deut. Naturforscher und Aerzte, Sept., 1909. Z. angew. Chem., 1909, 22, 1989—1990.

IN certain parts of Hungary resin is collected from the *Picea montana* Schirr., and put on the market wrapped in the bark of the tree. This tree yields a larger quantity of resin than the ordinary spruce, *Picea excelsa*. Owing to unsuitable methods of collection the resin suffers very much in appearance, and the author is endeavouring to introduce more rational processes.—J. F. B.

Turpentine oil; Examination of —. P. Nicolardot and L. Clément. Comptes rend., 1909, 149, 572—574.

TO detect adulterants in turpentine, the authors distil fractionally at a pressure of 18 cm. of mercury, when the whole distillation can be carried out at 50° C. Rosin oil is detected by the increased amount of fixed residue. The separate fractions (5 or 6) are examined polarimetrically; pure turpentines give the same rotation up to the last fraction or the last but one, whilst samples containing rosin oil or petroleum show a continuous variation, the negative rotation of the first portions being diminished by petroleum and increased by rosin oil. The flashing point of the oil is lowered by petroleum spirit and raised by rosin oil, whilst "white petroleum" is without sensible effect on it. The alteration of rotatory power in open vessels in the dark and when exposed to light also affords indications of adulteration. Pure turpentine does not alter in the dark, whilst adulterated samples may do so through differential evaporation of their constituents. In the light, turpentine oxidises and becomes less strongly laevo-rotatory; samples containing rosin oil show this effect more strongly.—J. T. D.

Crude lac. D. Hooper. Ann. Rept. Indian Museum, Industrial Section, 1908-9, 7.

The following values were obtained on analysis of the four more important kinds of crude lac:

Lac.	Source.	Water.	Resins.	Colour- ing.	Residue.	Ash.
		per cent.	per cent.	per cent.	per cent.	per cent.
Kusum	<i>Schleichia trijuga</i>	1.8	85.6	2.5	9.4	1.0
Ficus	<i>Ficus</i>	1.8	83.9	2.6	10.2	1.5
Ber	<i>Zizyphus</i>					
	<i>Jujuba</i>	2.0	82.7	2.4	11.5	1.3
Palas	<i>Butea frondosa</i>	2.4	77.4	4.3	14.1	1.8

Kusum lac contains the largest amount of light-coloured resin and the smallest amount of impurities. The average iodine value was 11.4 per cent. The amount of resin in Keri or refuse lac was found to vary from 55 to 72 per cent. A sample from Burma, obtained in a new process of shellac manufacture, left only 15.5 per cent. of resin.

—E. W. L.

Gum benzoïn; Siamese ——. F. Reinitzer. Ges. deut. Naturforscher und Aerzte, Sept., 1909. Z. angew. Chem., 1909, 22, 1994.

SINCE gum benzoïn first exudes as a milk-white body, it cannot contain ready formed the brown siarésinotannol which Lüdy has described as its principal constituent. Siamese benzoïn in loose tears is quite crystalline; it melts at 59° C., and on heating at 40°–50° C. in the dark, it gradually becomes darker in colour and amorphous, probably owing to an oxidation process. The purified crystals melt at 72–8° C. and are monoclinic and colourless; they also undergo the above-mentioned change on heating. They consist of the benzoate of a resin-alcohol which the author terms *lubanol*. They give a green coloration with ferric chloride and are capable of combining with a further quantity of benzoic acid. Lubanol benzoate gives the Liebermann-Salkowski reaction, also a fine blue coloration on warming with chloral hydrate. Siamese benzoïn also contains the benzoate of a body resembling Lüdy's benzoresinotannol, but containing more oxygen than the latter. This body melts at 279° C., crystallises in large prismatic needles and is dextrorotatory in alcoholic solution: the author calls it *siarésinol*. Siarésinol gives a sodium salt sparingly soluble in water, and crystallising in long needles from alcohol. Siarésinol is not oxidised on heating at 40°–50° C.; it gives no coloration with ferric chloride, but it gives the Liebermann-Salkowski reaction. Lastly, Siamese benzoïn contains an amorphous benzoate, which turns reddish at the ordinary temperature, and which can be separated into two different bodies by means of carbon bisulphide. When heated at 100° C. in alkaline solution for a long time it is converted into Lüdy's siarésinotannol. Sumatra benzoïn likewise exudes originally with a white colour, and the sumatresinotannol must be regarded as a secondary oxidation product. Gum benzoïn is only produced under the stimulus of a wound in the tree, and cannot be a product of the bark; it must be regarded as a pathological product of the injured protoplasm, and the theory which derives its origin from tannin is untenable.—J. F. B.

PATENTS.

Gums, gum-resins, resins, and balsams; Process for the complete purification or refinement of —, and compositions produced therefrom. H. W. Johnson, Stockport. Eng. Pats. 20,529, Sept. 30, 1908, and 6917, March 23, 1909.

Two or more of the gums, resins, etc., are mixed together in the raw condition in the proportion desired, and the mixture heated *in vacuo* (preferably after admixture with a solvent such as alcohol) at a temperature sufficient to volatilise all volatile impurities (and the solvent). The expulsion of impurities is accelerated by making the vacuum intermittent, or by mechanical agitation. The

purified residue may be mixed with a suitable oil and used in the manufacture of cement, varnish, paints, etc. Special claim is made for a cement for sealing bottles, etc., which is prepared in this way from a mixture of gum sandarach (7 parts), and Canada or Oregon balsam (3 to 4 parts), subsequently incorporated with castor or other vegetable oil or with a mineral oil (3 parts). An addition of gum mastic or other gum or resin (3 parts) may be made to the original mixture to vary the physical properties of the finished composition. It is stated that a solution of such a preparation in a suitable spirit gives a lacquer, which, applied to outside work, will stand boiling water and is not affected by weather.—C. A. M.

Resinous matter; Process of recovering — [from fibrous vegetable material]. W. J. Hough, Toledo, Ohio. U.S. Pat. 931,608, Aug. 17, 1909.

FIBROUS vegetable material is treated according to the ordinary processes for the manufacture of wood-pulp, such as by heating it with an alkali solution. The liquid portion is then separated from the cellulose and the resins which precipitate from the solution are separated in turn. These resins may be used directly as a soap or they may be treated with an acid to liberate the resin. The alkaline liquid, after the separation of the resins, may be evaporated and subjected to destructive distillation; this operation furnishes gaseous products which may be utilised for heating purposes, and an oil which is useful as a wood preservative, whilst the alkali remains in the still and may be recovered for further use.—W. P. S.

Fats; Rapid method of drying — by oxidation and resinification by means of a current of ozone or ozonised air. Soc. Anon. des Plaques, Pellicules et Papiers Photographiques J. Jouglu. Fr. Pat. 401,747, Aug. 7, 1908.

SURFACES that have been painted, varnished, or treated with printing ink are submitted to the action of ozone mixed with air in proportions varying with the nature of the oil in the paint, varnish, etc.—C. A. M.

(C.)—INDIA-RUBBER, &c.

Latex of Kickxia elastica. E. Fickendey. Tropenpflanzer, 1909, No. 5. Gummi-Zeit., 1909, 24, 12–14. (See also this J., 1909, 945.)

LATEX taken from the trees in the dry season (January and February) showed a faintly acid reaction, had a sp. gr. of 0.979 to 0.988 at 25° C., and gave the following results on analysis:—Water, 47.68; minerals (ash), 0.99; precipitated by lead acetate, 1.98; peptones, 3.25; rubber, 40.72; and resins, 4.46 per cent. Proteins, albumoses, starch, sugar and oxydase were not present. The ash was faintly alkaline and contained:—Alumina, traces; lime, 4.20; magnesia, 39.41; sulphuric anhydride, 17.02; chlorine, 5.42, and phosphoric anhydride, 5.67 per cent.; a little alkali and carbon dioxide were also present. The size of the *Kickxia* latex globules, in comparison with those of other latices, is shown by the following figures:—*Castilleja elastica*, 2 μ to 3 μ ; *Ficus elastica*, 2 μ to 3 μ ; *Sapium spec.* (?), 0.5 μ to 4 μ , but generally 2 μ to 3 μ ; *Hevea brasiliensis*, 0.5 μ to 1 μ or 2 μ ; *Kickxia elastica*, 0.5 μ to 1 μ , also below 0.5 μ . The small size of the globules is one reason for the difficulty experienced in coagulating *Kickxia* latex. A second reason is found by the author in the presence of peptones in the latex. These act as inhibiting colloids, and when peptone-precipitants are added to the latex, coagulation is brought about. The processes available for coagulating *Kickxia* latex are:—(1) *Heating*: this results in a loss of about 8 per cent. of the rubber present, and the product contains lacunæ filled with liquid; (2) *Smoking*: this gives a rubber of good properties, though containing all the impurities of the latex; (3) *Addition of chemical reagents*: peptone precipitants. In practice a freshly-prepared solution of metaphosphoric acid would probably be most convenient. (4) "*Dialysis*" in porous earthenware vessels. Only applicable in the cases of latices which do not contain protective colloids. (3) and (4) are at present only laboratory methods.—E. W. L.

Raw rubber; Origin of "tackiness" in —. F. Frank. Gummi-Zeit., 1909, 24, 39—40. (Cf. Spence, this J., 1909, 374.)

THE author attributes the occurrence of "tackiness" in certain raw rubbers to the presence in the rubber, as coagulated, of imperfectly polymerised portions, which owe their existence to unsatisfactory methods of coagulation. In the smoking process employed in the case of fine Para, every portion of the latex comes under the influence of the coagulating, polymerising agent, and "tackiness" is normally absent. When a mass of raw rubber containing imperfectly polymerised portions is subjected to mechanical working, the faulty portions become distributed through the mass, upon which they exercise a solvent action resulting in general deterioration. The presence of water in the raw rubber tends to check any action of this kind. It is possible that bacterial or enzyme action may play a part in the spread of tackiness, the heat generated either rendering the sound rubber more liable to attack (solution), or even bringing about a direct depolymerisation. The following precautionary measures are advocated:—(1) Intimate mixing of the coagulating agent with the latex. (2) Use of only small quantities of latex at a time, in all cases where the process employed is such as to render likely the formation of lumps and consequent inclusion of uncoagulated latex. (3) Protection of the coagulated rubber from the action of light and heat. (4) Minimum mechanical treatment of the rubber at the place of origin. (5) Packing in cases, and storage in cool places during transport. (6) Presence in the raw rubber of a certain amount of moisture.

—E. W. L.

Assam rubber. D. Hooper. Ann. Rept. Indian Museum, Industrial Section, 1908-9, 6—7.

THE percentage of resin in *Ficus elastica* rubber varies from about 20—30 per cent., in the case of young trees, to less than 10 per cent. in rubber from older trees. The following analyses of rubber from various sources are given:—

Source.	Age of trees.	Water.	Rubber.	Resins.	Protein.	Ash.
	years.	per cent.	per cent.	per cent.	per cent.	per cent.
Harduar	33	0.5	83.0	15.1	1.0	0.4
Government Plantation	33	1.4	85.1	11.5	1.2	0.8
	33	2.8	80.4	13.4	1.4	2.0
ushai	70	0.4	89.1	8.8	0.7	1.0
shutan	—	1.0	83.1	14.2	0.7	1.0
diehmi	100—150	1.3	79.4	16.6	1.2	1.5
Average..	—	1.2	83.4	13.3	1.0	1.1

Other samples of rubber, collected by native agency, are brought into Assam from neighbouring districts. One sample from Bhutan and two from Akha Hills were found to contain, respectively:—90.9, 89.9 and 92.8 per cent. of rubber, and 4.9, 6.5 and 4.9 per cent. of resins. These are, therefore, probably not *F. elastica* rubber.—E. W. L.

Rubber; Determination of — as tetrabromide. T. Budde. Gummi-Zeit., 1909, 24, 4—6.

REPLYING to criticisms by Harries and Kimpel (this J., 1909, 945), of his method for the estimation of rubber in raw and cold-vulcanised samples, the author questions the accuracy of the assumption on which those criticisms are mainly based, viz. that Para rubber, purified by Harries' method (this J., 1905, 448) contains, within very narrow limits, 100 per cent. of pure rubber. It is also pointed out that in a case where raw rubber might be assumed to contain an impurity similar to the hydrocarbon, $C_{10}H_{16}$, found in dammar resin, the properties of this hydrocarbon are such that it could only be separated from the rubber hydrocarbon with extreme difficulty, if at all; the analytical results would not, however, indicate its presence. The author shows, moreover, that the prolonged action of bromine gives rise to high results, which is the direct opposite of what should occur if the more highly

brominated derivatives of rubber are soluble in the mixed solvents employed. From an examination of a number of results the conclusion is drawn that a six hours' bromination gives the most accurate figures. Again the hydrocarbon ($C_{10}H_{16}$) of dammar resin gives, on bromination, products soluble in the mixed solvents of Budde's process, which exhibit a very similar behaviour to that of the soluble body described by Harries and Kimpel (*loc. cit.*). The following revised instructions are given for carrying out the tetrabromide method:—0.15 to 0.2 grm. of the finely-divided sample is covered with 50 c.c. of carbon tetrachloride and allowed to stand for 24 hours. 50 c.c. of the bromine solution (6 c.c. of bromine and 1 grm. of iodine in 1 litre of carbon tetrachloride) are added, and allowed to interact with the swollen or dissolved rubber for 6 hours, with occasional agitation. Half its own volume of alcohol is added to the liquid, which is then vigorously shaken, and allowed to stand overnight. The liquid is poured off through a filter, the residue washed with a mixture of carbon tetrachloride and alcohol (2:1), then with pure alcohol, and finally allowed to remain for 3 to 4 hours in contact with carbon bisulphide. 50 c.c. of benzene (petroleum spirit) are now added, the liquid allowed to clear, and then poured off through the original filter. The precipitate is well washed, in the flask, with alcohol, until all traces of free bromine are removed. The filter and contents are placed in the flask, 25 c.c. of N/5 silver nitrate and 20 c.c. of nitric acid (sp. gr. 1.40) are added, and the flask is covered with a funnel and heated on asbestos wire gauze. When the whole of the rubber bromide is decomposed, the liquid is cooled, and the excess of silver titrated with N/5 ammonium thiocyanate, using ferric ammonium sulphate as indicator. From the amount of silver nitrate used the combined bromine is calculated, and from the latter the rubber, using the factor 0.425,

—E. W. L.

PATENTS.

Rubber articles subject to compression, expansion or torsion; Manufacture of — [from vulcanised waste]. T. Gare, New Brighton. Eng. Pat. 20,302, Sept. 28, 1908.

THE invention consists in the manufacture, by the process described in Eng. Pat. 12,454 of 1906 (this J., 1907, 539), of articles, such as buffers, tyres, valves, springs, etc., which are subject to compression, expansion or torsion. In order to distribute the degree of elasticity of the various portions of the article in accordance with the degree of expansion at each part thereof, layers of powdered vulcanised waste of different quality, or degree of elasticity, are employed. Thus a buffer may be made up of seven horizontal layers, of which the two outer layers and the middle layer may consist of a low quality, with a low degree of elasticity, the two layers adjacent to the middle layer having a greater degree of elasticity, and the two adjacent to the outer layers a still greater degree of elasticity. The qualities may be made to merge gradually one into the other by the employment of mixtures of different qualities of powdered rubber, and the layers may be made to take a wave-like form to prevent creeping.—E. W. L.

Sheet rubber and rubber articles; Manufacture of —. T. Gare, New Brighton. Eng. Pat. 20,303, Sept. 28, 1908.

A KNITTED fabric, used as a base or as an insertion, is coated with a solution of rubber, preferably of the kind described in Eng. Pat. 19,894 of 1906 (this J., 1907, 1288). The surface is then coated with rubber in the form of dust or powder, and the sheet subjected to heat and pressure, preferably in the manner claimed in Eng. Pats. 12,454 of 1906, and 3112 of 1908 (this J., 1907, 534; 1909, 319). Claim is also made for the manufacture of articles from sheet rubber prepared in this way.—C. A. M.

Rubber; Process of reclaiming devulcanised —. E. E. A. G. Meyer, New Brunswick, N.J. U.S. Pat. 936,468, Oct. 12, 1909.

WASTE rubber is "devulcanised" by treating it with a mixture of two solvents, one of which is a rubber solvent

while the other is not, and the product is "depolymerised" by heating it at temperatures above 120° C. with a neutral resinous soap (which may be made from the natural rubber resins) associated or not with an oil which is saponifiable at temperatures above 120°. The process of "depolymerisation" may be conducted under increased pressure. (See also this J., 1909, 375.)—E. W. L.

Elastic composition suitable for filling motor car tyres, &c.
E. C. R. Marks, London. From A. Schaar, Hamburg.
Eng. Pat. 23,264, Oct. 31, 1908.

ONE part by weight of a suitable animal or vegetable colloid such as "tjen-tjen" or Japan glue, is dissolved by heating it with from two to six parts by weight of glycerin. From two to three per cent. of salicylic acid, and about one to two per cent. of tannin are then added to the semi-fluid mass, the resulting mixture being known as the "basic material." Just before use—as, for instance, before charging into a tyre—the basic material is heated to 70–80° C., and from two to twelve per cent. of "lysoform" (a mixture of about equal parts of formaldehyde and soap solution) and 0.25 to 0.5 per cent. of hexamethylenetetramine are incorporated with it. The product on cooling resembles gelatin; it is very soft and its elasticity is permanent. It is not melted by the heat generated in the tyre during running, and does not become crumbly and brittle from the same cause. Still it can be melted and forced into the tyre when freshly made, owing to the fact that only a fraction of the lysoform and of the hexamethylenetetramine have so far come into action. The permanent softness of the material is due more especially to the salicylic acid. The material may be used as an insulator for electricity, heat or sound.—E. W. L.

Washing caoutchouc, gutta-percha, and similar substances; Apparatus for —. F. Kempter, Stuttgart, Germany.
U.S. Pat. 935,849, Oct. 5, 1909, and 936,635, Oct. 12, 1909.

SEE Eng. Pat. 13,908 of 1907; this J., 1907, 1207.—T. F. B.

Ebonite or similar substances; Material for replacing —.
M. Hofmann, J. A. Benoit, and E. Torrini. Fr. Pat. 401,547, July 29, 1908.

SEE Eng. Pat. 10,731 of 1908; this J., 1909, 100.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

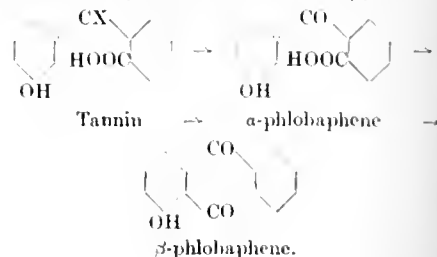
Hides; The interfibrillar substance of animal —. E. H. B. Van Lier. Z. physiol. Chem., 1909, 61, 177–187. Collegium, 1909, 321–328.

THE author has investigated the nature of the compound that is formed by the action of lime upon the "connective" or "binding" tissue of hide, and has experimented with the hides and skins of various animals. The experiments were carried out as follows. Slices of freshly shaved hide were laid one on another and submitted to a pressure of 250 atmospheres for 24 hours, for the removal of blood and tissue-juice. Pieces of the pressed hide weighing about 100 grms. were immersed in 400 c.c. of half-saturated lime water for 1 day, then strained, and immersed in water for 1 day. The alternate extractions with lime-water and water were repeated until an extract was obtained which gave no precipitate with acetic acid. The extracts were strained, and filtered through compressed paper pulp with the aid of the pump. Those obtained at first yielded opalescent filtrates, but in the final stages clear filtrates were obtained. Cattle and horse hides were completely extracted in 8 days, but calf-skins took much longer. Acetic acid was added to the combined filtered extracts, and precipitated a sticky stringy mass soluble in excess of acetic acid. The precipitate was washed with water faintly acidulated with acetic acid, and then dissolved in water, with the addition of sufficient lime-water or caustic soda to give a neutral reaction. It was then reprecipitated with acetic acid, the precipitate collected, washed with aqueous alcohol, alcohol and ether, and dried. The author has named

this substance "coriomucoid" and has compared it with, and found it similar to "tendomucoid," which is prepared in a like manner from animal tendons. He entirely disagrees with the view of Reimer (Ding. Poly. Jour. civ. 143), who stated that "corin" (the name given to his product) was quite different in character and composition from mucin. The author suggests that Reimer's failure to detect any mucous substance was probably due to the fact that he did not work with fresh hide and most likely lost the substance in his long liming process before unhairing. "Coriomucoid," prepared from various hides, contained higher percentages of carbon and nitrogen than "tendomucoid," and exhibited in general the properties of mucin; e.g., (1) after digesting with hydrochloric acid it reduced Fehling's solution; (2) it was soluble in solutions of alkaline earths; (3) it was soluble in excess of acid. While "coriomucoid" is precipitated as a sticky, stringy mass, "tendomucoid" appears as a flocculent precipitate, and the former is more easily precipitated with acid, the latter sometimes requiring the addition of hydrochloric as well as acetic acid for complete precipitation. By the action of sodium hydroxide, the author has isolated a substance, with the properties of glucosylonic acid as described and prepared by Levene (Z. physiol. Chem., 31, 395, 39, 1) from both "tendomucoid" and "coriomucoid," and although the chemical nature of this substance is not thoroughly established, the author considers it proof that "coriomucoid" and "tendomucoid" are very similar substances.—S. H.

Phlobaphenes [reds]; The formation of —. M. Nierenstein and T. A. Webster. Collegium, 1909, 337–341.

AN account is given of experiments on the mechanism of phlobaphene formation from the tannin of mangrove bark. An infusion of the bark was prepared with hot water, clarified by casein, and subjected to the action of air, air free from carbonic acid, oxygen, and air in the presence of hydrogen peroxide. In every case the concentration of tannin decreased as the amount of phlobaphenes increased. The oxidation by means of oxygen yielded a product which was named the β -phlobaphene of mangrove-tannin. Oxidation by potassium persulphate in acetic acid solution and in the presence of sulphuric acid (this J., 1905, 1087) apparently yielded the same product. This phlobaphene, on distillation with zinc dust yielded anthracene. The oxidation with hydrogen peroxide gave a product which was named the α -phlobaphene of mangrove-tannin. This phlobaphene yielded diphenylmethane on distillation with zinc dust, and on digestion with 1 per cent. sulphuric acid yielded the β -phlobaphene. The authors conclude, therefore, that the formation of phlobaphenes is due partly to oxidation and partly to dehydration. They suggest the following type formulae:—



—H. G. B.

Mould on leather; Prevention of —. L. Manstetten. Ledertechn. Rundsch., 1909, 250, 258–259; J. Amer. Leather Chem. Assoc., 1909, 4, 266–267.

CLEANLINESS of walls, floors, vats and supports in the drying and storage rooms is chiefly recommended for preventing mould on leather. To disinfect a storage room, burning sulphur is said to be most suitable, and in obstinate cases sprinkling the floor with dilute hydrofluoric acid. Formalin is said to be comparatively ineffective. A 0.05 per cent. solution of corrosive sublimate is recommended to destroy mould on the hanging poles, cloths, etc.

A 2 per cent. solution of sodium fluoride may be employed with advantage on leather. Salicylic acid in the oil employed will also arrest the evil.—H. G. B.

Extracts; Influence of — on tanning methods. S. C. Hemie, J. Amer. Leather Chem. Assoc., 1909, 4, 260-263.

The author points out that American methods of tanning are in a transition stage in consequence of the growing use of tanning extracts, and also because of the increased employment of myrobalans, valonia, and mangrove-bark. This gradual change has been proceeding for the last twelve years. The use of tanning extracts to any great extent involves a greater strength in tannin and a lower non-tannin content in liquors of any given barkometer strength, when compared with the liquors obtained by leaching oak and hemlock barks. Many tanning extracts also contain quickly penetrating tannins, which are liable to tan the hide before it has been plumped sufficiently by the acids in the liquors. Tanning extracts moreover yield sweeter tan liquors than those obtained from bark. These points must be borne in mind when transforming a bark tannage into an extract tannage.—H. G. B.

Chebulic myrobalans (Terminalia chebula). D. Hoogen, Ann. Rept. Indian Museum, Industrial Section, 1908, 9, 11-12.

Two kinds of nuts, from trees growing in the Poona District, respectively green and brown in colour, were found to possess approximately equal tanning values; the total extract and tannin were, respectively, in the green nuts, 48.1 and 35.0, and in the brown nuts 50.8 and 35.8 per cent. The colour of the fruit is in no sense an indication of its tanning value. Experiments point to the superiority of mature nuts, fallen from the tree in the ordinary course.—E. W. L.

Catechol-tannins. H. Franke, Collegium, 1909, 330-336.

The author points out that solutions of catechol-tannins which impart a yellowish-brown to red-brown colour to leather, are generally stable, with the exception of oak-bark and pine-bark liquors, which contain ellagitannic acid, and form ellagic acid in the tanning process, producing a somewhat brighter colour. It is stated that these "mixed" tannins consist of two parts, (1) a colourless substance easily soluble in cold water, the solution becoming reddish-brown on standing, and (2) a brown or reddish-brown substance, soluble only in hot water and which precipitates on cooling, but in the presence of the first constituent partly remains in solution. This latter substance (phlobaphenes) appears as a sediment in tanning liquors (particularly those of quebracho), and sometimes causes disagreeable patches on the leather. If the colourless oak-bark tannic acid be heated with water at 100° C., a difficultly soluble substance is formed which is identical with the oak-bark phlobaphene, so that it is evident that by oxidation the tannic acid is converted into the phlobaphene. The same effect can also be brought about by bringing the tannin in contact with a current of warm air, and this accounts for the fact that some leathers darken in drying or on exposure to the sun. It is obvious therefore, that to obtain bright coloured liquors, the tanning materials should be extracted with cold water. The author discusses colloidal and colloidal solutions, and points out that, even after repeated filtration, some substance remains suspended in pine or quebracho liquors, giving the appearance of a colloidal solution.—S. H.

Tannin: Action of zinc dust on —. L. F. Iljin, J. prakt. Chem., 1909, 80, 332-336.

GALLOTANNIC ACID (100 grms.) was dissolved in water (1 litre) and boiled with zinc dust (100 grms.) for 15-20 hours. On cooling, a precipitate separated which on acidification and extraction with ether was separated into gallic acid (dissolved in the ether) and a brown syrup. On evaporating in a vacuum the ethyl acetate solution of the latter and subsequent similar treatment with alcohol, an amorphous voluminous powder was obtained. The substance becomes colloidal when dissolved

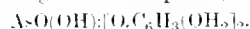
in water and has the formula, $C_{66}H_{48}O_{31}$, and $[a]_D^{20} = -24.1$ in 95 per cent. alcoholic solution. When heated with dilute sulphuric acid it yields gallic acid.—J. C. C.

Artificial tannin: Composition and constitution of —. P. Biginelli, Gaz. chim. ital., 1909, 39, 11, 268-283.

On boiling an aqueous or alcoholic solution of gallic acid with arsenic acid, carbon dioxide is evolved, and arsenic acid becomes combined, with formation of violet-coloured products. These latter are soluble in water and give precipitates with solutions of alkaloids just as natural tannin does; one or more of them, alone or mixed with unaltered gallic acid, constitute the so-called artificial tannin, or digallic acid, of Schiff. They contain combined arsenic which cannot be completely removed by means of hydrogen sulphide, except after addition of an acid such as hydrochloric acid: when freed from arsenic in this manner, the products no longer have properties similar to those of natural tannin. By using an aqueous solution of gallic acid and heating with arsenic acid only at 80-90° C., combination takes place with practically no liberation of carbon dioxide, and according to the relative proportions of the two acids, one or other (or a mixture) of the two compounds, arsenicogallic acid, $C_6H_2(OH)_2(COOH)O.AsO(OH)_2$, and arsenicodigallic acid, $AsO(OH)_2[(O.C_6H_2(OH)_2COOH)_2]$, is produced. These substances are partially dissociated in aqueous solution (completely in presence of acetic acid or mineral acids) and form addition-compounds with ether and water just as natural tannin does (see this J., 1908, 181). If the solution of gallic acid be boiled with arsenic acid, carbon dioxide is evolved, a portion of the gallic acid being converted into hexahydroxybenzophenone. The latter combines with arsenic acid to form dihexahydroxybenzophenonearsenic acid,



and possibly other compounds. Pyrogallol combines with arsenic acid to give the compound,



These compounds of hexahydroxybenzophenone and pyrogallol with arsenic acid have properties similar to those of the gallic acid compounds and may be classed as artificial tannins. On the other hand, phenol, the dihydroxybenzenes, phloroglucinol, and hydroxyquinol do not form similar compounds with arsenic acid.—A. S.

Tannin: Artificial —. P. Biginelli, Gaz. chim. ital., 1909, 39, 11, 283-289.

The yellow substance prepared by Schiff by the action of phosphorus oxychloride on gallic acid, and called by him artificial tannin or digallic acid, is shown by the author to contain phosphorus and to consist essentially of phosphotrigallic acid, $PO[(O.C_6H_2(OH)_2COOH)_3]$. It has properties similar to those of the compounds of gallic acid with arsenic acid (see preceding abstract). Antimonic acid also combines with gallic acid, hexahydroxybenzophenone, and pyrogallol to form compounds analogous to those furnished by arsenic acid (*loc. cit.*).—A. S.

PATENTS.

Skins and hides: Treatment of — for the removal of fat, grease, oil, and lime, and for disinfecting purposes. F. H. E. Lehmann, Eilenburg, Germany. Eng. Pat. 4488, Feb. 23, 1909.

The raw or partly dressed hides or skins are subjected to the action of alternating or continuous electric currents in a bath provided with diaphragms, or the skins are suspended or moved between the electrodes so that they themselves form the diaphragms. For the removal of fat or oil, an alkaline bath is employed, and it is generally possible to remove the hair from the skins thus treated, but in some cases where the skins contain only a small quantity of fat, treatment with lime may be necessary. If lime be used, it is subsequently removed from the skins by subjecting them to the action of an electric current in an alkaline, acid, or neutral bath. Simultaneously with the removal of the fat by the above process, the

skins may undergo a disinfecting process. The chlorides present themselves act as disinfectants, and formaldehyde may be added to the bath.—W. P. S.

Protids; Process for the dissolution and subsequent coagulation of — and the application of the resulting products to industrial purposes.—H. L. J. Chavassieu, Lyons, France. Eng. Pat. 26,155, Dec. 3, 1908.

SEE FR. Pat. 395,402 of 1907; this J., 1909, 422.—T. F. B.

Glauc; Preparation of colourless —.—J. Lehmann, Paris. Eng. Pat. 1865, Jan. 16, 1909.

SEE FR. Pat. 398,598 of 1909; this J., 1909, 897.—T. F. B.

XV.—MANURES, &c.

The Fertilisers and Feeding Stuffs (Methods of Analysis) Regulations, 1908. Dated November 9, 1908. Statutory Rules and Orders, 1908. No. 964.

THE Board of Agriculture and Fisheries, in pursuance of the provisions of the Fertilisers and Feeding Stuffs Act, 1906, hereby make the following Regulations:—

1. These Regulations shall take effect on the first day of January, 1909, and remain in force until altered or revoked by the Board of Agriculture and Fisheries.

2. In these Regulations—"The Act" means the Fertilisers and Feeding Stuffs Act, 1906. "Fertiliser" means any article used for fertilising the soil. "Feeding stuff" means any article used as food for cattle (as defined by the Act, *i.e.*, bulls, cows, oxen, heifers, calves, sheep, goats, swine, or horses) or poultry. Other expressions have the same respective meanings as in the Act.

Methods of analysis of fertilisers.

3. The methods of analysis of a fertiliser for the purposes of the Act shall be as follows:—

(i.) *Preparation of the sample for analysis.*—(a) In the case of powdered fertilisers in a dry, or moderately dry, condition, the sample shall be passed through a sieve with perforations about one millimetre in diameter. Adventitious materials which cannot be conveniently crushed, *e.g.*, fragments of metal in basic slag, shall be removed and allowed for. (b) Other substances which are dry enough to powder but which are not in a fine condition shall be pulverised until the sample passes through a sieve with perforations about one millimetre in diameter. (c) Wool, hair, hoof, shoddy, and similar substances, shall be pulled apart and cut until in a fine condition; or, if dry, they may be passed through a shredding machine. (d) Moist fertilisers which do not admit of being passed through a sieve shall be thoroughly mixed by the most suitable means. (e) In the case of horn, shoddy, and other substances which gain or lose water during the process of pulverising, the proportion of water shall be estimated in the coarse and in the powdered condition respectively, and the results of the analysis of the powdered sample shall be calculated to the water content of the original coarse substance. (f) Crystalline or saline materials, such as sulphate of ammonia, nitrate of soda, or potash salts, may be prepared by being well mixed and rapidly ground in a stoneware mortar, the portion finally reserved for analysis being especially finely ground. (g) When the sample has been passed through the sieve and thoroughly mixed, or, if not passed through the sieve, has been thoroughly mixed, not less than 100 grms. shall be placed in a stoppered bottle, and from this the portions for analysis shall be weighed.

(ii.) *Determination of moisture (loss on drying).*—A weighed quantity of the sample shall be dried at 100° C.

(iii.) *Determination of nitrogen.*—The presence or absence of nitrates must first be ascertained. (a) *Nitrogen in absence of nitrates.*—(a) A weighed portion of the sample shall be transferred to a Kjeldahl digestion flask; 10 grms. of potassium sulphate and 25 c.c. of concentrated sulphuric acid shall be added, and the flask heated until a clear liquid, colourless, or of light straw colour, is obtained. A small crystal of copper sulphate or a globule of mercury may be added to the liquid in the digestion flask. (b) The quantity of ammonia shall be determined

by distillation into standard acid after liberation with alkali, and, where mercury has been used, with the addition also of sodium or potassium sulphide solution. (b) *Nitrogen when nitrates are present.*—(a) A weighed portion of the sample shall be transferred to a Kjeldahl digestion flask; 30 c.c. of concentrated sulphuric acid, containing 1 gm. of sulcylic acid, shall be added, and the flask shaken so as to mix its contents without delay. The shaking shall be continued at intervals during ten minutes, the flask being kept cool, and then 5 grms. of sodium thiosulphate and 10 grms. of potassium sulphate shall be added. The flask shall be heated until the contents are colourless or nearly so. Copper sulphate or mercury may be used as described in paragraph (iii.) (a) (a). (b) The quantity of ammonia shall be determined as above prescribed in paragraph (iii.) (a) (b). (c) *Nitrogen in form of ammonium salts.*—A weighed portion of the sample shall be transferred to a distillation flask, and the quantity of ammonia determined as above prescribed in paragraph (iii.) (a) (b). (d) *Nitrogen in nitrates in the absence of ammonium salts and of organic nitrogen.*—One gm. of the sample shall be placed in a half-litre Erlenmeyer flask with 50 c.c. of water. 10 grms. of reduced iron and 20 c.c. of sulphuric acid of 1.35 sp. gr. shall be added. The flask shall be closed with a rubber stopper provided with a thistle tube, the head of which shall be half filled with glass beads. The liquid shall be boiled for five minutes, and the flask shall then be removed from the flame, any liquid that may have accumulated among the beads being rinsed back with water into the flask. The solution shall be boiled for three minutes more, and the beads again washed with a little water. The ammonia shall then be determined as above prescribed in paragraph (iii.) (a) (b). When the proportion of nitrates is small a larger quantity of the sample shall be taken. (e) *Control experiment in determination of nitrogen.*—The materials used in any of the methods described under this paragraph (iii.) shall be determined as to their freedom from nitrogen by means of a control experiment carried out under similar conditions with the same quantities of the reagents which have been employed in the actual analysis, in the case of (a) 1 gm. of pure sugar being used in place of the weighed portion of the sample. The quantity of standard acid used in the control experiment shall be deducted from the total quantity of acid found to have been neutralised in the distillation of the sample.

(iv.) *Determination of phosphates.* (a) *Phosphates soluble in water.*—In the case of superphosphates, dissolved bones, and similar substances, 20 grms. of the sample shall be continuously agitated for 30 minutes in a litre flask with 800 c.c. of water. The flask shall then be filled to the mark, and again shaken, and the contents filtered. 50 c.c. of the filtrate shall be boiled with 20 c.c. of concentrated nitric acid and the phosphoric acid shall be determined by the molybdate method prescribed below in paragraph (iv.) (d). In the case of fertilisers in which the proportion of phosphates soluble in water is small, a larger quantity of the filtrate prepared as above shall be taken. (b) *Phosphates soluble in the prescribed citric acid solution.*—5 grms. of the sample shall be transferred to a stoppered bottle of about 1 litre capacity. 10 grms. of pure crystallised citric acid shall be dissolved in water, the volume shall be made up to 500 c.c., and the solution shall be added to the weighed portion of the sample in the bottle. To lessen the possibility of caking, the portion of the sample in the bottle may be moistened with 5 c.c. of alcohol or methylated spirit before the citric acid solution is added; and in that case the volume of the citric acid solution shall be 495 c.c. instead of 500 c.c. The bottle shall be at once fitted into a mechanical shaking apparatus, and shall be continuously agitated during 30 minutes. The solution shall then be filtered through a large "folded" filter, the whole of the liquid being poured on the paper at once. If not clear, the filtrate shall be again poured through the same paper. 50 c.c. of the filtrate shall be taken and the phosphoric acid shall be determined by the molybdate method prescribed below in paragraph (iv.) (d). (c) *Total phosphoric acid.*—A weighed portion of the sample, in which, if necessary, the organic matter has been destroyed by ignition and the silica removed by appropriate means, shall be dissolved in nitric acid and boiled,

the solution being made up to a definite bulk. The phosphoric acid shall be determined in an aliquot part of the solution by the molybdate method prescribed below in paragraph (iv.) (d). (d) *Molybdate method*.—To the solution, which should preferably contain from 0.1 to 0.2 gm. of phosphoric oxide (P_2O_5), obtained as above described in paragraphs (iv.) (a), (b) or (c), 100 to 150 c.c. of molybdic acid solution prepared as described below, or an excess of such solution, shall be added, and the vessel containing the solution shall be placed in a water bath maintained at $0^\circ C.$ for 15 minutes, or until the solution has reached $0^\circ C.$ It shall then be taken out of the bath and allowed to cool, and the solution filtered, the phospho-molybdate precipitate being washed several times by decantation and finally on the paper with 1 per cent. nitric acid solution. The filtrate and washings shall be mixed with more molybdic acid solution and allowed to stand for some time in a warm place. The phospho-molybdate precipitate shall be dissolved in cold 2 per cent. ammonia solution, prepared as described below, and about 100 c.c. of the ammonia solution shall be used for the solution and washings. 15 to 20 c.c. of magnesia mixture prepared as described below, or an excess of such mixture, shall then be added drop by drop, with constant stirring. After standing at least 2 hours with occasional stirring, the precipitate shall be filtered off, washed with 2 per cent. ammonia solution, dried, and finally weighed as magnesium pyrophosphate. The filtrate and washings shall be tested by the addition of more magnesia mixture. (e) *Preparation of molybdic acid solution*.—125 grms. of molybdic acid and 100 c.c. of water shall be placed in a litre flask, and the molybdic acid shall be dissolved by the addition, while the flask is shaken, of 300 c.c. of 8 per cent. ammonia solution, prepared as described below. 400 grms. of ammonium nitrate shall be added, the solution shall be made up to the mark with water, and the whole added to 1 litre of nitric acid (sp. gr. 1.19). The solution shall be maintained at about $35^\circ C.$ for 24 hours and then filtered. (f) *Preparation of magnesia mixture*.—110 grms. of crystallised magnesium chloride and 140 grms. of ammonium chloride shall be dissolved in 1,300 c.c. of water. This solution shall be mixed with 700 c.c. of 8 per cent. ammonia solution, and the whole shall be allowed to stand for not less than three days and shall be then filtered. (g) *Preparation of the ammonia solutions*.—The 8 per cent. ammonia solution shall be prepared by mixing one volume of ammonia solution of sp. gr. 0.880 with three volumes of water. This solution shall then be adjusted by the addition of more strong ammonia solution or water as required until the sp. gr. of the solution is 0.967. The 2 per cent. ammonia solution shall be prepared by mixing one volume of 8 per cent. ammonia solution with three volumes of water.

(v.) *Determination of potash*.—(a) *Muriate of potash free from sulphates*.—A weighed portion of the sample about 5 grms. in the case of concentrated muriate of potash or 10 grms. in the case of low-grade muriate) shall be dissolved in water, the solution shall be filtered if necessary and made up to 500 c.c. To 50 c.c. of the solution, placed in a porcelain basin, a few drops of hydrochloric acid shall be added, and also 10 c.c. or 20 c.c. according to whether the portion weighed was 5 grms. or 10 grms.) of a solution of platinum chloride containing 0 grms. of platinum per 100 c.c. After evaporation to a syrupy consistency on a water-bath, the contents of the basin shall be allowed to cool and then treated with alcohol of sp. gr. 0.864, being washed by decantation until the alcohol is colourless. The washings shall be passed through a weighed or counterpoised filter paper, on which the precipitate shall be finally collected, washed with alcohol as above, dried at $100^\circ C.$ and weighed. The precipitate is to be regarded as K_2PtCl_6 . (b) *Salts of potash containing sulphates*.—A weighed portion of the sample (about 5 grms. in the case of concentrated sulphate of potash or 10 grms. in the case of kainit or other low-grade salts) shall be boiled with 20 c.c. of hydrochloric acid and 300 c.c. of water in a half-litre flask. Barium chloride solution shall be cautiously added, drop by drop, to the boiling solution until the sulphuric acid is completely precipitated. Any slight excess of barium shall be removed by the addition of the least possible excess of dilute

sulphuric acid. The liquid (without filtration) shall be cooled and made up to 500 c.c. A portion shall then be filtered, and 50 c.c. of the filtrate shall be treated as in paragraph (v.) (a), 10 c.c. or 20 c.c. of platinum chloride solution, as the case may be, being used. (c) *Potash in guanos and mixed fertilisers*.—Ten grms. of the sample shall be gently ignited in order to char organic matter, if present, and shall then be heated for ten minutes with 10 c.c. of concentrated hydrochloric acid, and finally boiled with 300 c.c. of water. The liquid shall be filtered into a half-litre flask, raised to the boiling point, and a slight excess of powdered barium hydrate shall be added. The contents of the flask shall be cooled, made up to 500 c.c. and filtered. Of the filtrate 250 c.c. shall be treated with ammonia solution and excess of ammonium carbonate, and then, while boiling, with a little powdered ammonium oxalate, cooled, made up to 500 c.c. and filtered. Of the filtrate, 100 c.c. are to be evaporated in a platinum dish, and the residue heated, first in the air-bath and then very gently over a low flame, till all ammonium salts are expelled, the temperature being carefully kept below that of low redness. The residue shall be treated with hot water, filtered if necessary, and the potash shall be determined in the filtrate as in paragraph (v.) (a).

Methods of analysis of feeding stuffs.

4. The methods of analysis of a feeding stuff for the purposes of the Act shall be as follows:—

(i.) *Preparation of the sample*.—(a) If the sample is already in a fine condition, e.g., a meal, it shall be thoroughly mixed, and a portion for the determination of the moisture shall be at once taken. (b) If the sample is not in a fine condition, e.g., a cake, it shall be carefully pulverised until the whole passes through a sieve with perforations from 2 to 3 mm. in diameter. It shall then be thoroughly mixed, and a portion for the determination of the moisture shall be at once taken. (c) From the sample thus prepared, a portion not less than 100 grms. in weight shall be taken and further powdered if necessary and passed through a sieve with perforations of about one mm. in diameter. (d) If the original sample is appreciably damp, or if the operations of pulverisation and mixing are likely to result in loss or gain of moisture, the moisture shall be determined in this portion, as well as in the sample prepared as in paragraph (i.) (b), in order that the results of the analysis may be corrected to correspond with the sample in its original condition as regards moisture. (e) Materials which cannot be conveniently pulverised or passed through a sieve shall be thoroughly mixed and sampled by the most suitable means. (f) The prepared portion of the sample shall be placed in a stoppered bottle and from it the portions for analysis shall be weighed.

(ii.) *Determination of moisture (loss on drying)*.—A weighed quantity of the sample shall be dried at $100^\circ C.$

(iii.) *Determination of oil*.—(a) A weighed quantity of the sample shall be placed in a Soxhlet thimble, which shall then be placed in the Soxhlet extraction tube and extracted with washed, re-distilled ether. At the end of 3 to 4 hours the thimble shall be removed from the Soxhlet tube, dried, and its contents finely ground in a small mortar previously rinsed with ether. The substance shall then be returned to the thimble, the mortar being washed out with ether, and the extraction continued for another hour. After evaporation of the solvent the oil shall be dried at $100^\circ C.$ and weighed. The oil shall be re-dissolved in ether and any undissolved matter shall be weighed and deducted. (b) In the case of samples containing saccharine matter, e.g., sugar meals, the weighed portion in the Soxhlet thimble shall be washed twice with water, and then dried, previous to the extraction.

(iv.) *Determination of albuminoids*.—The percentage of albuminoids shall be ascertained by multiplying the percentage of nitrogen by 6.25. The determination of nitrogen shall be carried out as for fertilisers in absence of nitrates, (iii.) (a), with control as in (iii.) (c).

5. In calculating the results of analyses the atomic weights adopted by the International Committee on Atomic Weights shall be employed.

6. Every certificate which is affected by Regulation

No. 3 of the Fertilisers and Feeding Stuffs (General) Regulations, 1906, and these regulations, and which is dated on or after the first day of January, 1909, shall contain the following words:—"The analysis was made in accordance with the Fertilisers and Feeding Stuffs (Methods of Analysis) Regulations, 1908."

7. These regulations may be cited as the Fertilisers and Feeding Stuffs (Method of Analysis) Regulations, 1908.

PATENTS.

Manure: *Manufacture of* ——. A. M. Johnson and J. Austin, Birmingham. Eng. Pat. 11,924, May 20, 1909.

CLAIM is made for a manure prepared by evaporating horse urine, with or without the addition of sulphuric or other suitable acid, until it is brought to the consistency of a syrup, such that it will solidify on cooling; or, by evaporating to the point at which charring begins. The solid may be broken up and used directly, but it is preferred to add solid ingredients, such as gypsum, charcoal, dry earth, ground bones, superphosphates, or the like, before or after solidification. Raw blood also may be added to the urine, before evaporating. The evaporation is best carried out in a vacuum pan at a low temperature, the times evolved being conducted to a suitable vessel containing acid.—F. SÖRN.

Fertilisers: *Method of making solid* ——. B. F. Halvorsen, Assignor to Norsk Hydro-Elektrisk Kvaestof-aktieselskab, Christiania. U.S. Pat. 936,317, Oct. 12, 1909.

SEE FR. PAT. 390,242 OF 1908; this J., 1908, 1033.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Beets of high potash- and low soda-content. K. Andriik and J. Urban. Z. Zuckerind. Böhm., 1909, 34, 1—5.

PREVIOUS investigations have shown that substitution of soda for part of the potash in the beet leads to a smaller content of sugar in the root. The authors have now examined the effect of a deficiency of soda in the soil on the formation of sugar in the beet. Beet seeds from plants of high sugar content were sown at the end of April in drift sand (from the Elbe) of low soda-content; potassium chloride, superphosphate, and ammonium sulphate were used as manure, and the plants were watered with rain water. Growth was slow at first, but improved later, though the weight of the plant at the time of harvest was moderate. The roots were characterised by the formation of fine rootlets in great abundance, due probably to a deficiency of moisture, since in the sandy soil used, most of the moisture and with it the nutrient material, would accumulate at the bottom of the pot in which the plant was grown. The sugar-content of the roots was high (19.4 and 20.5 per cent.). The ratio of potash to soda in one of the plants was found to be 3.61 to 1, the highest hitherto observed by the authors, though they propose to make further experiments with a view to increasing it. The investigation shows that a high ratio of potash to soda is correlated with a high sugar-content in the beet, which appears to confirm the authors' conjecture that beet of low soda-content is rich in sugar.—L. E.

Beetroot juice: *Industrial fermentation of* ——. Formic aldehyde in plants: beetroots. L. Gentil. Bull. Assoc. Chim. Sucr. et Dist., 1909, 27, 169—179.

THE author has shown that during growth, small quantities of formic aldehyde occur in the leaves, and to a somewhat less extent, in the root of the beet; when the leaves have ripened and turned yellow, the formic aldehyde in this part of the plant almost disappears. At the beginning of the campaign, when the roots are not fully ripe, fermentation is often difficult. Since this trouble is obviated by boiling the juice, it might be supposed that it is due to formic aldehyde. Such is not the case, however, since a medium, prepared by dissolving invert sugar, peptone and

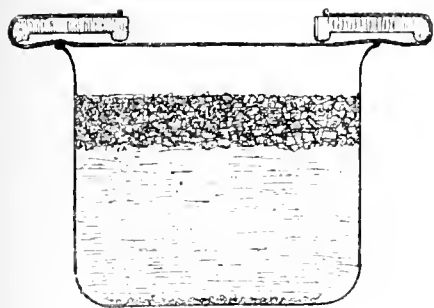
distillery yeast-ash in the liquor obtained by distilling the leaves or root of the beet with dilute sodium carbonate solution, is normally fermented by distillery yeast. The difficulty appears to be chiefly due to incomplete hydrolysis of the sugar. During the first few days of the process of extracting the sugar from the cossettes, the sugar is not subjected to the action of hot dilute acid. The authors show that the sugar in beetroot juice is only slightly hydrolysed when treated with 0.25 per cent. of sulphuric acid at 30° C., whereas, at the boiling temperature, hydrolysis is nearly complete. It is probable that the hydrolysing power of the yeasts employed by distillers is weak and may disappear altogether under the conditions which prevail in the fermentation. It is advisable, therefore, to use hot, acid vinasse instead of water for diffusion and to replace the diffusers made of sheet iron by cast iron diffusers in order to avoid the danger of the acid liquor attacking the metal.—L. E.

Raw cane sugars: *Influence of temperature on the polarisation of* ——. H. W. Wiley and A. H. Bryan. Z. V. deutsch. Zucker-Ind., 1909, 916—922.

THE influence of variations of temperature on the polarisation of raw cane sugars is considerable, owing to the presence of appreciable quantities of invert sugar in the products. According to careful measurements the polarisation of sucrose is diminished by 0.0003° Ventzke per 1 per cent. of sugar for a rise of temperature of 1° C. The polarisation of dextrose is for all practical purposes unaffected by moderate variations of temperature. The polarisation of levulose is profoundly modified, the levo-rotation decreasing as the temperature rises. This decrease amounts to 0.00812° Ventzke per 1 per cent. of levulose for 1° C. rise of temperature. Hence it follows that the influence of the temperature on the polarisation of raw cane sugars depends on the composition of the sugar and that two samples which have the same polarisation at one temperature will not necessarily be identical at another temperature. The authors have investigated the influence of temperature on the direct polarisation of a number of samples of raw cane sugars and have tabulated the results. The solutions were made up at the same temperatures as those at which they were subsequently polarised. The results agreed in most cases with the values calculated from the known composition of the samples, sucrose being determined by Clerget's method and invert sugar by cupric reduction. The influence of a rise of temperature of 1° C. may be calculated by multiplying the percentage of sucrose by — 0.0003 and adding to the product one-half of the invert sugar multiplied by + 0.00812. Any difference between the observed and calculated values may be attributed to the fact that the reducing sugars present do not always consist of equal parts of dextrose and levulose. As a general rule it was found that when the direct polarisation reached 83—84° Ventzke, the readings at higher temperatures were lower than those at lower temperatures, but with polarisations below these values, the readings at higher temperatures were either equal to or higher than those at lower temperatures. The point at which the variation due to levulose compensates that due to the sucrose is, however, not fixed but depends on the general composition of the sample.—J. F. B.

Sugar in fresh or exhausted cossettes: *Determination of* ——. by H. Pellé's aqueous digestion method, using the Sachs-Le Docte procedure with hot digestion. A. Le Docte. Bull. Assoc. Chim. Sucr. et Dist., 1909, 27, 180—190.

THE procedure is substantially the same as the modified Sachs-Le Docte method of hot aqueous digestion recently described by Herzfeld (this J., 1909, 846). The author, however, uses tinned copper beakers. The contrivance used to prevent loss of water by evaporation during heating, consists of a metal rim fitted with a rubber envelope, the whole being placed on the beaker as shown in the figure. The amount of water lost during the digestion is quite negligible. A rectangular water-bath, capable of holding six beakers, is employed; this bath is provided with an outer overflow trough and a gauge. The latter is provided with an upper mark corresponding to the height of the bath, and a lower mark indicating the height



at which the water should stand in order that the bath may be full when the beakers are introduced. The bath is also provided with a cover and the beakers are placed in orifices in the latter. Experiment has shown that digestion for 20–25 minutes at 80° C. without any stirring either before or during heating, suffices for complete diffusion; to insure absolute certainty, the author heats the mixture for 30 minutes. The following method of working renders any attention during digestion quite unnecessary:—The water in the bath is heated to boiling, the cover, with the beakers suspended from it, is then placed on the bath, and the source of heat is removed. With a laboratory temperature of 15°–20° C., the bath cools to about 75°–80° C. in 30 minutes; the conditions requisite to produce this fall of temperature are easily determined by trial. The cover and beakers are then transferred to a double-bottomed refrigerating bath containing cylindrical compartments for the reception of the beakers. The current of cooling water is distributed from the space below the false bottom through each cylinder and overflows from the top of the bath; if the cooling water is at 15° C., the contents of the beakers may be cooled to 17°–18° C. in 7–8 minutes. A similar bath is used for digestion if it is desired to effect the heating with a current of hot water which should be maintained at a temperature of 80°–82° C. After cooling, the beakers are shaken before removing the covers; the contents are then filtered and polarised. The weights of the material employed are (for the German saccharimeter): 26 grms. of fresh cossettes or 61 grms. of exhausted cossettes. The material is digested as above described with 177 c.c. of a mixture of water and basic lead acetate solution (containing 5–6 c.c. of the latter) and a 400 mm. tube is used for the polarisation; in the case of the exhausted cossettes, the reading is divided by 2.—L. E.

Sugar-house products; Influence of the non-sugars on the determination of the dry substance in —. V. Staněk. Z. Zuckerind. Böhm., 1909, 34, 5–20.

In the determination of the amount of dry substance in sugar-house products, the most serious errors are those due to the presence of non-sugar substances. With a view to discovering to what extent the presence of various non-sugar substances vitiates the results of such determinations, the author has made experiments with formate, acetate, butyrate, lactate, and glutamate of sodium, with formate, acetate, lactate, and glutamate of potassium, and with betaine. Solutions of these substances of various, known concentrations were prepared and used for determinations of (1) the degrees Balling of the density at 17.5° C., (2) the percentage of dry substance from the refractive index at 20° C., and (3) the percentage of dry substance by heating the solution, mixed with sand, to 102° C. until the weight was practically constant. The results obtained by the piconometric and refractometric methods differed widely from the actual percentages in many cases. Thus, amounts ranging from 44 per cent. (betaine) to 162 per cent. (sodium formate) of the actual quantity of substance were found from the determination of densities of 5 per cent. solutions; with the refractometric method, amounts ranging from 72 per cent. (potassium formate) to 128 per cent. (sodium glutamate) of the actual quantity of substance were found in 5 per cent. solutions. Of course, in mixtures of non-sugar substances positive and negative errors

would counteract each other more or less. With most of the non-sugar substances, piconometric determinations give high results, whilst with the refractometric method, the reverse is the case. Since, however, the examination of sugar-house products and of the mixtures of non-sugar substances present in molasses waste liquors by the refractometric method, yields lower results than those obtained by the gravimetric method, it must be concluded that such materials contain a considerable quantity of an unknown substance of high refractive index. By both physical methods, higher results are obtained with the sodium salts than with the potassium salts of organic acids. In all cases, contraction, which varies with different non-sugar substances, occurs on dilution; the results appear to indicate also that other changes occur on dilution, perhaps in the specific refraction of the non-sugar substances. The non-sugar substances investigated can be freed from water by drying in an air-oven at 102° C.; betaine is thereby converted into the lactone. Salts of volatile organic acids are slightly dissociated on drying, and yield traces of carbonates. It may be presumed that the behaviour of the non-sugar substances on drying would be affected by the presence of large quantities of sucrose; the author proposes to deal with this subject later.—L. E.

Sucrose and other sugars; New, sensitive reaction for —. E. Pozzi-Escot. Bull. Assoc. Chim. Sucri. et Dist., 1909, 27, 179–180.

One c.c. of a 5 per cent. solution of ammonium molybdate, and 2 c.c. of the solution under examination, are placed in a test-tube and 10–12 c.c. of sulphuric acid are carefully poured down the side of the tube. If the solution contains more than 0.0005 grm. of sucrose, a blue ring appears in less than 20 minutes at the junction of the acid and the aqueous solution. If the coloration does not appear, the upper part of the tube is heated until the liquid just boils but no longer, and in less than 30 minutes the blue ring appears; in this way, 0.00002 grm. of sucrose gives a distinct reaction. The author proposes to show shortly that the reaction may be used to distinguish different sugars.—L. E.

Malt sugar [maltose]; Action of Fehling's solution on —. W. L. Lewis. Amer. Chem. J., 1909, 42, 391–319. (See this J., 1908, 31.)

The mode of procedure was as follows:—Solutions of barium hydroxide (181 grms. of crystallised barium hydroxide in 750 c.c. of water), copper sulphate (95.6 grms. of hydrated salt in 300 c.c.), and maltose (24 grms. of hydrated maltose in 70 c.c.), were heated to boiling. The unfiltered barium hydroxide solution was added slowly, and with shaking, to the copper solution, the hot solution of maltose being similarly added to the mixture. The whole was heated, with occasional shaking, in boiling water for an hour, during which time complete reduction was effected. The quantity of maltose used was just sufficient to reduce practically the whole of the copper under these conditions. The nature and proportions of the products were then determined; the carbon dioxide was determined in independent experiments in which a solution of 46.1 grms. of sodium hydroxide in 400 c.c. of water was substituted for the barium hydroxide solution previously mentioned. A total quantity of 135.8 grms. of anhydrous maltose yielded: carbon dioxide, 10.6; formic acid, 4.74; non-volatile gums consisting chiefly of glucoside-acids, 132.8 grms. On hydrolysis, the latter yielded 47.5 grms. of dextrose and 82.35 grms. of non-volatile acids, including: oxalic acid, 0.35; glycollic acid, 3.92; *D*-mannonic lactone, 30.25; and a new hexonic acid (most probably α -hydroxymethyl-*D*-ribonic acid), 10.5 grms. The nature of the remaining 37 grms. of acids was not established. The proportions of the various acids (especially formic and carbonic acids) differ markedly from those observed by Nef in the case of dextrose, levulose, and mannose respectively (*loc. cit.*), and whilst these hexoses were found to yield large amounts of glyceric and trihydroxybutyric acids, the author has not established, with certainty, the presence of any monobasic acids containing 3 or 4 atoms of carbon

in the products from maltose. It is certain also, that oxidation of maltose by Fehling's solution is not accompanied by any very appreciable hydrolysis into two molecules of dextrose, the main oxidation products being glucosido-monobasic acids. According to the author's experiments, it is extremely probable that only two hexonic acids, *viz.*, *d*-mannonic and α -hydroxymethyl-*d*-ribonic acids, are obtained in the hydrolysis of the glucosido-acids formed by the action of Fehling's solution on maltose. "In that case, both acids must be formed by an asymmetric benzilic acid rearrangement from 1,2-maltosone and 2,3-maltosone respectively." "1,2-*d*-Glucosone which must be the common intermediate product when dextrose, levulose, and *d*-mannose are oxidised by Fehling's solution, gives, on the other hand, by a partial asymmetric benzilic acid rearrangement, mainly *d*-gluconic acid and only small amounts of *d*-mannonic acid" (*ibid.*). The author has made preliminary experiments on the behaviour of barium hydroxide on *d*-maltosone and *d*-glucosone which tend to confirm these conclusions with regard to the formation of hexonic acids from maltose and the hexoses in question, but further work is necessary to obtain decisive results.—L. E.

Siris. D. Hooper. Ann. Rept. Indian Museum, Industrial Section, 1908-9, 16.

Siris or *sirish* is a yellowish powder consisting of the roots of *Eromurus aucherianus*, a plant of the lily family. It has a sweetish taste like that of liquorice root. It possesses the property of forming an adhesive vegetable glue with water, and is employed for moulding into vessels for containing oil. Its composition is as follows:—moisture, 9.75; sugar, etc., 49.50; mucilage, 45.17; albumin, 5.93; fibre, 12.00; and ash, 7.65 per cent.—E. W. L.

Sugar production in 1907-8. Monit. Off. du Commerce, Oct. 14, 1909. [T.R.]

The total sugar production of Europe during the season 1908-9 is estimated at 6,487,000 metric tons, as compared with 6,562,000 tons in 1907-8. This amount is distributed among the various producing countries as follows:—

	1907-8.	1908-9.
	Metric tons.	Metric tons.
France.....	727,712	785,000
Germany.....	2,129,597	2,060,000
Austria-Hungary.....	1,424,657	1,400,000
Russia.....	1,410,000	1,275,000
Belgium.....	232,352	255,000
Holland.....	175,184	212,000
Other countries.....	462,772	500,000
Total.....	6,562,274	6,487,000

Metric ton=2,204.6 lb.

The production of cane and beet sugar in extra-European countries is estimated at 7,765,500 metric tons in 1908-9 as against 7,349,381 tons in 1907-8. Thus the total production of sugar during the 1908-9 season was about 14,252,500 metric tons, as compared with 13,911,655 tons in 1907-8.

PATENTS.

Sugar; Art of making — S. von Grabski, Kruschwitz, Germany. U.S. Pat. 934,965, Sept. 21, 1909.

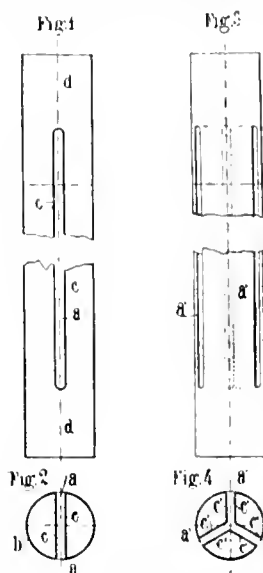
BETTER chips are dried by means of hot lime-kiln gases, from which mechanical impurities have been removed. The gases are then freed from the moisture absorbed from the chips, and utilised in the carbonatation process.—W. P. S.

Saccharine juices; Process for sulphitating and desulphitating — and its applications to various fermentation industries. E. A. Barbet. Sixth Addition, dated July 18, 1908, to Fr. Pat. 361,869, Oct. 27, 1905 (this J., 1906, 1229; 1907, 109, 708, 1250; 1908, 826, 953).

THE juice is heated, prior to desulphitation, by passage through a coil heated by waste steam; at a certain stage

of its descent through the desulphitating column, the juice passes out through a pipe to another heating coil and thence back to the desulphitating column at a stage lower than that at which it left. The perforated plates of the desulphitating column, and the heating and refrigerating coils, are so constructed that only a small quantity of liquid is under treatment at a given time. The desulphitating column consists of cement (reinforced or not), and is made in one piece or built of rings. The desulphitation is carried out under reduced pressure, the amount of air introduced being controlled by a special mercury regulator. A current of air, sterilised by filtration through cotton wool, is injected into the desulphitated and cooled juice, and the latter subsequently passes to the airating column described in the fourth addition (*loc. cit.*, 1908, 826).—L. E.

Juice boilers for sugar or other industries. H. Degroise. Fr. Pat. 401,492, April 1, 1909.



THE tubes of the tubular heaters are slit longitudinally as shown at, *a, a'*, and the edges of the slits are joined by walls, *c, c'*, so that the tubes are divided into two or three compartments in order to increase the heating surface. The slits do not extend to the ends, *d*, of the tubes which are expanded into the tube plates.—W. H. C.

Diffusion; Process and apparatus for continuous — K. Abraham. Fr. Pat. 401,818, April 7, 1909. Under Int. Conv., April 9, 1908.

THE cosettes previously heated to 70–90° C., *e.g.*, by admixture of hot juice, are carried, *e.g.*, by a screw conveyor in a network casing, to the lower, conical, fixed part of a vertical diffuser. This part of the diffuser is provided with sieves through which the descending juice passes to a chamber or chambers bounded on one side by the sieves. Sufficient space is left between the wall of the diffuser and the sieves for the cosettes to pass into the upper part of the diffuser which is kept slowly rotating. As the cosettes ascend, they slowly acquire the rotatory motion and become uniformly distributed. Water (preferably heated to 50° C.) is introduced at the top of the diffuser in quantity nearly sufficient to fill the latter. The juice is drawn off from the above-mentioned chambers by cocks, the latter serving to control the circulation of the juice. The cosettes which leave the top of the diffuser are then expressed; the press-water, or the press-water mixed with molasses, may be introduced by means of a funnel into the diffuser at such a depth below the surface that its sugar-content is equal to that of the juice at that depth. The juice which drains through the conveyor casing passes into a back, and thence, together with the juice

from the bottom of the diffuser, through a reheater, to be mixed, afterwards, with fresh cossettes. The juice which overflows from the back passes to the saturators; if desired, the juice from the bottom of the diffuser may be sent to the saturators direct. Both the juice that goes to the reheater, and that which goes to the saturators, should be freed from pulp; the latter, after admixture with a little juice, is pumped into the lower part of the diffuser.—L. E.

Sugar juices, etc.; Process for the purification of — by means of hydrofluosilicic acid. Soc. Civile des Brevets du A. Schoonjans. Ger. Pat. 213,126, Sept. 26, 1907.

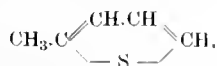
THE content of potassium combined with organic acids present in the sugar juice is first determined in a small portion, for example, by precipitation with tartaric acid, and then the juice is treated with a quantity of hydrofluosilicic acid sufficient only to precipitate this portion of the potassium. It is claimed that in this way the precipitate produced is of a crystalline form and filters readily. The potassium salts of inorganic acids left in the juice are said to have no injurious influence on the crystallisation of the sugar.—A. S.

Dextrine, gum, starch, or like materials; Manufacture of —. C. Hervey, Salford. Eng. Pat. 20,484, Sept. 29, 1908.

THIS invention relates to the manufacture of dextrin, gum, starch, etc., from farinaceous or mealy substances. The raw material is mixed with only a sufficient quantity of salt solution or salt and acid (mineral or organic acid or acids) solution to render it damp; e.g., 1 ton of raw material is mixed with a solution of 20 lb. of sodium chloride in about 20 gallons of water. The mixture is powdered and graded in a dressing machine, and the fine powder is then submitted to the action of an electric current until the desired degree of conversion is attained, the product finally being passed through another dressing machine.—L. E.

Carbohydrates into hydrocarbons; Process for converting —. A. Heinemann, London. Eng. Pat. 13,252, June 22, 1908.

CARBOHYDRATES are converted into levulinic acid, $\text{CH}_3\text{CO}\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{COOH}$, by treatment with dilute sulphuric or hydrochloric acid. When this is heated to $130^\circ\text{--}140^\circ\text{C}$. with $1\frac{1}{2}$ parts of phosphorus trisulphide, thiitolene,



distils over. Instead of phosphorus trisulphide, sulphur, hydrogen sulphide, or alkali or other sulphides may be used. If phosphorus pentasulphide is used, hydroxythiitolene is produced; this is converted into thiitolene by reduction. The thiitolene is now passed, together with hydrogen or water-gas, through a tube containing finely-divided metal (e.g., copper or nickel), heated to $300\text{--}500^\circ\text{C}$., when the sulphur is eliminated and methylbutine, C_5H_8 , or $\text{CH}_2\text{C}(\text{CH}_3)\cdot\text{CH}:\text{CH}_2$, is produced. When a temperature above 500°C . is employed, the polymer, $\text{C}_{10}\text{H}_{16}$, is formed.—T. F. B.

Sugar; Process for making — [synthetically]. C. P. Stewart, Assignor to National Sugar Co., Los Angeles, Cal. U.S. Pat. 935,942, Oct. 5, 1909.

SEE Fr. Pat. 381,292 of 1907; this J., 1908, 171.—T. F. B.

Amorphophallus; Method of making insoluble in water the [mucilaginous] root substances of various kinds of —. Mertens und Co., and H. Jerosch, Charlottenburg, and H. Lyneke, Berlin. Eng. Pat. 18,493, Sept. 3, 1908.

SEE Fr. Pat. 393,426 of 1908; this J., 1909, 103.—T. F. B.

Purifying gums, gum resins, etc. Eng. Pats. 20,529 and 6917. See XIII.B.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt; Proteolytic enzyme of —. P. Schudrowitz. J. Inst. Brewing, 1909, 15, 592–595.

THE author has determined, by the method previously described (this J., 1903, 958), the proteolytic capacities of a number of malts, prepared under known conditions from barleys of known origin of the season 1904. A table is given showing the values obtained, together with the other analytical numbers for the malts. In general, the proteolytic capacities show a much smaller range than do the corresponding diastatic powers, probably owing to the fact that the proteolytic enzyme is of a much more sensitive nature than diastase. At the same time there are a number of cases in which the figures for proteolytic capacity appear to give useful hints which are not afforded by the figures for diastatic power.—T. H. P.

Yeast; A new method for purifying infected —. G. Thevenot. Amer. Brew., 1909, 8, 397. Z. Spiritusind., 1909, 32, 461.

THE researches of Hemeberg on the purification of infected yeast by washing in antiseptics have been continued by the author who finds that dilute sulphuric acid yields the best results. Very small quantities of the acid destroy bacteria while notably larger concentrations are necessary to affect yeast cells. In practice the author prefers to use a solution of ammonium persulphate which yields by hydrolysis, ammonium sulphate, sulphuric acid and free oxygen. 75–100 lb. of yeast are diluted with an equal weight of water containing 1 lb. of ammonium persulphate; after standing over night the liquid is drawn off and the yeast washed with water.—R. L. S.

Dextrose, mannose, and fructose; Fermentation of — by yeast-juice. A. Harden and W. J. Young. Roy. Soc. Proc., 1909, 81B., 336–347.

THE results communicated previously by the authors (this J., 1906, 490 and 1111; 1908, 870) were obtained exclusively with dextrose. In the present paper an account is given of the behaviour of mannose and fructose towards yeast-juice both in the presence and absence of added phosphate. Buchner examined the fermentation of fructose by yeast-juice and found that it proceeded at precisely the same rate as that of dextrose, but no experiments with mannose appear to have been performed. The fructose employed in the authors' experiments was Kahlbaum's fructose prepared from inulin. The mannose was prepared by the hydrolysis of ivory-nut and was purified by conversion into the phenylhydrazone, which was recrystallised from hot water and was finally decomposed by benzaldehyde in the usual manner. All the experiments were carried out at a temperature of 25°C . in the presence of toluene. The results of the investigation show that mannose behaves towards yeast-juice, both in the presence and absence of added phosphates, in the same manner as does dextrose. Fructose resembles dextrose and mannose in its behaviour towards yeast-juice, but in the presence of phosphates it is much more rapidly fermented than the other sugars, and the optimum concentration of phosphate is much higher. Fructose has the property of inducing rapid fermentation in the presence of yeast-juice in solutions of dextrose and mannose containing such an excess of phosphate that fermentation otherwise proceeds very slowly. This property, taken in connection with the facts that fructose is rapidly fermented in the presence of phosphate, and that the optimum concentration of phosphate for fructose is much higher than for dextrose or mannose, appears to indicate that fructose when added to yeast-juice does not merely act as a substance to be fermented, but, in addition, bears some specific relation to, or actually forms a permanent part of, the fermenting complex. No similar property is possessed by dextrose or mannose. W. P. S.

Brewing waters; Determination of gypsum and other salts in treated —. H. F. E. Hulton and F. E. Day. Brewers' J., 1909, 45, 620.

By determining the sp. gr. of solutions of gypsum of various concentrations the authors find that the increase

of sp. gr. is exactly proportional to the amount of gypsum in solution, which amount can be ascertained by the use of an appropriate factor. Each grain of dissolved gypsum per gallon corresponds with an increase in sp. gr. of 0.0114 of a degree (water—1000) so that by multiplying the difference in sp. gr. of the treated and untreated waters by 1.0-0.114, or 88.1, the number of grains of gypsum which have been dissolved in each gallon of water is obtained. The method may be applied to the determination of added salts other than gypsum, and the following factors are given for obtaining the number of grains per gallon of various salts: calcium carbonate, 44; crystallised magnesium sulphate, 135; anhydrous magnesium sulphate, 66; anhydrous sodium carbonate, 64; sodium chloride, 100; anhydrous sodium sulphate, 73; potassium sulphate, 85; potassium nitrate, 111.

—W. P. S.

Wine: Phosphoric compounds in —, P. Carles. Bull. Soc. Chim., 1909, 5, 962—969.

THE author has determined in a number of Gironde wines, the total phosphoric acid and the amount present as inorganic phosphate, the difference between these amounts giving the phosphoric acid combined with organic compounds. The majority of the wines examined contained phosphoric acid in both forms. Contrary to the generally accepted view that the organic phosphate is present as lecithin, the author's experiments indicate that more probably it is present as potassium or calcium glycerophosphate. Normally the organic phosphate corresponds to about one-tenth of the total or one-fifth when calculated as glycerophosphate. In the Gironde red wines the amount of phosphoric acid as inorganic phosphate varies from 0.59 to 0.235 gm. per litre, that as organic phosphate from 0.13 to 0.005 gm. The white wines contain 0.6 to 0.10 gm. of phosphoric acid present as inorganic phosphate per litre and up to 0.05 gm. as organic phosphate. The maximum of inorganic acid is found in the red "palus" wines grown on the old alluvial soils of the Garonne and in the White Sauternes; the red "palus" wines also contain most organic phosphate, but the amount is very variable. The phosphoric acid content of the Gironde wines deserves consideration in connection with their physiological value.—E. F. A.

Salicylic acid: Determination of — in wine, W. D. Bigelow. U.S. Dept. of Agric. Bull. No. 122, 1909, 64—67.

AFTER carrying out a number of experiments with different solvents for the extraction of the salicylic acid, the author recommends the following method for the determination of salicylic acid in wine. One hundred c.c. of the sample are acidified with 5 c.c. of sulphuric acid (1:3), 50 c.c. of either carbon tetrachloride or toluene are added, the mixture is gently but thoroughly mixed, and the solvent separated by centrifugal action. Twenty-five c.c. of the solvent are then transferred to a weighed flask, the solvent is allowed to evaporate spontaneously, and the residue is weighed. The residue is then dissolved in alcohol, and titrated with $N/100$ barium hydroxide solution; each c.c. of this solution corresponds with 0.00138 gm. of salicylic acid. This gravimetric and volumetric determination was found to be the more accurate when the amount of salicylic acid present was not less than 0.025 gm. per 100 c.c. With smaller quantities it was found to be better to dissolve the residue of salicylic acid in alcohol, and determine the quantity colorimetrically with ferric chloride, after diluting the alcoholic solution with water.—W. P. S.

Wine vinegar bacteria, A. J. Perold. Zentralbl. Bakt., n. Parasitenk., 1909, II. Abt., 24, 13—55. Chem. Zentr., 1909, 2, 1364.

THE results of the author's investigations of wines of different origin show that each type of wine contains a distinct kind of acetic bacteria. Sweet wines of high gravity contain acetic bacteria which are powerful producers of acid, whilst the lighter Mid-European wines contain acetic bacteria which are less active in this respect. It was not found possible to isolate two different kinds of acetic bacteria from one wine. The proportions of

alcohol required to prevent the souring of the wines are different for the different kinds of bacteria, amounting to as much as 15.5—16 per cent. by volume in the case of the bacteria of sweet wines of high gravity.—A. S.

Spirits: Methods of analysis of distilled —, L. M. Tolman and W. E. Hillyer. U.S. Dept. of Agric., Bull. No. 122, 1909, 206—212.

A FEW modifications of some of the methods adopted by the Association of Official Agricultural Chemists (U.S.A.) are suggested, the alterations mentioned having been found to be of value.

Determination of colouring matters.—Fifty c.c. of the whiskey are evaporated to dryness, the residue is dissolved in 26.3 c.c. of 95 per cent. alcohol and diluted to a volume of 50 c.c. with water. Twenty-five c.c. of this solution are placed in a separating funnel and mixed with 20 c.c. of a solution consisting of 100 c.c. of amyl alcohol, 3 c.c. of syrupy phosphoric acid and 3 c.c. of water. The mixture is agitated and allowed to separate three times successively, the aqueous layer being then drawn off and diluted to a volume of 25 c.c. with 50 per cent. alcohol. The coloration of this solution is then compared in a colorimeter with that of the remaining 25 c.c. which have not been treated with the amyl alcohol mixture, the percentage of colour insoluble in amyl alcohol being thus obtained, that is to say, curand can be separated from the natural colouring matter of the whiskey. The natural colouring matter can also be determined by evaporating 50 c.c. of the sample to dryness, taking up the residue with 15 c.c. of water, filtering the solution, and washing the filter until the filtrate measures nearly 25 c.c. About 26.3 c.c. of 95 per cent. alcohol are then added to the filtrate, and the volume is made up to 50 c.c. by the addition of water. The colour of this solution is then compared with that of the original sample, the reading, subtracted from 100, giving the percentage of natural colouring matters.

Determination of fusel oil.—A few modifications in the Allen-Marquardt method (see Schidrowitz, this J., 1902, 815) are suggested. In the extraction part of the method the carbon tetrachloride used should be of the highest purity, and two washings with sodium sulphate solution are considered to be necessary in order to remove all sodium chloride from the carbon tetrachloride extract. The oxidising part of the process is carried out as follows:—Exactly 50 c.c. of a solution, prepared by adding 200 c.c. of concentrated sulphuric acid to a solution of 200 grms. of potassium bichromate in 1800 c.c. of water, are added to the carbon tetrachloride solution of the higher alcohols and the mixture is boiled gently for 8 hours under a high reflux condenser. The mixture is then transferred to a separating funnel, and the bichromate solution is separated from the carbon tetrachloride. The latter is washed free from bichromate, and the total bichromate solution and washings are collected in a 500 c.c. flask and diluted to the mark with water. Two hundred c.c. of this solution are then treated with 50 c.c. of potassium iodide solution (100 grms. of the salt to 100 c.c. of water), 50 c.c. of approximately $\frac{3}{4}N$ -sodium thiosulphate solution, and 20 c.c. of concentrated hydrochloric acid. The excess of bichromate is then titrated with $N/10$ sodium thiosulphate solution. A blank determination is carried out at the same time, starting at the point where the carbon tetrachloride is washed with sodium chloride. The difference in the number of c.c. of $N/10$ thiosulphate solution used in the actual determination and in the blank corresponds with the amount of fusel oil present. Each c.c. of $N/10$ thiosulphate solution is equivalent to 0.001773 gm. of amyl alcohol, in terms of which the fusel oil may be expressed. This factor was obtained by actual experiments with amyl alcohol.—W. P. S.

Fusel oil: Determination of — by alkaline permanganate, A. S. Mitchell and C. R. Smith. U.S. Dept. of Agric., Bull. No. 122, 1909, 199—205.

THE authors have worked out the conditions necessary to produce definite oxidation of the various higher alcohols by alkaline potassium permanganate solution, and suggest the following process for the determination of the higher alcohols obtained in the carbon tetrachloride

extract from distilled spirits. This carbon tetrachloride solution of the alcohols, obtained as in the Allen-Marquardt process (see Schidrowitz, this J., 1902, 815), is placed in a separating funnel, 10 c.c. of potassium hydroxide solution (1:1) are added, and the mixture is cooled to a temperature of approximately 0° C. Exactly 100 c.c. of a 2 per cent. potassium permanganate solution are placed in a flask and also cooled to 0° C., the bulk of this solution being then added to the contents of the separating funnel. The funnel is now removed from the ice-bath, its contents are shaken for 5 minutes, and allowed to stand for 30 minutes, during which time the mixture attains the ordinary temperature. One hundred c.c. of hydrogen peroxide solution of a strength slightly in excess of the permanganate solution are next placed in a 1-litre Erlenmeyer flask, 100 c.c. of 25 per cent. sulphuric acid are added, and the contents of the separating funnel are then run in gradually with constant shaking. The funnel and the flask containing the residue of the permanganate solution are rinsed with water and the washings are added to the peroxide solution. The excess of hydrogen peroxide is then titrated with an accurately standardised potassium permanganate solution containing about 10 grms. of the salt per litre. A control experiment is run at the same time, using the same amounts of the various solutions. One gm. of potassium permanganate is equal to 0.475 gm. of propyl alcohol, or 0.585 gm. of isobutyl alcohol, or 0.696 gm. of amyl alcohol. Consequently, the difference in the amount of permanganate consumed in the two determinations, expressed in grms. and multiplied by 0.696, gives the quantity of alcohols present in terms of amyl alcohol.—W. P. S.

Formation of hydrocyanic acid from ammonia and wood charcoal and from di- and trimethylamine. [Utilisation of nitrogen of vinasse.] Voerkelius. See VII.

Industrial fermentation of beetroot juice. Gentil. See XVI.

ERRATUM.—This J., 1908, page 515, column 2; line 33 from bottom for "Calcium" read "Sodium."

PATENTS.

Malt; Process of saccharifying —. C. Schwensen and W. Lazarus, Kiel, Germany. Eng. Pat. 19,212, Sept. 12, 1908.

THE mash is saccharified at a temperature of from 30° to 75° C. and the wort is separated and filtered through the husks until it is perfectly clear. The residue of husks is then heated under pressure to a temperature of from 110° to 200° C. until the starch remaining in the residue is opened up. After cooling to 70° C. it is mixed with a part or the whole of the clear wort obtained in the first operation, and the saccharifying process is carried to completion, with or without increasing the temperature. The opened-up starch in the residue of husks may be saccharified by means of a specially prepared malt extract when it is desired to manufacture beer containing a large quantity of dextrin.—W. P. S.

Malt; Apparatus for making —. G. J. Meyer, Buffalo, N.Y. U.S. Pat. 936,011, Oct. 5, 1909.

THE malting apparatus comprises an upright rectangular malting chamber, having perforated side inlet and outlet walls and perforated end walls, and adapted to contain a body of grain; also means for causing a current of air to flow through the chamber and body of grain, the chamber having inoperative portions adjacent to the corners between its air-outlet wall and its end walls. Another form of the apparatus has an inlet at its upper end and an outlet at its lower end and a vertically movable "follower" arranged in the lower part of the chamber operating to open and close the outlet.—J. F. B.

Refrigerators and the like, particularly for use in brewing. M. Dand, Steyning, Sussex, and Lawrence and Co., Ltd., London. Eng. Pat. 20,045, Sept. 23, 1908.

THE refrigerator consists of two vertical corrugated cooling surfaces mounted in a frame so that a narrow channel is

formed between them. The cooling liquid flows upwards through this channel. The wort or other liquid is introduced at the top of the apparatus and is spread over the corrugated surfaces by means of a horizontal perforated pipe and a perforated channel. After flowing down the corrugated surfaces the liquid is collected in a trough; to prevent "fobbing," the liquid does not flow directly into the trough but passes over inclined plates and then through a narrow space between the plates and the sides of the trough. The whole apparatus is enclosed by means of hinged, sliding or other type of doors so as to render the refrigerator germ-proof, this arrangement, together with the "anti-fobbing" plates, being the main object of the invention.—W. P. S.

Beer; Method of de-alcoholising —. F. J. Prihyl, Uniontown, Pa. U.S. Pat. 935,814, Oct. 5, 1909.

BEER containing carbonic acid gas and alcohol is heated and sprayed to remove the carbon dioxide. This gas is collected and stored in a separate vessel. The de-carbonated beer is then heated to a temperature of 150° F. and again sprayed to volatilise the alcohol. The de-alcoholised beer is cooled and re-impregnated with the gas previously withdrawn from it, together with a further quantity of gas derived from a newly brewed beer.—J. F. B.

Wines and fermented liquids; Process for sulphiting — with known quantities of sulphur dioxide. J. Laborde. First Addition, dated March 12, 1909, to Fr. Pat. 360,838, Dec. 11, 1905 (this J., 1906, 491).

THE present addition relates to improvements in the design of the bottle holding the liquefied sulphur dioxide. This is made of stout glass and graduated to show the dose contained. The present bottle is more easily charged, and is closed with a rubber stopper, through which passes a tube which is clamped in position by screws and which carries on its extremity the metallic capsule which seals the bottle. The cage, which holds the bottle and the pick for piercing the capsule, has perforated walls through which the gas escapes and is distributed in the form of small bubbles.—J. F. B.

Distilling and rectifying apparatus; Auxiliary plate-chamber for —. R. Vallat. Fr. Pat. 401,001, March 6, 1909. Under Int. Conv., Aug. 10, 1908.

THE arrangement described is intended to be fitted externally round the upper plates of any distilling or rectifying column, and consists of an annular plate chamber, fitted with scrubbing-caps and heating coil. The connection is made in such a manner that the purified spirit coming from the top of the column is caused to undergo a supplementary rectification in the external chamber before it can pass to the condenser, the feints produced in this chamber being returned to the next lower plates of the main column.—J. F. B.

Alcoholic liquids; Distillation and rectification of —. V. Slavicek, Vienna. Eng. Pat. 21,068, Oct. 6, 1908.

SEE Fr. Pat. 391,919 of 1908; this J., 1909, 377.—T. F. B.

Fermented beverages; Process of manufacturing —. E. W. Kuhn, London. U.S. Pat. 936,328, Oct. 12, 1909.

SEE Eng. Pat. 4622 of 1908; this J., 1908, 826.—T. F. B.

Malt kiln. R. Roth, Erfurt, Germany. U.S. Pat. 936,947, Oct. 12, 1909.

SEE Eng. Pat. 5409 of 1909; this J., 1909, 1057.—T. F. B.

Sulphitating and desulphitating saccharine juices. Addition to Fr. Pat. 361,869. See XVI

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(1.)—FOODS.

Cows' milk; The presence of an anaerobase and a catalase in —. J. Sarthou. J. Pharm. Chim., 1909, 30, 350—351.

BORDAS and Touplain have recently published (this J., 1909, 538) the results of an investigation on the presence of catalases and peroxydases in milk, and they come to the conclusion that the reactions pointing to the presence of these enzymes are, in reality, due to the catalytic action of calcium caseinate. The author does not agree with this opinion, and, in confirmation of the actual presence of catalytic enzymes in milk, draws attention to the anaerobase, discovered by Raulnitz, Dupouy, Gilley, etc., which only produces a coloration with *p*-phenylenediamine in the presence of hydrogen peroxide, and to the catalase discovered by Sarthou, Rullmann and Reiss; this catalase decomposes hydrogen peroxide without yielding a coloration with *p*-phenylenediamine, guaiacol, etc.—W. P. S.

Butter; Influence of acidity of cream on the flavour of —. L. A. Rogers and C. E. Gray. U.S. Dept. Agriculture, 1909, Bull. No. 119.

THE authors' experiments, which are described in detail, show that butter is liable to develop unpleasant flavours, even when stored at very low temperatures (-10°F), and that the amount of alteration increases with the acidity of the cream used in the preparation of the butter. No micro-organisms to which this more rapid deterioration of butter from highly acid cream could be attributed, were found either in the butter or the cream, and the agency of enzymes was excluded by the fact that heating the ripened cream did not check the occurrence of these changes. In the case of butter prepared from pasteurised cream acidified with various acids, there was a gradual development of unpleasant flavours, and from these results it would appear that the acid normally developed in milk by the lactic acid bacteria, or added in the form of pure acid to the cream, produces, or helps to produce, slow decomposition of unstable compounds in the butter. It is possible to make butter on a commercial scale from sweet pasteurised cream without the aid of a "starter," but to avoid too great a loss of fat, special attention must be given to the temperature and speed of churning. Fresh butter made in this way, shows much less change on storage than that made by the ordinary method, but as a rule the flavour of sweet-cream butter will be too mild for the average taste. Woody and other extraneous flavours are also more noticeable in such butter than in butter of a more pronounced flavour.—C. A. M.

Fat; Determination of — in the products of the pork butcher and in other substances containing water. G. Perrier. Ann. Chim. anal. appl., 1909, 14, 367—369.

TEN grms. of the sample are ground in a mortar with 3 to 4 grms. of coarse sand, and to the mixture 20 to 25 grms. of anhydrous sodium sulphate are added. After thorough mixing, the mass is allowed to stand for 30 minutes, and then transferred to a paper cartridge and extracted with anhydrous ether. The ethereal extract is evaporated, and the residue of fat dried.—C. A. M.

Wheat flour in rye flour; Modification of the Bamihl test for detecting —. A. L. Winton. U.S. Dept. of Agric., Bull. No. 122, 1909, 217—219.

THE test depends on the presence of gluten in wheat flour and the absence of considerable amounts of it in rye and other flours. The original test consisted in rubbing up a small quantity of the flour with water on a microscope slide by means of a cover glass, and noting under the microscope whether or not gluten strings or rolls are formed. The objections to the test are that the traces of gluten present in pure rye flour render it impossible to compare at a glance the amount found in pure rye flour with that from a suspected sample. The author's modi-

fication consists in employing a dilute solution of eosin in place of water and dispensing with the microscope entirely. The gluten absorbs the dyestuff and becomes very conspicuous. Parallel tests with pure wheat and rye flours should be carried out for the sake of comparison, and flours containing much bran tissue or coarse lumps should be sifted through bolting-cloth before applying the test.—W. P. S.

Starch in cocoa products; Determination of —. W. L. Dubois. U.S. Dept. of Agric., Bull. No. 122, 1909, 214—215.

THE following method is recommended as being rapid and accurate for the removal of fat and sugar from cocoa previous to the determination of the starch. Four grms. of the cocoa, or 8 grms. in the case of sweetened cocoa, are shaken in an 8-oz. flask with 100 c.c. of light petroleum until the material is completely disintegrated; the mixture is then subjected to centrifugal action, the clear petroleum spirit is drawn off, and the process repeated. This procedure removes practically all the fat, and the residue is then transferred to a flask and the hydrolysis and determination of the starch proceeded with in the usual way. The sugar is removed from sweetened cocoa by treating the fat-free residue with 100 c.c. of water, submitting the mixture to centrifugal action, and separating the clear aqueous solution. It may be necessary to filter the latter if the speed of the centrifugal machine is low. The process is repeated and the residue is transferred to the filter paper and washed with sufficient water to yield a filtrate of 500 c.c. The residue is then hydrolysed.—W. P. S.

Cinnamic acid; Detection of — in foods. W. D. Bigelow. U.S. Dept. of Agric., Bull. No. 122, 1909, 77—78.

THE method proposed is based on the fact that cinnamic acid is oxidised to benzaldehyde by dilute chromic acid mixture. One hundred grms. of the sample (ketchup, for instance) are mixed with 100 c.c. of water and 5 c.c. of sulphuric acid (1:5), and the mixture is extracted with three successive quantities (50, 25, and 25 c.c.) of chloroform. The chloroform extract is rendered ammoniacal and evaporated to dryness. The residue is dissolved in a small quantity of hot water, the solution filtered and evaporated to dryness, and the residue heated to boiling with 5 c.c. of dilute chromic acid mixture (1 part of dilute sulphuric acid saturated with potassium bichromate and 7 parts of water). The odour of benzaldehyde is most strongly developed when the mixture is cooled until sulphuric acid fumes are no longer apparent. The test will detect the presence of 0.025 gm. of cinnamic acid in 1 kilo. of substance. The reaction is also given by cinnamic aldehyde.—W. P. S.

Nuts yielding Borno tallow. Beadle and Stevens. See XII.

Sulphite wood-pulp waste liquors [as a feeding stuff]. Stutzer. See XIX.

Fertilisers and feeding stuffs (Methods of Analysis) Regulations. See XV.

PATENTS.

Whole-milk; Method of and means for warming — before pasteurising. C. A. Carlson, Stockholm. Eng. Pat. 24,239, Nov. 11, 1908.

THE whole-milk is placed in a reservoir from which it is raised by means of a pump into a closed vessel, which delivers it to the pasteuriser. A portion of the milk, however, flows from the closed vessel and over a spiral tube, in which gas is compressed by means of a force pump. The milk absorbs the heat generated by the compression of the gas and is then conducted back again to the main reservoir. Another portion of the milk is circulated round the force-pump and returned to the reservoir; in this way the temperature of the whole-milk is raised before the latter passes to the pasteuriser.—W. P. S.

Milk; Preserved —. T. B. Wagner, Chicago, U.S. Pat. 934,641, Sept. 21, 1909.

THE preserved milk is prepared by condensing a mixture of milk and crystallised dextrose. It is free from objectionable sweetness, is readily soluble in water, and may be kept indefinitely without undergoing change.—W. P. S.

Flour moths; Process for destroying —. W. Roeder, Hanover, Germany. Eng. Pat. 11,353, May 13, 1909.

TURPENTINE, or a mixture consisting of turpentine, 80, linseed oil, 10, and poppyseed oil, 10 per cent., is allowed to evaporate in the rooms or spaces in flour mills for the purpose of killing flour moths. The turpentine or the mixture may be applied to a suitable material, such as woollen waste, which is then hung up in the rooms or attached to the inner sides of the valves of the pipes, to the underside of the covers of the collecting and mixing receptacles, etc.—W. P. S.

Fermentation apparatus [for bakers' use]; An automatic —. A. J. Durand. Fr. Pat. 401,471, March 25, 1909.

THE apparatus consists of three cylindrical vessels of different diameters. The smallest cylinder which contains the dough stands inside the largest vessel, which is only about one-third of the height of the first; the annular space between them contains water. The third cylinder, which is 1 cm. taller than the first, is inverted over this, and resting on the bottom of the largest, constitutes a water-seal over the fermentation vessel of the nature of a gasometer. The top of the inverted cylinder has a double wall, so that the cylinder containing the dough is surrounded on all sides by an insulating envelope. The inverted cylinder has holes in its sides at a convenient height so that an automatic regulation of the pressure takes place when the accumulation of gas becomes sufficiently great to raise the holes above the water-seal. Fermentation thus takes place in a closed vessel, insulated from variations of temperature, and the automatic regulation of the pressure simultaneously regulates the temperature of the mass.—J. F. B.

Coffee free from caffeine; Process of obtaining —. K. H. Wimmer, Bremen, Germany. U.S. Pat. 936,392, Oct. 12, 1909.

SEE FR. Pat. 384,233 of 1907; this J., 1908, 465.—T. F. B.

(B.)—SANITATION: WATER PURIFICATION.

PATENTS.

Refuse destructors. H. N. Leask, Manchester, and E. Damour, Paris. Eng. Pat. 20,649, Oct. 1, 1908.

THE invention consists in placing beyond the combustion chamber one pair or more of regenerators filled with chequer-brickwork. Through one regenerator of each pair the gases from the combustion chamber are passed on their way to the boiler until this regenerator becomes heated to a high temperature; the gases are then turned off into the other regenerator, and air is drawn through the one previously heated until it is cooled again, when the directions of the air and the hot gases are interchanged. By this means a secondary supply of very hot air is continuously obtained and is led to the top of the furnace grate, thus insuring thorough incineration of the refuse. The primary air-supply is heated in a recuperator placed beyond the boiler and is led to the bottom of the furnace grate.—J. H. J.

[*Water*] *filters*. F. Candy, London. Eng. Pat. 22,524, Oct. 23, 1908.

THE patent relates to improvements in closed filters in which the water is passed downwards under pressure. The water on entering the chamber flows over the outside of a cone, being broken up by annular ribs round the cone, and falls evenly over a toothed rim at the bottom of the cone on to the top layer of filtering medium. Under the upper layers of filtering medium and above the middle layers of sand, a space is left, and by a pipe leading into this space a mixture of water and a coagulant or other

material is introduced and spread over the surface of the sand. Into this space also water can be injected through a pipe with fish-tail nozzles giving a horizontal jet, for the purpose of scouring the surface of the sand during the process of cleaning the filter by a reversal of the flow. This scouring action can also be secured by a shaft with arms revolving in the space mentioned and carrying dependent plates or other means for scraping the surface of the sand. The various layers of the filter material are supported on grids of metal tubes flattened together at their points of support on a frame but otherwise with a small space between each pipe.—J. H. J.

Water filters. E. C. R. Marks, London. From Oliver-Roche Co., New York. Eng. Pat. 27,271, Dec. 15, 1908.

IMPROVEMENTS are claimed in the type of apparatus which comprises an outer case provided with a chamber for purified liquid in the bottom, and a chamber for unpurified liquid in the upper portion, the latter chamber containing a floating filter-tank connected with the lower chamber by a flexible conduit. The improvements consist in the provision of an intermediate cooling chamber between the upper and lower chambers, and of a special filter in the filter-tank. The filter comprises a number of separate metallic screens of different electric potential, and without any electrical connection by a metallic conductor within the filter; a layer of granular charcoal is disposed between the screens. By means of this filter, which for instance may consist of an upper fine copper screen, a lower, coarser screen of zinc or galvanised iron and an intermediate layer of granular charcoal, sufficient oxygen may be liberated from the water to destroy undesirable bacteria.—L. E.

Water; Purification of —. E. E. M. Payne and W. H. Staynes, Leicester. Eng. Pat. 6935, Mar. 23, 1909.

CAUSTIC soda is added to a solution of disodium phosphate producing trisodium phosphate and leaving in excess the calculated amount of caustic soda necessary to combine with the carbonic acid and acid carbonates present in the water to be treated. This solution is added to the water, the mixture agitated and allowed to settle. Carbonates and phosphates of the bases present are formed as a bulky precipitate which carries down with it any suspended matter in the water. The clear water is drawn off, and the sludge run off on to draining beds and air dried. The resulting powder is treated with sulphuric acid and soda-ash, and the sodium phosphate regenerated.—J. H. J.

Water; Method of purifying —. W. B. Bull, Chicago, Ill. U.S. Pat. 935,637, Oct. 5, 1909.

THE water is charged with carbon dioxide, passed through a mass of finely-divided iron, and finally treated with slaked lime or lime water.—J. W. H.

Water-distilling apparatus. W. H. Shephard, Portsmouth, Va. U.S. Pat. 935,932, Oct. 5, 1909.

CYLINDRICAL water chambers project into each end of a horizontal drum, and are connected together by a number of horizontal water-tubes and one horizontal steam-tube. The ends of the steam-tube which project into each water chamber are slotted and provided with strainers. The horizontal drum forms the steam jacket for heating the water contained in the chambers and tubes.—J. W. H.

Sewage and waste waters; Apparatus for the biological purification of —. J. J. E. Donzal. Second Addition, dated March 23, 1909, to Fr. Pat. 385,573, March 21, 1907 (this J., 1908, 639, 764).

THE liquefaction tank of the apparatus (*loc. cit.*) is divided into two compartments by means of a vertical partition having a number of holes near its lower end. The sewage is delivered into the first compartment, and, after passing into the second compartment and through two horizontal perforated partitions placed across the latter, is delivered, by means of an automatically acting siphon vessel, over the surface of the filter beds contained in the oxidising tank. These beds are supported on open pipes, and a

space is left between the sides of the beds and the walls of the tank in order to ensure complete ventilation of the beds.—W. P. S.

Ozonisation ; Process of direct —. A. Breydel. Fr. Pat. 401,401, March 30, 1909.

LIQUIDS or other bodies are submitted to the direct action of the electric discharge by being made to pass, in a capillary thickness, over a series of superposed plates of dielectric material, in the interior of which are metallic armatures, and between which the discharge passes. If the substance be pasty or a solid, it is spread in a very thin layer on an endless band which passes between the dielectric plates. It is claimed for the process, that a preliminary fulguration of the germs takes place in the space above the substance, the molecules of which come into direct contact with the nascent ozone; this is, therefore, instantly utilised and no cooling is required.

—F. SOHN.

Ozone ; Apparatus for treating liquids with —. Felten und Guilleaume-Lahmeyerwerke Actien-Ges. Fr. Pat. 401,599, April 2, 1909.

THE patent is for an apparatus for treating liquids with ozone, in which very intimate contact is brought about by subdividing the liquid into very fine streams or drops. An apparatus is described by way of example, which consists essentially of an ozone generator and a mixing device which may be attached to a water tap, if water be the liquid in question. Ozonised air or oxygen is aspirated into this mixer by the stream of water, and the water is broken up in the mixer by passing through a succession of perforated cups arranged as baffles. The mixture of water and gas then enters an outer chamber, in striking against the wall of which the water is further subdivided, and complete absorption of the ozone may be attained. The whole apparatus is arranged to work automatically; as soon as the tap is turned on, communication with the ozoniser is opened and the electric discharge started by means of a special valve and interruptor; valves also prevent the possibility of water getting back to the ozone generator.—F. SOHN.

Sewage and the like ; Apparatus for the bacteriological treatment of —. G. A. Lucas, Levallois-Perret, France. U.S. Pat. 936,464, Oct. 12, 1909.

SEE Eng. Pat. 21,444 of 1906; this J., 1907, 1062.—T. F. B.

(C).—DISINFECTANTS.

Disinfectants, and methods of testing the same. H. Bechhold. Ver. deutsch. Chem., Sept., 1909. Z. angew. Chem., 1909, 22, 2033—2035.

THE following suggestions are made as to the testing of disinfectants:—(1). In all cases the disinfectant should be removed, after action, by a suitable solvent, instead of being rendered inoperative by chemical means; comparable results, under conditions resembling those obtaining in practice, are thus obtained. (2). Disinfectants are found to have very different relative values when tested on different micro-organisms; tests should therefore be extensive, instead of being confined to one species of organism. (3). Many micro-organisms are damaged on drying as in Krönig and Paul's method; in such cases it is found best to allow the disinfectant to act on freshly grown agar-culture. Attention is also drawn to the value of the halogen-substituted naphthols as disinfectants. Experiments show that some of these compounds are more powerful than any disinfectant in present use, except mercuric chloride; compared with lysol, for instance, which (reckoned on its cresol content) prevents the growth of *Staphylococcus* in dilutions of 1:1000, tribromonaphthol may be noted, which kills this bacterium in dilutions of 1:250,000. These compounds have the further advantage of being odourless and non-poisonous.

—F. SOHN.

PATENT.

Fungicides. P. S. U. Pickering, Ridgmont, Beds., and W. A. Voss, Rayleigh, Essex. Eng. Pat. 17,116, July 22, 1909.

THE object of the invention is to make a paste, consisting mainly of basic copper sulphate, capable of ready diffusion in water and of unimpaired activity. For this purpose 100 galls. of 10 per cent. copper sulphate solution are treated with calcium hydroxide solution in quantity sufficient to precipitate all the copper without leaving any perceptible alkaline reaction in the liquid; about 3000 galls. of lime-water are usually required. The precipitate is collected on calico filters and the liquid is allowed to drain away until the paste has the desired consistence. Finely-powdered *Quillaia* bark may be added in quantity not exceeding one-twentieth of the weight of the paste.—W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

Sulphite wood-pulp digestion process ; Production of methyl alcohol in the —. H. Bergstrom. Papierfabrikant, 1909, 8, 970—971.

METHYL alcohol has been obtained in considerable quantities from the condensed vapours blown off after the digestion of wood by the soda process (this J., 1908, 1037; 1909, 37). The author has examined a similar distillate from the sulphite pulp digesters and has found that it contained about 1 per cent. of methyl alcohol. Only a portion of the total methyl alcohol formed passes off with the vapours, a certain amount remaining behind in the waste liquors. This latter observation has a bearing on the proposed utilisation of these waste liquors for the production of ethyl alcohol by fermentation. In connection with the question of the chemical constitution of wood, the author mentions that when wood is boiled under atmospheric pressure with a dilute solution of an alkali hydroxide, ammonia, methyl alcohol, acetaldehyde, and acetone are formed. The same products are also formed from peat and "white moss," but in different proportions.

—J. F. B.

Sulphite wood-pulp waste liquors ; Researches on — [as a feeding stuff]. A. Stutzer. Ges. deut. Naturforscher und Aerzte, Sept., 1909. Z. angew. Chem., 1909, 22, 1999—2005.

THE waste liquors from the manufacture of sulphite wood pulp contain on an average 120 grms. of organic matter and 10—15 grms. of mineral matter per litre. The calorific value of the dry substance, including the mineral matter, is 4250 calories per kilo; the organic matter has a greater calorific value than starch or cellulose. The author has, therefore, been led to investigate the possibility of utilising the large quantities of waste liquors, which now pollute the rivers, for the purpose of feeding cattle. The most deleterious constituent of the liquors in this respect is the sulphurous acid, both free and in the form of salts, that combined with the organic matter being probably harmless. It is impossible to remove the sulphur dioxide by precipitation in the form of calcium monosulphite; chalk apparently has no effect in this direction, and lime removes only a portion of the sulphurous acid. In the case of lime and the fixed alkalis, an abnormally large proportion is required to neutralise the liquors, owing to their action on the carbohydrates to form acid bodies, presumably saccharins; ammonia has no such action. In order to render the liquors available for feeding purposes the proportion of sulphurous acid must be reduced below 0.1 per cent. The only way in which the author has been able to effect this satisfactorily is by combination with an aldehyde, e.g., formaldehyde. If the liquors be concentrated to one-half or one-third of their bulk, a portion of the sulphurous acid is expelled as gas. Before the sulphurous acid can combine with formaldehyde it must be converted into calcium bisulphite. This is best done by the addition of a small excess of calcium carbonate; the liquid still has an acid reaction, owing to the organic

matter, and calcium monosulphite is not produced. The removal of the sulphurous acid is more complete the larger the quantity of formaldehyde added. A sample of liquor containing 2.3 grms. of sulphur dioxide per litre, when treated with 2.5 c.c. of formalin per litre showed only 0.809 grm.; with 5 c.c. per litre this was reduced to 0.369 grm., and with 20 c.c. to 0.016 grm. It is difficult to control the process analytically because a portion of the sulphur dioxide found on distillation with dilute phosphoric acid must be derived from the hydrolysis of harmless organic compounds. In fact, the hydroxymethanesulphonic acid itself, formed by the addition of formaldehyde, is not stable, though more so than the organic sulphonic acids of the liquors. Before the liquors can be used, the excess of formaldehyde must be fixed in a harmless form. This may be done by neutralising the liquid with ammonia; in practice the author makes use of the nitrogenous matters of molasses. Experiments have been made upon sheep with a fodder prepared as follows: 100 litres of waste wood liquor, evaporated to half the volume, treated with powdered limestone and formalin, filtered, further evaporated, then mixed with 20 kilos. of beet molasses and finally with 6.25 kilos. of finely chopped peat-moss. About 20 litres of wood liquor are allowed per 1000 kilos. of body weight of the animal.

—J. F. B.

PATENTS.

Transfer papers; Manufacture of — E. Lövinsohn, Charlottenburg, Germany. Eng. Pat. 22,420, Oct. 22, 1908.

In preparing transfer papers, colours are employed which melt when heated. The design is printed cold on the transfer paper, and since by this method the whole of the pigment is not transferred by a single impression, it is possible to obtain as many as eight transfers from one pattern, owing to the fact that the tints of the fusible colours deepen by the application of heat. Suitable colours are Victoria Green and Blue, Rhodamine, and Ceresine. Other colours may be used if mixed with a non-drying varnish, such as a viscous solution of rosin or copal in mineral oil. (Reference is directed to Eng. Pat. 4471 of 1874, and 17,338 and 17,793 of 1905; this J., 1906, 17; 1907, 16).—J. F. B.

Air-proof and water-proof [metallised] papers and films; Manufacture of — J. D. and B. D. Galay, Moscow. Eng. Pat. 1715, Jan. 23, 1909.

A MIXTURE is made, composed of 3 parts of powdered metal, e.g., aluminium, 100 parts of collodion, containing about 3 per cent. of nitrocellulose, and 2–3 parts of glycerin or castor or other vegetable oil. This emulsion is contained in a trough and the paper to be proofed is drawn through it and then dried. Films are made by pouring the emulsion on a polished plate and evaporating the solvent.—J. F. B.

Waste paper; Process of recovering — S. Finkelstein, Harrisburg, Pa. U.S. Pat. 936,106, Oct. 5, 1909.

PRINTED paper is reduced to a pulp and boiled for about one hour in water to remove the gummy constituents. The pulp is then bleached, by boiling it with a solution of sodium hyposulphite and sulphuric acid for one hour, and finally washed. The bleaching solution contains 4 oz. of hyposulphite and 1 oz. of oil of vitriol per gallon.

—J. F. B.

Soda pulp mills; Treatment of the "black lyes" of — E. L. Rinman. Fr. Pat. 401,856, April 8, 1909. Under Int. Conv., April 14, 1908.

THE organic constituents of the black lyes from soda pulp mills, whether working the sulphate process or not, may be classified as "humous" substances, the sodium compounds of which are decomposed by carbonic acid, and ulmic acids, the salts of which are not readily decomposed. The lyes are concentrated until they contain about 100 grms. of sodium oxide per litre; they are then saturated with carbon dioxide, and a salt, preferably sodium chloride, is added to the extent of 50 grms. per litre. In order to

obtain the humous matters in a granular form, suitable for filtration, the precipitation should be effected at a temperature of 75° C. After precipitation it is desirable to cool the liquid before filtering and to filter as soon as possible. The sodium ulmates remain in solution and exert an action as precipitating salts; the presence of the sodium chloride is stated to be beneficial in the digestion process and to yield a tougher fibre, but it is necessary to increase the quantity of alkali used correspondingly. The purified liquor may be re-causticised and used for a considerable number of times before it is necessary to regenerate the alkali by calcination or crystallisation. Ammonium carbonate may be used to assist precipitation in place of sodium chloride if means are provided for the recovery of the ammonia.—J. F. B.

Celluloid-like products; Manufacture of — A. G. Bloxam, London. From Chem. Fab. Griesheim-Elektron, Frankfurt a/Main, Germany. Eng. Pat. 15,855, July 7, 1909.

THE camphor used in the manufacture of celluloid may be wholly or partly replaced by dihydroxydiphenylsulphone. The product is nearly odourless and is not affected by light.—J. F. B.

Paper and the like; Process and apparatus for marbleizing — H. Metzger, Assignor to Akt.-Ges. f. Buntpapier und Leimfabrik., Aschaffenburg, Germany. U.S. Pat. 936,010, Oct. 5, 1909.

SEE Eng. Pat. 426 of 1908; this J., 1908, 640.—T. F. B.

Cellulose; Process for preparing a soluble — P. Marino. Fr. Pat. 401,527, April 2, 1909. Under Int. Conv., April 3, 1908.

SEE Eng. Pat. 7430 of 1908; this J., 1909, 812.—T. F. B.

Recovering resinous matter [from fibrous vegetable material]. U.S. Pat. 931,608. See XIII.B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Alkaloid reactions with perhydrol [concentrated hydrogen peroxide]. E. Schär. Schweiz. Chem. Ges., Sept., 1909. Chem.-Zeit., 1909, 33, 1042.

A MIXTURE of concentrated hydrogen peroxide solution and strong sulphuric acid is a good reagent for several alkaloids. Quinine gives a strong yellow coloration, nicotine a dark chocolate-red. The activity of the reagent is increased in certain cases by the addition of small quantities of colloidal platinum. Under these circumstances strychnine yields a bright purple-red coloration which develops slowly, but is quite stable. A combination of hydrogen peroxide, hydrochloric acid and colloidal platinum can be used in the thalioquin-reaction, and for the detection of caffeine and theobromine, in place of chlorine water and ammonia.—F. SHDN.

Brucinesulphonic acids and the cause of the brucine-nitric acid reaction. (Strychnine alkaloids, 6th Communication.) H. Leuchs and W. Geiger. Ber., 1909, 42, 3067–3075.

BRUCINE was treated with sulphur dioxide and manganese dioxide in a manner similar to that used for the preparation of strychninesulphonic acid (this J., 1909, 905). Three isomeric sulphonic acids were formed, and could be separated owing to their different solubilities in water. Brucinesulphonic acid I., $C_{23}H_{26}O_7N_2S$, can be crystallised from 12 parts of hot water. It is hardly soluble in alcohol, but readily soluble in sodium hydroxide or sodium carbonate solutions, and in 20 per cent. hydrochloric acid. It can be heated to 300° C. without melting, and has $[\alpha]_D = -241.3'$ at 20° C. Acid II. resembles the preceding in its properties. It can be crystallised from 55 parts of hot water, melts with decomposition at 260° C. and has $[\alpha]_D = +29.2'$ at 20° C. in alkaline solution. The third acid has about the same solubility as the second acid, but crystallises in pointed prisms, instead of

rectangular tablets. It decomposes at 245° C., and has $[\alpha]_D^{20} = +156.8^\circ$ at 20° C. in alkaline solution. When brucinesulphonic acid 1. is treated with cold 5N-nitric acid, transparent red crystals are formed, and the liquid when filtered deposits deep-yellow needles. The red substance is a quinone, $C_{21}H_{20}O_7 \cdot N_2S_3H_2O$. It is hardly soluble in organic solvents, but easily soluble in alkalis. Bi-desmethylnitrobrucinesulphonic acid hydrate, $C_{21}H_{23}O_{10}N_2S_3$, is the yellow substance formed by the action of nitric acid on brucinesulphonic acid. It crystallises from 270 parts of hot water in yellow needles, and dissolves in alkalis with a yellow colour. The quinone can be converted into a quinol (hydroquinone) by means of sulphur dioxide, and the substance so formed crystallises from 400 parts of water in colourless needles.

—F. SUDX.

Pilocarpus pennatifolius and *Erythroxylon Coca*; Alkaloids of —. O. Tammann. Ges. dent. Naturforscher und Aerzte, Sept., 1909. Z. angew. Chem., 1909, 22, 1987.

It is general it may be said that in both the plants mentioned in the title, the alkaloids occur mainly in the cells containing little or no chlorophyll; the oxalate cells are always free from alkaloids. The author has determined that in the *Pilocarpus* the largest quantity of alkaloid exists in the epidermis of the leaves, particularly on the upper surface; the chlorophyll granules contain no alkaloid. Tropical plants grown in Europe under glass, if properly tended, may produce as much alkaloid as in their natural state, sometimes even more. Considerable differences were found between different individuals grown in the same house. In *Pilocarpus* the flower stalks and buds contain the highest percentage of alkaloid (0.51 and 0.44 per cent.), and the stems contain the lowest (0.18 per cent.); the leaves and petioles contain 0.23–0.24 per cent. The absolute quantity of alkaloid in the leaves increases as the leaf develops, but the percentage decreases. If stored in a damp room the alkaloid-content of *Pilocarpus* leaves rapidly diminishes; a loss of 50 per cent. was found in the course of six weeks. In the case of *Coca* leaves the quantity of alkaloid does not increase with the age of the leaf. The alkaloids of *Coca* seeds are almost entirely extracted by the steeping water in the process of germination, but the embryonic plant, 4 days old, contains newly-formed alkaloid immediately under the root-point. Both in *Pilocarpus* and *Coca* the alkaloids are waste products which play the part of secretions. The alkaloid-bearing tissues of the pith and the inner nerve-parenchyma are sharply differentiated from their alkaloid-free surroundings and are completely analogous to other secretion tissues, such as tannin ducts and oxalate cells.—J. F. B.

Cheiriline. W. Schneider. Ber., 1909, 42, 3416–3420.

THE author has made fresh ultimate analyses of cheiriline obtained from wallflower seeds (*Cheiranthus cheiri*) and from *Erysimum nanum compactum aureum*. He now adopts the formula, $C_{15}H_{15}O_2NS_2$, which differs from those previously proposed by himself and Wagner (this J., 1909, 106). The behaviour of the base towards sodium hydroxide resembles that of a mustard oil.—F. SUDX.

Umbelliferae; The chemistry of certain drugs of the family of the —. J. Herzog and D. Krohn. Ges. dent. Naturforscher und Aerzte, Sept., 1909. Z. angew. Chem., 1909, 22, 1988–1989.

It has previously been shown that the pimpinellin obtained from *Pimpinella* possesses the chemical properties of a lactone; the authors have now isolated similar bodies from other plants of the family of the *Umbelliferae*. The *Rhizoma Imperatoriae* yielded by a special process of extraction four different chemical compounds: *Oxy-pucedanin*, $C_{13}H_{12}O_4$, m. pt. 142°–142.5° C., yield 1.3 per cent.; *ostruthin*, $C_{15}H_{16}O_3$, m. pt. 118°–119° C., yield 0.5 per cent.; *ostruthol*, $C_{24}H_{24}O_8$, m. pt. 134°–134.5° C., yield 0.3 per cent.; *osthol*, $C_{15}H_{16}O_3$, m. pt. 83°–84° C., yield 0.1 per cent. From the *Rhizoma Pucedani* there were likewise obtained: *Pucedanin*, m. pt. 109° C., yield 2 per cent., and *oxy-pucedanin*, yield

0.3 per cent. All these bodies show the properties of lactones, being soluble in excess of alkalis and re-formed from their neutral salts by the action of the carbon dioxide of the air. The authors have studied oxy-pucedanin in some detail. It forms addition products with the hydracids and is converted into an isomeride on boiling with 10 per cent. sulphuric acid; this isomeride does not combine with the hydracids. Oxy-pucedanin contains no free hydroxyl group; when boiled with 1 per cent. sulphuric acid it combines with 1 molecule of water, and this hydration product contains a hydroxy-group. On reduction with aluminium amalgam, oxy-pucedanin combines with only one atom of hydrogen per molecule and the product, according to molecular weight determinations, has the formula $(C_{13}H_{15}O_4)_2$. Ostruthin also forms an addition product with hydrogen chloride; so does osthol, which latter contains a methoxyl group in its molecule.—J. F. B.

Caragana arborescens and its bitter principle [caraganin]. E. Reeb. J. Pharm. Elsass-Lothring., 1909, 86. Pharm. Zentralh., 1909, 50, 738.

Caragana arborescens, a native of the Urals, is widely cultivated as a horticultural plant. Its leaves contain a bitter glucoside, *caraganin*. The dried extract obtained with 95 per cent. alcohol was redissolved in a very little water, and the glucoside salted out from the aqueous solution by means of sodium sulphate. The precipitate was washed with a saturated solution of the same salt, and then extracted with alcohol. The solvent was distilled off and the residue again treated as before with water and sodium sulphate. The process was repeated three or four times; the partly purified glucoside was then precipitated with lead acetate. After liberation from the lead compound by means of hydrogen sulphide, in the usual manner, caraganin was obtained in yellow scales, or as a yellow powder, on evaporation. It has an intensely bitter taste; gives a chestnut-brown colour with sulphuric acid; gives indigo-blue streaks with sulphuric acid and ammonium molybdate; and a dirty green colour with nitric acid. If a layer of Lafou's reagent (sulphuric and selenious acids) be floated over a solution of caraganin, a peach-coloured ring will be formed. Caraganin is hydrolysed with formation of dextrose, by heating with dilute mineral acids.—I. O. B.

Medicinal plants in relation to their therapeutic activity; Sterilisation of —. E. Perrot and A. Goris. Bull. d. Sci. pharm., 1909, 16, [7].

THE authors have prepared from different vegetable substances so-called "physiological extracts" which contain the complex constituents of the plants in their original condition. Their experiments shew that the bark of the horse-chestnut tree contains a compound of aesculin and aesculannic acid, which is easily decomposed by long boiling when in solution. An extract which contains such a compound in the undecomposed state, may differ in its action from a solution where decomposition has taken place. In order to get a suitable extract of kola, the nuts must be sterilised and extracted with alcohol (this J., 1908, 996). Digitalis leaves when sterilised, preserve their colour and odour. If the leaves are then extracted with 80 per cent. alcohol, the extract evaporated at the ordinary temperature, and the residue treated with ether, a yellow coloured powder is obtained, soluble in water, which the authors term the "physiological extract" of digitalis.—F. SUDX.

Citral; Determination of — in terpenoid essence of lemon. S. H. Baer. U.S. Dept. of Agric., Bull. No. 122, 1909, 229–230.

THE colorimetric method for the determination of citral is only applicable if pure citral, distilled water, and aldehyde-free alcohol be employed in the manufacture of the essences. Such is never the case, and on this account, together with the fact that no indication is obtained as to whether the citral used is prepared from lemon oil or lemon-grass oil, the author is of opinion

that the colorimetric method requires further examination before it can be adopted as an official process.

—W. P. S.

Samphire oil; Composition and fractionation of —.
F. Borde. Bull. Sci. Pharmacol., 1909, 16, 393—399.
Chem. Zentr., 1909, 2, 1335.

By fractional distillation *in vacuo*, the author has isolated four constituents from samphire oil (see this J., 1909, 623), viz., (1), a terpene, b.pt., 158°—160° C.; sp. gr. at 0°/4° C., 0.8703; $[\alpha]_D^{20} = +44.37'$; iodine value (mols.), 336; this is probably *d*-pinene; (2), an optically inactive hydrocarbon of the composition, $C_{15}H_{26}$; b.pt., 176°—180° C.; sp. gr. at 0°/4° C., 0.8957; iodine value, 175.5; (3), a compound of b.pt. about 210° C.; sp. gr., 0.95023; iodine value, 156; $[\alpha]_D^{20} = +1.4'$; and (4), an isomeride of apiol; b.pt., 285°—295° C.; sp. gr. 1.1753; iodine value, 119 (see this J., 1909, 906). The quantities of these four constituents present in the oils from the fruits, from the leaves and stalks, and from the whole plant, respectively, are shown in the following table:—

	Oil from:		
	Fruits.	Leaves and stalks.	Whole plant.
	per cent.	per cent.	per cent.
Active hydrocarbon .	12	18	15
Inactive hydrocarbon .	48	17	49
Compound of b. pt. 210° C.	5	5	5
Apiol isomeride	35	60	49

—A. S.

Cloves; Determination of the essential oil and the eugenol in —. R. Reich. Z. Unters. Nahr.- u. Genussm., 1909, 18, 401—412.

THE direct determination of the essential oil in cloves can be satisfactorily carried out in a special form of steam-distillation apparatus. By this method the powdered cloves are packed into a small steam-jacketed cartridge, through which steam can be led into a condenser. The distillate is shaken with a suitable solvent, the extract is evaporated, and the residue weighed. To determine the eugenol, 1.0—1.5 gm. of the oil is warmed on the water-bath with 20 c.c. of 5 per cent. sodium hydroxide. 20 c.c. of light petroleum are added, and the aqueous portion made up to 30 c.c. with sodium hydroxide solution. 5 c.c. of 25 per cent. sulphuric acid are added to one-half of the alkaline liquid, followed by the addition of 6 grms. of common salt. 20 c.c. of pentane are now added, the liquid shaken, and after standing, an aliquot portion is removed and evaporated in a tared flask. Amboua cloves contain 21.3—22.1 per cent. of oil, and 17—17.6 per cent. of eugenol. Zanzibar cloves contain 18.4—20.1 per cent. of oil, and 15.4 to 16.6 per cent. of eugenol. The clove stalks contain 5.8 to 6.7 per cent. of oil, and 5.4—5.7 per cent. of eugenol. The anthophylli contain 2.2 to 9.2 per cent. of oil. The oil from Amboua cloves contains 79.0—80.6 per cent. of eugenol, that from Zanzibar cloves 80.0—86.1 per cent., that from commercial clove powder 85.0—87.9 per cent., from clove stalks 83.1—84.5 per cent., and from the anthophylli 85.5 to 85.9 per cent. Commercial ground cloves contain 17.0—19.3 per cent. of oil and 15.5 to 16.3 per cent. of eugenol.—F. SHDN.

Sesquiterpenes. 3rd communication. "Caryophyllene" from oil of cloves. Gurjun balsam oil. A method of preparation of the nitrosochlorides of mono- and sesquiterpenes. E. Deussen. Annalen, 1909, 369, 41—59.

It has been shown that caryophyllene nitrosate (m.pt. 148°—149° C.) yields a nitrolamine base melting at 128° C. The same substance can be obtained from inactive α -caryophyllene nitrosochloride, and should therefore be styled α -caryophyllenenitrolbenzylamine.

When the blue caryophyllene nitrosite is boiled with light petroleum or oxidised with chromic acid, a nitrosate, m.pt. 131°—132° C. and with an optical rotation of about 60°, is produced. This substance may be styled *d*-caryophyllene nitrosate. When the blue nitrosite, m.pt. 115° C. is treated with benzylamine, β -caryophyllenenitrolbenzylamine, m.pt. 172°—173° C. is produced. The sesquiterpene from which the blue nitrosite is derived, the author terms β -caryophyllene, whilst a second sesquiterpene must be present in oil of cloves, and is called γ -caryophyllene. When the blue nitrosite is treated with alcoholic potassium hydroxide, β -caryophyllenenitrosite is produced, which melts at 139° C. A longer action of the same reagent produces a substance, $C_{15}H_{25}NO_2$ or $C_{15}H_{23}NO_2$, melting at 162—163° C. When the blue nitrosite is dissolved in alcohol and subjected to the action of light, a substance, $C_{15}H_{22}N_2O_4$, is produced, which melts at 131°—132° C., and has $[\alpha]_D^{20} = +57.22'$ in benzene solution. It decolorises bromine, and appears to be identical with *d*-caryophyllene nitrosate. If benzene be used in place of alcohol in the above reaction, a saturated compound, $C_{15}H_{24}N_4O_5$, is produced, which melts at 158°—159° C., and is optically inactive. Light has only an accelerating effect on the formation of α -caryophyllene nitrosochloride. The mother liquors left after the preparation of this α -nitrosochloride contain an unsaturated "nitro-compound," $C_{15}H_{23}NO_2$ or $C_{15}H_{25}NO_2$, which melts at 164° C., and has $[\alpha]_D^{20} = +22.4'$ in chloroform. When α -caryophyllene nitrosochloride is treated with sodium methoxide, a substance $C_{15}H_{23}ON$, m.pt. 116° C. is produced. If sodium ethoxide or propylate is used, an unsaturated substance, $C_{15}H_{23}NO$, is obtained, which melts at 128°—129° C. In the mother-liquors left in the preparation of the blue nitrosite, a bicyclic hydrocarbon has been found. This yields a nitrosochloride, m.pt. 116° C., which can be resolved into two isomerides melting at 122° and 146° C. These nitrosochlorides, and β -nitrosochloride, each yield β -caryophyllenenitrolbenzylamine, m.pt. 172°—173° C. When treated with sodium ethoxide, they each yield a substance, $C_{15}H_{25}NO_3$, which is unsaturated, dextro-rotatory, and melts at 162°—163° C. When caryophyllene is treated with sulphuric and acetic acids, a sesquiterpene is found amongst the products. It has the sp. gr. 0.9227 at 19° C., $n_D^{20} = 1.49533$ at 20° C., and it boils at 126°—127° C. at 24 mm. When *isocaryophyllene*, obtained from the mother liquors of the blue nitrosite, is oxidised with permanganate, a small amount of a glycol, $C_{15}H_{24}O_4$, m.pt. 120° C. is produced, with larger amounts of α,α -dimethylsuccinic acid. The same glycol was formed by the oxidation of "caryophyllene," and the oxime was found to melt at 187°—188° C. The "caryophyllene" of clove oil contains three isomeric sesquiterpenes, the α -, β -, and γ -modifications, of which, β -caryophyllene yields the blue nitrosite. A formula for this sesquiterpene is given. Gurjun balsam oil when oxidised in acetone solution with powdered permanganate yields a ketone, $C_{15}H_{24}O$, boiling between 170°—180° C. at 12 mm., and giving a semicarbazone, m.pt. 234° C. An apparatus for the preparation of large quantities of nitrosochlorides is described.—F. SHDN.

Terpenes and essential oils. 101st Communication. O.
Wallach. Annalen, 1909, 369, 63—103.

THE author has carried out a number of experiments with fenchone, the results of which confirm Scumler's formula for this substance (this J., 1908, 181). The work may be summarised as follows: The behaviour of fenchone towards sodium, and towards potassium hydroxide was examined. In the latter reaction, fencholic acid is produced, and is fully described. When the salts of fencholic acid are distilled, a hydrocarbon, $C_{10}H_{16}$, is produced. Fencholic acid amide was treated with bromine and an alkali, and a pure *isocyanate* obtained, as well as fenchylamine. The oxidation products of fencholic acid were also examined. If potassium hydroxide be allowed to act upon *isofenchone*, *isofencholic acid* is produced. The paper concludes with an examination of the action of potassium hydroxide on cyclohexanone.—F. SHDN.

Lemon industry of Italy. U.S. Dept. of Agriculture Bull., 1909. [T.R.]

Calcium citrate.—In 1899 Italy exported 3 million pounds and 17 million pounds in 1908. Of the average shipments the United States took from 32.5 to 40.7 per cent.; France and the United Kingdom were the next heaviest buyers. The imports into the United States rose from 443,981 lb. valued at \$52,137 in 1894, to 3,872,924 lb. valued at \$726,626, in 1907, but fell to 3,853,105 lb. valued at \$580,293 in 1908.

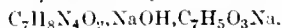
Lemon oil.—The total exports from Italy of lemon oil during the last ten years approximated 1,000,000 pounds per annum, of which quantity the United States took from 21.9 to 38.8 per cent. The shipments were given as follows:—

Year ended December 31.	Quantity.
	pounds.
1900.....	743,024
1902.....	1,197,213
1904.....	886,990
1906.....	971,334
1908.....	1,551,256

From 100,000 lemons of average quality are produced 100 lb. of oil and 675 lb. of calcium citrate, equal to 430 lb. of citric acid. The average prices of these ranges from £16 to £20 for oil and £15 to £19 for citrate. The average value of lemons to the Sicilian grower is about £30 per 100,000, but those used for by-products are worth about £20.

Theobromine-sodium salicylate; Characterisation of commercial.—O. Frey. Z. Allgem. österr. Apoth.-Ver., 1909, 47, 433—434.

THE author has found that determination of the theobromine alone in commercial theobromine-sodium salicylate is not sufficient to exclude unsatisfactory samples. He has drawn up the following scheme. The theoretical composition is represented by the formula.



The substance is a white, microcrystalline, odourless, and hygroscopic powder, with a sweetish but salt-like and alkaline taste, and easily soluble in water. A 20 per cent. solution prepared in the cold is clear and colourless, or at the most, slightly yellow. It has an alkaline reaction, and when acidified with acetic acid gives a violet colour with ferric chloride. Mineral acids precipitate the salicylic acid as well as the theobromine. If 10 grms. of the solution are extracted twice with 10 grms. of chloroform, the chloroform should not leave more than 0.01 gm. of residue. The water present should be determined by heating in a steam-oven. 1 gm. of the dried substance dissolved in 100 grms. of recently boiled and cooled water, should not require more than 2.9 c.c. of N/1 acid using phenolphthalein as indicator. The same weight dissolved in 400 c.c. of water should not require more than 2.9 c.c. of N/1 acid when methyl orange is used. To determine the salicylic acid, 1 gm. of the dried salt is dissolved in water, 3 c.c. of dilute sulphuric acid are added, the free salicylic acid is extracted with ether, the ether evaporated, and the residue dissolved in alcohol and water. The solution should require 26.5 to 27.5 c.c. of N/10 sodium hydroxide using phenolphthalein as indicator. 2 grms. of the dried salt are dissolved in 10 c.c. of water and 5.4 c.c. of N/1-sulphuric acid added. The now neutral liquid is made alkaline with a drop of ammonia, and allowed to stand for 3 hours at 15°–20° C. The precipitated theobromine is filtered off on a tared filter, washed twice with 10 c.c. of water, and dried at 100° C. The weight should be from 0.75 to 0.80 gm.—F. SHDN.

Chinosol [neutral orthohydroxyquinoline sulphate]; Characters and tests for—F. Zernik. Pharm. Zentralh., 1909, 50, 771.

CHINOSOL forms a crystalline, pale yellow powder with a saffron-like odour, and a burning taste. It melts at 175°–177.5° C., is readily soluble in water, sparingly so in

alcohol; insoluble in ether. The 1:49 aqueous solution is acid in reaction; when treated with ferric chloride it gives an intense green colour, and a white precipitate with barium chloride. With sodium carbonate solution it gives a white crystalline precipitate of felted needles, which when collected, washed, and dried in a desiccator should melt at 73° to 75° C. Chinosol should leave no weighable residue when burnt.—J. O. B.

Solubilities of the salicylates of the U.S.P. in aqueous alcohol solutions at 25° C. A. Seidell. J. Amer. Chem. Soc., 1909, 31, 1164—1168.

THE author has determined the solubility of several salicylates, in water, and alcohol, and in mixtures of the two at 25° C. Tables and curves showing the results are given. The following table compares the author's results with those of the U.S.P.:—

	Parts of solvent to dissolve 1 part of salicylate at 25° C.			
	In water.		In 92.3 wt. per cent. alcohol.	
	Author.	U.S.P.	Author.	U.S.P.
Ammonium salicylate.....	0.97	0.9	2.33	2.3
Lithium salicylate.....	0.786	very soluble	1.193	very soluble
Phenyl ".....	6665.0	2333.0	4.65	5.0
Quinine ".....	1538.0	77.0	20.65	11.0
Salicylic acid....	453.0	308.0	2.13	2.0
Sodium salicylate.....	0.867	0.8	7.33	5.5
Strontium ".....	18.85	18.0	48.51	66.0
Bismuth subsalicylate.....	10,000.0	—	625.0	—

—F. SHDN.

Salicylates; Methods for the determination of—A. Seidell. J. Amer. Chem. Soc., 1909, 31, 1168—1177.

THE bromate method of Freyer and the iodine method of Messinger and Vortmann for the determination of salicylates have been found by the author to be unreliable. A more satisfactory method is as follows:—The weighed sample of the salicylate, dissolved in a small quantity of water, is placed in a stoppered bottle with 50 c.c. of strong hydrochloric acid. The solution is titrated with N/5 bromate solution, the bottle being shaken and warmed gently after each addition. The bromate is added till the yellow colour of the excess of bromine remains for five minutes after the addition of the last two drops, the temperature being between 80° and 100° C. In this reaction 4 atoms of bromine combine with one molecule of the salicylate. The method gives fairly concordant results. Excess of a standard solution of bromine in hydrochloric acid may be added to the salicylate, and the uncombined bromine determined by means of stannous chloride.—F. SHDN.

Ketones by means of acetoacetic ester; Preparation of pure—A. Michael and K. Wolgast. Ber., 1909, 42, 3176—3177.

IT has been known that dialkylacetoacetic esters are not hydrolysed by cold potassium hydroxide, whilst the mono-alkyl derivatives are readily hydrolysed. When alkyl halides are allowed to act upon the sodium compound of acetoacetic ester, a mixture of mono- and dialkyl derivatives is produced, which may be separated by means of cold potassium hydroxide solution. Ethylacetoacetic ester was prepared in the usual way, and shaken with ammonia. It was then shaken with 5 per cent. potassium hydroxide, when the monoethylacetoacetic ester was hydrolysed and went into solution. The alkaline liquid was acidified after standing, and heated, when methyl-propylketone was produced.—F. SHDN.

Aldehydes and ketones; A general reaction for —. H. Franzen. Ber., 1909, 42, 3293—3295.

SOLUTIONS of potassium cyanide and calcium chloride were mixed and shaken for several hours with benzaldehyde. A bright orange-yellow powder was obtained, which proved to be the calcium compound of mandelic acid nitrile, $[C_6H_5.CH(CN).O]_2Ca$. This substance is partly decomposed by boiling water into benzaldehyde and calcium cyanide, and is only slightly acted upon by boiling alcohol. Dilute acids cause the liberation of mandelic acid nitrile. Solid crystalline substances have been obtained in the same way from several ketones and aldehydes. Barium, strontium, and magnesium cyanides also give the same reaction.—F. SIDN.

Iodine in organic substances; Detection and determination of —. Determination of iodoform in iodoform gauze. V. Paolini. Monit. Scient., 1909, 71, 648.

THE method is based upon the fact that when organic substances, containing small quantities of iodine compounds, are submitted to the action of nascent hydrogen, the iodine is completely converted into hydrogen iodide. For the determination of iodoform in iodoform gauze, the process is as follows:—10 grms. of the gauze, cut into small pieces, are introduced into a half-litre flask and covered with 40 grms. of zinc dust; the mixture is then moistened with 60 c.c. of 25 per cent. sulphuric acid and heated for 2—3 hours, using a reflux tube; 40—50 c.c. of acid are then added and the heating continued for some hours, the end of the reaction being indicated by the gauze becoming colourless. The gauze is now washed by decantation 4 or 5 times and the volume of the solution made up to 1 litre. To 100 c.c. of this liquid, 100 c.c. of carbon bisulphide or chloroform are added and several c.c. of potassium nitrite solution; these are shaken together, the carbon bisulphide washed 3 times, and the iodine titrated with $N/10$ thiosulphate in the presence of sodium bicarbonate.—F. SODN.

Reducing reactions with phosphorous and hypophosphorous acids [and determination of these acids]. Sieverts. See XXIII. Inorg. Quant.

Separating mixtures of some aliphatic acids by means of benzene and toluene. (1), Hodgson. (2), Keane and Narracett. See XXIII. Org. Quant.

PATENTS.

Arsenoarylglycollic acids and arsenoarylthioglycollic acids; Manufacture of —. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning. Hoechst a/Main, Germany. Eng. Pat. 4246, Feb. 20, 1909. Addition to Eng. Pat. 9855, May 6, 1908. (See Ger. Pats. 206,057 and 206,456; this J., 1909, 328.)

ARSENOARYLGOLLYLIC acids are produced by the action of powerful reducing agents, such as sodium amalgam or hydrosulphite, on the oxyarylglycolarsinic acids, and arsenoarylthioglycollic acids by the similar reduction of the corresponding thio-derivatives.—J. F. B.

Aminophenylarsinic acid (atoxyl) and its derivatives; Preparation of derivatives of —. A. Monneyrat. Fr. Pat. 401,586, July 30, 1908.

AMINOPHENYLARSINIC acid and its derivatives are converted into their sulphophenyl derivatives by treatment with phenylsulphonic chloride. The products are slightly soluble in water, and form readily soluble salts with alkaline bases and with alkaloïds; the salts of cinchona alkaloïds are mentioned particularly. New derivatives of the composition, $C_6H_5.NH.CO.NH.C_6H_3R.AsO(OH)_2$, are obtained by the action of phenyl isocyanate on amino-arylarsinic acids.—T. F. B.

Esters of phenols chlorinated in a side-chain; Process of making compound — and also hydroxybenzyl alcohols, hydroxybenzaldehydes, and hydroxybenzoic acids. F. Raschig. Fr. Pat. 401,845, April 8, 1909.

WHEN cresols, xylenols, etc., are treated with chlorine, the halogen only enters the benzene nucleus. If, however,

the phenols are converted into their esters by means of inorganic or organic acids, such as carbonic acid, phosphoric acid, and benzenesulphonic acid, and these are treated with chlorine, one, two, or three atoms of halogen can be introduced into the side chain of the phenol. The preparation of the dichlorides of *o*- and *p*-cresol carbonate, the trichloride of *m*-cresol carbonate, the dichloride of *o*-cresol phosphate, the dichloride of *o*-hydroxybenzylidenechloride phosphite ($CHCl_2.C_6H_4.O)_3PCl_2$, and the benzenesulphonate of *o*-hydroxybenzylidene chloride, is described. When these substances, or similar compounds, are treated with saponifying agents (*e.g.*, alcoholic alkali solutions) they are converted into hydroxybenzyl alcohols, hydroxybenzaldehydes, and hydroxybenzoic acids.

—T. F. B.

Salts of organic acids; Process for the preparation of compounds of — with sulphur dioxide. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 212,902, Jan. 9, 1907.

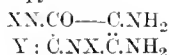
THE process claimed consists in acting on salts of organic carboxylic or sulphonic acids with sulphur dioxide, care being taken that the amount of water present is insufficient to cause formation of the free acids. The process can be carried out by passing sulphur dioxide gas over the powdered salt; by mixing the salt with liquefied sulphur dioxide; or by allowing sulphur dioxide to act on the salt dissolved or suspended in a liquid which possesses no, or only feeble, ionising power. The products are said to be suitable for the preparation of chlorides and anhydrides.—A. S.

Cascara-sagrada; Process for the preparation of a clear extract, soluble in water, not containing zinc, and free from bitterness, from —. M. Penschuck. Ger. Pat. 213,292, Feb. 7, 1909. Addition to Ger. Pat. 206,467.

A SIMPLIFIED form of the process described in the main patent (see this J., 1909, 161) is claimed. The powdered bark is mixed with zinc oxide and with sufficient water to moisten the mass, which is compressed and left for 1—2 hours. It is then warmed on the water-bath to 30°—40° C. and after several hours, extracted with water, and the extract evaporated as described in the main patent.—A. S.

Xanthine and guanine derivatives substituted in the 8-position; Process for preparing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 213,711, Jan. 18, 1908.

WHEN 4,5-diaminopyrimidines of the general formula,



(where X represents hydrogen or a substituent and Y oxygen or -NH), are treated with fatty acids or substituted fatty acids, 5-acidylamino-4-aminopyrimidines are formed. If these are treated with solutions of alkaline condensing agents, or if their alkali salts are heated, water is eliminated and purine or guanine derivatives substituted in the 8-position are produced. The following fatty acids and derivatives are mentioned:—Acetic, propionic, oxalic, succinic, cyanoacetic, lactic, hippuric, and hydroxyisobutyric acids, acetylglucosyl, ethoxy- and methoxyacetic acids, and α - β -dihydroxypropionic acid.—T. F. B.

Aromatic hydroxylated nitro-compounds; Process for preparing —. R. Wolfenstein and O. Boeters. Ger. Pat. 214,045, Aug. 21, 1907. Addition to Ger. Pat. 194,883, Aug. 4, 1906. (See Eng. Pat. 17,521 of 1907; this J., 1907, 1194.)

By treating aromatic hydrocarbons or their substitution products or derivatives, or heterocyclic compounds which contain at least one benzene nucleus, with nitrogen oxides or their hydrates (other than nitric acid) or mixtures of these, in presence of mercury or mercury compounds, hydroxylated nitro-compounds are obtained. Nitrogen dioxide, nitrogen tetroxide, nitric anhydride, and nitrous acid are suitable for the process.—T. F. B.

Protein substances from anthrax bacilli; Process for obtaining active —. Kalle und Co. Ger. Pat. 214,071, Sept. 17, 1908. Addition to Ger. Pat. 212,830, May 17, 1908 (see this J., 1909, 1062).

THE anthrax bacilli, after treatment with nitrous acid, are heated with dilute alkali, *e.g.*, a 1 per cent. solution of potassium hydroxide, instead of with dimethylamine as described in Ger. Pat. 212,831 (*loc. cit.*), a previous addition to the main patent.—A. S.

1-*Paradiakylaminoaryl-2,4-dialkyl-3-oxymethyl-5-pyrazolone*. F. Stolz and K. Streitwolf, Assignors to Farbwerke vorm. Meister, Lucius, und Brünig, Höchst on Maine, Germany. U.S. Pat. 936,380, Oct. 12, 1909.

SEE Edg. Pat. 4128 of 1909; this J., 1909, 854.—T. F. B.

Lactic acid; Process of making concentrated —. C. H. Boehringer Sohn. Fr. Pat. 401,395, March 29, 1909.

SEE Eng. Pat. 7094 of 1909; this J., 1909, 674.—T. F. B.

Solvents for fats and essential oils. Fr. Pat. 401,704. See XII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENT.

Cinematograph film; Sensitive —. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. First Addition, dated July 24, 1908, to Fr. Pat. 400,385, June 3, 1908. (See Eng. Pat. 16,114 of 1908; this J., 1909, 491.)

THE film consists of a gelatin film coated with a sensitive emulsion, supported on another film, of some impermeable material the dimensions of which are not altered by the various photographic processes. This insures that the gelatin film, when finally stripped from its support, shall be the same size throughout its length.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives; Report of the Chief Inspector (C. N. Hake) of — for the State of Victoria for the year 1908.

THE following table gives the quantities of explosives imported into the State during the years 1907 and 1908:—

	1908.	1907.
	lb.	lb.
Gelignite	752,550	948,900
Gelatin-dynamite	244,250	310,500
Blasting gelatin	104,400	120,300
Cheddite	15,000	15,000
Ripplite	10,000	6,400
Powder fuse	75,000	77,000
Blasting powder	202,125	155,000
Sporting powder	31,050	26,675
Total	1,434,375	1,659,775
Detonators (number)	2,015,000	3,575,800

There were 1026 tests made with explosives. Of these 182 were with blasting gelatin, of which 72 samples were rejected. 509 samples of gelignite were examined and 85 rejected, and 146 samples of gelatin-dynamite, of which 14 were rejected. It is stated that the blasting gelatin imported from European ports was far from satisfactory, over 10 per cent. of the total importations being condemned, partly on account of low stability, and partly owing to the exudation of nitroglycerin. The gelatin-dynamite and gelignite imported during the year were of a very satisfactory nature, all the consignments being passed. All consignments of cheddite complied with the requirements of the Act. The total number of factories under licence was seven, and sixteen Rack-a-rock manufacturing licences

were issued during the year. The total number of magazines under licence was 236, and there were twelve Government magazines available for public use, chiefly for the storage of commercial explosives. No accidents by fire or explosion occurred during the year in the manufacture or transport of explosives.—G. W. McD.

Glycerol ethers; Some nitro-derivatives of —. E. Paternò and T. Benelli. Gaz. chim. ital., 1909, 39, II., 312—314.

THE authors have prepared the nitro-derivatives of the α -dimethyl and α -diethyl ethers of glycerol, obtained by the action of methyl and ethyl alcoholic solutions of potassium hydroxide on epichlorhydrin. The glycerol-ether was allowed to flow drop by drop into a mixture of 100 parts of concentrated sulphuric acid, 20 of concentrated nitric acid, and 30 of anhydrous potassium nitrate, the liquid being kept well stirred, and the temperature kept below 15° C. in the case of the methyl-ether, or 0° C. in that of the ethyl derivative. The reaction product was diluted with water, the oily nitro-derivative separated, washed first with water and then with a dilute solution of sodium carbonate, and purified by distilling with steam in presence of a small quantity of sodium carbonate. The nitro-derivative of the dimethyl ether, $\text{CH}_2(\text{OCH}_3)\cdot\text{CH}(\text{ONO}_2)\cdot\text{CH}_2(\text{OCH}_3)$, is a colourless neutral liquid, soluble in the common organic solvents; it boils at 180° C. and solidifies at about -15° C. It burns readily but is not explosive. A mixture of nitroglycerin (m. pt. -18° C.) with 2 per cent. of the nitro-derivative of the methyl ether melts at -34° C. Ten per cent. of it has no appreciable effect on the sensitiveness of explosion of nitroglycerin. It has a good gelatinising action on nitro-cellulose. Substitution of the nitro-derivative of glycerol-dimethyl ether for the whole or a part of the nitroglycerin in an explosive lowers the ballistic power. The nitro-derivative of glycerol-diethyl ether boils, with decomposition and evolution of heat, at 168°—170° C. When cooled to -75° C. it becomes pasty, but is still mobile at -60° C. —A. S.

Determining carbon monoxide in mine gas. Weiskopf. See XXIII. Inorg. Quant.

PATENTS.

Explosive compound. F. H. Briggs, Painesville, Ohio, Assignor to The American Dynamite Co., Cleveland, Ohio. U.S. Pat. 934,990, Sept. 28, 1909.

THE explosive consists of an intimate mixture of potassium chlorate, oil of mirbane, and pulverised slate.—W. P. S.

Blasting cartridge. T. Tarrton, Kilgore, Idaho, Assignor to W. Hoskins, La Grange, Ill. U.S. Pat. 936,192, Oct. 5, 1909.

THE cartridge, formed of an explosive containing nitroglycerin, has a wrapper of bibulous paper in contact with the explosive, in order to absorb any nitroglycerin exuding in the course of storage, the whole being surrounded by a waterproof external wrapper, *e.g.*, one of paraffined paper. —J. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

PATENT.

Gases; Apparatus for analysing —. O. Rodhe. Fr. Pat. 401,800, April 7, 1909. Under Int. Conv., May 9 and July 22, 1908.

SEE Eng. Pat. 18,829 of 1908; this J., 1909, 1065.—T. F. B.

INORGANIC—QUALITATIVE.

Detecting sodium sulphite in presence of sodium sulphate and sodium thiosulphate. Weston. See VII.

INORGANIC—QUANTITATIVE.

Cobalt and nickel; Sanchez' method for separation of —. H. Grossmann. *Z. angew. Chem.*, 1909, 22, 2005—2006.

THE author has subjected Sanchez' method (this J., 1909, 749) to a critical investigation. Sanchez starts with the separation of nickel and cobalt from other metals of the ammonium sulphide group by the use of dilute hydrochloric acid, a method which has been shown to be inexact by Funk (this J., 1906, 954). Next, he assumes that the precipitated nickel and cobalt sesquihydroxides have the composition, Ni_2O_3 and Co_2O_3 , after incineration, whereas the fact is that the precipitates formed in the manner indicated by Sanchez always contain alkali, and the oxides which are stable on strong ignition have the formulæ, NiO and Co_3O_4 . The special feature of Sanchez' method, viz., the separation of the two metals by means of potassium cyanide and silver nitrate, whereby silver cobalticyanide is precipitated, is sound and has been verified by the author, but the subsequent precipitation of the nickel by sodium hydroxide and bromine solution does not yield a pure sesquihydroxide. Bellucci and Clavari have shown that, whatever conditions be chosen, the oxide so obtained always contains either more or less oxygen than would correspond to the formula, Ni_2O_3 . The author concludes that Sanchez' method cannot be preferred to the more rapid and accurate methods of separation based on the use of thiocyanate, dimethylglyoxime and dieryandimidine.—J. F. B.

Arsenic; Irregularities in the volumetric determination of — after previous distillation. [Presence of pyrrole as an impurity in ammonia.] L. Brandt. *Chem.-Zeit.*, 1909, 33, 1114—1115.

IN the determination of arsenic with standard iodine, after previous distillation with strong hydrochloric acid, it is usual to nearly neutralise the distillate with sodium hydroxide or ammonia, before adding sodium bicarbonate. Errors have been detected in both these methods of neutralisation. Sodium hydroxide (even "pure by alcohol") is liable to contain an oxidising agent, which converts part of the arsenious chloride into arsenic acid, causing low results. Ammonia, on the other hand, often contains pyrrole as an impurity, and this combines with iodine: the pyrrole may be detected by boiling the nearly neutralised ammonia, and testing the vapour in the usual way with a pine splinter moistened with hydrochloric acid. It may be destroyed by adding to the ammonia a slight excess of permanganate, and repeating this several times, as the colour disappears; the solution is allowed to stand for 24 hours with frequent shaking, and the hydrated oxide of manganese is then filtered off; ammonia, free from pyrrole and suitable for the determination, is thus obtained. About 5 c.c. of a freshly prepared 2 per cent. solution of pure starch should be used as indicator in the titration.

—F. SODN.

Silica; Separation of — from silicon and carbon. E. Britzke. *Chem.-Zeit.*, 1909, 33, 1098—1099.

SILICA may be separated quantitatively from silicon and carbon (as graphite or as carborundum or iron carbide) by the action of hydrogen chloride gas at a bright red heat, silicon and carbon being converted into volatile products, but the silica remaining unchanged. The hydrogen chloride used must be quite dry. When such mixtures as the above are heated in a current of chlorine, as in Limmer's method (this J., 1908, 121), the carbon is found to remain behind with the silica. A combination of the two methods on different quantities of material is, therefore, suggested for the determination of carbon and silica.—F. SODN.

Earth [niobic and tantallic] acids; Determination of —. L. Weiss and M. Landecker. *Z. anorg. Chem.*, 1909, 64, 65—103.

TANTALIC acid is completely precipitated by carbon dioxide from a solution of the melt obtained by fusing the acid with sodium carbonate and sodium nitrate, whereas the corresponding niobate solution is not decomposed in this way. Niobic acid may also be distinguished from tantallic acid by the fact that no precipitate is obtained, even on standing, when its solution in dilute sulphuric acid is added to concentrated ammonium sulphate. Furthermore, potassium ferrocyanide gives a greyish-green precipitate with a solution of niobic acid in hydrochloric acid, but with tantallic acid a reddish-brown precipitate slowly appears. The best method of distinguishing the two acids, however, is considered to be the microscopic examination of the characteristic crystals obtained, when hydrofluoric acid is added to a solution of a tantalate or niobate which is then neutralised with potassium hydroxide. Several new methods are given for the quantitative separation of niobium, tantalum, and titanium from other metals and from each other, and these have been applied to the analysis of tantalite, the following process being given:—The finely-powdered material is decomposed by fusion with potassium bisulphate, and the cooled melt is extracted with water containing sulphuric acid; to the boiling solution sulphurous acid is added, until the precipitate formed becomes flocculent, and the liquid is kept boiling for 20—30 minutes, which causes all the tin to be precipitated as metastannic acid along with the earth acids. After filtration, the residue is washed with hot sulphurous acid solution containing sulphuric acid, until free from iron, and the filtrate, containing all the elements present in the material, other than niobium, tantalum, titanium, and tin, is dealt with by known methods, after precipitating any remaining tin with hydrogen sulphide. Tin is extracted from the residue of acids, after neutralisation by ammonia, by digestion and subsequent washing with hot yellow ammonium sulphide. The residue is then ignited and fused with sodium carbonate, with the addition of sodium nitrate, no unnecessary excess of either reagent being employed. The melt is extracted with hot water and the liquid boiled for some time, and then filtered from the residue, which contains the titanium. If the filtrate be found free from titanium, it is treated with carbon dioxide to precipitate the tantalum, the gas being passed through the liquid for about 1½ hours in the cold, and the solution then boiled for a short time. If the filtrate contain titanium, it is precipitated with hydrogen sulphide, and the precipitate is dissolved, together with the former titanium residue, in a mixture of sulphuric acid and hydrogen peroxide, the solution being reduced with sulphur dioxide and the titanium precipitated with ammonia. The sodium sulphide in the filtrate, containing tantalum and niobium, is decomposed by sulphuric acid, the earth acids are precipitated with ammonia, and the precipitate again fused with sodium carbonate and sodium nitrate, the melt being dissolved in water and the tantalum precipitated as tantallic acid by a current of carbon dioxide. Before igniting precipitates of niobic, tantallic, and titanic acids, it is recommended that the filter-paper be freed as far as possible from precipitate and moistened with ammonium nitrate. In the event of insoluble sulphates or silver chloride being present with the acids, the latter may be readily separated by dissolving in a mixture of acid and hydrogen peroxide.

—F. SODN.

Phosphorous and hypophosphorous acids; Reducing reactions with, — [and determination of these acids]. A. Sieverts. *Z. anorg. Chem.*, 1909, 64, 29—64.

THE action of phosphorous and hypophosphorous acids on the salts of the heavy metals has been quantitatively studied, both the amount of metal reduced and of acid oxidised being determined. Rupp and Finck's method of determining phosphorous and hypophosphorous acids (this J., 1902, 1473) may be shortened by effecting the oxidation of the hypophosphorous acid by warming in a pressure flask at 70° C. for 30 minutes; the titration of

the excess of iodine is best done with arsenious acid 2 hours after the solution has been rendered alkaline with bicarbonate. For the determination of phosphorous and hypophosphorous acids in the presence of each other, they are first oxidised to phosphoric acid by bromine, and then, in a second sample, they are titrated iodometrically; from the quantity of iodine used, together with that of the phosphoric acid, which is determined gravimetrically, the quantity of each acid present may be calculated. It is noted that these acids suffer no appreciable oxidation on exposure to air, being remarkably stable towards many oxidising agents. Gold and silver salts are reduced to the metal by phosphorous or hypophosphorous acid, no hydride being formed. Silver is deposited first as a black precipitate which probably contains colloidal silver. Copper sulphate is reduced by phosphorous acid to metallic copper, but cupric chloride is reduced to the cuprous salt. Hypophosphorous acid reduces copper sulphate in excess to the metal, without the evolution of hydrogen, but, if the acid be in excess, copper hydride is precipitated, though mixed with metallic copper. Platinum chloride is not reduced by hypophosphorous acid; palladium chloride, however, is reduced in the cold, both by this and by phosphorous acid. Nickel and cobalt salts are not reduced by either acid. The freshly precipitated palladium, copper, gold, and silver act catalytically on the excess of hypophosphorous acid, according to the equation: $\text{H}_2\text{PO}'_2 + \text{H}_2\text{O} = \text{H}_2\text{PO}'_3 + \text{H}_2$, but platinum black has no such action, although nickel and cobalt, reduced from their oxides by hydrogen at $320^\circ\text{--}330^\circ\text{C.}$, are very effective. Palladium is the best catalyst, acting at the ordinary temperature, and cobalt and nickel come next in activity; gold, silver, and copper act but slowly at 100°C. Finely-divided iron is rapidly dissolved by hypophosphite solutions.—F. SODN.

Carbon monoxide; Determination of —, in mine gas. E. H. Weiskopf. J. Chem. Met. and Min. Soc., S. Africa, 1909, 9, 258—265, 306—307.

IN connection with a paper by Cullen on the nature of the gases resulting from the use of high explosives (this J., 1909, 162), the method employed for the determination of the carbon monoxide is now described. The process consists in the use of iodine pentoxide, which reacts with carbon monoxide, producing free iodine and carbon dioxide, thus: $\text{I}_2\text{O}_5 + 5\text{CO} = \text{I}_2 + 5\text{CO}_2$. The applicability of this reaction for the estimation of traces of carbon monoxide was originally demonstrated by Nieloux (Comptes rend., 1898, 126, 746). After being freed from moisture, carbon dioxide and unsaturated hydrocarbons or other interfering constituents, the gas passes through an absorption coil containing iodine pentoxide kept at 150°C. by immersion in an oil bath. The vapour of the liberated iodine is absorbed in potassium iodide solution and subsequently titrated with thiosulphate. The fact that unsaturated hydrocarbons are also oxidised by iodine pentoxide with liberation of iodine is specially emphasised, as also is the difficulty of their complete absorption by the usual reagents. The absorbent used for this purpose in the present instance, and which was found to be very efficient, consisted of strong sulphuric acid (99 to 99.5 per cent. H_2SO_4) kept at 165°C. Figures and data involved in the analysis of samples of mine gas, taken before and after blasting with gelignite, are appended, while the origin of the carbon monoxide itself is also discussed.—W. E. F. P.

Technical assay of zinc. Greenwood and Brislée. See X.

Testing galvanised and other zinc-coated metals. Walker. See X.

Determining gypsum and other salts in treated brewing waters. Hulton and Day. See XVII.

ORGANIC—QUALITATIVE.

Blood; Value of benzidine for the detection of minute traces of —. E. J. McWeeney. Roy. Dublin Soc. Proc., 1909, 12, 216—224.

SCHLESINGER and Holst (Deutsch. med. Wochenschr., 1906) have drawn attention to the value of benzidine for the

detection of traces of blood in faecal matter. The author finds that a solution of benzidine in acetic acid at once produces a blue coloration with a 1 in 200,000 solution of blood in presence of hydrogen peroxide: in absence of blood, no colour develops for about two minutes. Dried blood in particulate form from stains, etc., is very readily detected by this means, and its reaction is quite distinct from that of other body-fluids. Similar reactions are given by many freshly cut vegetables, but after boiling, no reaction takes place, whereas blood solutions react equally well after ten minutes' boiling.—T. F. B.

Detecting fats in vaseline. Ferraro. See III.

Detecting wheat flour in rye flour. Trowbridge. See XVIII.A.

Detecting cinnamic acid in foods. Bigelow. See XVIII.A.

Reaction for sucrose and other sugars. Pozzi-Escot. See XVI.

Alkaloid reactions with perhydrol [hydrogen peroxide]. Schär. See XX.

Brucinesulphonic acids and the cause of brucine-nitric acid reaction. Leuchs and Geiger. See XX.

Characters and tests for chinisol [neutral orthohydroxyquinoline sulphate]. Zernik. See XX.

General reaction for aldehydes and ketones. Franzen. See XX.

ORGANIC—QUANTITATIVE.

Aliphatic acids; Separation of mixtures of some — by means of benzene and toluene. T. R. Hodgson. Analyst, 1909, 34, 435.

LASSERRE (Ann. de l'Institut Pasteur, 1907, 829) devised a method of separating formic and acetic acids from butyric, valeric, iso-valeric acids, etc., by extracting the aqueous solution of the mixed fatty acids with benzene. The formic and acetic acids were said to remain in the aqueous layer, whilst the higher acids were removed by the benzene. The author's experiments with weighed quantities of the pure fatty acids indicated that the separation thus effected was incomplete, and that the amount of error varied with the quantity of acids, the proportion of volatile solvent used, and the number of extractions. Similar results were obtained when toluene and light petroleum spirit were used for the extraction. By working under constant conditions, however, the method may in some cases be found useful. The best results are obtained when the aqueous solution of the fatty acids is extracted with twice its volume of benzene.—C. A. M.

Aliphatic acids; Separation of mixtures of some — by means of benzene. C. A. Keane and P. Narracott. Analyst, 1909, 34, 436—438.

IN the authors' experiments to test the reliability of Lasserre's method of separation (see preceding abstract), determinations were made of the ratio of distribution of the acids between water and benzene. Where the proportion of benzene to aqueous solution was as 1:1, the solubility of isovaleric acid in benzene was only about 100 times greater than that of formic or acetic acids. By using a larger proportion of benzene to water (10:1), a somewhat better separation was effected, whilst when the water was in large excess (1:10) similar differences of solubility were observed, but isovaleric acid was only about 200 times more soluble than acetic acid in the benzene. The ratio of distribution between the two solvents varied with the concentration of the different acids, although it was maintained in a mixture of acids. In the authors' opinion Lasserre's method does not afford a satisfactory means of separation.—C. A. M.

Turpentine oil: Examination of —. Nicolardot. See XIII.B.

Determining rubber as tetrabromide. Budde. See XIII.C.

Influence of temperature on the polarisation of raw cane sugars. Wiley and Bryan. See XVI.

Determining sugar in fresh or exhausted cossattes. Le Docte. See XVI.

Influence of the non-sugar on the determination of the dry substance in sugar-house products. Stanek. See XVI.

Determining salicylic acid in wines. Bigelow. See XVII.

Analysis of distilled spirits. Tolman and Hillyer. See XVII.

Determination of fusel oil. Mitchell and Smith. See XVII.

Determining fat in pork-butchers' products and in other substances containing water. Perrier. See XVIII.A.

Determining starch in cocoa products. Dubois. See XVIII.A.

Determining citral in terpeneless essence of lemon. Baer. See XX.

Determining essential oil and eugenol in cloves. Reich. See XX.

Characterisation of theobromine-sodium salicylate. Frey. See XX.

Determination of salicylates. Seidell. See XX.

Detecting and determining iodine in organic substances.
Determining iodoform in iodoform gauze. Paolini. See XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Colloidal solutions of metals obtained by the action of boiling distilled water. M. Traube-Mengarini and A. Scala. Atti R. Accad. dei Lincei, Roma, 1909, [5], 18, II., 111—116. Chem. Zentr., 1909, 2, 1411—1412. (See this J., 1909, 857.)

By repeatedly boiling the purest water in a silver dish containing pieces of silver, and then concentrating, solutions containing up to 0.0162 grm. of silver per 100 c.c. were obtained. Similar experiments in a platinum dish gave a solution of a faint greenish colour, which contained in colloidal solution mostly copper and copper oxide, but also traces of platinum; traces of platinum were also dissolved in a similar manner from a platinum dish, but only with great difficulty. In commercial "platinum solutions," prepared by the electrical process, the authors were able to detect considerable quantities of copper, but could not with certainty detect platinum.—A. S.

Chemical accidents: First aid in —. Nobel's Explosives Company, Ltd. Chem. Trade J., 1909, 45, 358.

Sulphuric and nitric acid burns.—Acid burns are sometimes very deceptive as to their severity, especially those from nitric acid. This acid causes a yellowish stain on the skin, which has a peculiar parchment-like feeling to the touch. The burn is apt to be made light of at first, but in a few days a red line, denoting inflammation, begins to form round the yellowish patch, following which separation of the slough commences, which takes a con-

siderable time and leaves a raw, granulating surface, slow in healing. If it is not carefully attended to, so as to keep the granulation down, it will leave a prominent scar and permanent disfigurement.

Treatment.—In all cases of severe burns, either from nitric or sulphuric acids, the patient should at once be plunged into the usual tank containing water and bicarbonate of soda; then the part should be thoroughly bathed with pure warm water, afterwards applying a cloth saturated with oil, and then covering with cotton wool and a bandage. The patient should be taken at once to his home or to an hospital. Then commences the proper treatment of the burn, which is suitable for both nitric and sulphuric acid burns. A piece of surgeon's lint saturated with carron oil (equal parts of linseed oil and lime-water) is applied, the smooth surface of the lint being placed to the part, and is covered with oiled silk or gutta tissue, cotton wool or gamgee and absorbent bandage. This dressing should be changed night and morning for the first few days, but should the burn be very severe and painful, then a thin piece of cotton cloth saturated with carron oil, and a warm bread-and-water poultice are applied, covered as before with wool or gamgee and a bandage. The poultices should be renewed at least two or three times in the 24 hours and continued until the separation of the slough, when the carron oil G.P. tissue dressings are reverted to, as at first. Should the burn become irritable and slow in healing then carbolic oil, borie lint, or the following paste may be tried, according as is found suitable. Paste—composed of equal parts, by weight, of carron oil and zinc oxide ointment. Should the granulations become exuberant or above the level of the surrounding skin, they should be painted over with a two per cent. solution of cocaine, before being touched, every second day, with a solution of nitrate of silver (15 to 20 grs. to the ounce of distilled water), or with solid lunar caustic, afterwards being dressed with carbolic or carron oil, as before.

Acid burns of eyes.—Acid burns of the eyes should on no account be bathed with alkaline solutions, but at once and liberally, with pure warm water, or warm water and milk, allowing the fluid to run freely over the eyeballs. Afterwards a few drops of a two per cent. solution of cocaine hydrochloride, slightly warmed, are applied, then a little pure castor oil, and lastly, a piece of lint saturated with warm water is placed over the eye and held there by means of a light bandage. This can be repeated two or three times a day. Cocaine alkaloid dissolved in castor oil is sometimes used, but the first method is best. A two per cent. ointment of cocaine hydrochloride and vaseline applied to the eyelids, affords great relief, and should be applied at bed-time. In using the cocaine solution, a good plan is to warm a teaspoon in hot water, thus making the application more agreeable to the injured eye. This treatment should be continued for a few days, but the after-treatment must depend entirely upon the severity of the burn.

Books Received.

UEBER DIE ERHALTUNG DER MASSE BEI CHEMISCHEN UMSETZUNGEN. [Abhandlungen der deutschen Bunsen-Gesellschaft für angewandte physikalische Chemie.] No. 1. Von H. LANDOLT. Wilhelm Knapp's Verlag. Halle a. S. 1909. Price M1.80.

8vo volume, containing 47 pages of subject matter.

BEITRÄGE ZUR KENNTNISS DES ELEKTROCHEMISCHEN VERHALTENS DES EISENS. [Abhandlungen der deutschen Bunsen-Gesellschaft für angewandte physikalische Chemie.] No. 2. Von F. FOERSTER. Wilhelm Knapp's Verlag. Halle a. S. 1909. Price M3.20.

8vo volume, containing 83 pages of subject matter and six illustrations. The subjects of the various chapters

are:—I. Experiments on the equilibrium potential of iron. II. Active iron. III. Theoretical considerations. (i). The views hitherto entertained as to the passive condition of iron. (ii). Hydrogen content of iron, and the active condition of the metal. (iii). Variation of the potential of active iron. (iv). The spontaneous activation of iron. (v). Disturbances of the spontaneous activation by oxide incrustations. (vi). Activation by halogens, &c. (vii). General remarks. IV. Electrolytic separation of iron. V. Electrolytic iron.

CHEMICAL CONVERSION TABLES. For use in the analysis of Fertilisers, Fertilising material, Cotton seed, Iron and its products, Food products, &c. By H. B. BATTLE, Ph.D., Montgomery, Ala. and W. J. GASCOYNE, Ph.D., Baltimore, M.D. Williams and Wilkins Publishing Company, Baltimore, Md. 1909. Price \$2.50.

SMALL Svo volume, containing 13 tables, arranged for immediate and ready reference, by means of projecting portions of each table, in step-like order as in the index of a ledger; each of these projections containing the title of the table indexed. Thus:—Tables of, I. Phosphoric acid. II. Potash. III. Ammonia and protein. IV. Nitrogen weight. V. Chlorine. VI. Sulphur. VII. Alumina. VIII. Phosphorus and magnesia. IX. Silicon. X. Manganese. XI. International atomic weights, 1909. XII. Conversion factors. XIII. Weights and measures.

PRACTICAL POINTS FOR PRACTICAL BREWERS. A Reference Book for all interested in the Arts of Brewing and Malting. Compiled by the staff of the National Brewers' Academy. Editors: FRANCIS WYATT, EMIL SCHLICHTING. The National Brewers' Academy and Consulting Bureau, New York. 1909. Price 6s. 3d., or \$1.50 net.

SMALL volume of pocket book size and shape, and containing 159 pages of matter. There is an alphabetical index of subjects. The matters treated of are as follows:—I. Instructions for taking and sending samples. II. Permissible limits for differences in analytical results. III. Table with composition of certain water supplies in the United States. IV. Scheme for examination of water for brewery use. V. Practical points on malting barleys, &c., and on malt kilning. VI. Malt adjuncts. VII. Comparative table of brewing value of various cereal products. VIII. Brewing sugars. IX. Practical points on hops. X. American beers, &c. XI. General points on the mashing process for lager beers. XII. Chief points in brewing ales and porters. XIII. Causes of loss in brewery operations. XIV. Points on refrigeration. XV. Micro-organisms. XVI. Moulds. XVII. Bacteria. XVIII. Cultivated yeasts. XIX. Beer turbidities. XX. Antiseptics and cleaning agents. Also series of tables, statistics, constants, weights and measures, &c.

A MANUAL OF FORENSIC CHEMISTRY DEALING ESPECIALLY WITH CHEMICAL EVIDENCE, ITS PREPARATION AND ADDUCTION. Based upon a course of lectures delivered at University College, University of London. By WILLIAM JAGO, Stevens and Haynes, Bell Yard, Temple Bar, London. 1909. Price 5s. net.

Svo volume, containing 252 pages of subject matter, and an alphabetical index of subjects. The matter in this work is classified and arranged in the following chapters:—I. Introductory, defining nature of chemistry; of forensic chemistry; evidence; burden of proof; chemical evidence, &c. II. Adulteration of food. III. Adulteration of drugs. IV. Use or non-use of new manufacturing processes. V. Use of preservatives and colouring matters. VI. More important criminal matters. VII. Chemical evidence in civil actions. VIII. Practice. (i). Proceedings under Food and Drugs Act. (ii). Meaning of *prima facie* evidence. (iii). Precautions by analyst, and by solicitor. (iv). Reference to "Somerset House." (v). Example of ruling in civil action, &c.

CHEMISTRY IN DAILY LIFE. Popular Lectures by Dr. LASSAR-COHN, Professor in the University of Königsberg. Translated by M. M. PATTISON MUIR, M.A. Fourth edition, revised and augmented. H. Grevel and Co., 33, King Street, Covent Garden, London, W.C. 1909. Price 6s. net.

Svo volume, containing 295 pages of subject matter, with 25 illustrations, and an alphabetical index of subjects. The subject matter is classified as follows:—I. Breathing. Weight of the air. Analysis of air. Combustion.—Matches. II. Nature of flame. Candles. Cooking by gas. Electric furnace. Acetylene. III. Food of plants. Manuring fallow land. Artificial manures. Food and foodstuffs. IV. Mixed diet. Butter. Margarin. Starch. The sugars, &c. V. Quantity of food necessary, and nutritive values of the chief foods. Fermentation. Wine. Cider. Beer, spirits. Absolute alcohol, &c. VI. Wine vinegar. Wood vinegar. Glacial acetic acid. Wood spirit. Acetone. Explosives. Wool, cotton, silk, &c. VII. Tanning. Leather. Parchment. Bleaching. Antichlor. Dyeing. Mordants. Lakes. Substantive colours, &c. Calico printing. VIII. Oil painting. Drying and non-drying oils. Varnishes. Inks. Cellulose. Paper, &c. IX. Potash. Soda. Sulphuric acid, alkalis, &c. X. Glass. Photography. The X rays. Radio-activity.—Radium. XI. Noble and base metals. Ores. XII. Alloys. Alkaloids, &c.

LABORATORY NOTES ON IRON AND STEEL ANALYSES. By WALTER MACFARLANE. Longmans, Green, and Co., 39, Paternoster Row, London; also New York, Bombay, and Calcutta. 1909. Price 7s. 6d.

Svo volume, containing 450 pages of subject matter, with 25 illustrations, and an alphabetical index of subjects. The grouping of the subjects proceeds as follows:—I. ANALYSIS OF STEEL. Determination of (i), combined carbon. (ii), silicon. (iii), phosphorus. (iv), manganese. (v), sulphur. II. ANALYSIS OF PIG IRON. Determination of combined carbon, graphitic carbon, silicon, phosphorus, manganese, sulphur, carbon, iron, chromium, chromic oxide, nickel, arsenic, aluminium, copper, tungsten, vanadium, molybdenum. III. Analysis of quick-cutting tool steel. IV. Analysis of alloys used in making quick-cutting steel. V. Analyses of (i), tungsten powder. (ii), iron ores. (iii), clayband ironstone. VI. Determination of lead, copper, and zinc in ores. VII. Analyses of iron ores requiring treatment with fusion mixture. Analyses of hematite ore, limestone, calcined limestone, dolomite, blast furnace slags, puddler's cinder, flue cinder, &c., basic slag. VIII. Miscellaneous determinations. IX. Notes on sampling. X. General notes on laboratory operations, &c. XI. Baumann's auto-sulphur printing method. XII. Blast furnace calculations. XIII. United States Steel Corporation methods for ore analysis. XIV. Cushman's method of comparing rate of corrosion.

PHILIPPINE ISLANDS. NEW CUSTOMS TARIFF. [Cd. 4903.] Wyman and Sons, Fetter Lane, London, E.C. Price 6ld.

THIS is a copy of the Act of United States Congress, approved August 5th, 1909, giving the new Customs tariff of the Philippine Islands, together with the rates of duty formerly in force.

RECENT ADVANCES IN PHYSICAL AND INORGANIC CHEMISTRY. By A. W. STEWART, D.Sc. With an introduction by Sir WM. RAMSAY, K.C.B., F.R.S. Longmans, Green, and Co., 39, Paternoster Row, London; also New York, Bombay, and Calcutta. 1909. Price 7s. 6d.

Svo volume, containing 250 pages of subject matter, and alphabetical indexes of names of authors and investigators, and of subjects. There are 25 illustrations. The text is classified as follows:—I. Some hydroxylamine derivatives. II. Colloids. III. Reactions in liquid ammonia. IV. Fixation of nitrogen. V. Double salts.

VI. The problem of the oceanic salt deposits. VII. The cobaltamines. VIII. Absorption spectra. IX. The elements of the rare earths. X. Atomic weights. XI. The inactive gases. XII. The radioactive elements. XIII. Radioactive changes. XIV. Radioactive emanations.

REVIEW OF THE TRADE OF INDIA IN 1908-9. [Cd. 4912.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 3d.

COLONIAL IMPORT DUTIES, 1909. Return relating to the Rates of Import Duties levied upon the principal and other articles imported into the British Colonies, Possessions, and Protectorates. [Cd. 4874.] Price 2s. 9d. Wyman and Sons, Fetter Lane, E.C.

New Books.*

Autenrieth, Prof. Dr. Wilh.: Die Auffindung der Gifte u. stark wirkender Arzneistoffe. Zum Gebrauche in chem. Laboratorien. 4^{te} vollständig neu bearb. Aufl. (XI, 286 S. m. 20 Abbildgn.) gr. 8°. Tübingen, J. C. B. Mohr. 1909. M. 7.60; geb. M. 8.60.

Binz, Prof. Dr. Arth.: Chemisches Praktikum f. Anfänger. Mit Berücksicht. der Technologie. (154 S. m. Abbildgn.) 8°. Berlin, G. Reimer. 1909. M. 4.; geb. M. 4.80.

Blanc, F.: Etude analytique et comparative des charbons au point de vue de leurs impuretés. Courbes caractéristiques. Application au lavage et à la recherche de la valeur commerciale des charbons. In-8, avec 20 figures. Béranger. Paris. 1909. 3 fr. 50.

Caven, R. M.: Systematic Qualitative Analysis. For Students of Inorganic Chemistry. Cr. 8vo, pp. 240. Blackie. London. 1909. Net 3s. 6d.

Conte, P.: Le arti grafiche fotomeccaniche. Fototipografia, fotolitografia, fotocollografia, fotosilografia, fotocalcografia, fotomodellatura, processi a colori, triceromia, fotocollocromia, fotoeromia, processi galvanici, processi fotografici, con un dizionarietto tecnico e cenno storico sulle arti grafiche. 4a ediz. Milano, 16^o fig. p. XII, 228 e 8 tav. (Manuali Hoepli.) 1909. Lire 2.50.

Denz, Ferd.: Die Holzverkohlung u. der Köhlereibetrieb. Wien, M. Perles. 1909. M. 10.

Escard, J.: La Fabrication électrochimique de l'acide nitrique et des composés nitrés à l'aide des éléments de l'air. 2e édition. In-8 de 52 figures. Dunod et Pinat. Paris. 1909. 4 fr. 50.

Gentile, J. G., Lehrbuch der Farbenfabrikation: Anweisung zur Darstellg., Untersucht. u. Verwendg. der im Handel vorkomm. Malerfarben. Zum Gebrauch f. Farben-, Tusch- u. Tapetenfabrikanten, Chemiker, Techniker, Kaufleute, Maler, Koloristen u. andere Farbenkonsumenten. 3. umgearb. u. stark verm. Aufl., hrsg. v. Dr. A. Buntrock. gr. 8°. F. Vieweg und Sohn, Braunschweig. 1909. 2. Bd. Die Mineralfarben. (XI, 454 S. m. 58 Abbildgn. 1909. M. 10. 3 Bd. Die Lackfarben. (189 S.) 1909. M. 5.

Holland (A.) et L. Bertiaux: Analyse des métaux par l'électrolyse. 2e édition entièrement refondue et augmentée. In-8. Dunod et Pinat. Paris. 1909. 9 fr. 50.

Monier (F.), F. Chesney et E. Roux: Traité théorique et pratique sur les fraudes et falsifications. Tromperies, Falsifications des denrées alimentaires, des boissons, substances médicamenteuses, etc., suivi du texte des lois, décrets, arrêtés, ordonnances, instructions, circulaires et de formules. Préface de M. le docteur Bordas. Tome I. In-8. Larose et L. Tenin. Prix de l'ouvrage complet en 2 volumes. Paris. 1909. Fr. 20.

Oppenheimer, Carl: Handbuch d. Biochemie d. Menschen u. d. Tiere. Hrsg. v. Carl Oppenheimer. 19. Lfg. Jena, G. Fischer. 1909. M. 5.

Pages, G.: Les Falsifications des denrées alimentaires et la loi du 1er août 1905. In-8. Dunod et Pinat. Paris. 1909. Fr. 7.50.

Report of the Senior Analyst of the Cape of Good Hope for the year 1908. Folio, pp. 25. W. Wesley. London. 1909. Net 2s.

Schneider, Dr. W. v.: Mineralische Düngemittel u. Ernteerträge. Umgearb. Ausg. der in russ. Sprache al-Beylage zur Zeitschrift "Rationelle Düng." erschienenen Schrift. (116 S.) gr. 8°. Riga, N. Kymmell. 1909. M. 1.80.

Seubert, Karl: Internationale Atomgewichte. Nach den Festsetzgn. des internationalen Atomgewichtsausschusses hrsg. (2 Bl.) 68,5×92,5 cm. Leipzig. Breitkopf und Härtel. 1909. M. 1.

Spangenberg, Osk.: Farben-Harmonie. Praktisches Nachschlagewerk. f. Weber, Wirker, Posamentierer, Färber, Dekorateur, Kostümierer u. solche, die durch pass. u. geschmackvolle Zusammenstellg. v. Farben dem Auge wohlthuende Effekte hervorbringen wollen. 2. verm. u. verb. Aufl. (5 Taf. m. aufgeklebten Stoffmustern u. 1 Taf. Text.) 31×21,5 cm. Apolda, Selbstverlag. 1909. Auf Pappe, in Leporelloform, in Leinw. kart. M. 10.

Teichert, milchw. Untersuchungsanst. Vorst. Dr. Kurt: Methoden zur Untersuchung v. Milch u. Molkeerzeugnissen. Lex. 8°. Stuttgart, F. Enke. Mit 54 Abbildgn. n. 27 Tabu. (374 S.) 1909. M. 11.40; geb. in Leinw. M. 12.

Weinreich, P.: Dampfspannungen üb. Salmiakgeist. (15 S.) kl. 8vo. Magdeburg, Verlag Erika. 1909. Pf. 40.

Winslow, Kenelm, M.D.: The production and handling of clean milk, including practical milk inspection. 2nd Ed. N.Y., William R. Jenkins Co., 1909. 14+367 p. illustr. pls. 8°. \$3.25.

Zabel's Jahr- u. Adressbuch der Zuckerfabriken Europa's f. die Kampagne 1909-10. Hrsg. vom "Centralblatt f. die Zuckerindustrie." Bearb. v. C. Art. Schallheim. (46, 187 u. 49 S. m. 1 Bildnis.) gr. 8°. Magdeburg, Verlagsanstalt f. Zuckerindustrie. 1909. Geb. in Leinw. M. 4.

* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in foregoing list can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

23,534. Siemens. Regenerative gas re-heating furnaces.* Oct. 14.

23,552. Schroder. Cooling or drying apparatus. [Ger. Appl., Oct. 15, 1908.]* Oct. 14.

23,846. Ward. See under XXIII.

23,864. Dieker (Maschinenbau A.-G. Gölzern-Grimma). Liquid vaporising or concentrating apparatus. Oct. 18.

23,866. Lindahl. See under X.

23,869. Raab. Heating or evaporating solids or liquids. [Ger. Appl., Sept. 30, 1909.]* Oct. 18.

23,975. Phillips and Bulteel. Accelerating chemical changes in mixtures of solids and vapours or gases. Oct. 19.

23,978. Tixier. Filters for liquids or gases. [Fr. Appl. Oct. 21, 1908.]* Oct. 19.

24,074. Morison. Apparatus for heating and evaporating liquids. Oct. 20.

24,402 and 24,403. Arbuckle and Osborne. Separating comminuted solid matter such as pulverised ore from liquids.* Oct. 23.

24,458. Simpson. Apparatus for distilling volatilisable solids and for heating and separating gases *in vacuo*. Oct. 25.

24,465. Keyser. Heating drums. [U.S. Appl. Nov. 6, 1908.]* Oct. 25.

24,540. Spence, and Spence and Sons, Ltd. Preparation of comminuted solids. Oct. 26.

24,665 and 24,666. Robinson (Massey-Harris Co.). Centrifugal separators.* Oct. 27.

24,805. Johnson (Koepp und Co.). Absorption of gas from a mixture of gases by hot liquor. Oct. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

13,588 (1908). Groth. Storage vessels for liquefied gases. Oct. 20.

15,683 (1908). Feld. Subjecting gases to the action of liquids. Nov. 3.

21,767 (1908). Cudlipp. Centrifugal hydro-extractors. Oct. 27.

22,118 (1908). Lang. Heating materials by the heat developed on formation of metallic sulphides. Oct. 27.

23,189 (1908). Wilfley Mining Machinery Co., and Rondebush. Apparatus for separating solids from liquids. Oct. 20.

27,000 (1908). Bovone. Kilns. Nov. 3.

27,551 (1908). Snowden. Kilns. Nov. 3.

1151 (1909). Thompson (Badische Maschinenfabr. u. Eisengiesserei). Separating substances of different specific gravities. Nov. 3.

1716 (1909). Sacro. Manufacture of filters. Oct. 27.

4325 (1909). Marks (Jahn-Kommanditges.). Centrifugal separating apparatus. Oct. 20.

6167 (1909). Ernst. Process of cleaning gases. Oct. 20.

8621 (1909). Streller. Rendering organic and inorganic bodies transparent or translucent. Nov. 3.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

23,171. Gebr. Siemens und Co. Manufacture of arc light electrodes. [Ger. Appl., Nov. 19, 1908.]* Oct. 11.

23,434. Visseaux. Manufacture of incandescent mantles.* Oct. 13.

23,555. Graigola Merthyr Co., Ltd., Yeo, and Goskar. Manufacture of artificial or patent fuel. Oct. 14.

23,624. Williams. Removing cyanogen from coal gas, etc. Oct. 15.

23,671. Müller. Manufacture of coke and gas.* Oct. 15.

23,709. Clarkson and Behrmann. Manufacture of briquettes from peat-bog.

23,760. Oligny, and Peat Gas and Coal Co. Peat gas producing process. Oct. 16.

23,767. Oligny, and Peat Gas and Coal Co. Peat gas plants.* Oct. 16.

23,810. Goldstein. Manufacture of absorbent coal. [Addition to No. 17,914 of 1909. Ger. Appl., Aug. 6, 1909.]* Oct. 18.

24,014. Du Thil. Gas producers.* Oct. 19.

24,030. Fielding and Eady. Apparatus for purifying and washing gas. Oct. 20.

24,261. Burstall. Apparatus for separating suspended matter from gases.* Oct. 22.

24,353. Lessing. Carbonisation of coal. Oct. 23.

24,443. Muller and Bonnet. Manufacture of incandescent mantles. [Addition to No. 6555 of 1909. Fr. Appl., Nov. 3, 1908.]* Oct. 25.

24,725. Sheldon. Gas producers.* Oct. 27.

25,018. Graf and Smyth. *See under X*.

25,019. Richards and Pringle. Distilling or partially distilling coal for the production of fuel. Oct. 30.

25,036. Baker. Apparatus for making gas. Oct. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

21,763 (1908). Burkheiser. Purifying gases generated by dry distillation and obtaining by-products. Oct. 27.

22,851 (1908). Tully. Gas producer apparatus. Nov. 3.

24,803 (1908). Tully. Gas producers. Nov. 3.

25,736 (1908). Temple. Washing or purifying apparatus for gas generating plants. Oct. 20.

28,201 (1908). Dempster and Sons, and Toogood. Vertical retorts. Oct. 27.

1630 (1909). Milbourne. Gas purifiers. Nov. 3.

1937 (1909). Dempster and Sons, Ltd., and Brooke. Gas retorts. Oct. 20.

6167 (1909). Ernst. *See under I*.

7092 (1909). Heinrich. Manufacture of electric incandescent filaments of refractory metals or their alloys. Oct. 27.

7615 (1909). Pieph. Production of gas for lighting, heating, and power-producing. Oct. 27.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

23,348. Wohle. Petroleum and other hydrocarbon oils. Oct. 12.

23,766. Hugendick. Continuous distillation of tar. [Ger. Appl., Oct. 16, 1908.]* Oct. 16.

23,977. Phillips and Bulteel. Production of light oils from heavier mineral oils. Oct. 19.

24,216. Roesch (Burchard). Treating oil and petrol for lighting, heating, and other purposes. Oct. 21.

COMPLETE SPECIFICATIONS ACCEPTED.

21,800 (1908). Gutensohn. Treatment of tar. Oct. 27.

22,853 (1908). Reilly. Purification of tar. Oct. 27.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

23,181. Johnson (Badische Anilin und Soda Fabrik). Manufacture of halogen derivatives of indigo. Oct. 11.

23,204. Newton (Bayer and Co.). Manufacture of azo dyestuffs. [Addition to No. 1397 of 1909.] Oct. 11.

23,532. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of azo dyestuffs and pigment colours therefrom. Oct. 14.

23,738. Bloxam. (Act.-Ges. f. Anilinfabr.). Manufacture of monoazo dyestuffs for chrome mordanted wool. Oct. 16.

23,873 and 23,874. Johnson (Badische Anilin und Soda Fabrik). Reduction of indigo and similar colouring matters. Oct. 18.

23,875. Johnson (Badische Anilin und Soda Fabrik). Manufacture of vat colouring matter. Oct. 18.

23,992. Levinstein, and Levinstein, Ltd. Manufacture of azo dyestuffs. Oct. 19.

24,487. Newton (Bayer and Co.). Manufacture of acid wool dyestuffs. Oct. 25.

24,703. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs. Oct. 27.

24,920. Meister, Lucius, und Brünig. Manufacture of dyestuffs of the anthraquinone series. [Ger. Appl. Feb. 1, 1909.]* Oct. 29.

COMPLETE SPECIFICATIONS ACCEPTED.

1244 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the pyrazolone group. Oct. 27.

1920 (1909). Fowler. *See under V.*

2609 (1909). Imray (Meister, Lucius, und Brünig). Manufacture of greenish-blue hexabromindigo. Nov. 3.

5382 (1909). Newton (Bayer and Co.). Manufacture of derivatives of the anthracene series. Nov. 3.

5786 (1909). Newton (Bayer and Co.). Manufacture of dyestuffs of the anthraquinone series. Oct. 20.

10,666 (1909). Ges. f. Chem. Ind. in Basel. Manufacture of green vat dyestuffs. Oct. 27.

10,936 (1909). Imray (Soc. Chem. Ind. in Basel). Manufacture of substantive azo dyestuffs. Oct. 20.

12,371 (1909). Mesiter, Lucius, und Brünig. Manufacture of disazo dyestuffs. Oct. 20.

14,315 (1909). Imray (Soc. Chem. Ind. in Basel). Manufacture of substantive tetrazo dyestuffs. Oct. 27.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

23,422. Westbrook and Biggs. Rendering cotton, woollen, and other material waterproof. Oct. 13.

23,428. Levinstein, and Levinstein, Ltd. Production of multi-coloured effects on woollen goods. Oct. 13.

23,437. Malard. Treatment by liquid processes of textile and other materials. [Addition to No. 759 of 1908.]* Oct. 13.

23,547. Friedlander and Tuebben. Providing linen, &c., with a washable coating. [Ger. Appl. March 15, 1909.]* Oct. 14.

23,637. Bradford Dyers' Assoc., and others. Apparatus for printing textile fabrics. Oct. 15.

24,006. Zimmer. Waterproofing and glazing linen and other textile articles. Oct. 19.

24,198. Borrel. Dyeing and printing woven materials. Oct. 21.

24,217. Green. Production of aniline black on textile fibres and fabrics. [Addition to No. 16,189 of 1907.]* Oct. 21.

24,404. Schumacher and Resch. Apparatus for dyeing wound yarn. [Fr. Appl. Oct. 24, 1908.]* Oct. 23.

24,607. Psarski. Dyeing machine.* Oct. 26.

COMPLETE SPECIFICATIONS ACCEPTED.

21,536 (1908). Sumner. Treatment of ramie and similar substances. Oct. 20.

21,872 (1908). Dreaper. Machinery for artificial silk, &c. Oct. 27.

1920 (1909). Fowler. Dyeing and dyes therefor. Oct. 20.

11,700 (1909). Friedrich. *See under XIX.*

20,312 (1909). Imray (Soc. Chem. Ind. in Basel). Obtaining fast grey prints and vat dyeings. Nov. 3.

20,728 (1909). Bernhardt. Preserving the silk finish and similar effects on textile goods. Oct. 27.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

APPLICATION.

23,233. Krüger. *See under XIX.*

COMPLETE SPECIFICATION ACCEPTED.

24,114 (1908). Polack. *See under XIV.*

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

23,188. Parker. Production of ozone.* Oct. 11.

23,209. Soc. Chim. des Usines du Rhone, and Meyer. Manufacture of zinc sulphide. [Fr. Appl. Nov. 19, 1908.]* Oct. 11.

23,240. Hodgkinson and Coote. *See under XIII.A.*

23,419. Eschelmann, Harmuth, and Ges. der Tentelw-schen Chem. Fabr. Apparatus for making sulphuric anhydride by the catalytic process.* Oct. 13.

23,442. Chem. Fabr. Griesheim-Elektron. Manufacture of sulphuric acid. [Addition to No. 20,401 of 1909. Ger. Appl. April 15, 1909.]* Oct. 13.

23,629. New (Weichert). Manufacture of bleach liquors.* Oct. 15.

23,645. Soc. Chim. des Usines du Rhone, and Meyer. Manufacture of zinc sulphide. [Ger. Appl. Nov. 6, 1908.]* Oct. 15.

23,976. Phillips and Bulteel. Production of oxidised nitrogen and ammonia. Oct. 19.

24,709. Johnson (Badische Anilin und Soda Fabrik). Manufacture of derivatives of formaldehyde sulphonylic acid. Oct. 27.

24,716. Eycken and others. *See under XI.*

24,768. Pope. Manufacture of lead oxide. Oct. 28.

24,945. Ozonair, Ltd., and Joseph. Production of ozone.* Oct. 29.

25,027. Kleneke. Manufacture of sulphuric acid. [Ger. Appl. Nov. 7, 1908.]* Oct. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

19,302 (1908). Malcolm and Munton. Treatment of brine. Oct. 20.

22,434 (1908). De Briaillies. Manufacture, concentration, and simultaneous purification of sulphuric acid. Oct. 20.

491 (1909). Poulson. Manufacture of gelatinous silica. Oct. 20.

5293 (1909). Pape. Preparation of zinc oxide for reduction. Oct. 20.

7307 (1909). Sinding-Larsen. Manufacture of silicon nitride. Nov. 3.

9394 (1909). Schlossberg. Manufacture of acid- and fire-proof bodies of pure silicic anhydride. Oct. 20.

15,996 (1909). Serpek. Production of aluminium nitride. Oct. 20.

21,032 (1909). Cons. f. Electrochem. Ind. Production of hydrogen. Nov. 3.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

23,351. British Thomson-Houston Co. (General Electric Co.). Refractory materials. Oct. 12.

23,852. Kasseker. Printing ink or colour for pottery or ceramic transfer pictures. Oct. 18.

- 24,213. Osman and Co., and Fidler. *See under IX.*
 24,344. Redfern and Sharratt. Printing on pottery and the like. Oct. 23.

COMPLETE SPECIFICATIONS ACCEPTED.

- 25,797 (1908). Rembaux. Glass annealing furnaces or ovens. Oct. 27.
 9394 (1909). Schlossberg. *See under VII.*

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

- 23,695. Barnett and Thompson. Kilns for burning bricks, &c. Oct. 16.
 23,850. Gorhan and Schneider. Manufacture of artificial stones.* Oct. 18.
 23,996. Goddard. Building material. Oct. 19.
 24,111. Kuldkepp and Graf. *See under XIX.*
 24,213. Osman and Co., and Fidler. Continuous kilns for burning bricks, tiles, terracotta goods, &c. Oct. 21.
 24,584. De Canderberg. Making gelatinous cement for the manufacture of artificial paving blocks, &c. Oct. 26.
 24,620. Soc. Anon des Ciments Franç. Rotary furnaces for treating cements. [Fr. Appl., Nov. 5, 1908.]* Oct. 26.
 24,758. Accettola. Manufacture of artificial marble. Oct. 28.
 24,919. Baker. Ceramic marble.* Oct. 29.

COMPLETE SPECIFICATIONS ACCEPTED.

- 22,854 (1908). Reilly. Impregnating wood. Nov. 3.
 23,990 (1908). Diamand. Obtaining solutions of metallic salts free from acid for wood preserving. Oct. 20.
 6299 (1909). Berglund. Fireproof stone. Oct. 27.
 12,126 (1909). Hartung. Manufacture of artificial stone slabs, &c. Nov. 3.
 12,587 (1909). Hasselmann. Preservation of wood. Oct. 27.
 15,164 (1909). Metzger. Manufacture of cement from blast furnace slag. Oct. 27.

X.—METALS AND METALLURGY.

APPLICATIONS.

- 23,215. Kuzel and Wedekind. Production of pure zirconium and other rare metals. Oct. 11.
 23,241. Hodgkinson and Harvey. Recovery of zinc from silicious zinc ores and partial removal of phosphorus from phosphatic iron ores simultaneously in the blast furnace. Oct. 12.
 23,315. Askenasy. Production of aluminium. [Ger. Appl., Dec. 1, 1908.]* Oct. 12.
 23,439 and 23,440. Johnson (Chem. Fabr. Griesheim-Elektron). Purification of magnesium and magnesium alloys. Oct. 13.
 23,441. Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of dense castings of magnesium or its alloys. Oct. 13.
 23,499. British Thomson-Houston Co. (General Electric Co.). Tungsten and molybdenum. Oct. 14.
 23,536. Duke. Metallic alloys. Oct. 14.
 23,590. Butterfield. Treatment of complex ores of lead, zinc, and copper. Oct. 15.
 23,866. Lindahl. Centrifugal slime separators. [Swed. Appl., Oct. 30, 1908.]* Oct. 18.
 23,973. Kent. Metallic alloys. Oct. 19.
 24,003. Lockwood. Treatment of auriferous or argentiferous minerals. Oct. 19.

- 24,402 and 24,403. Arbuckle and Osborne. *See under I.*
 24,729. Potter. Working manganese steel. [Addition to No. 24,685 of 1908.]* Oct. 27.
 24,839. Reid. Refining metals. [U.S. Appl., Feb. 3, 1909.]* Oct. 28.
 24,841. Langbein-Pfanhauser-Werke. *See under XI.*
 24,923. Duke. Alloy. Oct. 29.
 25,018. Graf and Smyth. Manufacture of a gas for metallurgical and other purposes. Oct. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

- 14,933 (1908). Reynolds. Manufacture of steel and similar metallurgical operations. Oct. 27.
 22,982 (1908). Soc. Anon. d'Exploitation des Brevets Cubilot A. Baillot. Smelting furnaces. Oct. 20.
 22,948 (1908). Johnson. Melting and refining iron. Nov. 3.
 23,594 (1908). Von Schütz. Detinning tin plate waste by means of chlorine. Oct. 29.
 5293 (1909). Pape. *See under VII.*
 8834 and 8835 (1909). Wales. Treatment of armour or deck plates or the like. Nov. 3.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

- 23,225. British Thomson-Houston Co. (General Electric Co.). Insulating compounds. Oct. 11.
 23,421. Walton. Manufacture of an insulating composition. Oct. 13.
 24,302. Evans-Jackson (Hiorth). Electric induction furnaces.* Oct. 22.
 24,498. Helfenstein. Utilising gases from reducing operations carried out in electric furnaces. Oct. 25.
 24,631. Sauna. Utilising electrolytic spongy zinc.* Oct. 26.
 24,697. Ruthenburg. Electrodes for electric furnaces. Oct. 27.
 24,716. Eycken and others. Electrolytic apparatus for producing pure oxygen and hydrogen. [Fr. Appl., Dec. 9, 1908.]* Oct. 27.
 24,735. Harris. Electro-deposition apparatus. Oct. 28.
 24,841. Langbein-Pfanhauser-Werke. Production of ductile electrolytic iron. [Ger. Appl., Nov. 3, 1908.]* Oct. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

- 21,687 (1908). Smith and Deakin. Apparatus for the electrodeposition of metals. Oct. 20.
 24,594 (1908). Billiter. Electrolysis of liquids. Oct. 27.
 12,482 (1909). Walker and Pinson. Electroplating apparatus. Oct. 20.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

- 23,613. Reihl. Treatment of wood oil to render it adapted for making varnishes, enamels, paints, drying oils, linoleums, &c. Oct. 15.
 24,646. Locke and others. Cleansing preparations. Oct. 27.
 24,721. Arnaud and Posternac. Preparing certain unsaturated fatty acids from natural oils. [Fr. Appl., Dec. 28, 1908.]* Oct. 27.

COMPLETE SPECIFICATION ACCEPTED.

- 9441 (1909). Nauton frères et de Marsac, and Tesse. Saponaceous neutral paste. Nov. 3.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

- 23,240. Hodgkinson and Coote. Preparation of barytes or barium sulphate for use as a paint material. Oct. 12.
 23,532. Bloxam (Act.-Ges. f. Anilinfabr.). *See under IV.*
 23,613. Reihl. *See under XII.*
 23,852. Kasseker. *See under VIII.*
 24,001. Fabr. de Vernis et Prod. Chimiques. Composition for coating ships' hulls, &c. [Fr. Appl., Nov. 17, 1908.]* Oct. 19.
 24,119. Perry. Manufacture of paints.* Oct. 20.
 24,768. Pope. *See under VII.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 26,469 (1908). Weilue et Cie. Colour for printing decorative paintings. Oct. 20.
 2114 (1909). Walker and Sohn. Manufacture of vehicles for paints, &c. Oct. 20.
 16,291 (1909). Hochstetter. Inks. Oct. 27.

(B.)—RESINS, VARNISHES.

APPLICATIONS.

- 23,613. Reihl. *See under XII.*
 23,668. Turcat and Nuth. Preparation of substitutes for natural lacquers and varnishes. [Fr. Appl., Oct. 16, 1908.]* Oct. 15.
 24,714. Thompson (Stuhlmann). Manufacture of resin size in pulverulent form. Oct. 27.
 24,825. Freymuth. Centrifugal separators for treating lac.* Oct. 28.

COMPLETE SPECIFICATION ACCEPTED.

- 1990 (1909). Genthe. Manufacture of linoxyn and like products especially for use in making linoleum, &c. Oct. 20.

(C.)—INDIA-RUBBER.

APPLICATION.

- 23,308. Collier. Manufacture of a flexible material from india-rubber. Oct. 12.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

- 24,508. Griffith. Treatment of chrome-tanned leather.* Oct. 25.
 24,899. Damköhler and Schwindt. Treatment of tannin-containing extracts from vegetable matter, particularly extracts of mangrove bark.* Oct. 29.

COMPLETE SPECIFICATIONS ACCEPTED.

- 22,869 (1908). Silberrad. Dressing of leather. Oct. 27.
 23,186 (1908). Tillberg. Treatment of organic tanning extracts. Nov. 3.
 24,141 (1908). Polack A.-G. Superficially colouring leather and leather-like materials. Oct. 20.

XV.—MANURES, &c.

APPLICATIONS.

- 23,238. Ginster. Manufacture of manure and fertilisers.* Oct. 12.
 24,224. Epstein. Treatment of manure and the like. Oct. 22.

COMPLETE SPECIFICATION ACCEPTED.

- 21,630 (1908). Lehbauer and others. Manufacture of artificial manure from offal, &c. Oct. 20.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATION.

- 24,589. Ewen and Tomlinson. Producing fermentable sugar from lignocellulose.* Oct. 26.

COMPLETE SPECIFICATION ACCEPTED.

- 8447 (1909). Boidin. Treatment of amylaceous materials. Oct. 20.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

- 23,322. Rowley. Beer. Oct. 2.
 23,701. Jackson. Carbonating malt liquors. Oct. 16.
 24,300. Smith. Process of making extract of hops. Oct. 22.

COMPLETE SPECIFICATIONS ACCEPTED.

- 25,193 (1908). Dombach. Treatment of grain. Oct. 27.
 5790 and 6397 (1909). Haeck. Maturing and purifying alcoholic liquors. Oct. 27.
 11,277 (1909). Allen. Manufacture of beer and other fermented liquors. Oct. 20.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

- 23,127. Bond. Utilisation of whey for dietetic purposes. Oct. 11.
 23,765. Greiser. Manufacture of cocoa.* Oct. 16.
 23,839. Chitty and Jago. Treatment of wheaten stock and flour. Oct. 18.
 24,040. Levin. Strengthening flour. Oct. 20.
 24,278. Jones. Treatment of flour and meal. Oct. 22.

COMPLETE SPECIFICATIONS ACCEPTED.

- 9883 (1909). Girard. Cereal foods and their manufacture. Oct. 20.
 18,201 (1909). Buer. Improving the flavour of cream to be used in making butter. Nov. 3.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATION.

- 24,741. Brightmore. Bacteria filtering beds. Oct. 28.

COMPLETE SPECIFICATIONS ACCEPTED.

- 27,270 (1908). Marks (Oliver-Roche Co.). Water purifiers. Nov. 3.
 4212 (1909). Candy. Purification of water. Oct. 20.
 16,837 (1909). Geiger. Mechanical filtration of sewage water. Oct. 27.

(C.)—DISINFECTANTS.

- 23,230. Gebr. Heyl und Co. Disinfectant and its production. [Ger. Appl., June 30, 1909.]* Oct. 11.

COMPLETE SPECIFICATION ACCEPTED.

22,339 (1908). South American Improved Chilling Co. and Leaver. Disinfecting and sterilising. Oct. 27.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

23,233. Krüger. Embossing and colouring paper.* Oct. 11.

23,625. Deiss. Manufacture of cellulose.* Oct. 15.

24,111. Kuldkepp and Graf. Sizing and impregnating paper, wood, &c. Oct. 20.

24,714. Thompson (Stuhlmann). *See under XIII B.*

COMPLETE SPECIFICATIONS ACCEPTED.

23,192 (1908). Hollins and Taylor. Manufacture of cellulose. Nov. 3.

8945 (1909). Lederer. Manufacture of sheets or objects from cellulose acetate. Nov. 3.

11,700 (1909). Freidrich. Producing formations of cellulose such as ribbons, threads, films, &c. Nov. 3.

XX.—FINE CHEMICALS, ALKALOIDS,
ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

24,009. Einhorn. Carboxyalkylsalicylosalicylic acids and their manufacture.* Oct. 19.

24,062. Arnaud and Posternak. Preparation of iodine derivatives of fatty acids. [Fr. Appl., Oct. 20, 1908.]* Oct. 20.

24,298. Newton (Bayer und Co.). Manufacture of β -methyladipic acid. Oct. 22.

24,299. Newton (Bayer und Co.). Manufacture of tetranitromethane. Oct. 22.

24,379. Wetter (Hoffmann-La Roche und Co.). Opium preparations for pharmaceutical purposes. Oct. 23.

24,505. Chem. Fabr. auf Actien vorm. E. Schering. Manufacture of curative agents. [Ger. Appl., Oct. 26, 1908.]* Oct. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

1431 (1909). Kalle und Co. Producing substances for conferring immunity against disease. Oct. 27.

1984 and 4321 (1909). Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Oct. 27.

14,912 (1909). Bromley. Medicinal compound. Oct. 27.

17,834 (1909). Gerber. Manufacture of alkyl ethers of phenols and other aromatic hydroxyl derivatives. Nov. 3.

XXI.—PHOTOGRAPHIC MATERIALS AND
PROCESSES.

COMPLETE SPECIFICATIONS ACCEPTED.

13,328 (1909). Brandenberger. Manufacture of photographic films. Oct. 20.

14,343 (1909). Dupuis. Manufacture of cinematographic films. Oct. 20.

XXII.—EXPLOSIVES, MATCHES, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

28,012 (1908). Harris. Explosives. Nov. 3.

3937 (1909). Lake (Verein. Köln-Rottweiler Pulverfabr.). Manufacture of plastic ammonium nitrate explosives. Nov. 3.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATIONS.

23,746. Lovibond. Apparatus for use in estimating the intensity of colours. Oct. 16.

23,846. Ward. Apparatus for recording the percentage of carbon dioxide in gases of furnace flues, &c. Oct. 18.

COMPLETE SPECIFICATION ACCEPTED.

22,748 (1908). Chapman. Photometer. Oct. 20.

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DR. J. LEWKOWITSCH IN THE CHAIR.

ON NAPHTHALENE PICRATE AND THE QUANTITATIVE DETERMINATION OF NAPHTHALENE.

BY W. P. JORISSEN AND J. RUTTEN.

In the course of a large number of determinations of naphthalene by the Colman-Smith method,¹ the results obtained were always too low.² In these experiments coal gas freed from naphthalene or air was passed together with naphthalene through U-tubes containing picric acid solution, which were weighed before and after the experiment. Niermeyer³ obtained similar results independently. When it was attempted to determine the picrate formed by filtering, washing with water, and drying in a desiccator, the results were lower still: 82 per cent. of the naphthalene *in maximo*. It was, however, observed that accurate results were obtained when the washing bottles contained not only a saturated solution of picric acid, but some undissolved picric acid as well. The method used⁴ was as follows: 250 c.c. of a saturated solution of picric acid is evaporated to about 150 c.c., and transferred whilst hot to two gas-washing bottles. The coal gas, which has been freed beforehand from tar, cyanogen, hydrogen sulphide, and ammonia, is passed through the bottles at a rate of 30–40 litres an hour. When a fair quantity of picrate has been formed in the first bottle, the gas-meter is read and the picric acid solution together with the picrate are transferred to a 250 c.c. flask. The bottles are washed with water, which is added to the solution, and the latter is made up to 250 c.c. with water and heated in the closed flask for half an hour at 40° C., and shaken from time to time, in order to dissolve the picric acid.

The cooled solution is filtered and 25 c.c. of the filtrate are titrated by a solution of potassium hydroxide of known strength, using litmus as indicator; 25 c.c. of the original solution are also titrated. From the difference, the quantity of absorbed naphthalene may be easily calculated.

The results obtained were as follows:—

Naphthalene found by weighing the U-tube.	Naphthalene found by titration.
mgrs.	mgrs.
147	145
158	154
139	141
215	217
389	383

The fact that it is necessary to have enough undissolved picric acid in the gas-washing flasks is explained by the phase rule. Picric acid, naphthalene picrate, naphthalene, and the saturated solution cannot be in equilibrium with each other at the same time; hence, if there is equilibrium between the saturated solution, picric acid, and naphthalene picrate, any naphthalene which is added is transformed into naphthalene picrate as long as picric acid crystals are present.

If the method was to give good results, it was necessary that the picrate should be practically insoluble in a saturated solution of picric acid. This was found to be the case. 100 c.c. of water were shaken for some weeks

with 5 grms. of picric acid and 2.5 (in other exp. 5) grms. of naphthalene picrate at a temperature of 25° C. A large thermostat was used, which was kept at a constant temperature by means of a toluene regulator. The precipitate was then allowed to collect at the bottom of the bottles, and part of each solution was drawn off and weighed. After heating with excess of a solution of sodium hydroxide of known strength (about decinormal), the remaining sodium hydroxide was titrated by means of sulphuric acid (about decinormal), using phenolphthalein as indicator. The strength of the sodium hydroxide solution was tested by means of pure picric acid.

For the determination of the naphthalene, some 10 per cent. sodium hydroxide solution was added to weighed quantities of the solutions; the separated naphthalene was filtered off into a small tube containing asbestos (which had been heated beforehand, in order to remove traces of organic matter). After washing with water, the small tube was placed in a combustion tube partly filled with copper oxide, and the naphthalene was decomposed in a stream of pure oxygen. The carbon dioxide formed was absorbed as usual and weighed. In this way it was found that 100 grms. of the solution contained 1.44 grms. of picric acid and 0.0027 gm. of naphthalene. Some experiments were made with pure naphthalene picrate in order to verify these results; the weighed quantity of the substance was treated with sodium hydroxide, the naphthalene was filtered off and was decomposed as in the experiments described above.

Naphthalene picrate.	Carbon dioxide produced.	Naphthalene calculated from the carbon dioxide.	Naphthalene calculated from the picrate.
mgrms.	mgrms.	mgrms.	mgrms.
41.1	48.8	14.2	14.7
56.1	65.1	19.0	20.1

Naphthalene is practically insoluble in water; in 100 grms. of the saturated solution of picric acid and naphthalene picrate about 3 mgrms. are found. As the solutions used in Rutten's method are not saturated at the moment when they are filtered, the inaccuracy caused by the solubility of the naphthalene is very small.

Solubility experiments were also made at the same temperature (25° C.) with picric acid alone, and with naphthalene picrate and naphthalene. It was found that 100 grms. of the saturated solution of picric acid dissolved 1.33 grms. of this substance.⁵ In 100 grms. of the solution, which is in equilibrium with naphthalene picrate and naphthalene 0.183 gm. of picric acid and a trace of naphthalene are present.

In consequence of this, the "solubility" of the naphthalene picrate observed by Colman and Smith, who found that 100 c.c. of water at a temperature of 14° dissolve 0.1857 gm. of "naphthalene picrate," is to be interpreted in a somewhat different manner. The decomposition of naphthalene picrate by water, which is a great drawback in using the method of Colman and Smith, had already been observed some 50 years ago by Fritzsche.⁶ He stated that the crystals were superficially decomposed when treated with cold water. On boiling the solution with water it was found that naphthalene distilled with the water vapour. That the picrate can be recrystallised from a weak solution of picric acid, is shown by the diagram obtained when the results of the solubility determinations are plotted in a triangle after the manner of Schreinemakers, when treating three component systems. From this diagram, which we reproduced elsewhere⁷, various other conclusions can be drawn.

¹ This J., 1900, 128. J. Gas Lighting, 1900 (March 27).

² Rutten, Het Gas, 1908, 447.

³ Ibid., Feb., 1908.

⁴ Rutten, Ibid., 1908, 449.

⁵ Marchand (Jahresb., 1847, 48, 539), found 1.21 grms. at 20° and 1.36 grms. at 26° C.

⁶ J. prakt. Chem., 1858, 73, 285.

⁷ Chem. Weekblad, 1909, No. 16.

Paternò and Nasini,⁸ who determined the freezing point of solutions of naphthalene picrate in acetic acid, found that in dilute solutions it is almost completely dissociated into naphthalene and picric acid. Anschütz⁹ observed the same in benzene solutions. In order to ascertain whether this is also the case in alcoholic solutions, we determined the boiling point of such solutions, using Landsberger's apparatus.¹⁰ Solutions which contained 5.68 grms. and 11.67 grms. of naphthalene picrate in 100 grms. of absolute alcohol, showed elevations of the boiling point of 0.345° and 0.650° C. From these data the molecular weights 189 and 206 are calculated. As half of the molecular weight of the picrate is 179, it follows that in alcoholic solution too the decomposition is considerable and increases with the dilution.

These experiments were made in connection with the method of Stavorinus¹¹ for the determination of naphthalene in coal gas. The gas is passed through glacial acetic acid, and the dissolved naphthalene is precipitated again by diluting or by neutralising the acid. After filtration through a filter, drying at 100° C., and washing with water, the naphthalene is put into a small crystallising vessel, containing 5 grms. of picric acid and 50 c.c. of strong alcohol. The solution is evaporated on a water-bath, and the remaining substance is dried till the weight does not change any more. After heating on the water-bath for 6 or 10 hours, and even after having added another 50 c.c. of alcohol, the weight of the residue was stated by Stavorinus to remain constant. Now Nierneyer and also Rütten observed considerable decrements of this weight. The latter observed the same at a temperature of 60°. Our observations on the decomposition of the picrate in alcoholic solutions offer an explanation for the observed evaporation of naphthalene during that of the alcohol. Also on heating the pure dry picrate at a temperature of 100° for some days we found that the naphthalene is totally evaporated (also traces of the picric acid; the vessel is coloured yellow).

DISCUSSION.

Mr. C. J. D. Gair said the figures placed on the board showing the accuracy of the new method were very little more in accord with one another than similar figures found with Dr. Colman's own test. There was nothing particularly wrong with any well-known test for the estimation of naphthalene in coal gas, if care were taken to see that the naphthalene was entirely converted into naphthalene picrate, and not left as naphthalene plus naphthalene picrate. If the gas to be tested was passed into acetic acid, as suggested by himself in a former paper (this J., 1907, 1263), the naphthalene went completely into solution and could be precipitated as pure naphthalene picrate by the addition of picric acid solution in excess. In the naphthalene test lacmoid indicator was generally used, but he had not found that an ideal indicator. He considered that phenolphthalein gave a much sharper and more delicate end reaction.

Dr. H. G. COLMAN said that in their original paper Colman and Smith had pointed out that the precipitate of naphthalene picrate must only be slightly washed with water, as otherwise the results came out too low, for the reasons mentioned by the author. In his present practice, he avoided washing the picrate altogether, the naphthalene picrate solution, after heating and subsequent cooling, being poured into a measuring cylinder, its volume noted, and then filtered through a dry filter paper, the first few c.c. of the filtrate being rejected as these are weaker than the rest. 100 c.c. or more of the remainder of the filtrate was then titrated with $N/10$ soda in the usual manner, and from the result, and the total volume of the solution, the amount of picric acid in the whole solution was readily

calculated. A slight error was introduced as the naphthalene picrate crystals were measured along with the liquid, but the magnitude of the error was very small.

Nottingham Section.

Meeting held at Nottingham on Wednesday, October 27th, 1909.

MR. S. J. PENTECOST IN THE CHAIR.

INAUGURAL ADDRESS.

RECENT PROGRESS IN THE TEXTILE INDUSTRIES.

BY S. J. PENTECOST.

I wish to call attention to one or two points of local interest to dyers and bleachers and afterwards to refer briefly to advances that have been made during the last year or two in certain branches of chemical industry connected with lace and hosiery manufacture.

Some years ago I brought before this Society for discussion a question of some interest to the local trades, viz., the development of certain stains in bleached goods, after being either despatched or kept in stock. The particular stains then dealt with were mineral oil stains caused by oil dropping from a shaft or being thrown from a hot bearing. It was shown that this oil penetrated the cuticular layer or envelope of the cotton fibre, and was not removed in the ordinary course of bleaching. Although the goods appeared to be clear and white when finished, the oil from the interior of the fibre oozed to the surface and formed a pale yellow stain. I recall the discussion at this time in order once more to emphasise the need in our local industries for manufacturers to realise the importance of the proper length of time being given for the bleaching process. Manufacturers insist on large quantities of lace goods being bleached within six or seven hours, or in a single night. But Scheurer has pointed out that the oil and waxy matters of the cotton fibre cannot be saponified and removed in less than six hours' boiling where the most suitable alkalis and emulsifiers are used. It is clear, then, that goods having, besides their ordinary impurities, an amount of graphite or mineral oil in parts of their surface, cannot be satisfactorily bleached in the short time given by this hurried process, one which can only be carried out with the aid of dummies to help the penetration. It is further clear that goods hurriedly bleached will not compare favourably with those which have been longer in process, such as Lancashire goods, which are, as a rule, kept by the bleacher for three or four weeks. The purity of the bleach depends very largely upon the thoroughness of the boiling process.

Another stain which has caused trouble by developing after goods have left the bleacher is one which consists of a violet pink coloration, appearing at the edges of goods stocked in the warehouse. For some time this stain was a source of great perplexity both to the chemist and to the bleacher. In some goods brought under my notice, the fault was attributed by a chemist to whom the stain had been submitted, to the formation of a pink manganese salt derived probably from the bleaching powder, in the preparation of which by the Weldon process manganese dioxide is used. It was found, however, that the same thing occurred in goods bleached by powder produced by the electrolytic process, in which no manganese compound is used. It was then submitted to me. Some years previously I had noticed that it had occurred on goods which had been dried in proximity to the ageing chamber used for the aniline black process, and at once the cause of the stain was clear. It was due to the oxidation of the aniline fumes, by which means the faint magenta or mauveine colour was formed on the goods. Recently Böttiger has given further proofs that this stain was a mauveine, that, in fact, it represented pseudo-mauveine, $C_{21}H_{20}N_4$. He obtained this from cotton dyed with aniline black, by extracting it with water acidulated with hydrochloric acid. On evaporation to dryness, the hydrochloride of the pseudo-mauveine remains as a blackish-

⁸ Gazz. chim. ital., 19, 202 (1889).

⁹ Ann. der Chem., 253, 346 (1889). That this decomposition partially takes place when the substance is melted, may be concluded from the form of the melting point curve as observed by Kreman (Sitz. Ber. Akad. Wien, Math. naturw. Kl. 113 Abt. (1), 6, 814; 1904) and by Saposchukow and Rdotlowsky (Journ. russ. phys. Soc., 35, 1073; 1904).

¹⁰ Ber. d. deutsch. chem. Ges., 27, 1101, (1894).

¹¹ Het Gas, Oct., 1905, p. 477.

green mass, readily soluble in alcohol to a red-violet colour. Other reactions on this substance with various reagents left no room for doubt that the violet dyestuff was identical with pseudo-mauveine. Having thus ascertained the chemical nature of this by-product, he set about finding the best method of preventing its formation. Pseudo-mauveine is formed, according to Sir W. Perkin, by the action of various oxidising agents, especially chromic acid, on aniline, and as aniline is always present in small amount in the cotton if oxidation has reached the green stage, it is this aniline which yields pseudo-mauveine on chroming. It should then be possible to prevent this by well washing the greened cotton before chroming. In practice, however, the black turns out thin, uneven, and liable to green, while a small amount of violet is still found. This shows that it is also formed from the oxidation product of aniline which has been fixed on the fibre (*i.e.*, from emeraldine) and chromic acid, but the amount so formed is very small and its formation cannot well be prevented. If, however, as much of the aniline salt as possible is converted into emeraldine in the ageing process, the after-formation of mauveine during chroming will be reduced to a minimum. The conversion can be attained by raising the amount of sodium chlorate in the black padding liquor, taking great care not to increase it too much or the fibre will be tendered. The temperature of the ageing should not exceed 55° C., nor in the chroming process should the strength of the sodium bichromate exceed 10 grms. per litre. Taking precautions such as these, good results are obtained as regards shade, depth, non-greening, etc. It has been thus shown that the red-violet by-product which is formed along with aniline black in dyeing is pseudo-mauveine, and that this is formed chiefly from the unchanged aniline salt present on the greened cotton. By using a large quantity of sodium chlorate and as small an amount as possible of bichromate, the danger of the development of these violet-red stains may be reduced to a minimum.

The processes of bleaching as carried out in the lace and hosiery trades have undergone little alteration during recent years. Most bleachers use caustic soda in place of lime for boiling, generally preferring the higher strengths, *e.g.*, 70 and 77 per cent.; while much of the bleaching powder used locally is now made by electrolysis of salt solution by the Hargeaves-Bird process. *Electric bleaching*—or bleaching by solutions made by electrolysis brine or common salt—has not made much progress in Nottingham. So far as I am aware, only one plant (the Vogelsang) is at present in use. A distinct advance, however, has recently been made in the construction of plant for this method of bleaching, and those patented by Jaeglé, Schoop of Nürnberg, and later Oettel, make the process much more practicable than was the earlier process of Hermite, which was brought before this Section about 18 years ago.

The advantages claimed for modern electrolytic bleaching are:—

(1). The effective bleaching power of the sodium hypochlorite produced, which is claimed to have twice the bleaching power of a solution of bleaching powder containing the same percentage of chlorine.

(2). It is less liable to tender the fabric than ordinary bleach. As it contains no lime or magnesia salts the fibres do not suffer, and the "feel" and appearance of the goods is said to be improved. For this reason also it is an ideal bleach for artificial silk.

(3). Economy over chloride of lime as follows:—(a) Less "sour" or acid is required. (b) Goods lose 2 per cent. less in weight than when chloride of lime is used.

(4). Uniformity in strength of solution: this does not vary as the chloride of lime solution is liable to do.

(5). Cleanliness and convenience are claimed: no lime dust, no smell, and little room required for plant.

In one of the processes mentioned (the Haas-Oettel) a tank of 166 galls. capacity requires 286 lb. of salt to make a brine of 23° Tw. strength. This is circulated in the electrolyser for 12 hours at a temperature of 20° C. The current used is 43 amperes at 110 volts, and this gives a product containing 16.2 lb. of chlorine per 100 galls. or 264 lb. chlorine for the 166 galls., at a cost for power and salt of 3s. 1½d. These latter costs are based on the price of

coal being 10s. per ton and salt 12s. per ton. These figures work out decidedly in favour of the electrolytic method, and it seems probable that where works produce their own current, the electrolytic method is the cheaper; but if the current were taken from our City Corporation, it would come slightly dearer. At some Swiss works where water power is available for generation of current, the cost is brought down considerably. The question of economy therefore lies largely with the cost of the current used. It should be borne in mind, however, that so far as the bleaching of lace is concerned, the cost of the production of bleaching liquor from bleaching powder does not exceed 8 per cent. of the total cost of the bleaching process. The saving claimed therefore by makers of electrolytic plant over the use of bleaching powder is but a very small percentage of the total cost of bleaching.

The electrolytic method of bleaching is in use on the Continent in print and paper works and in laundries; as well as in works in which artificial silk is treated. It may also be advantageous for *wool chlorination*. The application of chlorine to woollen hosiery for the production of an "unshrinkable" finish has come to be extensively practised in this district. It is well known that ordinary bleaching liquor converts woollen fabrics into a gummy mass, but dilute chlorine solution applied carefully has the effect of smoothing down the delicate edges of the scales of the wool fibre, to which the felting properties are attributed. This is probably effected by the formation of small quantities of the gummy substance on the scale edges, and thus it is that the felting and interlocking power of the scale fibre is destroyed.

One method of carrying out this process is as follows:—A solution of hypochlorite of soda is prepared by dissolving 28 parts by weight of bleaching powder in 10 gallons of water, allowing to settle and decanting the clear liquor. To this is then gradually added with constant stirring 16 parts of pure alkali (Na_2CO_3) dissolved in 14 gallons of water. The liquor thickens up and then slowly becomes thin after the whole of the alkali has been added. The precipitate is allowed to settle and the solution decanted. The soda should be in excess of that required theoretically, as it prevents to some extent the yellowing of the wool. For the same reason it is advisable not to work with a bleaching powder solution of too great a strength of available chlorine, otherwise chlorate is likely to be formed, and this has a yellowing action on the wool. One gallon of this liquor is used for every 10 lb. of wool. It is well to add this in two lots instead of all at once. Five minutes' treatment of the wool may be given in the first bath, sufficient hydrochloric acid being run in gradually to set free the chlorine. The liquor is then run off and a second similar bath given. The goods are afterwards rinsed, and then in order to restore the colour, treated in a bath of bisulphite of soda in the proportion of 1 pint of bisulphite to every 20 lb. of wool with the gradual addition of dilute sulphuric acid. The acid must be added very slowly. The goods are then rinsed, scoured with soap, and rinsed off.

It is doubtful whether woollen hosiery treated in this manner maintains the warmth associated with the wearing of woollen hosiery, and it is certain that it wears into holes more quickly. This is probably due, not to a tendering of the wool fibre, but to the fact that those portions of the garment exposed to the greatest wear do not felt up in washing and thus the increased strength which felting gives is not obtained.

According to Pearson (Soc. Dye and Col. Journal, 1909), wool treated by this process may be distinguished from non-chlorinated wool by two simple tests, *viz.*:—

(1.) If a drop of water be placed on a piece of treated fabric it is at once absorbed and the wetted part has a round contour, while in the case of ordinary wool, the drop is absorbed slowly and the contour of the wet part is irregular.

(2.) On wetting out chlorinated wool and rubbing together two surfaces of it between finger and thumb, a characteristic scroop or crispness of touch is felt.

Lime soap in silk washing.—In the lectures on bleaching given before this Section last session the importance of softened water was strongly insisted upon, and it was shown how the sticky lime soap arrested the pedesis, *i.e.*, the move-

ment of dirt particles in solutions, phenomena formerly known as the "Brownian movement." Important as pure water is in cotton bleaching, it is doubly so in the case of silk where hard water not only means loss of soap, but inferior colours and loss of lustre, with bad penetration of stiffening agents. And here I wish to point out a difficulty which often troubles the silk lace dyer. In preparing silk for the lace machine, it has to be softened in order that it may be wound compactly upon the beams and bobbins. These latter consist of two thin brass discs fixed close together on a central perforated axle. The silk is soaked in a 10 per cent. soap solution at 120° F. for 8 to 12 hours. It is then wrung and hung up in a room to dry at about 85° F., afterwards being wound on the bobbins by an ingenious machine which winds perhaps 80 together. These bobbins hold about 120 yards of silk. The filled brass bobbins are threaded on to a spindle, pressed tightly together by an arrangement of screws and nuts, and put into an oven heated by a steam jacket. Here they are subjected to a temperature of 150 to 200° F. Care is taken that the temperature is not raised too high, lest the silk gum should melt and fasten the threads together. If water or steam be introduced the same fault may occur and the silk be spoilt.

This process used to be and is now to some extent carried out by special silk washers, who were sorely tempted to weight the silk with soap, fats, etc., and to abstract a percentage of the silk entrusted to their care for their own profit. This practice, we believe, does not obtain now, and the fact that magnesium chloride, Epsom salts, common salt, soap, fats, and more rarely glue, are used occasionally to weight raw silk probably led up to it. The need, however, is thus emphasised for careful valuation of silks in the conditioning house, on the basis of obtaining the net weight of *boiled off* silk sold. But the point I wish to call attention to is that the soaps used for this soaking are principally palm oil and tallow soaps. These with the hard water of this neighbourhood form lime soaps which become fixed in the silk gum and cannot be entirely removed, unless the silk is boiled off. They therefore interfere with the lustre and springiness of the lace fabric when finished, and the tulles, veilings, and laces which contain lime soap compare unfavourably with those finished in continental towns, where a good supply of soft water is available. It is therefore highly desirable that lace makers should wash their silk in softened water, or if this is not to be had, that they should at least use soaps which are least affected by hard water, viz.:—palm kernel oil soaps or a sulfonated oil soap.

Silk weighting.—I come now to the consideration of silk weighting as carried out by the dyer. The practice of weighting silk has hitherto, perhaps fortunately, only interested silk lace dyers to a limited extent.

The principal goods weighted here are silk bobbin, nets, tulles, and some few glove fabrics. The late Sir Thomas Wardle, in a lecture given some years ago before this Section on Tussah silk, condemned the continental practice of heavily weighting silk, and many authorities have echoed this condemnation since.

In spite of this, however, the demand for weighted silks has increased rather than diminished, owing to the fact that a weighted silk is naturally cheaper than a pure silk. When heavily weighted by the tin phosphate or silico-tin-phosphate processes, defects in the nature of stains and tender or rotten places are liable to develop after storage and keeping in stock.

During recent years these defects have caused continual trouble, and the matter has been considered by the Crefeld Chamber of Commerce as well as by the Silk Associations of Zürich and Turin. Proposals were made that dyers should guarantee the weighted silk for 1, 1½, or 2 years, while others suggested standardising the method and degree of weighting. Ultimately, however, investigations were made by Gnehm and Baenziger, Gianoli, and Sisley, which showed that the elasticity of the silk decreased in proportion to the weighting absorbed by the silk. Numerous experiments also showed that a temperature of 100° F. in six months weakened the weighted silk considerably; while the action of light was very pronounced—a fabric weighted 130 per cent. being tendered in eight days by exposure to sunlight. Sisley considers

that the light acts by reducing the stannic hydroxide, thus setting free the oxygen which alters the fibre. With a view to finding a remedy for this, in 1903 several investigators suggested and patented the use of certain alkaline sulpho-cyanates, which served to paralyse the action of oxygen and the chlorides, and to increase the resistance of weighted silks to the action of light. Later, Sisley patented the use of thio-carbamide for this purpose, and this is shown by a number of trials extending over three years to have given satisfactory results. It has now been adopted by several large firms of silk dyers on the Continent.

Hydroquinone and tannin have also been suggested for the same purpose. In the case of sulphocyanic acid or its salts the addition is made to the tin bath, whereas when hydroquinone, hydroquinonesulphonic acid, or thio-urea are used they are applied as an after treatment to the silk goods.

Aniline Black.—The dye-stuff known as Aniline Black holds a place in cotton-dyeing second in importance to no other colouring matter, yet it is surprising how little definite information we possess as to its chemical constitution. Excepting the valuable investigations of Caro and of Wiltstätter and Moore, little has been published in recent years. During the present year, however, Prof. Green, of Leeds, in a paper read before the Society of Dyers and Colourists (this J., 1909, 700), has not only adduced plausible explanations of the chemical reactions taking place in the three successive stages of the production of (1) Emeraldine, (2) Nigraniline, (3) Ungreenable Black, but has indicated and introduced a new commercial method for the production of aniline black by air oxidation.

It has long been found that in the production of an "aged" or "oxidation" black upon cotton materials, in spite of the greatest precautions in the ageing chamber with regard to humidity, temperature, and ventilation, a certain diminution of strength of the material is unavoidable. This "tendering" is the cause of considerable loss. Its origin is twofold:—(1) The hydrolytic action of hydrochloric acid or other mineral acid set free from its combination with aniline; (2) The oxidising action exerted by the chlorine or oxides of chlorine produced from the chlorate, which tend to convert the cotton into oxycellulose.

According to Prof. Green, following Beltzer, the second of these two causes is by far the more important, though the liability to oxidation of the cellulose increases with its acidity. Various attempts have been made in the past to reduce the acidity of the aniline mixture and thus lessen the tendency to production of oxycellulose. They have been attended with but little success, as the acidity of the mixture cannot be materially reduced without at the same time greatly retarding the development of the necessary emeraldine.

Prof. Green has, however, in a process recently patented endeavoured to overcome this defect by replacing the chlorate oxidation by the much milder action of atmospheric oxygen. His method is based upon the fact that the presence of small quantities of paradiamines or of para-amido-phenols increases the oxidisability of aniline by oxygen. (Eng. Pat. No. 16,189 of 1907, see also this J., 1908, 683.)

It is remarkable how small a quantity of a para-diamine exerts a catalytic effect. Even 2 per cent. of *p*-phenylenediamine on the weight of aniline employed produces a marked result, though larger quantities than this are usually employed in practice. Other para-diamines may be used also.

The new process is already being successfully used for piece dyeing, and bids fair to extend to the dyeing of cotton yarn, cotton hosiery, and raw cotton. The cloth is padded with a solution containing aniline, hydrochloric or other acid, a copper salt, and a small quantity of paraphenylenediamine. It is then dried and afterwards oxidised by exposure to air with or without a passage through an ageing chamber. The emeraldine having been thus developed on the material, is converted into black by chroming. The black produced is said to be fully equal in brilliancy and depth of shade to an ordinary black dyed by the copper chlorate process. In addition to the great advantage of leaving the material stronger, the process presents, according to Prof. Green, a technical

superiority over the older processes in the following respects:—

(1) Greater cheapness of production owing to a more complete utilisation of the aniline; (2) Greater stability of the padding solutions, on account of the absence of chlorate; (3) No evolution of poisonous vapours in the ager.

If this new method does, as is claimed for it, produce a brilliant aniline black upon goods without tendering, and has indeed the other advantages named, it is well worthy of the careful consideration of those members of our Society more specially interested; but in any case, as a recent example of chemical research producing valuable results in technology, it demands the attention and approbation of us all.

New vat dyes.—Perhaps the most notable advance in dyeing cotton goods during the past year has been the introduction of a series of vat dyes giving a wide range of bright colours which are very fast to light, washing, and bleaching. They are not, however, fast to the soda boil.

The first of this series was the thio-indigo red of Friedländer, which was manufactured by Kalle and Co. A large number of patents have since been taken out by various colour firms for blues, violets, scarlets, and other colours dyed by the vat method. This method has been made possible and easy of application by the discovery of the stable hydrosulphites. These are compounds of sodium hydrosulphites and formaldehyde, and they are sold under the names of Hyraldite A., Hydrosulphite N.F., Rongalite, etc. Decroline, another of these substances, is the zinc salt of formaldehyde and sulphonylic acid. It is insoluble in water, but soluble in acids, and is used as a stripping agent by the garment dyer, as well as for bleaching straw.

Artificial silk.—The rapid progress made during the past year in the manufacture of artificial silk has brought this fibre into extensive use for the weaving of various fabrics, and its production has already become an important chemical industry. In lace manufacture its use has rapidly grown, more especially for embroidered laces. On Lever's machines it is more difficult to work, owing to the chafing through the intricate parts of the machine; but the trouble is being gradually overcome. The total output is estimated at 5000 tons per year, and of this England produces over 700 tons. Works at Coventry are turning out large quantities of material, and new works are being erected at Flint for the Vereinigte Glanzstoff Fabriken. Other works are also projected.

The "A" silks are prepared by dissolving cellulose or its derivatives in various solvents and forcing the fluid through capillary tubes or fine orifices into a coagulating solution, from which the prepared cellulose issues in the form of a fibre, which is then reeled off with other fibres similarly produced.

Two classes of "A" silk may be distinguished, viz.: That prepared from nitrated cellulose in ether-alcohol solution and that made from aqueous cellulose solutions. The first of these comprises the Chardonnnet and Lehner and Besançon silks, and in the second class are those silks prepared from cuprammonium solutions of cellulose and from viscose. The zinc chloride-cellulose solution forced through an orifice and coagulated by alcohol or acetone, also produces a thread of similar characteristics (Dreaper and Tompkins).

Chardonnnet silk is made by projecting collodion through fine glass tubes into air or water, where solidification occurs. The resulting fibre is then wound on a reel and the ether, etc., recovered. The silk thus produced is denitrated by treating with ammonium sulphide. This product is extraordinarily brilliant, but owing to its loss of strength and elasticity when wet, is unsuited for manufacturing goods that have to be stretched or pulled out.

For this reason and the important factor of relative cost, this class of artificial silk is being gradually replaced by those products obtained by dissolving the cellulose direct, without previous nitration.

The Glanzstoff and Thiele processes consist in dissolving cellulose in ammoniacal solution of copper hydroxide and forcing the liquid through fine spinning nozzles into a precipitating medium consisting of 32 parts caustic soda,

8 parts glucose, and 100 parts water. In this, the copper is dissolved out of the fibre at a temperature of 50° C. for fine threads and 75° for thick threads, gradually reduced to cuprous oxide and precipitated, giving a reddish colour to the bath. This by contrast with the bluish shade of the thread, helps the worker to detect broken threads. The threads are afterwards washed in dilute acid in order to dissolve out copper compounds and caustic soda. In Dr. Thiele's process very fine threads are produced. The sample shown is a silk of 45 deniers, the usual thickness of this class of silk being 120 deniers or more.

Viscose silk is produced from viscose, which is made by treating cellulose with caustic soda (mercerising), and subjecting the product to the action of carbon bisulphide vapour. The cellulose xanthate thus formed is dissolved to 8 to 10 per cent. cellulose strength and projected into suitable aqueous precipitating media.

This class of silk is being produced in increasing quantities at the works in Coventry, and by reason of its softness, brilliance, and strength when in a wet state is finding its way into the Nottingham and Lancashire textile industries. It is supplied in sizes of 120 deniers and upwards. In the micro-photograph it will be seen that the Thiele silk of 45 deniers is as fine as the natural silk. I may remark in passing that large profits have been earned by some of the companies engaged in these processes—a Belgian company, for example, reported last year 145 per cent. profit, while a German company also paid 40 per cent.

Besides the silks mentioned, Messrs. Bayer and Co. have patented the production of threads made from cellulose acetates dissolved in chloroform and precipitated by ethyl alcohol, benzene, or by other reagents.

Filaments from gelatine and casein have also been made, but have not proved successful commercially.

Time does not permit me to do more than call attention to the so-called soluble starches—especially to a product recently put on the market under the name of Feculose, which is made by the action of glacial acetic acid on highly dried starch—the acetic acid being afterwards recovered by distillation. By the kindness of Mr. J. Allan, Managing Director of Messrs. Wotherspoon, Limited, I am enabled to show you some films given by it, which show great transparency, suppleness, and brilliancy. The specimens of paper also show its applicability in paper coating, and in the manufacture of fruit pastilles. (See this J., 1909, 288.)

Yorkshire Section.

Meeting held at Leeds on Monday, November 8th, 1909.

PROF. W. M. GARDNER IN THE CHAIR.

THE COST OF TREATING TRADE EFFLUENTS.

BY W. McD. MACKEY AND J. MILLER.

The treatment of trade effluents in such wise as to satisfy the authorities who have charge of the rivers and streams is a subject that is now engaging the attention of chemists. It was thought, therefore, that a short paper on the subject of cost of the chemicals used, might be of some interest. No rule can be laid down as to what will satisfy an authority in charge of a stream; obviously, the effluent into a trout stream must be purer than that which may pass into a stream in a manufacturing district, where the avoidance of active nuisance is all that can be aimed at. The requirements of the authorities in a manufacturing area may be regarded as met if the effluent is free from matter in suspension; is neutral in reaction or slightly alkaline; contains nothing of an actively poisonous or offensive nature; and is not heavily charged with organic matter. Freedom from matter in suspension falls more to the engineer than the chemist—though the type of chemical treatment is not without influence on the subsequent clarification. In any case the chemist is asked to treat effluents so that when clarified they will at least fulfil the other conditions mentioned.

Waste dye effluents naturally bulk largely in this district, and the chemical treatment usually resolves itself into addition—in the right proportion—of lime alone, or of a salt of aluminium (usually aluminoferric) with lime, or soda, or both. If lime alone be sufficient, the cost is very low. The following table gives the cost per pound of the principal precipitants and also of neutralising effect compared with lime:—

	Price in pence, per lb.	Price per ton.
Lime	0.085	£ 8. 16. 0
Aluminoferric	0.29	2 15 0
Copperas	0.29	2 15 0
Soda ash	0.59	5 10 0
Sodium hydroxide	1.15	10 15 0
Barium hydroxide	1.07	10 0 0
Barium carbonate	0.59	5 10 0

Cost of neutralising effect compared with lime.

Lb.		Pence.
1.00	Lime (CaO)	0.085
1.89	Soda ash (Na ₂ CO ₃) equals 1 lb. lime ..	1.11
1.43	Sodium hydroxide (NaHO) ..	1.64
5.62	Barium .. (BaH ₂ O ₂ .8H ₂ O) ..	6.01
3.51	.. carbonate (BaCO ₃) ..	2.07

Thus, 3 lb. lime per 1000 gallons (a usual quantity) only costs 0.25 penny, but if 1 lb. aluminoferric or copperas be also added, the cost is rather more than doubled, and it is to be remembered also that the addition of lime itself must be increased owing to its reaction with the aluminium sulphate. Soda ash is seldom employed except where the treated effluent is used again in the mill, either for dyeing or boiler purposes. Generally soda ash when used as a neutralising and precipitating agent, gives with dye liquors a worse colour than when lime is used.

In some cases where the precipitate with lime is very light, the addition of an aluminium salt is useful as giving a denser precipitate, and the subsequent clarification of the effluent, when a subsidence method is employed, is facilitated. But beyond this advantage we have not found, in the dye liquors with which we have had experience, that the addition of an aluminium salt gives any advantage, either as shown in the colour of the final effluent, or in purification as indicated by the "Oxygen absorbed" determination. Nor when an aluminium salt is used does it seem to matter whether it is added before or after the lime. In a paper by one of us, read last year at Bradford before the Society of Dyers and Colourists (Feb., 1909, No. 2, Vol. xxv.), a table is given showing the results of some experiments from which we may quote as follows:—

	Oxygen absorbed imparts per 100,000
No. 1.	
Untreated effluent (filtered through filter paper)	17.0
After treatment with lime	4.68
" " " aluminoferric then lime ..	4.40
" " " lime then aluminoferric ..	4.70
No. 2.	
Untreated effluent (filtered through filter paper)	16.8
After treatment with lime	4.80
" " " aluminoferric then lime ..	4.80
" " " lime then aluminoferric ..	4.72
No. 3.	
Untreated effluent (filtered through filter paper)	7.24
After treatment with lime	4.24
" " " aluminoferric then lime ..	2.44
" " " lime then aluminoferric ..	3.28
" " " aluminoferric only	4.36

The last might be taken as favouring the addition of aluminoferric before the lime, and certainly this was our decided opinion before the experiments were made.

Either with or without the addition of aluminoferric or alumina in some form, the use of lime is attended with the disadvantage that the treated effluent—no matter how pure from organic contamination—is still very hard. This is owing to the large amount of acidity shown by most of the waste dye liquors, against which lime has to be added. Whether the turning of what may be described as very hard water into a stream can be considered a nuisance, either in the ordinary or legal sense, must depend on the nature of the particular stream. If every mill on a stream were turning in excessively hard effluent, it would be a hardship on those who had a prescriptive right to use the water for steam raising purposes.

The practice of "stripping," which involves the use of acid, has been increasing of late years, and to this is due the excessive acidity which is occasionally met with in untreated effluents, resulting in excessive hardness in the treated effluents. If the question of hardness in the effluents turned into the stream ever became of importance, the difficulty could be met by reserving the stripping liquor for special treatment.

The use of barium hydroxide has been suggested, and as the acid in waste dye liquor is for the most part sulphuric, the suggestion seems a good one from the chemical point of view, but here cost is prohibitive, at least at the present price; a reference to the table showing that against lime at 0.085 penny per pound, barium hydroxide is 1.07 penny, and its neutralising effect compared with 1 lb. of lime is as 5.62 to 1. The cost of 5.62 lb. of barium hydroxide being 6.01 pence the comparative cost of neutralising effect is as 70 to 1. Even barium carbonate which is 0.59 penny per lb., when compared with lime is as 3.51 to 1, and the relative cost is as 24 to 1. It is to be remembered also in connection with barium hydroxide that the acidity to be neutralised is not entirely due to sulphuric acid.

The question of colour in effluents has not so far become acute, that is to say, so long as the conditions named at the beginning of the paper are fulfilled, the authorities give a very wide margin in the matter of colour. But no doubt if reasonably cheap methods of decolorising waste dye liquors were available, the authorities would press manufacturers to apply them, but no general method of treatment can be successful with such complex liquids.

There is another class of trade effluent, the treatment of which at present is very unsatisfactory, i.e., spent gas or ammonia liquor. These liquors are heavily charged with free lime and contain phenols, sulphocyanides and possibly cyanides; and though the recovery of valuable by-products always seems imminent and possibly is done on a small scale, yet we do not know of any method which could be compared with, say, the well-known process of the recovery of seak oil from seak or soap sud. We merely aimed at the total destruction of the oxidisable matter, and our results were as follows, being laboratory experiments only:—

Ozone in alkaline effluent: The sulphocyanides and phenols were destroyed, and the "oxygen absorbed" reduced from 302.9 to 13.9 parts per 100,000, the cost being about 15s. per 1000 gallons. This was done in 1907 and no doubt ozone could be made cheaper now.

Oxygen: The effect of oxygen at 15 atmospheres pressure was tried on samples of effluent: alkaline with soda, with lime, and acid with sulphuric acid respectively. No destruction of sulphocyanide or phenol, nor reduction of "oxygen absorbed" was obtained.

Permanganate and sulphuric acid: The sulphocyanides were destroyed; "oxygen absorbed" in resulting effluent was not determined. The amount of permanganate required per 1000 gallons was about 50 pounds. The effect of hydrogen peroxide and of electrolysis (using iron electrodes) was tried on the alkaline effluent, without result. One point in favour of the use of such reagents as ozone, oxygen, and hydrogen peroxide is that they only add oxygen to the effluent.

Evaporation is successfully employed when waste heat or gas is available, as at Scotch blast furnaces. If heat be considered a chemical and the price be stated in terms of coal, in direct evaporation 9 tons

of water is evaporated by 1 ton of coal, and coal at a low pit price of 4s. per ton works out at 2s. per 1000 gallons. By multiple effect evaporation much higher efficiency can be obtained but this means expensive and complicated plant, and even taking the efficiency as doubled, the cost is still 1s. per 1000 gallons. In the case of waste ammonia liquor, evaporation would readily lend

itself to the recovery of residuals, but we know of no case in which this has been effected. So far as by-product coke ovens are concerned, there seems good reason to hope that, owing to the more scientific methods that are now coming into practice in the recovery of tar and ammonia at modern plants, the waste liquor in its present offensive form will soon be a thing of the past.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Liquefied gases; Storage vessels for —. L. A. Groth, London. Eng. Pat. 13,588, Dec. 16, 1908.

VALVES of porous material, such as cardboard, are provided in vessels for storing liquefied gases, in order to relieve pressure. A jacketed vessel is provided in its upper part with such a valve opening into the jacket, and in its lower part with a similar valve opening into the atmosphere.—J. W. H.

Separation of solid material from liquids; Apparatus for —. The Wilfley Mining Machinery Co., Ltd., and F. L. Roubush, London. Eng. Pat. 23,189, Oct. 30, 1908.

A HORIZONTAL perforated drum covered with filtering material is rotated while partially immersed in a tank containing the material to be filtered. A partial vacuum is produced inside the drum and the filtrate removed by means of a pipe passing through the hollow axle of the drum. The material is fed into the tank up to a constant level by means of a valve controlled by a float and is kept in agitation by a stirrer rocked by an eccentric upon the drum axle. As the separated solid matter is carried round upon the filtering material, it is squeezed by an apron supported across the drum and washed with water at the same time. The washed material is it reaches the level of the material in the tank again, is removed by a scraper from the apparatus and the cleaned filtering material at once re-commences filtration of the material in the tank.—J. W. H.

Filter [for air]. A. Rahe, Assignor to K. and T. Möller, Ges.m.b.H., Brackwede, Germany. U.S. Pat. 930,561, Aug. 10, 1909.

A NUMBER of rectangular frames open at one side are arranged in a series with their open sides alternately facing in opposite directions. A length of filter-cloth is folded over the frames so as to form a series of pockets facing alternately in opposite directions. The frames are then clamped together and fitted into a casing. The air enters one side of the casing, enters the openings on one side, passes through the single layer of fabric between adjacent pockets, and is discharged through the openings on the other side.—W. H. C.

Filter of progressively decreasing porosity. C. Chau. Second Addition, dated Jan. 20, 1909, to Fr. Pat. 372,281, Dec. 5, 1906 (this J., 1907, 599; 1908, 493).

THE liquid is supplied to the filter from an overhead reservoir arranged on the principle of the "Mariotte bottle" in order to obtain a constant and steady feed. The air-supply pipe to this reservoir is bent and prolonged downwards until it dips into the lower reservoir, into which the filtered liquid flows. When sufficient liquid has accumulated in this lower reservoir to seal the end of the air pipe, the supply of air to the Mariotte apparatus is cut off, and filtration ceases automatically until some

of the filtered liquid is drawn off. Then, as soon as the lower end of the air pipe becomes unsealed, air passes up into the upper reservoir and filtration automatically commences again.—W. H. C.

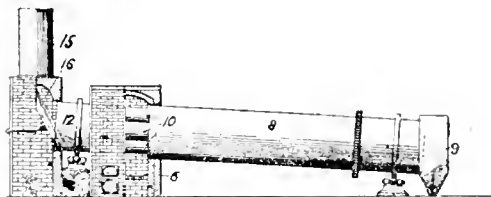
Filter-presses. J. B. Vernay. Fr. Pat. 402,250, April 20, 1909.

THE plates of the press are provided with vertical ribs forming channels on the upper part of each face and with broken horizontal ribs forming zig-zag channels on the lower part. The washing liquid is supplied separately to the upper end of each of the vertical channels to ensure thorough washing of the cake.—W. H. C.

Evaporator. T. Suzuki, Sunamura, Japan. U.S. Pat. 937,114, Oct. 19, 1909.

THE apparatus consists of a chamber divided by vertical, perforated partitions into ingress, egress, and central compartments. The liquid to be evaporated is contained in shallow pans supported in rows one above the other in the central compartment, space being left between each row of pans for the passage of air. A relatively low pressure is maintained in the egress compartment and a regulated quantity of air is supplied to the ingress compartment, so that a steady flow of air, equally distributed through all the perforations, is maintained across the central compartment.—W. H. C.

Dryer. R. K. Meade, Nazareth, Pa., Assignor to J. W. Fuller, jun., Catasauqua, Pa. U.S. Pat. 937,255, Oct. 19, 1909.



THE materials to be dried are fed through the shoot, 15, into the chamber, 12, from which they pass through the tubes, 10, and are discharged from the other end into the chamber, 9. The tubes, 10, pass through and are rotated with the drum, 8. The gases from the furnace, 6, pass through the drum exteriorly to the tubes, 10, and return through the tubes, 10, to the stack, 15. —W. H. C.

Dehydrating apparatus. D. Porter. Fr. Pat. 402,151, April 17, 1909.

THE articles to be dried are placed on moulds or supports carried on endless bands passing through a chamber through which a current of hot air is caused to flow in an opposite direction. The supports are automatically transferred from one band to the next at each end of the chamber.—W. H. C.

Rendering bodies transparent or translucent. H. Streller. Fr. Pat. 401,961, April 10, 1909. Under Int. Conv., April 11, 1908.

The body to be rendered transparent is impregnated with a solution which has approximately the same index of refraction as the substance treated. If the body contains water or other fluid this is first extracted.

—W. H. C.

Heating solid, fluid, and gaseous materials by means of the reaction heat developed on the formation of metallic sulphides. A. Lang, Karlsruhe, Germany. Eng. Pat. 22,118, Oct. 19, 1908. Under Int. Conv., Oct. 21, 1907.

SEE Fr. Pat. 395,536 of 1908; this J., 1909, 591. —T. F. B.

Source of oil.	Sp. gr. at 15° C.	Yield of carburetted water-gas in cb. m. per hour.	Gross calorific value of gas in calories per cb. m.	Average consumption of coke, in kilos.		Average consumption of oil, in kilos.		Cost of materials for production of 1 million calories.			Value of other gas-oils compared with that of No. 11, per 100 kilos.
				per cb. m. of gas.	per million calories.	per cb. m. of gas.	per million calories.	Coke (1s. 11½d. per 100 kilos.)	Gas-oil.	Total.	
Germany	0.866	600	4893	0.400	100	0.448	92	(1s. 11½d.)	(8s. 5½d.)	(10s. 5d.)	(8s. 1½d.)
Austria	0.858	580	4928	0.498	101	0.422	86	(1s. 11½d.)	(7s. 5½d.)	(9s. 5d.)	(8s. 8d.)
do.	0.862	618	4878	0.547	132	0.426	87	(2s. 7d.)	(7s. 6½d.)	(10s. 1½d.)	(7s. 10½d.)
do.	0.877	609	4926	0.532	115	0.439	95	(2s. 3d.)	(8s. 3½d.)	(10s. 6½d.)	(7s. 7d.)
do.	0.866	602	4991	0.532	114	0.444	95	(2s. 2½d.)	(8s. 5d.)	(10s. 7½d.)	(7s. 7d.)

NOTE.—The prices of the oils per 100 kilos., free Darmstadt, including duty, were, in the order given in the table: 9s. 2½d., 8s. 8d., 8s. 8d., 8s. 8½d., and 8s. 10½d.

—A. S.

Filters; Manufacture of —. R. Snero, Schöneberg, Germany. Eng. Pat. 1716, Jan. 23, 1909.

SEE Fr. Pat. 397,114 of 1908; this J., 1909, 691. —T. F. B.

Centrifugal apparatus for separating purposes. E. C. R. Marks, London. From Jahn-Kommandit-Ges. Maschinenbau-Anstalt, Eisengiesserei. und Kiesselschmiede, Arnswalde, Germany. Eng. Pat. 4325, Feb. 22, 1909.

SEE Fr. Pat. 399,829 of 1909; this J., 1909, 929. —T. F. B.

Concentrating liquids; Apparatus for —. O. Venter, Chemnitz, Germany. U.S. Pat. 937,976, Oct. 26, 1909.

SEE Eng. Pat. 27,647 of 1907; this J., 1908, 1143. —T. F. B.

II.—FUEL, GAS, AND LIGHT.

Coal dust; Experiments with — in the testing gallery of the Rossiter coal district, Austria. Czaplinski and Jicinsky. See XXII.

Coal; Determining the volatile matter of —. H. Beck. J. Gasbel., 1909, 52, 960–962. (See also Constant, this J., 1909, 692.)

IN view of the irregular results furnished by the Muck method with different quantities of substance and kinds of crucible, it is recommended that 1–5 grms. of the finely-powdered coal be placed in a platinum or porcelain crucible, tightly covered with a perforated lid, and strongly heated for a few seconds to start the evolution of gas. As soon as the gas ignites, the flame is lowered and the rate of heating regulated so that the gases will ignite on the approach of a small flame, without, however, continuing to burn after the latter has been withdrawn. When ignition is no longer produced by the test flame, the temperature is again raised for about a minute. The end point of the test is reached when the yellowish hydrogen flame from the crucible goes out; any incrustation on the top of the lid being then burned off. The under side of the cover and the sides of the crucible should remain coated with deposited carbon. The results are very concordant, whichever kind of crucible is used, and are 2–4 per cent. higher than those from the Muck method. With regard to the relation between the yield of coke in crucible tests and in the coke-oven, the author considers that no comparison is practicable, but that the value of the crucible test is chiefly confined to the "degree of volatility" of coal in the crucible, this degree expressing the amount of volatile matters in 100 parts of the pure

coal, after deducting the content of moisture and ash. These results should enable a comparison to be drawn as to the relative susceptibility of the different kinds of coal to chemical decomposition, the factor of volatility providing a constant for each coal and serving to estimate its technical value. —C. S.

Gas oils; Valuation of —. L. Kalbfuss. J. Gasbelucht., 1909, 52, 933–936.

THE author has carried out tests with four cheap Austria oils and one German oil in the carburetted water-gas plant of the Darmstadt gas-works, which comprises two separate systems each with a capacity of about 12,500 cb. m. of gas per 24 hours. The results are shown in the following table:—

Gas testing. "Local Govt. Officer," Oct. 30, 1909. [T.R.]

AMONG the Acts passed during the current Session of Parliament, affecting the work of the London County Council, is the Gas Light and Coke Company's Act, 1909, which received the Royal Assent on August 16th, 1909. The Act makes certain alterations as regards the standard quality of the gas to be supplied by the company in London.

As from the date of the passing of the Act, the standard illuminating power of the gas was reduced from 16 to 14 candles, thus placing the company in a uniform position in this respect with the other two metropolitan gas companies. Provision is made for a consequential reduction in the standard price, etc., of gas, and for the company to supply, *gratis*, burners suitable for the lower illuminating power in place of those already in use. The standard of calorific power fixed is 125 calories net per cubic foot of gas, with an allowance of 12½ calories (10 per cent.) on an average of each of three days, or of 18½ calories on any one day; that is to say, the company is now liable to forfeitures if the calorific power falls below 106½ calories on any one day or below 112½ calories on an average of three days. The Board of Trade is authorised to vary the standard on the expiration of three years on appeal by either the company or the Council.

The Public Control Committee of the County Council have arranged for the testings for calorific power, which up to the passing of the Act were taken for information only, to be continued, but for only one testing for illuminating power with the flat flame burner to be made weekly on Sundays at each testing place, instead of three testings daily, the daily testings for sulphur impurities being continued; and that a test for calorific value on Sundays shall be substituted for the usual illuminating power testings by means of the argand burner. In view of the diminishing importance of illuminating power testings, and the general unification of the standard, the Committee have given authority for the number of testing places at which such testings shall be made on Sundays in the districts of the two companies not working to a calorific standard, to be varied from time to time.

Smoke tintometer. Lowdon. See XXIII. Apparatus.

PATENTS.

Fuel; Artificial —. H. C. Morris, Swansea. Eng. Pat. 6163, Mar. 15, 1909.

POWDERED coal is mixed with powdered maize or other grain, or with flour derived therefrom, in the dry con-

dition, together with finely-ground pitch. The dry mixture is passed into a pug-mill and steam is introduced. The mass is finally moulded into briquettes. Suitable proportions of the binding materials are 1 part by measure of maize, etc., and 5 parts of pitch, to 94 parts of coal.

—A. T. L.

Briquettes; Agglomerating powdered coal of all kinds for the formation of — without the use of resin or other binding agent which would cause smoke, &c., during combustion. E. M. Heckel. Fr. Pat. 402,247, April 20, 1909.

THE process consists in the use as binding agent of a material prepared in the following manner:—0.65 grm. of potassium bichromate is dissolved in 100 c.c. of warm water, and 25 grms. of rice flour are added. The mixture is heated to 90°–100° C. and stirred into a paste. The paste is kept at 50°–60° C. and stirred, while 10 grms. of Portland or other cement are added. Finally, 1 kilo. of the powdered fuel to be agglomerated is mixed with the binding agent, the mass is formed into briquettes and dried. The proportions used vary with the fuel, those given being suitable for anthracite or steam-coal.

—A. T. L.

Fuel; Plant for the treatment of — and the recovery and primary separation of the by-products from same. W. G. Moore, Birmingham, and W. A. E. Crombie, London. Eng. Pat. 6966, Sept. 30, 1908.

THE plant comprises a battery of inclined retorts in which a high vacuum, for example a vacuum of 25 inches, is maintained, as in Eng. Pat. 7732 of 1906 (this J., 1907, 461), and a condenser or series of condensers arranged between the retorts and the vacuum pump. The gases from the retorts pass successively through air-cooled and water-cooled condensers, before reaching the vacuum pump, whereby the by-products are fractionally separated. From the vacuum pump, the uncondensed gases are discharged into a receiver provided with a catch-pot and further cooled to condense as much as possible of the by-products. If desired, these gases may be forced by a compressor through a coil and finally be allowed to escape against a series of inclined perforated plates whereby a further quantity of by-products (benzene) is condensed. The retorts are of metal and are completely encased in a perforated refractory jacket built up of sections and held in place between rebated blocks surrounding the retorts at intervals along their length.—A. T. L.

Gas retorts. R. Dempster and Sons, Ltd., and R. M. Brooke, Elland, Yorks. Eng. Pat. 1937, Jan. 27, 1909.

THE invention relates to the heating of vertical gas retorts arranged in a setting divided into compartments by horizontal partitions as described in Eng. Pat. 16,405 of 1908 (this J., 1909, 647). In order to ensure uniformity in the heating, each horizontal compartment is divided by vertical walls into a number of parallel flues in such a manner that only half of each retort in each row of retorts is heated by the gases in one flue. One or more vertical combustion chambers are provided adjacent to the retort setting, and orifices are provided so that each of the horizontal flues receives a separate stream of gases from the combustion chamber. These separate flues unite at the side of the setting remote from the combustion chambers, and the whole of the gases from one combustion chamber passes in the reverse direction through a horizontal flue adjacent to the end wall of the setting so as to heat the outer surfaces of the retorts in the end row, and then to the regenerators.—A. T. L.

Gas generators. G. Schimming, Berlin. Eng. Pat. 21,660, Oct. 13, 1908. Under Int. Conv., Oct. 14, 1907.

THE patent relates to gas-generators working with a down-draught in order to produce gas free from tar, from bituminous fuel. The raw fuel is fed mechanically in small quantities to the top of the fuel column, and in order to accelerate the transmission of heat to the raw fuel, the air supply is made intermittent, being interrupted for example 120 times per minute by a mechanically operated valve on the air pipe. The gas generated while

the air supply is cut off, penetrates into the layer of fresh fuel. In order further to promote this heating of the fresh fuel, a pump may be provided, open either to the air chamber above the fuel or to the gas chamber below the fuel column, and operated synchronously with the valve so as to draw or force the gas up into the layer of raw fuel while the air supply is interrupted.—A. T. L.

Gas-producer for the destruction of refuse and the gasification of fuels and their waste-products. V. Sepulchre. Fr. Pat. 401,859, Aug. 11, 1908.

THE gas producer comprises a lower, or gas-producing chamber without a grate and with tuyères in the vertical walls, and an upper chamber in which the refuse, &c., is heated by the gas from the lower chamber. This upper chamber contains a long vertical cylindrical shell arranged centrally within it, into which the refuse is charged, the hot gases from the lower chamber circulating around this shell before reaching the gas outlet. The moisture and gases liberated from the refuse, &c., in the upper chamber may be led away by a pipe which terminates in a series of truncated conical hoods within the mass of refuse, or this pipe may lead down into the gas-producing chamber when it is desired to destroy the tar.—A. T. L.

Gas producers. Morgan Construction Co. Fr. Pat. 402,413, April 26, 1909.

THE lower part of the gas-producer chamber is of inverted truncated conical form, and is supported upon a rotating water-trough so as to rotate with it. A stationary casing fixed to the upper part of the producer extends downwards outside the rotating part of the producer and is sealed by the water in the trough. The vertical space between the upper edge of the rotating part and the lower edge of the fixed part of the producer is filled by a horizontal annular plate, supported by hooks from the fixed outer casing, in order to prevent the passage of fuel or ash. The water-trough is supported on wedges on a rotating ring, and its position is adjusted vertically by means of these wedges, leaving sufficient play between the fixed and rotating parts of the producer to allow for expansion. The outer wall of the water-trough is outwardly inclined, and the ash is removed automatically as the trough rotates, by a stationary scraper in the water-trough arranged adjacent to its outer wall, and suitably inclined, so as to lift the ashes over the top edge of the trough. To control the rate at which the ashes are removed, this scraper may be adjusted parallel to itself and toward or away from the bottom of the trough, and an opening through which the ashes are discharged may be regulated by a sliding cover.—A. T. L.

Gas-producer. E. Gobbe. Fr. Pat. 402,767, May 6, 1909. Under Int. Conv., May 16, 1908.

A GAS-PRODUCER for the manufacture of lighting gas and coke comprises a tall vertical cylindrical chamber with hollow walls of refractory material. The interior of this chamber communicates with the interior of the hollow walls by orifices at about the centre of its height. The producer is heated initially by burning fuel in the lower part, the products of combustion escaping through the hollow walls to a chimney. The upper part of the producer is then charged with coal and the gases distilled from the coal are drawn off by a fan. A part of these gases passes downwards and is admitted to the lower end of the producer so as to carry heat from the coke therein to the coal in the upper part of the producer. The heat is maintained by the combustion of the coke in the lower part of the producer during the periods at which the doors are opened for the withdrawal of coke. In a modification, a small gas-producer is arranged adjacent to the main producer, and flues are provided so that the gases from this producer may be circulated around, or may pass up within, the upper part of the main producer, and so that some of the lighting gas produced may circulate through the small producer and thence through the main producer, after the small producer has been blown with air.—A. T. L.

Gas generating plants; Washing or purifying apparatus for use in —. E. Temple, Sydney, N.S.W. Eng. Pat. 25,736, Nov. 28, 1908.

THE apparatus is of the kind in which a series of buckets on an endless chain passing over rotating chain-wheels, entrap the gas and carry it beneath the water-level in a scrubbing chamber, the gas escaping into the space above the water level in a second chamber communicating with the former below the surface of the water. The invention consists in charging this second chamber with a column of coke, flint, or pebbles up to the water level so as to aid the scrubbing of the gas. A further improvement consists in the provision of a water-lock between the scrubber and the engine. This consists of a closed box or tank with vertical inlet and outlet pipes for the gas extending below the normal water level so as to seal both pipes when the engine is not in use, and a third vertical pipe extending further below the water level and open to the air. When the scrubber is in operation the pressure of the gases forces water from the water-lock up this open pipe, so that the water level is lowered, and the ends of the gas inlet and outlet pipes are unsealed.—A. T. L.

Coal gas; Process for rendering — transportable. A. Menz. Fr. Pat. 402,330, April 23, 1909. Under Int. Conv., April 25 and Aug. 3, 1908.

THE gas is forced into steel bombs at about 200 atmospheres pressure, or the same quantity of gas is introduced into the bomb by compressing at a lower pressure, but at a temperature at which the compressed gas solidifies.—A. T. L.

Mantles; Refractory and indestructible filament for incandescence —. R. Laigle. Second Addition, dated Aug. 1, 1908, to Fr. Pat. 382,749, Oct. 11, 1907 (this J., 1908, 216).

THE patent is for the use, in carrying out the process described in the principal patent, of thorium and cerium oxides having a fibrous structure. These oxides are obtained by impregnating cotton or other fibrous materials with the nitrates, and after drying, burning away the cotton. The waste from incandescence mantles may be used.—A. T. L.

Electric incandescent lamps; Process for fastening the filaments of — to the electrodes. T. McKenna, London. From Glühlampenwerk Anker Ges.m.b.H., Berlin, Germany. Eng. Pat. 20,915, Oct. 3, 1908.

THE ends of metal filaments are coated with the metal of which the leading-in wires consist, and the filaments are then fused to the leading-in wires. The coating of platinum, silver, nickel, copper, iron, or their alloys, may be obtained by electrolytic deposition.—A. T. L.

Gas producers; Revolving grate for —. H. Rehmman, Mülheim on Ruhr, Germany. U.S. Pat. 937,466, Oct. 19, 1909.

SEE Fr. Pat. 377,731 of 1907; this J., 1907, 1079.—T. F. B.

Gases generated by dry distillation; Process of purifying —, and of obtaining by-products therefrom. K. Burkheiser, Aix-la-Chapelle, Germany. Eng. Pat. 21,763, Oct. 14, 1908. Addition to Eng. Pat. 20,920 of 1908, dated Oct. 14, 1907.

SEE Fr. Pat. 324,926 of 1908; this J., 1909, 359.—T. F. B.

Gases; Process of cleaning —. A. Ernst, Pittsburgh, U.S.A. Eng. Pat. 6167, March 15, 1909. Under Int. Conv., April 15, 1908.

SEE U.S. Pat. 900,062 of 1908; this J., 1908, 1052.—T. F. B.

Filaments for incandescence electric lamps and their manufacture. Cie. Franç. pour l'Exploitation des Proc. Thomson-Houston. First Addition, dated April 24, 1909, to Fr. Pat. 349,857, April 15, 1904.

SEE Eng. Pat. 5416 of 1908; this J., 1908, 1197.—T. F. B.

Denaturing and carburetting alcohol. Addition to Fr. Pat. 368,713. See XVII.

Photometer. Eng. Pat. 22,748. See XXIII. Apparatus.

Self-recording gas analysis apparatus. Fr. Pat. 402,190. See XXIII. Apparatus.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Coal-tar; Some constituents of —. II. Pseudocumene. G. Schultz and E. Herzfeld. III. Normal decane. G. Schultz and E. Hartogh. IV. New constituents of solvent naphtha. G. Schultz and A. Perl. V. Normal propylbenzene. G. Schultz and J. Führer. Ber., 1909, 42, 3602–3619.

II.—For the isolation of pseudocumene, Jacobsen's method was followed (Annalen, 1877, 184, 199), a quantity of solvent naphtha (90 per cent. distilling over up to 175° C.) being fractionated so as to obtain 1080 c.c. of distillate boiling between 165° and 170° C., and the latter sulphonated. Pseudocumenesulphonic acid is soluble with difficulty in sulphuric acid and crystallises out. The sulphonic acid thus obtained must however be recrystallised several times from water or dilute sulphuric acid in order to purify it; 1035 grms. of the crude sulphonic acid yielded 410 grms. of the pure acid in the form of colourless rhombic crystals. In order to isolate the hydrocarbon, the sulphonic acid was heated to its melting point (110° C.) and then just when decomposition began to take place, steam at a temperature of 250° C. was passed in, the process being stopped when signs of foaming were observed. In this way 150 grms. of pure pseudocumene were obtained, which boiled at 166° C. at 712 mm. pressure, and had the sp. gr. 0.877 at 18° C. From the hydrocarbon the authors prepared the following derivatives:—Monochloropseudocumene (m. pt. 70° C.), trichloropseudocumene (needles, m. pt. 197° C.), mononitropseudocumene (m. pt. 71° C., b. pt. 265° C.), nitrotrimellitic acid (needles, m. pt. 175° C.), azoxyxypseudocumene (yellow needles, m. pt. 66° C.), dinitropseudocumene, probably $C_6H(CH_3)_2(NO_2)_2[(CH_3)_3C:(NO_2)_2 = 1:2:4:3:5]$, (yellowish needles, m. pt. 171°–172° C.), and trinitropseudocumene (m. pt. 185° C.).

III.—Eleven litres of tar oil (b. pt. 150°–180° C.) which had been previously treated with sulphuric acid in order to separate the pseudocumene and mesitylene as sulphonic acids, were treated repeatedly first with ordinary sulphuric acid and later with sulphuric acid monohydrate. In this way 2320 grms. of an oil were obtained of which 2100 grms. distilled below 200° C., and a further 210 grms. above 300° C. The lower-boiling fraction was treated repeatedly with a mixture of nitric and sulphuric acids, and the final unaltered oil, after washing with alkali and water, was distilled over sodium; it proved to be normal decane, b. pt. 172° C. at 760 mm. and sp. gr. 0.7387 at 15° C. Its mono- and dichloro-derivatives, decyl alcohol, and capric acid were prepared from it.

IV.—By fractionation of a large quantity of solvent naphtha, 4.5 litres of a portion distilling between 153° and 162° C. were obtained, and this was separated into three fractions boiling at 153°–157° C., 157°–160° C., and 160°–162° C. respectively. The first fraction (153°–157° C.) was nitrated, and the crude nitro-product was reduced with stannous chloride and hydrochloric acid. The mixture of amino-compounds was benzoylated and the benzoyl derivatives separated by crystallisation from alcohol into four compounds melting at 115°, 124°, 151°, and 165° C. respectively. Of these, the first and last were identified as the benzoylamino-compounds of *n*-propylbenzene and *p*-ethyltoluene respectively. The two remaining fractions (157°–160°, and 160°–162° C.) were sulphonated in stages, and the different sulphonic acid fractions converted into sulphamides; on sulphonation a portion was left unattacked consisting of *p*-ethyltoluene with some decane. The different sulphamides were identified as derivatives of

mesitylene, *o*-ethyltoluene, *m*-ethyltoluene, and *p*-ethyltoluene. The portion of solvent naphtha distilling between the xylenes and the trimethylbenzenes thus contains *n*-propylbenzene and *o*-, *m*-, and *p*-ethyltoluenes.

V.—Normal propylbenzenesulphonic acid can also be isolated from the mother-liquors obtained in the purification of pseudocumenesulphonic acid (see III., above).

- A. S.

PATENT.

Tar; Methods of purifying —. P. C. Reilly, Indianapolis, U.S.A. Eng. Pat. 22,853, Oct. 27, 1908.

SEE FR. Pat. 395,738 of 1908; this J., 1909, 516.—T. F. B.

IV.—COLOURING MATTERS AND DYE-STUFFS.

Carthamine (Preliminary Note). T. Kametaka and A. G. Perkin. Chem. Soc. Proc., 1909, 25, 223.

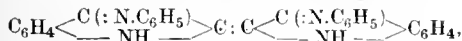
CARTHAMINE, the red colouring matter of safflower (*Carthamus tinctoria*), was first isolated by Schlieper (Annalen, 1846, 53, 362) as a red, amorphous powder possessing a cantharides iridescence, and to this he assigned the formula $C_{14}H_{16}O_7$. Radcliffe (J. Soc. Dyers, 1897, 13, 158) obtained carthamine from safflower extract as red, iridescent needles melting at 165° — 169° (provisional), but did not analyse this product. The authors corroborate the work of Radcliffe, but regard the compound he prepared as a salt of carthamine, rather than the free colouring matter itself. They find that the crystalline substance is most readily obtained from the extract by means of pyridine and water, but that an elaborate purification is necessary to obtain a pure compound free from calcium, magnesium, and potassium salts. It forms red, iridescent needles, which, when dried at 110° , are exceedingly hygroscopic and are decomposed at about 228° — 230° . Analyses indicate that the formula of carthamine is probably $C_{14}H_{14}O_7$. On fusion with potassium hydroxide, carthamine gives *p*-hydroxybenzoic acid, as stated by Malin (Annalen, 1865, 136, 117), but in the pure condition the dyestuff appears to be much more stable than has been previously suggested.

Monazo-dyestuffs and their fastness to light; Relation between the chemical constitution of —. E. R. Watson. Chem. Soc. Proc., 1909, 25, 224.

THE author puts forward the theory that the fading in light of an azo-dyestuff is due to the oxidation of that part of the molecule which contains hydroxy- or amino-groups, and that the fastness of such a dyestuff is increased by introducing into the phenolic or arylamino-part such other groups as will reduce the tendency to become oxidised.

Indigo; The action of primary amines on ——. E. Grandmougin and E. Dessoulavy. Ber., 1909, 42, 3636—3641.

WHEN indigo (60 grms.) is boiled with aniline (300 grms.) and anhydrous powdered boric acid (60 grms.) added (the operation requires 3—4 hours), indigodianilide,



is formed. When crystallised from pyridine or xylene it forms dark blue needles which dissolve in xylene, pyridine, nitrobenzene, acetic acid or dimethylamine with a dark blue green colour: the substance is sparingly soluble in ether or chloroform and almost insoluble in alcohol. On oxidation it yields isatin and on reduction a leuco-compound which, however, being insoluble in alkali, is useless for dyeing purposes. Similar compounds are obtained from indigo and the toluidines, *m*-4-xylidine and *m*-2-xylidine. Also 7:7'-dimethylindigo similarly yields an anilide and a toluidide.—J. C. C.

Dehydroindigo; New oxidation product of indigo. I.
L. Kalb. Ber., 1909, 42, 3642—3652.

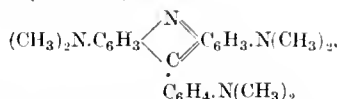
DEHYDROINDIGO,



is prepared (1) by oxidising indigo with lead peroxide suspended in benzene with the addition of a little acetic acid, (2) by hydrolysing the acetate (O'Neill, Chem. News, 1892, 65, 124; Marchlewski and Radcliffe, J. prakt. Chem., 1898, 58, 102; see this J., 1898, 432) with benzene and pyridine, and (3) by treating a suspension of indigo and calcium hydroxide in chloroform with bromine. Dehydroindigo is an extremely reactive compound of quinone-like character. It crystallises in dark yellowish-red six-sided leaflets with a red brown reflex. It is soluble in most of the common organic solvents and is readily converted into indigo on heating in the air. It is reduced to indigo by stannous chloride or by quinol. On treatment with glacial acetic acid it yields the diacetate referred to above, and readily forms salts with other acids. The author has obtained also 5:5'-dibromodehydroindigo by similar means: this also yields an acetate. (See also page 1192.)—A. C. C.

Amino-derivatives of phenylauramine and rheonine. E. Grandmougin and A. Lang. Ber., 1909, 42, 3631—3635.

THE authors have prepared the following derivatives of phenylauramine: *m*-aminophenylauramine, $C_{23}H_{26}N_4$, bright yellow crystals, m. pt. 198° C.; dimethyl-*m*-aminophenylauramine, $C_{25}H_{30}N_4$, bright yellow crystals, m. pt. 180° C.; diethyl-*m*-aminophenylauramine, $C_{27}H_{34}N_4$, yellow prisms, m. pt. 157° C.; *m*-aminotolylauramine, bright yellow crystals, m. pt. 229° C.; dimethyl-*p*-aminophenylauramine, $C_{25}H_{30}N_4$, deep yellow crystals, m. pt. 179° C.; diethyl-*p*-aminophenylauramine, deep yellow crystals, m. pt. 142° C. By heating dimethyl-*m*-aminophenylauramine with zinc chloride during two hours at 206°—216° C., hexamethylrhoeine (hexamethyltriamino-9-phenylacridine),



is obtained. The zinc chloride double salt forms brown needles with a green reflex and the base dissolves in acids with a deep red colour; the solution in concentrated sulphuric acid is yellow with a green fluorescence.

—J. C. C.

Carbazole derivatives; Some —. P. Ziersch. Ber., 1909, **42**, 3797—3800.

3-NITROCARBAZOLE is conveniently prepared by treating a suspension of carbazole in glacial acetic acid with concentrated nitric acid (sp. gr. 1.38). In this reaction is formed a new nitro-compound which is provisionally called 1-nitrocarbazole. The corresponding aminocarbazoles, obtained by reduction with sodium hyposulphite (hydrosulphite), give red violet dyestuffs when diazotised and combined with naphthol- or aminonaphthol-sulphonic acids. When dinitrocarbazole (Ger. Pat. 46,438) is treated with chlorine in acetic acid solution, a dichloro-derivative is obtained from which the corresponding diamino-compound was prepared. When tetrazotised and combined with naphtholdisulphonic acids, dichlorodiaminocarbazole furnishes violet wool dyestuffs. By nitrating carbazole with fuming nitric acid a tetranitrocarbazole, m. pt. 285° C., identical with one described by Ciamician and Silber (Annalen, 285, 163), results. This on reduction yields a tetra-amino-derivative, of which all four groups can be diazotised. The diazo-compound gives with 2-amino-8-naphthol-6-sulphonic acid a Bordeaux red dyestuff which dyes wool well with the addition of acetic acid and sodium sulphate.—J. C. C.

Colouring of alimentary products. Colours allowed to be used in France. Muttelet. See XVIII A.

PATENTS.

Azo colouring matters [dyestuffs]; Production of —. J. Y. Johnston, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 1816, Jan. 25, 1909. Addition to Eng. Pat. 25,311, Nov. 24, 1908.

INSTEAD of the α -naphtholsulphonic acids mentioned in the chief patent (this J., 1909, 469), 2:3:6-naphthol-disulphonic acid is combined with diazotised benzoyl- p -phenylenediaminesulphonic acid. The lakes prepared from this and similar dyestuffs possess a better covering power than those previously described.—J. C. C.

Halogen-anthraquinones; Process for preparing —. Badische Anilin und Soda Fabrik. Ger. Pat. 214,714, Feb. 26, 1908.

WHEN the halogen-anthraquinonesulphonic acids, prepared according to Fr. Pat. 384,471 (this J., 1908, 442) by the halogenation of anthraquinonesulphonic acids, are treated with halogens or substances producing halogens, in presence of water, the sulphonic acid group is replaced by halogen, resulting in the formation of poly-halogen-anthraquinones.—T. F. B.

Azo dyestuffs; Manufacture of substantive —. O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 10,936, May 8, 1909.

Azo dyestuffs which can be further diazotised on the fibre or in substance are obtained by first diazotising a monoazo dyestuff prepared by combining one molecular proportion of an aminobenzoyl-2:5-aminonaphthol-7-sulphonic acid, an aminoaryl-5-hydroxy-1:2-naphthiminazol-7-sulphonic acid, or an aminoaryl-5-hydroxynaphthylthiazol-7-sulphonic acid with one molecular proportion of a monodiazocompound, and then combining the product of the diazotisation with an aminoarylpyrazolonecarboxylic acid. The dyestuffs obtained dye cotton in orange red to blue red shades. By diazotisation on the fibre and combining with β -naphthol, dyes fast to washing are obtained without essential change of tint.—J. C. C.

Blue substantive dyestuffs; Manufacture of —. Act.-Ges. f. Anilinfabr., Berlin, Germany. Eng. Pat. 11,364, May 13, 1909. Under Int. Conv., May 26, 1908.

BLUE disazo substantive dyestuffs are obtained by combining diazotised p -nitro-aniline- o -sulphonic acid with 1:6- or 1:7-naphthylaminesulphonic acid, or a mixture of these acids, or aminocresol methyl ether, again diazotising the azo compound obtained, and then allowing it to act on 2:5-aminonaphthol-7-sulphonic acid or a derivative thereof containing alkyl or aryl substituents in the amino-group.—J. C. C.

Disazo dyestuffs; Manufacture of —. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 12,371, May 25, 1909. Under Int. Conv., July 2, 1908.

THE disazo dyestuffs obtained by combining two molecular proportions of diazotised o -nitroaniline with one of 1:8-aminonaphthol-3:6- (or 4:6-) disulphonic acid—the first molecule of diazo-compound being combined in acid, and the second in alkaline solution—form dark brown powders having a bronze lustre. They give a green solution in sulphuric acid, and dye wool in greenish black shades.—J. C. C.

Disazo dyestuffs; Process for preparing yellowish- to bluish-red —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 214,497, Oct. 27, 1908. Addition to Ger. Pat. 204,102, April 26, 1906.

A DIAZO compound is combined with p -aminobenzoyl-2,5,7-aminonaphtholsulphonic acid; the resulting dyestuff is diazotised, combined with p -nitrobenzoyl-2,5,7-aminonaphtholsulphonic acid, and the nitro-group reduced, e.g., by means of sodium sulphide. The dyestuffs thus obtained dye unmordanted cotton orange to bluish-red shades.—T. F. B.

Sulphur dyestuff. J. Flachslander, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 935,009, Sept. 28, 1909.

A NEW sulphide dyestuff is obtained by heating dinitrochlorophenol ($\text{OH}:\text{NO}_2:\text{NO}_2:\text{Cl}=1:2:4:6$) with sulphur and sodium sulphide to 115°C . for about 16 hours. The dyestuff is precipitated with air. It dyes cotton in black shades.—J. C. C.

Vat [anthracene] dyestuff. P. Thomaschewski, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 935,827, Oct. 5, 1909.

VAT dyestuffs of the anthracene series are obtained by converting an aminoanthraquinone into its derivatives containing a hydroxynaphthylcarbonyl group, $\text{C}_{10}\text{H}_6(\text{OH})\text{CO}$, in the amino-group. Example: 10 parts of 1-aminoanthraquinone are heated to 125°C . with 100 parts of nitrobenzene, 10 parts of 2-naphthol-3-carboxylic acid and 8 parts of thionyl chloride. The condensation product crystallises from the cold liquid in orange yellow prisms. It gives a reddish brown colour with sulphuric acid, and with alkaline hydrosulphite yields a red vat from which cotton, wool or silk is dyed in pure yellow shades.—J. C. C.

Vat [anthracene] dyestuff. L. Wolman, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 935,878, Oct. 5, 1909.

BY treating an aminoanthraquinone with an anthraquinonecarboxylic acid, new substituted aminoanthraquinones are obtained which contain the group, $\text{C}_{10}\text{H}_7\text{O}_2\text{CO}$, in the amino-group. Example: 10 parts of anthraquinone-2-carboxylic acid are heated with 200 parts of nitrobenzene and 6 parts of thionyl chloride to 140°C . After cooling to 100°C , 10 parts of 1-aminoanthraquinone are added and the mixture is heated for 1–2 hours to 110° – 120°C . On cooling, the new product forms yellow crystals. It gives a yellow solution with sulphuric acid and with alkaline hydrosulphite yields a brownish vat from which cotton, wool or silk is dyed in pure greenish yellow shades.—J. C. C.

Azo dyestuffs and their intermediate products; Process for the production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 402,030, April 14, 1909. Under Int. Conv., May 18, 1908.

DISAZO dyestuffs are obtained by treating sulphonic or carboxylic acids of aminoazo-compounds of the benzene or naphthalene series which contain no other auxochrome group than the amino-group, with phosgene or its polymerides or with thiophosgene. Example: 962 parts of the sodium salt of the aminoazo-dyestuff prepared from 1-naphthylamine-3:6-disulphonic acid and o -anisidine are dissolved in 9000 parts of water and 600 parts of sodium carbonate, and into this solution a current of phosgene is introduced until the formation of the dyestuff is complete. The dyestuff gives reddish yellow shades on cotton.—J. C. C.

Secondary disazo dyestuffs and their intermediate products; Process for the production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 402,120, April 16, 1908. Under Int. Conv., April 22, 1908.

SECONDARY disazo dyestuffs are prepared by combining the diazo-compounds of benzenoid amines which contain a negative group in the ortho-position to the amino-group, or of naphthylamines containing a negative group in the 1- or 2- (ortho) position, with an amine which can later be diazotised. The intermediate product is then diazotised and combined with 2-amino-5-naphthol-7-sulphonic acid or its alkyl or aryl derivatives or substituted derivatives containing the substituent in the ortho-position to the amino-group. The dyestuff obtained from aniline- o -sulphonic acid, p -xylydine, and 2-amino-5-naphthol-1:7-disulphonic acid dyes cotton in reddish violet shades and that from 1-naphthylamine-2:6-disulphonic acid, 1-naphthylamine, and 2-ethylamino-5-naphthol-7-sulphonic acid dyes cotton in bluish violet shades. A list of 32 similar dyestuffs is given in the patent.—J. C. C.

Azo dyestuffs dyeing cotton direct; Process for the production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 402,126, April 16, 1909. Under Int. Conv., April 22, 1908.

SECONDARY disazo-dyestuffs are prepared by combining the diazo-compounds of aminoazo-derivatives of the benzene or naphthalene series (except those of peri-aminonaphthol or its sulphonic acids) with the acyl derivatives of 2-amino-5-naphthol-7-sulphonic acid or 2-amino-5-naphthol-1:7-disulphonic acid. Diazotised aminoazobenzene and 2-ethylurethane-5-naphthol-1:7-disulphonic acid, $\text{OH.C}_{10}\text{H}_4(\text{SO}_3\text{H})_2\text{NH.CO}_2\text{C}_2\text{H}_5$, gives a dyestuff which dyes cotton in scarlet shades fast to light. Diazotised aminoazobenzenemonosulphonic acid and 2-benzoylamino-5-naphthol-7-sulphonic acid furnish a dyestuff producing on cotton pure red shades which are fast to light, and the dyestuff obtained from diazotised aminoazobenzenecarboxylic acid and 2-benzoylamino-5-naphthol-7-sulphonic acid dyes cotton red. A list of 40 of these dyestuffs is given in the patent.—J. C. C.

Azo dyestuffs; Process of production of new — and their intermediate products. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 402,546, April 30, 1909. Under Int. Conv., May 29 and Oct. 23, 1908.

NEW azo dyestuffs are obtained by combining the diazo-compounds of two molecules of the same or of two different aminodiphenyl ethers or their homologues, or of one molecule of such an ether and one molecule of some other diazo-compound, with one molecule of a peri-aminonaphtholsulphonic acid. The dyestuff obtained from two molecules of diazotised *p*-aminodiphenyl ether and one of 1:8-aminonaphthol-4:6-disulphonic acid dyes wool from an acid bath in blue black shades. The dyestuff prepared by combining diazotised dichloroaniline with 1:8-aminonaphthol-3:6-disulphonic acid in acid solution and then adding one molecule of diazotised *o*-aminodiphenyl ether in alkaline solution, dyes wool from an acid bath in greenish blue-black shades.—J. C. C.

Anthracene compounds and their intermediate products; Process for the production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 402,741, May 5, 1909.

NEW anthracene derivatives are obtained by condensing halogenated anthraquinones with thiosalicilic acid or its derivatives and treating the products with dehydrating agents. Example: 154 kilos. of thiosalicilic acid are dissolved in 1250 kilos. of water by means of sodium hydroxide. The solution is mixed with 242.5 kilos. of 1-chloroanthraquinone and heated in an autoclave at 180°–185° C. for twelve hours. After cooling, the mass is diluted, rendered alkaline, boiled and filtered. On acidification, the condensation product separates; it crystallises from alcohol in prisms, m. pt. 246° C. One part of this product is added to 5 parts of melted zinc chloride and the mixture heated for a short time until the precipitate obtained by diluting a sample with water is no longer soluble in sodium hydroxide. The mixture is then heated with water and the precipitate is filtered and washed with warm water. The compound so obtained can be purified by boiling it with dilute sodium hydroxide, water, alcohol and ether. It forms a red powder which gives a yellowish red solution with sulphuric acid and dyes cotton from the hydrosulphite vat in orange shades.—J. C. C.

Vat dyestuffs of the anthracene series; Process for preparing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 213,500, Aug. 5, 1908.

SUBSTANCES which dye unmordanted cotton red shades from the vat, are obtained by treating benzoylated 1,5-diaminoanthraquinone or its derivatives with concentrated or fuming sulphuric acid, whereby a hydroxyl-group is introduced into the nucleus.—T. F. B.

Triphenylmethane dyestuffs; Process for preparing blue chrome acid —. Anilinfarben- und Extract-Fabr. vorm. J. R. Geigy. Ger. Pat. 213,502, July 19, 1908. Addition to Ger. Pat. 189,938, Sept. 29, 1906 (see Fr. Pat. 384,979; this J., 1908, 497).

THE aldehydes used in the process of Ger. Pat. 199,943 (this J., 1908, 936) are replaced by the following:—*o*-Chloro-*o*-bromobenzaldehyde, 4,6-dibromo-2-chloro-5-aminobenzaldehyde, 2,4,6-tribromo-5-aminobenzaldehyde, 4,6-dibromo-2-chloro-5-hydroxybenzaldehyde. The chromed dyeings produced by these dyestuffs are much greener in shade than those produced by the dyestuffs of Ger. Pat. 199,943.—T. F. B.

Triphenylmethane dyestuffs; Process for preparing acid chrome —. Anilinfarben- und Extract-Fabr. vorm. J. R. Geigy. Ger. Pat. 213,503, Aug. 25, 1908. Addition to Ger. Pat. 189,938, Sept. 29, 1906 (see Fr. Pat. 384,979; this J., 1908, 497).

IN the principal patent and in Ger. Pats. 198,909, 199,943, and 199,944 (this J., 1908, 801 and 936) *o*-hydroxycarboxylic acids are condensed with aldehydes produced from substituted toluene derivatives by the chlorination method, to form leuco-triphenylmethane dyestuffs. These aldehydes may be replaced by the corresponding chlorides, Ar.CHCl_2 , or by the sulphates, obtained by the action of sulphuric acid on the chlorides; these chlorides or sulphates may also be nitrated or sulphonated to obtain corresponding derivatives to those used in the above-mentioned patents.—T. F. B.

Sulphonation of organic compounds. F. Thümmeler. Ger. Pat. 214,156, Feb. 4, 1909.

SALTS of vanadium are used as catalytic agents in the sulphonation of organic compounds. For example, 100 grms. of anthraquinone are treated with 80 grms. of fuming sulphuric acid (60 per cent. anhydride) in presence of 0.1 to 0.2 gm. of vanadium sulphate, for one hour at 170° C. In that time, 86 grms. of the anthraquinone will have been sulphonated.—T. F. B.

Dyestuffs of the anthracene series; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5786, March 10, 1909.

SEE Ger. Pat. 213,500 of 1908; preceding.—T. F. B.

[Azo] dyestuffs; Yellow —. O. Günther and L. Hesse, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 935,016, 935,017, and 935,018, Sept. 28, 1909.

SEE Fr. Pat. 402,030 of 1909; preceding.—T. F. B.

[Anthracene] dyestuff; Vat —. J. Deinet, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 935,781, Oct. 5, 1909.

SEE Fr. Pat. 400,653 of 1909; this J., 1909, 1029.—T. F. B.

Tri- and tetra-bromindigos and process of making same. W. Bauer, Vohwinkel, and A. Herre, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 937,040 and 937,041, Oct. 19, 1909.

SEE Eng. Pat. 4423 of 1908; this J., 1909, 18.—T. F. B.

[Azo] dyestuffs; Process for producing — and the products thereof. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 402,200, April 19, 1909. Under Int. Conv., May 22, 1908.

SEE U.S. Pats. 935,829 and 935,830 of 1909; this J., 1909, 1120.—T. F. B.

Vat dyestuffs; Manufacture of green —. Ges. f. Chem. Industrie in Basel, Basle, Switzerland. Eng. Pat. 10,666, May 5, 1909. Under Int. Conv., May 11, 1908.

SEE Ger. Pat. 210,828 of 1908; this J., 1909, 790.—T. F. B.

Tetrazo dyestuffs capable of being further diazotised on the fibre or in mass: Manufacture of substantives — O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 14,315, June 18, 1909.

SEE U.S. Pat. 936,367 of 1909; this J., 1909, 1120.—T. F. B.

Vat dyestuffs: Production of green — Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 402,150, April 17, 1909. Under Int. Conv., May 11, 1908.

SEE Ger. Pat. 210,828 of 1908; this J., 1909, 790.—T. F. B.

Alpha-isatinanilide: Process of making sulphurous acid compound of — C. Stephan and A. Rahtjen, Hamburg, Germany. U.S. Pat. 937,194, Oct. 19, 1909.

SEE Ger. Pat. 204,478 of 1907; this J., 1909, 86.—T. F. B.

Izo dyestuff. E. Ulrichs, Elberfeld, Assignor to Wülting, Dahl, and Co., A.-G., Barmen, Germany. U.S. Pat. 937,741, Oct. 19, 1909.

SEE Eng. Pat. 4859 of 1909; this J., 1909, 975.—T. F. B.

Sulphide dyestuffs: Process for producing derivatives of — L. Cassella und Co. Fr. Pat. 401,944, Aug. 14, 1908.

SEE Eng. Pat. 17,352 of 1908; this J., 1909, 650.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS AND FIBRES.

Cotton: Presence of iron in mercerised — L. Lefèvre and E. Biondel. Rev. Gen. Mat. Col., 1909, 13, 313—314.

THE ash of raw Egyptian cotton ("Maco") contains 1.5 per cent. of iron oxide, whereas the ash of the same cotton after mercerisation was found to contain 8 per cent. In neither case have such minute quantities any influence on the colour of the yarn. The circumstance that the "écru" colour of the cotton is deepened by mercerisation is due to the action of the alkali on the organic colouring matters. The increase in the iron-content of the cotton, as the result of mercerisation, is explained by the authors in the following manner: The concentrated lye dissolves from the cotton a certain quantity of pectic matters and soluble forms of cellulose, during the passage of the yarn or fabrics; and this solvent action is even more pronounced in the process of hot washing. These organic matters, like other hydroxylated bodies, possess the property of holding ferric oxide in alkaline solution. Consequently, the rust which may form on the tanks or parts of the machinery is dissolved by the lye and absorbed by the cotton. This solvent action is particularly marked in factories where the dilute washings are utilised for the preparation of fresh lye. In fact it is frequently necessary to use these contaminated lyes for other purposes, in order to economise the quantity of acid required to remove the iron oxide absorbed by the cotton. The concentration of the "sours," usually employed for clearing the chalk and last traces of alkali from the cotton, is too weak to have any effect on the iron oxide absorbed under the above conditions.—J. F. B.

Wool: The properties of — and the hydrolytic changes occurring during dyeing. W. Snida. Z. angew. Chem., 1909, 22, 2131—2134.

KERATIN is closely allied to the representative albuminoids, but slight differences are noticeable in keratin from different sources, or even from one and the same source, according to the age, feeding, or state of health of the animal producing it. In preparing wool for experimental investigations, it is important to remember that purification should only be carried out by treating with volatile solvents (for fats) and lukewarm water and that

the use of hot water, alkalis and acids, should be avoided. To most reagents, in the cold, wool is an indifferent substance, but with rise of temperature, hydrolytic decomposition begins and the basic character of the wool becomes more pronounced the further the hydrolysis proceeds. Wool possesses amphoteric properties, with a tendency towards basicity, and therefore for dyeing it, acid dyestuffs are the most suitable. Experiments show (1), that from a neutral bath wool is hardly dyed at all by the salts of colour acids; (2), that the free colour acids are readily taken up from such a neutral bath (3), in an acid bath the salts of colour acids also dye the wool; (4), basic dyestuffs (which are usually the hydrochlorides of colour bases) dye readily from a neutral bath; but (5), in an acid bath they have very little effect upon the wool. Should the dyeing properties depend upon interaction between acid or basic groups in the wool and the colour acids and bases, case (1) could be explained upon the assumption that the acid groups of the wool are incapable of decomposing the colour salt, whilst in case (2) the basic groups combine directly with the free colour acid. In case (1) it may be assumed that the basic portion of the wool combines with the hydrochloric acid of the colour salt, whilst the acid portion unites with the colour base, but it must not be forgotten that a pronounced hydrolysis evident also in case (3)—is noticeable. The result in case (5) may be explained by assuming that the free acid hydrolyses the wool substance and saturates the basic groups, thus preventing the dissociation of the colour salt. Many salts and esters have a similar influence in preventing the dyeing of wool with basic dyestuffs, without interfering with its affinity for acid dyestuffs, and the more pronounced the acidic nature of the salt, etc., may be, the greater is its influence. Should the hypothesis be correct, that the colour acid is capable (by formation of an insoluble combination with the basic groups of the wool) of displacing a mineral acid, then by first treating the wool with an acid which produces an insoluble combination, it should be rendered incapable of being dyed by acid dyestuffs in the ordinary manner. Experiments with metatungstic and phosphotungstic acids show that such is indeed the case. In general, the author's results show that in the mordanting and dyeing of wool with acid mordants or direct (acid) dyestuffs, there is an initial hydrolysis of the wool, followed by the formation of a more or less insoluble compound by the union of its active groups with certain components of the mordant or dyestuff. Since by the hydrolysis of albuminoids the more resistant portion retains the basic groups, it is explicable why in the hydrolysis of wool, acid dyestuffs produce precipitates after basic dyestuffs have ceased to do so, and that dyeings produced with acid dyestuffs are in general more solid than those produced with basic ones.—F. M.

Dehydroindigo. II. Dehydroindigo bisulphite and a new process of indigo dyeing. L. Kalb. Ber., 1909, 42, 3653—3664. (See page 1189.)

DEHYDROINDIGO sodium bisulphite, $C_{16}H_8N_2O_2 \cdot 2NaHSO_3$, is prepared either from dehydroindigo and aqueous bisulphite solution or from dehydroindigo salts by double decomposition with the normal sulphite. It is a well-crystallised salt, having a canary yellow colour and an intensely sweet taste. With alkalis it yields indigo and with reducing agents it yields indigo or indigo white. With bromine and chlorine it yields the corresponding 5:7:5':7':tetrahalogenated derivatives. A new method of producing indigo dyeings is afforded by steeping the fibre (or printing it) with an aqueous solution of dehydroindigo bisulphite, drying, and dipping the fibre into dilute mineral acids, alkali carbonates or hydroxides at 80°—100° C. Indigo is at once produced on the fibre. Good dyeings are obtained with cotton and silk, but not with wool. After dyeing, the goods are passed through an appropriate bath of acid or alkali and finally washed. The tetrahalogenated compounds of dehydroindigo are extremely sensitive to light and this property may be used to obtain photographs by using paper impregnated with them as a printing paper. After exposure, a positive is produced in tetrachloro- or tetrabromo-indigo. For fixing, the paper is washed with water.—J. C. C.

Dyeing; Theory of — in practice. G. Friedländer. Chem.-Zeit., 1909, 33, 1159.

A LARGE number of benzidine dyestuffs alter their shades under the influence of dry heat. Red dyestuffs become more yellowish, yellow dyestuffs bluer, and blue dyestuffs redder on ironing, the reverse change taking place on cooling. On comparing the constitution of those substantive dyestuffs which are fast with those which are not fast to ironing, it was found that the latter are characterised by containing a relatively large number of sulphonic groups. Investigations were also instituted regarding the general constitutional characteristics of those substantive dyestuffs which dye the cotton in half-silk tissues, but leave the silk white. As a result the rule is formulated that such benzidine dyestuffs as contain one or two amino-groups and are of a relatively strongly sulphonic acid nature, e.g., Diamine Black BH (from benzidine, γ -aminonaphtholsulphonic acid, and aminonaphtholdisulphonic acid H) will prove the best representatives of this group. Various benzidine dyestuffs containing as components only hydroxynaphthalenesulphonic acids, e.g., Brilliant Azurine B (from dianisidine and dihydroxynaphthalenesulphonic acid S) show the same property, but, in general, in a lesser degree. This is accounted for by the fact that an amino group produces in a dyestuff of this class a superior affinity for cotton, while the sulphonic groups tend to prevent the dyeing of the silk. The same principle obtains with regard to half-wool, *viz.*, that it is those substantive dyestuffs of a strongly sulphonic acid character which will leave the wool least stained, but, owing to the strongly basic nature of this fibre, a small portion of the dyestuff is attracted to it and staining results. The author regrets the small choice of dyestuffs available to the half-silk dyer which dye cotton and leave the silk white. He enumerates the principal members of this group, giving the constitution of several and deducing the afore-mentioned rules therefrom. Deep Bordeaux, full brown, and bright dark blue self dyestuffs of the above class are, he thinks, desiderata yet to be put on the market.—J. L. H.

Carbon, amorphous; Decolorising properties of different kinds of —. L. Pelet and C. Mazzoli. Bull. Soc. Chim., 1909, 5, 1011—1019.

THE authors determined the adsorptive power for Methylene Blue and Crystal Ponceau of a number of different commercial samples of amorphous carbon, including blood charcoal, animal charcoal, bone charcoal, wood charcoal, lampblack, and three specimens of the decolorising carbon of the Stassfurter Chem. Fabr. vorm. Vorster und Grüneberg, marked RT, ETB, and ET respectively. The values obtained were referred to 100 grms. of the organic matter of the charcoal, since it was found that the mineral constituents (calcium carbonate and phosphate, ferric oxide, etc.), possess no adsorptive power. Samples of the charcoals were then treated in the following ways:—(1), washed for a long time with hot distilled water; (2), heated repeatedly for several hours with concentrated hydrochloric acid; (3), heated for 3 hours with concentrated sulphuric acid, in order to destroy any cyanogen groups that might be present; (4), heated for 3 hours with a concentrated solution of sodium hydroxide in order to eliminate the whole or a part of any amino-groups present; (5), treated with sodium nitrite and hydrochloric acid and then heated to boiling, in order to destroy any amino-groups. In every case the treated charcoal was washed thoroughly with water, until the electrical conductivity of the wash-water remained approximately constant; this was essential since electrolytes even in traces have considerable influence on adsorption. On again determining the adsorptive powers of the charcoals after the treatments, it was found that these had not been sensibly modified. The exceptions noted in the case of charcoal treated with caustic soda are attributed to retention of alkali by the charcoal, since when after the treatment the first washing was made with dilute hydrochloric acid, the differences were diminished. The authors conclude that there is no relation between the adsorptive power of charcoal and the presence in the latter of nitrogen (compare

Knecht, this J., 1909, 700) or of chemically active nitrogenous groups (compare Glassner and Suida, this J., 1907, 1195).—A. S.

Wool gelatin and animal size; Method of distinguishing between —. A. Herz and C. E. Barraclough. J. Soc. Dyers and Col., 1909, 25, 274—276.

ANIMAL fibres in general were found on boiling to yield a water-soluble substance which gave the tannin and biuret reactions for gelatin. These tests therefore did not afford a means of distinguishing between wool or hair material unsized and a similar material sized with glue or gelatin, except in cases where the sizing was very heavy. But it was found that solutions of lead acetate and of basic lead acetate precipitate the wool gelatin from solution but do not affect solutions of ordinary glue or gelatin; these reagents the authors therefore consider the most suitable for distinguishing between the two kinds of gelatin. They recommend the use of the tannin-salt reaction as a second test. A list of the actions of various reagents on wool gelatin and ordinary gelatin is given. Wool gelatin precipitates basic dyestuffs, with which it forms lakes; but with acid and direct dyestuffs no such combinations are formed. Further experiments seemed to show that wool gelatin consists of three substances: (1), one which is not precipitated by Night Blue but which is precipitated by the tannin-salt reagent (a filtered mixture of 100 c.c. of a 2 per cent. solution of tannin and 100 c.c. of a saturated solution of salt); (2), one which is precipitated by Night Blue and on this precipitate being decomposed with barium hydroxide goes into solution, and after removal of excess of barium hydroxide is again capable of precipitation either by Night Blue or tannin-salt; (3), one which is precipitated by Night Blue but on decomposing the precipitate with barium hydroxide, remains insoluble and mixed with the insoluble Night Blue base.—S.H.H.

Preparing viscose. Todtenhaupt. See XIX.

PATENTS.

Ramie, China grass, and other fibrous substances; Treatment of —. L. H. Raw and R. G. Orr, London. Eng. Pat. 20,173, Sept. 25, 1908.

THE raw material is thinly spread out and pressed down on to bare and levelled ground which should contain the normal quantity of moisture. At intervals of a few days the material is turned over and again pressed down. This treatment is continued until it is found by trial that a dried sample readily disintegrates on shaking and allows of the ready separation of the fibres. For China grass a treatment of 8—10 days is usually sufficient.

—P. F. C.

Ramie and other similar substances; Treatment of —. R. Sumner, Horton, Bucks. Eng. Pat. 21,536, Oct. 12, 1908.

THE raw material is spread out in a trench about a foot deep and covered with three to five inches of earth for a few days. The period of treatment is varied according to the condition of the raw material and the nature of the desired product. (Reference is directed to Eng. Pat. 8288 of 1907).—P. F. C.

Vegetable fibres contained in straw, grasses, bast, "hurd" and the like; Process for obtaining and preparing for spinning and weaving purposes the —. F. A. Reichmann, Barmen, Germany. Eng. Pat. 12,059, May 21, 1909.

THE material to be treated, thrashed rye-straw for example, is boiled with a solution of sodium hydroxide of $\frac{1}{2}^{\circ}$ B. until the gliadin is dissolved and the straw readily divides up into its fibres. The dirty lye is then run off and a cold solution of sodium or potassium hydroxide of at least 15° B. is poured over the fibre. This causes the individual fibres to curl and separate from one another. After two or three minutes the lye is removed and the material is washed and then treated with a solution of hydrofluoric acid of 1° — 2° B. in a wooden or leaden

vessel for about five hours. The fibres are finally washed with water to which small quantities of ammonia and magnesium chloride are added and are then dried.—P. F. C.

Artificial hair or silky threads; Manufacture of — G. B. Ellis, London. From Le Crinoid Soc. Anon., Rouen, France. Eng. Pat. 21,191, Oct. 7, 1908.

THE concentration of the caustic alkali solution (employed in the coagulation of the solution of cellulose in cuprammonium hydroxide) is of importance, it having been found that with a low concentration the coagulation is not complete; with too strong a solution however the thread, after formation, tends to become brittle and is irregular in form owing to the capillary tubes of the spinneret becoming blocked. The latter faults are obviated by adding sodium carbonate to the bath (which should contain 50 per cent. of caustic soda and 25 per cent. of sodium carbonate) and maintaining the temperature of the same at about 35° C. The threads are passed through a second, weaker bath and then through a solution of sodium bisulphate (to remove the excess of copper hydroxide), after which they are washed and dried.—F. M.

Radiform fibres and the process of producing them. H. Farjas and A. Jaboin, Paris. Eng. Pat. 14,760, June 23, 1909. Under Int. Conv., Dec. 4, 1908.

THE fibres are cleaned, dried, then placed in a suitable mordanting solution such as for example a 10 per cent. solution of tannin or a concentrated solution of alum and then dried again. In the first case, they are next immersed in a 2 per cent. solution of ammonia at 22° C., in the second case in water. They are dried once more and placed in a solution of a radium salt the concentration being determined by the degree of radioactivity it is desired to obtain. After remaining in the solution for about half an hour, the fibres are removed and dried.—P. F. C.

Bleaching and otherwise treating fabrics with liquids; Method of and apparatus for — H. L. Gantt, Pawtucket, Rhode Island, U.S.A. Eng. Pat. 16,429, Aug. 4, 1908.

THE apparatus consists of a tank which is provided with a partition reaching almost to the bottom. The fabric to be treated is plaited lattice-wise in rope form into the space between the partition and one of the walls but is prevented from falling below the partition by a supporting arm. This arm is so hinged on to the wall of the tank that sufficient space is just left between its free end and the bottom of the partition for the withdrawal of the fabric from the bottom of the pile. This withdrawal is effected at the same rate as the fabric is delivered into the apparatus, by means of a pair of squeezing rollers arranged inside the tank between the partition and the other wall. These rollers lead the fabric to a second pair of squeezers arranged outside the tank and provided underneath with a trough which collects the expressed liquor and re-delivers it into the apparatus. The liquor is circulated through the pile of cloth by means of a pump, steam being delivered into the circulating pipe to maintain the necessary temperature.—P. F. C.

Dyeing, bleaching, washing or similarly treating textile fabrics or other materials or substances. J. W. Balme and C. H. Ashton, Halifax. Eng. Pat. 21,621, Oct. 13, 1908.

A VESSEL is built-upon the same lines as an ordinary jigger but using glazed earthenware or fireclay instead of wood. Instead of having a copper steam pipe for heating purposes, a hollow passage is moulded in the lower part of the apparatus, one end being capable of attachment to a steam supply. The walls of this passage are perforated. The rollers are made of blocks of glazed earthenware provided with a central opening for the passage of a shaft.—P. F. C.

Rollers for use in dyeing, bleaching, and like machines. J. W. Balme, Halifax. Eng. Pat. 4626, Feb. 25, 1909.

THE roller comprises an earthenware or porcelain shell, provided on its interior surface with two diametrically

opposed longitudinal projecting tongues which extend nearly from end to end of the shell. Two semi-circular longitudinal wooden cores are so grooved that they can fit on to these tongues whilst their meeting faces are also grooved to accommodate a shafting. In building up a roller, the wooden supports are clamped together at each end by means of annular metal rings, which are sunk into their ends. They are then placed inside the shell and the shaft is pushed through the opening provided for it. Wedges are driven in between the shaft and the annular rings. Any gaps remaining are filled up with liquid cement.—P. F. C.

Dyeing and dyes [dyestuffs] for use therein. C. Fowler, Bradford. Eng. Pat. 1920, Jan. 26, 1909.

FOR dyeing union goods two colours in one bath, a combination is employed of a direct cotton dyestuff with alizarin or mordant dyestuffs of a different shade. With these colours the following substances may be employed:—inorganic acid salts; organic or inorganic salts which dissociate and liberate acids, such as ammonium acetate; chromium, iron, copper, aluminium or zinc salts and organic or inorganic acids. Example:—1 part of Chlorazol Fast Yellow B, 3 parts of Alizarin Blue S and 5 parts of sodium acid sulphate are mixed and the mixture is used for dyeing union goods, one part of potassium bichromate being preferably added to the dye-bath after boiling for half an hour.—P. F. C.

Acetylcellulose; Process for dyeing — Knoll und Co. Addition, dated Apr. 5, 1909, to Fr. Pat. 383,636, Nov. 6, 1907 (this J., 1908, 332).

IN a variation of the principal patent, acetylcellulose is treated with aqueous solutions of inorganic acids instead of with organic substances or their solutions, in order to make it capable of absorbing dyestuffs and dye-forming substances more readily. This treatment with inorganic acids has also the effect of swelling the fibre and increasing its elasticity without any accompanying hydrolytic dissociation. It is necessary to eliminate all traces of the acid from the fibre after treatment and to dye the fibre before drying.—H. P. P.

Turkey-red; Process for dyeing close and heavy pieces by means of — Eitorfer Türkischrot-Stückfärberei. Fr. Pat. 402,032, April 14, 1909.

THE pieces after passing several times through Turkey-red oil, are guided full width through the alizarin dye-bath where they are subjected to a pounding or beating, which causes the liquor to penetrate, forming the lake throughout the fabric. They are then returned to the oil bath. In the case of fustians, twill, etc., which are mercerised, the beating process follows the dyeing.—H. P. P.

Silk; Process for weighting — by means of a mixture of stannic chloride and zinc salts. H. Salvaterra. Ger. Pat. 214,372, Sept. 20, 1907.

SILK is degummed and washed in the usual manner, and is then digested for an hour in a solution obtained by mixing stannic chloride solution of 30° B. with zinc sulphate solution of 30°–45° B.; the proportions may vary, but it is mentioned that equal parts can be used with advantage. The excess of solution is removed in a centrifugal or similar apparatus, and the silk is immersed in a solution of tartaric acid of such strength that no turbidity is produced; it is then washed with water, treated at 75° C. in a solution of sodium phosphate of 5°–8° B., centrifuged, and washed. The process is repeated until the desired increase in weight is reached. It is stated that the elasticity and strength of the fibres remains practically unaltered by this method.—T. F. B.

Silk weighted with stannic chloride; Process for increasing the stability of — E. Herzog. Ger. Pat. 213,471, May 13, 1908.

AFTER long exposure to sunlight, the tensile strength and elasticity of silk weighted with tin decrease to a considerable extent. This can be avoided if an alkali thiosulphate (e.g., 10 per cent. on the weight of the silk) be added to the dye-bath, or to the brightening bath, or to both.—T. F. B.

Yellow dyeings on un mordanted vegetable fibres; Process for producing —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 213,473, June 5, 1908.

THE leuco-compound obtained by alkaline reduction (e.g., by hydrosulphite) of dibenzoyl-1,5- or -1,8-diaminoanthraquinone, is used as a vat for impregnating un-mordanted vegetable fibres; after immersion for about an hour, the fibres are exposed to the air, washed, soured, washed, soaped, and dried. Fast golden-yellow shades are thus produced.—T. F. B.

Dyeings with sulphide dyestuffs; Process for treating —. R. vom Hove. Ger. Pat. 214,038, Oct. 15, 1908. Addition to Ger. Pat. 204,442, Oct. 9, 1907.

THE process described in the chief patent (this J., 1909, 58) for increasing the fastness to soaping of black dyeings with sulphide dyestuffs, is equally applicable to sulphide dyeings of other shades.—T. F. B.

Sizing composition. M. Rossi, Cervignano, Austria-Hungary. U.S. Pat. 937,095, Oct. 19, 1909.

A SIZING composition for textile fabrics consists of about 100 parts of the product resulting from the action of sulphur dioxide on wet starch and about 30 parts of a soap-like compound of ammonia and an unsaturated fatty acid.—H. P. P.

Printing and dyeing textiles; Process and apparatus for —. F. Ashton. Fr. Pat. 402,105, April 16, 1909. Under Int. Conv., April 18, 1908.

SEE Eng. Pat. 8620 of 1908; this J., 1909, 519.—T. F. B.

Ramie and other fibres; Process for rendering — water-repellent and for permanently colouring them without the use of dyestuffs. A. M. Hart. Fr. Pat. 402,415, April 26, 1909.

SEE Eng. Pat. 13,020 of 1908; this J., 1909, 472.—T. F. B.

Preparing formaldehydesulphoxylates from nitrogen-derivatives of methylsulphoxylates. Ger. Pat. 214,043. See VII.

solution, at least 1 grm. of free ammonia is liberated per 100 c.c. of solution; otherwise an appreciable amount of calcium carbonate, etc., will be dissolved. If the method is applied to substances containing only small quantities of caustic lime in presence of large quantities of calcium carbonate, at least 1 grm. of free ammonia should be added to 100 c.c. of the ammonium chloride solution used. A still larger excess of free ammonia further decreases the solubility of calcium carbonate in ammonium chloride solution.—J. L. H.

Sodium carbonate and sodium thiosulphate; Spontaneous crystallisation of solutions of —. B. M. Jones. Chem. Soc. Trans., 1909, 95, 1672—1683.

SUPERSATURATED solutions of sodium carbonate, free from crystal nuclei, are found to crystallise at definite temperatures when slowly cooled (or in some cases heated) and subjected to mechanical friction, and supersolubility curves have been traced, giving the temperature of spontaneous crystallisation of supersaturated solutions of varying strengths and showing the conditions under which ice and the compounds, $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ and $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$, are formed; these curves lie very roughly parallel to the solubility curves. The less stable hydrate, $\text{Na}_2\text{CO}_3 \cdot 7\text{H}_2\text{O}$, is rarely produced, the conditions favouring its formation occurring only between narrow limits of concentration, and even in such solutions there is an almost equal tendency to produce the decahydrate. Supersaturated solutions of sodium thiosulphate, containing 0—40 and 179—255 parts of anhydrous salt to 100 parts of water, also crystallise at definite temperatures, and supersolubility curves are given for ice and the monohydrate, $\text{Na}_2\text{S}_2\text{O}_3 \cdot \text{H}_2\text{O}$ (secondary). Of the 14 possible solid phases these are the only two which crystallise spontaneously, within the space of one or two hours, from supersaturated solutions which are slowly cooled and constantly shaken, but the anhydrous salt, the primary dihydrate, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$, the secondary pentahydrate, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$, and the ordinary (primary) pentahydrate have been obtained from solutions kept at rest for longer periods.—F. SODX.

Carbonates of some heavy metals. K. Feist. Arch. Pharm., 1909, 217, 439—447.

SATISFACTORY results for the preparation of carbonates of the heavy metals can be obtained by the addition of water to a mixture of a salt of the metal and sodium carbonate in suitable proportions. Basic zinc carbonate was prepared by powdering together 100 grms. of crystallised zinc sulphate and 120 grms. of sodium carbonate crystals, water was then added, and the precipitate collected and washed with cold water. It had approximately the composition, $\text{ZnCO}_3 \cdot \text{Zn}(\text{OH})_2$. A mixture of 100 grms. of copper sulphate crystals with 140 grms. of sodium carbonate crystals gave a basic copper carbonate which generally contained traces of basic copper sulphate. Equal weights of lead acetate and sodium carbonate crystals, when treated in the same way, gave a basic lead carbonate, which differed very little in its composition from that of normal lead carbonate. The basic carbonates of aluminium and iron can be prepared by similar reactions and give products which serve as the starting point for the production of other salts of these metals.—F. SODX.

Silver sulphite; Action of heat on —, and on the alkali-silver sulphites. H. Banbigny. Comptes rend., 1909, 149, 735—737.

THE statement is commonly found in text-books that silver sulphite and the alkali-silver sulphites, heated to 100° C. or boiled with water, form metallic silver, sulphate, and sulphur dioxide. The real fact is that dithionate is formed under these circumstances, and that only when the temperature is further raised, does this decompose into sulphate and sulphur dioxide.—J. T. D.

Salts in non-aqueous solutions; Reactions of —. A. Naumann. Ber., 1909, 42, 3789—3796. (See also this J., 1904, 1088, and 1905, 26).

THE following salts are soluble (those marked * with difficulty or sparingly) in methyl acetate: Potassium

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Pyridine in "aqueous ammonia" [ammonia solution]; Determination of —. A. C. Houghton. J. Ind. and Eng. Chem., 1909, 1, 698—700.

THE determination of pyridine in ammonia solution is of importance to manufacturers of anhydrous ammonia for refrigerating purposes, as it causes considerable trouble in the ammonia-compressors. The following method has been used in practice for several years and is said to give accurate results. 100 c.c. of the ammonia solution are diluted with 150 c.c. of distilled water, then rendered neutral to methyl orange by means of dilute (1:3) sulphuric acid, and after adding 5 c.c. of N/1 caustic soda, distilled. The vapours are passed through 100 c.c. of a solution of sodium hypobromite (25 c.c. of bromine added to a solution of 100 grms. of caustic soda in 1000 c.c. water), and then into N/10 acid. The ammonia is decomposed by the hypobromite solution, with formation of nitrogen, so that only pyridine is absorbed by the acid, and titration of the excess of acid gives the necessary data for calculating the amount of pyridine present.—A. S.

Caustic lime, etc.; Determination of — in the presence of calcium carbonate. Heyer. Chem.-Zeit., 1909, 33, 1157—1158.

THE process for the determination of oxides, hydroxides, succrates of alkaline-earth metals in presence of carbonates, phosphates, sulphates, etc. of the same, which depends on treatment with a cold dilute aqueous solution of ammonium chloride, and subsequent determination of the dissolved lime, results sufficiently accurate for technical purposes can be obtained only if the substance contains so much caustic lime that on adding the ammonium chloride

thiocyanate, iodide,* permanganate*: Sodium iodide, thiocyanate; Lithium bromide, chloride,* iodide, thiocyanate; Rubidium iodide; Ammonium thiocyanate; Barium iodide, bromide*: Strontium bromide; Calcium nitrate, bromide; Magnesium bromide,* iodide*: Cuprous bromide,* chloride,* iodide; Cupric bromide, chloride, thiocyanate; Zinc bromide, chloride, iodide, nitrate; Lead iodide*: Cadmium bromide,* iodide; Cerie chloride*, bromide; Chromium trichloride,* trioxide; Manganous chloride*: Ferrous chloride; Ferric chloride*: Cobalt bromide, chloride, iodide, nitrate, thiocyanate; Nickel chloride,* nitrate*: Thallous iodide*: Thallie chloride*: Uranium bromide, nitrate; Uranyl chloride, iodide; Bismuth chloride, iodide; Stannous chloride; Stannic iodide; Silver nitrate,* arsenite; Mercurous iodide,* nitrate; Mercuric chloride, bromide, iodide, cyanide, potassium iodide; Auric bromide; Platinic chloride*: Palladium iodide; Iodine; Sulphur.* The following are insoluble:—Potassium chloride, chlorate, perchlorate, carbonate, bicarbonate, nitrate, nitrite, sulphate, bisulphate, anhydrosulphate (pyrosulphate), fluoride, bromide, bromate, iodate, periodate, cyanide, sulphide, silicate, silicofluoride, chromate, pyrophosphate, ferrocyanide, ferri-cyanide, pyroantimonate, hydroxide; Sodium chloride, chlorate, bromide, bromate, iodate, periodate, fluoride, nitrate, nitrite, carbonate, bicarbonate, anhydrosulphate, sulphate, sulphite, bisulphite, phosphate, pyrophosphate, silicate, silicofluoride, molybdate, tungstate, hydroxide; Lithium fluoride, iodate, carbonate, sulphate, metaborate, pyroborate, phosphate, silicate, silicofluoride, hydroxide; Cesium chloride, sulphate; Rubidium chloride, bromide, nitrate, sulphate; Ammonium chloride, bromide, nitrate, sulphate; Barium chloride, chlorate, bromate, cyanide, sulphate, sulphite, dithionate, nitrate, carbonate, tetraborate, chromate, phosphate, oxide; Strontium chloride, carbonate, metaborate, nitrate, sulphate, sulphide, oxide; Calcium chloride (?), fluoride, carbonate, sulphate, sulphite, tetraborate, phosphate, silicate, sulphide, oxide; Magnesium chloride, fluoride, sulphate, bisulphate, carbonate, silicate, arsenate, oxide; Cuprous thiocyanate; Cupric fluoride, cyanide, nitrate, sulphate, carbonate, phosphate, silicate, silicofluoride, sulphide, borate, arsenate, Zinc fluoride, cyanide, carbonate, sulphate, phosphate, oxide; Lead chloride, bromide, nitrate, sulphate, phosphate, silicate, basic carbonate; Cadmium chloride, carbonate, sulphate, oxide; Chromium fluoride, carbonate, sulphate, phosphate; Erbium sulphate; Manganous carbonate, sulphate, phosphate; Ferrous sulphate, sulphide; Ferric sulphate; Cobalt cyanide, sulphate, carbonate, phosphate, arsenate; Luteo- and Purpureo-cobalt chlorides; Nickel cyanide, sulphate, phosphate; Thallous chloride, bromide, carbonate; Bismuth sulphate; Aluminium potassium sulphate; Stannic sulphide; Silver chloride, bromide, iodide, iodate, nitrate, cyanide, thiocyanate, carbonate, sulphate, phosphate; Mercurous chloride, bromide; Mercuric sulphate; Palladic iodide. The solutions of iodides are at first clear and colourless, but become gradually yellow and brown from separation of iodine.

Potassium thiocyanate reacts with sodium iodide, forming a precipitate of potassium iodide; using excess of sodium iodide, the whole of the potassium is precipitated. With lithium nitrate, a precipitate of potassium nitrate falls, but the precipitation is never complete.

Cobalt chloride: 1 grm. dissolves in 271 grms. of the acetate, giving a blue solution, from which traces of water precipitate on the glass vessel a red deposit of textile-like appearance. The solution with potassium thiocyanate precipitates (completely, if the cobalt solution be in excess) potassium chloride. With lithium nitrate, lithium chloride falls, but some lithium always remains in solution. Dry ammonia, passed into the cobalt solution, gives a rose-red precipitate of composition represented by the formula, $\text{CoCl}_2 \cdot 6\text{NH}_3$.

Cobalt bromide dissolves to the extent of 1 grm. in 9.7 grms. of the acetate. It precipitates potassium completely as bromide from the thiocyanate. With ammonia it yields a compound, $\text{CoBr}_2 \cdot 6\text{NH}_3$, which at 120°C gives off ammonia, leaving the substance, $\text{CoBr}_2 \cdot 2\text{NH}_3$. Hydrogen sulphide produces hardly any effect on the cobalt bromide solution, but a mixture of hydrogen

sulphide and ammonia precipitates the cobalt completely as sulphide, leaving ammonium bromide in solution.

Cupric chloride: 1 grm. dissolves in 181 grms. of the acetate. Stannous chloride forms cuprous chloride which precipitates. Ammonia gives the compound, $\text{CuCl}_2 \cdot 6\text{NH}_3$, which at 135° forms the compound, $\text{CuCl}_2 \cdot 2\text{NH}_3$. Hydrogen sulphide precipitates cupric sulphide.

Mercuric chloride: 1 grm. dissolves in 2.35 grms. of methyl acetate. Precipitates potassium or ammonium chloride, but not completely, from the corresponding thiocyanate, barium chloride completely from the iodide. Its chlorine can be completely precipitated as potassium chloride, by excess of potassium-mercuric iodide. Ammonia yields the compound, $\text{HgCl}_2 \cdot 2\text{NH}_3$, hydrogen sulphide gives the compound, $\text{HgCl}_2 \cdot 2\text{HgS}$, and a mixture of the two gives mercuric sulphide. Stannous chloride in deficit precipitates calomel, in excess metallic mercury.

Mercuric bromide: 1 grm. dissolves in 4.56 grms. of the ester. With ammonia, hydrogen sulphide, and a mixture of the two, it behaves analogously to the chloride.

Calcium nitrate: 1 grm. dissolves in 1.44 grms. of methyl acetate. Hydrochloric acid gas produces a precipitate having the composition represented by $\text{CaCl}_2 \cdot \text{CH}_3\text{COOCH}_3$. Neither mercuric chloride, stannous chloride, zinc chloride, cupric chloride, nor cobalt chloride produces any precipitate.

Calcium chloride: This salt does not dissolve in methyl acetate, but when shaken with it, produces the compound described above, $\text{CaCl}_2 \cdot \text{CH}_3\text{COOCH}_3$.—J. T. D.

Chlorine and hydrogen: Influence of gaseous oxides of nitrogen on the rate of interaction of —. D. L. Chapman and P. S. MacMahon. Chem. Soc. Proc., 1909, 25, 224.

It was shown that the brown gas resulting from the interaction of nitric oxide and chlorine—presumably nitrogen peroxide—inhibits the union of hydrogen and chlorine in the light. The inhibitor is slowly absorbed by the chlorine water in the actinometer, and as it is removed, the electrolytic gas gradually recovers its original sensitiveness; the removal of the last trace of inhibitor appears to be facilitated by the action of light. The retardation observed with nitrous oxide was so small that the authors conclude that this gas behaves as a diluent only. In this respect it resembles nitrogen and carbon dioxide.

Bismuth trisulphide; Solubility of — in alkali sulphides, and of bismuth trioxide in alkali hydroxides. J. Knox. Chem. Soc. Proc., 1909, 25, 226.

The author finds that dried precipitated bismuth sulphide dissolves in solutions of both sodium and potassium sulphides, and that the solubility increases rapidly with the concentration of the alkali sulphide. The solubility in potassium sulphide is rather greater than in sodium sulphide of the same concentration. The addition of alkali hydroxides to the alkali sulphide solutions greatly increases the solubility of bismuth sulphide. In a solution of sodium disulphide the solubility of bismuth sulphide is about one-third of that in the corresponding strength of the monosulphide, whilst in solutions of ammonium sulphide and of alkali hydrosulphides and hydroxides, bismuth sulphide is insoluble. From these facts it is shown that the solubility of bismuth sulphide in alkali sulphide solutions must depend on the formation of a complex anion with the sulphur ion of these solutions. Bismuth trioxide dissolves to a slight extent in alkali hydroxides, the solubility being approximately proportional to the concentration of the alkali hydroxide. Towards strong bases it therefore behaves as the anhydride of a weak acid, but to a much less extent than the corresponding oxides of arsenic and antimony.

Carbon; Ordinary —. H. Le Chatelier and Wologdine. Comptes rend., 1909, 148, 1715—1718.

It is generally believed that there exist several distinct modifications of amorphous carbon having different specific gravities and heats of combustion. Of these different varieties, however, the authors have found that acetylene black and retort carbon contain notable quantities of graphite. This finely-divided graphite yields on oxida-

tion graphitic oxide, which settles only with extreme slowness and thus may escape recognition; it can be identified by the production of a voluminous mass of pyrographitic oxide on deflagration. Lampblack, sugar charcoal, wood charcoal, and carbon filaments of electric incandescence lamps were found to be free from graphite. Specimens of these four kinds of carbon when purified by treatment with chlorine at red heat, and then freed as far as possible from gases by compression and the action of a vacuum, were found to have specific gravities ranging from 1.7 to 1.8. The authors consider that in all probability only one variety of amorphous carbon, of sp. gr. about 1.8, exists, the lower values being due to inclusions of gas. Acetylene black and retort carbon, which as stated above, contain graphite, had specific gravities of 2.05 and 1.99 after similar treatment; moreover the residue left after partial combustion of acetylene black had the sp. gr. 2.15.—A. S.

Oxyhydrogen gas; Catalysis of — by means of colloidal palladium. C. Paal and W. Hartmann. J. prakt. Chem., 1909, 80, 337—348.

EXPERIMENTS on the catalytic behaviour of solutions of colloidal palladium (this J., 1904, 208) towards mixtures of hydrogen and oxygen show that the presence of even a slight excess of hydrogen greatly accelerates the formation of water, a maximum being reached when 3.64—12.76 volumes of hydrogen are present to 1 volume of oxygen; a large excess of oxygen causes a marked reduction in the speed of catalysis. Palladium thus behaves quite differently from platinum which produces its maximum effect with normal oxyhydrogen gas.—F. SODX.

Decolorising properties of different kinds of amorphous carbon. Pelet and Mazzoli. See V.

Determining sulphur in alkali polysulphides. Dusserre and Vuilleumier. See XVIIIIC.

Detecting arsenic acid in presence of arsenious acid. Lutz and Swinne. See XXIII. Inorg. Quant.

Nitrates from the atmosphere. Birkland-Eyde process. S. Eyde. See XV.

PATENTS.

Sulphuric acid; Apparatus for the manufacture of dilute — [by a contact process]. A. M. G. Sebillot and L. Maulefibre, Paris. Eng. Pat. 2192, Jan. 29, 1909. Under Int. Conv., Jan. 29, 1908.

THE process is essentially the same as that described in Fr. Pat. 386,672 (see this J., 1908, 696). The apparatus comprises a chamber provided with superposed perforated shelves, each covered with asbestos cloth supporting the finely-divided catalytic material. The gases from the roasting furnace are mixed with air and steam and led into the top of this chamber, leaving through a pipe at the bottom, which is provided with a cock for running off any condensed sulphuric acid. The gases from the chamber pass through a lead worm immersed in cold water, then through a sheet iron chamber, lined with lead, and containing catalytic material which is sprinkled with water, and finally to the intake of a fan, which produces the necessary draught through the apparatus.—A. S.

Sulphur trioxide; Process and apparatus for making —. G. Eschellmann and A. Harmuth, St. Petersburg. Assignors to General Chemical Co., New York. U.S. Pats. 937,147 and 937,148, Oct. 19, 1909.

(1). THE claim is for filtering lubricating oil from the gases used in making sulphur trioxide by the contact process, in their transit from a gas-pump to the contact chamber. (2). The apparatus comprises an oil-lubricated gas-pump, a contact chamber, and a filter for removing oil from the gases in transit from the pump to the contact chamber.—O. R.

Concentration of acids; Process and apparatus for the continuous —, the extraction of nitric acid by distillation from mixtures containing sulphuric acid, &c. Aktiebolaget Swedish Nitric Syndicate. Fr. Pat. 402,078, April 15, 1909. Under Int. Conv., May 6, 1908.

FOR the continuous concentration of sulphuric or other acid or the separation of nitric acid by distillation from admixed sulphuric acid, the acid is allowed to flow down a vertical column filled with refractory material, which is heated externally by being enclosed in a furnace shaft, and at the same time a current of hot air or other suitable gas is made to pass upwards through the column. The air may be heated by passing down through a pipe in the same shaft, or, the column may be furnished with openings in its lower part, through which the heated gases from the shaft may be drawn or forced. A very slight current of gas is found sufficient to greatly increase the efficiency of the column.—F. SODX.

Nitric acid; Process and apparatus for the concentration of —. Aktiebolaget Swedish Nitric Syndicate. Fr. Pat. 402,079, April 15, 1909. Under Int. Conv., May 6, 1908.

THE process is for the concentration of dilute nitric acid and especially of the weak acid obtained by the oxidation of atmospheric nitrogen. The concentration is effected in two steps, being first carried to about 60 per cent. by direct contact with hot gases, such as those coming from the electric furnaces, and then to 90—97 per cent. by mixing with strong sulphuric acid and distilling off the nitric acid, preferably using the apparatus described in the preceding abstract. The waste heat from the furnace gases is utilised in three stages in the following order:—(1), in heating apparatus for the continuous concentration of the diluted sulphuric acid, resulting from the above process for concentrating nitric acid, in order to bring it up to its original strength again; (2), in heating the column in which the nitric and sulphuric acids are separated; and (3), in concentrating the weak nitric acid up to 60 per cent., preferably by direct contact with the hot gases in a series of four absorption towers. The necessary cooling of the gases from the electric furnaces is thus effected, and a large proportion of the acid produced may be concentrated to 95—97 per cent. strength.—F. SODX.

Alkali carbonates; Manufacture of —. L. Rivière. Third Addition, dated April 9, 1909, to Fr. Pat. 396,448, Nov. 16, 1908 (this J., 1909, 599, 707, 937).

THE alkali fluoride is obtained by decomposing the fluosilicate in an electric furnace or by electrolysis, instead of as previously described. It is then converted into carbonate, as before, by interaction with calcium carbonate; but, as not more than 70 per cent. of the fluoride is thus decomposed, an additional treatment with an alkaline-earth aluminate is proposed; this decomposes the remainder, giving a soluble alkali aluminate, which may be decomposed in solution by carbon dioxide, to give the alkali carbonate and a precipitate of aluminium hydroxide.—F. SODX.

Brine; Treatment of —. G. W. Malcolm, Davenham, and F. T. Minton, Winsford, Cheshire. Eng. Pat. 19,302, Sept. 14, 1908.

A PORTION of the raw brine is electrolysed, and the resulting alkaline solution is mixed with the main bulk of the raw brine, whereby the magnesia and part of the lime present are precipitated. The mixture is filtered, and the clear liquor is then mixed with a further quantity of the electrolysed brine, and carbonated by means of flue gases, to precipitate the remainder of the lime as calcium carbonate. The flue gases are derived from steam generators, which operate non-condensing engines, by which the dynamos producing the electric current are driven, the exhaust steam being used to heat the vacuum pans, in which the purified brine is evaporated. The chlorine evolved in the electrolysis is collected and used for the manufacture of bleaching powder.—O. R.

Potassium salts; Process for the removal of magnesium chloride from solutions of crude —. Consolidierte Alkali-Werke, Act.-Ges. Ger. Pat. 214,948, Jan. 3, 1908.

THE solution of the crude potassium salts is treated with carnallite, whereby potassium chloride is precipitated, the liquor being warmed to prevent lowering of temperature during this operation. The mother liquor from the potassium chloride is then concentrated either in a vacuum apparatus or in an apparatus in which evaporation is effected by a current of air, so that the heat of the liquor is utilised. Carnallite separates from the concentrated liquor, and is used over again, whilst the final liquor is very rich in magnesium chloride.—A. S.

Silica; Manufacture of gelatinous —. A. Poulson, Farnworth, Lancs. Eng. Pat. 491, Jan. 8, 1909.

SODIUM silicate solution of about 25 Tw. is mixed with dilute hydrochloric acid of about 15° Tw. The separation of gelatinous silica is complete in 21 to 36 hours, after which it is washed free from sodium chloride and other soluble matter.—O. R.

Aluminium nitride; Production of —. O. Serpek, Niedermorschweiler, Germany. Eng. Pat. 15,996, July 8, 1909. Under Int. Conv., Sept. 22, 1908.

ALUMINA and carbon in the presence of iron are heated in a current of nitrogen in an electric furnace. The aluminium carbide first formed reacts with excess of alumina to form metallic aluminium, which at once combines with nitrogen to form aluminium nitride. To carry out the process continuously, a bath of iron carbide is kept in circulation by means of a stream of producer gas, which is supplied through an apparatus acting like a circulating injector. A mixture of alumina and carbon is supplied at one end of the furnace and molten aluminium nitride is drawn off at the other. The escaping carbon monoxide is collected and used to pre-heat the raw materials.—O. R.

Precipitated barium sulphate and carbonate; Manufacture of — [from barytes]. C. E. Maistre. First Addition, dated April 26, 1909, to Fr. Pat. 383,758, Nov. 8, 1907 (this J., 1908, 405).

THE crude barium sulphide, obtained by the process previously claimed, is lixiviated with a solution of ammonium chloride, so as to form barium chloride and ammonium sulphide, which are separated by distillation. The ammonium sulphide may then be decomposed by carbon dioxide; this causes a deposition of sulphur and the formation of ammonium bicarbonate, which may be made to react with sodium chloride, so that the ammonium chloride is recovered and sodium bicarbonate obtained, the latter being converted into the normal carbonate and carbon dioxide by calcination. The barium chloride may either be crystallised, or the solution, containing more or less ammonia, may be treated with carbon dioxide, in order to transform it into barium carbonate. The precipitated sulphur may be converted into sulphuric acid for the production of precipitated barium sulphate.—F. SODX.

Hydrogen peroxide; Manufacture of stable, solid mixtures yielding — on treatment with water. Chem. Werke vorm. H. Byk. Fr. Pat. 401,911, April 9, 1909. Under Int. Conv., April 14, 1908.

A PERBORATE, totally or partially dehydrated, is mixed with the equivalent amount of a dry, solid, organic or inorganic acid, or of a solid acid salt, to form a mixture, which yields hydrogen peroxide as soon as it is brought into contact with water.—O. R.

Compounds containing oxygen and nitrogen [nitrates and nitrites]; Production of — by electrical means. P. Bunet and A. Badin. Fr. Pat. 402,012, Aug. 17, 1908.

THE object of the invention is to effect an improvement in the yield of oxides of nitrogen obtained by means of the electric arc; this is done by maintaining the temperature of the arc practically constant during its existence, and by suddenly cooling the products by contact with

a liquid, such as water or alkali, capable of absorbing the oxides of nitrogen. The constant temperature is attained by using an alternating current of fairly high frequency (200—1000 periods per sec.), as directly obtainable with an ordinary generator. The electrodes are arranged to form an upright fork contained in a closely fitting chamber of refractory material, through which a regulated supply of air may be passed from below and which opens above into a larger chamber; a succession of expanding arcs travels up between the electrodes, and each is immediately extinguished at the entrance to the upper chamber by jets of the pulverised absorbing liquid, which absorbs the oxides of nitrogen in the state of oxidation in which they exist at the instant of extinguishing the arc; all dilution of the treated air is thus avoided.—F. SODX.

Ammonium sulphate; Apparatus for granulating, drying, and screening —. Soc. du Gaz de Paris. Fr. Pat. 402,161, Aug. 21, 1908.

THE wet salt is fed through a hopper containing a distributing appliance, to the bottom of a chain elevator, which conveys it into a granulating apparatus. This consists of a series of parallel plates, milled at their edges and mounted on a common vertical axle, about which they rotate horizontally between baille-knives, which are fixed to the casing of the apparatus. Passing from the granulating apparatus, the material falls into a drying chamber, which consists of a long horizontal cylinder fitted with a screw conveyor. Hot gases pass from a furnace through the cylinder in the opposite direction to that of the material. Near the extremity of the drying chamber, the dry salt falls through a screen into a delivering hopper, any material which is too coarse to pass through the screen, being propelled by the conveyor against a grooved plate, which forms the end wall of the drying chamber. The material thus lodged between the end of the conveyor and the grooved plate, is thereby subjected to a process of trituration, which enables it to pass through the screen.—O. R.

Gas-pump [especially for the compression of sulphur dioxide]. J. Carrier. Fr. Pat. 402,810, May 6, 1909.

A CAST iron piston works vertically inside a cast iron cylinder, which forms the body of the pump. The latter is fitted with upper and lower inlet valves on the left side, and with upper and lower outlet valves on the right side. Each valve consists of a circular rubber disc attached to an iron washer of slightly smaller diameter, the rubber disc fitting tightly in the mouth of a tube, which communicates with the pump, and the outer portion of the disc, between the end of the iron washer and the tube, having free play inwards, for aspiration, and outwards for delivery. This is ensured by fixing the rubber discs inside with the iron washers outside, in the case of the inlet valves, and in the reverse order in the case of the outlet valves. The inlet valves communicate by means of suitable tubes with the source of the gas to be compressed, and the outlet valves, by way of a common collecting tube, with the receptacle for the compressed gas. When the piston descends, gas is aspirated through the top left-hand valve and delivered through the bottom right-hand valve, the bottom left-hand valve and the top right-hand valve being at the same time closed by the pressures produced in the cylinder. When the piston ascends, gas is aspirated through the bottom left-hand valve and delivered through the top right-hand valve, the top left-hand valve and the bottom right-hand valve being in this case closed by the pressures produced.—O. R.

Reactions between gases or mixtures of gases; Process for preventing decomposition of the reaction-products in chemical —. A. Scherbius. Ger. Pat. 213,709, Feb. 21, 1906.

IN gas reactions which take place at high temperatures, where it is necessary to rapidly cool the reaction-products to a point at which the reverse reaction cannot take place, it is proposed to effect this cooling by allowing the heated and compressed gases to flow out through a relatively long nozzle, the diameter of which gradually increases, into a chamber in which a lower pressure prevails. The

nozzle itself is preferably cooled. Claim is alternatively made for cooling the gases by utilising their energy to drive a turbine.—A. S.

Oxalic acid together with cryolite; Process for the preparation of —. G. Muth. Ger. Pat. 214,010, June 21, 1908.

A SOLUTION of alkali oxalate in aluminium sulphate solution or a mixture of alkali sulphate, aluminium hydroxide, and water is treated with hydrofluoric acid, either gaseous or in solution, in order to obtain a solution of oxalic acid and a precipitate of artificial cryolite (aluminium-sodium fluoride).—A. S.

Formaldehyde sulphonylates; Process for the preparation of — from nitrogen-derivatives of methylenesulphonylates. Chem. Fabr. von Heyden Akt.-Ges. Ger. Pat. 214,043, July 12, 1908.

THE claim is for the preparation of formaldehydesulphonylates by the action of formaldehyde on the nitrogenous derivatives of methylenesulphonylates obtained by the action of ammonia or amines on formaldehydesulphonylates or by the reduction of the products obtained by the action of ammonia or amines on formaldehydesulphites. For example, the reaction product from aminomethylene-sulphurous acid or its salts and zinc dust (alone or in presence of acids) is digested, in the form of the zinc salt, with formaldehyde and freshly-precipitated zinc hydroxide in order to obtain the slightly soluble, basic, formaldehyde-zinc sulphonylate.—A. S.

Charcoal with great absorptive power; Process for the preparation of — from finely-divided, earthy lignites. R. Goldstein. Ger. Pat. 213,828, March 26, 1907.

EARTHY lignites, unsuitable for distillation, are intimately mixed with a mixture of kaolin and water, and the mass is carbonised in a closed furnace at not too high a temperature. For many purposes the product is said to possess a greater decolorising and deodorising power than animal charcoal and similar substances.—A. S.

Sulphuric acid; Process for the manufacture, concentration, and simultaneous purification of —. G. C. de Briailles, Paris. Eng. Pat. 22,434, Oct. 22, 1908.

SEE Addition of Oct. 19, 1908, to Fr. Pat. 393,665 of 1907; this J., 1909, 473.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Silvering of mirrors; Protection for the —. A. Perot. Comptes rend., 1909, 149, 725.

THE mirror, freshly polished and freed from dust, has poured over its surface a dilute solution of celluloid in amyl acetate, which is then drained off as far as possible. The adhering solution, on evaporation of the solvent, leaves an extremely thin and uniform coating of celluloid on the silver, insufficient to interfere with the clearness or brightness of the image, but enough to protect the metallic surface. The coating is not very hard, and must therefore be protected from mechanical damage; dust must be removed from it by a very light feather brush.—J. T. D.

Ceramic colours; Production of —. A. Heubach. Trans. Amer. Ceram. Soc., 1909, 11, 48—59.

THE different kinds of colours used in the ceramic industry are classified, according to the temperature at which they are fired, as enamel colours, coloured glazes, underglaze colours for low and higher temperatures, and colours for sharp fire. For red enamel colours, ferric oxide and gold are used, the iron giving tints from light orange red to deep cherry-red by choosing a suitable temperature; the flux $1.0\text{PbO}, 0.5\text{SiO}_2, 0.5\text{B}_2\text{O}_3$ is recommended. Red-brown to light brown enamels are obtained from chromium-iron, iron-alumina, and iron-zinc colours. A coral-red can be produced with 28 parts of lead chromate and 75 of a flux made from 85 parts of minium and 15 of flint. To produce purple, carmine, and pink enamels, gold is used. Gold-purple is probably a mixture of colloidal gold and colloidal stannic acid in different proportions. Stannic ammonium chloride (pink salt) is added to dilute gold chloride solution to obtain a purple,

and this may be rendered deeper in colour by adding stannous chloride. Ammonia alum may be substituted for stannic ammonium chloride. For these colours, a flux composed of $0.65\text{—}0.8\text{ PbO}, 0.2\text{—}0.25\text{ Na}_2\text{O}, 0.0\text{—}0.12\text{K}_2\text{O}, 0.5\text{—}1.0\text{ SiO}_2, 0.4\text{—}0.5\text{ B}_2\text{O}_3$, is used. It is necessary to add a small percentage of silver carbonate or chloride to prevent the colours turning violet. All these colours must be fired in an oxidising atmosphere and at a temperature about 800°C . For higher fire, chromium-tin stains are used, either in the glaze or as underglaze. For the production of red glazes the composition of the stains is not so essential as that of the glazes. The author is unable to recommend a good glaze formula, but it should contain much lead and little or no boric acid. If the stains are to be used as underglaze, they should be mixed with kaolin or the body-mixture or glaze to make them adhere to the body and unite with the glaze. The stains themselves are of the following compositions:—Dark red, $0.0047\text{ K}_2\text{O}, 0.9768\text{ CaO}, 0.0181\text{ PbO}, 0.011\text{Cr}_2\text{O}_3, 1.11\text{ SiO}_2, 1.12\text{ SnO}_2, 0.005\text{ B}_2\text{O}_3$; pink, $0.013\text{ K}_2\text{O}, 0.987\text{ CaO}, 0.013\text{ Cr}_2\text{O}_3, 2.26\text{ SiO}_2, 1.31\text{ SnO}_2$; lilac, $0.45\text{K}_2\text{O}, 0.55\text{ Na}_2\text{O}, 0.45\text{ Cr}_2\text{O}_3, 14.28\text{ SnO}_2, 1.10\text{ B}_2\text{O}_3$. Red copper glazes (*rouge flamé*, etc.) develop best between cones 4 and 7. They must be fired in a reducing atmosphere, but if reduced too much they turn brown. Dark colours result from a small content of copper, 0.10 per cent., while an increasing amount of copper gives lighter tints. Seger's copper-red glazes contain barium oxide, but the author recommends the following:— $0.30\text{ CaO}, 0.07\text{ MgO}, 0.16\text{ K}_2\text{O}, 0.29\text{ PbO}, 0.12\text{ Na}_2\text{O}, 0.06\text{ CaO}, 0.20\text{ Al}_2\text{O}_3, 1.06\text{ SiO}_2, 0.11\text{ B}_2\text{O}_3, 0.07\text{ SnO}_2$, for a bluish red; $0.25\text{ CaO}, 0.05\text{ MgO}, 0.14\text{ K}_2\text{O}, 0.32\text{ PbO}, 0.12\text{ Na}_2\text{O}, 0.05\text{ ZnO}, 0.07\text{ CuO}, 0.18\text{ Al}_2\text{O}_3, 2.40\text{ SiO}_2, 0.12\text{ B}_2\text{O}_3, 0.05\text{ SnO}_2$, for a blood red; $0.31\text{ CaO}, 0.02\text{ MgO}, 0.10\text{ K}_2\text{O}, 0.22\text{ PbO}, 0.11\text{ Na}_2\text{O}, 0.13\text{ ZnO}, 0.09\text{ CuO}, 0.26\text{ Al}_2\text{O}_3, 1.75\text{ SiO}_2, 0.22\text{ B}_2\text{O}_3, 0.09\text{ SnO}_2$, for a light red. *Rouge-flamé* may also be produced by reducing the surface only of the glaze. For colours fired higher than cone 9, red can only be produced by gold and chromium-aluminium colours, either as underglaze or in the body. The gold chloride may be dissolved in glycerin, or its aqueous solution be added to a slip and the gold precipitated by sodium hydroxide and glycerin or grape sugar, or stannous chloride. All chromium-aluminium stains should be fired higher than the ware on which they are to be applied. As a colouring ingredient for biscuit ware, the formula $1.0\text{ K}_2\text{O}, 16.53\text{ Al}_2\text{O}_3, 1.00\text{ Cr}_2\text{O}_3, 3.27\text{ B}_2\text{O}_3$, gives a violet-red, fired at cone 14. A salmon colour, used under the glaze, is given by $0.046\text{ K}_2\text{O}, 0.658\text{ MgO}, 0.296\text{ ZnO}, 0.722\text{ Al}_2\text{O}_3, 0.046\text{ Cr}_2\text{O}_3, 0.08\text{ B}_2\text{O}_3$.—H. H. S.

Sheet iron enamels; Coefficient of expansion of —. M. Mayer and B. Havas. Sprechsaal, 1909, 42, 497—499.

THE authors' determinations were made by the Fness method (Poggendorf's Annalen, 180, 497) with rods about 100 mm. long and 7 mm. thick, with pointed ends. The enamel specimens were prepared by drawing from the fused mass, and after cooling in the air, were cut to length, and the ends ground. The results obtained with different enamels are shown in the following table:—

	Ground enamels.			Cover enamels.		Colourless glaze.
	I.	II.	III.	I.	II.	
Silica	51.00	64.86	54.69	55.91	51.00	53.10
Boric anhydride ..	15.79	9.46	12.47	6.93	6.80	14.35
Aluminium fluoride ..	—	—	—	3.95	6.92	—
Sodium fluoride ..	—	—	—	6.03	9.62	—
Calcium fluoride ..	—	3.67	1.68	1.73	—	4.58
Cobalt oxide	0.25	0.21	0.31	—	—	—
Manganese oxide ..	6.71	0.51	0.45	—	—	—
Alumina	7.86	6.45	8.83	10.30	8.85	7.01
Lime	1.51	1.01	1.26	0.54	1.77	1.21
Potassium oxide ..	2.60	1.71	2.54	1.73	2.22	2.49
Sodium oxide	14.84	12.12	14.77	12.85	13.39	17.29
Coefficient of cubical expansion $\times 10^7$..	288.0	245.1	289.2	326.7	348.0	308.6

Six specimens of stamped sheet iron had coefficients of cubical expansion ranging from 384.6×10^{-7} to 418.5×10^{-7} , and a specimen of rolled sheet iron had the coefficient 420×10^{-7} . The results obtained show that the generally accepted view that the function of the ground enamel is to equalise the differences between the expansions of the sheet iron and of the cover enamel is untenable. Actually the ground enamel has a lower coefficient of expansion than the cover enamel, that of the latter being 25–28 per cent. less than that of the iron. An iron rod having a coefficient of expansion of 405×10^{-7} was coated with a ground enamel having a coefficient of 289.2×10^{-7} ; the coefficient of the enamelled rod was 402.9×10^{-7} ; hence the ground enamel must possess great elasticity. The same enamelled rod when coated with a cover enamel having a coefficient of 300.3×10^{-7} , had a coefficient of expansion of 363.9×10^{-7} , that is the expansion was reduced by about 10 per cent. The above results show that the enamel is under great tension, and this may explain the spontaneous formation of cracks in enamelled ware. The aim in practice should be to prepare cover enamels of good covering power, so that only a thin coating is required.—A. S.

PATENTS.

Glass; Electric furnace for the continuous manufacture of —. M. Sauvageon. First Addition, dated Feb. 6, 1909, to Fr. Pat. 401,744, Aug. 7, 1908 (this J., 1909, 1130).

THE improvements permit the employment of a current of low tension, so that no danger may accrue to the glass-blower. The furnace now consists of a tank separated into two parts by a float of refractory material. The part receiving the material to be melted contains the electrodes, mounted so that the current travels transversely through the bath. The part where the glass is collected receives additional heat from gas flames or arcs or an electric resistance. The furnace may also be made with a melting-tank in the middle, and a working-tank on each side.—H. H. S.

Silica ware; Preparation of acid-resisting and refractory —. I. Schlossberg. Fr. Pat. 402,428, April 26, 1909. Under Int. Conv., April 27, 1908.

THE process depends on the reaction represented by the equation: $\text{Na}_2\text{Si}_2\text{O}_7 + \text{H}_2\text{SiF}_6 = \text{Na}_2\text{SiF}_6 + 4\text{SiO}_2 + \text{H}_2\text{O}$. The alkali silicate is made into a vessel of the desired form, and this is then treated with hydrofluosilicic acid and heated to redness. According to the temperature, sodium silicofluoride, or sodium fluoride and silicon tetrachloride, distil over and are condensed, while the vessel remains, composed of pure silica.—H. H. S.

Mineral teeth; Mixture for the burning of artificial —. H. Wienand. Ger. Pat. 214,282, April 9, 1908.

THE mixture claimed consists of kaolin, kieselguhr, and quartz sand with granulated particles of refractory metals, such as nickel or nickel alloys, saturated with carbon. The artificial teeth, e.g., of porcelain, are placed on this mixture and the burning carried out in the usual manner. It is stated that owing to absorption of carbon from the nickel or nickel alloy, the metal fittings of the teeth remain soft and unoxidised, and owing to the slow rate of cooling of the mixture, the production of cracks in the teeth is prevented.—A. S.

Acid- and fire-proof bodies consisting of pure silicic anhydride; Process for the manufacture of —. I. Schlossberg, Charlottenburg, Germany. Eng. Pat. 9394, April 20, 1909.

SEE Fr. Pat. 402,428 of 1909; preceding.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

PATENTS.

Stone; Fire-proof — and process of manufacturing same. S. W. Berglund, Stockholm. Eng. Pat. 6299, March 16, 1909.

SEE Fr. Pat. 399,384 of 1909; this J., 1909, 984. From 2 to 20 per cent. of graphite is added to the mixture of quartz and lime.—T. F. B.

Aluminous materials; Method of treating —. A. C. Higgins, Worcester, Mass. U.S. Pat. 930,376, Aug. 10, 1909.

ABRASIVE materials made by fusing alumina in the electric furnace often contain iron, titanium and silicon, either as elements, alloys, carbides or oxides. As these are often irregularly disseminated, and are subject to oxidation and other changes, they give rise to objectionable local modifications of structure. The fused product is accordingly broken up into suitable sizes and roasted in an oxidising atmosphere. It may then be sold for making abrasive papers and the like, or it may be ground, washed with acid or alkaline solutions, moulded with clay and feldspar into vessels, and fired in the usual way.—H. H. S.

Wood; Process of staining, impregnating, or preserving — by chemical reaction. A. Jalm and M. Grünhut. Fr. Pat. 402,527, April 29, 1909.

SUBSTANCES that have been introduced into wood as solutions for staining or preserving are usually washed out in the course of time by the action of water. To overcome this, the wood, after being steamed to decompose albumin, is treated successively with the solutions or vapours that will form the desired stain or preservative by chemical action. For example, if it be desired to stain wood yellow, a solution of cadmium chloride is first forced into the wood, and then a solution of sodium sulphide follows. Insoluble cadmium sulphide is formed in the wood, while sodium chloride is washed out.—H. H. S.

Refractory basic stones of low heat conductivity; Process for the manufacture of —. J. Carstens and P. Kretzmann. Ger. Pat. 214,234, Feb. 5, 1909.

HIGHLY basic materials such as cement or slag are fused and used as binding material for the production of stones from basic granular materials such as cement clinker or lime. Stones thus produced are stated to possess good strength and low heat conductivity.—A. S.

Cements, cires, and similar materials; Process for treating — in a rotary kiln. G. Polysius. First Addition, dated April 15, 1909, to Fr. Pat. 390,316, May 16, 1908 (this J., 1908, 1021).

THE improvement consists in feeding the fuel into the kiln under pressure, which enables the feeding tube to be much shortened and causes the zone of greatest heat to be displaced into the interior of the cylinder to such an extent that the whole capacity of the cylinder may be utilised, and all the cooling effected in the one cylinder.—H. H. S.

Wood preserving; Process for obtaining solutions of metallic salts free from acid for —. B. Diamand, Idaweiche, Germany. Eng. Pat. 23,990, Nov. 9, 1908.

SEE Fr. Pat. 396,974 of 1908; this J., 1909, 658.—T. F. B.

Neutralising solutions of salts [for wood preserving]. B. Diamand, Idaweiche, Germany. U.S. Pat. 938,128, Oct. 26, 1909.

SEE Fr. Pat. 396,974 of 1908; this J., 1909, 658.—T. F. B.

Wood; Process of preserving —. W. A. G. von Heidenstam and K. L. F. Friedemann, Stockholm. U.S. Pat. 937,802, Oct. 26, 1909.

SEE Fr. Pat. 399,712 of 1909; this J., 1909, 984.—T. F. B.

Portland cement; Waterproof or impermeable — and process for preparing it. Meramec Portland Cement and Material Co. Fr. Pat. 402,208, April 20, 1909.

SEE U.S. Pat. 931,884 of 1909; this J., 1909, 1037.—T. F. B.

X.—METALS AND METALLURGY.

Blast-furnaces; Limit of fuel economy in iron —. X. M. Langdon. Trans. Amer. Inst. Min. Eng., 1909, 919—940.

IN order to ascertain whether additional large fuel economies in iron blast-furnace practice are likely to be effected in the future, the author compares the theoretical fuel requirements for each detail of the smelting, with data from actual and hypothetical furnace practice. He tabulates the direct heat requirements under ten heads, *viz.*, reduction of iron, reduction of silicon, expulsion of moisture, of carbon dioxide, and of volatile substances in the fuel, expulsion of volatile substances in the ore and of combined water, fusion of the iron, fusion of the slag, and decomposition of the moisture in the blast. The heat carried off in the flue gases, and in the flue dust, and that lost by radiation is classed under indirect utilisation of heat. The heat supplied comprises, in the zone of fusion, the heat carried in by the blast and that of carbon burning to carbon monoxide at the tuyères; in the zone of reduction, carbon burning to carbon monoxide and carbon monoxide burning to carbon dioxide. Tables are given showing, in B.T.U., the total heat required theoretically, and the heat supplied, in the case of 27 furnace runs, together with details of the charges and products. The figures show that although improvements may still be effected in the direction of fuel economy by the elimination of moisture and volatile matter, yet there is no room for such striking reductions as resulted from the use of the dry blast.

—F. R.

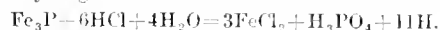
Iron for electrical work; Effect of manganese on —. C. F. Burgess and J. Aston. Electrochem. and Met. Ind., 1909, 7, 476—478. (See also this J., 1909, 1134, 1135.)

THE magnetic permeability, coercive force, and retentivity of different alloys of pure iron and manganese were investigated. A series of 10 alloys containing from 0.5 to 10.42 per cent. of manganese were made by heating the metals in a magnesia-lined graphite crucible in an electric resistance furnace. Unannealed forged bars showed a successive deterioration in permeability, with increased manganese content, until at 10.42 per cent. the bar was non-magnetic. Annealing at 675° C. increased the permeability in all the alloys, but a second annealing at 1000° C. practically reduced the permeability to that of the raw forged bars. Three of the bars were subsequently quenched at 900° C. with similar results to those obtained by annealing at 675° C. The values for retentivity and coercive force decreased and increased respectively with successively larger amounts of manganese, and both closely followed the fluctuation of the permeability when the alloys were subjected to similar thermal treatment. A series of tables and curves is given.—F. R.

Iron; Phosphides of —. H. Le Chatelier and S. Wologdine. Comptes rend., 1909, 149, 709—714.

IN chemical literature 9 phosphides of iron are described, having the formulae, Fe_3P , Fe_2P , Fe_3P_2 , Fe_2P_2 , Fe_2P_3 , FeP , Fe_3P_4 , and Fe_2P_5 . Of these, five are certainly mixtures, and the other four are definite compounds, though the separate existence even of two of these (FeP and Fe_2P_3) is hardly established so certainly as that of the other two (Fe_3P and Fe_2P), the evidence for which is based on:—(a), The constancy of their composition when prepared by different methods; (b), the existence of characteristic points of magnetic transformation; (c), the existence of maxima in the fusion curve of phosphorus-iron mixtures at points corresponding with their composition; (d), their behaviour in regard to solubility in dilute or concentrated acids. The modes of preparation and chief characters of these

four phosphides are summarised below:— Fe_3P .—By treating phosphoric pig irons with weak acids (Stead); by fusing 9 parts of reduced iron with 1 part of phosphorus, powdering the mass after reaction, and separating the most strongly magnetic portions, which consist of Fe_3P ; by fusing copper phosphide with enough iron to remove the phosphorus completely, pulverising the upper layer after cooling, and removing from it any non-magnetic portions. Specific gravity, 6.74. Temperature of magnetic transformation, 445°—435° C. Magnetic permeability about one-third that of iron. Melting-point, 1110° C. Insoluble in dilute hydrochloric acid, but soluble in the concentrated acid, with evolution, not of phosphine, but of pure hydrogen—



It is not yet certain whether or not this compound, with that next described, can form a solid solution. Fe_2P .—By fusing cupric phosphide with a quantity of iron insufficient to remove all the phosphorus, and treating the ingot with nitric acid, when crystalline needles of Fe_2P are left undissolved; by fusing reduced iron with phosphorus, as above—the non-magnetic portion consists of this substance; by reducing ferric phosphate by the "thermite" method. Specific gravity, 6.56. Temperature of magnetic transformation, 80° C. Permeability about one-fiftieth of that of Fe_3P . Melting-point, 1290° C. Is not attacked even by hot concentrated acids, save boiling *aqua regia*, which dissolves it. FeP .—By passing phosphorus vapour at a red-heat over Fe_2P , pulverising the product, and repeating the treatment with phosphorus vapour as long as increase of weight occurs. Sp. gr. 5.76. Temperature of magnetic transformation, 48° C. Permeability $1\frac{1}{2}$ times that of Fe_2P . Fe_3P_2 .—By passing hydrogen containing the vapour of phosphorus di-iodide over iron reduced from the oxalate. On the edges of the boat are found steel-grey crystals of sp. gr. 4.5. They are very feebly magnetic, and show no transformation point, but slightly increase in permeability when cooled to —50° C.—J. T. D.

Cyanide treatment of silver minerals. T. P. Holt. J. Ind. and Eng. Chem., 1909, 1, 694—698.

THE author's experiments were made mostly with chemical compounds and with artificial ores of known mineralogical composition. The detailed results are given in the form of curve-diagrams, but the following conclusions are drawn:—The halogen compounds of silver are the most soluble in cyanide solution and dissolve without the aid of oxygen. In an aerated cyanide solution, native silver is next in order of solubility. In order to obtain good extractions in the case of silver sulphide (argentite), the presence of oxygen or an oxidising agent is essential, and soluble sulphides must be removed from the solution as they are formed. For this latter purpose, lead acetate is commonly employed, but litharge may be used with advantage, being less expensive and not seriously affecting the extraction when present in slight excess. Mercury compounds when used in this connection are effective by reason of their ability to form insoluble sulphides. The solubility of complex antimony- and arsenic-silver minerals in cyanide solution is diminished by the presence of mercury or lead compounds. Cyanogen bromide alone is not a solvent of silver minerals, but in some cases increases the extraction obtainable with cyanide solution, owing to its oxidising action. As a preliminary to treatment with cyanide solution, a chloridising roast is about equally effective with all silver minerals. Foreign minerals interfere more in the cyaniding of silver ores than in that of gold ores.—A. S.

Manganese silver ores; Cyanide treatment of Mexican —. E. M. Hamilton. J. Chem. Met. and Min. Soc., S. Africa, 1909, 10, 65—67. (See also Linton, this J., 1909, 606.)

THE author describes a long series of tests made on a refractory manganese-silver ore in order to render it amenable to cyaniding. Only with five of the methods were any appreciable extractions with cyanide subsequently obtained, *viz.*, (1), a preliminary chloridising

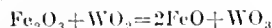
roast; (2), roasting with sulphur out of contact with air; (3), treatment with alkali sulphides; (4), treatment with hydrochloric acid; (5), treatment with a 5 per cent. solution of sulphurous acid. The preliminary treatment with hydrochloric acid enabled a 94 per cent. extraction to be made in the laboratory, but the high cost prohibited its adoption on a practical scale. An 84 per cent. extraction was obtained by the use of the sulphurous acid solution with the consumption of only four lb. of cyanide per ton, and this method would have been used had the ore been a little richer.—F. R.

Copper-aluminium alloys; Transformation-points of —.
(*Relation of electrical resistance to temperature*).
M. Barrée. *Comptes rend.*, 1909, **149**, 678—681.

FROM the curves representing the variation of the electrical resistance with temperature in the alloys of copper and aluminium, the author draws the following conclusions:—1. The observed transformation-temperatures (about 500° and 750° C.) agree with those recorded by Guillet. There is also shown in the curves a singular point at 200° C., but further observation of other characters is required to show whether this is a transformation-point or not. 2. The variations of resistance are reversible, save near the transformation-temperatures; these points, on the cooling-curve, are lower than on the heating-curve. 3. Successive heatings do not affect the temperatures of transformation, but cause the curves to become better defined, probably through the alloys becoming more nearly homogeneous. 4. The very strong tendency to liquation in these alloys, even in very small ingots, is clearly brought out by these observations.—J. T. D.

Tungsten; A volumetric process for the determination of —.
E. Knecht and E. Hilbert. *Chem. Soc. Proc.*, 1909, **25**, 227.

THE process is based in the first instance on the well-known fact that tungstic acid is reduced by zinc and hydrochloric acid to tungsten dioxide, which, in presence of excess of acid, yields a clear light brown solution. If now a solution of a ferric salt be added, the dioxide is oxidised to the trioxide. The end-point is perceived by the disappearance of the intense blue colour of the intermediate compound corresponding with tungsten pentachloride, the reaction



being quantitative. It is thus possible to determine tungsten volumetrically in presence of iron. Potassium thiocyanate may also serve as indicator, but does not offer any particular advantage.

Vanadium; Colorimetric method for the estimation of small quantities of —.
A. W. Gregory. *Chem. Soc. Proc.*, 1909, **25**, 232.

THE method is based on the colour reaction which takes place when a solution of vanadium in concentrated sulphuric acid is added to a solution of strychnine in the same acid. A violet colour is first formed, and this changes to orange. As the latter colour is quite permanent, and is proportional to the quantity of vanadium present, a comparison of the colour produced with that given by a known amount of vanadium under similar conditions indicates the amount of vanadium present in the solution tested. This test is not given by titanium, tungsten, or molybdenum, nor does their presence in relatively large quantities interfere with the formation of the colour given by vanadium. The presence of iron interferes with the reaction. This element must therefore be removed before the test can be applied.

Mercury, and also mercury and silver; Volumetric determination of —.
E. Rupp and L. Krauss. *Ber.*, 1902, **35**, 2015—2017.

Mercury.—As an example, a solution of 25.3529 grms. of pure mercuric oxide in nitric acid, was made, and this was diluted with water to 1 litre. 10 c.c. of this solution was now diluted with 50 c.c. of water, and 1–2 c.c. of a cold saturated solution of iron alum added, and sufficient nitric acid of about 30 per cent. strength to completely

decolorise it. The resulting solution was then titrated with a $N/10$ potassium thiocyanate solution, in the usual way, so as to leave a faint light brown coloration. In the present case, 23.40–23.45 c.c. were required, corresponding to 99.80–100.03 per cent. of the true amount. Volhard's original method with a neutral solution instead of one containing some excess of nitric acid, is not so accurate. (*Annalen*, 190, 1.) See also Cohn, this J., 1901, 1243.

Mercury and silver.—10 c.c. of the mercuric solution already referred to, and 10 c.c. of $N/10$ silver nitrate solution, were also treated with water, iron alum, and nitric acid as already described, and then in the usual way with $N/10$ thiocyanate solution, until the faint brown tint appeared. Thus, it is clear that since the thiocyanate produces at first no precipitation, that the mercury is converted into thiocyanate, which at first dissolves in still unchanged mercuric nitrate solution, whilst the silver is only subsequently precipitated. When the sum of both components (mercury and silver) is ascertained, the silver alone is determined in another portion of 10 c.c. of the mixed solution, by the Gay-Lussac method with $N/10$ sodium chloride solution, the liquid being well shaken before each renewed addition of sodium chloride. Results accurate.

Mercury; The volumetric determination of —, and the determination of silver in presence of mercury.
Joseph Knox. *Chem. Soc. Proc.*, 1909, **25**, 227.

THE thiocyanate method of Rupp and Krauss (see preceding abstract) for the determination of mercury in a solution of mercuric nitrate has been tested, and found to be both rapid and accurate.

The author showed that the estimation of silver by Gay-Lussac's method in presence of mercuric nitrate (by Rupp and Krauss' method) is impracticable, and described a volumetric method which depends on the solubility of silver chloride in potassium cyanide, but the gravimetric estimation of the silver is recommended as being more accurate and convenient. The accuracy of the latter method has been proved in a considerable number of determinations, in which the quantity of mercuric nitrate present was varied greatly.

Vanadium in ores, etc.; Rapid method of determining —.
P. y Alvarez. *Chem.-Zeit.*, 1909, **33**, 1149.

FROM 0.5 to 1 gm. of the finely-ground ore is fused with 7 or 8 times its weight of pure dry sodium peroxide, keeping the mixture at a red heat for about 20 minutes. After extraction of the mass with boiling water, the alkaline filtrate is acidified with sulphuric acid, alcohol added, and without filtering, a current of sulphurous acid is passed through until the solution is nearly saturated. This is necessary to effect complete reduction, especially if arsenic be present. If necessary the blue liquid is filtered, and the alcohol and sulphurous acid removed by heating and passing a current of carbon dioxide through the solution. At this stage if arsenic is present the solution is treated with sulphuretted hydrogen, the arsenic sulphide filtered off, and the excess of sulphuretted hydrogen expelled by boiling. The vanadium solution, which should be of approximately 1 per cent. strength, is titrated with potassium permanganate. As a check, a solution of ammonium metavanadate from which the ammonia has been expelled by caustic soda, is treated under precisely similar conditions with regard to concentration, acidity, and temperature. The oxidation of the hypovanadic acid to vanadic acid is considered complete when the change from the blue to pink colour is permanent.—W. N. B.

Vanadium and other metals; Preparation of — by the thermite method.
W. Prandtl and B. Bleyer. *Z. anorg. Chem.*, 1909, **64**, 217—221.

A MIXTURE of calcium and aluminium, unlike aluminium alone, readily reduces vanadium pentoxide to the metal, and the heat evolved is sufficient to melt the product. The vanadium obtained is not however quite pure, containing not more than 94.5 per cent. (using 100 grms. of fused and powdered vanadium pentoxide, 55 grms.

of calcium, and 24.7 grms. of aluminium); it is crystalline and very hard, being difficult to break with a hammer, and scratches glass, steel, and quartz. Pure vanadium can be obtained in the above process only by using pure calcium and aluminium. As a cheap and efficient substitute for magnesia-lined crucibles, a cylindrical tin canister, lined with finely-ground fluorspar or other suitable material, is recommended, an open cylinder of smaller diameter, such as a lamp chimney, being temporarily introduced during the packing process and withdrawn after the thermite mixture has been filled in. Manganese, chromium, iron, cobalt, and nickel have also been successfully prepared by this method.—F. SODX.

Vanadium; Preparation of — by the aluminothermic method. R. Vogel and G. Tammann. Z. anorg. Chem., 1909, 64, 225.

EXPERIMENTS by the authors show that it is possible to reduce vanadium pentoxide by means of aluminium alone (compare preceding abstract), and metal containing 99.07 per cent. of vanadium has been obtained by the process, but the conditions necessary for success have not been fully ascertained.—F. SODX.

Metals; Emission of gas by heated — G. Belloc. Comptes rend., 1909, 149, 672–673.

STEEL heated *in vacuo* begins to give off gas at 150°–200° C., and the evolution is very noticeable at 400° C. When the evolution at a given temperature ceases, more gas is evolved, not only if the temperature be raised higher, but also if, after an interval of time, the metal be again heated to the original temperature. Thus, 50 grms. of steel wire yielded, on seven successive heatings

to 780° C., at intervals of 3 days, quantities of gas gradually diminishing from 3.30 to 0.20 c.c., and amounting in all to 9.55 c.c.—J. T. D.

Ozone; Action of —, on metals, and the cause of passivity. W. Manchot. Ber., 1909, 42, 3942–3945.

As previously shown (this J., 1907, 825), ozone reacts on silver most readily at a temperature of 240° C., but if the metal be rubbed with various oxides, including silver oxide, ozone acts readily on it at the ordinary temperature. By anodic oxidation in sodium hydroxide or in acid, silver acquires this same property of becoming acted on by ozone at the ordinary temperature; and such an anodic silver plate is found to be electro-positive towards, or "nobler" than, a pure silver plate not reactive to ozone, so that it may be spoken of as "passive" silver. By utilising the action of ozone as a test for the presence of oxide, the author finds that all silver heated in the air to 200° C. or above becomes coated with oxide, though the film so formed may be not only unweighable, but insufficient to affect visibly the polish of the metallic surface.

Other metals behave similarly to silver, in their relations to ozone; and the ozone test lends support to the "oxide film" theory of passivity, for iron and other metals brought into the passive state by immersion in acid or otherwise, all show, when tested with ozone, a film of oxide, though their weight or their appearance may not have been sensibly altered. He suggests that the loss of passivity may be caused by the rupture of continuity between the film and the underlying metal.—J. T. D.

Mineral produce of the United Kingdom and of the Isle of Man. Mines and Quarries Report and Statistics, Part 3. [T.R.]

Description of mineral.	1907.		1908.	
	Quantity.	Value at the mines and quarries.	Quantity.	Value at the mines and quarries.
	tons.	£	tons.	£
Alum shale	9,905	1,692	5,373	739
Arsenical pyrites	1,772	2,990	3,218†	3,931
Arsenic	1,499	35,829	1,936	19,190
Barium (compounds)	41,974	38,440	38,947	35,221
Bauxite	7,537	1,884	11,716	3,025
Bog ore	6,200	1,573	4,295	1,074
Chalk	4,779,387	200,882	4,261,585	174,447
Chert, flint, jasper, etc.	53,664	12,705	63,790	15,204
Clay and shale	14,827,895	1,850,387	14,407,470	1,839,772
Coal	267,830,962	120,527,378	261,528,795	116,598,848
Copper ore	6,525	21,253	5,186‡	17,103
Copper precipitate	267	12,665	255	7,950
Diatomite	150	450	450	500
Fluorspar	49,462	23,311	34,700	15,568
Gold ore	12,978	5,625	7,123	2,675
Graphite	—	—	101	101
Gravel and sand	2,400,392	183,625	2,193,047‡	163,301
Gypsum	235,517	88,629	228,316	88,678
Igneous rocks	5,674,470	1,158,951	6,113,735	1,232,868
Iron ore	15,731,604*	4,433,418	15,031,025†	3,724,165
Iron pyrites	10,194	4,489	9,448	4,339
Lead ore	32,533	419,247	29,249	259,408
Limestone (other than chalk) ..	12,509,142	1,323,624	11,610,656	1,229,155
Manganese ore	16,098	16,516	6,308	4,858
Mica	14,615	5,074	21,161	8,361
Ochre, umber, etc.	11,692	14,408	15,396‡	14,181
Oil shale	2,600,028	806,323	2,892,039	795,257
Phosphate of lime	32	46	9	14
Salt	1,984,656	648,596	1,843,959‡	589,339
Sandstone	5,012,053	1,397,285	5,024,832	1,426,142
Silver ore	4	348	—	—
Slate	443,554	1,178,609	414,229	1,031,877
Sulphate of strontia	10,745	8,059	16,469	12,352
Tin ore (dressed)	7,080	706,700	8,008	594,800
Uranium ore	71	6,500	71	7,550
Wolfram ore	322	41,044	223	18,785
Zinc ore	26,082	100,533	15,225	62,892
Total values		£135,279,088		£139,003,670

* Exclusive of 432 tons of micaceous iron ore, used for paint, and placed under the heading "Ochre, umber, etc."

† Exclusive of 327 tons of micaceous iron ore, used for paint, and placed under the heading "Ochre, umber, etc."

‡ These figures differ slightly from those given in Part I., page 10, owing to correction of errors in certain returns, viz.:—4,431 tons arsenical pyrites corrected to 3,218 tons; 5,457 tons copper ore and copper precipitate corrected to 5,441 tons; 2,193,927 tons gravel and sand corrected to 2,193,047 tons; 15,434 tons ochre, umber, etc., corrected to 15,396 tons; salt, 1,841,363, corrected to 1,843,959 tons. (See also this J., 1909, 387.)

Summary of the metals obtainable by smelting from the ores in the above table.

Description of metal.	1907.		1908.	
	Quantity.	Value at the average market price.	Quantity.	Value at the average market price.
Aluminium	—	£	—	£
Copper	666 tons	62,073	579 tons	36,935
Gold (bar)	1,911 ozs.	6,228	915 ozs.	3,311
Iron	5,126,940 tons	19,004,413	4,847,448 tons	15,362,946
Lead	24,460 „	470,722	20,999 „	288,124
Silver	153,684 ozs.	19,331	135,268 ozs.	13,739
Sodium	—	—	—	—
Tin	4,407 tons	769,438	5,052 tons	676,258
Zinc	7,600 „	186,612	5,832 „	—
Total values	—	£20,528,417	—	£16,504,052

§ Information not supplied.

In 1908, 35,233,523 tons of coal were used in the manufacture of coke; 7,323,817 tons of coke were produced at gas works and 11,213,651 tons at coke ovens; a total of 18,537,468 tons, valued at £12,467,287. There were 26,214 coke ovens in use in the United Kingdom in 1908; of these, 19,478 were bee-hive ovens, 2198 were Coppée ovens, 1044 Simon-Carvès, 876 Otto-Hilgenstocks, 760 Semet-Solvays, 378 Koppers, 294 Simplex, and 210 of the Hüssener type. Of the Coppée ovens, 1122 were in operation in Glamorgan and 592 in Monmouth.

Coefficient of expansion of sheet iron enamels. Mayer and Havas. See VIII.

ERRATUM.

THIS Journal, 1909, 1136, col. 2, l. 10 from bottom, for "1906" read "1909."

PATENTS.

Metal [iron or steel]; Method of hardening and toughening — H. W. Partin, Portsmouth, Va. U.S. Pat. 937,263, Oct. 19, 1909.

"THE heated metal is treated with a mixture of powdered borax and soda, with or without common salt or salt and cobalt," and then tempered. Or, after treating with borax and soda the metal is immersed in an aqueous bath of lime, soda and borax, with or without sal-ammoniac. —F. R.

Steel; Production of — free from protoxides. O. Thullner, Assignor to Firm of Bismarckhütte, Bismarckhütte, Germany. U.S. Pat. 937,486, Oct. 19, 1909.

STEEL is first "blown" and then transferred to a basic electric furnace, where silicon is added. The metal is heated until both the slag and metal are deoxidised, after which a further amount of silicon is added. —F. R.

Steels; Refining of liquid — obtained in furnaces not heated electrically. Soc. Anon. Electrometallurgique (Procédés P. Girod). Fr. Pat. 402,758, May 6, 1909.

THE liquid steel from the Thomas, Bessemer or Martin furnace is run into an electric furnace. It should not be in a peroxidised condition but, on the contrary, should contain a certain quantity of carbon, silicon, manganese and even phosphorus. In order to facilitate the disengagement of the gases retained in the metal, and the separation of the slag, the temperature is allowed to fall to about 700°—900° C., or even lower. It is this cooling, as opposed to the supposed efficacy of raising the temperature to 2000° C., which constitutes the essential feature of the process. Finally, after the cooling, the temperature of the charge is raised, a certain quantity of iron ore or metallic oxide being added in order to facilitate the elimination of residual impurities. —C. A. W.

Spathic iron ores; Method for increasing the reducibility of —. Cöln-Müsoner Bergwerks-Act.-Ver. Fr. Pat. 402,077, April 15, 1909.

CARBONATE ores of iron are crushed and pressed, with or without an agglutinant, into small cakes, which are heated, out of contact with air, until sufficient cohesion is obtained. The masses so produced are firm and porous and do not so readily slip down the furnace out of the zone of reduction. Moreover, by a sufficient admission of air, they may be converted into oxides more readily reducible by the carbon monoxide. In order to apply the process to the poorer spathic ores, it is advisable to enrich the material by eliminating the gangue, if necessary by some method of magnetic separation. By means of the process, cast iron containing large proportions of manganese can be obtained from certain spathic ores, without the addition of other manganiferous ores. —C. A. W.

[Gold-silver] alloys. E. B. Craft and J. W. Harris, Hackensack, N.J., Assignors to Western Electric Co., Chicago, Ill. U.S. Pat. 937,284 and 937,285, Oct. 19, 1909.

A GOLD-SILVER alloy hardened with platinum consists of 67.5 to 70 per cent. of gold, 25 of silver and 5 to 7.5 of platinum. Another alloy consists of the same quantities of gold and silver but with 5 to 7.5 per cent. of nickel in place of the platinum. —F. R.

Gold amalgam; Apparatus for distilling mercury from —. W. E. Bennett, London. U.S. Pat. 937,356, Oct. 19, 1909.

THE amalgam is contained in a tray, supported on a tall iron stand placed in the centre of a water trough. The tray is surrounded by a cylindrical cover opening only below the surface of the water, and an annular fire-basket is arranged round the upper part of the cover. The products of combustion are carried away by means of a hood resting on the fire-basket. —F. R.

Smelting furnaces. Soc. Anon. d'Exploitation des Brevets Cubilot A. Baillot. Eng. Pat. 22,082, Oct. 19, 1908. Under Int. Conv., Jan. 8, 1908.

THE invention consists of a combined smelting furnace and fore-hearth (for cast iron), so arranged that each part is under separate control, the waste heat of the furnace being utilised for heating the air for the blast. The pig-iron flowing from the furnace into the previously heated fore-hearth, is there subjected to the action of the blast, solid fuel being absent, and is thus partially decarburised. (Reference is directed to Eng. Pat. 16 of 1864, 10,206 of 1887, 14,376 of 1899, and 9974 of 1902; this J., 1888, 570; 1903, 568.) —W. E. F. P.

Furnace for the treatment of metals, ores, and alloys. E. T. Fennell, Woolwich, and J. Sackett, Charlton, Kent. Eng. Pat. 22,412, Oct. 22, 1908.

A ROTATING cylindrical ore conveyor lined with refractory material and heated internally by the combustion of

vaporised oil in combination with a hot blast, is placed between an inclined feeding shoot and a regenerative open-hearth furnace of cylindrical shape. A mixture of finely powdered ore, flux and small non-caking fuel, is mechanically fed by means of the inclined shoot into the ore conveyor. The ore is reduced and desulphurised during its passage through the conveyor and eventually falls into the furnace hearth, where a bath of molten iron and slag is maintained.—F. R.

Ore-reducing furnace. G. F. Rendall, Assignor to American Reduction Co., N.J. U.S. Pat. 931,145, Aug. 17, 1909.

THE patent relates to a furnace in which combustible gases generated in retorts first pass through reducing chambers charged with the calcined ore, and are then burned in the furnace proper which is charged with the ore to be calcined. This furnace comprises an inclined chamber, which is charged with ore at its upper end; the calcined ore is discharged at the lower end of this chamber into two reducing chambers arranged one at either side thereof and communicating with it through conduits inclined downwards. The reduced ore is finally discharged through a valved outlet into closed trucks which are provided with valved charging conduits and with couplings for connecting these to the furnace outlets, so that the ore is not exposed to the air. Each reducing chamber is provided with a hinged perforated plate forming a false bottom to support the ore, and the gas from the retorts is admitted beneath these plates. The ore is discharged by lowering these plates so that the front edge comes below the discharge orifice. The retort furnace is arranged in the base of the structure and hot air and combustion products are drawn from the flue of the retort furnace and forced by a blower into the inclined calcining chamber, where they mix with the gas which has passed through the reducing chambers, and ignite it so as to heat the ore. Water-sealed covers are provided so as to prevent damage from any explosion which may occur in the calcining chamber.—A. T. L.

Tin-plate waste; Process for de-tinning —, by means of chlorine. H. von Schütz, Wetzlar, Prussia. Eng. Pat. 23,594, Nov. 4, 1908. Under Int. Conv., Dec. 13, 1907. Addition to Eng. Pat. 22,337 of 1908.

THE process is conducted as described in the main patent (see Fr. Pat. 395,999 of Nov. 6, 1908; this J., 1909, 480), all the operations being performed in the chlorination chamber itself.—W. E. F. P.

Aluminium; Soldering of —. A. Nielsen, Drammen, Norway. Eng. Pat. 15,105, June 28, 1909. Addition to Eng. Pat. 5055 of 1908, dated March 9, 1907.

IN place of electrolytically coating the aluminium object to be soldered, first with nickel and subsequently with tin, as in the main patent (see this J., 1908, 1157), a coating of copper is now substituted for that of tin. The copper electrolyte consists of about a 22 per cent. aqueous solution of copper sulphate, acidified with sulphuric acid. The nickel electrolyte consists of about 4 parts by weight of nickel salts, 2 of "spirits of ammonia," 20 of citric acid, and 100 of water.—F. R.

Sherardizing apparatus. [Coating metals with zinc.] A. F. Schroeder, Cleveland, Ohio. U.S. Pat. 933,725, Sept. 7, 1909.

THE articles to be sherardized are placed, together with the zinc dust, into a series of horizontal cylinders arranged upon a movable carriage which is run on rails into the furnace. The cylinders, which are rotatable about their long axes, have covers extending their entire length. When the operation is finished, the carriage is drawn from the furnace and the covers of the cylinders removed. A large tightly-fitting cover is then placed over the whole carriage and the cylinders rotated, causing their contents to be deposited on to a sieve placed between the rails, the cover preventing the scattering of the zinc dust.—F. R.

Copper; Recovery of the — contained in exhausted cleansing baths. A. Göpfert. Fr. Pat. 402,338, April 22, 1909.

IN order to recover the metal from the exhausted acid solutions which have been employed for cleaning articles of copper or copper alloys, it has been usual to add scrap iron to the concentrated liquid. In practice, however, this reaction is accompanied by an abundant evolution of injurious nitrous fumes and by the production of great heat which may give rise to spontaneous inflammation, in the presence of oily substances. It is therefore proposed to dilute the cupriferous solution with a certain amount of liquid from which the copper has been precipitated. This liquid is contained within earthenware vessels arranged in tiers one above the other, so that the overflow from one passes into the next following. Each receptacle contains a partition reaching about two-thirds of the way down and forming a vertical channel connected with the overflow. The vessels having been filled with scrap iron up to the lower edges of the partitions, and with the liquid free from copper up to the brims, the cupriferous solution is run gradually into the top one, the flow being continued until the purified liquid has been displaced throughout the system. The solution diluted in this way is allowed to remain in contact with the iron for 24 hours, when the whole of the copper will have been precipitated.—C. A. W.

Metals or their alloys; Treatment of —. A. E. Greene. Fr. Pat. 402,353, April 24, 1909. Under Int. Conv., April 26 and July 22, 1908.

IN the application of the method to the elimination of oxidisable elements, as in the refining of steel, the material is maintained in the fused state at a temperature at which the affinity for oxygen of the element or elements to be eliminated, is greater than the affinity for oxygen of those to be retained. Under these conditions the metal is submitted to the action of a gaseous mixture which has an oxidising action towards those elements to be eliminated, but a reducing action towards those to be retained. Preferably, some gas is used in the gaseous mixture, which acts as a reducing agent towards the flux employed as well as towards the oxides of all the metals to be retained. In this way, by the use of a calcareous flux, the diminution of sulphur, phosphorus and analogous impurities is facilitated. Blast-furnace gases, containing both oxides of carbon, at suitable pressures, can be employed, in this way, for the selective elimination of the elements. Thus, in the production of a steel, it is possible to oxidise and remove the carbon, whilst retaining the silicon, or, on the other hand, the whole of the silicon can be removed without eliminating the carbon. The electric furnace employed is provided with an arrangement by which the gases may be mixed before entering the tuyères, and with an aspirator, so that the pressure within the reaction chamber can be exactly regulated. The method is applicable to the production direct from the ore, or from the blast-furnace product, of low-carbon steels containing manganese, titanium, silicon, nickel, cobalt, molybdenum, tungsten, or chromium. As an example, the heated product from a Bessemer converter was maintained in the furnace at a temperature of 1700° C., the flux employed consisting of lime or fluorspar. The composition of the gas passed through the tuyères was: Carbon dioxide, 14 per cent.; carbon monoxide, 21 per cent., the remainder being composed of inert gases. Under these conditions, and without any oxidation of iron, the proportion of phosphorus was reduced from 0.96 to 0.19 per cent., that of sulphur falling from 0.41 to 0.13 per cent.—C. A. W.

Aluminium alloys; Light —. Soc. Anon. Le Ferro-Nickel. Fr. Pat. 402,450, Aug. 29, 1908.

THE claim relates to a class of light alloys of aluminium with copper, manganese, and silver, the proportions of the components varying between the limits: aluminium 94 to 98 per cent., copper 1.50 to 4.00 per cent., manganese 0.25 to 1.25 per cent., silver 0.25 to 1.25 per cent. The mechanical properties, resistance to rupture, limit of elasticity and extension, of two alloys, having the respective compositions, aluminium 96.5 and 95.5 per

cent., copper, silver and manganese 3.5 and 4.5 per cent., are much superior to those of pure aluminium. The alloys are ductile, very malleable, and may be forged and rolled in the hot or cold conditions.—C. A. W.

Sulphide ores; Roasting of ——. Maschinenbau-Anstalt Humboldt. Fr. Pat. 402,737, May 5, 1909. Under Int. Conv., Dec. 21, 1908.

THE claim is for effecting the roasting of sulphide ores under diminished pressure.—C. A. W.

Iron alloys, especially for use for armour plates. S. S. Wales. Fr. Pat. 402,989, April 15, 1909.

SEE U.S. Pat. 921,924 of 1909; this J., 1909, 660.—T. F. B.

Armour plates, etc.; Manufacture of ——. S. S. Wales. Fr. Pat. 402,133, April 16, 1909.

SEE U.S. Pat. 921,925 of 1909; this J., 1909, 669.—T. F. B.

Blast-furnace dust; Process for agglomerating ——. W. Schumacher. Fr. Pat. 402,405, April 26, 1909.

SEE Eng. Pat. 14,399 of 1908; this J., 1909, 889.—T. F. B.

Zinc oxide; Process for the preparation of — for reduction. H. Pape, Hamburg-Billwärder, Germany. Eng. Pat. 5293, March 4, 1909.

SEE Fr. Pat. 400,547 of 1909; this J., 1909, 1044.—T. F. B.

Sulphide ores; Method of treating poor ——. A. Holdsworth, London. U.S. Pat. 938,055, Oct. 26, 1909.

SEE Eng. Pat. 25,574 of 1906; this J., 1908, 287.—T. F. B.

Minerals and similar materials; Process and apparatus for treating ——. F. D. Weeks. Fr. Pat. 402,110, April 16, 1909. Under Int. Conv., April 18, 1908.

SEE U.S. Pat. 916,903 of 1909; this J., 1909, 479.—T. F. B.

Treating cement, ores, etc., in a rotary kiln. Addition to Fr. Pat. 390,316. See IX.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Electrode efficiency of furnaces. C. Hering. Electrochem. and Met. Ind., 1909, 7, 473–474.

If the voltage between the inside or hot ends of the two electrodes of an electric furnace be divided by the voltage between the outer or cold ends, a figure is obtained which is called by the author, "electrode efficiency." In addition to the electrical loss, there is also a heat conduction loss, so that there is a certain drop of voltage in the electrodes of an electric furnace at which the total losses are a minimum. This voltage is called by the author "electrode voltage," and is a physical constant. It is independent of the length and cross-section of the electrode and also of the current passing through it. It is, however, dependent on the temperature drop in the electrode and as a constant must be understood to refer to 1 degree temperature drop. For 1 degree of temperature drop,

$$e = A \sqrt{\frac{k}{K}} \text{ or } e = A \sqrt{\frac{r}{K}},$$

where e is the "electrode voltage," k the heat conductivity, K the electrical conductivity, r the electrical resistivity (resistance), and A is a constant depending on the units employed. For carbon, $e = 0.0224$ volt, and for graphite, $e = 0.0231$ volt. The designer of an electric furnace can only reach these minimum losses, and he can only increase the electrode efficiency by increasing the total voltage of which the electrode voltage is a small part.—J. W. H.

Electrolytic determination of cobalt. Bruylants. See XXIII. Inorg. Quant.

PATENTS.

Insulating process for electrical machines. A. J. Boulton, London. From Felten und Guillaume-Lahmeyerwerke Act.-Ges., Frankfurt a. M., Germany. Eng. Pat. 19,263, Sept. 14, 1908.

PARTS of electrical machinery to be insulated are coated with a solution which can be converted, by subsequent treatment, into a solid mass. For example, the parts may be covered with a solution of acetylcellulose, or with a solution of rubber, which is subsequently vulcanised. The parts to be insulated may be held apart mechanically during the operation. (Reference is directed to Eng. Pats. 5647 of 1894; 16,248 of 1895; 13,973 of 1900; 2264 of 1902; 18,251 and 26,456 of 1903; 2066 of 1906.)—J. W. H.

Electrical-heating method. W. M. Johnson, Iola, Kans., Assignor to The Continuous Zinc Furnace Co., Hartford, Conn. U.S. Pat. 937,074, Oct. 19, 1909.

LEAKAGE of current, through the walls or lining of an electric furnace, is reduced by feeding, between the charge and the walls of the furnace, a granular material containing the constituents of the charge, but having a high electrical resistance relatively to that of the charge.—B. N.

Silicon carbide [electrically]; Process of producing ——. F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 937,119, Oct. 19, 1909.

A CHARGE of silicious and carbonaceous material is supplied to a furnace, and within the charge is maintained an electric arc, of sufficient heating capacity to produce silicon carbide. The arc zone is moved, from the material formed, in the direction of the unreduced mixture, thus allowing a column of silicon carbide to build up under the electrodes. Portions of the silicon carbide are withdrawn from time to time from the end of the column farthest from the arc zone, and fresh material is supplied as required.—B. N.

Exciting liquid, replacing bichromate in batteries of great output. P. M. Séguin. Fr. Pat. 402,161, Aug. 21, 1908.

POTASSIUM or sodium bichromate is replaced by a liquid composed of distilled water, nitric acid, sulphuric acid, lead peroxide, zinc oxide, and sodium chloride in suitable proportions.—B. N.

Furnace; Electric — with superposed recharger. A. Helfenstein. Fr. Pat. 402,652, May 3, 1909.

IN the cover of the furnace, at the side of the recharger, large gas-tight openings are arranged, which may be closed in a suitable manner at will, and which serve to facilitate observation and regulation of the process of reduction taking place in closed furnaces.—B. N.

Electrodes of electric furnaces; Process and arrangement for bringing the electric current to the ——. Soc. des Carbures Métalliques. Fr. Pat. 402,712, May 5, 1909.

THE connecting rod is provided with a head-piece, conical in shape, and this is bound, in a convenient manner, in a suitable hollow in the carbon forming the electrode. The method is suitable for the electrolysis of melted salts, as, e.g., in the extraction of aluminium.—B. N.

Electric batteries. L. P. Basset, Enghien, France. Eng. Pat. 22,236, Oct. 20, 1908. Under Int. Conv., Oct. 31, 1907.

SEE Fr. Pat. 383,540 of 1907; this J., 1908, 241.—T. F. B.

Battery-electrode. G. A. Wedekind and H. P. R. L. Pörske, Hamburg, Germany. U.S. Pat. 937,730, Oct. 19, 1909.

SEE Fr. Pat. 337,276 of 1903; this J., 1904, 612.—T. F. B.

Electrolysis of liquids. J. Billiter, Aschersleben, Germany. Eng. Pat. 24,594, Nov. 16, 1908.

SEE U.S. Pat. 903,951 of 1908; this J., 1909, 28.—T. F. B.

Electrolytic apparatus. A. Brichaux, Brussels. Assignor to Solvay Process Co., Syracuse, N.Y. U.S. Pat. 937,918, Oct. 26, 1909.

SEE Eng. Pat. 7471 of 1898; this J., 1899, 376.—T. F. B.

Compounds of oxygen and nitrogen: Process and apparatus for the production of —. F. Haber and A. Koenig, Karlsruhe. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 938,316, Oct. 26, 1909.

SEE Fr. Pat. 392,670 of 1908; this J., 1909, 28.—T. F. B.

Fastening filaments of electric incandescent lamps to the electrodes. Eng. Pat. 20,915. See II.

Treatment of bromine. Eng. Pat. 19,302. See VII.

Electrical production of compounds containing oxygen and nitrogen. Fr. Pat. 402,912. See VII.

Electric furnace for the continuous manufacture of glass. Addition to Fr. Pat. 401,744. See VIII.

Preparing potable water. U.S. Pat. 937,210. See XVIII B.

(B.)—ELECTRO-METALLURGY.

Zinc smelting: Electric —. The Côte Pierron process. E. Fleuryville, La Houille Blanche, 1908, 7, 273. Electrochem. and Metal. Ind., 1909, 7, 468—472.

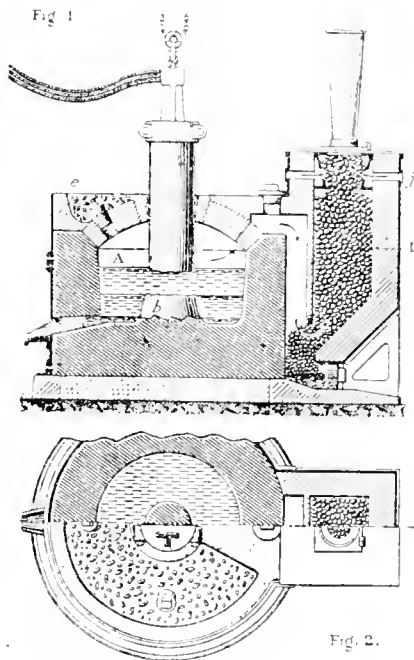


Fig. 2.

THE Côte-Pierron process consists in reducing zinc sulphide by means of iron in the electric furnace. The furnace adopted on a commercial scale after testing several types, is shown in the illustration. The lower part of the crucible, A, with the projection, b, is made of graphite and is connected with one pole of the electric circuit. The roof is formed of refractory fire-brick and is provided with openings, c, for the introduction of the charge. The zinc vapours pass into the condenser, I, which is filled with particles of carbon. Air is admitted through the opening, j, to raise the falling carbon to a red heat so that at a point lower in the condenser, the zinc "mist" may be reduced. The furnace was also used for the manufacture of zinc oxide by passing the zinc vapour to a combustion apparatus and collecting the oxide in settling chambers. The results of a run were:—Time of experiments, 240 hours; weight of ore smelted, 14,560 kilos.; average content, 43.6 per cent. of zinc; weight of iron used, 6235 kilos.; weight of fluxes added,

3480 kilos.; mean current, 4300 amps.; E.M.F., 40 volts; power factor, 0.80; weight of zinc oxide obtained, 6730 kilos.; metallic zinc condensed, 182 kilos.; zinc content of the slag and iron sulphide, 2.7 per cent.; consumption of electrodes, 193 kilos.; cost of electric energy, 65 francs (£2 11s. 6d.) per H.P.-year. For the production of commercial white zinc oxide, free from iron, which cannot be obtained by the process described, the reaction of lime and carbon with zinc sulphide, was utilised:



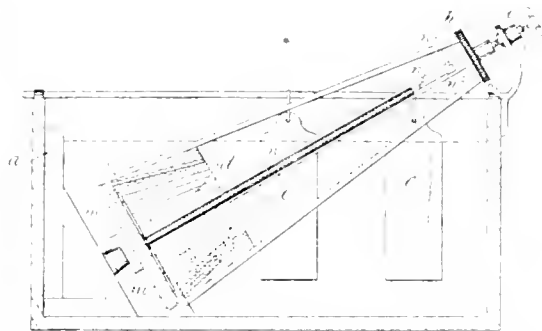
The furnace used was formed of a graphite crucible, 110 cm. diam. inside, 65 cm. high. The results obtained were:

Time of running, 600 hours; weight of ore smelted, 28,345 kilos.; current, 3800 amps.; E.M.F., 42 volts; power factor, 0.85; lime, 12,384 kilos.; carbon, 3146 kilos.; consumption of electrodes, 1286 kilos.; zinc content of charge, 10,587 kilos.; zinc oxide obtained, 12,370 kilos.; cost of manufacture, 4598 francs (£182 7s.).

The zinc oxide obtained contained 98.6—99.0 per cent. of zinc oxide and 0.2—0.3 per cent. of iron. According to its whiteness the oxide was divided into two brands, 70 per cent. being of the better quality.—J. W. H.

PATENTS.

Electro-deposition of metals: Apparatus for —. T. A. Smith and T. Deakin, Walsall. Eng. Pat. 21,687, Oct. 14, 1908.



A STATIONARY tank, a (see Fig.), contains the plating solution and the anodes, c. A barrel, d, containing the material to be plated, is arranged to rotate in this tank with its axis at an angle of 35° or 40° to the horizontal. The lower end of the barrel is entirely closed. The cathode connection is made by means of a brush or other device, though the wheel, h, the rod, n, n², n³, in the axis of the barrel, to a number of arms, m, on the base of the barrel. The axle is encased in fibre to prevent contact with the material being plated. The barrel is rotated by means of the worm wheel, k, and may be lifted from the tank by releasing the adjustable screw, i. This construction admits of the work being removed through the open end of the barrel, at any time during the process, for examination.—J. W. H.

Electro-plating apparatus. R. Walker and W. C. Pinson, Wolverhampton. Eng. Pat. 12,482, May 26, 1909.

THE claim is for a basket for holding the articles to be plated, consisting of a wooden frame, suspended in the bath by wires and having a bottom of wire gauze. Bars are placed across the wooden frame, above the articles, to support the anode. Electrical connections are made to the wire gauze and the anode.—J. W. H.

Reducing metallic compounds [electrically]: Method of —. F. J. Torpe, Niagara Falls, N.Y. U.S. Pat. 937,120, Oct. 19, 1909.

METALLIC or silicon compounds, which are subject to volatilisation losses at the temperature of reduction, are reduced by supporting a charge of the compound and a reducing agent, on a hearth which is impervious to the charge but pervious to the products of reduction. An electric arc, of sufficient intensity to reduce the compound, is maintained within the charge, so that the temperature

of the latter, between the hearth and the reduction zone, is kept below the volatilisation temperature of the silicon or metal. The fused product is removed from the reduction zone, and allowed to pass through the hearth to a receiving space below, in which it is maintained in a fused condition.—B. N.

Mercury; Method of oxidising metals dissolved in —. J. Whiting, Boston, Mass., and C. F. Burgess, Madison, Wis., Assignors to The Whiting Co., Boston, Mass. U.S. Pat. 937,128, Oct. 19, 1909.

A SERIES of carbon surfaces is arranged at the bottom of a containing tank and exposed to an oxidising electrolyte; and a moving body of the amalgam is placed in electrical contact with the carbon surfaces by means of a relatively quiescent body of comparatively pure mercury underlying the amalgam.—F. R.

[Silver] *Precious metals; Process of recovering* —. J. H. Reid, Newark, N.J. U.S. Pat. 937,387, Oct. 19, 1909.

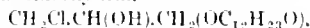
ARGENTIFEROUS ores, containing nickel and cobalt or the like, are finely powdered, mixed with lead and a flux and passed through an electric arc. The volatile products are removed by suction and the molten metal and flux are rotated, in order to effect a separation by gravity.

—F. R.

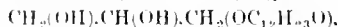
XII.—FATTY OILS, FATS, WAXES, AND, SOAPS.

Mixed triglycerides; Synthesis of —. (Synthesis of fats. III.). A. Grün and A. von Skopnik. Ber., 1909, 42, 3750—3759. (See also this J., 1907, 536).

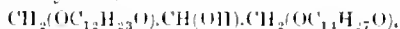
TRIGLYCERIDES containing three different acid radicals in any desired order can be prepared by replacing in succession the primary hydroxyl group, the chlorine atom, and the secondary hydroxyl group of α -monochlorhydrin by different fatty acid radicals. The authors have prepared in this way the three isomeric mixed triglycerides of lauric, myristic, and stearic acids. α -Monochlorhydrin was warmed with an equivalent quantity of lauryl chloride, the reaction product dissolved in ether, washed with water and with sodium carbonate solution, dried with fused sodium sulphate, and the ether distilled off *in vacuo*. The α -lauro- α' -chlorhydrin,



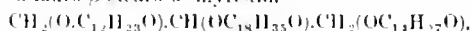
this obtained is a faintly yellow, mobile oil at the ordinary temperature, which crystallises from light petroleum spirit at about -10°C . in small, white crystals; it is soluble in the common organic solvents. By treatment with silver nitrite (Ber., 1907, 40, 1792; this J., 1907, 536), it is converted into α -monolaurin,



which forms white, lustrous leaflets, easily soluble in ether and warm petroleum spirit, and soluble with difficulty in alcohol. The crystals melt at 52°C ., but when the melted substance has solidified and is again heated, it melts at $40-41^\circ\text{C}$. β -Monolaurin prepared from β -lauro- $\alpha\alpha'$ -dichlorhydrin, melts at $58-5^\circ\text{C}$. α -Lauro- α' -myristin,



was obtained by heating α -lauro- α' -chlorhydrin with potassium myristate at 140°C . in a current of hydrogen. It can be crystallised from very dilute solutions in a mixture of ether and petroleum spirit below 0°C ., and forms very small, lustrous, white crystals, which are soluble in the ordinary fat solvents; it melts at $40-42^\circ\text{C}$., and after solidification, at $34-35^\circ\text{C}$. When warmed with the calculated quantity of stearyl chloride, it is converted into α -lauro- β -stearo- α' -myristin,



which crystallises from ether in very soft, white crystals, almost insoluble in alcohol. It melts at $37-38^\circ\text{C}$., and after solidification, at 35°C . α -Stearo- α' -chlorhydrin, prepared in a similar manner to α -lauro- α' -chlorhydrin, forms white crystals soluble in benzene, ether, and warm

petroleum spirit; it melts at $48-49^\circ\text{C}$., and after solidification, at $39-40^\circ\text{C}$. α -Stearo- α' -laurin from α -stearo- α' -chlorhydrin and potassium laurate, forms white crystals easily soluble in benzene, chloroform, and ether, soluble with difficulty in alcohol and in cold petroleum spirit; it melts at $52-53^\circ\text{C}$., and after solidification, at 45°C . α -Stearo- β -myristo- α' -laurin prepared from α -stearo- α' -laurin and myristyl chloride forms soft, dull white crystals, which melt at $48-49^\circ\text{C}$. (46°C . after keeping for a long time), and after solidification, at $44-45^\circ\text{C}$. α -Stearo- α' -myristin obtained from α -stearo- α' -chlorhydrin and potassium myristate, softens at 47°C . and melts at $52-53^\circ\text{C}$. (at 44°C . after solidification). α -Stearo- β -lauro- α' -myristin from α -stearo- α' -myristin and lauryl chloride, forms soft, yellowish-white, ill-defined crystals, which melt at 42°C ., and after solidification, at 32°C . The melting points of mixtures of the three isomeric triglycerides are shown in the following table:—

	M. pt. of crystals.	M. pt. after solidification.
	$^\circ\text{C}$.	$^\circ\text{C}$.
Stearolauromyristin + laurostearomyristin ...	39	33
Laurostearomyristin + stearomyristolaurin ...	42	39
Stearolauromyristin + stearomyristolaurin ...	45	36
Stearolauromyristin + laurostearomyristin + stearomyristolaurin	39—41	37

—A. S.

Olive oil, Tunisian; Reactions of —. R. Marcille. Ann. des Falsific., 1909, 2, 224—239.

OLIVE oils obtained from Northern Tunis frequently yield a reaction with the Villiaveccchia and Fabris test (hydrochloric acid and furfural) which may lead to the conclusion that the oil is adulterated with sesame oil; oils from the Souss and Sfax regions also yield a similar, but less marked, reaction. With a little practice, however, the coloration given by this class of oils may be readily distinguished from that obtained with mixtures of olive oil with sesame oil, and in no case do the oils give a positive reaction in Bellier's test (a mixture of nitric acid, sp. gr. 1.4 with a solution of resorcinol in benzene). This test is, consequently, recommended as a reliable means of ascertaining the absence of sesame oil in olive oils which, from the results of other tests, may be suspected of containing sesame oil. The constituent which gives the reaction with hydrochloric acid and furfural is removed by washing the oil with hot water containing a little sodium bicarbonate, and washing with hot water alone eliminates the greater part of the substance. The quantity of the latter present appears to diminish when the oil is kept; it is found more frequently in freshly prepared oils. (See also this J., 1907, 1185).—W. P. S.

Sesame oil; Furfural reaction for the detection of —. H. Imbert and L. Durand. Ann. de Falsific., 1909, 2, 317—319.

CERTAIN Algerian and Tunisian olive oils give a red coloration with hydrochloric acid and furfural, which might easily be mistaken for the coloration given by sesame oil. Any mistake may be obviated by applying the test to the fatty acids of the oil, or by a preliminary washing with water rendered alkaline with sodium bicarbonate, as proposed by Marcille (see preceding abstract). A sample of pure olive oil containing 1 per cent. of sesame oil still gave a red coloration after being boiled for 5 minutes each time with 6 successive portions of the alkaline solution, whereas the substance in the Tunisian and Algerian olive oils giving a red coloration was readily extracted by boiling with water alone, and especially with water containing bicarbonate.—C. A. M.

Oils obtained by extraction with carbon bisulphide; Detection of — in commercial oils. Cusson. Ann. des Falsific., 1909, 2, 409—410.

ONLY the lowest grade of edible oils are stated to be mixed with oils that have been extracted with carbon bisulphide.

The presence of faint traces of this solvent in an oil may be detected as follows:—About 200 grms. of the oil are thoroughly shaken with 50 grms. of 90 per cent. alcohol, and the flask then connected with a condenser and heated on a water-bath. The distillate is received in a flask cooled in water and containing a little alcoholic potassium hydroxide solution, and the heating is continued until about one-third of the alcohol has distilled. Any traces

practically unlimited quantities. Whether soya-bean oil would find an economic use comparable to that of cottonseed oil remains to be determined, as does also the feeding value of soya-bean meal from which the oil has been extracted.

The relative richness of the soya bean in oil and other constituents as compared with other oily seeds is shown in the following tables:—

Analyses of seeds of seven varieties of soya beans.

Variety.	Fresh or air-dry substance.					
	Water.	Protein.	Fat.	Nitrogen-free extract.	Fibre.	Ash.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Austin	8.67	36.59	20.55	24.41	4.00	5.78
Ito san	7.42	34.66	19.19	27.61	5.15	5.97
Kingston	7.45	36.24	18.96	26.28	4.79	6.28
Mammoth	7.49	32.99	21.03	29.36	4.12	5.91
Guelph	7.43	33.96	22.72	25.47	4.57	5.85
Medium yellow	8.00	35.54	19.78	26.30	4.53	5.85
Samarow	7.43	37.82	20.23	23.65	5.05	5.82
Average	7.70	35.40	20.35	26.15	4.60	5.70

Analyses of cottonseed, sunflower seed, and peanuts.

Kind of seed.	Fresh or air-dry substance.					
	Water.	Protein.	Fat.	Nitrogen-free extract.	Fibre.	Ash.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Cottonseed (whole)—						
Minimum	8.00	13.62	10.40	7.58	17.60	2.89
Maximum	17.51	29.70	29.34	36.70	32.40	8.00
Average of 25 analyses	9.92	19.38	19.45	22.57	22.57	4.74
Sunflower seed (whole)—						
Minimum	8.50	15.80	20.90	22.00	29.50	2.10
Maximum	8.80	16.70	21.50	20.70	30.30	3.20
Average of 8 analyses	8.60	16.30	21.20	21.40	29.90	2.60
Peanut (kernels)—						
Minimum	4.90	23.20	25.00	12.70	2.00	1.90
Maximum	13.20	31.50	47.40	19.10	18.40	3.80
Average of 7 analyses	7.50	27.90	39.60	15.60	7.00	2.40

of carbon bisulphide carried over will be converted into potassium xanthate, which may be detected by rendering the distillate faintly acid with acetic acid, and adding a few drops of an alcoholic solution of copper acetate. A yellow coloration (or precipitate after a short time) of copper xanthate indicates that the oil under examination contained oil obtained by extraction with carbon bisulphide.—C. A. M.

Oil, edible; Adulteration of — with mineral oil. L. Ronnet. Ann. des Falsific., 1909, 2, 220—221.

A SAMPLE of edible oil examined by the author gave the following analytical results:—Sp. gr. at 15° C., 0.8905; refractometer value, 32.5; saponification value, 66.0; iodine value (Hübl), 44.9; Maumené test, 37°; unsaponifiable matter, 66.36 per cent. The oil gave a reaction for sesamé oil, but no indications were obtained of the presence of linseed, cottonseed, or resin oils. As shown by these figures, the sample consisted of a mixture of vegetable oil, 34 per cent., with mineral oil, 66 per cent. The vegetable oil was, probably, poppy-seed oil containing about 6 per cent. of sesamé oil.—W. P. S.

Soya bean oil and meal. U.S. Dept. of Agri. Bull., Oct., 1909. [T.R.]

DURING the past ten years soya-bean meal has been imported into Europe in large quantities from Manchuria, and has met with a ready sale at a price above that of cottonseed meal. This would seem to assure a market for

Bean cake and bean oil in Darien, Japan. Chem. Trade J., 1909, 45, 429—430.

A CHEMICAL analysis of bean cake, as at present prepared, gives the following results:—

	Sample No. 1.	Sample No. 2.	Sample No. 3.
	per cent.	per cent.	per cent.
Water	17.38	16.90	19.10
Oily substances	9.76	9.70	9.18
Albuminous substances	40.98	41.66	45.02
Carbohydrate	20.73	20.64	15.62
Woody fibre	6.65	6.64	6.23
Ash	4.50	4.45	4.78

By the present method, using hand-presses, the amount of oil extracted from the beans is about 8 per cent. At one mill in Darien, which is fitted with hydraulic presses, nearly 10 per cent. can be obtained. The quantity of oil in the soya bean is from 16 to 17 per cent.

Linolic acid. A. Rollett. Z. physiol. Chem., 1909, 62, 410—421.

PURE linolic acid was obtained by converting the crystalline linolic acid tetrabromide prepared from poppy-seed oil into the methyl ester of linolic acid, and purifying this by distillation under reduced pressure. The purified ester was then saponified in the cold by Henriques' method, the sodium linolate solution acidified, and the linolic acid extracted with petroleum spirit. It was a light yellow

oil, which when distilled *in vacuo* yielded a colourless liquid boiling at 229–230° C. under a pressure of 16 mm., and having a sp. gr. at 18/4° C. of 0.9026. (Value hitherto accepted—0.9206 at 14° C.) When brominated the pure acid yielded, at most, 50 per cent. of crystalline tetrabromide, whilst the filtrate contained a syrupy tetrabromide, which on reduction with nascent hydrogen gave pure linoleic acid. On again brominating this acid (from the fluid tetrabromide) 26.2 per cent. of the crystalline tetrabromide was obtained. It was not possible to decide with certainty whether the fluid tetrabromide was identical with the crystalline product, but prevented from crystallisation by traces of impurities, or whether they were individual chemical substances. In any case, however, these experiments prove that the bromine addition method does not give quantitative results, and although valuable as a qualitative test cannot be relied upon for the determination of linoleic acid in mixtures of fatty acids. Further experiments showed that the presence of oleic acid does not reduce the yield of tetrabromide, but that the presence of a large proportion of linolenic acid renders difficult even the detection of linoleic acid. By the oxidation of pure linoleic acid with alkaline potassium permanganate, Hazura's sativic acid (m. pt. 171°–173° C.) was obtained, together with a small amount of another, as yet unidentified substance, which could be extracted with hot benzene. In the author's opinion the foregoing facts, and in particular, the formation of (possibly) isomeric bromine addition compounds corresponding to the same linoleic acid, find an explanation in stereoisomeric relationships arising out of the two double linkages in the molecule of linoleic acid. (See also Lewkowitsch, *Chem. Technol. and Anal. of Oils, Fats, and Waxes*, Fourth Edit., Vol. I., p. 154.)—C. A. M.

Linolenic acid and linseed oil. A. Rollett. *Z. physiol. Chem.*, 1909, 62, 422–431.

A METHOD similar to that of Erdmann and Bedford (this J., 1909, 530) was used in the preparation of linolenic acid from linseed oil. When purified by distillation under reduced pressure and in an atmosphere of carbon dioxide, it was a colourless liquid, boiling between 230° and 232° C. under a pressure of 17 mm., and having an iodine value of 267.4 (theory=274.2). Its sp. gr. at 18°/4° C. was 0.9141, whilst the linolenic acid prepared by Hehner and Mitchell (this J., 1899, 77) had a sp. gr. of 0.9228 at 15° C. When brominated it absorbed 6 atoms of bromine, two of them more slowly than the other four, and yielded about 20 per cent. of a solid hexabromide, and about 80 per cent. of a syrupy liquid, which had the composition of an impure tetrabromide (see this J., 1909, 531). By the further action of bromine, added at intervals of several hours, this tetrabromide was converted in two days into a saturated fluid hexabromide, $C_{18}H_{32}Br_6O_2$, which on reduction with nascent hydrogen yielded linolenic acid. Contrary to the experience of Erdmann, Bedford, and Raspe (this J., 1909, 531), the linolenic acid reduced from this fluid bromide gave, on bromination, a fresh deposit of the solid hexabromide. Moreover, on oxidising pure linolenic acid with alkaline permanganate solution, the author obtained both the linnic and isolinnic acid of Hazura. From these results and a comparison of the yields of hexabromide with the iodine value of the linseed oil from which it was obtained, the author concludes that there is insufficient evidence of the existence of either Hazura's isolinolenic acid or the β -linolenic acid of Erdmann, Bedford and Raspe (*loc. cit.*). The formation of two distinct ozonides upon which Erdmann, Bedford and Raspe base their argument is no more proof of the existence of isomeric linolenic acids than is the formation of different bromine addition compounds. Four addition bromides may theoretically be obtained from a given linolenic acid, and the fact that the experimental yields of solid hexabromide are invariably less than 25 per cent. is therefore quite in accordance with what might be expected.—C. A. M.

Ricinolic acid; Derivatives of —. A. Grün. *Ber.*, 1909, 42, 3759–3763.

THE results obtained by Chonowsky (this J., 1909, 1093) with respect to the action of sulphuric acid on ricinoleic

acid differ considerably from those obtained by previous workers (see Benedikt and Ulzer, *Monatsh. Chem.*, 1887, 8, 208; also Juillard, this J., 1894, 820; 1895, 811). Juillard showed that dihydroxystearic acid is one of the reaction-products, and the author (this J., 1907, 57) showed that this dihydroxystearic acid was a mixture of isomerides, of which he isolated three, one melting at 90° C., having $[\alpha]_D = +6.45^\circ$; and two optically inactive acids melting at 69.5° C. and 108° C. respectively. More recently the author and Wetterkamp have isolated the fourth possible isomeride, which melts at 126° C. Chonowsky's products melting at 73°–74° C. and 115°–116° C. were probably mixtures of the acids melting at (1), 69.5° and 90° C. and (2), 108° and 126° C. respectively. In the formation of dihydroxystearic acids from ricinoleic acid and sulphuric acid, relatively stable inner esters of the type, $C_7H_{13}O_2(OH)_2.CO.O.C_7H_{13}(OH)(COOH)$, are formed as intermediate products (see this J., 1908, 1212; 1909, 1146), and the so-called "glycidic acids" obtained by Chonowsky, of which neither a description nor an analysis is given, may have consisted of these ester-acids or of a mixture of them with dihydroxystearic acids. High-molecular hydroxy-acids show a great tendency to form these inner esters, and hence their production seems much more likely than that of inner ethers (glycidic acids).—A. S.

Cottonseed products; Uniform methods for analysis of —. Oil, Paint and Drug Reporter, Oct. 25, 1909.

AT a recent meeting of the official chemists appointed by the Interstate Cottonseed Crushers' Association, held at Memphis, Tenn., to determine upon a uniform method of analysis, the following methods were decided upon for recommendation:—

Cottonseed meal.

Moisture.—Five grms. dried at 105° C. for two hours in double wall oven (preferably oil bath).

Oil.—Extract 5 grms. of meal (without previous drying) with petroleum ether boiling under 70° C. in a short siphon Soxhlet apparatus for two hours. Evaporate off the ether and weigh the residue as oil.

Optional method.—Oil: Extract 5 grms. of thoroughly dried meal (the portion used for the moisture determination) with petroleum ether boiling under 70° C. in a short siphon Soxhlet apparatus for two hours. Evaporate off the ether and weigh the residue as oil.

Nitrogen. Kjeldahl-Gunning method.—Determination:—(a) Digestion.—1.7 gm. of cottonseed meal are brought into a digestion flask with approximately 0.7 gm. of mercuric oxide (or 0.5 gm. metallic mercury) and 10 grms. of potassium sulphate (free from ammonia) and 25 c.c. of sulphuric acid of 1.84 sp. gr. The flask is placed in an inclined position, and heated below the boiling point of the acid for from 5 to 15 minutes, or until frothing has ceased. The procedure of digestion is now the same as in the regular Kjeldahl method, except that no potassium permanganate is added.

(b) Distillation.—After cooling, the contents of the flask are transferred to the distilling flask with about 300 c.c. of distilled water, a few pieces of granulated zinc, pumice stone, or 0.5 gm. of zinc dust when found necessary to keep the contents of the flask from bumping, and 25 c.c. of potassium sulphide solution are added, with shaking. Next 60 c.c. of soda solution of 1.50 sp. gr. are added, or sufficient to make the reaction strongly alkaline, pouring it down the side of the flask so that it does not mix at once with the acid solution. The flask is connected with the condenser (of block tin), the contents mixed by shaking, and then distilled until all ammonia has passed over into the standard acid, which is an accurately measured quantity of $N/2$ sulphuric acid to which is added about 50 c.c. distilled water. The distillate is then titrated with $N/4$ caustic soda or ammonia solution, using cochineal solution as indicator.

Fatty acids in soap stock.

The following method was adopted as the official method for the determination of total fatty acids in soap stock:—

Total fatty acids—Gravimetric method.—Weigh out 8 to 10 grms. of well-mixed sample into a small extraction flask. Saponify with an alcoholic soda solution over a steam bath and heat, with occasional stirring, until all alcohol is driven off.

Wash out with about 400 c.c. of hot water into a beaker, and digest on the water bath until complete solution of the soap is effected. Acidify with dilute sulphuric acid and continue heating on bath until the layer of fatty acids has become clear. Cool and filter off the liquor from the cake of fatty acids, washing with cold water until no trace of sulphuric acid is left. Allow the fatty acids to dry thoroughly, preferably by standing over night. Transfer the fatty acids to a folded filter paper and place in a Soxhlet extractor. Dissolve fat adhering to beaker with warm gasoline, and extract with redistilled gasoline for three hours. Drive off the gasoline and heat to constant weight. Calculate percentage on original weight.

Note.—Time is saved by chilling the melted fat in running water and by dissolving the majority of the dry fat cake in a beaker and on the filter paper with warm gasoline, allowing to filter through into the tared flask, then wrapping up filter paper and extracting as usual for one and a half hours.

Moisture to be reported.

The committee recommended that a moisture determination be made and reported on all samples of cottonseed meal or cake.

It was moved and adopted that President Allen be requested to warn the members of the Interstate Cottonseed Crushers' Association against using oil sample cans sealed with a linoleum washer or gasket.

The following resolution was adopted:—

"The committee recommends that the rule in regard to sending samples in air-tight cases be rigidly enforced as a step toward securing more accurate and uniform analytical results. It is the unanimous opinion of the committee that a very large percentage of the discrepancies in chemical analyses is due to carelessness in the preparation and preservation of samples."

Next followed a discussion of the present method of determining refining losses in crude oil, and it was decided to make no changes at the present time, except the following, and the method now and in use for the past two years be continued.

"After the addition of the caustic soda solution a more thorough and vigorous agitation of the oil is recommended until all the caustic soda solution is thoroughly incorporated throughout the oil. Allow oil to stand for three hours at 125° F. before cooling and draining, instead of one hour as formerly."

Beeswax; French Codex test for foreign fats, resins, and waxes in.—P. Le Naour. Ann. Chim. analyt., 1909, 14, 369—370.

THE official test of the French Codex, 1908, specifies that when 1 gm. of beeswax is boiled for 30 minutes with 35 c.c. of aqueous, 15 per cent. sodium hydroxide solution, the amount of water lost by evaporation being replaced by the addition of hot water, the liquid, cooled and strained through absorbent cotton, should not give a precipitate when acidified with hydrochloric acid. This result is taken to indicate freedom from admixture with foreign fats, waxes, and resins. The test is found to be defective. No precipitate is obtained, under the conditions indicated, even when fragments of a stearic candle are thus treated, nor if 20 per cent. aqueous potassium hydroxide be substituted for the sodium hydroxide solution for saponifying. But if saturated solution of sodium carbonate be used in place of the hydroxide, sodium stearate is formed, solidifying on cooling, but re-dissolving on warming; on acidifying with hydrochloric acid, stearic acid is liberated.—J. O. B.

Cultivation and uses of soya beans. Edie. See XVIII.A.

PATENTS.

Hydroxyfatty acids; Process for the preparation of—from the addition compounds of hypochlorous acid or chlorine with the glycerides of vegetable or animal oils. G. Imbert and Consortium für elektrochem. Ind. Ges.m.b.H. Ger. Pat. 214,154, March 29, 1908. Addition to Ger. Pat. 208,699, Sept. 22, 1906.

IN the process described in the main patent (see Fr. Pat. 368,543 of 1906; this J., 1907, 25), hydroxyfatty acids were prepared from the addition compounds of hypochlorous acid or chlorine with fatty acids, by heating them with alkali, alkali carbonates, or alkaline-earths under pressure. According to the present patent, the addition-compounds of the glycerides are used and a further quantity of alkali carbonate or bicarbonate, necessary for the saponification of the glyceride, is added.—A. S.

"Oleine-vaseline" and "vaseline-grease" for lubrication obtained by extracting the mucilaginous principle from a mixture of sea-weeds. C. de la Guéronnière. Fr. Pat. 402,095, Apr. 16, 1909.

A MIXTURE of the chief mucilaginous seaweeds (*Fucus crispus*, 75; *pearl fucus*, 20; and agar-agar, 5 per cent.), previously freed separately from ligneous tissue and boiled with hot water containing 10 per cent. of sodium chloride and 5 per cent. of potassium carbonate, is gently boiled with a 10 per cent. solution of sodium chloride until solution occurs. For "oleo-vaseline" from 700 grms. to one kilo. of the mixture is used with 100 litres of aqueous solution, whilst for "vaseline-grease" twice that proportion of seaweed is required. The solution is filtered hot, and preserved by the addition of turpentine oil, alcohol, sulphurous acid, or phenol, etc.—C. A. M.

Soaps containing solvents for fats; Preparation of—A. Welier. Fr. Pat. 402,172, Apr. 17, 1909.

TO obtain soaps containing at least 3 per cent. of a fat solvent (e.g., turpentine oil, or ethylene perchloride) it is necessary to use as the base soaps containing not more than 30 per cent. of fatty acids (or 55 per cent. in the case of castor oil soaps). The proportion of fatty acids in commercial soaps may be reduced to the necessary extent by the addition of water; or a solution of free fatty acids in the required solvent may be saponified with a potash lye and incorporated during the process with water. Only in the case of soaps prepared from castor oil fatty acids can caustic soda or ammonia by themselves be used for the saponification. It is essential during the saponification to exclude as far as possible the usual additions of alkali salts, such as potassium or sodium carbonates, chlorides, sulphates, etc. In this way it is possible to obtain soaps containing (partially in a state of solution) 20 to 25 per cent. of ether, acetone, carbon tetrachloride, etc., and yet soluble in water.—C. A. M.

Soaps containing mercury compounds; Production of—Farbenfabriken vorm. Bayer and Co. Fr. Pat., 402,740, May 5, 1909. Under Int. Conv., May 19, 1908.

ORDINARY soaps are incorporated with alkali salts of complex mercuric substitution compounds of carboxylic acids of the aliphatic or aromatic series, such as, e.g., the sodium salt of oxymercuri-acetic acid, $\text{OH.Hg.CH}_2\text{COONa}$, or of oxymercuri-salicylic acid, $\text{HO.Hg.C}_6\text{H}_4(\text{ONa}).\text{COONa}$.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

PATENTS.

Inks. R. Hochstetter, Cincinnati, U.S.A. Eng. Pat. 16,291, July 13, 1909.

SEE U.S. Pats. 928,450 and 928,915 of 1909; this J., 1909, 879 and 880. A small quantity of glucose is added to inks containing organic pigments to prevent spreading on paper.—T. F. B.

Ultramarines; Manufacture of —. F. Bellet, Paris.
U.S. Pat. 938,408, Oct. 26, 1909.

SEE Fr. Pat. 400,103 of 1908; this J., 1909, 992.—T. F. B.

Azo dyestuffs [for lakes]. Eng. Pat. 1816. See IV.

(B.)—RESINS, VARNISHES.

Oil of turpentine; Composition of —. E. Darmais.
Comptes rend., 1909, 149, 730—733.

Not only the dextro-rotatory (this J., 1908, 866) but also the levo-rotatory turpentine oils consist of a mixture of a compound of high and a compound of low, dispersive power. The latter is in all cases levo-rotatory, and is the same substance whether the oil as a whole be dextro- or levo-rotatory. Its specific rotatory power is $[\alpha]_D = -21.7^\circ$. It probably forms about 38 per cent. of oil of turpentine, the remainder being one or other of the forms of pinene.
—J. T. D.

Japan lac; Main constituent of —. II. Oxidation of the dimethyl ether of urushiol with ozone. R. Majima.
Ber., 1909, 42, 3664—3673.

In previous investigations (this J., 1907, 1245; 1909, 532) it was concluded that urushiol had the composition, $C_{20}H_{30}O_2$, and the constitution of a divalent phenol with an unsaturated aliphatic side-chain. Further evidence as to the constitution of urushiol and the position of the double linkages in the side chain has been obtained by the ozonisation of its dimethyl ether. When this compound was treated with strong (14 to 18 per cent.) ozone at a low temperature, it yielded a tetra-ozonide, $C_{22}H_{34}O_{12}$, in the form of a light yellow semi-solid mass, which exploded violently when heated even to $60^\circ C$. When boiled with glacial acetic acid it was decomposed, the products of the decomposition including acetaldehyde, oxalic acid, α -naphthol and azelaic acid. It is probable that part of the ozone in this ozonide is in direct combination with the aromatic nucleus of the dimethylurushiol mol. This view is supported by the fact that methyleugenol, which is known to contain only one double linkage in its allyl group, forms a very explosive triozonide on treatment with concentrated ozone. When, however, more dilute (about 6 per cent.) ozone is used, only the side-chain of methyleugenol is attacked, and a mono-ozonide is obtained. In like manner, dimethylurushiol reacts with 6 per cent. ozone to form chiefly a di- or triozonide, according to the duration of the treatment. If, in the triozonide, all three ozone mols. are in the side-chain, the latter must have the composition, $-C_{11}H_{23}$, and the formula of urushiol itself must be $C_{20}H_{28}O_2$. It is not yet possible to come to a definite conclusion on this point. Dimethylurushiol diozonide was a fluid substance, which was much less explosive than the tetra-ozonide. On decomposition with hot water it yielded acetaldehyde, carbon dioxide, α -naphthol, and a substance containing 2 methoxyl groups in its mol., together with slight amounts of azelaic and oxalic acids. In the decomposition with cold water, acetaldehyde and the semi-aldehyde of malonic acid appeared to be the primary products. The triozonide was a light yellow substance which exploded with some violence when heated in a flame. On treatment with water it yielded the same products of decomposition as the diozonide, but with increased yields of azelaic and oxalic acids. In the author's opinion it is possible that dimethylurushiol is not an individual substance, but consists of at least two closely-allied compounds with isomeric side-chains, the relationship being comparable to that of eugenol and iso-eugenol.—C. A. M.

PATENT.

Linoxyn and like products; Process of manufacturing especially intended for utilisation in the manufacture of linoleum and like products. A. Genthe, Goslar, Germany. Eng. Pat. 1990, Jan. 27, 1909. Under Int. Conv., Feb. 26, 1908.

SEE Fr. Pat. 398,804 of 1909; this J., 1909, 1050.—T. F. B.

(C.)—INDIA-RUBBER, &c.

PATENTS.

Vulcanised rubber; Process of re-claiming —. R. Hutcheson, R. Milne, and R. F. and C. A. Hutcheson, Glasgow. Eng. Pats. 23,627, Nov. 5, 1908, and 26,643, Dec. 9, 1908.

THE comminuted rubber is freed from sulphur by a known process, and then, with or without addition of filling or colouring materials, subjected to the joint action of a temperature not exceeding $248^\circ F$. and high pressure (e.g., 1000 lb. per sq. in.).—A. S.

Plastic and elastic substances; Manufacture of —. The Commercial Products Co., Ltd. Fr. Pat. 402,028, April 14, 1909. Under Int. Conv., July 15, 1908.

A SOLUTION of gelatin (with or without casein or albumin) in phenol or anhydrous glycerin, or a mixture of the two, or in other anhydrous solvents, is made into an emulsion with a suitable proportion of gum-lac or similar substance, dinitrocellulose or acetyl cellulose, and camphor dissolved in aniline. The mixture is shaken with a preparation of anhydrous formaldehyde, such as, e.g., paraformaldehyde or a solution of formaldehyde in anhydrous glycerin, until the mass becomes thick and homogeneous, after which it is poured into moulds and pressed if desired. Special claim is made for the use in the gelatin emulsion of a new form of celluloid in which the camphor may be replaced by anhydroformaldehydeaniline or by a resinate thereof.
—C. A. M.

Ebonite and vulcanite; Manufacture of —. O. C. Immisch, Finchley. U.S. Pat. 937,745, Oct. 19, 1909.
SEE Eng. Pat. 28,365 of 1907; this J., 1909, 484.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Distinguishing wool gelatin and animal size. Herz and Barraclough. See V.

PATENTS.

Tanning skins and hides; Process of —. H. Schmid, Mühlhausen, Germany, Assignor to C. H. Boehringer Sohn, Nieder Ingelheim, Germany. U.S. Pat. 937,720, Oct. 19, 1909.

THE process consists in tanning skins and hides, by means of metallic salts, in the first place, by impregnating the prepared skins and hides with the solution of a basic salt of a sesquioxide, and then treating the impregnated skins and hides with an alkaline solution of another metallic oxide, for instance with a solution of sodium zincate, in which a soluble oil may be dissolved.—S. H.

Dressing for leather; Process for the manufacture of a —. Chem. Fabr. "Electro," Ges. m. b. H. Fr. Pat. 402,292, April 22, 1909.

GUM-LAC is treated with some suitable alkali (e.g. ammonia, borax, or sodium phosphate) to give a powder soluble in water. This powder is mixed intimately with soap and a colouring matter soluble in water and suitable for staining leather. The product is a solid powder, soluble in water and suitable for leather dressing.—H. G. B.

Leather, artificial leather, and other fibrous matters; Process for increasing the hardness and resistance to wear of —. L. Krajewski. Fr. Pat. 402,400, April 27, 1909.

THE process consists in filling the pores of leather or other fibrous material with finely powdered hard bodies (e.g. carborundum). For example, leather may be impregnated, before or after tanning, with hard bodies in a state of very fine subdivision, and then heated with an agglutinant or binding agent.—H. G. B.

Glue from rabbit skins; Manufacture of dry —. Bonnefoy et Winder. Fr. Pat. 402,775, May 6, 1909.

THE skins after unhairing are washed first in water and afterwards in a boiling solution of "Solvay salt." After passing through superheaters, where they are exposed to dry steam, the skins are treated for the extraction of the glue in an autoclave and the product finished in the ordinary way.—H. G. B.

Leather and leather-like materials; Process of superficially colouring —. B. Polack Akt.-Ges., Waltershausen, Germany. Eng. Pat. 24,141, Nov. 10, 1908. Under Int. Conv., Oct. 20, 1908.

SEE Fr. Pat. 396,299 of 1908; this J., 1909, 598.—T. F. B.

Furs and skins of animals and skins of birds; Process for degreasing, de-liming, sterilising, preserving, and disinfecting — by aid of the electric current. F. H. E. Lehmann. Fr. Pat. 402,946, April 15, 1909.

SEE Eng. Pat. 4488 of 1909; this J., 1909, 1151.—T. F. B.

XV.—MANURES, &c.

Soil; Effect of partial sterilisation of — on the production of plant food. E. J. Russell and H. B. Hutchinson. J. Agric. Science, 1909, 3, 111—144.

It has been known for many years that when soil is partially sterilised, either by heat or by volatile antiseptics such as carbon bisulphide, toluene, etc., it becomes more productive and capable of yielding larger crops. Darbishire and Russell (J. Agric. Science, 1908, 2, 305) have shown that the property is a general one, holding for all kinds of soil and for all plants except those of the leguminous order. Moreover not only is a better crop obtained (two, three or even four times as much after heating, and an increase of from 20 to 50 per cent. after treatment with antiseptics), but the plants contain more nitrogen and phosphorus than those grown on untreated soils. The authors have studied exhaustively the effects of heating to 98° C., and of treatment with 4 per cent. of toluene on two different soils, one of which had been unmanured for many years, whilst the other had received occasional dressings of artificial manures since 1902. After treatment, the soils were moistened and kept in bottles stopped with cotton-wool, when it was found that in the partially sterilised soils there was a small immediate production of ammonia, then after a period of little change, a rapid production of ammonia, followed in turn by a period of slow production; in one month about 40 parts of nitrogen per million parts of soil had been converted into ammonia. In untreated soil there was no accumulation of ammonia, whilst when after the treatment with toluene, the latter was allowed to remain in the soil, there was only a slow production of ammonia. The production of ammonia is mainly due to the work of micro-organisms, the presence of moisture is essential, and in soil which has been completely sterilised by heating to 125° C., after the initial formation of ammonia due to the effect of heat, no further quantity is produced. The production of unstable nitrogen compounds (those decomposed by boiling with water and magnesia) is also accelerated by partial sterilisation, but that of humus is hardly affected. Nitrifying organisms are destroyed by the treatment, but if they are subsequently introduced, nitrification at once begins in the soils which have been treated with toluene, but not in those which have been heated. The amount of total nitrogen in the soil is not greatly affected by the treatment, the most significant effects of which are the increased production of ammonia, and the cessation of the nitrifying process. Bacteriological investigation showed that after the partially sterilised soils are moistened, bacteria multiply more rapidly and become much more numerous than in untreated soils, and this increase of bacteria proceeds *pari passu* with the increased production of ammonia. On adding a filtered extract containing bacteria from an untreated soil to a partially sterilised soil, there was an increase in the rate of production of ammonia and in the

number of bacteria, but no such increase was observed on adding the untreated soil itself to the partially sterilised soil, or on adding an extract of the treated soil to the untreated soil. The conclusion is drawn therefore that the untreated soil contains a factor, not bacterial, limiting the development of bacteria, this factor being rendered non-effective by heating and by treatment with toluene. It was found that large organisms—*protozoa*, etc.—are present in the untreated, but not in the partially sterilised soils; some of them are known to destroy bacteria, whilst all of them, by reason of their large size, must be severe competitors. It is these large organisms, which, in the opinion of the authors, limit the bacterial activity, and hence the fertility of untreated soils, a condition of equilibrium being established between the large organisms and the bacteria, beyond which the latter cannot multiply. On partial sterilisation the large organisms are killed, but the bacterial spores are not, and subsequently, in presence of moisture, the spores germinate, and the resulting bacteria multiply with great rapidity, not being subject to competition or to the attacks of their enemies. The new species of bacteria appear to be somewhat less active than the old races, but owing to their enormously greater numbers, there is a largely increased amount of ammonia produced.—A. S.

Calcium carbonate in soils; Determination of —. F. S. Marr. J. Agric. Science, 1909, 3, 155—160.

WHEN the amount of calcium carbonate in soils is determined by means of the amount of carbon dioxide evolved on boiling with dilute (1:1) sulphuric acid, abnormal results are obtained in the case of soils containing a high proportion of humus and having an acid reaction towards litmus. Experiments showed that this is due to the evolution of carbon dioxide from the organic matter of the soil by the action of boiling acid. Where the proportion of calcium carbonate is relatively high, the error introduced in this way is not very considerable, but the reverse is the case with soils, especially acid soils, containing less than 1 per cent. of calcium carbonate. The error can be reduced considerably by using weaker acid, for example 5 c.c. of strong hydrochloric acid (2 c.c. in the case of acid soils or those poor in calcium carbonate) to 100 c.c. of water; whilst by boiling under diminished pressure—for 20 minutes at about 50° C.—the calcium carbonate can be readily decomposed, with practically no evolution of carbon dioxide from the organic matter.—R. C. P.

Ammonium salts; Direct assimilation of —, by plants. H. B. Hutchinson and N. H. J. Miller. J. Agric. Science, 1909, 3, 179—194.

ADDITIONAL evidence of direct assimilation of ammonium salts by plants seems desirable, the question possessing a further interest in the case of leguminous plants, since whilst non-leguminous crops (whether able to assimilate ammonia or not) undoubtedly take up, under normal conditions, most of their nitrogen in the form of nitrates, there is no conclusive evidence as to the form of nitrogen appropriated by leguminous plants from their root nodules. The experiments described by the authors comprise sterilisation of seeds; observations of wheat grown in sand and water cultures; peas growing in water culture; and determination of percentage of nitrogen in the mixed herbage of the Rothamsted grass plots. Sterilisation was found to be best effected by treating the seeds in a warm mercuric chloride solution after removal of air-bubbles by means of a vacuum pump, and washing in sterilised water. The sterilised seeds were transferred to Petri dishes and a sterilised solution of agar was poured in; on solidification, the plates were inverted and placed in an incubator at 20° C. The plants having germinated and attained roots from 1 to 1½ inches length, in 3 or 4 days, were transferred to sterile wide test-tubes containing distilled water over which a plug of cotton wool had been placed. On this cotton wool the seedlings were allowed to grow until the shoot was approximately 3 inches long; and they were carried over to the culture bottles at the end of 7—8 days. The culture bottles used were three-necked Woulff's bottles provided with means of aerating the contents or introducing more water as required, while

maintaining sterile conditions. A series of Woullf's bottles were filled with a solution of non-nitrogenous salts, and nitrogen was added in the form of ammonium sulphate or sodium nitrate to the contents of some of the bottles. The contents of other bottles, again, were inoculated with nitrifying organisms. At the end of each experiment the dry matter of the plants, the total nitrogen in the crop and the nitrogen in the dry matter were tabulated for each bottle. From the results obtained, the authors deduce the following conclusions:—Agricultural plants of various kinds can produce normal growth when supplied with nitrogen in the form of ammonium salts under conditions which exclude the possibility of nitrification. Some plants grow equally well with ammonium salts or nitrate as source of nitrogen. Other plants, while assimilating ammoniacal nitrogen in the absence of nitrates, appear to prefer nitrates. It is less certain whether ammonium salts can ever produce better final results than nitrates, although there are indications that this may be the case. Lehmann (Biedermann's Centrallbl., 1875, 7, 403) found that whilst buckwheat failed to grow well with ammonium salts, maize did far better with this form of nitrogen than with nitrates during the first period of growth. Later on the nitrate plants recovered, and the ammonia plants became unhealthy. Kellner (Landw. Vers.-Stat., 1884, 30, 18) showed that paddy rice also prefers ammonium salts to nitrates to commence with, and that nitrates are better than ammonium salts for later growth. The best results of all were obtained when both forms of nitrogen were employed together. Plants which take up nitrogen exclusively in the form of ammonium salts generally contain very distinctly higher percentages of nitrogen than when supplied with nitrates. The question arises whether the high percentages of nitrogen in leguminous plants may be due to the nitrogen—or most of it—being assimilated in a form more suited to the rapid production of proteids than nitrate.—R. C. P.

Basic slag; Amount of free lime and the composition of the soluble phosphates in —. C. G. T. Morison. J. Agric. Science, 1909, 3, 161—170.

IN four samples of basic slag examined, the amount of lime present both as carbonate and oxide did not exceed $7\frac{1}{2}$ per cent. To determine what influence this amount of free lime had on the action of the solvents employed for determining the soluble phosphoric acid, a solution of carbon dioxide approximately saturated at atmospheric pressure, was first employed. With this solution five successive extractions were made on each of four samples of slag; the quantity of phosphoric acid dissolved in no case amounted to 70 per cent. of the total; and the proportion was very much the same for all the slags. It would appear, therefore, that the easily soluble constituent is the same in each case. Since, the first action of the carbon dioxide would almost certainly be the conversion of the free lime into carbonate, it would be expected that the slag containing the least quantity of free lime should show the highest percentage of phosphoric acid soluble at the first extraction. This is precisely what occurs. Thus owing to the small mass of carbon dioxide entering into the reaction, the extent to which the phosphates are attacked is masked by the presence of varying quantities of free lime. Hence it follows that although the natural solvent in the soil is carbon dioxide, it is not possible to make use of it as a solvent for the determination of soluble phosphoric acid in basic slag. Further determinations were made of the amount of phosphoric acid soluble in a 1 per cent. solution of citric acid. Here in presence of a much larger mass of acid, the small amount of lime has no longer any effect. In three out of the four slags as much as 93—97 per cent. of the total phosphoric acid present was dissolved. In the case of samples which gave the same percentage of total phosphoric acid soluble in carbon dioxide solution, the proportions soluble in citric acid were vastly different. Experiments showed that fine grinding of the slag resulted in a marked effect in the ease of treatment with citric acid, but not with carbon dioxide solution. Thus it would appear that there are at least two sources of phosphoric acid, one of which is very readily soluble in a weak acid like carbon dioxide, and one or

more which are attacked by citric acid to an extent depending on the amount of surface exposed. After discussing the evidence as to the composition of the soluble phosphoric compound in basic slag, the author states that his results, together with those of Stead (Proc. Cleveland Inst. of Engineers, 1895) show that this is not tetra-calcium phosphate, but a body in which the molecular ratio of phosphoric acid to lime is 1:5. This body is probably a substance of the composition $(\text{MO})_5\text{M}_2\text{O}_5\text{SiO}_2\text{I}_2\text{O}_5$, where M is calcium more or less replaced by ferrous iron, and M_2 is ferrous iron. This coincides with the opinion of Kroll (Stahl und Eisen, No. 19, May 6, 1908).—R.C.P.

Nitrates from the atmosphere; Manufacture of — by the electric arc —. Birkeland-Eyde process. S. Eyde. J. Soc. Arts, 1909, 57, 568—574.

THE author gives a description of the present method of carrying out the Birkeland-Eyde process for the utilisation of atmospheric nitrogen at Notodden, Norway (see also this J., 1906, 27, 567; 1907, 175, 290). There are 36 furnaces installed in a furnace-house constructed of masonry and iron; 32 of the furnaces are supplied from the Svalgfos and 4 from the Tinfos power station, the current being transmitted by means of 18 copper wires of 12 mm. diam. These wires pass to oil-cooled current-transformers in the furnace-house, each of which is furnished with an induction coil in order to regulate the supply of power to the furnaces. The furnaces are constructed of cast steel and iron, lined with fire-brick so as to form a circular reaction-chamber, into which the water-cooled electrodes of thick copper tubing project radially. The electrodes need renewal every third or fourth week, and the furnace lining every fourth or sixth month. The temperature of the arc flame is about 3500°C . The reaction-products leave the furnace at a temperature of $800^\circ\text{--}1000^\circ\text{C}$. and are led through two large pipes, 2 m. diam., to four boilers where their heat is utilised in generating steam, which is used among other purposes for evaporating the liquors obtained subsequently, and, in winter, for warming the buildings. The gases then pass through a large number of aluminium tubes, cooled by flowing water, into iron cylinders, lined with acid-proof stone, where the oxidation of the nitric oxide is completed, and next to the absorption towers, packed with quartz. The first set of towers is constructed of granite and fed with water, and the final tower or towers are built of wood and fed with a solution of soda. The passage of the gases from the furnaces through the towers is effected by means of aluminium centrifugal fans. In the granite towers the absorbing liquid is circulated until it contains 35 per cent. of nitric acid by volume, when it is run into granite cisterns, and thence into granite vats containing limestone. The resulting calcium nitrate solution is evaporated in a vacuum apparatus and then either run into thin iron drums, or into shallow iron pans. In the latter case the hard brittle mass obtained is broken, crushed, and packed into paper-lined casks. The sodium nitrite solution from the wooden towers is concentrated and allowed to crystallise.

Trials of the calcium nitrate as a fertiliser have been made in Norway, Sweden, France, Germany, Austria-Hungary, Italy, and the United Kingdom, and it is stated that for a given quantity of nitrogen, it is quite equal to sodium nitrate, and indeed superior on soils deficient in lime.—A. S.

Hydro-electric nitrogen works at Notodden, Norway. Engineering, Nov. 5, 1909.

DURING the first two years after the Birkeland-Eyde process (see preceding abstract) was started in Norway, the production of calcium nitrate amounted to about 2000 tons per annum, the whole of which, with the exception of a few trial lots sent to England, was disposed of in Scandinavia and on the Continent. Since the new factory at Notodden has been in operation the output has amounted to about 20,000 tons per annum. Vast resources in the way of water power have, however, now been acquired, and large works are being constructed where it will be possible to utilise the power of the famous

Rjukanfos, the energy of which is estimated at about 250,000 horse-power. When these works are finished it is expected that the annual output of calcium nitrate will be 100,000 tons, and this amount will probably increase rapidly as time goes on.

Bean cake and bean oil in Darien, Japan. See XII

Cultivation and uses of soya beans. Edic. See XVIII.4.

PATENT.

Nitrophosphate; Manufacture of manure from —. Le Nitrogène (Soc. Anon.). Fr. Pat. 402,688, May 4, 1909. Under Int. Conv., May 13 and June 20, 1908.

CALCIUM nitrophosphate, resulting from the action of nitric acid on tricalcium phosphate, is mixed with sufficient lime or calcium carbonate, to convert all the phosphoric acid present into its tricalcium salt, and the excess of water present is fixed by the addition of the requisite amount of quicklime or anhydrous calcium nitrate.—O. R.

Utilising waste substances in sugar cane plantations. Eng. Pat. 15,093. See XVI.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar in beetroots, beet juices, and sugar-house products; Influence of optically active non-sugar on the polarimetric results in the determination of —. O. E. Kopecky. Z. Zuckerind. Böhm., 1909, 34, 44—57, 99—115. (Compare Neumann, this J., 1906, 858.)

THE author's conclusions, based on observations extending over 6 years, are essentially as follows:—Differences exist between the direct polarisation and the Clerget value of beet juices and all sugar-house products: with beetroots, the amount of difference depends on climatic conditions during cultivation. The differences are caused by dextro-rotatory non-sugars (which do not consist only of raffinose, dextrose, or asparagin). These substances do not appear to be precipitable by basic lead acetate, but are removed or decomposed by barium hydroxide: they do not reduce Fehling's solution and are strongly melassagenic. Since the polarisation differences vary at different stages of manufacture, it may be supposed that the substances responsible for these differences belong to different groups of dextro-rotatory non-sugars, some being removed in the course of manufacture, whilst others pass more or less unchanged into the final products. Amongst the non-sugars which cause the polarisation differences, are compounds which yield mucic acid on oxidation with nitric acid: the nature of these compounds (or compound) has not, however, been determined. These polarisation differences sometimes cause the high polarisations and purities observed in beet juices, and the very high, untraceable loss of sugar which often occurs in sugar-houses. The use of the method of direct polarisation for factory control is not admissible in cases where polarisation differences occur. Hence, the factory products should always be examined for such polarisation differences, or else the Clerget method should be used exclusively: a new method which would be expeditious and trustworthy is much to be desired (compare Herles, this J., 1908, 1168; 1909, 32). Polarisation differences must be regarded as an abnormal phenomenon, unknown, or too small to be noticeable, in earlier years.—L. E.

Sulphurous acid [in sugar juices, etc.]; Conversion of — into sulphuric acid. Saillard and Wehrung. Suppl. à la Circul. hebdom. du Synd. des Fabr. de Sucre de France, 1909, No. 1057; Deutsche Zuckerind., 1909, 34, 843.

THE authors' experiments show that the oxidation of alkali sulphites to sulphates by the passage of a current of air through the solution, is retarded by the presence of various other substances (e.g., sucrose, invert sugar, the non-sugar of sugar-house products). In the case of sugar-house liquors, this oxidation is slowest in molasses. The tendency to oxidation increases with the content of air

in the gas used for sulphitation: trouble from this cause, however, is avoided by keeping the solutions alkaline and in a state of continuous motion, though it is preferable to use liquefied sulphur dioxide for sulphitation.—L. E.

[Cane] Molasses; Observations on —. H. A. Tempany. West Ind. Bull., 1909, 10, 139—142.

The froth fermentation of molasses.—The mode of frothing varies according to the nature of the product. With muscovado molasses, evolution of gas generally begins suddenly, ceasing in two or three days and sometimes in a few hours. With vacuum-pan molasses, evolution of gas generally continues for relatively long periods; it is almost invariably accompanied by the rising of a thick black scum, and always, apparently, by true fermentative changes. The author shows that the conditions giving rise to frothing cannot be communicated by inoculation; hence, frothing is not due to the action of organisms. He confirms the suggestion of Prinsen-Geerligs that frothing is due to decomposition of gummy substances (glucanates) formed by the action of lime on glucose. In vacuum-pan molasses, these gums, in course of time, generally rise to the surface in an impure state (the above-mentioned scum); they contain more ash than the molasses itself. It is suggested that these gums, being insoluble, may adversely affect the recovery of sugar from second massecuites by forming a coating on the small sugar crystals. This can be avoided to some extent by allowing the massecuite to stand undisturbed, when the gums rise to the surface. It is also suggested that the reason why juices from canes grown on certain highly calcareous soils are very liable to give extremely gummy products, is that the excess of lime in the soil increases the amount contained in the juice, and gives rise to additional formation of glucanates. *The souring of molasses.*—Solutions containing sucrose, small quantities of invert sugar and traces of plant food constituents, were inoculated with various kinds of fermenting molasses, and examined after the lapse of 5 weeks. Various organisms were found to develop (*Bacillus pasteurianus*, in two cases) and considerable quantities of reducing sugars were formed. The changes likely to occur in molasses as a result of organic activity are illustrated by examination of fermenting second vacuum-pan molasses. It was found that a decrease in the total sugar-content as well as a conversion of sucrose into reducing sugar, and a decrease in the ash-content occurred: the last is probably to be traced to glucanates being thrown out of solution. The changes in the composition of molasses, due to fermentation, are almost invariably accompanied by undesirable alterations in flavour. Muscovado molasses appears to be less liable to these changes than exhausted vacuum-pan molasses: since, at present, however, muscovado molasses is the most valuable product of the cane sugar industry, any risk of such changes should be carefully guarded against.—L. E.

Lactose; Action of calcium hydroxide on —. H. Kiliani. Ber., 1909, 42, 3903—3904.

CONTRARY to an earlier statement (Ber., 1885, 18, 631), the formation of iso-, meta-, and para-saccharinic acids by the action of calcium hydroxide on lactose, may be accelerated by heating, without any serious decrease in the yield. The modified method is as follows:—One part of lactose, dissolved in 9 parts of water, is treated with 0.2 part of calcium oxide (previously slaked and cooled), the whole being frequently shaken in a closed flask for 2 days. After a further period of 24 hours, the clear solution is poured into another flask, and the latter is immersed, to the level of its contents, in water. The water is heated to boiling as quickly as possible, and kept at this point for 10 hours. A bulky dark precipitate (about 45 grms. from 1 kilo. of lactose, containing uncrystallisable substances and much calcium carbonate) is formed; the dark-red filtrate from this precipitate is concentrated to 3 parts (referred to the lactose), whereupon calcium isosaccharinate, mixed with a little calcium carbonate, separates (1 kilo. of lactose

yielded 199 grms. of calcium isosaccharinate). The mother-liquor is decomposed with the calculated quantity of oxalic acid; the acid solution is evaporated to a thick syrup, the latter being extracted once with 4 volumes of a mixture of absolute alcohol (1 part) and dry ether (4 parts). The residual syrup is dissolved in about 10 parts of water and boiled with barium carbonate for 2 hours in a capacious flask. The solution thus obtained, is concentrated to a weight equal to that of the lactose employed, saturated with alcohol, seeded with barium meta- or para-saccharinate, and left to stand under conditions precluding evaporation. After 4 days, the author thus obtained 141 grms. of a mixture of barium salts from 1 kilo. of lactose. That this mixture consisted of meta- and para-saccharinate was proved by decomposing it with the requisite quantity of sulphuric acid, evaporating the solution to a syrup, whereupon the metasaccharin crystallised out, and converting the residue into the brucine salt of parasaccharinic acid (Ber., 1909, 42, 2609). Since the constitutions of the saccharinic acids are established, the author recommends the following names for them:—*a*-Methylol- α , γ , δ -triolpentane-acid for isosaccharinic acid, α , γ , δ -tetrolhexane-acid for metasaccharinic acid, α -ethyl (ω -ol)- α , β , γ -triolbutane-acid for parasaccharinic acid, and α -methyl-tetrolpentane-acid for Peligot's saccharinic acid.—L. E.

Adsorption of certain bases by soluble starch. A. Reyckler. Bull. Soc. Chim. Belg., 1909, 23, 378—383.

THE author subjects the results of Fouard (this J., 1907, 832; 1908, 238, 635, 1215; 1909, 433, 898) to mathematical analysis and criticism and arrives at the conclusion that, according to Fouard's figures, the reactions between soluble starch and bases take place according to Guldberg and Waage's Law of mass action, and are therefore chemical in nature. He considers it probable that starch forms compounds similar in character to alcoholates.

—E. F.

PATENTS.

Waste substances in sugar cane plantations; Utilisation of — and the manufacture of a manure therefrom. W. P. Thompson, London. From J. F. J. Van der Kolk, Java. Eng. Pat. 15,093, June 28, 1909.

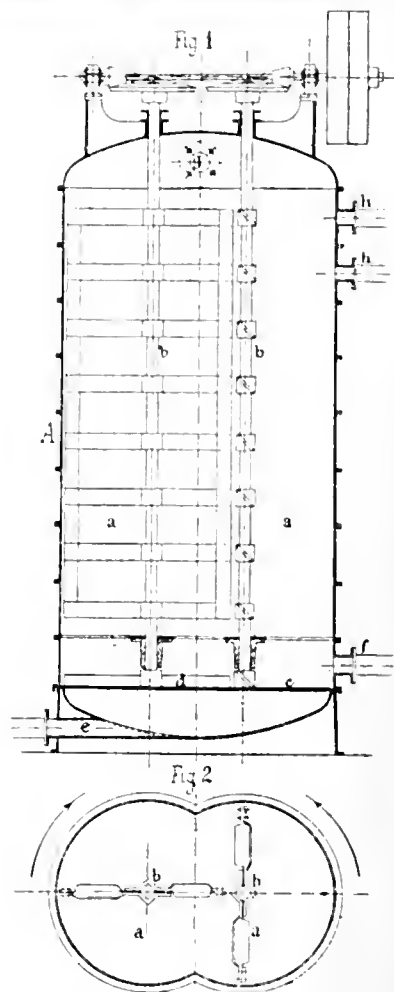
MOLASSES is mixed with the ash of cane bagasse, filter-press mud, and finely ground raw bagasse so as to form a practically dry powder which may be used as a fertiliser for sugar canes.—W. P. S.

Sugar house and distillery; Process for charging the diffusers used in the —. L. A. Lambert. Second Addition, dated Aug. 20, 1908, to Fr. Pat. 396,628, Jan. 31, 1908 (this J., 1909, 617, 898).

CLAIM having been made for the application of the process described in the original patent to a circular battery, that claim is now extended to a line diffusion battery ("batterie en ligne"). The employment of a pump for transferring the mixture of cosettes and juice to the diffuser which is to be charged, is avoided by placing the vessel, in which the mixing is effected, above the battery.—L. E.

Beetroot juice; Process and apparatus for mixing, double extraction, and progressive and continuous exhaustion especially applicable to —. E. Viez. Fr. Pat. 401,759, Jan. 29, 1909.

THE material (e.g., beetroot pulp or cosettes) is mixed with the solvent (e.g., beetroot juice, water, or vinasse), and the whole is pumped through the pipe, *f*, into the lower part of the vessel, *A*. This vessel consists of two juxtaposed vertical columns, *a*, and is provided with a perforated false bottom, *c*. Part of the liquor flows through the false bottom to the outlet, *e*, below; the remainder, with the solid matter, passes upwards, meeting a descending stream of solvent introduced through the pipes, *h*. Extraction is facilitated by the action of stirrers, *b*, with inclined blades, placed in each column; the scrapers, *d*, mounted on the same axes as the stirring blades, scrape the false bottom, *c*. The exhausted material is evacuated through



the outlet, *g*. If desired, the material to be treated may be introduced at the upper part of the vessel and evacuated below, the solvent then being introduced at the lower part and the juice withdrawn above.—L. E.

Sugar syrups; Process and apparatus for direct conversion of — into sugars ready for consumption and of pleasant flavour. C. Grière. Fr. Pat. 402,305, Apr. 22, 1909. Under Int. Conv., Apr. 23, 1908.

A SUGAR solution, preferably of high purity, is rapidly evaporated, at first in a vacuum and then in air, the solution being protected from the air by a stratum of vapour. Evaporation is continued until a temperature of 120°—130° C. is attained. The brief action of a high temperature (about 125° C.) imparts a flavour to beet sugar similar to that of cane sugar; in the case of cane sugar the temperature should not be raised to so high a point. The syrup is now treated with a quantity (amounting to 50 or 100 per cent. of the syrup, or even more) of fine sugar, similar in quality to that of the product desired, in a malaxeur. The pasty crystalline mass thus obtained is transferred to a screw conveyor consisting of a closed vessel through which passes a shaft carrying a helix and stirring arms; the mass is submitted to the action of a current of cold air passing through the conveyor, and leaves the conveyor in the form of a powder which is subsequently sifted. Instead of adding sugar to the evaporated solution, the latter may be further evaporated in a vacuum, or successively in a vacuum and in air; or again, a small quantity of sugar may be added to the evaporated solution, the mixture then being submitted to the action of a partial vacuum.

—L. E.

Milk-sugar [lucose] from whey; Process of extracting — J. A. R. Nilsson and S. A. Hellqvist, Björketorp, Sweden. U.S. Pat. 938,017, Oct. 26, 1909.

AFTER separating the greater part of the albuminous substances by precipitation and filtration, the whey is concentrated to a sp. gr. of about 1.11. The solution is again treated with a precipitant and filtered to remove the remainder of albuminous substances and other impurities, and then concentrated until crystallisation begins, the refined lactose being finally extracted.—L. E.

Starch; Manufacture of soluble — Administration des Mines de Bouxwiller. Fr. Pat. 402,060, April 15, 1909.

SEE Eng. Pat. 9370 of 1909; this J., 1909, 950.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Beers; The quantity of sulphurous acid in non-sulphited — Bonn. Ann. des Falsific., 1909, 2, 44—45.

IN view of the fact that, by a decree dated July 28, 1908, the sale of beer containing more than 50 mgrms. of sulphur dioxide is prohibited in France, the author has examined a number of samples of beer to which neither sulphurous acid nor sulphites had been added, in order to ascertain what quantities, if any, of sulphurous acid exist normally in such beers. Fifteen samples were analysed and the amount of sulphur dioxide found varied from 12.8 to 25.6 mgrms. per litre. This sulphur dioxide was evidently derived from the raw materials, and the question is raised whether these figures should not be taken into account in calculating the quantity of the preservative actually added to a beer.—W. P. S.

Wines of Loire-Inferieure; Free tartaric acid in — A. and P. Audonard. Ann. des Falsific., 1909, 2, 267—274.

IN 1906 and 1907 the proportion of free tartaric acid in certain wines from Loire-Inferieure exceeded 1 gm. per litre, and in the wine of Gros-Plant grapes, reached 3 to 4 grms. per litre. Since the same kind of vine produces, in the same year, in different places, grapes containing different amounts of free tartaric acid, it is probable that the degree of maturity of the fruit has some influence upon the acidity, although this factor is not of very great importance. Any correlation between the excess of free tartaric acid and exhaustion of the soil of potassium is excluded by the fact that the soil of Loire-Inferieure is particularly rich in that element. With regard to the possibility of the later ripening of the vine Gros-Plant compared with Muscatel, and the consequent exposure of the fruit to lower temperatures being the cause, it is pointed out that other vines (e.g., Gros-Lot and Cinq-Mars) also ripen later than Muscatel vines, but that their grapes do not contain a larger proportion of free tartaric acid. The chief factor appears to be inherent in the nature of the vine. In any case, the authors' results show the risk of relying upon calculations based upon the excess of free tartaric acid as evidence of the watering of a wine, without knowing more of its origin. In the author's opinion the composition of the principal wines of all the wine-producing districts ought to be determined every year, so as to obtain values upon which commercial transactions might be based.—C. A. M.

Kirsch liqueurs; Nature of the cyanogen compounds contained in — X. Roques and L. Lévy. Ann. des Falsific., 1909, 2, 196—200.

IN order to ascertain in what form hydrocyanic acid exists in Kirsch liqueurs, the authors made a number of comparative distillations of both old and new liqueurs and of a solution of hydrocyanic acid in 50 per cent. alcohol. A litre of each was distilled and nine fractions of 100 c.c. were collected in each case, the hydrocyanic acid in them being then determined by titration with $N/20$

solution of silver nitrate in the presence of potassium iodide and ammonia. The samples were also saponified with sodium hydroxide and then subjected to similar distillation after acidifying with phosphoric acid. On direct distillation, two freshly-prepared samples of Kirsch liqueur yielded quantities of hydrocyanic acid corresponding with 15.95 and 22.0 c.c. of $N/20$ silver nitrate, respectively, whilst samples which were several years old, yielded quantities of hydrocyanic acid requiring from 6.80 to 17.25 c.c. After saponification, the distillates contained slightly more hydrocyanic acid, the increase varying from 0.05 to 2.75, as expressed in c.c. of the silver nitrate solution. The rate of distillation of the hydrocyanic acid, as shown by the quantities of the latter in the fractions, was different, both in the case of old and new liqueurs, from that of the alcoholic hydrocyanic acid solution, but after saponification, the rate was approximately the same in all three. The authors conclude that the hydrocyanic acid is present in the liqueurs partly in the free state and partly combined with fatty substances, as the latter were noticed in some of the distillates. The acid does not appear to be present as an ethyl ester.—W. P. S.

Treatment of plants with arsenic salts and the pure food supply. Porchet. See XVIII.4.

PATENTS.

Beer and other fermented liquors; Manufacture of — G. W. J. Allen, Bristol. Eng. Pat. 11,277, May 12, 1909.

THE beer, or other fermented liquor, is subjected, during fermentation, to the action of an electric current of high voltage (say 120,000) and low ampérage (say 24 or 25 millampères) derived from the secondary of an induction coil, provided with an interrupter or trembler. Fermentation can be stopped in this way at any desired period, and the alcoholic content, flavour, and quality, thus regulated.—L. E.

Alcohol; Process for combined denaturing and carburetting of — A. J. Durnpt. First Addition, dated Aug. 27, 1908, to Fr. Pat. 368,713, Aug. 8, 1906 (this J., 1907, 29).

THE following improved process is claimed:—Alcohol (of 95 per cent. concentration), methylvated to the extent of 2 or 10 per cent., is distilled with dehydrated coal tar oil. Part of the distillate is reserved, the remainder being mixed, in suitable proportions, with benzol (distilling between 81° and 102° C.), petroleum ether, and crude petroleum. A single distillate may be obtained from this mixture, consisting of a carburetted and denatured alcohol which does not congeal and which is suitable for motors. Again, the mixture may be fractionated into an alcohol B (carburetted to the extent of 45 per cent.) distilling below 77°—78° C., and an alcohol A (carburetted to the extent of 20 per cent.) distilling from 77°—78° to 80°—81° C. These two fractions constitute about two-thirds and one-third respectively, of the whole distillate. The freezing point of alcohol B may be lowered by adding to 100 volumes, 25 volumes of the reserved part of the first distillate, in the cold; this operation reduces the degree of carburetting to 36 per cent. The alcohol A may be used for various purposes, such as denaturation, illumination, heating.—L. E.

Musts; Apparatus for continuous desulphitation and concentration of — J. Sicard and F. P. Vidal. Fr. Pat. 402,328, Apr. 23, 1909.

THE must passes from a constant level reservoir to a regenerator, and thence through a pipe from which it is discharged into the centre of a large dish; the exit of this pipe is provided with a cock which is governed by a float, whereby the level of the liquid in the dish is kept constant. The dish is provided with a helicoidal partition and the passage formed by the latter contains a worm with an inlet at the periphery and an outlet at the centre of the dish. Vapour is passed through this worm from a boiler; its return to the boiler is insured by the elevated position of the dish. The must passes

from the centre of the dish through the passage formed by the partition and undergoes desulphitation; if the rate of circulation is slow, the must becomes concentrated. The must is evacuated through a pipe at the periphery of the dish and passes to a cooling worm contained in the above-mentioned regenerator.—L. E.

Alcoholic liquors; Process and apparatus for maturing and purifying —. A. Haack, Jonzac, France. Eng. Pats. 5790, March 10, 1909, Under Int. Conv., March 11, 1908, and 6397, March 17, 1909, Under Int. Conv., March 21, 1908.

SEE FR. Pat. 389,333 of 1908 and Addition thereto; this J., 1908, 994 and 1036.—T. F. B.

Kreuss; Process for the production of —. A. Eisenberg, St. Petersburg. U.S. Pat. 938,374, Oct. 26, 1909.

SEE Eng. Pat. 20,978 of 1908; this J., 1909, 901.—T. F. B.

Charging the diffusers used in the sugar-house and distillery. Addition to Fr. Pat. 396,628. See XVI.

Obtaining alcohol from waste liquors of manufacture of wood pulp. Fr. Pat. 402,331. See XIX.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Casein in milk; Rapid method of determining —. T. B. Robertson. J. Ind. and Eng. Chem., 1909, 1, 723—725.

THE author has previously shown that the percentage of casein in a solution can be determined by aid of the formula: $c = \frac{n - n_1}{0.00152}$, where c is the percentage of casein,

n is the refractive index of the solution, and n_1 is a constant which depends upon the concentration and nature of the alkaline (or acid) solution used as solvent, being 1.33444 for N/10 sodium hydroxide solution at 20° C. The method may be applied to the determination of casein in milk. 50 c.c. of the sample are diluted to 250 c.c., and 75 c.c. of N/10 acetic acid are added slowly, with continuous stirring. After washing the precipitate by decantation, it is collected on a 15 cm. S. and S. No. 589 "white band" paper, and after draining for 1 hour, the paper and precipitate are macerated in 100 c.c. of N/10 sodium hydroxide until the paper is converted into a fine pulp and the casein completely dissolved. The solution is then filtered, and the refractive index of the filtrate determined at 20° C. with a Pulfrich refractometer. The number of grams of casein in the 50 c.c. of milk is calculated from the formula, $n - 1.33444 - \frac{0.00152}{c}$, where n is the refractive index of the solution.

In order to overcome the slight error due to the water associated with the filter and precipitate, the final solution, before filtration, may be diluted to an accurately measured volume with N/10 sodium hydroxide. If the refractive index be determined at temperatures between 10° and 20° C., 0.00007 must be added to the value of the constant n_1 (1.33444) for every degree by which the temperature is less than 20° C., whilst for temperatures between 20° and 30° C., 0.001 must be subtracted for every degree above 20° C.—A. S.

Milk; Preservatives in —. Times, Nov. 10, 1909. [T.R.]

THE National Pure Food Association recently agreed to a resolution regretting the decision of the Local Government Board to allow an increased amount of boric acid in milk during the summer months. In reply the Local Government Board states that it neither allows nor

encourages the use of any boric acid in milk, and have not come to any such decision as that referred to in the resolution of the Association.

Butter; Quantity of water in — from Northern France. L. Vuallart. Ann. des Falsific., 1909, 2, 41—44.

THE author has determined the quantity of water in 111 samples of butter obtained from farmers and factories in some of the Northern Departments of France. Eighty-six of these samples contained less than 15 per cent. of water; eleven contained from 15 to 16 per cent.; ten from 16 to 18 per cent.; two from 18 to 19 per cent.; and the remaining two samples contained 20.5 and 23.3 per cent., respectively. The two latter samples exhibited a watery appearance when cut, but had not the pasty, emulsified consistence of butters intentionally mixed with an excess of water. The undue proportion of water in the butters was apparently due to careless or negligent working.—W. P. S.

Flour bleaching, its relation to bread production and nutrition. J. A. Wesener and G. L. Teller. J. Ind. and Eng. Chem., 1909, 1, 700—711.

A DISCUSSION of the question of the effect of bleaching on the quality of flour, in which the authors bring forward evidence against the view that bleaching is detrimental (compare Ladd, this J., 1909, 377). Their conclusion is that the effect of bleaching, when properly carried out, is to destroy a small amount of yellow colouring matter, which in itself is of no value as a food material. It is further claimed that bleaching tends to make more pronounced any defects in the flour, and that commercially bleached flours do not contain any substance that, in the minute quantities in which it is present, has in any way an injurious effect on the bread-making qualities of the flour, or is in any way poisonous, or has any toxicological or preservative action, or any action which is prejudicial to digestion or nutrition. (See also this J., 1906, 194; 1908, 136; 1909, 669, 737.)—A. S.

Soya beans; Cultivation and uses of —. E. S. Edie. Liverpool University Inst. of Commercial Research in the Tropics, Bull. No. 1, Vol. 1, 1909.

IN the Southern States of N. America the soya plant is grown for fodder, for it has been found that with an addition thereof to their food, cows give a greater yield of milk of better quality. In Japan a liquid resembling cows' milk is prepared from soya beans, and when condensed *in vacuo*, after the addition of cane sugar and potassium phosphate, gives a product resembling condensed milk. This preparation has considerable nutritive value, but is unsuitable for children. The bean meal is made into biscuits, and in some parts of Europe is now used instead of rye meal for bread. In England it is used in admixture with flour in making brown bread. Experiments carried out at Cirencester showed that the butter from cows fed upon soya bean cake had not quite so good a flavour as that from cows fed upon decorticated cotton cake, but that the yield of butter from the milk and percentage of butter fat were slightly higher. The general conclusion was that for winter feeding soya beans would be the better food. In the East, and especially on sugar plantations in Southern China, the oil cake is used as a fertiliser. As yet, the cultivation of soya beans is restricted to the Far East, and to some of the N. American States. It could probably be successfully grown in most of the British African Colonies. The most favourable soil is a medium one fairly rich in phosphoric acid, potassium and calcium, and on good land the yield may reach 100 bushels of seed and 9 to 12 tons of fresh fodder per acre. Where the beans are the chief object the best method is to grow the plant between rows of maize or other crops. There are over 20 varieties of soya beans (see Bull. No. 98, Bureau Plant Ind., U.S. Dept. Agriculture), but the chief variety known in Europe is yellow and resembles a pea in appearance. Three grades of these beans are imported, which are shipped at: (1), Dalny; (2), Vladivostok; and (3),

Hankow, respectively. Analyses of 5 distinct varieties used as food by the Chinese in Liverpool were made by the author with the following results:—

Sample.	Moisture.	Ash.	Oil.	Albumi- noids.	Carbo- hydrates.	Woody fibre.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
1	11.17	4.36	16.76	39.75	22.30	—
2	9.91	5.31	16.45	40.46	21.45	5.80
3	10.62	4.51	18.11	37.07	24.46	5.23
4	—	—	—	35.42	24.58	—

A sample of the beans grown in W. Africa from seed sent out this year gave the following results:—Moisture, 10.52; ash, 4.62; oil, 17.26; albuminoids, 36.05; carbohydrates, 26.16; and woody fibre, 5.39 per cent. These figures indicate that, in the first season, at all events, the soya bean did not deteriorate in W. Africa. The plants also matured rapidly.—C. A. M.

Alimentary products; The colouring of —. Colours allowed to be used in France. F. Muttetlet. Ann. des Falsific. 1909, 2, 26—38; 243—251.

By a decree issued by the French Minister of the Interior and dated August 4, 1908, certain dyestuffs may be employed for colouring articles of food, beverages, etc. These colours are as follows:—Eosine (tetrabromofluoresceine); Erythrosine (methyl and ethyl derivatives of Eosine); Bengal-phloxine Rose (iodine and bromine derivatives of chlorinated Fluoresceine); Bordeaux-ponceau Reds (prepared by the action of sulphonic derivatives of naphthol on diazoxylenes); Acid Yellow, Golden Yellow (sulphonic derivatives of naphthol); Acid Magenta (free from arsenic and prepared by Couper's process); Lyons Blue, Light Blue, Couper Blue (derivatives of triphenylrosaniline or of diphenylamine); Malachite Green (tetramethyldiaminotriphenylcarbinol hydrochloride); greens made of mixtures of the above-mentioned blues and yellows; Paris Violet (penta- and hexa-methyl-pararosanine hydrochlorides); and Methylaniline Violet. The author considers that other dyestuffs might be admitted as coming under the above nomenclature, and suggests that the list might be enlarged so as to also include:—Rhodamine B (diethylmetaminophenolphthalein); Bordeaux S (naphthionic-azo- β -naphtholdisulphonic acid R); New Cocaine (naphthionic-azo- β -naphtholdisulphonic acid G); Solid Red E (naphthionic-azo- β -naphtholmonosulphonic acid S); Bordeaux G (aminoazotoluenesulpho-azo- β -naphtholmonosulphonic acid S); Ponceau 2R (metaxylidine-azo- β -naphtholdisulphonic acid R); Xylidine Scarlet (xylidine-azo- β -naphtholmonosulphonic acid S); Acid Magenta (magenta-trisulphonic acid); Magenta (rosaniline and para-rosaniline hydrochlorides); Orange I (sulphanilic-azo- α -naphthol); Naphthol Yellow S (dinitro- α -naphtholsulphonic acid); Chrysoine (sulphanilic-azo-resorcinol); Auramine O (diminotetramethyldiaminodiphenylmethane hydrochloride); Acid Green (diethyldibenzylaminotriphenylcarbinoltrisulphonic acid); Patent Blue (meta-hydroxytetra-ethyl-diaminotriphenylcarbinoldisulphonic acid); and Couper's Blacks (sulphonated indolines and nigrosines). The use of Martins Yellow (dinitro- α -naphthol) and a Malachite Green (tetramethyldiaminotriphenylcarbinol picrate) is not permitted.—W. P. S.

Arsenic salts; Treatment of plants with —, and the pure food supply. F. Porchet. Agrik.-Chem. Sektion des Schweiz. Ver. anal. Chem., Sept., 1909. Chem.-Zeit., 1909, 33, 1128—1129.

The use of salts of arsenic in solution as insecticides for fruit trees and vines is widespread, and the question arises whether the quantity of arsenic used is sufficient to harm the health of the consumer of the fruit, etc. Experiments were made on pear trees with and without treatment with lead arsenate, also examinations of fruit juices from plants treated with Schweinfurt green. The analyses were made by the Marsh-Strzyzowski method (Oesterr. Chem.-Zeit., 1904, [4]). It was found that traces

of arsenic are naturally present in the fruits, wines, and especially in the wine-lees, but that these are noticeably increased by treatment of the trees with arsenic compounds. The amounts found were 0.2—0.3 mgrm. per kilo. of fruit, mostly in the juice. In the case of the grape, the must contained only very small traces of arsenic, from nil up to 0.1 mgrm. per litre, whilst the lees contained 3—20 mgrms. of arsenic trioxide per kilo. There is no danger to health therefore in the use of the arsenic treatment process.—J. H. J.

Adulteration of edible oil with mineral oil. Roumet. See XVIII.A.

PATENTS.

Substances, animal and vegetable; Process of preserving — [by means of liquid nitrogen]. E. Cadoret. Fr. Pat. 402,623, Sept. 2, 1908.

ANIMAL or vegetable substances are preserved by treating them, in any suitable way, with liquid nitrogen either concentrated or diluted.—W. P. S.

Alimentary substance consisting chiefly of glutamic acid; Method of manufacturing an —. K. Ikeda and S. Suzuki. Fr. Pat. 402,630, May 1, 1909.

ALBUMINOUS substances, preferably of vegetable origin, are digested with an excess of either hydrochloric acid or sulphuric acid, to which may be added metallic iron or tin, sulphurous acid, etc., in order to increase the hydrolytic action. The acid used is then removed as far as possible, the solution is neutralised by the addition of sodium hydroxide, and evaporated to a syrupy consistence, or to dryness. The neutralised solution may also be subjected to electrolysis, the anode used being made of iron, aluminium, or zinc. A glutamate of these metals is thus obtained which may be afterwards converted into the sodium salt. This treatment is useful in order to remove objectionable odours and foreign substances from the product.—W. P. S.

Wheat flour; Milling and conditioning —. H. Simon, Ltd. Fr. Pat. 402,755, May 6, 1909. Under Int. Conv., May 7, 1908.

SEE Eng. Pat. 9946 of 1908; this J., 1909, 1059.—T. F. B.

(B.)—SANITATION; WATER PURIFICATION.

PATENTS.

Waters; Purification of potable — [neutralisation of acidity]. F. Candy, London. Eng. Pat. 24,430, Nov. 13, 1908.

THE object of the invention is to neutralise the acidity of moorland and upland waters in order to prevent the solvent action of these waters on lead pipes. For this purpose the water is passed through a bed or layer consisting of fragments of magnesium oxide, or a mixture of the latter with ordinary filtering material. It is preferable to filter the water through an ordinary filter-bed before passing it through the magnesium oxide layer. The magnesium oxide is obtained by thoroughly igniting magnesite, and the size of the fragments used and the depth of the layer will depend on the acidity of the water, the rate of flow, and the hardness, if any, that it is desired to impart to the water.—W. P. S.

Water; Purification of —. F. Candy, London. Eng. Pat. 4212, Feb. 20, 1909.

THE free or available chlorine remaining in water that has been treated with chlorine or substances containing available chlorine, is removed by passing the water through a bed or layer of fragments of coke, or other carbonaceous matter, or by agitating the water with powdered coke or other powdered carbonaceous material, and then removing the particles of dechlorinating agent by filtration or deposition.—L. E.

Water; Process of preparing potable — J. T. Harris, New York. U.S. Pat. 937,210, Oct. 19, 1909.

THE water is subjected to electrolysis in the presence of iron and aluminium hydroxides and a compound of copper. The anodes employed consist of iron and aluminium, whilst the cathode is made of copper.—W. P. S.

Water and other liquids; Apparatus for purifying — E. Gobbi. Second Addition, dated April 19, 1909, to Fr. Pat. 359,128, Jan. 11, 1905.

RIDGES or projections are provided on one of the surfaces of the plates employed in the filtering apparatus described in the main patent (see Eng. Pat. 83 of 1906; this J., 1906, 802); interstices of any desired section are thus produced between the plates.—W. P. S.

Trade effluents; Process and apparatus for purifying — by decantation. V. Antoine. First Addition, dated April 2, 1909, to Fr. Pat. 374,040, Jan. 29, 1907 (this J., 1907, 775).

MODIFICATIONS in the apparatus described in the original patent (*loc. cit.*) are given. The stem of the funnel through which the water is introduced increases in diameter as it descends towards the bottom of the conical tank and a pipe, gradually decreasing in diameter, passes down the centre of the stem of the funnel and ends just above the sludge outlet. A short, cone-shaped device may be fitted concentrically at the bottom of the tank in order to aid in the separation of the suspended matters, this object being also facilitated by the shape of the funnel-stem. Other forms of the apparatus are described, in one of which the inlet funnel carrying the aluminium sulphate is placed outside the tank, the stem of the funnel entering the side of the tank towards the bottom of the latter.—W. P. S.

Sewage; trade effluents, etc.; Process for the automatic sterilisation of — F. Duret. Fr. Pat. 402,005, April 14, 1909.

THE sewage or other liquid is conducted into the bottom of a closed chamber where it is subjected to anaerobic fermentation. It then passes from the top of this chamber to the bottom of a second chamber to which air is admitted, and thence to a third chamber containing a siphon and a ball-float which operates an automatic device for the introduction of the sterilising agent. The siphon delivers the treated liquid into a series of mixing chambers, pipes connecting the bottom of one chamber with the top of the next, and so on. Trade effluents need not be subjected to the preliminary anaerobic and aerobic fermentation, and the composition of the sterilising agent may be altered as desired.—W. P. S.

Filters; Process and apparatus for cleansing — A. Endler. Fr. Pat. 402,277, April 21, 1909.

THE process relates to the cleansing of solid filters made of porous porcelain, clay, etc., such as the Berkefeld filter-cylinders, and for this purpose the jacket surrounding the filter-cylinder is partially filled with granular material. The jacket is provided with a double bottom so that compressed air may be admitted to the jacket. This air agitates the granular matter and causes the removal of the solid substances adhering to the sides of the cylinder. Compressed air may also be admitted to the interior of the cylinders. Where several of the filter cylinders are fitted in one outer vessel, each cylinder may be enclosed in a separate jacket which is partially filled with the granular matter, the necessary compressed air pipes being fitted to each.—W. P. S.

Water; Compound for purifying — C. W. Schultze, Assignor to The Clarine Co., Buffalo, N.Y. U.S. Pat. 935,695, Oct. 5, 1909.

See Fr. Pat. 400,525 of 1909; this J., 1909, 1060.—W. P. S.

Water-purifying apparatus. H. Reisert, Cologne, Germany. U.S. Pat. 938,075, Oct. 26, 1909.

SEE Eng. Pat. 18,355 of 1908; this J., 1909, 957.—T. F. B.

Gas-producer for destruction of refuse, etc. Fr. Pat. 401,859. See 11.

(C.)—DISINFECTANTS.

Bordeaux spraying. S. U. Pickering. J. Agric. Science, 1909, 3, 171—178.

THE author has pointed out previously (this J., 1907, 1291) that the fungicidal action of Bordeaux mixture is due to the normal copper sulphate formed by the action of carbon dioxide on the basic sulphate, and hence that the mixture (Woburn Bordeaux) produced by adding only sufficient lime to precipitate all the copper, and containing the substance, $4\text{CuO} \cdot \text{SO}_3$, should be $2\frac{1}{2}$ times as effective as ordinary Bordeaux mixture obtained with equal parts of lime and copper sulphate, and containing the compound, $10\text{CuO} \cdot \text{SO}_3$, with excess of lime. Direct determinations of the copper sulphate recoverable by the action of carbon dioxide prove the existence of secondary reactions, which greatly increase the relative efficacy of the Woburn mixture. With Woburn Bordeaux, 25 per cent. of copper sulphate was produced in two hours, and a total of 40 per cent. was reached in two days. With ordinary Bordeaux, in one experiment 3.7, and in another 2.7 per cent. was produced, and this only after a delay of from 2 to 24 hours. Hence it results that $\frac{1}{4}$ lb. of copper sulphate per 100 gallons, in the form of Woburn Bordeaux, would be as efficient as 16 lb. in the form of the ordinary Bordeaux. Dried Bordeaux, though largely used as a labour-saving substitute, is much inferior to the Woburn Bordeaux; less than 4 per cent. of the copper sulphate being recoverable, or a little more than in the ordinary mixture. In practical spraying, the efficiency of the dried Bordeaux is generally regarded as somewhat less than that of the ordinary mixture. The addition of treacle to Bordeaux mixtures has been advocated as a means of getting part of the copper into solution before use, and also for increasing the adhesion to the leaves. Experiments show an increase in the amount of copper rendered soluble, and a quickening of the action; the author questions whether this acceleration of action would be beneficial. Moreover, with ordinary Bordeaux and treacle, decomposition takes place, with precipitation of cuprous oxide, thus robbing the mixture of its soluble copper. A mixture of copper sulphate and sodium carbonate, known as "Soda Bordeaux," has been suggested as a substitute for ordinary Bordeaux, but it cannot be regarded as an efficient fungicide, and reports as to its action seem generally to be unfavourable.

—R. C. P.

Sulphur in alkali polysulphides; Determination of — C. Dusserre and V. Vuilleumier. Agrik.-chem. Sektion des Schweiz. Ver. anal. Chem., Sept., 1909. Chem.-Zeit., 1909, 33, 1129.

THE use of alkali polysulphides in the treatment of vine disease is extending. Their market value depends upon their content of sulphur as polysulphide, which does not lend itself to easy estimation. The authors have worked out a new method: 10 grms. of the substance are dissolved in 500 c.c. of water and the solution filtered; 5 c.c. of this solution are placed in a flask with 30—40 c.c. of concentrated ammonia and diluted with an equal bulk of water. On gradually heating to boiling and adding $N/10$ silver nitrate drop by drop, a colloidal solution is formed and the liquid remains transparent. On addition of more silver nitrate and stirring the boiling solution, a black precipitate is suddenly formed and the supernatant liquid becomes colourless. The number of c.c. of silver nitrate used multiplied by 1.6 gives the percentage of sulphur as polysulphide in the sample. Figures are quoted showing the close agreement between this process and the more exact but longer cadmium process on polysulphides from various sources.—J. H. J.

Tobacco-juices; Determination of nicotine in concentrated — F. Porehet and F. Régis. Agrik.-chem. Sektion des Schweiz. Ver. anal. Chem., Sept., 1909. Chem.-Zeit., 1909, 33, 1128.

THE methods of Schloesing (ether extraction), Biel (steam extraction), and Toth (absorption of ammonia and

separation by a mixture of ether and petroleum spirit) for the estimation of the nicotine in tobacco-juice were compared as to their suitability for use in the valuation of juices used as insecticides in vineyards. Schloesing's method gave much lower values than the other two, but these also varied slightly according to the nature of the juices. In duplicate analyses of the same samples containing from 4–10 per cent. of nicotine, the greatest difference was 1 per cent. with Bied's method and 0.8 per cent. with Toth's. The latter method is recommended as being quickly carried out and sufficiently accurate for technical purposes.—J. H. J.

Treatment of plants with arsenic salts and the pure food supply. Porchet. See XVIII. A.

PATENTS.

Product for the treatment of cryptogamous diseases of plants and especially of mildew, and process of manufacturing the same. "Cuprosa," Soc. Anon. Suisse pour la Production du Sulfate de Cuivre. First Addition, dated April 22, 1909, to Fr. Pat. 375,849, Mar. 18, 1907 (this J., 1907, 987).

OXYCHLORIDE of copper is intimately mixed with sulphur or inert material, such as powdered talc, plaster, etc., and the mixture, which should contain not less than 5 per cent. of copper, is applied to plants in the dry state by the usual means.—F. SOBX.

Cerium compounds of phenols; Process for preparing —. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 214,782, Feb. 21, 1907.

COMPOUNDS of cerium with phenols and their derivatives are produced by the action of cerium salts on the phenols, e.g. in presence of alkali. The preparation of the compounds of phenol, guaiacol, tri-iodo-*m*-cresol, and β -naphthol are described. The products are stated to possess powerful disinfectant properties, and to be less irritating and less poisonous than the phenols themselves.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Viscose; Improvement in the preparation of —. F. Todtenhaupt. Chem.-Zeit., 1909, 33, 1149.

THE author notes that little variation of the originally patented process of making viscose (Eng. Pat. 8700 of 1892) has resulted from later experiences. Steam (Eng. Pat. 7023 of 1903) closely follows the details set forth in the original patent. These conditions are: 100 parts of cellulose are treated with a 17.7 per cent. solution of caustic soda for 24 hours, the excess of soda removed by pressing until the total weight is three times the original, and after keeping in a closed vessel for 48 hours, 75 parts of carbon bisulphide are added, and the mixture stirred for 5 hours. The product thus obtained after the spontaneous evaporation of the excess of carbon bisulphide, is dissolved in water. According to the author, lumps of alkali-cellulose are not acted upon by the carbon bisulphide, owing to the "balling" of the former, and to prevent this, he suggests the use of a non-reacting solvent, e.g., petroleum spirit or carbon tetrachloride, the time of reaction being extended proportionately according to the ratio of carbon bisulphide to the solvent. In this way, it is stated, the coagulation of the cellulose xanthogenate is prevented, and the viscose is obtained as open loose masses from which the excess liquid can easily be recovered by pressing.—W. N. B.

PATENTS.

Alcohol; Process for obtaining — from the waste liquors of the manufacture of wood pulp by soluble sulphites. Stora Kopparbergs Bergslags Aktiebolag. Fr. Pat. 402,331, April 23, 1909. Under Int. Conv., May 9 and Oct. 7, 1908.

THE lime mud (which, besides calcium carbonate, contains organic matters and salts of sodium and magnesium)

obtained as a waste product in the treatment of the waste liquors with sodium sulphate or carbonate, is used to neutralise the waste liquor which contains, in addition to glucose and other organic substances, a small quantity of calcium bisulphite and free sulphurous acid. Not only is neutralisation thus effected, but the liquor is also enriched with nutritive substances necessary for the subsequent fermentation. If necessary, the liquor is rendered neutral, or slightly acid, by addition of acid or alkali, and is then separated from the precipitate. The liquor is then cooled, preferably by being sprayed downwards from the top of a tower and encountering a current of air moving upwards; by this treatment, it is also concentrated and saturated with air. It is then treated with an enzyme preparation or with yeast, and with nutrient yeast extract, the alcohol formed being separated by distillation or otherwise.—L. E.

Celluloid-like substance; Process for the preparation of a — which burns with difficulty. B. G. Buchstab, Ger. Pat. 214,398, July 23, 1908.

AIR or oxygen is blown through a solution of gun-cotton, the evaporated solvent being replaced by methyl alcohol or other suitable solvent. The product thus obtained is then worked up into celluloid with the addition of lactic acid or its salts, or strontium chloride, in place of camphor, and a small proportion of castor oil.—A. S.

Cellulose compounds in shapes; Process for making —. L. Lederer. Fr. Pat. 402,072, April 15, 1909. Under Int. Conv., July 3, 1908.

SEE Eng. Pat. 11,625 of 1909; this J., 1909, 1030.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Belladonna berries; Amount of alkaloid in —. J. H. Williams. Pharm. J., 1909, 83, 493.

THE amount of total alkaloids in the fruit of *Atropa belladonna* varies from 0.107 to 0.132 per cent., in both ripe and unripe berries.—J. O. B.

Elaterium; Chemical examination of —, and the characters of elaterin. F. B. Power and C. W. Moore. Pharm. J., 1909, 83, 501–504.

AN examination was made of the best English elaterium. After distilling with steam, the portion insoluble in water was extracted with chloroform and alcohol. The extracts obtained with these solvents were extracted with light petroleum and ether. The ether extract consisted chiefly of a colourless crystalline product, which corresponded in its properties to the "elaterin" of the Pharmacopœias. It melted at 217°–220° C. and had $[\alpha]_D = -16.4^\circ$. By fractional crystallisation this product was found to contain 60 per cent. of a substance, which had practically no purgative action, melted at 230° C., and had $[\alpha]_D = -52.9^\circ$. Smaller fractions were obtained, which together had $[\alpha]_D = +13.9^\circ$, and showed a high degree of physiological activity. Commercial samples of English and German "elaterin" yielded similar results on examination. The purgative action of elaterin appears to depend upon the amount of dextro-rotatory substance present.—F. SHDN.

Clove oil; Alcoholic constituents of —. H. Masson. Comptes rend., 1909, 149, 630–632.

ON examining that fraction of a clove oil which passed over below 125° C. at 10 mm. pressure, the author was able to identify methylamylcarbinol, methylheptylcarbinol, and benzyl alcohol. The presence of methylfurfural in the higher-boiling portion of the fraction was also indicated, but absolute identification was not obtained.—J. A.

Carrot oil. E. Richter. Arch. Pharm., 1909, 247, 401—413.

THE author has found the following substances in carrot oil. It contains 0.01 per cent. of free isobutyric acid, and 0.80 per cent. of free palmitic acid; 7—9 per cent. of esters are present, acetic acid being found in this form; *d*-pinene and *l*-limonene were found to the extent of 14 per cent. After fractionation in a vacuum, a crystalline alcohol, $C_{17}H_{34}O$, styled *dancol*, was obtained, which melts at $115-116^{\circ}C$. A satisfactory method of purifying this alcohol was to convert it into the sodium salt of a xanthogenic acid, and liberate the alcohol from this compound. A large proportion of the oil consists of high-boiling sesquiterpenes, with high densities. When distilled at 24 mm. three fractions were obtained, boiling at $135-146^{\circ}$, $149-153^{\circ}$, and $156-164^{\circ}C$. respectively.

—F. SODN.

Ethyl ether. Part I. Influence of water and alcohol on its boiling-point. J. Wade and H. Finnmere. Chem. Soc. Proc., 1909, 25, 236—237.

ETHER as usually purified is not homogeneous, and is resolvable into two physical constituents by accurate fractionation. The more volatile constituent contains water that has escaped the ordinary drying agents, and under suitable conditions may be isolated as a binary mixture of ether and water, having a constant and minimum boiling-point, 34.15° (corr.), and containing about 1.3 per cent. of water. At the ordinary temperature this binary mixture is practically a saturated solution of water in ether; it has been found incidentally that the solubility of water is approximately constant at 0.013 gram per gram of ether between 20° and 15° , and then decreases to 0.009 gram per gram at 10° , the lowest temperature employed. The less volatile constituent obtained on fractionating ordinary ether is approximately pure ether, b. pt. 34.50° (corr.). In presence of alcohol the boiling point may be appreciably raised, by an amount varying with the proportion of alcohol in the still; the highest observed was 34.73° (corr.). There is no evidence, however, of the formation of a mixture of constant boiling point, for although a very appreciable amount of alcohol passes over with the ether, this may be gradually eliminated by repeated fractionation. Alcohol has a similar influence on the boiling point of the binary aqueous mixture, and when ether containing both water and alcohol is fractionated, indications of a third physical constituent are sometimes obtained. This, however, is not due to the formation of a binary mixture of ether and alcohol, nor to that of a ternary mixture of all three substances, but is probably caused by the elevation in the boiling point of the binary aqueous mixture as the concentration of the alcohol increases. The mutually opposing influences of water and alcohol on the boiling point of ether render constancy of its boiling point as determined in the ordinary manner useless as a criterion of purity.

Ethyl acetate; Preparation of —. J. Habermann and H. Brezina. J. prakt. Chem., 1909, 80, 349—354.

WHEN a mixture of alcohol, acetic acid, and anhydrous copper sulphate is heated for many hours on the water-bath, fractionation of the product, dried with anhydrous magnesium sulphate, is found to give, besides unused alcohol and acetic acid, a liquid boiling at $70^{\circ}-72^{\circ}C$. A small proportion of a similar liquid is obtained by the systematic fractionation of commercial ethyl acetate, and in both cases, after treatment with calcium chloride and redistillation, pure ethyl acetate is obtained. The liquid boiling at $70^{\circ}-72^{\circ}C$. is apparently a compound of ethyl acetate and alcohol in molecular proportions.

—F. SODN.

Formic acid; Determination of —. H. Franzen and G. Greve. J. prakt. Chem., 1909, 80, 368—389.

THE authors have modified the method of determining formic acid by means of mercuric chloride, so as to make it applicable to solutions of widely varying concentration;

at the same time the quantity of mercuric chloride necessary has been reduced and the rapidity of the method considerably increased. Where it is not possible to carry out the determination directly on the solution to be examined, accurate results may be obtained by first distilling the formic acid in a current of steam and in the presence of phosphoric acid, using the neutralised distillate for the estimation. This is carried out as follows:—To the solution, containing 0.2—1 gram. of formic acid, as a soluble salt, in 1 litre, are added 7.5—15 grms. of mercuric chloride, dissolved in 100—200 c.c. of hot water; the liquid is stirred and heated on the water-bath, until the precipitated mercurous chloride has settled, and then sodium hydroxide is added to the hot liquid, until a brownish precipitate of mercuric oxide becomes permanent. The liquid is again heated on the water-bath, and, after the precipitate has completely settled, the neutralising is repeated. The precipitate is once more made to settle by heating on the water-bath, and then 20 c.c. of strong hydrochloric acid are added and the heating continued for an hour. The whole process of reduction takes about 2½ hours. The precipitate is collected in a Gooch crucible, well washed with hot water, dried for 6—8 hours in the steam oven and then for several hours in a vacuum desiccator; its weight multiplied by the factor 0.097726 gives the corresponding weight of formic acid.—F. SODN.

PATENTS.

Organic compounds; Catalytic agent for fixing and liberating hydrogen in —. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 401,876, April 8, 1909. Under Int. Conv., April 18 and July 17, 1908.

PURE nickel, obtained by reduction of the nitrate, is inactive for the purpose of converting borneol into camphor; if, however, a small quantity of sodium carbonate be added to the nitrate before reduction, a very active product is obtained; a similar mixture is obtained by adding 0.17 per cent. of pure sodium oxide to the nickel; other bases or salts which are not readily reduced at a red heat may be used in place of sodium oxide. Further, if a small quantity of certain other metals is introduced into the nickel, the mixture will have a very powerful catalytic action. Mixtures of 6.7 per cent. of cobalt or copper with 93.3 per cent. of nickel may be used; they are obtained by the reduction of the mixed nitrates. The process is not confined to the use of nickel; other metals possessing catalytic action can be used with equal effect.—T. F. B.

Mercury derivatives of fatty acids or their anhydrides; Process of preparing salts of —. W. Schoeller and W. Schrauth. Ger. Pat. 213,371, Dec. 6, 1907. Addition to Ger. Pat. 208,634, July 11, 1907 (see this J., 1909, 543).

THE salts of malonic acid or monoalkylmalonic acids are condensed with mercuric oxide or mercuric salts in presence of alkalis, to form the salts of mercuri-fatty acids or their anhydrides described in the principal patent.—T. F. B.

p-Methoxysulcylaldehyde from resorcinolaldehyde; Process for preparing — by methylation with methyl halides or dimethyl sulphate. Kalle und Co. Ger. Pat. 214,153, April 28, 1908.

p-METHOXYSULCYLALDEHYDE is obtained in a state of purity, and in good yields, as a stable substance of m. pt. $41^{\circ}C$. (not $62^{\circ}-63^{\circ}$, as stated previously), and easily soluble in warm water, by methylation of resorcinolaldehyde by means of a methyl halide or methyl sulphate, excess of alkali being avoided.—T. F. B.

Formaldehyde, together with methyl alcohol and formic acid; Process for the preparation of — from methane or gaseous mixtures containing methane by oxidation with air or oxygen. Sauerstoff- und Stickstoff-Ind. Hausmann und Co. Ger. Pat. 214,155, Sept. 26, 1906.

THE claim is for the use of bark, bast, or the like, as contact substance in the production of formaldehyde, methyl

alcohol, and formic acid from methane by oxidation. It is stated that by use of bark, *e.g.*, tan bark, oxidation can be effected at 30°–50° C., whereas with granulated copper, a temperature of about 600° C. is necessary.—A. S.

α-Bromoisovaleric ester of cholesterol; Process for preparing the —. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 214,157, July 19, 1908.

THE *α*-bromoisovaleric ester of cholesterol is a tasteless substance, of m. pt. 132°–133° C., insoluble in water, sparingly soluble in cold alcohol, and readily soluble in benzene. It is prepared from cholesterol and *α*-bromoisovaleric acid by the usual methods for making esters.

—T. F. B.

Arsenic-albumin compound; Process for the preparation of an —. F. A. V. Klopfer. Ger. Pat. 214,717, July 10, 1908.

THE nuclein-free protein of wheat (glutenin+gliadin) mixed with alcohol, is treated with arsenic trichloride at the ordinary temperature. For example, 10 kilos. of a mixture of gliadin and glutenin are mixed with 10 kilos. of 99 per cent. alcohol, and a mixture of 3 kilos. of arsenic trichloride and 5 kilos. of 99 per cent. alcohol added, with continuous stirring. After shaking in a closed vessel for six hours, the alcohol is distilled off *in vacuo*, and the residue powdered, washed with 99 per cent. alcohol, and dried *in vacuo*. The product, which is of therapeutic value, is a brownish powder soluble in hot water and in sodium hydroxide solution, but insoluble in organic solvents and in dilute acids.—A. S.

Alkyl ethers; Process for preparing aromatic —. A. Gerber. Ger. Pat. 214,783, Aug. 1, 1908.

ALKYL ethers of compounds containing a phenolic hydroxyl group are obtained by the action of normal alkylsulphurous esters on the alkali or alkaline-earth salts of the hydroxy-compounds, in presence of organic solvents, preferably aliphatic alcohols. The process as applied to the preparation of *o*-cresol methyl ether and codeine from *o*-cresol and morphine respectively, is described in detail. The sulphurous esters are readily prepared by the action of sulphur chloride or thionyl chloride on the absolute alcohol.—T. F. B.

Extracts of purgative drugs; Process for the preparation of purified —. Knoll und Co. Ger. Pat. 214,895, Aug. 25, 1908.

THE alcoholic extract of the drug (*Cascara sagrada* bark, senna leaves, aloes, etc.) is concentrated *in vacuo*, treated with ether so long as a precipitate is produced, filtered, evaporated, and mixed with lactose or the like.—A. S.

Thorium; Process for the separation of — from cerite and ytterbia earths. A. Rosenheim, R. J. Meyer, and J. Koppel. Ger. Pat. 214,886, Oct. 25, 1908.

THE process depends upon the fact that from a strongly acid solution, thorium is completely precipitated by the addition of hydrofluosilicic acid or a soluble silicofluoride, whereas the elements of the cerite and ytterbia earths remain almost entirely in solution.—A. S.

Guaiacol-5-monosulphonic acid carbonate and its salts; Process for preparing —. F. Hoffmann-La Roche und Co. Ger. Pat. 215,050, April 12, 1908.

GUAIACOL carbonate is treated, without heating, with concentrated sulphuric acid until the product is soluble in water. On cooling the mixture with ice, guaiacol-5-sulphonic acid carbonate, $(\text{CH}_3\text{O}.\text{C}_6\text{H}_3.\text{SO}_3\text{H})_2.\text{O}_2\text{CO}$, separates out, and may be purified by washing with concentrated hydrochloric acid. It melts at 115°–117° C., with evolution of carbon dioxide, and can be converted into its salts by the usual methods.—T. F. B.

Sodium arylimides; Process for preparing —. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Roessler. Ger. Pat. 215,339, Oct. 8, 1907.

COMPOUNDS of sodium with primary or secondary aromatic amines are readily produced by heating together metallic sodium and the amine, in presence of a heavy metal, oxide, or salt, possessing catalytic properties, *e.g.*, copper, nickel, or cobalt, or their oxides or salts. Heavy metals which tend to form alloys with sodium should not be used. By this process, sodium can be made to combine with aniline in presence of a catalyser at 140° C.—T. F. B.

Pharmaceutical compound [p-aminobenzoic acid isopropyl ester]; Manufacture of a new —. P. A. Newton. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4321, Feb. 22, 1909.

SEE Ger. Pat. 211,801 of 1908; this J., 1909, 854.—T. F. B.

Aminoarylsulfinic acid; Derivatives of —. P. Ehrlich and A. Berthelm, Frankfurt, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 937,929, Oct. 26, 1909.

SEE Fr. Pat. 392,857 of 1908; this J., 1909, 107.—T. F. B.

Guaiacol carbonate sulpho-acid derivative. A. Einhorn. Munich, Assignor to C. H. Boehringer Sohn, Nieder Ingelheim, Germany. U.S. Pat. 938,132, Oct. 26, 1909.

SEE Fr. Pat. 391,601 of 1908; this J., 1908, 1176.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic developers; The developing power of —. Lumière and Seyewetz. Phot. Mitt., 1909, 46, 260. Chem.-Zeit., 1909, 33, Rep., 852.

THE following are results of tests made on rapid plates, using Chapman Jones' scale-photometer:—Increasing the temperature of development has generally little influence on contrast, but quinol and adanol give greater contrasts at lower temperatures. With most developers increase of temperature increases fog very largely, but there is only a slight increase with edinol, *p*-aminophenol, hydramine, and catechol. Dilution generally causes decrease of contrasts without further liability to fog. In the case of edinol, after the diminution caused by the addition of two volumes of water, no further diminution ensues on further dilution. Except with developers where sodium sulphite is used as accelerator, its further addition does not diminish contrasts. Increase of the proportion of alkali in most alkaline developers has no noticeable effect on contrast. Addition of bromide increases contrasts, prolongs development, and prevents fog-formation.—T. F. B.

Dehydroindigo bisulphite and a new process of indigo dyeing [and printing photographs]. Kalb. See V.

PATENTS.

Photographic films; Manufacture of —. E. Brandenberger, Thaon, France. Eng. Pat. 13,328, June 7, 1909.

CELLULOSE films obtained from aqueous solutions, especially from viscose, are submitted to the action of the various solutions or substances necessary for preparing sensitive surfaces; the first treatment must be either with water or with an aqueous solution, in order to cause the film to swell and become suitably absorbent. For example, the film may first be immersed in a solution of an alkali bromide and then in a solution of silver nitrate. The resulting film may be supported on paper, glass, &c.

—T. F. B.

Colour screens or plates for photography; Manufacture of — J. H. Christensen, Holte, Denmark. Eng. Pat. 21,097, Oct. 6, 1908. Addition to Eng. Pat. 20,971, Jan. 25, 1908 (see this J., 1909, 491).

THREE or more viscous solutions of dextrin, resin, etc., are coloured with the colours desired for the screen or plate, and separately emulsified in a viscous solution, for instance of 30 parts of gum dammar in 35 parts of turpentine oil; by this means the dextrin solution is divided into globules of approximately uniform size. When emulsification is complete, the greater portion of the gum dammar is removed, for example by repeated dilution and decantation with turpentine oil, and the coloured globules are transferred by dilution and decantation into a volatile liquid, preferably petroleum spirit. This liquid is poured on to glass or other plates, which may be coated with a thin layer of lac or caoutchouc; the globules will soon settle, and the lowest layer will adhere to the lac or caoutchouc, whilst the remainder are rinsed off by means of petroleum spirit. When the solvent has evaporated, the globules will cover the plate, but the gum dammar which remains will prevent the different coloured globules from intermingling.—T. F. B.

Photographic film. J. Bourdeaux. Fr. Pat. 401,912, April 9, 1909.

PHOTOGRAPHIC films are prepared by applying a sensitive emulsion to gelatin films which have been coated with a suitable protective varnish or collodion. If desired, the gelatin may first be treated with a chromium salt or with formaldehyde.—T. F. B.

Bichromated-gelatin images; Process for developing — L. Jacobsen. Ger. Pat. 213,772, July 19, 1908.

PEPSIN, or other ferments which decompose albumin, will not decompose bichromated gelatin. If pigmented bichromated-gelatin paper which has been exposed behind a negative, is treated with, for example, a 1 per cent. solution of pepsin containing also 1-5 per cent. of hydrochloric acid, for three hours at 25° C., development will be complete. The advantage of the prolonged development is that it produces finer half-tones.—T. F. B.

Photographic anti-halation plates; Preparation of intermediate films for — J. Hauff und Co. Ger. Pat. 213,774, Jan. 19, 1909.

GLASS plates are coated with a solution of 3 grms. of gelatin and 0.5 grm. of copper sulphate in 100 c.c. of water; when this has set, the plates are immersed in a strong solution of hydroferrocyanic acid, washed, dried, and provided with a sensitive emulsion over this anti-halation film. The copper ferrocyanide thus produced is less actinic than uranium or molybdenum ferrocyanide (Ger. Pat. 210,057), hence a thinner layer suffices.—T. F. B.

Developing exposed silver bromide films in daylight; Process for — R. Freund. Ger. Pat. 213,775, Oct. 11, 1908.

EXPOSED silver bromide films are treated with an alkali iodide solution, which converts the bromide into an insensitive silver iodide; the plates, etc., may then be developed in daylight by means of a strongly alkaline developer, the following formula being recommended:—Quinol, 8 grms.; methyl-*p*-aminophenol sulphate, 1 grm.; anhydrous sodium sulphite, 20 grms.; potassium bromide, 40 grms.; potassium hydroxide, 198 grms.; water, 1200 grms.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosion which occurred in the corning house of the gunpowder factory of the Chilwarth Gunpowder Co., Ltd., at Fernilee, in the County of Derby, on August 12th, 1909; Circumstances attending an — Major A. Cooper-Key, H.M. Chief Inspector of Explosives. [Cd. 4925.] (See also this J., 1906, 828; 1909, 1664.)

ABOUT half a ton of gunpowder exploded and three lives were lost. The conclusion is arrived at that the explosion

was due to some hard foreign body passing between the rolls; nevertheless an examination did not show any marks, of recent date, of a nature to cause an explosion. Major Cooper-Key points out, however, that the crushing of a moderately hard flat article between the rolls would quite possibly give rise to the development of sufficient heat to fire the gunpowder dust, without leaving a mark of any kind. There was no evidence to show whether this foreign body was carried into the building in one of the barrels containing the presscake, whether it fell from the roof, or whether it was a piece of the machinery itself.

—G. W. McD.

Coal dust; Experiments with — in the testing gallery of the Rossiter coal district, Austria. Czaplinski and Jicinsky. Z. ges. Schiess- und Sprengstoffw., 1909, 4, 415-417. (See also this J., 1909, 42, 260, 511, 692, 748, 1024; 1908, 888, 971, 1143; 1905, 939; 1896, 319.)

THE experiments were carried out with coal dust alone, no pit gas being used. The effect of water sprays, and the influence of dry and wet dust-free zones and of dry stone dust zones were also investigated. The explosives were fired in a chamber 1.3 m. wide, 1.7 m. deep, and 1.85 m. high, which communicated with a gallery 293.7 m. long. The coal dust was placed in this gallery on horizontal or inclined shelves. The pressure developed in the gallery after explosion was measured by a manometer with an automatic registering device. The length of the flame produced was determined by means of sulphur matches fixed in wooden blocks and placed at distances of 1 m. along the length of the gallery. Samples of the gas in the gallery, after the explosion, were collected in flasks. Analyses showed the following composition: Carbon dioxide (0.8-6.45 per cent.), carbon monoxide (0.3-3.2 per cent.), and oxygen (10.9-18.8 per cent.). Two explosives were used—gelatin-dynamite No. 1, and black powder. The gelatin-dynamite was fired by means of a 1 grm. detonator whilst freely suspended. The black powder was fired from a mortar with a bore 450 mm. deep and 27 mm. diameter, and the only stemming used was a paper plug 3 mm. thick.

Coal dust.—The natural coal dust from the mines was used and it was not in any way pulverised, as was the case, for instance, at Althof's (*loc. cit.*). The finest sample used left a residue of only 3.8 per cent. on a sieve of 3480 meshes to the sq. cm.; the coarsest a residue of 19.5 per cent. on a sieve of 1160 meshes to the sq. cm. The moisture varied from 0.58-4.5 per cent.; ash from 9-17 per cent. and volatile matter from 19.2-22.8 per cent.

Coal dust explosions with gelatin-dynamite.—300 grms. of dynamite when fired in the explosion chamber (free from coal dust) produced a flame of less than 1 m. in length and a pressure of 1.3 atmospheres. No coal dust explosion was caused when 200-300 grms. of dynamite were fired in the gallery, 47 m. from the chamber, in the presence of 12.5 kilos. of coal dust containing 2 per cent. of moisture; nor was there an explosion when the explosive was fired from the chamber in presence of 6 kilos. of coal dust containing 4.5 per cent. of moisture. On using coal dust containing only 0.74-1.02 per cent. of moisture in the explosion chamber, the following results were obtained: With 7 kilos. of coal dust a flame of 16 m.; with 13 kilos. a flame of 37 m. Spreading 30 kilos. of coal dust in the gallery, and keeping it in agitation produced on explosion a flame 106 m. long.

Coal dust explosions with black powder.—The charge, fired from a mortar, was 300 grms. Coal dust (2½ kilos.) kept in suspension in the explosion chamber, produced a flame 15 m. long, which was increased to 30 m. when 10 kilos. of coal dust were spread 5 m. from the chamber. A flame length of 147 m. was obtained with 30 kilos. of coal dust, placed in the gallery some 88 m. from the explosion chamber, and kept in agitation. Different flame lengths were obtained dependent on whether the mortar was placed with its muzzle facing towards the explosion chamber or down the gallery. The moisture content of the coal dust was found to be a very important factor. Where from 2 to 4.5 per cent. of moisture was present, very short flames resulted, and explosions of only a minor nature took place. Water sprays were found to shorten

the flame length very considerably. Wet zones had a similar effect, whilst in a limited number of experiments the use of stone dust was not found to be efficacious.

—G. W. McD.

PATENT.

High explosive. H. Cottu and J. Teyssen. Fr. Pat. 402,693, Sept. 3, 1908.

CLAIM is made for an explosive consisting of a mixture of trinitrotoluene, barium nitrate (or other nitrate) and gun-cotton in proportions varying according to the use for which the preparation is required. An explosive which is particularly suitable for mines and which can be exploded without the use of a detonator may be obtained by mixing trinitrotoluene (10 per cent. or more) with ordinary black gunpowder, and, if desired, compressing the mixture into compact blocks.—C. A. M.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Smoke tintometer. J. Lowdon. Engineering, 1909, 33, 627.

THE instrument, which is intended for determining the relative "density" of smoke, consists of a tube with an eye-piece at one end, and two circular apertures at the other. In front of one of these apertures is a diaphragm which can be rotated and has five circular openings of the same diameter as the aperture in the end of the instrument; four of the openings are fitted with tinted glasses corresponding to, and graduated from, the standard tints of Ringelmann's smoke scale. In using the instrument, the free opening in the diaphragm is made to coincide with one of the apertures in the end of the instrument, and the clear sky is observed through this aperture and the smoke through the other. The diaphragm is then rotated until the illumination through both apertures appears to be identical.—A. S.

PATENTS.

Photometer. H. Chapman, Sheffield. Eng. Pat. 22,748, Oct. 27, 1908.

THE light to be tested falls directly on to, or is reflected on to, a radiometer, or on to a screen (*e.g.*, of opalescent, opal, or ground glass) interposed between the source of light and a radiometer. On the other side of the radiometer, and opposite the screen, is a small aperture, so placed, that when the wings of the radiometer revolve, light is alternately admitted through, and cut off from, the aperture; again, the aperture may be placed in any convenient position, the light being reflected through it by a mirror or the like. A small cut-off shutter, operated by clockwork or other device, is interposed between the radiometer and the aperture, so that the flashes of light may be allowed to pass through the aperture for any given period, the number of flashes, which indicate the candle power of the source of light, being counted. A small ampère-meter and a small volt-meter may be attached to the above apparatus when testing electric lamps, or a gas-meter when testing gas lights. Since the wings of a radiometer revolve at different speeds according to the kind of light falling on them, even when the light is of the same candle power and is placed at the same distance, a compensating device is adopted. This consists of a number of shutters or screens operated by a lever (or levers) moving over a scale. A second compensating device may be provided, consisting of one or more screens (*e.g.*, of opal, opalescent, coloured or ground glass), compensation being effected by the use of different combinations of screens. A schedule or diagram is used for ascertaining the total watts, and watts per candle

power, in the case of electric lights; with a set of diagrams suitably inscribed, the efficiency of any form of light may be ascertained.—L. E.

Gas analysis apparatus; Self-recording —. M. C. Brenot. Fr. Pat. 402,190, April 19, 1909.

THE patent relates to the apparatus described in Fr. Pat. 339,498 (this J., 1908, 1000). The improvements are in the aspirating device, and the control of the three-way cocks and of the recording instrument. The aspirating device is a hollow annular drum with its axis horizontal. The lower part of this drum contains water, and the upper part is divided into two chambers by a radial partition. One of these chambers is always open to the air, and the other is opened alternately to the gas intake and to the measuring vessel by means of a three-way cock. The drum is oscillated about its axis so as alternately to increase and decrease the volume of the gas chamber and thus to pump gas into the measuring vessel. The apparatus is controlled from a continuously rotating shaft. A crank on this shaft carries a flexible plate which engages with a projection on the drum of the aspirating device and rotates the drum in one direction until the plate is turned aside by a fixed cam-surface, the return movement of the drum being effected by a counterweight hanging from a pulley on the spindle of the drum. The three-way cocks are moved to and fro at the required times by two cams on the rotating shaft, by means of rocking levers held against the cams by springs and engaging alternately with a rod connected to the cock. The recording instrument is actuated by an electro-magnet, the circuit being closed at the required time by an arm on the rotating shaft.—A. T. L.

INORGANIC—QUALITATIVE.

Arsenic acid; Detection of — in the presence of arsenious acid by means of magnesia mixture. O. Lutz and R. Swinne. Z. anorg. Chem., 1909, 64, 298–301.

THE authors' experiments lead them to regard magnesia mixture as useless for the detection of arsenate ions in the presence of arsenite ions.—F. SODX.

Reactions of salts in non-aqueous solutions. Naumann. See VII.

INORGANIC—QUANTITATIVE.

Manganese and chromium; [Quantitative] separation of —. F. Falco. Arch. Pharm., 1909, 247, 431–436.

THE ammonium persulphate method of Dittrich and Hassel (this J., 1903, 230) for the separation of manganese and chromium gives good results. Kassner's method (Arch. Pharm., 1894, 232, 229) requires modification. The substance which should not contain more than 0.01 to 0.02 gm. of manganese is dissolved and treated with excess of sodium peroxide. The precipitate is filtered off, washed and dissolved in warm 20 per cent. hydrochloric acid. The solution is now treated with excess of bromine water and the manganese precipitated with ammonia. The precipitate is collected, washed and ignited.—F. SODX.

Cobalt; Rapid electrolytic determination of —. P. Bruylants. Bull. Soc. Chim. Belg., 1909, 23, 383–400.

COBALT can be accurately determined from an ammoniacal solution if a cathodic potential of 1.35 volts is maintained; if the cathodic potential is not regulated, satisfactory results are only obtained with a current density and voltage much less than are ordinarily used for the determination of nickel. If the ordinary rapid method of determining nickel is applied to the determination of cobalt, this metal is always obtained in a spongy and oxidised condition. Electrolytically precipitated cobalt shows a great tendency to oxidise and redissolve, and must therefore be washed without interruption of the current; in this direction its properties, from the standpoint of electrolytic determination, much resemble those of lead and

manganese. Accurate determinations cannot be made under any conditions from an oxalic acid solution. Cobalt and zinc cannot be electrolytically separated by Fischer's method, from an ammoniacal solution containing sodium sulphite; for although cobalt is thus precipitated free from zinc, it absorbs large quantities of sulphur. An approximate separation of the two metals may be effected from an ammoniacal solution with a cathodic potential of 1.35 volts.—E. F.

Gas testing. "Local Govt. officer." See II.

Determining pyridine in aqua ammonia. Houghton. See VII.

Determining caustic lime, etc., in presence of calcium carbonate, etc. Heyer. See VII.

Tungsten; Volumetric process for —. E. Knecht and E. Hibbert. See X.

Determining vanadium in ores. Alvarez. See X.

Determining small quantities of vanadium by colorimetric method. A. W. Gregory. See X.

Determining calcium carbonate in soils. Marr. See XV.

Determining sulphur in alkali polysulphides. Dusserre and Vuilleumier. See XVIII C.

Determining mercury volumetrically; also mercury and silver together. Rupp and Krauss. See X. Also J. Knox. See X.

ORGANIC—QUALITATIVE.

Distinguishing wool gelatin and animal size. Herz and Barraclough. See V.

Reactions of Tunisian olive oil. Marcille. See XII.

Furfural reaction for detection of sesame oil. Imbert and Durand. See XII.

Detecting oils obtained by extraction with carbon bisulphide in commercial oils. Cusson. See XII.

French codex test for foreign fats, resins, and waxes in beeswax. Le Naour. See XII.

ORGANIC—QUANTITATIVE.

Determining volatile matter of coal. Beck. See II.

Cotton-seed products; U.S. uniform methods of analysis for —. See XII.

Influence of optically active non-sugar on determination of sugar in beetroots, etc. Kopecky. See XVI.

Determining casein in milk. Robertson. See XVIII A.

Determining nicotine in concentrated tobacco-juices. Porchet and Régis. See XVIII C.

Determining formic acid. Franzen and Greve. See XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Ozone; Demonstration of the presence of —, in flames. W. Manchot. Ber., 1909, 42, 3948—3951.

SILVER at 240° C., exposed to the tip of a flame, affords a most delicate test for the presence of ozone. In this way

it is easy to demonstrate the presence of ozone in the oxyhydrogen flame, in the coal-gas and air blowpipe flame, and in the carbon monoxide flame—in air with difficulty, in oxygen much more readily. Neither hydrogen peroxide nor nitrogen oxides produce the same black stains as ozone.

The presence of hydrogen peroxide in hot flames can be demonstrated by directing them against the surface of a solution of a titanium salt; in this way it can be shown in the oxyhydrogen flame, and in the carbon monoxide flame fed with oxygen, provided in the latter case the gases are moist. This shows that the production of hydrogen peroxide is a result of the temperature, and not a stage of the reactions occurring in the burning of hydrogen and oxygen.—J. T. D.

PATENT.

Tobacco; Process of renovating, cleansing, and aromatising —. S. B. Heddles, Janesville, Wis. U.S. Pat. 937,801, Oct. 26, 1909.

Tin: tobacco is spread out in a receiving vessel and sprayed with an atomised liquid composition (a liquid containing formaldehyde and water, or formaldehyde, wines, and spirits) which retains moisture and prevents the growth of mould. The tobacco is kept in a moist condition after spraying, until the composition is absorbed and the material is softened and conditioned for handling. The individual leaves are then sprayed a second time with the composition, and the tobacco is kept moist until the composition is again absorbed.—L. E.

Trade Report.

German chemical industries. Oil, Paint, and Drug Rep., Oct. 25, 1909.

At a meeting of the Association for the Protection of the Interests of the German Chemical Industry, held recently at Bonn, it was reported that the German chemical industries showed an increase of only 0.72 per cent. in the number of persons employed in the year 1908, and the total amount of wages paid increased only 2.6 per cent. The exports of German chemical products decreased in the same year by £1,476,000 in value, of which the decrease under the head of coal-tar colours alone amounted to £1,333,000. The decrease in sales brought about an increase in the cost of production, and in the meantime prices had to be cut on account of keener competition. The average profit on the capital invested receded in 1908 from 11.16 per cent. to 9.25 per cent.

The transactions in the tar-colour industries fell off 32.7 per cent. as compared with 1907. In the gunpowder and high-explosives trade the decrease was 22 per cent.; in trades relating to pharmaceutical, photographic, and technical preparations, 9 per cent.; in the alkali salts and acids trades, 7.3 per cent.; and in the artificial fertiliser trade, 2.8 per cent.

Books Received.

HISTORY OF CHEMISTRY. Sir EDWARD THORPE, C.B., LL.D., F.R.S. Vol. I. From the Earliest Times to the Middle of the Nineteenth Century. Watts and Co., 17, Johnson's Court, Fleet Street, E.C. 1909. Price 1s. net.

CROWN 8vo volume, containing frontispiece, 142 pages of subject matter, bibliographic list referring to Vol. I., and the alphabetical index. The text is classified as follows:—I. Chemistry of the Ancients, II. Chemical

Philosophy of the Ancients. III. Alchemy. IV. The Philosopher's Stone. V. Iatro-Chemistry. VI. "The Sceptical Chemist." : The Dawn of Scientific Chemistry. VII. Phlogistonism. VIII. Lavoisier and La Revolution chimique. IX. The Atomic Theory. X. The Beginnings of Electro-Chemistry. XI. The Foundations of Organic Chemistry. XII. The Rise of Physical Chemistry.

CHEMICAL NOTES AND EQUATIONS, INORGANIC AND ORGANIC. By G. H. GEMMELL, Professor of Chemistry, Royal Veterinary College, Edinburgh. 2nd Edition. Baillière, Tindall and Cox, 8, Henrietta Street, Covent Garden, London. 1909. Price 5s. net.

CROWN Svo volume, containing 256 pages of subject matter, and alphabetical index. The classification of matter is indicated as follows:—I. General principles. II. The elements. III. Organic chemistry. Each subject is treated as concisely as possible and according to the following general method, the order of which is followed for each substance:—(i.) History (of substance dealt with). (ii.) Occurrence (iii.) Properties. (iv.) Uses and so on.

UNTERSUCHUNG DER MINERALÖLE UND FETTE, SOWIE DER IHNEN VERWANDTEN STOFFE. Von Professor Dr. D. HOLDE. Dritte, verbesserte und vermehrte Auflage. Julius Springer's Verlag, Berlin. 1909. Price M. 12.

Svo volume, containing 444 pages of subject matter, with 93 illustrations, and alphabetical indexes of subjects and authors. The subject matter receives the following classification:—CHAP. I.—I. PETROLEUM AND ITS PRODUCTS. A. Crude petroleum. (i.) Physical tests. (ii.) Chemical tests. B. Petroleum spirit (benzine). C. Illuminating oil. D. Lubricating and cleaning oils from crude petroleum. E. Gas oils from crude petroleum. F. Transformer oils (for electric power stations and works). G. Driving oils and heating oils. H. Lubricating oils. Physical and chemical tests. J. Testing thick lubricants. K. Emulsifiable mineral oils. L. Paraffin scale (solid paraffin), from crude petroleum. M. Vaseline. N. Tarry and pitch-like products of distillation. (Petroleum tar, asphaltum, and pitch.) O. Residua or waste products of the petroleum industry. CHAP. II.—NATURAL ASPHALTUM. CHAP. III.—OZOKERITE AND MONTAN WAX. CHAP. IV.—TARS, OBTAINED BY DISTILLATION FROM COAL, LIGNITES, SHALES, AND PEAT. A. Coal-tar and its products. B. Lignite tar and its products. C. Products from bituminous shales. D. Peat tar. CHAP. V.—SAPONIFIABLE FATS AND WAXES. A. Vegetable and animal fats and oils. B. Waxes. CHAP. VI.—TECHNICAL PRODUCTS PREPARED FROM SAPONIFIABLE FATS AND WAXES. A. Stearine candles. B. Wool oils. C. Soaps. D. Soap powder. E. Turkey-red oil. F. Varnishes and lacquers. G. Blown oils. H. Dégras. I. Linoleum. K. Iodised fats. L. Faktis (rubber substitutes from vegetable oils by heating with sulphur or sulphur chloride). APPENDIX.—Mineral oils, etc. An opening chapter is devoted to literary materials employed, viz., standard works and journals.

SUMMARY OF ALLOYS. By Dr. ERNST JAENECKE. The Employment of Physical Chemistry in Metallography. Dr. Max Jänecké, Verlagsbuchhandlung, Osterstrasse, Hannover. 1909. Price M. 3.

PAMPHLET containing 39 pages of subject matter, and 23 illustrations. The subject is classified as follows:—I. Historical notes. II. The phase rule. III. Binary metallic mixtures, forming one liquid and two solid phases. IV. Alloys with three solid phases. The author claims that in this work for the first time a systematic order has been followed. Also full literary references are given, with a classified bibliography of alloys.

METHODES OFFICIELLES POUR L'ANALYSE DES DENRÉES ALIMENTAIRES. Annales de la Société Universelle de la Croix Blanche de Genève. En vente au Bureau des "Annales des Falsifications," 16, Place Vendôme, Paris. 1909. Price 2.50 fr.

PAMPHLET, containing 82 pages of subject matter, devoted to the French and Swiss official methods of analysis of food-

stuffs, etc., and classified as follows:—Introduction by the Minister of Agriculture of France (Service de la Répression des Fraudes). I. Ordinary wines. II. Alcohols, brandies, and liqueurs. III. Ciders and perry. IV. Beers. VII. Milks. VIII. Fatty matters. IX. Flours, bread, pastries, oatmeal, bread raspings, or powders. X. Confections, syrups, honey, lemonades, sugars. XI. Spices, condiments. XVI. Antiseptics and sweetening agents.

CULTIVATION AND USES OF SOYA BEANS. (The Liverpool University Institute of Commercial Research in the Tropics.) Bulletin. By E. S. EDIE, M.A., B.Sc. C. Tilling and Co., Ltd., 53, Victoria Street, Liverpool. 1909. Price 6d.

PAMPHLET of 7 pages. See pages 1209 and 1218.

MINES AND QUARRIES: GENERAL REPORT AND STATISTICS FOR 1908. Part III.—Output. [Cd. 4937.] Price 1s. 5d.

THIS return, which is prepared annually by the Home Office, contains statistics as to the quantity and value of various minerals raised in the United Kingdom. (See page 1203.)

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 25,095. Cowper-Coles. Precipitation of smoke. Nov. 1.
- 25,254. Rorke and Rorke. Thermostats. Nov. 2.
- 25,299. Pritchard. Contacting vapours and gases with liquids. Nov. 3.
- 25,351. Wilfley Mining Machinery Co. and Roberts. Apparatus for separating liquid from solid material. Nov. 3.
- 25,638. Waterhouse and Bourne. Distilling.* Nov. 6.
- 25,679. Durant and Metals Extraction Corp., Ltd. Apparatus for bringing gas into contact with a liquid. Nov. 6.
- 25,686. Shaw. Apparatus for vaporising, pasteurising, &c. Nov. 8.
- 25,761. Hansen and Winkler. Centrifugal apparatus for separating air or gas from liquid. [Addition to No. 12,004 of 1909.]* Nov. 8.
- 25,768. Fairweather (Huff Electrostatic Separator Co.). Separating ingredients of comminuted material.* Nov. 8.
- 25,807. Nagle. Rotary drying apparatus. Nov. 9.
- 27,809. Swan. See under X.
- 28,245. Coombs and Seaborn. Apparatus for separating suspended solids from liquids. Nov. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

- 18,402 (1908). Monison. Water-distributing devices for cooling towers. Nov. 10.
- 25,216 (1908). Hofmann and Main. Apparatus for drying dissolved leather, congealed blood, paints, pigments, &c. Nov. 10.
- 25,232 (1908). Rathmell. Condensers, coolers, heaters, evaporators, &c. Nov. 10.

- 26,068 (1908). Hodgkinson. *See under VII.*
 2544 (1909). Baxter. Machines for separating solids of different densities. Nov. 10.
 4604 (1909). Vallat. *See under XVII.*
 6452 (1909). Heenan. Cooling apparatus or apparatus for treating gases with liquids. Nov. 17.
 20,140 (1909). Sheard. Filtering apparatus. Nov. 10.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 25,052. Clegg. Gas retorts. Nov. 1.
 25,360. Simonin. Utilisation of materials employed for purifying illuminating gas. [Fr. Appl., Nov. 5, 1908.]* Nov. 3.
 25,474. Glasgow. Water-gas apparatus.* Nov. 4.
 25,889. Kuzel. Improving the quality of metallurgical filaments. [Ger. Appl., Dec. 21, 1908.]* Nov. 9.
 25,942. Ledoux, Shelley, and Simon-Carves Bye-Product Coke Oven Co., Ltd. Coke ovens. Nov. 10.
 26,124. Otto und Co. Removing tar from hot gases from coke ovens, gas retorts, &c. [Ger. Appl., Dec. 22, 1908.]* Nov. 11.
 26,125. Otto-Hilgenstock Coke-Oven Co. (Otto und Co.). Coke ovens.* Nov. 11.
 26,169. Grice. Suction or other producer plants. Nov. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

- 24,169 (1908). Lake (Hydrocarbon Converter Co.). Manufacture of gas from liquid hydrocarbons. Nov. 17.
 24,469 (1908). Peek. Coke ovens. Nov. 17.
 27,841 (1908). Chandler. Apparatus for gas purification. Nov. 10.
 2071 (1909). Clacher. Purification of carbon. Nov. 17.
 5010 (1909). Rhenania-Gluhlicht Comp. Ges. Incandescent mantles for gas lighting. Nov. 10.
 10,745 (1909). Weickert. Mantles or incandescence bodies for gas lighting. Nov. 10.
 23,831 (1909). Lake (Hydrocarbon Converter Co.). Manufacture of gas from liquid hydrocarbons. Nov. 17.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

COMPLETE SPECIFICATIONS ACCEPTED.

- 3074 (1909). Sprenger. Purification of tar, tar oils, pine oils, &c. Nov. 17.
 4604 (1909). Vallat. *See under XVII.*

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

- 25,752. Bloxam (Durand, Huguenin, et Cie.). Manufacture of galloxyaniline derivatives.* Nov. 8.
 25,986. Newton (Bayer und Co.). Manufacture of vat dyes of the anthracene series. Nov. 10.
 26,055. Frank. Colouring matters. Nov. 11.
 26,344. Newton (Bayer und Co.). Manufacture of acid wool dyestuffs. [Addition to No. 7820 of 1909.] Nov. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

- 1397 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Nov. 10.
 7931 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Nov. 10.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

- 25,117. Meister, Lucius, und Brüning. Fixing anthraquinone dyestuffs. [Addition to No. 24,920 of 1909. Ger. Appl., Feb. 1, 1909.]* Nov. 1.
 25,222. Textil-Maschinenfabr. B. Cohnen. Dyeing apparatus. [Ger. Appl., Nov. 2, 1908.]* Nov. 2.
 25,321. Chambers and Moffatt. Wool-scouring solution for making anhydrous wool fat, &c. Nov. 3.
 25,489. Halstead. Rollers for use in dyeing, bleaching, &c. Nov. 5.
 25,999. Becke and Beil. Dyeing half woollen goods. [Ger. Appl., April 8, 1909.]* Nov. 10.
 26,024. Daniell. Cop tubes.* Nov. 10.
 26,025 to 26,028. Daniell and Hebden. Dyeing yarn or the like.* Nov. 10.
 26,029. Daniell and Hebden. Dyeing apparatus.* Nov. 10.
 26,150. De Ferranti. Treatment of fibrous material. Nov. 11.
 26,253. Oppenheim. Producing damask effects on fabrics by printing. [Ger. Appl., Nov. 12, 1908.]* Nov. 12.
 26,317. British Cotton and Wool Dyers' Assoc., and Robson. Machine for mercerising, dyeing, bleaching, &c., cotton or other vegetable fibre or fabrics. Nov. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

- 23,171 (1908). Corron. Machines for dyeing yarns, &c. Nov. 10.
 25,441 (1908). Corron. Machines for dyeing or otherwise treating yarns. Nov. 17.
 7617 (1909). Friedrich. Production of a dissolved substance for use in making artificial threads, &c. Nov. 17.
 8976 (1909). Moller-Holtkamp. Piece-dyeing heavy and close fabrics with Turkey red. Nov. 10.
 15,341 (1909). Bright and Bros., Ltd., and Oldroyd. Colouring yarns for making carpets, &c. Nov. 10.
 24,404 (1909). Schumacher and Resch. Apparatus for dyeing wound yarn. Nov. 17.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

- 25,082. Gerrard. Treatment of salt. Nov. 1.
 25,111. Norsk Hydro-Elektrisk Kvaestofaktieselskab. Manufacture of ammonium nitrate. [Norw. Appl., Nov. 4, 1908.]* Nov. 1.
 25,203. Pope. Manufacture of lead oxide. Nov. 2.
 25,459. Jensen (Spitz). Production of pure tin oxide. [Addition to No. 28,565 of 1908.]* Nov. 4.
 25,460. Pettigrew. Saturator for sulphate of ammonia and other salts. Nov. 4.
 26,140. Rollin and Hedworth Barium Co. Manufacture of barium oxide. [Comprised in No. 27,587, Dec. 18, 1908.] Nov. 11.
 26,175. Pope. Manufacture of lead oxide. Nov. 12.
 26,206. Lloyd. Treating nitrate of lime to prevent deliquescence. Nov. 12.
 26,258. Swan and Kendal. Apparatus for making alkali cyanides. Nov. 12.
 26,263. Freeth and Coekesedge. Manufacture of ammonium chloride from ammonium sulphate and common salt. Nov. 12.
 26,264. Ormandy and Kay. Manufacture of borax, soap, soap powder, soda, &c. Nov. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

- 23,889 (1908). Frerichs. Production of ammonia. Nov. 17.
 26,068 (1908). Hodgkinson. Apparatus for evaporating brine or other solutions. Nov. 17.
 26,257 (1908). Eckford. Manufacture of lead oxide. Nov. 10.
 7495 (1909). Chem. Werke vorm. Dr. H. Byk. Manufacture of solid durable perborate preparations. Nov. 10.
 22,034 (1909). Jaubert. Production of oxygen. Nov. 17.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

- 25,146. Hewitt. Drying and burning or calcining slip, slurry, chalk, clay, &c. Nov. 1.
 25,692. Fletcher. Enamelling muffles. Nov. 8.
 25,908. Kempton. Regenerative glass furnace.* Nov. 9.
 26,309. West and Lewis. *See under IX.*

COMPLETE SPECIFICATION ACCEPTED.

- 6560 (1909). Weber. Making slip from clays, porcelain, earth, &c. Nov. 10.

IX.—BUILDING MATERIALS. CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

- 25,146. Hewitt. *See under VIII.*
 26,309. West and Lewis. Kilns or ovens for firing bricks, tiles, pipes, china, &c. Nov. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

- 26,416 (1908). Wade. Black concrete or stone cement. Nov. 17.
 13,091 (1909). Langenbeck. Vitrified paving brick or block. Nov. 17.
 21,670 (1909). Sinclair. Cement. Nov. 17.

X.—METALS AND METALLURGY.

APPLICATIONS.

- 25,152. Simpson and Oviatt. Production of refined iron and of steel directly from iron ore. Nov. 1.
 25,244. Kjellin. Treatment of ores in blast furnaces.* Nov. 2.
 25,263. Felten und Guillaume Lahmeyerwerke. Converters. [Ger. Appl., Nov. 30, 1908.]* Nov. 2.
 25,809. Swan. Apparatus for separating liquids from finely-divided solids, especially for treating gold ores, slimes, &c. Nov. 9.
 25,847. Mason. Recovery of pure antimony from ores, &c.* Nov. 9.
 25,889. Kuzel. *See under II.*
 25,915. Jensen. Separation of tin or other metals from waste metal, alloys, &c. [Addition to No. 28,551 of 1908.]* Nov. 9.
 25,979. Lindblad and Stalhane. Reduction of zinc. [Swed. Appl., Nov. 11, 1908.]* Nov. 10.
 26,019. Sulman and Picard. Treatment of oxidised ores. Nov. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

- 16,667 (1908). Dick. Treatment of copper and other ores. Nov. 17.
 20,752 (1908). Lyon. Apparatus for washing and separating ores, minerals, &c. Nov. 10.
 23,529 (1908). Sterne (Block). Desiccation of air for metallurgical operations. Nov. 10.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

- 25,096. Cowper-Coles. Apparatus for electro-deposition of iron. Nov. 1.
 25,118. Imray (Soc. Chem. Ind. in Basle). Continuous electrolysis of aqueous solutions.* Nov. 1.
 25,251. Härdén. Electric furnaces.* Nov. 12.
 25,266. Härdén. Electric furnaces.* Nov. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

- 24,597 (1908). Winkler. Production of transparent, flexible, infusible insulating materials. Nov. 17.
 27,034 (1908). Vollert. Electrolytic cleaning of metal objects to be galvanised or nickelled. Nov. 17.
 4175 (1909). Ruthenburg. Electrodes for electric furnaces. Nov. 17.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

- 25,321. Chambers and Moffatt. *See under V.*
 25,904. Hollands. Soap. Nov. 9.
 26,264. Ormandy and Kay. *See under VII.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 8674 (1909). Grant. Manufacture of soap. Nov. 10.
 8982 (1909). Welter. Manufacture of soaps containing solvents of fat. Nov. 17.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

- 25,203. Pope. *See under VII.*
 26,175. Pope. *See under VII.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 24,627 (1908). Palk, Basset, and Nash. Paint, especially for use as anti-fouling composition for ships. Nov. 17.
 25,216 (1908). Hofmann and Main. *See under I.*
 26,257 (1908). Eckford. *See under VII.*

(B.)—RESINS, VARNISHES.

APPLICATION.

- 25,944. Coleman. Heating or treating varnish, &c.* Nov. 10.

COMPLETE SPECIFICATION ACCEPTED.

- 3074 (1909). Sprenger. *See under III.*

(C.)—INDIA-RUBBER.

COMPLETE SPECIFICATIONS ACCEPTED.

- 27,567 (1908). Capelle. Recovery or regeneration of indiarubber and similar products. Nov. 17.
 12,250 (1909). Clark. Apparatus for cleaning and devulcanising rubber. Nov. 10.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

- 25,842. Riches and Nelson. Preparing hides and skins for tanning and dressing. Nov. 9.
 26,040. Nance. Process of tanning. Nov. 10.
 26,231. Lehmann. Manufacture of vegetable glues. Nov. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

- 25,216 (1908). Hofmann and Main. *See under I.*
 19,804 (1909). Deutsche Versuchsanstalt f. Lederindustrie. Decolorising tannin extracts. Nov. 19.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATION.

- 25,121. Flick. Manufacture of soluble starch.* Nov. 1.

COMPLETE SPECIFICATION ACCEPTED.

- 2219 (1909). Wynberg and Wynberg. Treatment of sugar cane. Nov. 17.

XVII.—BREWING, WINES, SPIRITS, &c.

COMPLETE SPECIFICATION ACCEPTED.

- 4604 (1909). Vallat. Apparatus for distilling or rectifying wines, brandy, fermented worts, alcohols, petrols, essential oils, benzines, &c. Nov. 10.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

- 25,773. Wülfing. *See under XX.*
 25,956. Martin and others. Curing and ageing tobacco and like vegetable substances. [U.S. Appl., Nov. 30, 1908.]* Nov. 10.
 26,007. Carballé. Fermentation of milk.* Nov. 10.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

- 25,587. Schneider. *See under XIX.*
 25,665. Paul. Hardening abnormally soft water.* Nov. 6.

COMPLETE SPECIFICATIONS ACCEPTED.

- 23,651 (1908) and 6492 (1909). Morrison and Warren. Appliances for use in treating sewage effluent and the like. Nov. 10.
 5656 (1909). Schultze. Purification of water. Nov. 17.
 8593 (1909). Antoine. Apparatus for separating foreign substances from water. Nov. 17.

(C.)—DISINFECTANTS.

APPLICATION.

- 25,472. Chem. Fabr. Ladenburg. Disinfecting process. [Ger. Appl., May 24, 1909.]* Nov. 4.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

- 25,587. Schneider. Water-purifying apparatus for paper and like factories. Nov. 5.

- 25,771. Geller. Manufacture of paper and cardboard.* Nov. 8.

- 25,875. Pearson and Stoneham. Manufacture of paper. Nov. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

- 16,327 (1908). Milne. Machines for sizing and coating paper. Nov. 10.

- 24,131 (1908). Herz. Treatment of waste paper and fibrous materials in the preparation of paper pulp. Nov. 10.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

- 25,138. Chem. Pharm. Laboratorium "Sahir." Producing a dry formaldehyde compound. [Ger. Appl., Dec. 19, 1908.]* Nov. 1.

- 25,470. Einhorn. Manufacture of benzoysalicylic acid. [Ger. Appl., Nov. 13, 1908.]* Nov. 4.

- 25,678. Sefton-Jones (Quade). Preparation of sodium glycerophosphate. Nov. 6.

- 25,773. Wülfing. Preparing salts of lactalbumen. [Addition to No. 6179 of 1908.]* Nov. 8.

COMPLETE SPECIFICATIONS ACCEPTED.

- 26,075 (1908). Belart, and Digit Disinfectant Co. Production of compounds for internal use. Nov. 17.

- 3074 (1909). Sprenger. *See under III.*

- 4604 (1909). Vallat. *See under XVII.*

- 13,912 (1909). Zimmermann (Chem. Fabr. auf Aetien, vorm. E. Schering). Manufacture of cerium phenol compounds. Nov. 10.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATION.

- 25,998. Ruth. Colour photography. [Ger. Appl., Nov. 12, 1908.]* Nov. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

- 3601 (1909). Späth. Manufacture of a screen for colour photography. Nov. 10.

- 14,407 (1909). Danzer. Recovering the material of the support of cinematograph films and the metallic silver of the pictures. Nov. 10.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

- 25,553. Gray. Explosive compound.* Nov. 5.

- 26,239. Nobel's Explosives Co., and others. Explosives. Nov. 12.

- 26,359. Demetriade, Jonescu, and Coanda. Explosives.* Nov. 13.

- 26,362. Rintoul and Baker. Explosive and allied substances. Nov. 13.

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Canadian Section.

Meetings held at Toronto on Thursday, October 28th, and at Montreal on Friday, December 3rd, 1909.

WOOL: A CANADIAN NATURAL RESOURCE. A FIELD FOR CHEMISTRY IN SHEEP CULTURE AND ITS POSSIBILITIES.

BY JAMES P. MURRAY.

London Section.

Meeting held at Burlington House on Monday, November 1st, 1909.

DR. J. LEWKOWITSCH IN THE CHAIR.

TECHNICAL GAS CALORIMETRY.

BY J. H. COSTE, F.I.C.

When a fuel containing unoxidised or partially oxidised carbon and hydrogen, in any form, is burnt under suitable conditions the carbon is burnt to carbon-dioxide and the hydrogen to water; it depends on the conditions under which combustion takes place whether the water vapour formed is condensed or not. If it is condensed the latent heat of vaporisation of the whole of the water formed is included in the heating value of the fuel. When this happens the calorific value thus obtained is called the gross calorific value. It is only in such appliances as geysers that the heat given out from the water vapour in this way is utilised. In most cases the net calorific power, *i.e.*, the heat evolved by combustion when all the water is kept in the form of vapour, is all that can be utilised in heating appliances. The difference between gross and net calorific power is, therefore, a measure of the total amount of hydrogen present in a fuel.

It is obviously convenient to state the calorific power of gases in units of heat per unit volume. On the Continent the cubic metre is usually used in conjunction with the (great) calorie. In this country illuminating gas is bought and sold, under various Acts governing the gas industry, by the cubic foot, and all the results of statutory testings are corrected to a cubic foot at 60° F. and 30 in. barometer. The official testings of illuminating gas in the Metropolis are returned in calories per cubic foot and the only parliamentary standard for calorific power of illuminating gas is expressed in this manner. In all figures given in this paper the calorific power is expressed according to this official usage. The number of calories multiplied by 3.968 gives British Thermal Units.

I.—CALORIMETRY.

Any calorimetric method should give a means of determining, with such accuracy as may be possible, both gross and net calorific power. This object may be attained by either an indirect or a direct method.

A.—*The indirect method of determining calorific power.*—The researches of Julius Thomsen and of Berthelot have placed at our disposal values for the heat of combustion

of hydrocarbons and other combustible gases and vapours which are sufficiently reliable for most purposes. By means of these it is possible, if the composition of a gaseous mixture is known, to calculate its total calorific power.

In the case of coal gas and similar mixtures a difficulty arises in connection with the unsaturated hydrocarbons. It is difficult and in most cases impossible to decide their actual nature, and as the various hydrocarbons which may enter into their constitution have very different calorific values the matter is of importance as will be seen from the following table (calculated from Julius Thomsen's figures) giving the calorific values in great calories per cubic foot of various gases (A) measured at 0° C. and 760 mm., and (B) at 15.5° C. (60° F.) and 762 mm. (=30") the products in each case being cooled to 18° C.

Table I.

	(A.)		(B.)	
	gross.	net.	gross.	net.
Methane	268	240.5	254.3	228.2
Ethane	468	427.0	444.0	405.2
Ethylene	421	394	399.5	373
Propylene	622	581	590.2	551.3
Acetylene	392	378	371.9	358.7
Benzene	1010	969	958.3	919.4
Hydrogen	86.4	72.8	82.0	69.1
Carbon monoxide	85.9	85.9	81.5	81.5

It will be noticed that the difference between gross and net calorific power for each molecule of water formed by the combustion of a molecule of the gas is in (A) 14 calories, and in (B) 13 calories per cubic foot. In other words the difference between gross and net calorific power multiplied by $\frac{1.00}{1.14}$ or by $\frac{1.00}{1.13}$, as the case may be, will give the total percentage of hydrogen in the gas.

A gas, the calorific power of which had been found by direct means to be gross, 150.3 calories, net, 133.2 calories, was found to have the composition indicated below. The unsaturated hydrocarbons were assumed to be (1) ethylene, (2) propylene, (3) butylene.

Table II.

Composition.	Calorific power (calculated).			
	(1) gross.	(2) gross.	(3) gross.	
Carbon dioxide	nil	—	—	—
Oxygen	0.27	—	—	—
Unsaturated hydrocarbons	5.38	21.52	31.74	41.96
Carbon monoxide ..	13.09	10.73	10.73	10.73
Hydrogen	42.45	34.85	34.85	34.85
Methane	27.71	70.43	70.43	70.43
Nitrogen	11.10	—	—	—
	100.00	137.53 cal.	147.75 cal.	157.97 cal.
Per cent. total hydrogen	—	108.63	114.01	119.39
Deduction for latent heat	—	14.10 cal.	14.82 cal.	15.51 cal.
Net calorific power	—	123.43 "	132.95 "	142.40 "

It will be seen that the assumption that the unsaturated hydrocarbon is propylene gives results closely approaching those found experimentally. It is in fact found to be a good working convention for general purposes that the average calorific value of the unsaturated hydrocarbons is equal to that of propylene. The following table serves to illustrate the agreement between results calculated in this way and those obtained directly.

Table III.

Experimental.		Calculated.	
Gross.	Net.	Gross.	Net.
166.6*	149.3	167.4	150.0
150.3	133.2	148.2	132.8
143.0	127.7	143.2	128.2
148.0	130.3	143.5	128.5
143.5	127.0	143.6	128.6
145.7	129.3	143.9	128.8
145.8	131.0	147.3	131.8
143.3	128.3	144.7	129.2
143.1	126.2	140.0	125.6
152.6	134.2	152.3	134.9
143.5*	127.7	142.5	128.5
145.7*	129.3	143.8	128.3
144.5*	129.5	146.3	130.5

* Pure coal gas.

B.—*Direct methods of determining calorific power.*—Various forms of calorimeter have been devised for determining the calorific power of gases. They all depend on a known amount of water being heated to a measured extent by a known volume of gas. Two principal types of calorimeter have been proposed (a) in which a small and usually a fixed amount of gas is allowed to burn out and to heat a small and fixed amount of still water, (b) in which gas burnt at a measured rate is allowed to heat to an observed temperature a constant stream of water, a definite amount of which is collected during the period of observation. In the former class the highest temperature of a rise—a transient equilibrium—is noted, and in the latter the temperature which is reached as the result of a continuous equilibrium. The flow calorimeters are to all intents “geysers” in which special care is taken to insure complete combustion of the gas and complete absorption of the heat evolved. In either case it is obviously desirable that the proportions of gas burnt and water heated should be so adjusted that the rise of temperature may always be sufficiently great to insure reasonable sensitiveness of reading and not high enough to render loss by radiation a serious consideration. This optimum range of rise will vary in different instruments according to the efficiency of the measures taken to prevent radiation.

For the determination of the calorific value of a gas supply of any kind which can be burnt in practically unlimited quantities no doubt the flow type of calorimeter is the better, as the apparatus can be adjusted to remain in a state of thermal equilibrium for a considerable time, during which a relatively large volume of gas can be burnt and measured, and a correspondingly large volume of water heated and measured. Several readings of the temperature of the water at inlet and outlet can be taken and average temperatures computed for both inlet and outlet with a high degree of accuracy. The amount of water condensed in the abstraction of heat from the products of combustion can also be arranged to be sufficiently great to secure a good determination of net calorific power.

On the other hand the classical work of both Thomsen and Berthelot was carried out in calorimeters of the burn-out and fixed water type,* and for technical purposes both Hempel's and Simmance and Abady's portable calorimeters, which are of this type, give, if carefully adjusted and used, results of a fair degree of accuracy. Only the gross calorific power is determined in the two latter instruments.

Calorimeters of the still water type have been devised by Berthelot (bomb), Thomsen, Fischer, Hempel, Simmance and Abady, and of the flow type by Hartley, Junkers, Boys, and others.

It is, perhaps, desirable to summarise the principal features of some of the more important of these instruments

(A) STILL WATER CALORIMETERS.

Hempel's calorimeter.—This instrument which has been fully described in this Journal (1901, p. 880) is adapted for the combustion of small quantities—2 to 3 litres—of gas. The instrument is calibrated by means of pure hydrogen. No correction is made for radiation, and no precautions are taken to guard against loss of heat from this or other causes. No doubt if the calorific power of a gas is not very different from that of hydrogen the results obtained are fairly accurate, but in the case of coal gas the loss of heat by radiation would be greater and with producer gases less than with hydrogen. In an example given the rise of temperature for a reservoir full of hydrogen was 10.838°, which seems to be a rather large rise to measure in an unjacketed vessel. This is essentially a laboratory, not a field apparatus.

Simmance and Abady's portable calorimeter.—In this instrument the gas is collected in a holder capable of containing considerably more gas than is required for the actual determination. The gas is burnt from a small open tube burner like a Bunsen without the side holes. The calorimeter itself has an outer casing of polished metal separated from it by an air space. It consists of (1) two parallel cylindrical chimneys of different diameters communicating by means of a drum-shaped vessel into which their upper ends open and (2) water jackets for each of the chimneys opening into a larger one surrounding the upper drum-shaped vessel. This water vessel is covered and has a neck through which a cork can be inserted either for the purpose of shaking or to carry a thermometer. A suitable stand holds the calorimeter at such a height that the burner can be slid under the broader chimney which serves as a combustion chamber, the narrower one being for the escape of the exit gases after passing up the wide chimney and communicating their heat to the water during their passage across the drum, which has thin metal spirals depending from its inner upper surface. These serve both as baffles and collectors of heat. About 1 litre of water is placed in the vessel, the quantity varying according to the heat capacity of the instrument. The calorimeter is well shaken and the temperature of the water taken. The holder having been filled with gas is arranged to deliver, and the gas is lit as it issues from the burner. When the water confining the gas has risen to a certain mark, indicating that the proper quantity of gas is now in the holder, the burner is slid under the chimney and this quantity—about 0.05 cubic foot—allowed to burn out. The rise in temperature is noted after shaking, and this, with the amount of water and the known constant of the instrument, gives the data necessary for the calculation of the gross calorific power. It is best to calibrate the instrument with gas of known calorific power—preferably approximating to that of the kind of gas for which the instrument is most likely to be used.

(B) FLOW CALORIMETERS.

Flow calorimeters may be considered as of two classes (1) those in which the passage of both water and gas through the apparatus is, by one or many paths, very short and rather of the nature of a parallel arrangement and (II) those in which the water flows through a long tube around which the air slowly passes. The former class includes most of the flow calorimeters, Junkers' being both the best and the best known. Boys' instrument is the only representative of the latter.

Junkers' calorimeter is one of the earliest and best of its kind. A very good description with illustrations is given in this Society's Journal (1895, p. 631) by Hermann Kühne. The calorimeter is portable, fairly convenient and accurate, the height of the instrument and distance apart of the thermometers are the most inconvenient features. An arrangement exists for determination of net calorific power by measuring the condensed water. The calorimeter is sealed and apparently would hardly be worth repairing in case of leakage. The water content of this calorimeter is about 1700 c.c.

The method of using Junker's calorimeter is somewhat similar to that described for Boys' calorimeter. See, below.

* The difficulty of preparing large quantities of pure gases no doubt helped to determine this choice.

Boys' calorimeter was designed by Mr. C. V. Boys, in his capacity as a Metropolitan Gas Referee, for the purpose of official testings in the County of London. It is described in the Proceedings of the Royal Society (A. Vol. 77 1906, p. 122), in the Notification of the Metropolitan Gas Referees and in this Journal (1906, p. 234; 1907, p. 355). The water content of the coil and equalizing box is only 300 c.c. and of the space in the vessel used as a casing and to collect condensed water is only 400 c.c. up to the overflow. Another feature peculiar to this instrument is the free passage of the products of combustion through the apparatus. Mr. Boys is of opinion that "an inversion of the usual plan is essential to secure uniformity in the outlet temperature; that, in fact, the gases should have plenty of space to pass gently through the instrument and that the water should be taken through every channel strictly in series, all alternative parallel flow being prejudicial."

The instrument is convenient to manipulate, and it is not unduly subject to damage. The fact that it can be kept when not in use in an alkaline solution is a great advantage from the point of view of permanency.

It has stood the practical test of daily usage for nearly three years in each of the 19 gas testing places under the control of the London County Council. The most serious defect noticed has been leakage from the coils or unions. This can be tested for by placing the calorimeter in situ allowing it to drain well*, and then allowing water to flow at the usual rate for the same time as that during which the condensed water is collected. An appreciable collection of water indicates a leakage. It appears improbable that any other calorimeter at present in use would stand constant usage as well as this does when fairly treated. Certainly no other calorimeter is so easily taken to pieces for repair or for examination.

The official method of using the Boys calorimeter is described in the Notification of the Gas Referees. It is briefly as follows.—When a thermal balance has been established the temperatures of inlet and outlet water are taken at intervals during the combustion of $\frac{1}{3}$ cubic foot of gas and the water flowing through the instrument during this period is measured. The difference between the average inlet and outlet temperatures $\times 3$ and by the litres of water collected gives the *gross calorific power*. The condensed water is collected with the gas burning at the same rate as during the above experiment for not less than $\frac{1}{2}$ hour, and from its volume and the *gross calorific power* the *net calorific power* is calculated. A correction is made for the gain or loss to the system due to the flow of gases through the apparatus, and based on the difference of temperature between inlet and exit air, the composition of the exit air and the specific heat of its constituents. The above method of working is applicable to the Junkers of other similar apparatus. It is better to allow $\frac{1}{2}$ hour to elapse after starting before collecting condensed water as the surface of the coils is large, and water only runs down quite slowly. It is necessary to place the calorimeter centrally in the outer vessel as otherwise the flow of condensed water is very irregular. It would be an improvement to have three centring studs fixed inside the outer vessel or on the calorimeter casing.

Sources of error affecting the results obtained from flow calorimeters.—The following sources of error for the effects of which due allowance may be made are likely to affect the results of calorimeters of the Junkers or Boys type.

(1) Heat lost or gained in the exit gases according as they are hotter or cooler than the inlet air. (2) Heat lost or gained by condensation or evaporation of water during the passage of air through the calorimeter. (3) Losses by radiation from the body of the calorimeter. (4) Errors due to the assumption that 1 litre of water weighs one kilogramme. The values of these errors and the proper assignment of corrections to gross or net calorific power have been worked out in the case of the Boys' instrument.

(1) The volume of exit gas compared with that of gas

burnt has been determined by analysis of both gases. See table IV.

TABLE IV.

	I.	II.
Rate of burning, feet per hour	4.6	4.6
Carbon dioxide formed on explosion of gas, per cent.	56.0	57.1
Composition of exit gas.		
Carbon dioxide	8.76	8.52
Oxygen	6.17	4.47
Ratio—gas : air	1 : 6.9	1 : 7.2
gas : exit gases	1 : 6.4	1 : 6.7

The heat capacity of the products from 1 cubic foot of gas, on the assumption that 7 feet are obtained is about 0.06 cal. Experiments under varying conditions have led Boys to adopt the empirical correction of $\frac{1}{6}$ cal. for a difference of 1° between inlet and outlet air, indicating that other influences are included in this correction which under any conditions is small.

(2) If the temperature of the exit gases is above the dew point of the atmosphere of the laboratory, the exit gases which are fully saturated—will rob the system of an amount of heat equal to the latent heat of vaporization of the additional water contained in them and further the amount of condensed water will be reduced to a corresponding extent. On the other hand if the exit gases are cooler than the temperature at which dew is deposited in the laboratory the calorimeter will gain an amount of heat and of water corresponding to the reduced water-holding capacity of the air.

The extreme magnitude of this error can be illustrated by an example. Suppose the temperature of the laboratory to be 21°C . and the air fully saturated with aqueous vapour the temperature of the water supply being low, the exit gases having a temperature of only 10°C . If during the burning of 1 cubic foot 7 feet of these gases pass through the instrument corresponding to $7\frac{1}{2}$ feet of air entering the total amount of water vapour entering will be 4.3 grms. (0.5 grms. in gas + 3.8 grms. in air). The total amount of water leaving will be 1.8 grms. and the excess water condensed ($4.3 - 1.8$) = 2.5 grms. The heat of vaporization of 1 gm. of water at 100°C . is 0.536 great calorie, and at 0° is variously given as from 0.589 to 0.606 so that in any case not more than $2.5 \times 0.6 = 1.5$ calorie per foot of gas burnt could be the amount of error due to this cause. The ease of a low dew point and high outlet temperature may also be considered. It is seldom that the humidity of the atmosphere is less than $\frac{1}{3}$ of the maximum and the temperature of exit gases is seldom above 25° . Assuming both of these conditions and an air temperature of 21° the water vapour entering during the burning of 1 cubic foot would be $0.51 + \frac{7.5 \times 0.51}{3} = 1.78$ grms. and that

leaving the apparatus 4.55 grms., so that in this case the total loss would be 2.77 grms. per cubic foot = 1.66 calorie per cubic foot of gas burnt. That is, under quite extreme conditions the *gross* calorific power as determined without correction may be ± 1.6 calories from the truth owing to differences of humidity of the atmosphere. As the water condensed or evaporated gives up or takes away a corresponding amount of heat the *net* calorific power is unaffected.*

* The following table calculated from Regnault's values for water in 1 kilo. of saturated air was used in the above calculations.
Weight of water in 1 c.f. of gas saturated at $^\circ\text{C}$.

t.	Grms. water.	t.	Grms. water.
10	0.26	18	0.43
11	0.28	19	0.45
12	0.30	20	0.48
13	0.32	21	0.51
14	0.35	22	0.54
15	0.36	23	0.57
16	0.38	24	0.61
17	0.40	25	0.65

* It is best to leave it overnight.

(3) It is difficult to conceive that an instrument so well designed as Boys' calorimeter should allow appreciable loss by radiation or conduction. The outer casing is bright nickel, between this and the casing of the coils is an air space. The outer coil has cold water, usually at a lower temperature than the surrounding air circulating through it. A brattice of sheet brass lined with cork dust separates the outer coil from the inner hotter coil and the mixing chamber.

(4) The temperature of exit water varies between, say 24° and 40° C. The following table shows the percentage error caused by the supposition that 1 litre of water measured at various temperatures has a weight equal to 1000 grms.

TABLE V.

Temperature	Percentage amount of error (+)
20°	0.177
25°	0.293
30°	0.433
35°	0.594
40°	0.776

That is, for gas of 150 calories gross calorific power the results, both gross and net would be too high by from 0.26 to 1.16 calories according to the temperature of exit water.

Junkers' and Boys' calorimeters may be considered as the two most in use for practical purposes and it may be well to discuss at some length their respective advantages and disadvantages and the necessity for applying certain corrections to the results obtained with them.

Although both instruments are fairly portable the Junkers certainly has the advantage in this respect: its simplicity and the fixed arrangement for obtaining a proper head of water render it particularly suitable for fitting up in any locality. The flow of water can easily be regulated by means of the quadrant tap and for gases of very varying calorific power the use of a Bunsen flame enables perfect combustion to be attained at any reasonable rate of consumption. The rise of temperature attained by the exit water can be kept constant by altering the amount of water passing through the instrument. The Boys' instrument is easier to read owing to both thermometers being on the same level. It is more sensitive to rough handling.

The temperature of the exit water is more constant in the Boys' than the Junkers instrument as the following examples will show:—

There appears to be no reason to suppose that the average of several readings does not in either case accurately represent the average temperature of outlet water.

TABLE VI.

Junkers.				Boys.	
Inlet.		Exit.		Inlet.	Exit.
(A.)	(B.)	(A.)	(B.)		
16.93	16.99	27.13	37.88	17.38	42.30
—	—	.09	.89	—	.28
—	—	.10	.82	—	.26
—	—	.11	.86	—	.24
16.92	16.99	.11	.86	17.38	.24
—	—	.05	.83	—	.24
—	—	.13	.78	—	.24
—	—	.08	.78	—	.24
16.93	16.99	.10	.85	17.38	.24
—	—	—	.86	—	.26
—	—	—	.82	—	.26
—	—	—	.82	—	.27
—	16.99	—	.82	17.37	.24
—	—	—	.80	—	.24
—	—	—	.82	—	.25
Average ..	—	—	37.83	—	42.25
Average variation	—	0.018	0.027	—	0.014

The agreement of the results obtained by the simul.

taneous working of two Boys' calorimeters with the same gas is shown below:—

TABLE VII.

No. 1.		No. 26.	
Calorific power.			
	Gross.	net.	
I....	146.0	129.4	gross. 146.0 net. 129.5
II....	145.8	129.0	gross. 145.0 net. 129.2
III....	146.7	126.9	gross. 147.0 net. 128.5
IV....	147.9	130.9	gross. 145.9 net. 129.9
V....	146.1	129.0	gross. 146.3 net. 129.9
VI....	146.8	130.1	gross. 145.8* net. 130.2

* Gas burning at 2½ ft. per hour. All others at 4—5 feet.

A similar series has been carried out with the Boys and Junkers instruments.

TABLE VIII.

Boys' No. 26.		Junkers.	
	gross.	net.	gross.
I....	144.9	130.1	145.8
II....	145.1	130.2	146.1
III....	147.3	132.9	146.7
IV....	145.9	131.0	144.4
V....	144.0	130.6	145.0
VI....	143.8	129.3	144.7
VII....	143.9	129.8	144.6
Average	145.1	130.6	145.3

The behaviour of both instruments with gas burning at different rates, the water flow being maintained at a constant rate, is satisfactory as shown in the following series of experiments:—

TABLE IX.

Consumption of gas in feet per hour.	Calorific power.			
	Boys.		Junkers.	
	gross.	net.	gross.	net.
5	146.3	130.9	146.0	131.6
4	145.1	130.1	145.1	130.8
3	146.5	130.4	—	—
2	144.2	128.7	146.8	131.9

It has been suggested that combustion is not perfect in the Boys' instrument owing to the use of flat flames instead of atmospheric burners. To test this point a tube was inserted in one of the holes in the top of the calorimeter and the exit gases slowly aspirated (1) over pumice saturated with caustic potash solution (2) sulphuric acid (3) a weighed soda lime tube (4) a column of about 12 in. of heated copper oxide (5) a weighed sulphuric acid tube (6) a weighed soda-lime tube. 8 litres of carbon-dioxide-free products corresponding to nearly 9 litres of exit gases were collected, tubes (3) and (6) had not altered in weight and tube (5) had gained 0.008 grm. (=0.0009 grm. hydrogen); any unburnt carbon should have been oxidised by the copper oxide and weighed as carbon dioxide in (6). The gas* was burning in the calorimeter at 5.3 feet per hour—above the maximum rate allowed in official testings. The error due to imperfect combustion is therefore negligible.

Both instruments may be expected to give the best results when working under the conditions which should prevail in a physical laboratory and both give very good results under conditions much less satisfactory.

II.—The calorific power of gas considered in relation to methods of manufacture and to illuminating power.

The calorific power of gas depends—as undoubtedly does the illuminating power—on its composition. The relation between calorific power and composition is however much more direct than in the case of illuminating

* Ordinary house gas having a gross calorific power of 147 calories was used for this experiment.

DISCUSSION.

Prof. C. V. BOYS said that when calorimetry as a practical question in relation to official testings first arose, he made a great many tests with the Junkers and other calorimeters. He considered that the spasmodic variation of the thermometer at the outlet was objectionable; there were constant little jumps which would make it tiresome for gas examiners to use it. In making tests day by day it was desirable that as much as possible should be done by the apparatus, and that as little as possible should be left for the daily attention and judgment of the user of the instrument. It seemed essential that the outlet thermometer readings should be as smooth and even as that of the inlet water; so that one would merely have to make readings at definite times, and would not have to judge what the fair mean reading would be. The imperfect mixing of parallel flows of water through alternative channels would almost certainly give rise to jumps which no mixing-chamber, such as was at the top of the Junkers instrument, could possibly overcome. There was an instability of conditions which a small mixing-chamber could not possibly overcome. He felt that the difficulty could be overcome only by arranging that the water should take every part of the instrument in series; and that there should be no place where a pocket of water could accumulate until it got hot enough to force its own way on and overwhelm the other stream. He thought he was justified in that conclusion because his own outlet thermometer was free from these jumps, appearing quite constant sometimes for minutes together almost as if it were stuck; and he had not seen that in any other calorimeter. There seemed to be an idea that the real scientific test of the value of gas was the net test; but he was by no means sure that this was a very scientific test, for this reason: In taking a net test, the heat due to the condensation of most of the steam and the cooling of the resulting condensed water to the outlet temperature, was subtracted from the total observed heat, but this did not represent any actual use of the heating power, as the heat given out by the permanent gases in cooling from the boiling point to the outlet temperature was included in the net value. The figure so obtained was absolutely artificial; it meant nothing. As the Gas Referees had prescribed a net test his position might seem inconsistent, but calorimetry was practised largely, and the gross and net values were in universal use long before there was any question of making official testings of the calorific value of gas, and it was obviously desirable in instituting an official test not to depart from recognised practice. There was no reason for selecting one particular net value, even if it did correctly represent the use of gas; every user of gas should be equally entitled to a special net value to meet his requirements. He thought it right to describe the calorific value by the use of calories rather than by B.T.U. It was more easy to obtain appliances, which should be cheap and accurate, based upon the metric than upon our system, and having so made the measurement it was most natural and direct so to state it. With regard to the centering of the instrument inside the case, there would be no difficulty in providing that the inner casing should not bear up against the condensed water outlet.

Mr. J. W. HELPS agreed with the author as to the impossibility of being able to deduce the calorific power from its illuminating power of a gas, and *vice versa*. He carried out some experiments on that point 10 years ago; and the figures now shown agreed closely with those he had obtained. He did not see the necessity for the two tests; the calorific test would be sufficient; the other was really of no practical use. Whatever burner was used for testing illuminating power, the extent to which a reduction could be made was limited by the heating power of the gas; and as it was possible to vary the conditions under which the gas was produced, so as to increase its calorific power while actually reducing its illuminating power, the infliction of a test for the latter stood in the way of the customer being supplied with the most suitable gas for his various purposes. That was an important question which would have to be considered,

and, in his opinion, it would not be long before they had the calorific standard.

Mr. W. J. DIBBIN said that there could be no question but that Professor Boys had devised a thoroughly trustworthy calorimeter, by means of which the calorific value of coal gas could be readily ascertained. The only way of getting a result with the old form of calorimeter was to take a number of observations, expunge any out-of-the-way ones, and take the average of the rest—which was not a very scientific method. This instrument certainly made a great advance. He looked on the ordinary gas photometer as now used as a thing of comparatively little value. He hoped, with Mr. Helps, that the time was not far distant when the calorific test would be the one reliable test of coal gas, so far as it was in use for lighting. It was unnecessary to enter into any discussion of the merits of water-gas; but it was a question to what temperature an incandescent mantle must be raised to produce sufficient light, and what quantity of gas was required to raise a definite quantity of water to a certain temperature for cooking.

Dr. H. G. COLMAN said that the figures given by Mr. Coste agreed closely with those he had obtained during the past 10 years, but he differed from him with regard to the table showing the relation between the results obtained by direct test with the calorimeter, and those calculated from the analysis of the gas. The calorimeter tests were always made with a wet meter, and the results calculated for moist gas at 60° F. and 30 inches Bar., under which circumstances they contained about 1.5 per cent. of moisture; the calculated results were made on the assumption of a dry gas, and if the moisture had been allowed for the calculated results would have come out about 1.5 per cent. lower* than the observed figures. For ordinary purposes it was sufficient to assume that the unsaturated hydrocarbons consisted of propylene, but in the newer methods of manufacture, especially in vertical retorts, the unsaturated hydrocarbons contained a smaller proportion of benzene and higher proportion of ethylene. He trusted that the day would soon come when a calorific standard would be substituted for one of illuminating power, and hoped that Mr. Coste's paper would help that day forward. He fully agreed with Mr. Helps, however, that the imposition of a double standard was much to be deprecated, and believed that in actual working it would soon be found impracticable. He had made thousands of tests with the Junkers calorimeter and had found it an excellent instrument. There were slight jumps sometimes in the reading of the outlet thermometer, but these jumps were only fractions of a degree, and in the ordinary run of a test there was practical agreement between the two instruments. The chief objection to the Junkers calorimeter was the different level of the two thermometers, which necessitated the jumping up and down of the operator during the test.

Mr. G. C. JONES wished to defend one class of manufacturers against the charge of not being able or willing to state the thermal efficiency of the goods they sold. Reputable gas-engine makers would always guarantee the efficiency of their engines. It was true they preferred to speak of so many feet of gas per H.P. hour, and natural that they showed an increasing preference for Manchester gas as the standard, but, if pressed, they would usually guarantee one H.P. hour for so many calories supplied to their engine in the form of gas. It would nearly always be found, however, that they refused to be debited with more than the so-called "net" calories. The general adoption of this term could be traced to certain discussions concerning the efficiencies of gas producers and gas engines which took place ten or fifteen years ago, when its use led to much confusion and some protests. Its adoption improved the paper efficiency of a gas-engine, but that was hardly a reason for retaining in their vocabulary a word which had been characterised by Prof. Boys as unscientific. If the discussion led to the disuse of that ambiguous term, Mr. Coste's paper would be remembered with gratitude by many of them.

* The actual difference according to The Gas Referees' table would be 1.8 per cent.—J. H. C.

Mr. C. J. D. GAIR said he had found the Simmance-Abady calorimeter gave excellent results. With the Junkers calorimeter there was a tendency for the outlet temperature to jump in working; but, with the Simmance-Abady this did not occur, neither was there the difficulty in the flow of the condensed water which in the Junkers was somewhat irregular, and, unless several cubic feet of gas were burned and the products collected, a proper reading was not ensured. A snap test could not be taken accurately with a Junkers calorimeter, but this was possible with the Simmance-Abady. It seemed an excellent suggestion to take propylene as the most correct hydrocarbon from which to calculate, but undoubtedly the calorific test itself was greatly to be preferred in obtaining the heating value of the gas.

Mr. COSTE, in reply, said he was very pleased to hear Professor Boys appreciated the point about the centering of the instrument. It was not made as a merely academical suggestion; but some little time ago they found that the differences between the "gross" and the "net" calorific power in certain results were such as they knew to be quite impossible, and a careful examination of the instrument showed that by placing the calorimeter eccentrically in the outer casing, similar erroneous results were obtained, while, by carefully centering it, the results at once became normal. There seemed to be such a general agreement that his general results were moderately accurate that he felt he had very little to defend. He noted Dr. Colman's point about moist gas; but the fact remained that the figures as calculated did agree very well for all practical purposes. It was always better, of course, to directly ascertain all figures which were capable of being so determined; but the results of analysis were frequently useful in cases where the direct determination would be impossible; and at other times were useful in confirming an observed result. He had stated in the paper that the Junkers was an excellent instrument; there was no doubt about the jumping which had been referred to, but the average temperatures were accurate.

Nottingham Section.

Meeting held at Nottingham on Wednesday, November 17th, 1909.

MR. S. J. PENTECOST IN THE CHAIR.

THE GROWTH OF MICRO-ORGANISMS ON COTTON.

BY S. R. TROTMAN, M.A., F.I.C.

In a recent communication (this J., Nov. 30, 1909, 1180) S. J. Pentecost has called attention to a pink discolouration sometimes caused in cotton goods by the formation of pseudo-mauveine. I have recently investigated a case of discolouration which, although superficially identical and to the eye indistinguishable from this, was nevertheless due to a totally different cause, namely, the growth of a chromogenic mould. The goods in question were examined and passed when finished, but after being stored for a fortnight, developed a faint pink colour so evenly distributed as to give them the appearance of having been dyed. The absence of aniline colouring matters was proved and microscopic examination showed the presence of mould. Cultures were then made from the material, with the result that pure cultures of a mould were obtained which had a rose-pink colour, and which were capable of reproducing the colour of the damaged cotton when sown on sterilised lace and cotton wool containing nitrogenous food material. The colour was not readily developed on gelatin but grew well on a starch medium, particularly in the presence of a trace of an organic acid; in neutral or alkaline media the growth was very slow. The goods in question had been dressed with starch and a little tartaric acid, and thus the most favourable conditions for the growth of the mould were

reproduced. The colonies consisted of very fine mycelia which were closely attached to the surface of the medium, and which only produced aerial colourless hyphae carrying sporangia after an interval of nearly a fortnight. A second batch of the same goods developed the colour while standing after the soda boil, and it was probable that this was the point of infection. The organism or its spores were capable of withstanding the "chemic" and acid and subsequently developed under the influence of the warmth of the warehouse. As I can find no published reference to such an organism and the results of its growth are so remarkable and so liable to be mistaken, I think it desirable to put its existence on record.

Although pure cellulose is very stable and not readily attacked by micro-organisms, impure cotton is very liable to bacterial damage. It sometimes becomes evident in the form of spots, or colonies, or a diffuse growth; occasionally a chromogenic organism may entirely alter the colour of cotton goods. Bacterial growth often causes tendering of the cotton fibre and always, in the case of finished goods, destruction of the dress, frequently accompanied by the production of a musty odour. Cotton may become infected during bleaching and finishing at almost any stage, and when once infected, especially with a spore-forming organism, the subsequent processes are often not sufficiently drastic to kill the latter, which lie dormant till the goods are stored and then form a fresh growth. Thus, in the case mentioned above, the infection was proved to take place before the goods were bleached, and neither the bleach nor the acid had killed the spores.

The principal causes of infection are:—(1) Impure water for steeping and other processes. (2) Incomplete removal of nitrogenous constituents during soda boil. (3) Allowing goods to lie about in a damp condition between the processes. (4) The use of inferior materials in dressing, such as low grade starch and glue. (5) Careless storing of finished goods. (6) Insufficient cleanliness of plant and buildings.

Impure water.—Where suspicious or polluted surface or subsoil waters are used, mildew frequently results. This is particularly noticeable when polluted waters are used for making up finishing mixtures, since the heat employed is rarely sufficient to kill spores. The rapidity with which dressing mixtures sometimes "sour" is often traceable to this cause.

Incomplete soda boil.—Pentecost and I have previously emphasised the fact that the first and most important rule of successful bleaching is a thorough soda boil. An incomplete boil leaves not only greasy matters, which protect the fibre from the action of the chlorine, but nitrogenous bodies, which may subsequently cause trouble both directly and indirectly, in that they render the cotton more liable to bacterial infection. A great deal of scoured cotton contains as much as 0.3 per cent. of nitrogen, and in practically every case of bacterial infection that I have examined I have found a high nitrogen content in the cotton after removing the dress by fermenting or other means.

Careless handling between processes.—The danger of allowing moist goods to lie about, especially in warm weather, is often not sufficiently realised. It is a common cause of mildew.

The use of low-grade finishing materials.—In many cases price is the only factor which determines the selection of finishing materials, no regard being paid to quality. But in the selection of starches and glues quality should be the chief factor. All starches containing an undue proportion of water are liable to be mouldy when used, and those containing much nitrogen are also unsuitable for many purposes. Further, many thin starches, which are often essentially mixtures of starch and dextrin, contain as much as six per cent. of dextrose or other reducing sugars. This no doubt exercises a selective influence upon aerial organisms. At any rate goods dressed with such starches do not, in my experience, keep well. The following is an example of a thin starch used for goods which afterwards developed mould:—Water, 10-40 per cent.; dextrin, 20-00 per cent.; dextrose, 6-95 per cent.; starch, 62-40 per cent.; mineral matter, 0-25 per cent. Inferior glues, in a similar way, owing to the large amount of soluble nitrogen which they contain and the deliquescent nature

of the peptones, are very liable to become mouldy. It is very rare to find mould where a high grade glue has been employed. I give examples of good and bad glues, both used for cotton goods.

	Good.	Bad.
	per cent.	per cent.
Water	14.23	16.00
Ash	1.33	2.35
Gelatin	78.08	66.25
Peptones, etc.	1.95	11.42
Non-gelatinous bodies	4.41	3.98

Careless storing of finished goods is sometimes responsible for the development of bacterial growth. This is often noticed in those that are made for export to warm and damp climates. All cotton goods, however carefully prepared, contain numerous organisms, and the conditions of storing should always be such as will discourage their growth. Of course cleanliness is also an important factor. Occurrence of mouldiness is not infrequently found to be due to organisms indigenous to the customers premises, and does not recur after the application of sanitary precautions.

A NEW CHROMOGENIC ORGANISM.

BY S. R. TROTMAN, M.A., F.I.C.

I recently had occasion to examine some skivers which had developed a discolouration during drying. This varied from pinkish-brown to a distinct pink. An analysis of the skivers showed a slight excess of lime and a preponderance of soluble extractive matter in the damaged goods. As excess of lime is liable to produce harshness and brownish discolouration, there was some reason for supposing that this might be the cause, but this would not account for the increased extractive matter. This suggested a decomposition possibly resulting from bacterial growth. Cultures made from the pink skin showed the presence of two chromogenic organisms;

one of these proved to be a variety of pink torula which produces a reddish brown growth on gelatin media, but not identical with the ordinary pink torula. The second was a mould which forms a bright scarlet mycelium, and when sown on sound skins produces a colour which is identical with that observed on the damaged ones. On gelatin the colonies start as colourless or faintly pink spots, which gradually become darker till they have a bright red colour. After growing for about a week a number of colourless aerial hyphae are thrown up, the colour being confined to the mycelium, which forms a skin-like growth on the surface of the gelatin and gradually causes its liquefaction. I believe that no instance of such an organism has been hitherto recorded.

New York Section.

Meeting held on Friday, October 22nd, 1909.

MR. MAXIMILIAN TOCH IN THE CHAIR.

A NEW FORM OF LEAD SULPHURIC ACID CHAMBER.

BY FREDERICK J. FALDING.

(See this Journal, October 15th, 1909, 1032).

Scottish Section.

Meeting held at Glasgow, on Tuesday, October 19th, 1909.

MR. D. J. PLAYFAIR IN THE CHAIR.

TEA MANUFACTURE: THE WITHERING PROCESS.

BY W. CARRICK ANDERSON, M.A., D.Sc.

(c.f. this Journal, 1909, 285—288.)

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

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I.—PLANT, APPARATUS, AND MACHINERY.

Magnesium chloride; Action of feed water containing — on the walls of steam boilers. A. E. Lange. Z. Ver. deutsch. Zuckerind., 1909, 1011—1019.

AFTER a brief account of earlier work on this subject, including that of Ost (this J., 1902, 1177), and that of Heyn and Bauer (this J., 1908, 569), the author describes experiments on the action of solutions of magnesium chloride at 100° C. alone, and in presence of different quantities of calcium carbonate, on iron. Polished iron plates, of equal areas, were used, and in most of the experiments the plates were wound with 2 turns of 1 mm. copper wire in order to approximate as closely as possible to the conditions which obtain in a boiler (i.e., iron in contact with copper). The plates were weighed, then immersed in the solution (maintained at a temperature of 100° C.) for 3 hours, and subsequently weighed again. In some comparative experiments, the plates were immersed in distilled water and in Berlin tap water. The main conclusions are as follows:—Iron is more strongly attacked by distilled water than by tap water. Magnesium chloride attacks iron in contact with copper more readily than iron alone; if an equivalent quantity of calcium carbonate is added to the magnesium chloride solution, the

extent to which the iron is attacked both in presence and in absence of copper, is reduced by more than 50 per cent. In absence of calcium carbonate, the passage of air through the solution of magnesium chloride, only slightly increases the action on iron; in presence of calcium carbonate (in quantity equivalent to the magnesium chloride), aeration considerably increases the action on iron; these two statements apply both when copper is present and when it is absent. A solution containing 5 grms. of magnesium chloride per litre attacks iron to about the same extent as tap water. The following are some of the figures showing the action of magnesium chloride on iron (copper being present in all cases) and the inhibitive influence of calcium carbonate on this action, the action of distilled water being represented by 100:—

5 grms. MgCl ₂ (per litre)	80.75
" " " + 1 eq. CaCO ₃	27.90
" " " + 1 " " "	22.10
10 grms. " " "	97.20
" " " + 1/2 " " "	49.10
" " " + 1/4 " " "	43.30
15 grms. " " "	98.20
" " " + 1/2 " " "	63.40
" " " + 1/4 " " "	48.10
25 grms. " " "	127.00
" " " + 1/2 " " "	89.50
" " " + 1/4 " " "	49.00

—L. E.

Volatile liquids lost in various industries; Recovery of — by cooling. G. Claude. Comptes rend., 1909, 149, 780—782.

IN order to recover volatile liquids, such as alcohol or ether, from air containing a small proportion of their vapours (such as is produced in the manufacture of Chardonnay silk, smokeless powder, celluloid, etc., the author proceeds as follows:—The air is subjected to a pressure of 4 atmospheres and passed through a water-cooled refrigerator where some water vapour is condensed; it then enters a multitubular condenser where it is gradually cooled until, at the top, the temperature is about -90°C . As the liquid first formed contains mostly water, that produced later is richer in the more volatile liquids, and the operation is so conducted that the liquid formed at any stage is not frozen. The air passing from the top of the apparatus is used again as a cooling medium. By this method it is possible to treat 20 cubic metres of air per horse-power-hour and to recover nine-tenths of the vapours present.—J. C. C.

PATENTS.

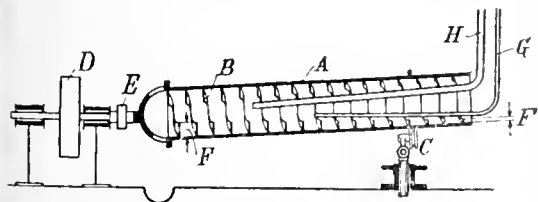
Subjecting gases or vapours to the action of liquids; Apparatus for — W. Feld. Hönningen-on-the-Rhine, Germany. Eng. Pat. 15,683, July 23, 1908.

THE claim is for improvements in the apparatus described in Eng. Pat. 11,206 of 1905; (this J., 1906, 838), and consists in providing horizontal or vertical perforated screens which are attached to and rotated by the vertical shaft which carries the spraying devices. The screens may be formed of perforated metal sheets, metallic gauze, or of a series of laths arranged like louvres. The object of the screens, through which both the gas and spray pass, is to facilitate the separation of the latter from the former.—W. H. C.

Pressing and straining animal and vegetable substances or other pulpy matter. S. G. Broadbent, Bradford. Eng. Pat. 22,150, Oct. 20, 1908.

THE claim is for improvements in presses having a cylindrical body, closed by a conical cover, and into which a conical ram is forced from below. The cylinder, cover, and ram-head are all perforated and covered with filter-cloth or other suitable filtering medium. The improvements consist in providing hollow chambers in the cylinder wall, cover, and ram-head into which the expressed liquid flows and from which it is discharged into appropriate receivers. One or more conical partition-plates may be arranged at suitable heights across the cylinder. These are hollow, and are perforated on their upper and lower surfaces and covered with filter-cloth. They serve to increase the ratio of the active filtering surface, the expressed liquid passing into the interior of the plate and being discharged from the edge into the perforations of the cylinder, whence it passes to the hollow chamber behind.—W. H. C.

Separating substances of different specific gravities and apparatus therefor. W. P. Thompson, Liverpool. From Badische Maschinenfabrik und Eisengiesserei vorm. G. Sebold und Sebold und Neff, Durlach, Germany. Eng. Pat. 1151, Jan. 16, 1909.



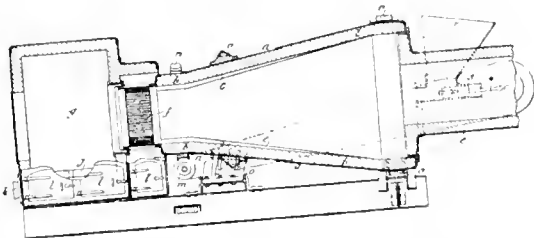
THE materials to be separated are fed into the drum, A, towards the lower end, by the pipe, H, and are washed by water fed through the pipe, G. The drum, A, is supported on the rollers, C, and by the bracket, E; it is rotated by the pulley, D, and is provided with an interior helical blade, B, which decreases in breadth from the lower to the upper end, as indicated at F, F, so that the turns of

the helix form settling pockets at the lower end of the drum. Provision may also be made for imparting to the drum a continuous or intermittent, vertical, horizontal or transversal shaking motion, this being effected by arranging the rollers which carry the upper end of the drum in a supporting ring resembling a "Cardan joint." The heavier material is carried upwards against the stream of water and is discharged from the upper end of the drum and the lighter portion is washed over the lower end of the helix.—W. H. C.

Filters; Automatic — A. James, London. Eng. Pat. 1315, Jan. 19, 1909.

THE claim is for improvements in the filters described in Eng. Pat. 11,623 of 1906 (this J., 1906, 989) and consists in arranging the rotating filter frames so that they are completely immersed in the pulp tank and that the vacuum is applied to both sides of the frame, with the result that filtration takes place on both faces simultaneously. Further, in order to facilitate the discharge of the cake, each frame is rotated during the introduction of the compressed air, the cake falling off from each filtering surface when it is facing downwards.—W. H. C.

Furnaces. Bell Bros., Ltd., and W. L. Johnson, Middlesbrough. Eng. Pat. 4123, Feb. 19, 1909.



THE fuel is fed by the plunger, s, from the hopper, r, into the upper end of the inclined conical furnace, formed of an outer metal casing, a, lined with refractory material, b, and provided with tapering projections, c, which lift up the fuel and drop it through the fire. The furnace is supported on rollers, a, a, and is rotated by the gear, m, n. The volatile portion of the fuel is burned off in the upper part of the furnace and the coked residue and ashes pass over the circular grate, f, through which any fine ash falls into the combustion chamber, g, where the coke is completely burned on the bars, j, by the aid of forced draught introduced through k. The ashes are removed through the doors, l, and the flame and hot gases pass through the fixed flue, e, into the tubes of the boiler. The furnace is designed to burn shale from coal washing plants and spoil heaps and other low-class fuels containing a high percentage of ash, which cannot be burned on ordinary grates.—W. H. C.

Barrels for oil and the like; Rendering liquid tight — [with waste sulphite pulp liquor]. B. Diamond, Idaweiche, Germany. Eng. Pat. 5206, March 3, 1909.

THE interior of the barrel is treated with waste sulphite pulp liquor resulting from the manufacture of cellulose from wood. The liquor should have a specific gravity of from 25° to 35°B , and is previously mixed with treacle, starch paste or water-glass.—W. H. C.

Evaporating apparatus. S. M. Lillie, Philadelphia, Pa. U.S. Pat. 939,143, Nov. 2, 1909.

THE apparatus consists of a shell divided by a vertical tube-plate into a steam chamber and an evaporating chamber. Horizontal tubes project from the steam chamber into the evaporating chamber, and the liquid to be evaporated is distributed over these tubes and over the vertical tube-plate by means of a perforated horizontal plate arranged above the tubes. The liquid is delivered on to this plate from a pipe running centrally across it, provided with two series of jets facing in opposite directions.—A. T. L.

Kilns. G. E. Snowden, New Cumberland, W. Va., U.S.A. Eng. Pat. 27,551, Dec. 18, 1908.

SEE U.S. Pat. 916,498 of 1909; this J., 1909, 465.—T. F. B.

Organic and inorganic bodies transparent and translucent; Process for rendering —. H. Streller, Leipzig, Germany. Eng. Pat. 8621, April 10, 1909. Under Int. Conv., April 11, 1908.

SEE Fr. Pat. 401 961 of 1909; this J., 1909, 1186.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Incandescence [electric] lamps; Total and monochromatic radiation of —. C. Féry and C. Chénaveau. Comptes rend., 1909, 149, 777-779.

By applying their experimental observations on the radiation of incandescence lamps with filaments of carbon and tungsten, to a mathematical expression connecting the absolute temperature of the filament with the number of watts expended, the authors find that the temperature (1780° C.) of a carbon filament is lower than that (1875° C.) of a tungsten filament. The specific yield of the tungsten filament is also greater (0.82 candle per watt) than that of a carbon filament (0.29 candle per watt). The latter observation confirms, from theoretical considerations on radiation, what is known in practical electric lighting.—J. C. C.

Development of the coal and iron industries. Greville Jones. See X.

PATENTS.

By-product retort coke-oven. H. Prentice, Bellevue, Pa. U.S. Pat. 939,086, Nov. 2, 1909.

THE walls separating adjacent coking chambers are provided with a series of separate horizontal combustion chambers arranged in pairs at different levels, each chamber having separate gas and air supplies. Between the two series of combustion chambers are arranged horizontal flues forming discharge passages for the burned gases, and alternately with these flues there are air heating flues, so that these latter are exposed at the top and bottom to the discharge flues and at the sides to the heating flues.—A. T. L.

Vertical retorts. R. Dempster and Sons, Ltd., and H. J. Toogood, Elland, Yorks. Eng. Pat. 28,201, Dec. 28, 1908.

VERTICAL retorts arranged in pairs or in rows are provided with a passage, controlled by a valve or seal, connecting the bottom-mouthpieces of two retorts which are charged alternately. The porosity of the charge varies during the process of coking, but by means of the connecting passage, the gas from the one retort can escape by way of the freshly charged retort in which the charge is more porous. The passage is closed by the valve, or seal, during charging. The invention is particularly applicable to retorts charged in the manner described in Eng. Pat. 19,437 of 1908 (this J., 1909, 1116).

—A. T. L.

Gas producer apparatus for the manufacture of gas suitable for heating and illuminating purposes. C. B. Tully, London. Eng. Pat. 22,851, Oct. 27, 1908.

THE patent relates to producers of the type in which a vertical retort for the decomposition of coal, tar, etc., is heated externally by the combustion of gas generated in a lower fuel chamber, there being separate air supplies to the gas generating chamber and to the combustion chamber for heating the retort. According to this invention, the valves controlling the two air supplies, the stack-valve, and a valve controlling the supply of steam to the lower part of the producer are inter-connected so that steam is admitted to the producer when the air valves and the stack-valve are closed, and to the stack-pipe when the air valves and the stack-valve are open.

—A. T. L.

Gas producers. C. B. Tully, London. Eng. Pat. 24,803, Nov. 18, 1908.

THE patent relates to producers of the kind in which liquid hydrocarbon is injected into a mass of incandescent fuel, the spraying nozzle being arranged beneath an arch which serves to keep a space in the neighbourhood of the nozzle free from fuel. In order to remove the carbon which is deposited on the incandescent fuel, a supply of air is admitted during the ordinary blowing of the producer through a louvre-like wall or grate arranged beneath the spraying nozzle and inclined inwards and downwards. The air chamber behind this wall is provided with an inspection-door and with a valved air inlet. A separate main valve controlling the supply to this air inlet may be inter-connected with other valves as described in Eng. Pat. 22,851 of 1908 (see preceding abstract), so that it is open when these other valves are set for blowing the producer to bring the fuel again to incandescence.

—A. T. L.

Peat-gas plant. J. D. Olinvy, Assignor to Peat Gas and Coal Co., Montreal. U.S. Pat. 938,691, Nov. 2, 1909.

THE apparatus comprises a horizontal retort-chamber mounted so as to rotate about its axis. The retort is provided with an axial air-inlet pipe leading from an air reservoir, and with an outlet pipe leading to a water-jacketed casing containing a carburetting chamber. The gas outlet from this casing leads through a series of condensing pipes to a gas-holder, and the casing is provided with a trapped overflow pipe for the tar.—A. T. L.

Peat and similar substances; Process and apparatus for the carbonisation of —. Oberbayerische Kokswerke u. Fabr. chem. Prod., A.-G. Ger. Pat. 213,852, May 6, 1908.

THREE gas-producers are used: the fresh peat is introduced into the first, wherein it is dried, and the steam produced is led into the third producer where it is converted into water-gas by means of the incandescent carbonised peat from the second producer. The second producer, fed with the dried peat from the first, is worked in the normal manner, the tarry and ammoniacal vapours being led away and condensed. A ring-pipe connected with all three producers is provided for collecting and distributing the steam.—A. S.

Gas; Apparatus for manufacturing —. B. Loomis, Hartford, Conn. U.S. Pat. 939,282, Nov. 9, 1909.

THE apparatus, which is designed for the manufacture of gas from moist materials, comprises a gas-producing chamber provided with a horizontal extension at its base. Above this horizontal extension, and opening into it, is a carbonising or distilling chamber, provided in its upper part with a vapour-outlet pipe leading to an air-condenser. The moist fuel is passed through a cutting apparatus and then fed to a "blower-elevator," which is supplied with heated air from the air-condenser. The current of air carries along the moist material, drying it in transit, and delivers it to a feed-hopper situated above the carbonising chamber.—A. S.

Gas-producer. Soc. Anon. des Houillères de Montrambert et de la Bérandière. Fr. Pat. 402,949, Sept. 12, 1908.

THE patent relates to a gas-producer with a rotating water-sealed ash-pit provided with a central vertical tuyère for the air-blast. The body of the producer is supported over the ash-pit on a polygonal framework of girders, two of the girders being extended in both directions so as to rest upon four short masonry columns. This arrangement allows of easy access to the ash-pit at all points. In order to break up the clinker, a number of rods or ploughs are provided, some being fixed to the body of the producer and others to the rotating ash-pit. The connection of the air main with the rotating tuyère is made by a water-sealed joint, excessive evaporation being prevented by heat-insulating packing between the air main and the water-lute.—A. T. L.

Gas-producer for fuels containing moisture and tarry substances. Soc. Genevoise pour la Construction d'Instruments de Physique et de Mécanique. Fr. Pat. 403,003, May 13, 1909. Under Int. Conv., June 4, 1908.

THE producer comprises an upper chamber in which the raw fuel is dried and deprived of its tarry constituents, and a lower gas-producer chamber into which the coked fuel descends. The fuel in the upper chamber is separated into two columns by a vertical partition, which may divide the chamber into two semi-cylindrical parts or into an inner cylinder and an outer annular space. One of these fuel columns is partly supported by a grate, beneath which air is admitted together with distillation products from the upper part of the chamber. This fuel column descends slowly, and is almost wholly burned in the upper part of the producer, thus serving to coke the raw fuel in the other column which can descend freely into the gas-producing chamber. This chamber is so arranged that any distillation products evolved in the upper part of it are mixed with the air-blast and injected into the lower part of the fuel column.—A. T. L.

Gas purifiers. R. J. Milbourn, Newport, Salop. Eng. Pat. 1630, Jan. 22, 1909.

THE patent relates to the valve arrangements of the purifiers described in Eng. Pat. H,356 of 1901 (this J., 1902, 599), the valves being arranged preferably outside the purifiers. The upper part of the purifier is fitted with a bend-pipe leading to a valved gas-outlet chamber and a long narrow opening in the lower part of the purifier is connected by a similarly shaped box or casing to a valved gas-inlet chamber. The gas-outlet and inlet chambers are arranged side by side with an opening in the dividing wall, and the gas outlet and inlet pipes are arranged with their open ends in line with this opening. A valve in each chamber is arranged so that it can be seated either on the opening in the dividing wall or on the end of the gas inlet or outlet pipe respectively.—A. T. L.

Incandescence gas mantles. V. B. Lewes. Fr. Pat. 403,195, May 21, 1909. Under Int. Conv., Jan. 22, 1909.

MANTLES composed of the oxides of aluminium and chromium, together with zirconium or thorium oxide give an agreeable light not so rich in violet and ultra-violet rays as is the ordinary thorium-cerium mantle, but these mantles cannot be used with upright burners on account of shrinkage and volatilisation in the hotter parts of the flame. The patent is for the use of such mantles with an inverted burner, which distributes the heat more evenly, and causes the weight of the mantle to counteract the tendency to shrinkage. A suitable composition is: aluminium oxide, 87 per cent.; zirconium oxide, 4 per cent.; chromium oxide, 9 per cent., but when thorium oxide is used, the composition may vary between the following limits: aluminium oxide, 48 to 60 per cent.; thorium oxide, 42 to 35 per cent.; chromium oxide, 5 to 10 per cent., and part of the thorium oxide may be replaced by zirconium oxide.—A. T. L.

Electric incandescence filaments of refractory metals or their alloys; Manufacture of non-carbon —. W. Heinrich, Charlottenburg, Germany. Eng. Pat. 7092, March 24, 1909.

A BINDING agent free from carbon is made by mixing 50 grms. of dry pure powdered sulphur with 60 grms. of dry amorphous phosphorus and heating the mixture until combination takes place. After cooling, a dark metallic shining liquid remains. 15 grms. of the powdered amorphous metal, for example tungsten are made into a paste with 3 grms. of the binding agent, and filaments formed from this paste are heated *in vacuo* to 400°–500° C., whereby most of the binding agent is expelled and a hard metal phosphide or sulphide compound is produced. The filaments are finally sintered and converted into the pure metal by heating *in vacuo* above 1000° C.—A. T. L.

Gas; Method of manufacturing —. C. B. Tully, Wood Green. U.S. Pat. 938,919, Nov. 2, 1909.

SEE Eng. Pat. 15,194 of 1905; this J., 1906, 841.—T. F. B.

Gas producer. G. L. Morton, Four Oaks. U.S. Pat. 939,288, Nov. 9, 1909.

SEE Eng. Pat. 3462 of 1908; this J., 1908, 848.—T. F. B.

Producer gas; Process for enriching — in carbon monoxide. H. Trachsler and F. Ernst. Fr. Pat. 402,029, April 14, 1909.

SEE Ger. Pat. 211,575 of 1908; this J., 1909, 930.—T. F. B.

Pyrometer. U.S. Pat. 938,034. See XXIII. Apparatus.

Candle-making machinery. Eng. Pat. 3559. See XII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Hydrocarbons of the naphthene and benzene series; Oxidation of — by treatment with air in the presence of alkalis. K. W. Charitschkoff. Chem.-Zeit., 1909, 33, 1165. (See also this J., 1909, 302, 974.)

By the oxidation of petroleum hydrocarbons with air, using an alkali as contact substance, the author finds that characteristic acids are produced. These acids differ from the naphthenic acids in their solubility in petroleum spirit and in the characteristics of their esters and salts; they also possess reducing properties, though no evidence of the presence of an aldehyde group could be obtained. The purified acids are very unstable, and readily condense to tarry matters upon warming or by treating with strong alkali. A hydrocarbon ($C_{16}H_{26}$, b. pt. 169°–171° C.), yielded upon oxidation at 150° C. a syrup which, purified to remove the naphthenic acid also produced, gave an acid containing 73.8 per cent. of carbon and 7.73 per cent. of hydrogen. The analytical figures, and molecular weight determinations agree with the empirical formula, $C_{20}H_{25}O_4$. A polymerisation has thus taken place, hence the names "polynaphthenic" or "asphaltogenic," acids chosen for the series. All members contain four atoms of oxygen, two of which are alcoholic, though one of the alcohol groups apparently possesses a pseudo-acid character. The determination of the structure is difficult, as the constitution of the monobasic acid is not quite clear. The method of oxidation may be useful in the examination of naturally occurring hydrocarbons; benzene hydrocarbons yield crystalline monobasic acids, and the fact that it is the side chains which are attacked and oxidised and not oxygen which is absorbed, as in the case of naphthenes and olefines, is difficult to explain by Kekulé's hypothesis. The constitution of the acid derivatives of benzene is probably different, so far as the ring is concerned, from that of the hydrocarbon itself.—F. M.

Durene. R. Willstätter and H. Kubli. Ber., 1909, 42, 4151–4163.

WITH the object of preparing aminodurene the authors have endeavoured to prepare nitrodurene but without success. The action of nitric acid on the hydrocarbon always leads to the formation of the dinitro-derivative. Treatment of iododurene with silver nitrite gave only a very small amount of the mononitro-compound mixed with the iodo-compound, and nitration with the aid of benzoyl nitrate gave ω -nitrodurene, $C_6H_2(CH_3)_3CH_2NO_2$ (Pentamethylbenzene gave a mixture of nitro- and ω -nitro-derivatives and hexamethylbenzene gave, with 1 mol. of benzoyl nitrate, the ether of pentamethylbenzyl alcohol, and with 2 mols., ω -dinitrohexamethylbenzene). Aminodurene was finally obtained by nitrating bromodurene and reducing the bromonitrodurene with zinc dust and acetic and hydriodic acids. Aminodurene, $C_6H_4(CH_3)_3NH_2$, crystallises in prisms melting at 75° C. and boiling at 261°–262° C. It has a weak naphthylamine-

like odour and is oxidised to duroquinone without the formation of any product analogous to Emeraldine or Aniline Black.—J. C. C.

Petroleum deposits in Russian Sakhalin. Board of Trade J., Nov. 25, 1909. [T.R.]

THE three petroliferous areas so far known to exist in Russian Sakhalin are all on the east coast, and may be distinguished as (1) the Okha River oil-field, (2) the Boatasin and Nutovo oil-fields, and (3) the Nabil Bay oil-field.

(1) *Okha River oil-field*.—This area contains a large "petroleum lake" covered with a thick coat of asphaltum. The principal natural outcrops of petroleum in this area, including this large lake and another smaller one, are found in the Allas Valley, through which the Okha flows into Urkt Bay. The "petroleum lake" is close to the junction of this river with the Berakian. There are also many outcrops in lateral valleys known as Malaya and Ivanovskaya. They are in the form of holes full of water, on the top of which floats a deposit of petroleum some three inches thick, of heavy consistency and greenish-black in colour.

(2) *Boatasin and Nutovo River oil-fields*.—This area is the one to which most attention has been paid. In 1898 there were found, some eight miles from the mouth of the Nutovo river, a number of petroleum outcrops resembling those in the Allas Valley, and also five "petroleum lakes" of a similar nature to those on the Okha, the largest being 420 ft. by 1,400 ft. The "lakes" are, in reality, considerable areas covered with petroleum in a decomposed state, in parts liquid and in parts in the form of asphaltum. In 1901, boring operations were commenced on the Boatasin; two petroliferous layers, both in sand-stone, were discovered, the first at a depth of 150 ft. and the other at 237 ft. In 1906 several 14 ft. shafts were sunk in the Nutovo district, in all of which was found a thin crust of asphaltum above a layer of peat some 2 ft. in thickness and soaked with petroleum, which towards the top was continually changing from a greenish-black liquid state to a thick state, and, on the surface, was quite viscous and black. Under the layer of peat was sand strongly impregnated with petroleum, and below this again was sandy clay. The quantity of petroleum collecting in the shafts did not exceed 5 to 6 gallons in 24 hours. Abundant inflammable gases, mainly methane, issued from holes in the peat-lag in the region of the petroleum lakes.

Buildings are now being erected on these fields and systematic boring will commence on the arrival of new plant.

(3) *Nabil Bay oil-field*.—This area consists of (A) deposits on the Noglik River, a tributary of the Imtchin, which runs into the Timi River close to its mouth, and (B) deposits round the south-east corner of Nabil Bay. From a 26-ft. shaft sunk in the Noglik territory 8 to 10 gallons of heavy dark green petroleum were obtained in 24 hours, the specific gravity being 0.9 at 17.5° C.

The level of the petroliferous strata in the Nutovo deposits is probably a deep one in comparison with that of the Japanese oil-fields, the first deposits being at not less than 600 ft. and the second layer at about 2,000 ft. Sakhalin petroleum is rich in kerosene, containing probably 85 per cent. The oil will probably not play in fountains, but will require pumping.

Asphaltum; Analysis of — E. Bornemann, Chem., Zeit., 1909, 33, 1225—1226.

ASPHALTUM products which, on account of their sticky or tarry nature, cannot be pulverised in the ordinary manner, are moistened in an agate mortar with alcohol and thoroughly ground until reduced to a smooth, more or less stiff paste, alcohol or water being, if necessary, added during the operation. The mortar is then heated with occasional or constant stirring of the contents, until these are left in powder form. Drying is completed at 105°—110° C. The bitumen determination is made as follows:—In a small beaker 2 grms. of finely powdered asphaltum are moistened with 2 c.c. of alcohol and shaken with 10 c.c. of hydrochloric acid (sp. gr. 1.12). After about 10—15 minutes, when the evolution of carbon dioxide has ceased, 50 c.c. of water are added, the separated bitumen allowed to settle, and the supernatant liquor decanted through a filter (4 in. diameter and free from fat) on which about 1 gm. of very finely divided asbestos has been previously deposited from aqueous suspension. The bitumen is rinsed on to this, and the funnel, beaker, and glass rod used in filtering are dried for 1—1½ hours at 105°—110° C. The bitumen is now rinsed from the beaker and rod with about 75 c.c. of chloroform-alcohol mixture (10:2), the first portions running through being returned, if necessary, to the filter. The flask containing the solution is then attached to a Soxhlet apparatus, and the filter extracted in the usual way. If an asbestos filtering-tube be employed instead of filter paper, ½—1 gm. of finely divided asbestos must be added to the mass in the beaker to ensure perfect filtration. Various measures, which may be taken to accelerate the drying of the bitumen, are also mentioned. To obtain accurate results when determining the gypsum in crude asphaltum, the residue left after removal of the bitumen with chloroform must be exhausted with warm water and the extract added to the acid solution first obtained. In the determination of silica, etc., the asphaltum should be first incinerated until carbon is entirely removed, in order that pure and white silicic acid be subsequently obtained.—J. L. H.

Asphaltic material; Chemical examination of — S. W. Parr, B. Mears, and D. L. Weatherhead. J. Ind. Eng. Chem., 1909, 1, 751—754.

THE principle of the following method lies in obtaining as complete a solution as possible of the bitumen, and separating successive precipitates from this solution by the addition of other solvents:—0.5 gm. of the powdered sample (e.g., gilsonite) is dissolved in 5 c.c. of carbon bisulphide, and the solution treated with 100 c.c. of hexane (sp. gr. 0.6516). The precipitate (No. 1), which corresponds to the "asphaltene" of the usual methods, is filtered off into a Gooch crucible, after standing for 2 hours, and dried at 105° C. until constant in weight. The filtrate is evaporated to dryness on the water-bath, the residue taken up with 10 c.c. of hexane, and the solution poured, with continual stirring, into 300 c.c. of methyl alcohol. The resulting precipitate (No. 2) is collected and dried at 105° C. as before. The filtrate from the second precipitate is evaporated to dryness, and the residue (No. 3) dried and weighed. The following average results were thus obtained in the analysis of typical asphaltum products:—

Material.	Precipitate No. 1.	Precipitate No. 2.	Precipitate No. 3.	Total.
	per cent.	per cent.	per cent.	per cent.
I. Gilsonite, 4 samples	47.16	43.07	10.10	99.99
II. "Sarco petroleum," 8 samples	6.85	75.15	10.71	99.92
III. Mixture of I. and II. in equal parts (6)	28.71	33.38	17.97	100.06
IV. Mixture of I. and II. (1:3), 7 samples	18.28	64.61	17.22	99.96
V. Light cementing pitch (3)	18.82	40.20	22.19	81.22
VI. Mixture of I., II. and V. in equal parts	26.13	48.76	21.30	96.19
VII. Trinidad Lake asphaltum cement (5 samples)	18.43	33.39	22.20	100.10
				(including 27 per cent. insoluble in CS ₂ .)
VIII. Pure coal-tar pitch (2)	21.0	none	49.77	—

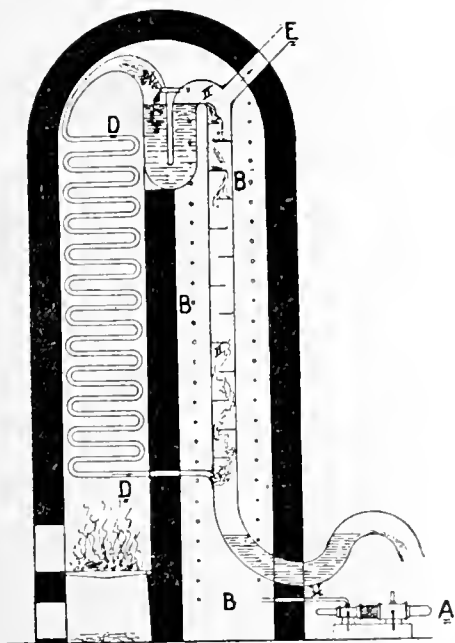
The precipitates (No. 1) were all solid at 105° C., with the exception of those from the coal-tar, which were viscous at the ordinary temperature, and fluid at 105° C. Precipitate No. 2 was sticky and soft at 105° C. in the case of gilsonite, and liquid in the other cases at that temperature, whilst precipitate No. 3 resembled machine oil except that it was more viscous. The mixtures showed the same general agreement in the divisions of the hydrocarbons as their components, and in the case of mixtures containing hard bitumen and tempering oil, the proportions of the latter could be approximately determined, provided that their percentage composition by this method of analysis were known. Loss of volatile substances in the melting process, however, would probably cause some discrepancy between the theoretical and actual results. The proportion of precipitate, No. 1, was found to stand in direct relationship to the sp. gr. of the precipitating solvent, and the preference was given to hexane as being more nearly constant in composition than the heavier petroleum distillates.—C. A. M.

PATENTS.

Tar; Treating — to recover certain light constituents, and to facilitate subsequent distillation. A. Gutensohn, London. Eng. Pat. 21,800, Oct. 15, 1908.

ONE hundred parts of an acid solution obtained by dissolving 1 part of chromic acid in 2 parts of water and adding 2 per cent. of concentrated sulphuric acid, are placed in a suitable closed vessel provided with an agitator and connected to a condenser. Two-thirds of the weight of gas-tar are added and the heat evolved is said to be sufficient to vaporise the lighter constituents of the tar, which pass into the condenser and are recovered. The solution is then drawn off and the heavier oils distilled off from the residue in the usual manner, but it is claimed that this can be effected at a lower temperature than that which is necessary with untreated tar and that no trouble from boiling over is to be anticipated. In order to obtain pitch of the right quality, the distillation is stopped when yellow fumes make their appearance. It is claimed that the pitch obtained from treated tar is more valuable than that from untreated tar and that it is more elastic.—W. H. C.

Liquids [tar]; Process for the evaporation of —. Apparatebau-Ges. "Köln." Ger. Pat. 215,005, Oct. 8, 1908.



In this process, which is specially suitable for the distillation of tar, the vapours evolved are passed through a superheater and then again brought in contact with the tar which is being distilled. The apparatus used is shown in the accompanying diagram. The tar is forced by the pump, A, through the coil, B, disposed in the cooler part of the furnace. The hot tar flows from the upper end of the coil, B, into the vessel, C, and overflows as shown. The vapours, or a portion of them, pass through the superheater, D, and then enter the lower part of the wide pipe, H, up which they rise, meeting the descending hot tar. The vapours pass away finally through the pipe, E, to the condensing apparatus.—A. S.

Ammoniacal liquor; Extraction of ammonia from —. M. Herry. Fr. Pat. 403,956, May 14, 1909.

THE liquor, separated from tar, is treated with a current of carbon dioxide in order to convert ammonium sulphides into carbonate. Sodium carbonate is then added in order to decompose cyanides, thiocyanates, etc., and the liquor is concentrated. The concentrated liquor can be used for the production of ammonium carbonate crystals, or the ammoniacal vapours can be mixed with the crude gas from the retorts in order to form ammonium sulphide, carbonate, thiocyanate, etc., which can be removed by washing, thus purifying the gas without the use of iron oxide.—A. T. L.

Rendering barrels for oil liquid tight. Eng. Pat. 5206. See I.

Vehicles for paints [from mineral oil residuum]. Eng. Pat. 2114. See XIII.A.

Rejuvenating asphalt. U.S. Pat. 938,698. See IX.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indian indigo crop. Chem. Trade J., Nov. 13, 1909. [T.R.]

THE First General Memorandum on the indigo crop of the season 1909-10, issued by the Commercial Intelligence Department of India, says that the average area under the crop in the last five years was 487,200 acres; but in 1908-9 the total acreage was only 237,600 acres (revised figures). The area now reported for 1909-10 amounts to 214,600 acres. The figures in brackets following the name of each province, indicate what percentage of the total indigo area of British India is ordinarily cultivated in that province.

Bengal (37.1 per cent.).—The area sown this year is estimated at 107,700 acres as compared with 135,300 acres last year. The season has been unfavourable. The average outturn for the province as a whole is estimated at 70 per cent. of the normal as compared with 73 per cent. last year. [Normal=20 lb. per acre.]

Madras (33.7 per cent.) reports the total area sown in *raiayatwari* villages up to the end of August to be 41,900 acres, which is 24 per cent. more than the area sown in the corresponding period of last year. The increase is mainly attributed to timely rains. The area reported from villages other than *raiayatwari* is 1,300 acres as compared with 1,700 acres last year. The condition of the crop fair to good.

United provinces (16.7 per cent.).—The total area sown is at present estimated at 31,500 acres compared with 30,700 acres last year. Germination was good. For the province as a whole the yield is estimated at 80 per cent. of the normal compared with 85 per cent. last year. [Normal=18 lb. per acre.]

Panjab (10.8 per cent.) estimates the area sown to be 32,200 acres as against 36,200 acres last year. The decrease is confined to Multan, and is due to a short supply of water in the canals at sowing time and to the presence of locusts.

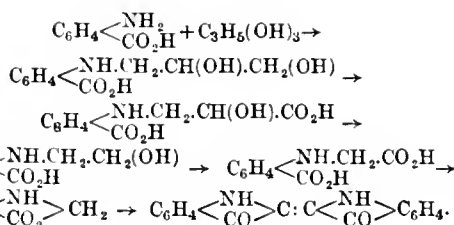
Indigo; Action of primary amines on —. (Addendum to Part I.) E. Grandmougin. Ber., 1909, 42, 4218. (Compare this J., 1909, 1189.)

7:7'-Dimethylindigo can be characterised by its spectroscopic behaviour. It dissolves in xylene with a violet blue colour: the dilute solution shows an absorption band at $\lambda=603.8$, whilst the corresponding band in the case of indigo is at $\lambda=591.4$. In glacial acetic acid the bands are: Indigo, $\lambda=615.9$, and dimethylindigo, $\lambda=617.7$.—J. C. C.

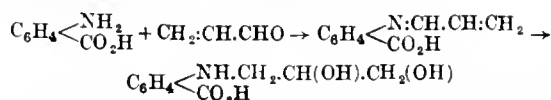
Indigo; Mechanism of formation of — from anthranilic acid and polyhydroxy-compounds. A new synthesis of indigo. Preliminary communication. I. Ostromisslenski and A. Pamfilow. J. Russ. Phys.-Chem. Ges., 1909, 41, 784-789. Chem. Zentr., 1909, 2, 1749-1750.

STARTING from the fact that hydroxy-derivatives of hydrocarbons are converted into carboxylic derivatives when fused with alkalis at high temperatures, the authors represent the formation of indigo on heating anthranilic acid with potassium hydroxide and glycerol or other polyhydroxy-compounds by the following scheme:—

Aniline Black.	Formula.	Base.	Salts.	Base with sulphur dioxide.	Solution in sulphuric acid.
Triquinonoid	$C_{48}H_{36}N_8$	dark blue	green	becomes bright green	reddish violet
Tetraquinonoid	$C_{48}H_{34}N_8$	blue black	dark green	very dark green	
Hydrolysed triquinonoid	$C_{48}H_{36}ON_7$	bluish dull black	greenish black	greenish black	bluer shade of violet
Hydrolysed tetraquinonoid	$C_{48}H_{34}ON_7$	dull black	dull black	remains black	



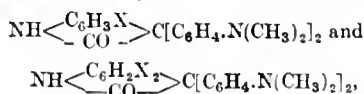
If aldehydes are used in place of glycerol, the reaction follows a similar course, except that Schiff's bases are first formed:—



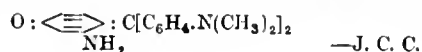
The production of indigo in a similar manner on heating a mixture of o-naminobenzylalcohol, glycerol, and potassium hydroxide to 200°-300° C. is well suited for a lecture experiment.—A. S.

Dimethylaniline-isatines; Oxidation of —. N. Danaila. Comptes rend., 1909, 149, 793-795.

DIMETHYLANILINEISATINE and its substituted derivatives of the general formula,



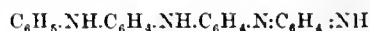
where X = Cl, Br, NO₂, and X₂ = Cl₂, Br₂, when oxidised with lead peroxide in presence of acetic acid, yield dyestuffs analogous to Malachite Green. The author considers that these dyestuffs are most probably represented by the formula,



Aniline Black. R. Willstätter and S. Dorogi. Ber., 1909, 42, 4118-4135. (Compare this J., 1909, 695).

THE authors distinguish the various forms of Aniline Black as follows: (1) Triquinonoid Black (i.e. the formula contains three quinonoid groupings) obtained by the action of bichromate on excess of aniline solution, also by using elderate and persulphate as oxidising agents, has the formula, C₄₈H₃₆N₈. (2) Tetraquinonoid Black obtained by further oxidation of the preceding with hydrogen peroxide, by the action of excess of oxidising agents on aniline, in which process is included that of A. G. Green (oxidation of aniline salt in presence of copper sulphate and a little p-phenylenediamine by air) and also oxidation with chloric acid. Willstätter and Moore's "Polymerisation Black" also consists of this variety. All these different preparations of oxidised Black are almost quantitatively oxidised to p-benzoquinone; they all lose one-eighth of their nitrogen as ammonia (showing that the molecule contains C₄₈); and they combine with 4.5 per cent. of hydrogen chloride, indicating the reacting fourth quinonoid nucleus. When the triquinonoid Black is hydrolysed and then treated with hydrogen peroxide, it yields the same tetraquinonoid oxy-compound as does the tetraquinonoid Black when hydrolysed. The colour reactions of these compounds are as follows:—

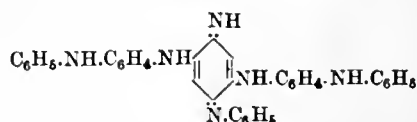
The hydrolysed compounds can be more easily obtained by employing an excess of strong oxidising agents. The authors are of the opinion that Emeraldine consists of the triquinonoid Black and suggest that the name be now used to denote the polymeride of phenylquinonedi-imine of the formula,



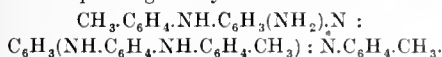
With regard to the technical production of Aniline Black on the fibre, the steaming and other processes which are necessary to obtain an ungreenable Black, result in the production of the hydrolysed tetraquinonoid Black. —J. C. C.

Quinonedi-imines; Polymerisation of —. R. Willstätter and H. Kubli. Ber., 1909, 42, 4135-4151.

WITH the object of throwing light on the constitution of Willstätter and Moore's Emeraldine, the authors have studied the polymerisation of para-substituted phenylquinone-di-imines, in particular quinonetolyl-di-imine, CH₃·C₆H₄·N:C₆H₄:NH, and the corresponding anisyl compound. Although phenylquinonedi-imine polymerises readily to the dimolecular Emeraldine, the para-substituted derivatives polymerise only with difficulty and then a trimolecular imine is formed which differs considerably from Emeraldine. A corresponding trimolecular imine, can be prepared from phenylquinonedi-imine itself when it is subjected to the same method of condensation, namely, passing hydrogen chloride through the solution of the imine in methyl alcohol. Oxidation experiments lead to the conclusion that the unsubstituted trimolecular polymeride has the constitution,



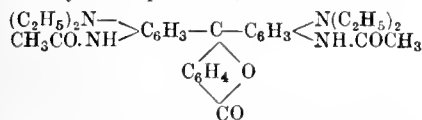
and the corresponding methyl derivative the constitution,



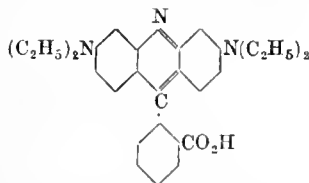
Willstätter and Moore's "red imine" has probably the constitution, $\text{C}_6\text{H}_3 \cdot \text{N} : \text{C}_6\text{H}_4 \cdot \text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{N} : \text{C}_6\text{H}_4 \cdot \text{O}$. This conclusion is confirmed by the fact that its methyl homologue is obtained by oxidising the leuco-base prepared by oxidising equimolecular proportions of *p*-hydroxydiphenylamine and *p*-aminophenyl-*p*-tolylamine with hydrogen peroxide. It forms brick red crystals melting at 205°–206°C. A corresponding red imine containing the methoxy-group, $\text{CH}_3 \cdot \text{O} \cdot \text{C}_6\text{H}_3 \cdot \text{N} : \text{C}_6\text{H}_4 \cdot \text{N} : \text{C}_6\text{H}_4 \cdot \text{O}$, was also prepared in an analogous manner.—J. C. C.

Flaveosine. E. Grandmougin and A. Lang. Ber., 1909, 42, 4014–4019.

THE authors have prepared Flaveosine as follows:—diethyl-*m*-phenylenediamine is acetylated by heating the base (10 grms.) with glacial acetic acid (12 grms.) and a few drops of acetic anhydride for 7 hours. The mono-acetyl derivative thus produced (9.1 parts), is heated with phthalic anhydride (3.3 parts), and acetic anhydride (2.25 parts) for 5 hours at 150°C., whereby diacetyl-diaminodiethylanilinephthalein,



is obtained. When this is boiled with 20 parts of 20 per cent. hydrochloric acid, Flaveosine is obtained in orange yellow needles, m.pt. 333°C. Its constitution is therefore proved to be represented by the formula,



Flaveosine dissolves readily in methyl and ethyl alcohols, in acetic acid and acetone; the solutions exhibit a green fluorescence. It is less soluble in benzene, ethyl acetate, chloroform or carbon tetrachloride and insoluble in ether and light petroleum. The solution in sulphuric acid is bright yellow with a blue-green fluorescence; on dilution, a deep red solution with a faint brown fluorescence is obtained which, on further dilution, becomes yellowish orange with a green fluorescence. The ethyl ester, on bromination, gives a red tetrabromo-derivative. The corresponding dyestuff containing methyl groups instead of the ethyl groups of Flaveosine, was prepared in an analogous manner; it dyes silk yellow with a green fluorescence, and yields a tetrabromo-derivative.—J. C. C.

Fastness to light of some coal tar colour lakes, and their behaviour as printing colours. E. Valenta. Chem.-Zeit., 1909, 33, 1165–1167.

THE belief that all the artificial dyestuffs are much more fugitive to light than the natural ones is quite without foundation, and arose through the manufacturers being led by the brilliance of the shades to use the dyestuffs for purposes for which they were unsuited. At first some of the Alizarin colours alone combined brilliancy with a high degree of fastness, but now there are many products which, for colour lakes, will fulfil all requirements in these respects, for example, the Azophor colours, the Azarines, Lithol Red, Permanent Red, Pigment Scarlet, etc.; also within the last few years many new dyestuffs have been produced of such properties that no complaint as to want of fastness can be substantiated. In comparative trials, the author employed as standard the alumina-oil lake of Alizarin (Turkey Red), and found that lakes prepared with some of the newer dyestuffs show a much greater degree of fastness even than this. He reports upon the

fastness of some 43 colour lakes (15 red, 10 yellow and orange, 4 green, and 14 blue and violet), giving the class to which each dyestuff belongs, the method of preparation of the lake and the printing paste, the method of exposure, and the results thereof, and certain other interesting data. Among the red colouring matters the lakes of Helio Fast Red RL and Helio Fast Pink RL (By.) are of much superior fastness to Alizarin, and Alizarin Red 1 B Paste Extra, Pigment Fast Red HL and Alizarin Red RX Paste (M.L.B.) are quite equal to it. Helio Fast Yellows 6 GL and GL (By.) are of much greater fastness than the standard, and with the highly resistant and brilliant Helio Fast Blue B (By.) must give very fast shades of green. Helio Fast Violet (By.), Alizarin Direct Violet (M.L.B.) and the Orthocyanines (Berlin) are also exceedingly fast. Very interesting is the behaviour of the Ethyl Green lake. This lake is prepared by precipitation (fixation) of Brilliant Green (a fugitive colour) with "green earth;" and was found, as a printing colour, to be much faster than many of the other greens tested.—F. M.

Capillary rise of dyestuffs. L. Pelet-Jolivet. Z. Chem. Ind. Kolloide, 1909, 5, 238–243.

THE author reported recently (this J., 1909, 85) on the capillary rise of dyestuffs in filter-paper. The present results were obtained with strips of linen, wool, and silk. As in former cases, the rise was found to be small when the affinity of the dyestuff for the material of the strip was small. The colour-bases show a medium rise, which is generally smaller than that of the colour-acids. The Rhodamines show an intermediate behaviour. The difference between colour-bases containing the amino-group and those containing a disubstituted amino-group is similar to that observed on cellulose fibre (*loc. cit.*). In general, dyestuffs of colloidal character ascend a shorter distance than the more crystalline dyestuffs of similar composition. The influence of electrolytes was investigated and was of the same kind as when cellulose was used. Increase of temperature appears to lessen the capillary rise. Solutions in alcohol and acetone showed considerable rise, but no separation of dyestuff and solvent, pointing to very weak adsorption. Other things being equal, the addition of an electrolyte causes a tendency to diminution of the charge on a phase boundary, coagulation of a colloid, increased adsorption in dyeing processes, and diminution of capillary rise.—E. F.

PATENTS.

Colouring matters [dyestuffs] of the pyrazolone group; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 1244, Jan. 18, 1909.

GREENISH yellow dyestuffs fast to light are obtained (1) by combining two molecular proportions of the hydrazine of 3-chloro-2-amino-1-methylbenzene-5-sulphonic acid with dihydroxytartaric acid; (2) by combining one molecular proportion of the above hydrazine with oxalyl-acetic ester to form a pyrazolone, saponifying, and acting on the resulting product with one molecular proportion of the diazo derivative of the first-mentioned sulphonic acid. —J. L. H.

Hexabromindigo; Manufacture of greenish-blue —. O. Imay, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/M., Germany. Eng. Pat. 2609, Feb. 3, 1909.

ALTHOUGH the statement has been made that by the direct bromination of indigo or of dibromo-indigo, no higher derivative than tetrabromo-indigo can be obtained, it is now found that penta- and even hexa-bromo-indigo is obtained when suitable conditions are chosen. Such conditions consist in the use of excess of bromine, raised temperature, a longer period of treatment, or more highly concentrated sulphuric acid. Several examples of the method of working are given. The hexa-bromo-indigo produced, dyes in the vat clear greenish-blue tints, and differs in constitution and properties from the hexahaloindigo produced by the bromination of *p,p*-dichloro-indigo.—F. M.

[Azo] dyestuffs which can be developed; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 214,798, April 3, 1908. Addition to Ger. Pat. 208,968, March 29, 1908 (see this J., 1909, 517).

DIAZOTISED mononitrobenzoylated diamines are combined with nitroarylacidyl-2,5,7-aminonaphtholsulphonic acids, and the dinitro-azo dyestuffs reduced to the corresponding diamino-compounds. The dyestuffs dye unmordanted cotton red shades, which are rendered fast to washing and "bleeding" by diazotisation and development with β -naphthol. An example is given in which diazotised *p*-nitrobenzoyl-*p*-phenylenediamine is combined with *m*-nitrobenzoyl-2,5,7-aminonaphtholsulphonic acid.

—T. F. B.

1-Aminonaphthalene-4,7-disulphonic acid and 1-aminonaphthalene-2,4,7-trisulphonic acid from 1,8-dinitronaphthalene; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 215,338, Oct. 7, 1908.

1,8-DINITRONAPHTHALENE is treated with solutions of sulphites (e.g., about 40 per cent. strength), at 70°–90° C., for 6 to 8 hours, using about 6 mols. of sulphite to each molecule of dinitronaphthalene; in this way 3 mols. of free alkali hydroxide are formed, which must be neutralised or otherwise removed, or formation of yellow products will result; this can be accomplished by addition of mineral or organic acids, or by passing carbon dioxide through the liquid, or by addition of a bisulphite or bicarbonate, to keep the solution neutral or very slightly alkaline; or, if desired, ammonium salts may be added to the sulphite. When the solution is clear, it is cooled, and the crystals of 1-naphthylsulphamine-4,7-disulphonic acid separated, and converted by dilute mineral acid into 1-naphthylamine-4,7-disulphonic acid. The mother liquor is treated with mineral acid, and the mixture of naphthylamine-di- and trisulphonic acids separated by fractional crystallisation.

—T. F. B.

Dyestuffs for animal fibres and processes for obtaining them. H. R. Vidal. First Addition, dated Aug. 29, 1908, to Fr. Pat. 391,465, Aug. 29, 1907.

The dyestuffs described in the main patent (see this J., 1908, 1150) may be obtained by effecting the oxidation in an alkaline instead of in a neutral solution. In presence of alkali, the reactions proceed more smoothly. The dyeings may be rendered faster by after-treatment with formaldehyde. The dyestuffs may also be used for the preparation of sulphide dyestuffs.—A. S.

Derivatives of the anthracene series; Manufacture of —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5382, March 5, 1909.

SEE Ger. Pat. 213,501 of 1908; this J., 1909, 1082.—T. F. B.

[Anthracene] dyestuffs; Yellow vat —. P. Fischer, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 938,565 and 938,566, Nov. 2, 1909.

SEE Ger. Pat. 210,019 and Fr. Pat. 399,495; this J., 1909, 650 and 933.—T. F. B.

Anthracene compounds. P. Thomaschewski, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 938,616 and 938,617, Nov. 2, 1909.

SEE Fr. Pat. 400,653 of 1909; this J., 1909, 1029.—T. F. B.

[Anthracene] colouring matters; Vat —. J. Deinet, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 938,618 and 938,619, Nov. 2, 1909.

SEE Fr. Pat. 400,653 of 1909; this J., 1909, 1029.—T. F. B.

Sulphurised dyestuffs of the anthracene series; Production of —. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 403,925, Sept. 14, 1908.

SEE Eng. Pat. 20,094 of 1908; this J., 1909, 361.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

Recovery of volatile liquids by cooling. Claude. See I.

Fastness to light of some coal tar colour lakes and their behaviour as printing colours. Valenta. See IV.

Capillary rise of dyestuffs. Pelet-Jolivet. See IV.

Determination of cellulose. Renker. See XIX.

PATENTS.

Artificial silk and the like; Manufacture of machinery for —. W. P. Dreaper, Felixstowe. Eng. Pat. 21,872, Oct. 16, 1908. Addition to Eng. Pat. 13,868, June 15, 1907.

RELATES to improvements in the constructive details of the apparatus described in the chief patent (see this J., 1908, 745).—J. L. H.

Cellulose threads, ribbons, films and the like; Production of —. P. Friedrich, Berlin. Eng. Pat. 11,700, May 18, 1909.

INSTEAD of precipitating the euprammonium cellulose solution with acids, alkalis, or alkalis and solutions of chlorides of the alkalis or alkaline earths, it is proposed to employ solutions of certain chlorides (calcium, magnesium, aluminium). The bath should be maintained in a slightly acid condition and organic substances such as alcohols and carbohydrates may be added to it with advantage. The threads obtained are said to be highly elastic and transparent, and possessed of good strength immediately after coagulation.—F. M.

Hygroscopic wadding; Process of manufacture of —. E. Nowicki. Fr. Pat. 402,196, Apr. 19, 1909.

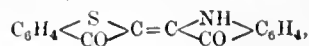
THE use of fibres of flax and hemp is claimed for the manufacture of absorbent wadding. These fibres are brought into a suitable condition by steeping for one day in a 1 per cent. solution of sulphuric acid, or for a shorter time in the heated acid. The usual treatment with alkalis is also specified for the purpose of dissolving the incrusting matters and separating the bundles of fibres into their ultimate units.—J. F. B.

Silk-finish and other similar effects on textile goods; Process for preserving the —. F. A. Bernhardt, Zittau, Germany. Eng. Pat. 20,728, Sept. 10, 1909. Under Int. Conv., July 17, 1909.

SILK or Schreiner finishes are said to be made permanent and fast to water by spraying on the finished fabrics a solution of caoutchouc or resin and paraffin wax in benzene or similar volatile solvent, e.g., 30 grms. of caoutchouc and 7 grms. of paraffin wax in 1 litre of benzene. The solution may be applied once, or (better) several times, in such a manner that a thin layer protecting the convex upper parts of the ribs is formed, without filling-up of the depressions between the ribs. The treated material is dried, or dried and steamed, after each application.—J. L. H.

Vat dyeings; Production of fast grey prints and —. O. Inray, London. From Society of Chem. Ind., Basle, Switzerland. Eng. Pat. 20,312, Sept. 4, 1909.

VAT dyestuffs which dye animal and vegetable fibres in violet to blue shades are obtained by treating the dyestuff of the constitution,



with halogens. Dyeings obtained with the mono-halogen derivatives are blue in colour and are converted into grey shades (very fast to washing, light, and chlorine), by treating with hot water, with or without the addition of soap, alkali, acid, salts or bichromate.—F. M.

Impregnating fabrics and other materials; Apparatus for —. E. W. Strohn. Buffalo, N.Y. U.S. Pat. 937,889. Oct. 26, 1909.

THE impregnating chamber is provided with front and rear doors, and with a tank for the impregnating liquid which may be removed from the chamber through the front door. A delivery drum containing the material to be impregnated is arranged in the tank, and a receiving drum for the material is placed in the upper portion of the chamber, this drum being removable through the rear door. Two pairs of pressure rolls are mounted in the chamber between the delivery and receiving drums for acting upon the material, and means are provided for raising and lowering the pressure rolls. The first rolls, after lowering, dip into and apply the liquid to the fabric, whilst the others squeeze the impregnated fabric.

—B. N.

Hank dyeing; Continuous process of —. J. and L. Regordosa Planas. Fr. Pat. 401,988, April 13, 1909.

IN the type of continuous machine where the hanks are suspended on carriers supported at either end by driven chains, the hanks are subjected to a rapid to and fro motion at the surface of the bath and an up and down motion in the bath, the object being to secure better penetration. The to and fro motion is effected by two horizontal rollers or rods placed respectively in front of and behind the descending rows of hanks and connected to the same supports, which latter are driven rapidly backwards and forwards. The motion in the bath is obtained by passing the rows of hanks as they come round over a horizontal roller which is driven rapidly up and down.

—H. P. P.

Impregnation of vegetable fibres; Process for the rapid —. P. Hoffmann and E. Decoster. Fr. Pat. 402,041, April 15, 1909.

To obviate the processes of boiling or degumming fibres before bleaching or dyeing, there are added to the dye-bath or to an impregnating bath before bleaching, from 5 to 10 grms. of an aromatic phenol, for instance, the rectified carboic acid obtained from coal-tar. The phenol or mixture of phenols is used preferably in the form of the monosulphonic derivatives or their alkali salts. On account of the penetrating odour attending their use, it is preferable to close in the vessels in which the treatment is effected. The odour disappears completely from the fibres, however, on drying. It is claimed that the above addition insures an immediate impregnation even in the cold.—H. P. P.

Washing linen and the like; Method of —. J. Mehne, Leipzig-Plagwitz, Germany. Eng. Pat. 7619, March 30, 1909.

SEE Fr. Pat. 401,211 of 1909; this J., 1909, 1084.—T. F. B.

Dyeing yarns and the like; Machines for —. C. Corron, St. Chamond, France. Eng. Pat. 23,171, Oct. 30, 1908.

SEE Fr. Pat. 397,798 of 1908; this J., 1909, 881.—T. F. B.

Blue, violet, and lilac shades, fast to washing and light; Process for producing — by printing. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 403,018, Sept. 14, 1908.

SEE Eng. Pat. 19,310 of 1908; this J., 1909, 202.—T. F. B.

Textile materials; Process for producing designs and colour effects on —. J. Hübner. Fr. Pat. 403,303, May 24, 1909. Under Int. Conv., June 10, 1908.

SEE U.S. Pat. 917,298 of 1909; this J., 1909, 472.—T. F. B.

Manufacture of cellulose. Eng. Pat. 23,192. See XIX.

Testing [thickness, weight, etc.] of paper, fabrics, and similar materials whilst in motion. Fr. Pat. 402,225. See XIX.

Preparing wood pulp for the manufacture of artificial filaments and nitrocellulose. Fr. Pat. 402,462. See XIX.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Sulphurous acid in the gas from sulphur furnaces; Determination of —. H. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1909, 27, 294-302.

SAILLARD and Wehrung (supplement to the "Circulaire du Syndicat des Fabricants de Sucre de France, Sept. 26, 1909), have described a method for determining sulphurous and sulphuric acids in sulphur burner gases which is essentially as follows:—A conical flask of known capacity is filled with the gases, at a temperature of 15° C., and a known volume of a standard solution of sodium hydroxide is then introduced to absorb the sulphur dioxide and trioxide. When absorption is complete, two aliquot portions of the solution are removed; one is used for determining the residual alkalinity, whilst the other is rendered almost neutral and then titrated with N/10 iodine solution. From the results, the percentages of sulphur dioxide and trioxide can be calculated. A Bunte burette may be used for collecting the sample of gas instead of a conical flask, but the latter is preferable.

—L. E.

Boric acid; Solubility and hydrates of —. R. Nasini and I. Ageno. Z. physikal. Chem., 1909, 69, 482-485.

IN view of the conflicting statements as to the solubility of loric acid, the authors have carried out a new series of determinations at different temperatures between 0° and 120°C. The results obtained were as follows, the figures representing grams of loric acid (H_3BO_3) in 100 grms. of solution: 0°C., 2.59; 12.5°, 3.69; 21°, 4.90; 31°, 6.44; 40°, 8.02; 50°, 10.35; 60°, 12.90; 69.5°, 15.58; 80°, 19.11; 90°, 23.30; 99.5°, 28.10; 108°, 36.7; 115°, 45.0; and 120°C., 52.4. At higher temperatures the loric acid had a considerable action on glass, and concordant results could not be obtained.

A dilatometric study of the transformations of loric acid proved the existence of transformation points at 107°—108° C. and 138°—140° C., corresponding to the formation of metaboric acid and pyroboric acid respectively. No indication was obtained of the existence of other hydrates than these.—A. S.

The German Potash Syndicate. U.S. Cons. Repts., Nov., 1909.

OWING to the extensive area of the potash fields, new mining companies are established every year. When the competition of these companies becomes acute they are admitted into the syndicate. At recent meetings of the syndicate a number of new companies were admitted. Then arose a dissension as to the allowance to be made to each of the old companies, some of which had concluded contracts with American customers (this J., 1909, 833). There are two groups of these mines, one the Schmidtman group, consisting of the Aschersleben and of the Sollstedt Mining Works, representing what is called the North Trust and also the International Agricultural Co. in the United States, and the Einigkeit Mining Works, with those of Westeregeln and Salzdetfurth, representing what is called the South Trust in the same country. On Sept. 30, the proposition of the Schmidtman group for the syndicate to take over certain contracts with American companies for the delivery of 54,000 tons of pure potassium salts at half the prevailing price was rejected and the syndicate broke up. The Schmidtman group and the Einigkeit Mining Works withdrew. Westeregeln and Salzdetfurth mines, which had hitherto acted in concert with Einigkeit, remained with the other mines, numbering about 50. These

resolved to form themselves into a new syndicate. At first, an attempt was made to coerce the recalcitrant members of the syndicate by the threat of an export duty on potassium salts. These responded that the American government would retaliate and that such a duty would only injure the syndicate by driving away the best customers it had. As this policy failed, it is now intended to bring the dissenting mines into subjection by under-selling.

The Schmidtmann group has made contracts with the North Trust and with the International Agricultural Co. for two years for the delivery of 54,000 tons of salts at half the present syndicate prices. As these prices are fixed on, this group expects to hold its own, even if the fighting syndicate should reduce the price of one double centner (220.46 lb.) of potassium chloride to 5 marks. On the other hand, the trusts are bound by their contracts for at least two years at the price fixed, and are exposed to the competition of outside parties, who purchase from the syndicate at lower prices. American dealers do not sell potassium salts, but mixed fertilisers, and it is upon this market that the battle must be fought out. It is a question whether the fighting syndicate will be able to supply sufficient mixed fertilisers to the market so as to attract the trade. Since the two mines, Westeregeln and Salzdetfurth, have broken off relations with the Einigkeit mine, it is claimed that the South Trust will not be able to supply its demand without the help of the syndicate. There are also the former customers of the Sollstedt mine, whose contracts were taken over by the old syndicate. The plan has been proposed to supply these parties with salts at very reduced prices, which the clauses of their contracts admit, and then give the contracts back to the Sollstedt mine, which, under their original contract with the syndicate, it would now be compelled to carry out.

The German Kali Works, the American representatives of the German Potash Syndicate, has now been incorporated under the Laws of the State of New York with a capital of \$100,000 fully paid, and will deal direct with the fertiliser factories outside of the three corporations controlling a large portion of the American trade.

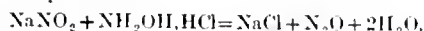
Gypsum in Nova Scotia. Oil, Paint, and Drug Rep., Nov. 1909. [T.R.]

CONSUL JOHN E. KEHL furnishes the following information concerning the new deposits of gypsum which are said to exist near Sydney, Nova Scotia:—

A local railway company has acquired considerable land at East Bay, about 15 miles from Sydney, which is said to contain inexhaustible deposits of gypsum. The whole extent of the company's present holdings and a large section round about appear to abound with the material. The deposit is being thoroughly exploited by the present owners, with the assistance of government experts. A calyx drill was used to ascertain the depth of the plaster; the drill was operated at the base of the face of a hill, and driven down about 80 ft.; no break was found in the deposit. The analysis, straight through, shows nearly 99 per cent. of purity. Some 20 tests have been made, and it is claimed that in every instance the pure gypsum has been found at an average of 10 to 12 ft. beneath the surface. Tide water with excellent shipping accommodations is less than three miles distant, and a Bill is now before the Nova Scotia legislature for the construction of a line of railway from East Bay to Sydney.

Nitrites; Analysis of — A. Sanin. J. Russ. Phys.-Chem. Ges., 1909, 41, 791-795. Chem. Zentr., 1909, 2, 1773.

THE method proposed depends upon the interaction of nitrites with hydroxylamine hydrochloride, in accordance with the equation:



About 5 grms. of the nitrite are dissolved in 1 litre of water, and 20 c.c. of the solution are warmed for 5-8 minutes with 20 c.c. of a standardised solution of hydroxylamine hydrochloride (about 10 grms. per litre) until

evolution of gas ceases. Then, after cooling, the excess of hydroxylamine hydrochloride is titrated with $\text{N}/20$ sodium hydroxide solution, using phenolphthalein as indicator.—A. S.

Water-glass solution; Influence of calcium carbonate on — O. Kallauner. Chem.-Zeit., 1909, 33, 1174-1175.

THE hardening of mixtures of calcium carbonate and water-glass on exposure to the air is found to be accompanied by absorption of atmospheric carbon dioxide and considerable loss of water; very little calcium silicate is formed. Hardening commences at the surface of the material, and the interior tends to remain soft; its principal cause is considered to be the separation of gelatinous silica, due to the influence of carbon dioxide and loss of water, the carbonate being practically inert. Strontium and barium carbonates behave like the calcium compound.—F. SODN.

Calcium cyanamide; Formation of — F. Foerster and H. Jacoby. Z. Elektrochem., 1909, 15, 820-834.

PREVIOUS work on the influence of calcium chloride and calcium fluoride on the formation of cyanamide from calcium carbide (this J., 1907, 423) has been extended. Rudolf's view that the efficacy of added salts is greatest at temperatures just above their melting points (this J., 1907, 822) is not confirmed. Although the addition of calcium fluoride affects the speed of the reaction, it does not alter the state of final equilibrium, which, for a given temperature, reaches the same point, whatever the amount of fluoride added. Under otherwise uniform conditions, the rate at which carbide, mixed with calcium fluoride, is transformed into cyanamide is proportional to the pressure of the free nitrogen. Larger quantities of material being used than in former experiments, it has been established that with carbide alone or with mixtures of carbide and calcium chloride, the temperature of the mass rises very considerably during the reaction, though further heating is necessary to make the absorption of nitrogen at all complete. With calcium fluoride, on the other hand, a much more uniform rate of reaction may be maintained at a lower temperature, and the total time required for complete absorption is no greater than when calcium chloride is used. Similar results have been obtained on the large scale by F. Carlsoo, who finds that with an addition of 10 per cent. of calcium chloride the temperature of the mass in the retort rises to 1000°C ., although, in the presence of the chloride, 800°C . would be a sufficiently high temperature for the rapid absorption of nitrogen; calcium fluoride, however, reduces the temperature at which absorption of nitrogen can take place and also keeps down the temperature of reaction by at least 100°C . The heat produced is not sufficient, even with carbide alone, to carry the reaction through a mass of cold material, when started at one point. Experiments at temperatures between 920° and 1100°C . show that addition of calcium fluoride does not appreciably affect the small proportion of cyanide formed during the production of cyanamide. The reaction, $\text{R}_2\text{N}_2\text{C} + \text{C} \rightleftharpoons 2 \text{RNC}$, tends towards the right, if R be potassium or sodium, and, the higher the temperature, the more cyanide is formed, but if R_2 stand for 1 atom of calcium, the reaction tends towards the left; thus, less than 4 per cent. of the used nitrogen is converted into cyanide by melting 0.69 gm. of calcium cyanamide with 12.5 grms. of calcium chloride, but 0.46 gm., melted with 6.0 grms. of sodium chloride, causes 69.9 per cent. of the nitrogen to be so transformed.

—F. SODN.

Radium, barium, strontium, and calcium bromides; Volatility of — A. Stock and H. Heynemann. Ber., 1909, 42, 4088-4093.

THE relative volatility of the bromides of calcium, strontium, and barium was estimated by heating the salts in a narrow quartz tube in a small electric furnace in the vacuum of a mercury pump, and noting the temperature at which a deposit of sublimed salt began to appear in the cool portion of the tube projecting from the furnace.

These temperatures are respectively for calcium bromide, 720° C.; strontium bromide, 770° C.; barium bromide, 820° C. No pure radium bromide being available, the corresponding estimation for that salt could not be made; but fractional sublimations of three samples of radio-active barium bromide ($\text{I}_{100}^{\text{Ba}}$, $\text{I}_{100}^{\text{Ba}}$, $\text{I}_{100}^{\text{Ba}}$, of radium salt) showed that the sublimed portion always contained a lower proportion of radium than the residue, the difference between the two being less as the sublimed portion formed a greater proportion of the whole. Possibly fractional sublimation may in certain circumstances be a convenient method for the concentration of radium compounds. —J. T. D.

Iodine; Oxidation of —, by means of ozone. F. Fichter and F. Rohner, Ber., 1909, 42, 4093-4100.

THE authors have re-investigated the product described by Ogier (Comptes rend., 1877, 85, 597, and 1878, 86, 722) and formulated by him as I_2O_5 . By using a solution of iodine in chloroform instead of iodine powder or vapour, and oxygen much richer in ozone than was obtainable in 1877, they have prepared larger quantities of the substance, and have shown that its composition agrees most nearly with the formula I_4O_9 . They regard it as the iodate of trivalent iodine, $\text{I}(\text{O}_3)_3$. Its most striking character is the avidity with which it absorbs moisture from the atmosphere, the yellow powder sinking down into a brown liquid, which consists of iodine and iodic acid— $5\text{I}_4\text{O}_9 + 9\text{H}_2\text{O} = 18\text{HIO}_3 + \text{I}_2$. —J. T. D.

Arsenic; Phosphorescence and oxidation of —. L. Bloch, Comptes rend., 1909, 149, 775-777.

THE author finds that when arsenic is oxidised by either air or pure oxygen, arsenic anhydride is always produced whether the phenomenon is accompanied by phosphorescence or by flame. The lower the temperature at which oxidation takes place, the greater is the proportion of arsenic anhydride obtained. In the most favourable experiment 1/30th part of the arsenic was converted into the anhydride. The latter is formed directly in this reaction and is not due to further oxidation of arsenious anhydride, as this was not oxidised when heated in a current of air at 250°-450° C. —J. C. C.

Electrolytic oxidation of ethyl alcohol to acetic acid. Askenasy and others. See XVII.

Detecting arsenious in presence of arsenic acid. Covelli. See XXIII. Inorg. Qual.

PATENTS.

Alumina; Manufacture of —. G. McCulloch, East St. Louis, Ill., Assignor to Aluminum Co. of America, Niagara Falls, N.Y. U.S. Pat. 938,269, Oct. 26, 1909.

IN the preparation of alumina from bauxite, after precipitating alumina from sodium aluminate solution by means of carbon dioxide, caustic alkali is added to the precipitate with the object of dissolving the silica precipitated with the alumina. The liquor containing the re-dissolved silica and alumina is withdrawn, and used for the treatment of further quantities of bauxite. —O. R.

Soda; Recovery of — in the manufacture of alumina. H. C. Peffer, East St. Louis, Ill., Assignor to Aluminum Co. of America, Pittsburg, Pa. U.S. Pat. 938,270, Oct. 26, 1909.

THE residual red mud, left in the manufacture of alumina from bauxite by the alkaline process, is heated with lime, or digested with lime and water under pressure, thereby rendering the soda soluble, after which the solution is filtered and the soda recovered. —O. R.

Alumina; Removal of silica in the manufacture of —. H. C. Peffer, East St. Louis, Ill., Assignor to Aluminum Co. of America, Pittsburg, Pa. U.S. Pat. 938,432, Oct. 26, 1909.

IN the process of preparing alumina from bauxite, in which the latter is digested with lime and sodium carbonate,

the sodium aluminate liquor formed is allowed to remain in contact with the residual red mud for about 6 hours to cause the precipitation of the silica. —O. R.

Slags and burnt pyrites containing barium and iron; Process for treating —. R. Alberti, Ger. Pat. 215,020, July 3, 1908.

THE powdered material is mixed with a quantity of hydrochloric acid sufficient to convert the metals into chlorides, and is then treated with superheated steam at a temperature of about 300° C., but not exceeding this. The sulphides present are decomposed and free sulphur distils over, together with hydrochloric acid resulting from the decomposition of iron and manganous chlorides; the reaction is complete when the issuing steam no longer has an acid reaction. By extracting the residue with water, a solution is obtained containing barium, zinc, and copper chlorides, and free from iron. —A. S.

Perborate preparations; Manufacture of solid, durable —. Chem. Werke vorm. Dr. H. Byk, Charlottenburg, Germany. Eng. Pat. 7495, March 29, 1909. Under Int. Conv., April 14, 1908.

SEE Fr. Pat. 401,911 of 1909; this J., 1909, 1198. —T. F. B.

Sodium sulphite and ammonium chloride; Process of making —. Dr. Friedrich and Co., and F. Hirsch, Fr. Pat. 402,872, May 10, 1909. Under Int. Conv., June 20, 1908.

SEE Eng. Pat. 11,123 of 1909; this J., 1909, 1034. —T. F. B.

Silicon nitride; Process of manufacturing —. A. Sinding-Larsen, Christiania. Eng. Pat. 7397, March 26, 1909.

SEE U.S. Pat. 928,476 of 1909; this J., 1909, 942. —T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Mosaic glass; Production of —. O. Parkert, Sprechaal, 1909, 42, 671.

MOSAIC glass is made by printing the mosaic design on to well-annealed flint glass by means of a transfer. The transfer is made by pouring a mixture of 20 parts of a solution of size, 10 parts of glucose, and 5 parts of glycerin, into plaster moulds cut to the required pattern, and soaked with paraffin. When the mixture has set, it is carefully removed and placed on a wooden plate dusted with resin. In the process of printing from the transfer, a thick syrup of gelatin solution and finely-powdered borax is used as medium, applied to the transfer by a fine hair-pencil. Ground lead-glass is now blown on to the ware, and whatever does not adhere is shaken off. The ware is then burnt again in a muffle-kiln. The firing must be carefully conducted, as many colours develop at a comparatively low temperature. The kiln is fitted with a press-roll to smooth out inequalities of the mosaic surfaces. Mosaic decoration on hollow glass ware is attended with greater difficulty. Gum-transfers are used, and a protecting composition is applied where the design is not wanted. —H. H. S.

PATENTS.

Glass annealing furnaces or ovens and the like. L. Rembaux, Maubrier s/Sambre, Belgium. Eng. Pat. 25,797, Nov. 30, 1908.

A CONTINUOUS annealing plant is described consisting of a series of ovens through which the charge of glass, supported on a suitable table or truck, is consecutively passed, each oven having a lower temperature than that from which it receives the glass. The ovens are separated by movable partitions, and the truck or table is heated in the first oven, and then moved along rails into the second oven, where it receives the sheet of cast glass. The first oven is heated by gas, and the waste gases are drawn from it down through refractory chequer-work below part of the floor of the second oven, passing up through openings in the floor, and then down through a second block of chequer-work, and on to the next oven. The

ovens are provided with flues for drawing off the heating gases in order to regulate the temperature as required. Hoists with the necessary accessories are provided at each end of the series of ovens, so that a tile which has passed through all the ovens can be returned to the preliminary heating oven. A series of annealing ovens may be arranged on each side of the casting house.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Colloids in clays. Rohland. *Sprechsaal*, 1909, 42, 655—657.

ACCORDING to the author the characteristic properties of clays, especially their plastic properties, are due to colloidal ingredients, especially to colloidal hydroxides of silicon, aluminium and iron, formed during the weathering of the granitic rocks from which clays are originally formed. Colloidal organic substances are also present and play a part in rendering the clay plastic. Pure kaolin only shows plastic properties to a small degree and in some cases not at all, as the active colloids have been removed in the process of sedimentation. Aluminium silicate itself is quite devoid of plastic properties, and very plastic clays, rich in zinc, are known which contain only 1 per cent. of aluminium silicate, but in contact with water, form colloidal zinc and silicon hydroxides. The author finds that strongly plastic clays adsorb colloids, dyestuffs of complicated composition, CO_3 -ions from carbonates, HCO_3 -ions from bicarbonates, B_4O_7 -ions from borates, and PO_4 -ions partially from phosphates. When digested with a mixture of water and an aromatic hydrocarbon, a certain quantity of the water is absorbed and the clay becomes absolutely impervious to the hydrocarbon, though water diffuses through it. Fuller's earth apparently also absorbs alcohol, acetone and other substances containing oxygen.—E. F.

Colloids in clays; Quantitative determination of —. K. Endell. *Z. Chem. Ind. Kolloide*, 1909, 5, 244—245.

THE dry, powdered clay is boiled with Canada-balsam, and after cooling, a section is prepared by polishing. This is then dyed for 12 hours in a cold, concentrated solution of Magenta and washed. The colloidal portions of the specimen become dyed and show a bright red colour, the other portion being yellow. A microphotograph of 280 diameters magnification is then prepared. The proportion of colloidal material can be estimated by cutting out the dark (colloidal) portions of the photograph and weighing, the whole photograph being also weighed.—E. F.

Cements; Solution and decomposition of —. Maynard. *Tonind.-Zeit.*, 1909, 33, 1462—1463.

THE author analysed specimens of Portland cement that had been exposed to the action of fresh water and of sea water for periods ranging from one day to 2½ years. He concludes that: (1), Even distilled water attacks cement in the course of time, lime entering into solution and diffusing to the surface of the cement; (2), cement combines with a considerable quantity of water in the course of time, and consequently; (3), the absolute volume of its constituents increases. (4), Silica does not appear to enter into solution within the range of time occupied by the experiments; (5), the amount of free lime increases for the space of one year, after which it decreases again; (6), sodium chloride is especially active in causing the decomposition of cement, calcium silicates being dissolved with the formation of a compound, the composition of which is still undetermined.—O. R.

Hydraulic binding materials; Behaviour of — in sea-water. M. Gary and C. Schneider. *Mitt. Königl. Materialprüfungsamt*, 1909, 27, 239—317.

A COMPREHENSIVE and detailed account of experiments still in progress on the behaviour in fresh water and sea

water of cement-mortars and cement-concretes prepared with and without addition of trass. The experimental results so far obtained are given in a large number of tables and curve-diagrams.—A. S.

Iron Portland cement [slag cement] in comparison with Portland cement; Examination of —. M. Gary and H. Burchartz. *Mitt. Königl. Materialprüfungsamt*, 1909, 27, 338—372.

AN account is given of a comprehensive series of comparative experiments with cement mortars prepared with iron Portland cement and Portland cement respectively, by a commission appointed in 1902 by the Prussian Minister of Public Works. After consideration of the results obtained, the commission reported on June 5, 1908, that iron Portland cement and Portland cement may be considered of equal value. If in air-hardening tests under standard conditions, iron Portland cement gives satisfactory results, there is no objection to be raised against its use in public buildings. Similar considerations are said to apply to the addition of suitable slags to ordinary Portland cement.—A. S.

Influence of calcium carbonate on waterglass solution. Kallauner. *See VII.*

PATENTS.

[Brick] kilns. E. Boyone, Novi Ligure, Italy. Eng. Pat. 27,000, Dec. 12, 1908.

IN kilns of the Hoffmann type, in order to prevent the unequal burning of the bricks, some of the rows of bricks in the lower tiers are arranged on a slide which passes transversely across the sole of the kiln. The bricks stacked on the slide are arranged so as to be independent of the others, and are free to be moved without disturbing the remainder. When it is judged that the lower rows are sufficiently burned, the slide is moved transversely by means of a crank and rod, fastened to it and which passes up through the wall of the kiln. In this way the passage of the gas through the lower horizontal rows of bricks is obstructed and it rises upwards and heats the upper rows only.—W. H. C.

Paving brick; Vitrified —. K. Langenbeck, Boston, Mass. U.S. Pat. 937,822, Oct. 26, 1909.

THE brick consists essentially of sifted coal ashes, "possessing the capability of felting," and of a bond of clay, which is more fusible than the ashes, the proportion of the clay used being insufficient to prevent the "felting" of the ashes.—O. R.

Wood; Process of preserving —, and a composition therefor. F. Hasselmann, Munich-Nymphenburg, Germany. Eng. Pat. 12,587, May 27, 1909. Under Int. Conv., May 27, 1908.

WOOD is treated with a solution, which is heated to a temperature of approximately 100° C., and is continuously agitated. The wood is left in the solution while it cools, and is then dried. The solution contains approximately 1.5 per cent. of ferric chloride, 2 per cent. of ammonia-alum, or schoenite, and 1.5 to 2 per cent. of magnesium chloride.—W. C. H.

Wood; Art of colouring and graining —. W. A. Hall, New York, Assignor to American Mahogany Co. U.S. Pats. 939,014, 939,015, and 939,016, Nov. 2, 1909.

(1), A VARIEGATED coloration is produced in wood, by treating it with a solution containing ingredients of different capillary activities or different penetrating qualities, in a closed vessel, which can either be exhausted, or in which the pressure can be raised. (2), Wood containing tannin is heated in a closed receptacle, from which the air is afterwards exhausted; ammoniacal gas is forced into the wood by pressure, and permeating it throughout, acts chemically on the tannin to colour the wood. The gas is removed from the wood by a second vacuum treatment. (3), Wood is artificially grained and coloured by indenting the surface to imitate grain figures, withdrawing the air from the wood by means of a vacuum, and then

forcing a colouring solution into and throughout the wood by pressure, and diffusing the colouring material by a boiling or steaming process, so that the colouring matter is largely lodged as a pigment deposit in the softer and indented portions, and also diffused throughout the denser portions of the wood. In this way a common wood is made to resemble a rare wood in shade and appearance. (See also U.S. Pats. 933,435—933,437 of 1909; this J., 1909, 1037.)—W. C. H.

Asphalt; Method of rejuvenating — J. A. W. Pine, New York. U.S. Pat. 938,698, Nov. 2, 1909.

THE method is applicable to asphalt which has partly or entirely lost its binding power through chemical action, or through causes other than injury due to wear or abrasion, and consists in heating the material to a temperature of between 300° and 400° F., in such a way that the heat penetrates uniformly throughout the mass, which is mechanically agitated during the heating process.

—W. C. H.

Calcium hydroxide mixtures which can be cast; Process for the preparation of — M. Schumacher. Ger. Pat. 215,161, Nov. 17, 1906.

SLAKED lime is mixed to a stiff paste with water and this is incorporated with a small quantity (2 per cent.) of a carbohydrate, such as gum, dextrin, or sugar, and 0.25 to 1 per cent. of alkali. The mixture becomes more fluid and can be cast in plaster moulds. Filling materials, such as sand, cellulose, peat, &c., may be added.—A. S.

Cement from blast furnace slag; Manufacture of — G. F. Metzger, Manchester. Eng. Pat. 15,164, June 29, 1909.

CEMENT is manufactured from hot blast-furnace slag by the application of water only, which is correctly proportioned to the temperature, flow, and quantity of the slag to cause the necessary reaction and ensure efficient granulation. The process may be carried out in any suitable machine or apparatus, the necessary ingredients being added, or the chemical proportions of the slag being varied inside the blast-furnace, to produce any particular quality of cement required.—W. C. H.

Cement and other products; Process of making — S. Peacock, Chicago, Ill., Assignor to American Cyanamid Co., New York. U.S. Pat. 939,078, Nov. 2, 1909.

By this process free phosphorus pentoxide and Portland cement are made in a single operation from phosphate rock. Silica is added to the rock, if necessary, so that the ratio of the total silica to the total alumina and ferric oxide together may be greater than 2, and less than 4, and enough lime, or its equivalent of calcium carbonate, is added to the rock mixture to combine with all the acidic oxides present. The quantities stated are 100 lb. of phosphate rock, about 8.3 lb. of silica, and 51.6 lb. of calcium carbonate. The mixture is suitably prepared and treated to form Portland cement and drive off phosphorus pentoxide which is then recovered.—W. C. H.

Wood; Methods of impregnating — P. C. Reilly, Indianapolis, U.S.A. Eng. Pat. 22,854, Oct. 27, 1908.

SEE U.S. Pat. 901,557 of 1908; this J., 1908, 1153.—T. F. B.

Wood; Process for preserving — F. Hasselmann. Fr. Pat. 403,370, May 26, 1909. Under Int. Conv., May 27, 1908.

SEE Eng. Pat. 12,587 of 1909; preceding.—T. F. B.

Cement; Manufacture of — S. O. Cowper-Coles, London. U.S. Pat. 939,217, Nov. 9, 1909.

SEE Eng. Pat. 22,425 of 1906; this J., 1908, 162.—T. F. B.

X.—METALS AND METALLURGY.

Coal and iron industries; Development of the — Greville Jones. Cleveland Institute of Engineers, Presidential Address, Nov., 1909.

IN the coal industry extensive developments have been carried out in South Yorkshire within easy distance of the iron and steel works in the Frodingham district, and the result will be, in the author's opinion, that it will be possible to produce in the Lincolnshire district, the cheapest pig-iron in the world, since besides coal, cheap self-fluxing ores are available. At the Barfoed Colliery in South Wales there is an installation of 100 Koppers by-product coke-ovens, and a washer capable of dealing with 120 tons of coal in 12 hours. By the washing process, small coal containing 6 per cent. of ash and 1.1 per cent. of sulphur is obtained from a mixture of "smalls" and dirt containing 20 per cent. of ash and 1.5 per cent. of sulphur. The gas from the coke-ovens is used for power purposes on the spot and is also conveyed to other collieries, some of which are 1½ miles distant. With respect to coke-ovens, in the United Kingdom there are in operation 2505 Coppée ovens without by-product plants and 5111 by-product ovens classified as follows: Simon-Carvès, 1201; Semet-Solvay, 1150; Otto, 1052; Koppers, 638; Simplex, 334; Coppée, 314; Huessener, 260; Collins, 50; Bauer, 12; others, 100.

Iron ore.—Large deposits of ore have, it is said, been found in Kent and Sussex; near Dover, the seam has been proved to a depth of 17 feet, and will, it is estimated, produce 107,000 tons per acre. The calcined ore contains 45 per cent. of iron; ore from the middle of the seam contains 49 per cent. The pisolitic iron ore from the deposit opened up in Carnarvonshire contains about 45 per cent. of iron, 15 of silica, 5.75 of lime, and 1—1.73 of phosphorus. In the author's opinion it would be suitable for use in place of puddler's "tap" in the manufacture of basic pig-iron for the basic steel process.

Iron manufacture.—There is only one dry-air plant (see Gayley, this J., 1904, 1148) at present in operation in the United Kingdom, viz., at Cardiff. The results obtained with hematite ore are shown in the following table, together with the average results obtained at Blaenavon, using ordinary air.

	Output.	Coke consumption.
Cardiff—	tons.	lb.
Average for 50 weeks with ordinary air	2001	2278
Average for 5 weeks with dry blast, operated for increased output	2530	1972
Average for 4 weeks with dry blast, operated for economy ..	2286	1857
Blaenavon—		
Average for 4 years with ordinary air	1238	1981

Dry-air plants are about to be installed at single works in Great Britain, Canada, and Germany, and at seven different works in the United States.

Blast-furnace gas.—At several places plants are in operation for the utilisation of blast-furnace gas for power purposes (see also this J., 1909, 603).

Steel manufacture.—Owing to the tendency of the available iron ores to increase in phosphorus-content, the acid Bessemer process will probably gradually be dispensed with. In the manufacture of basic Bessemer steel, the chief improvements have been the introduction of the Flohr process (see Goerens, this J., 1908, 571) and the Massenez process (see Richards, this J., 1907, 694). The greatest improvements in recent years have been made in the basic open-hearth process. The chief of these are:—(1), the use of molten iron; (2), the adoption of the mixer, whereby a regular supply of metal of uniform quality is insured; (3), the mechanical charging of scrap and ore; (4), furnaces of larger capacity, whereby a greater surface

of the metal is exposed to oxidation, and owing to the larger size of the regenerators, the fuel consumption is reduced. At several works the gas-producers used in connection with the open-hearth furnaces are provided with plants for the recovery of the ammonia, a yield of 95–105 lb. of ammonium sulphate per ton of fuel consumed being obtained; even with a yield of only 90 lb. of ammonium sulphate, the saving would amount to ls. 6d. per ton of steel made. In America, the use of the Blair water-cooled blocks in open-hearth furnaces (see Fr. Pat. 382,135; this J., 1908, 232) has effected considerable economy. *Talbot furnaces* (see this J., 1900, 539). Ten of these furnaces are now in operation in the United Kingdom, and there are 13 in course of construction.

Electric furnaces. (See this J., 1907, 327, 767; 1908, 691, 757, 817; 1909, 208, 1046). The number of electric iron and steel furnaces at present in operation or in course of construction, in different countries is as follows:—Germany, 20; Italy, 12; France, 12; U.S.A., 9; England, 6; Switzerland, 6; Austria, 5; Sweden, 5; Luxemburg, 4; Belgium, 2; Bohemia, 1; Brazil, 1; Spain, 1. Of the English furnaces, three are of the Kjellin type, two of the Frick type, and one of the Héroult type. The results of tests made by Guillet as to the uniformity of steel made in the Héroult electric furnace, are shown in the following table:—

	Soft steel.				Hard steel.					
	Large ingot.			Small ingot.	Large ingot.			Small ingot.		
	Top.	Middle.	Bottom.	Middle.	Top.	Middle.	Bottom.	Top.	Middle.	Bottom.
Carbon	0.084	0.069	0.068	0.070	1.015	1.016	1.022	1.018	1.013	0.22
Silicon	0.036	0.034	0.038	0.030	0.103	0.101	0.103	0.098	0.100	0.101
Manganese	0.233	0.230	0.240	0.230	0.144	0.148	0.158	0.151	0.150	0.146
Sulphur	0.019	0.020	0.022	0.022	0.021	0.019	0.021	0.020	—	0.019
Phosphorus	0.008	0.008	0.009	0.008	0.010	0.009	0.010	0.011	0.011	0.010

(See also Harbord, this J., 1909, 867.)—A. S.

Norwegian iron industry; Development of the —.
Chem.-Zeit., 1909, 33, 1199.

A ROYAL Commission has been engaged in Norway with the question of the development of the iron industry with the aid of electric power. The present production of iron ore in Norway is over 100,000 tons per annum, and it is estimated that it will soon reach 1,000,000 tons. The most important deposits of ore occur in North Norway, two types being recognised, viz., the Dunderlands and South Varanger types. At Dunderlands the conditions are unfavourable, but at South Varanger, there is a cheap supply of ore which can be concentrated magnetically with a small expenditure of power; it is anticipated that the production here will soon reach 600,000 tons per annum. In North Norway it is estimated that there are about 350 million tons of crude ore, of which 200 million tons consist of magnetite. In the Trondhjem district the ores contain sulphur, but this will not stand in the way of their use in electrical smelting processes; in this district there are about 20 million tons of ore with a content of 55 per cent. of iron. In Western Norway there are large deposits of titaniferous iron ore suitable for the manufacture of ferro-titanium; it is estimated that about 5 million tons are available. There are also several deposits of iron ore, amounting in all to about 5 million tons, in the southern and eastern parts of Norway.—A. S.

Malleable cast iron. R. Namias. Seventh Int. Congr. Appl. Chem., London, 1909. Engineering, 1909, 88, 669.

In the author's opinion sufficient attention is not paid to the chemical action taking place in the conversion of white cast iron into malleable iron. The composition of the

white cast iron used is of great importance; it should be comparatively low in silicon and manganese, as although up to 0.5 per cent. of silicon is beneficial, in that it facilitates the separation of graphite, an excess renders the product less malleable. As oxidising material, slightly better results were obtained with a mixture of ferric oxide and lime than with ferric oxide and quartz sand. In an Italian works the best results have been obtained with a mixture of small iron refuse and forge scale. The malleable iron prepared with this mixture from a silicious cast iron had the following composition at the surface and at a depth of 1–2 cm. respectively:—sulphur, 0.133, 0.148; phosphorus, 0.100, 0.103; manganese, 0.62, 0.61; silicon, 0.062, 1.59; (1) carbon, 0.28; (2), combined carbon, 0.35; graphitic carbon, 1.36 per cent. The author has made experiments with an oxidising mixture composed of carbon dioxide in presence of ferric oxide and a basic substance; the best results were obtained with a mixture of 1000 parts of ferric oxide, 50 of graphite and 150 of magnesia, carbon dioxide being evolved gradually and continuously. The carbon monoxide produced by the action of the carbon dioxide on the carbon of the cast iron, was re-oxidised to carbon dioxide by the ferric oxide. This mixture yielded results similar to those obtained with the mixture of iron refuse and forge-scale, and was cheaper and easier to prepare.—A. S.

Etching [iron and steel] with cuprammonium chloride.
M. Widemann. Stahl u. Eisen, 1909, 29, 1823–1824.

THE author has repeatedly tried to use cuprammonium chloride for etching steels for microscopic examination, but has found that the precipitated copper has greatly interfered with the method. In order to overcome this difficulty, the polished specimen is moved about rapidly in a large dish containing the etching solution, the polished surface being uppermost. As soon as sufficient action has taken place, the piece of metal is rinsed in running water, and while still wet, immersed in a 30 per cent. solution of potassium cyanide heated to 50° C. After 1–10 minutes the whole of the copper has dissolved; the specimen is now washed with water and dried in the usual manner. This method has been used with very great success on a great variety of steels.—A. H. C.

Titanic acid in ilmenite; Determination of —. E. Röer.
Chem.-Zeit., 1909, 33, 1225.

THE finely powdered ilmenite (0.5 gm.) is fused with sodium carbonate (10 grms.) first of all over a Bunsen, then over a blow-pipe flame for half an hour, the melt poured into a platinum dish to cool, then transferred, together with the crucible, to a beaker, covered with 50 c.c. of water and allowed to stand for 12 hours. The insoluble matter, consisting of sodium titanate, iron oxide, lime, and magnesia, is filtered off, washed with cold water and, by piercing the filter, introduced into a litre flask. The beaker and crucible are rinsed with a mixture of hot dilute hydrochloric and sulphuric acids, which is poured over the filter, and the latter then washed with boiling water. Should undissolved sodium titanate or iron oxide remain in the flask, the contents of the latter are boiled with a little dilute sulphuric acid until the liquid becomes clear or only a white precipitate remains. On cooling, the solution is made just alkaline with caustic soda, then faintly

acid with sulphuric acid, and 100 c.c. of saturated sulphurous acid together with boiling water added to make the volume 700 c.c. The whole is now boiled for an hour, and after addition of 20 c.c. of sulphurous acid, allowed to stand until the precipitated titanous acid has settled. It is collected on a thick filter, washed with boiling water until free from chlorine, incinerated and ignited as usual. In this process it is essential that sufficient sulphurous acid be added to completely reduce the iron present.—J. L. H.

Tungsten ores; Occurrence and utilisation of —. Bulletin Imp. Inst., 1909, 7, 285—295.

THE following table gives, as far as possible, the production of tungsten ores for the period 1905—1907:—

	1905.		1906.		1907.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£
Europe —						
United Kingdom	172	11,357	271	19,775	322.5	41,044
Portugal	284	20,455	561	45,437	599	75,207
Spain	368	6,655	413	8,949	378	7,783
Germany	33	2,613	51	4,692	61	8,506
Austria	58	4,188	56	4,634	43	5,628
France	25	2,373	18	1,918	59	7,098
Italy	—	—	25	1,000	16	698
Africa —						
Rhodesia (Wolfram)	—	—	15	1,503	11	1,149
" (Scheelite)	—	—	—	—	34	4,312
Asia —						
Malay States	—	—	135	—	80	—
Dutch East Indies	—	—	—	—	38*	—
Indo-China	—	—	24*	2,520	125*	11,960
Siam	—	—	—	—	9	—
Australasia —						
New South Wales (Scheelite)	138	10,122	109	7,647	196	23,781
" (Wolfram)	86.5	7,361	132	9,057	207	26,235
Queensland (Scheelite)	4	330	4.5	347	2.25	320
" (Wolfram)	1409	99,873	768	64,136	615	89,767
South Australia (Wolfram)	63	3,379	102	6,981	91	11,351
Tasmania	32	2,371	20	1,465	41	4,411
New Zealand (Scheelite)	28	1,848	55	3,407	137	15,486
America —						
United States	716	55,170	829	71,636	1458	182,761
Bolivia	66	—	—	—	392	—
Argentina	—	—	290	—	415	5,936

* Tin and wolfram ores.

The price obtainable for tungsten ores is affected in a very disproportionate degree by the percentage of tungstic oxide, WO_3 , present and also by their freedom from certain impurities. It is stated that the phosphorus and sulphur content should not greatly exceed 0.25 and 0.01 per cent. respectively. In Colorado in 1907, the price per unit of tungstic oxide in ores containing from 3 up to 60 per cent. of the oxide ranged from 13s. 5d. to £1 19s. 7d.

Tungsten is a bright grey metal with a hardness between 5.4 and 6, and having a sp. gr. of 19.13. Its melting point, according to a recent determination, is 3080° C. The chief application of tungsten is in the manufacture of steel, the tensile strength and elastic limit of which are raised, within certain limits, in proportion to the amount of tungsten present. The elongation, reduction of area, and resistance to shock diminish proportionately, whilst the hardness increases somewhat rapidly with the percentage of tungsten. Tungsten steels are largely used for the manufacture of high-speed tool-steels as they retain their temper even when worked red hot. A typical steel of this type contains 8.5 per cent. of tungsten, 4 of chromium, and 1.25 of carbon. An important use for tungsten is in the manufacture of filaments for electric glow lamps, which are claimed to have an efficiency of 1 to 1.2 watts per candle-power. The salts of tungsten are used, to a limited extent, in rendering wood and textile fabrics fireproof, as a mordant for silk and wool, and for colouring pottery, etc.—F. R.

Cuprous oxide in copper and its alloys; Determination of —. R. H. Greaves. Chem. News, 1909, 100, 233—235.

THE author has examined the method devised by Coffetti (this J., 1909, 313), which is based on the fact that cuprous

oxide is soluble in ammonia in absence of oxygen, whereas copper is insoluble. In order to shorten the time required, the apparatus was modified so that a greater surface of the copper was in contact with the ammonia solution. For mixtures of pure copper with cuprous oxide, the method was found to give excellent results, but when arsenic is present, the results are too high. Useful results can, however be obtained in the latter case by determining the arsenic dissolved, and making a correction on the basis that it dissolves as copper arsenate. Antimony has an effect similar to that of arsenic. When iron is present in metallic copper containing oxygen, it exists wholly or partly as oxide, and hence the total oxygen and oxygen present as cuprous oxide do not correspond. Serious errors

due to the presence of antimony and iron are not likely to occur with commercial coppers. The method appears to yield useful results with brass and bronze, but in the case of the latter it should be borne in mind that the injurious constituent is mainly stannic oxide.—A. S.

Zinc; Determination of — and the analysis of zinc ores. K. Voigt. Z. angew. Chem., 1909, 22, 2280—2285.

If ammonium phosphate be added to an ammoniacal solution of a zinc salt, and the solution be heated until it gives the amphoteric reaction (i.e., turns red litmus blue, and blue litmus red), the zinc is completely precipitated as the highly crystalline zinc ammonium phosphate. This on filtration, washing with water, and drying at 100° C., and igniting separately from the filter-paper, yields zinc pyrophosphate in which form it may be weighed; for calculating the zinc a factor of 0.4291 is used. The author uses this method for the estimation of zinc in zinc blende. After solution in *aqua regia*, the silica, alumina, iron and manganese are separated and estimated in the usual way. The lime, however, is separated by the use of ammonium carbonate instead of as oxalate, and the magnesium ammonium phosphate is precipitated by a 10 per cent. solution of ammonium phosphate free from sodium salts, the zinc remaining in solution. The zinc ammonium phosphate is now completely precipitated by heating the solution on a water bath, and finally on an asbestos plate until the above amphoteric reaction is obtained.—A. H. C.

Zinc blende; Interaction of carbon and silicon with — at high temperatures. W. Fraenkel. Metallurgie, 1909, 6, 682—688.

REFERENCE is made to previous work on the reduction of zinc blende, and to the possibility of the formation of

volatile sulpho-carbonyl compounds analogous to the metal-carbonyl compounds. Proceeding on the assumption of Percy and others, of the formation of zinc and carbon bisulphide from zinc blende and carbon, a mixture of very pure zinc-blende and sugar charcoal was heated in a quartz boat in a quartz tube in a Heraeus furnace. The temperature was determined by a thermo-junction close to the boat, and a stream of purified nitrogen was passed through the tube, carrying any volatile products against a water-cooled quartz tube at the other end. It was found that a mixture of 90 per cent. of zinc blende and 10 per cent. of carbon could be completely volatilised at a temperature of about 1350° C. without the formation of even traces of carbon bisulphide. A sublimate was formed, however, on the water-cooled tube, of which the analysis closely agreed with the composition, $ZnSSi$. It was a hard brittle substance, with a lustre like that of silicon, and a polished and etched specimen appeared homogeneous under the microscope. It evolved sulphuretted hydrogen when treated with acids, and hydrogen when treated with caustic alkalis. Experiments with a carbon boat showed that the silicon was derived from the quartz tube. A mixture of zinc blende and silicon gave the same volatile product. The author confirms the observation of Lepiarczyk (this J., 1909, 838), that a volatile product of zinc sulphide and carbon is formed in the zinc muffle, and shows that this vapour is able to reduce silica to silicon, producing a volatile substance which appears to be a molecular compound of zinc sulphide and silicon. In the technical production of zinc, owing to the presence of a large amount of silica in the zinc muffle, it is considered that there is a considerable loss of zinc due to the formation of this volatile product.—A. H. C.

Zinc alloys. B. E. Curry. J. Physical Chem., 1909, 13, 589—605.

THE melting-point curve of antimony-zinc alloys was re-determined by means of heating curves in place of cooling curves, in order to avoid errors caused by supercooling. The equilibrium diagram consists of six phases: pure antimony, pure zinc, the compound, $ZnSb$, and three series of solid solutions, α , β , γ . The α - and β -phases are not stable below 437° C. and 405° C. respectively, and the γ -phase is only stable below the solidifying point. Alloys with more than 45 per cent. of zinc are not homogeneous under any condition, and below 405° C. they consist entirely of γ -crystals and zinc. The freezing-point curve of zinc-tin alloys shows the absence of compounds. The two phases in the equilibrium diagram are pure zinc and a solution of zinc in tin. The alloys show a gradation in softness from pure zinc to pure tin, pure zinc being harder and more brittle than any of its alloys with tin. The freezing-point curve for zinc-cadmium alloys is similar to that of the zinc-tin series, the two phases being, in this case, the solid solutions of zinc in cadmium and of cadmium in zinc. The miscibility of zinc and lead and of zinc and bismuth is very slight; at the freezing point, mixtures of lead and zinc separate into two layers consisting practically of the pure metals, and in the latter case the phases separating are pure zinc and a solid solution of zinc in bismuth.—F. R.

Melting point determinations. W. P. White. Amer. J. Science, 1909, 28, 453—473.

THE author discusses the question of the determination of melting points (especially of metals and silicates) from temperature-time curves. As the result of numerous experiments on a number of substances, organic and inorganic, melting at temperatures between 0° and 1400° C., the methods employed in the geophysical laboratory of the Carnegie Institution, Washington, have been so improved, that the agreement of determinations of the melting points of silicates has increased about five-fold. The chief conclusions drawn from the investigation are as follows:—Melting and freezing point (temperature-time) curves of pure substances should consist of two vertical branches joined by a horizontal line corresponding to the melting point. Curves plotted from experimental data are, however, nearly always oblique—that is, they show an

interval within which the temperature continuously rises or falls, instead of a constant temperature. The chief cause of this obliquity is the presence of impurities in the substance under examination. The true melting point corresponds to the upper end of the oblique melting interval. In the case of some very viscous substances, mostly boron and silicon compounds, melting hysteresis ("time-lag") may be a serious cause of obliquity of the curve, e.g., the melting may take place only gradually even at temperatures 100° or more above the true melting point. This phenomenon may be recognised by the variability of the melting temperature with the rate of heating. In making determinations of the melting point of impure substances by the thermal method, more attention should be paid to the supply of heat to the charge; if this varies, the curve is distorted. Commonly the temperature of the furnace is made to rise or fall continuously and uniformly, but as the charge during melting or freezing remains at a practically constant temperature, the rate of supply of heat to the charge under the conditions stated will vary considerably. The freezing point is easier to observe than the melting point, but is inadmissible in the case of substances which show marked undercooling. The melting point curve is liable, where stirring is not practised, to obliquities caused by uneven temperature distribution, due to the difference of temperature between the inside and outside of the charge; also by irregularities in the flow of heat and conduction of heat by the thermo-element—these are less with narrow charges and small thermo-elements, but the error due to the latter cause may be several degrees with enclosed thermo-elements. Errors may also be introduced by electrical conductivity of the melt, when bare thermo-elements are used, contamination of the thermo-elements, and differentiation (melting of portions of charge of varying purity at different temperatures) and diathermaney of the charge. Melting points above 800° C. have been determined with results agreeing to within 0.05°, but in most cases at high temperatures, differences of from 0.5 to 1.5° C. are found, the cause of which has still to be determined.—A. S.

Melting point methods at high temperatures. W. P. White. Amer. J. Science, 1909, 28, 474—489.

FOR the determination of melting points at temperatures up to 1600° C., platinum resistance furnaces of simple construction (see Day and Allen, Phys. Rev., 1904, 19, 177) can be used with good results. Where uniformity of temperature throughout the working chamber is important, this is made higher and narrower, and fitted with four horizontal partitions to ward off the cooling effect of the ends, and a porcelain tube is disposed in the centre of the chamber to receive the crucible containing the substance. It is best to work with small quantities (2.5 grms.) of the substance, and it is advisable to use a second thermo-element to give directly the temperature in the neighbourhood of the charge, besides that giving the temperature of the furnace, since the measurement and regulation of the heat supply from the furnace to the charge is of great importance. Methods of treating and insulating thermo-elements and of avoiding the effects of contamination are described (see also Phys. Zeits., 1907, 8, 332). The melting points of very viscous substances, showing hysteresis or time-lag, can be determined accurately by slow heating, with occasional examination outside the furnace. Latent heats of fusion can be determined approximately from melting-curves by measuring the furnace temperature, but if the error is not to exceed 10 per cent. (about 10 calories in many silicates), special apparatus and methods of procedure are necessary. The smaller latent heats of transformation can usually be determined, within one or two calories, with no other apparatus than the two thermo-elements. For the determination of faint or sluggish thermal effects, rapid rates of heating and great precision in the regulation of the furnace and measurement of temperature are required. In order to accurately determine eutectic points by the thermal method, a means of detecting the presence of small residues of the component in excess is required (see Amer. J. Science, 1909, 27, 11).

—A. S.

Corrosion of metals; Paint and varnish coatings as accelerators in the —. W. H. Walker and W. K. Lewis. J. Ind. Eng. Chem., 1909, 1, 754—758.

It has been found that, in tin cans which have been lacquered inside with copal linseed oil varnish boiled at 140°—150° C., the corrosion has been much more rapid under the action of strongly acid fruits than in the case of untreated cans. This rapid corrosion takes place at the points where the lacquer has been removed in soldering, etc., and is sometimes so pronounced that a leak has resulted in a few weeks. The authors find that the explanation of this action lies in the depolarising influence of the lacquer itself, coupled with the action of the small proportion of air left in the can. The "linoxylin" coating being still unsaturated will absorb hydrogen. The protected surfaces will be thrown into the cathodic state, and the solution of the metal will thus be concentrated at the exposed points, and the corrosive process will continue there until the air has been consumed and the lacquer has become saturated. The remedy in the case of the fruit cans is to find a lacquer impervious to the solution, or, failing that, one that will not act as a hydrogen depolariser. A saturated varnish may be obtained by heating an ordinary varnish for a sufficient length of time, but the authors have not succeeded in discovering a non-porous coating. These results have also an important bearing upon the resistance of metals coated with paint, etc., to corrosive influences. Exposure of such films to the air eventually renders them completely saturated, but does not destroy their porosity, or obviate the possibility of corrosion at any exposed point caused by the depolarising action of the air through the film; and this explains the deterioration or pitting of iron or steel surfaces at places where the paint has peeled off.—C. A. M.

Mineral production of India. Board of Trade J., Nov. 18, 1909. [T.R.]

THE following table shows the production of minerals, metals, &c., in India in 1907 and 1908 (see also this J., 1909, 1132):—

		1907.		1908.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Coal	tons	11,147,339	2,609,726 (a)	12,769,635	3,356,209 (a)
Gold	ozs.	557,686	2,126,756	567,780	2,177,847
Petroleum	galls.	152,045,677	610,015	176,646,329	702,009
Salt	tons	1,102,783	434,076 (a)	1,279,937	522,794 (a)
Manganese ore	"	899,055	589,830 (b)	674,315	465,593 (b)
Saltpetre	"	357,582	274,679 (b)	386,199	292,758 (b)
Mica	cwts.	39,055	226,382 (b)	27,572	139,513 (b)
Jadestone	"	2,636	49,643 (b)	3,211	73,400 (b)
Ruby, sapphire, and spinel	"	—	98,258	—	47,954
Graphite	tons	2,433	7,411	2,873	14,365
Tin ore	cwts.	not stated	11,882 (a)	1,887	11,015 (a)
Iron ore	tons	67,839	13,427 (a)	59,224	10,637 (a)
Chromite	"	18,303	24,404 (a)	4,745	6,338 (a)
Magnesite	"	186	50 (a)	7,534	2,009 (a)
Diamonds	"	—	2,784	—	940
Amber	"	—	385	—	364
Total value		—	7,079,703	—	7,823,745

(a) Spot prices.

(b) Export values.

Vanadium ore in Peru; Discovery of —. Board of Trade J., Nov. 18, 1909. [T.R.]

DISCOVERIES of vanadium ore have recently been made in the Cerro de Paseo mining district. The exports of vanadium sulphites from Callao were 412 metric tons in 1907 and 1,805 metric tons in 1908. Samples of ore similar to that exported from Cerro de Paseo may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

Tellurium production of United States. Mineral Resources for 1908. [T.R.]

TELLURIUM is found at Cripple Creek in combination with gold and silver. Smaller quantities occur there in the

oxidised form. The principal mineral, calaverite, contains on an average, Te, 57.7 per cent., Au, 41.16 per cent., Ag, 1.65 per cent. In 1908, 20 tons of gold were produced, giving about 28 tons of tellurium which could be easily saved; but no use is known for it and there is no market.

Action of feed water containing magnesium chloride on walls of steam boilers. Lange. See 1.

PATENTS.

Steel; [Crucibles for] Manufacture of —, and similar metallurgical operations. A. Reynolds, London. Eng. Pat. 14,933, July 14, 1908.

IN metallurgical operations in which crucibles are used, the crucibles are provided with lids of refractory material, similar to the crucible lining, and inert to the charge and impervious to the atmosphere, in order to prevent reactions between the charge and atmosphere or furnace gases. The lids are supported and counterpoised so as to rest lightly or float on the charge.—W. C. H.

Iron; Process for melting and refining—and apparatus therefor. H. Johnson, Saxilby, Lincoln. Eng. Pat. 22,948, Oct. 28, 1908.

THE pig or scrap iron is melted in a cupola furnace which is provided at the bottom with a well capable of holding a considerable quantity of molten metal. A small proportion of the required blast is delivered, with or without the addition of steam, under slight pressure, through tuyères placed at the top of the well, the remainder being forced under high pressure through the body of molten metal. The burning gases from the "blowing" of the iron assist in heating and melting the descending charge.—F. R.

Armour and deck plates; Treatment of —. S. S. Wales, Munhall, Pa., U.S.A. Eng. Pat. 8834, April 14, 1909.

THE ballistic resistance of non-face-hardened armour and deck plates of nickel-chromium steel, containing less than 1 per cent. of vanadium, is increased by (1), heating to

about 700° C. and slowly cooling; (2), re-heating to about 900° C. and quenching in water to 400° C. or lower; (3), again heating to between 450° C. and 700° C. and slowly cooling. The plate is toughened, if desired, by a further heating to 900° C., quenching, and annealing, or rendered more ductile by a repetition of the third step.—F. R.

Manganese steel; Treating [damaged] —. W. S. Potter, New York, Assignor to Manganese Steel Rail Co., Mahwah, N.J., U.S. Pat. 939,163, Nov. 2, 1909.

WHEN the outer portion of an ingot has become injured by overheating, the ingot is rapidly heated to above 1200° C. and the surface worked, without causing elongation, in order that the defective part shall be firmly welded

to the main body. If desired, the outer portion, after heating, is rapidly cooled below 1150° C. previous to working it.—F. R.

Copper; Extraction of — from raw unroasted ores and other products. G. Schneider, Freideburg, Assignor to E. Abresch, Neustadt-on-the-Hardt, Germany. U.S. Pat. 937,965, Oct. 26, 1909.

ORES containing copper in the form of sulphide are subjected to the action of chlorine by being mixed with manganese dioxide and treated with a solution of hydrochloric acid, with or without the addition of sulphuric acid.—F. R.

Pulverising, desulphurising, oxidising metallic and other ores; Apparatus for —. R. Luckenbach, Colwyn, Pa., Assignor to Borindum Extraction Co. U.S. Pat. 938,005, Oct. 26, 1909.

THE pulveriser consists of an outer shell having a feed hopper and a discharge shoot and containing a conical grinding drum controlled by springs and mounted on a rotatable shaft, the ore being ground between the drum and the containing shell. A roller situated within the grinding cone and geared to the central shaft has a tension bearing on the inner surface of the cone.—F. R.

Chloridising ores; Method of —. C. A. Diehl, Cleveland, Ohio. U.S. Pat. 938,044, Oct. 26, 1909.

SULPHIDE ores are chloridised by subjecting them to the action of a gaseous mixture consisting of about four molecular parts of hydrochloric acid to one molecular part of sulphur dioxide.—F. R.

Furnace; Open-hearth —. L. L. Knox, Ben Ayon, and M. Murray, Wilkesburg, Pa., Assignors to Keystone Furnace Construction Co., Pittsburg, Pa. U.S. Pat. 938,245, Oct. 26, 1909.

IN a regenerative open-hearth furnace the gas and air up-takes are provided at their upper ends with removable chambers which lead through water-cooled ports or tuyères into the furnace.—F. R.

Furnace; Regenerative reversing —. L. L. Knox, Ben Ayon, Pa., Assignor to Keystone Furnace Construction Co., Pittsburg, Pa. U.S. Pat. 938,246, and 938,426, Oct. 26, 1909.

IN a regenerative furnace the gas and air up-takes, which are constructed separately from the furnace, are furnished with removable branched tops forming ports through which the air and gas are led into the furnace, the ends of the ports being water-jacketed, or the upper portion of the up-takes are widened transversely and formed into longitudinally arched ports leading directly into the furnace.—F. R.

Furnaces; Roasting and like —. U. Wedge, Ardmore, Pa. U.S. Pat. 939,880, Nov. 9, 1909.

THE furnace consists of a number of superimposed annular hearths over which the ore is caused to travel successively, by means of mechanical stirrers. The heating gases have access to only a portion of the hearth area, the remainder being arranged as a muffle. Means are provided for collecting the gases produced in the muffle portion.—F. R.

Furnace; Roasting —. U. Wedge, Ardmore, Pa. U.S. Pat. 939,881 and 939,934, Nov. 9, 1909.

THE furnace consists of a fixed, vertical, cylindrical body containing a number of superimposed annular hearths, and a central hollow rotating shaft cased with refractory material and sealed at its lower end to prevent access of air. The upper end of the shaft is closed by an automatic charging device, and means are provided for maintaining sufficient ore above the feed openings to form a lute and render the shaft substantially gas-tight.—F. R.

Furnace; Roasting —. A. R. Willley, Denver, Colo., Assignor to J. Seep, Oil City, Pa. U.S. Pat. 939,936, Nov. 9, 1909.

THE furnace consists of a reverberatory chamber having a hearth inclined longitudinally, down which the ore

is caused to travel in a direction opposed to that of the heating gases. The hearth is cooled at suitable intervals by means of a series of independently cooled water jackets to prevent overheating and consequent fritting of the ore.—F. R.

Alloy. G. Hartmann, Assignor to Hartmann Aluminum Solder Co., New York. U.S. Pat. 938,422, Oct. 26, 1909.

AN alloy prepared from commercially pure metals is made by fusing 170 parts of aluminium with 23 parts of magnesium, then adding 7 parts of nickel to the molten alloy, and finally adding 800 parts of tin. The alloys are well agitated before the addition of the next metal, which is always added in the molten state. The final alloy is cast in heated iron moulds and slowly cooled.—F. R.

Values of metallic ore matter; Concentration by amalgamation of —. R. Luckenbach, Colwyn, Pa., Assignor to Borindum Extraction Co., Arizona. U.S. Pat. 938,676, Nov. 2, 1909.

THE apparatus consists of a cylindrical vessel provided internally with a series of shallow circular pans which are adapted to contain an amalgamating substance and caused to rotate by means of a vertical shaft passing down the centre. At the bottom of each pan, a radial slot with upturned edges extends from the centre to the circumference. An agitator frame is fixed radially over each layer of amalgamating substance, the vertical scrapers being arranged diagonally on the bars, and, compared with those on the adjacent floors, at an opposite inclination. In a similar manner, except as regards the different inclinations, a row of jet tubes is supported radially over each pan opposite the scraper-frame, and through these, liquid is delivered. The ore, mixed if necessary with the requisite amount of liquid, is charged into the apparatus through a hopper at the top.—C. A. W.

Separation process; Roasting —. H. A. Wentworth, Newton, Assignor to Huff Electrostatic Separator Co., Boston, Mass. U.S. Pat. 938,732, Nov. 2, 1909.

THE process is adapted to the separation of zinc sulphide from the sulphides of iron, copper or lead. The mixture is roasted, the intensity of the heat being such as to oxidise the sulphides of the foreign metals at least superficially, but not so great as to materially affect the zinc sulphide. Subsequently the zinc sulphide is separated from the other ingredients by a flotation process.—C. A. W.

Silver; Process of assaying for —. J. C. Hames, Goldfield, Nev. U.S. Pat. 939,413, Nov. 9, 1909.

A QUANTITY of ore pulp is mixed with camphor, iodine, potassium iodide, and a solvent, and sodium cyanide subsequently added. The silver is precipitated on metallic zinc, dissolved in nitric acid and the amount of silver nitrate determined in the usual way with suitable indicators.—F. R.

Aluminium; Solder for —. L. Goppman, Pittsburg, Pa. U.S. Pat. 939,494, Nov. 9, 1909.

THE solder consists substantially of 49.05 per cent. of tin, 3.43 of antimony, 26.06 of lead, 20.31 of zinc and 1.1 of copper.—F. R.

Armour plates or the like; Treatment of —. S. S. Wales, Munhall, Pa., U.S.A. Eng. Pat. 8835, April 14, 1909.

SEE U.S. Pat. 921,924 and 921,925 of 1909; this J., 1909, 660.—T. F. B.

Copper or copper-nickel mattes; Treatment of —. J. T. Carrick, Assignor to B. S. Pattison, Johannesburg. U.S. Pat. 939,947, Nov. 9, 1909.

SEE Fr. Pat. 394,133 of 1908; this J., 1909, 236.—T. F. B.

Cement from blast-furnace slag. Eng. Pat. 15,164. See IX.

Lacquering [metallic] surfaces. Eng. Pat. 21,593. See XIIB.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Cadmium amalgams and the Weston normal cell. F. E. Smith. Physical Soc., Oct. 22, 1909. Electrician, Nov. 12, 1909, 199.

CADMIUM amalgams may be solid, liquid or a mixture of solid and liquid phases, the percentage composition of the phases depending on the temperature. When a completely liquid amalgam is cooled below the lower transition temperature, the centre of the resulting solid is of high cadmium concentration, and the outer skin of low cadmium concentration. Diffusion tends to produce uniformity, and, in consequence, the E.M.F. of a cell containing the amalgam is unstable for a considerable length of time. When the amalgam is slowly cooled to a temperature a little below the lower transition temperature, the difference of concentration between the inner and outer parts of the amalgam need be only small to enable the outer skin to be a two-phase system. The diffusion process will be slow and the E.M.F. may remain constant for a very long time. Amalgams which were of uniform cadmium concentration throughout were obtained by chilling completely liquid amalgams to a temperature of about -50°C .; although not initially stable, rapid diffusion processes resulted in these amalgams becoming approximately uniform throughout after a few days, and their electromotive properties were markedly different from those of slowly cooled amalgams. If, however, the temperature of such an amalgam is raised until two phases exist, subsequent cooling will not restore the uniform condition, and an unstable amalgam results. The experiments indicate that a 12.5 per cent. amalgam may be safely used at all temperatures between 12°C . and 60°C ., and a 10 per cent. amalgam at all temperatures between 0°C . and 51°C .. Experiments were made on the temperature coefficients of the anode and cathode limbs of the Weston normal cell, and show that if a difference of temperature of 1°C . exists, an error of about three parts in 10,000 is introduced.

Total and monochromatic radiation of incandescence [electric] lamps. Féry and Chénévian. See II.

Decomposition of the sugars. VI. Electrolytic reduction of dextrose. Löb. See XVI.

Electrolytic oxidation of ethyl alcohol to acetic acid. Askenasy and others. See XVII.

Detecting arsenious in presence of arsenic acid by electrolysis. Covelli. See XXIII. Inorg. Qual.

PATENTS.

Galvanic batteries. S. Benkő, Budapest, Hungary. Eng. Pat. 28,290, Dec. 28, 1908.

A METHOD of depolarising the elements in a carbon-zinc cell consists in forcing the electrolyte, mixed with a depolarising gas, through the porous carbon element by means of pressure or suction, applied alternately to its two sides.—F. R.

Active material for storage battery electrodes; Process of making —. J. W. Aylsworth, East Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 938,451, Oct. 26, 1909. (See also Eng. Pat. 1928 of 1906; this J., 1906, 852.)

NICKEL peroxide is deposited electrolytically from a cyanide solution, the latter containing also a mass of nickel cyanide to regenerate the solution. The active material is deposited on a moving anode, and the deposit removed continuously from the same.—B. N.

Electricity; Process of generating —. H. S. Blackmore. Mount Vernon, N.Y. U.S. Pat. 939,183, Nov. 2, 1909.

IN order to generate a current of electricity, a molten electrolyte, contained within a suitable vessel, is arranged in communication with electrodes, one of which is more

electropositive than the other, being composed, in fact, of some metallic carbide which is decomposed by the electrolyte. The latter is kept in a molten condition by means of a source of heat applied externally to the carbide electrode, which is itself contained within a separate vessel provided with inlet and outlet tubes through which the liquid is passed.—C. A. W.

Ions [electrically]; Process of and apparatus for the production of —. L. I. Blake, Denver, Colo. U.S. Pat. 937,759, Oct. 26, 1909.

THE gas-supply pipe, constructed of electrically conductive material, is provided with a series of jets or burners, insulated from the ground, and the generating or gaseous dissociating flame, in which the ions are produced, is charged or electrified by an external source of electromotive force. The supply pipe is surrounded by an insulated casing, provided with an insulated pipe or conduit for conveying the air carrying the ions to any desired point.—B. N.

Furnace; Electric —. A. C. Higgins, Worcester, Mass. Re-issue No. 13,027, dated Oct. 26, 1909, of U.S. Pat. 856,061, June 4, 1907.

SEE this J., 1907, 766.—T. F. B.

Electric discharges; Apparatus for producing —. H. Pauling, Assignor to Salpetersäure-Ind.-Ges., Gelsenkirchen, Germany. U.S. Pat. 939,441, Nov. 9, 1909.

SEE Fr. Pat. 368,715 of 1906; this J., 1907, 23.—T. F. B.

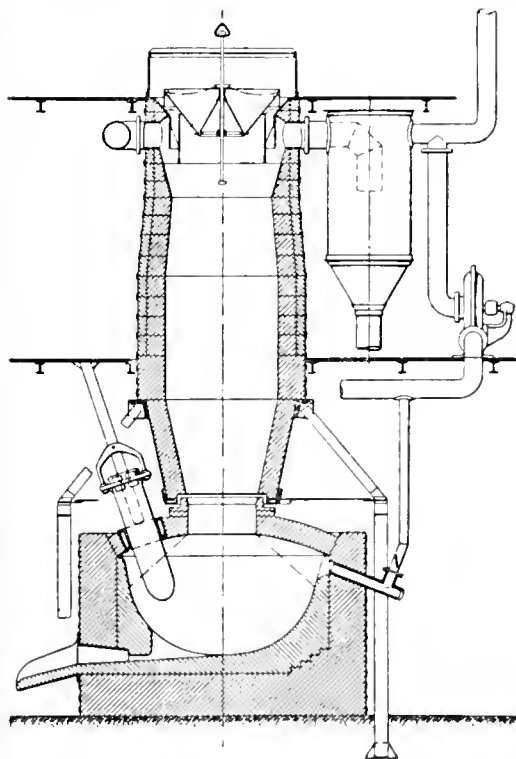
Voltaic high-current arcs; Process for the production of —. H. Pauling, Assignor to Salpetersäure-Ind.-Ges., Gelsenkirchen, Germany. U.S. Pat. 939,442, Nov. 9, 1909.

SEE Fr. Pat. 368,717 of 1906; this J., 1907, 23.—T. F. B.

Manufacture of non-carbon electric incandescence filaments. Eng. Pat. 7092. See II.

(B.)—ELECTRO-METALLURGY.

Pig-iron; Production of —. in the electric furnace at Domnarfvet (Sweden). B. Neumann. Stahl u. Eisen, 1909, 29, 1801-1814.



From the knowledge gained by the use of several experimental furnaces for the production of pig-iron by electrical reduction, a new form of electric furnace was started in technical operation at the end of 1908. It consists of two chief parts (see fig.), the lower electric smelting region, and an upper shaft similar in shape to the usual blast-furnace by means of which the charge is supplied to the electric hearth. This smelting region comprises a circular hearth of magnesite enclosed in a sheathing of iron bands, and lined with crushed magnesite; it is 3.5 m. (11.5 ft.) in diameter, and 2.4 m. (7.9 ft.) high. It is covered over with an arch which serves for the suitable introduction of the electrodes, and from a central hole in which the shaft rises to a height of 5.2 m. (17 ft.), having a diameter of 1.525 m. (5 ft.) at the widest part. At the top of the shaft is the usual cup and cone, and means for carrying off the waste gases. The whole shaft is increased in iron, and is supported by six pillars. This form of shaft has two advantages, firstly the weight of it is taken by the pillars, and not by the arch, and secondly, it enables repairs to be more easily executed. The particular shape of the boshes, and the size of the opening in the arch enables the charge to be supplied to the hearth as a heap, the sides of which slope at an angle of 56° – 55° , leaving a circular ring of air space around it, into which the waste gases, having passed through a dust chamber, are blown. These cool the smelting area, and warm the charge descending the shaft. Through inspection holes the temperature of the arch may be watched, and the gas circulation accordingly regulated. The electrodes are double in construction and held in a steel frame with a cooling box, a wedge making a good connection with the copper plates of the cable and at the same time fixing them firmly in position. They do not go directly into the charge, but strike through the air space. The furnace only requires four men to work it, with a foreman who can also superintend another furnace, and it is emptied every six hours.

The ore contained 66.34 per cent. of magnetic oxide of iron, and 21.21 per cent. of ferric oxide, i.e. 62.96 per cent. of iron, 0.3 per cent. of manganous oxide, and 2.34 per cent. of phosphoric anhydride. The charge consisted first of 95 parts of ore, 5 of lime, and 20 of coke, then 95 of ore, 2 of lime, and 19 of coke, and finally 100 of ore, 2 of lime and 17 of coke. The coke contained 85 per cent. of carbon, and 0.55 per cent. of sulphur. An average specimen of pig-iron obtained, showed on analysis, 3.2 per cent. of carbon, 0.075 of silicon, 0.39 of manganese, 1.90 of phosphorus, and 0.015 of sulphur. The slag contained 26.54 per cent. of silica, 54.48 of lime, 0.78 of sulphur, and 0.35 of iron. Very full working details of the furnace are given in the paper.—A. H. C.

Silver mirrors; Electrolytic formation of —. R. Lohnstein. *Physik. Zeits.*, 1909, 10, 672–673. *Chem. Zentr.*, 1909, 2, 1533.

IF an E.M.F. of a few volts be applied to silver electrodes dipping into distilled water, a weak current flows, leading to the formation of a solution of silver hydroxide, while finally a glistening film of silver appears on the surface of the liquid, and small silver mirrors are produced on the walls of the containing vessel near the electrodes. Better mirrors are produced if sugar or glycerin, or a small quantity of gelatin, ammonia, potassium hydroxide, or Rochelle salt be added to the water; the best results are obtained with a 2–3 per cent. solution of sugar. The mirrors produced at the cathode are thicker than those formed at the anode, the latter being mostly very thin and transparent. Similar results are obtained when platinum or copper cathodes are used.—A. S.

PATENTS.

Steel; [Electrical] Process of producing and refining —. F. C. Perkins, Buffalo, N.Y. U.S. Pat. 937,855, Oct. 26, 1909.

THE bath of iron is fused and treated by means of an electric current, which traverses a pair of composite electrodes, containing iron and surrounded by a mixture of slag-producing materials. The ends of the electrodes are arranged at the surface of the iron bath. Slag is thus

produced on the surface of the bath, and an arc is produced between the electrodes and the slag.—B. N.

Smelting-furnace; Electric —, and art of electric smelting. E. R. Taylor, Penn Yan, N.Y. U.S. Pats. 938,351 and 938,352, Oct. 26, 1909.

THE electric furnace is formed of a suitably lined metallic shell, stack-like in form, through which horizontal electrodes extend inwardly and enclose the working chamber. An inner structure of brick or the like forms a central flue-shaped coke passage, surrounded by "coarse-ore passages" extending vertically downwards towards the plane of the electrodes, and these in turn are surrounded by "fine-ore passages" within the shell, whereby heat is intercepted and utilised for heating the fine ore. On their way to the heat zone, the coarse and fine ores are gradually mixed, the materials being discharged in common into the working chamber above the electrodes. The top of the furnace is provided with a plate, in communication with the passages by means of feed openings, and supplied with material by means of superposed hoppers, the walls of which are rigidly connected with each other and with the top plate. Dry carbonaceous material is fed through the central column, and the coarse and fine ore columns are also separated by means of carbonaceous material fed between them.—B. N.

Metals, ores, and the like; Method of working —. O. Frick, Salt-jöbaden, Sweden. U.S. Pat. 938,752, Nov. 2, 1909.

IN order to increase the power factor in the treatment of ores and metals, two electric furnaces of the transformer or induction type, differing appreciably in size and capacity, are arranged in communication with one another. The principal portion of the charge having been melted in the smaller furnace, the fused material is conveyed into the larger one, where it is refined or stored in the ordinary manner.—C. A. W.

Furnace; Electric —. H. Röchling and W. Rodenhäuser, Völklingen, Germany. Assignors to the Gröndal Kjellin Co., Ltd., London. U.S. Pat. 939,095, Nov. 2, 1909.

SEE Fr. Pat. 366,440 of 1906; this J., 1906, 1054.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Fat of beef animals; Composition of — on different planes of nutrition. I. C. R. Moulton and P. F. Trowbridge. *J. Ind. Eng. Chem.*, 1909, 1, 761–768.

FROM the results of determinations described in detail, the authors conclude that there is an intimate connection between the amounts of fat and of moisture and protein in the fatty tissue of animals, a high proportion of fat being associated with a low proportion of moisture and protein. The proportion of fat in the fatty tissue increases with the fatness of the animal, and that of the moisture with the leanness, the condition and not the age being the determining factor. The percentage of fat in the fatty tissue increases from the outside to the inside of the animal, whilst that of moisture decreases. The iodine value of the fat increases with the age and with the fatness of the animal, whilst the m. pt. decreases. A similar increase in the iodine value and decrease in the m. pt. in the fat takes place on proceeding from the outside to the inside of the animal, and there is a relationship between the two values, the one rising as the other falls. The sp. gr. of the fat varies with the iodine value, whilst there appears to be a similar relationship between the m. pt. and the saponification value.—C. A. M.

Castor-oil seed from Fiji. Bull. Imp. Inst., 1909, 7, 272–273.

THREE varieties were examined:—(1) "Fiji castor-oil beans, Mexican variety."—Small, dark-brown and mottled,

yielding 47.4 per cent. of oil; (2) "Fiji castor-oil beans, Mexican variety."—Large white seeds, mottled with dark brown, yielding 49.6 per cent. of oil; (3) "Fiji castor-oil beans, Hawaiian variety."—Medium-sized, dark brown, mottled seeds, similar to No. 1, but larger. Yield of oil, 48.5 per cent. The oil-content of castor-oil seeds usually varies from 46 to 53 per cent. The Fijian seed would probably realise from £9 to £9 10s. per ton in London.

—E. W. L.

Ground [arachis] nuts from Fiji. Bull. Imp. Inst., 1909, 7, 272.

OF the samples examined, some containing two kernels, were from 1.2 to 1.8 inch in length, and others, containing one kernel, from 0.8 to 1.1 inch. The kernels were from 0.6 to 1.0 inch long, and formed 75 per cent. of the total weight of the nuts; they yielded on extraction 49.1 per cent. of oil, a good average yield. The value of the nuts is estimated at approximately £14 to £15 per ton in London.

—E. W. L.

Fat from dadap (Erythrina hypaphorus) seeds. N. H. Cohen. Chem. Weekblad, 1909, 6, 777—784. Chem. Zentr., 1909, 2, 1576.

THE fat contains formic acid, oleic acid, linolic acid (yielding dihydroxystearic acid melting at 132° C. on oxidation with permanganate), palmitic acid, behenic acid (m. pt. 75° C.), sitosterol, and two other cholesterol apparently related to the stigmasterol and brassicasterol of Windaus. The sitosterol, $C_{27}H_{44}O + H_2O$, crystallised from alcohol in leaflets melting at 136.5° C. The anhydrous substance, in chloroform solution (0.596 gm. in 25 c.c.) had the specific optical rotation, $[\alpha]_D^{25} = -34.2$. An acetate, $C_{29}H_{46}O_2$ (needles, m. pt. 130° C.) and a benzoate (leaflets, m. pt. 146.5° C.) were prepared. The benzoate when melted and allowed to cool, exhibited a play of colours, owing to a change from one labile phase to another at 107°—108° C. (see also this J., 1907, 192, 1244).—A. S.

Fat and wax of tubercle bacilli; Chemical nature of the —. A. Fontes. Zentralbl. Bakter. u. Parasitenk., 1909, 1, Abt., 49, 317—321. Chem. Zentr., 1909, 2, 1763—1764.

TUBERCLE bacilli were extracted in succession with xylene, 95 per cent. alcohol, ether, and chloroform. The xylene extract when treated with alcohol yielded a precipitate which was soluble in ordinary fat solvents, and consisted of small, refractive, amorphous particles, which were stained by Zeihl's solution (1 gm. of fuchsin, 5 grms. of phenol, 10 grms. of alcohol, and 100 grms. of water); the coloration was not destroyed by acid. This substance proved to be a wax, the alcoholic constituent of which was different from cholesterol, isocholesterol, and phytosterol. The wax, which had an odour resembling that of tuberculin, melted at 53.5° C. and solidified at 52° C.; the portion soluble in ether melted at 54.5° C., and that soluble in chloroform melted at 193° C. and solidified at 191° C. The xylene-alcohol solution, after precipitation of the wax, was found to contain a fatty acid, probably palmitic acid.—A. S.

Extracted wax. O. G. Gabrilowitsch. Russ. Führer d.d. Fettind., 1909, 56. Chem. Zentr., 1909, 2, 1599—1600.

THE characters of Russian beeswax, as determined by the author, are shown in the following table:—

	Minimum.	Maximum.	Average of 100 analyses.
Sp. gr.	0.95	0.97	0.96
Melting point	60° C.	64° C.	62° C.
Acid value	18	22	20
Saponification value..	88	100	94
Ratio number	3.88	3.55	3.7

In the examination of crude Russian wax, complete saponification is not effected by boiling for 1 hour with alcoholic sodium hydroxide solution. For determining

the ester value, the author boils with alcoholic alkali three times for periods of 2, 3, and 4 hours respectively, and makes two separate determinations. In the case of extracted wax, heating for 4 hours on the sand-bath was necessary in determining the saponification value; the values obtained during the first hour amounted to 64—70, in the second hour 70—80, and in the fourth hour, 80—90. In applying Weinwurm's test for unsaponifiable matter (this J., 1897, 939) to extracted wax, it was necessary to boil for 3 hours with alcoholic potassium hydroxide. The author gives the following average values for extracted wax; sp. gr. 0.955; m. pt. 63.5° C.; acid value, 19; saponification value, 90; ratio number, 3.8. He recommends that the extraction process should be more largely used in Russia, pointing out that with the primitive method of separating the wax at present in vogue, large quantities are burnt in the form of waste.

—A. S.

PATENTS.

Saponaceous neutral paste and process for the manufacture thereof. Soc. Nauton Frères et Co Marsac and T. F. Tesse, Paris. Eng. Pat. 9441, Apr. 21, 1909. Under Int. Conv., Mar. 10, 1909.

AN alkali sulphonate of castor oil is incorporated with an ordinary soap containing excess of alkali, to form a neutral paste with strong detergent properties. This paste may also contain an addition of a chlorinated hydrocarbon (preferably a chlorine derivative of ethylene or ethane) which has been rendered soluble or miscible with water by treatment with a sulphonated oil at a temperature near the b.pt. of the chlorinated hydrocarbon.—C. A. M.

Candle-making machinery. D. V. Plumbridge, London. Eng. Pat. 3559, Feb. 13, 1909.

THE melted wax is cooled in two stages, being first left in a plastic condition by passage through cooling tubes surrounded by warm water, and then, after introduction of the wick, passed through a tube cooled with cold water. The resulting solid bar with a central wick is then pressed in moulds to shape the candle ends. Claim is also made for a process of keeping the wax plastic, during the operations, by means of an electric current passed through wired asbestos rings arranged at suitable distances around the candle tube; also for the use of special movable compressors and blocks for moulding the plastic wax.

—C. A. M.

Filtration of oils, fats, waxes, and similar products, and apparatus therefor. J. Doull. Fr. Pat. 402,863, May 10, 1909. Under Int. Conv., May 12, 1908.

SEE Eng. Pat. 10,277 of 1908; this J., 1909, 317.—T. F. B.

Rendering liquid-tight barrels for oil. Eng. Pat. 5206. See I.

Pharmaceutical compounds [from chaulmoogra oil]. Eng. Pat. 1984. See XX.

Non-odorous phenol salve and ointment. U.S. Pat. 938,614. See XX.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

PIGMENTS, PAINTS.

Fastness to light of some coal tar colour lakes and their behaviour as printing colours. Valenta. See IV.

Paint and varnish coatings as accelerators in corrosion of metals. Walker and Lewis. See X.

PATENTS.

Paints and the like; Manufacture of vehicles for —
F. H. Walker, Bromley, Kent, and C. E. Sohn, London.
Eng. Pat. 2114, Jan. 28, 1909.

THE invention relates to the manufacture of a stable medium, suitable not only for blending with insoluble pigments but also for incorporating with oil-soluble and water-soluble colours. A mineral oil residuum is treated in the cold with a quantity of sulphuric acid sufficient to precipitate the asphaltic and resinous constituents. The treatment is preferably carried out in a mixer, with rotating and fixed arms. The mixture is allowed to separate, the oil is removed, and the residual tarry mass heated at 50° to 60° C. for a few hours, and then agitated with water and dilute caustic soda solution in small quantities at a time. An excess of fixed alkali must be avoided, and to this end the neutralisation may be completed by means of ammonia. By this means a completely homogeneous mass is obtained, which keeps indefinitely without visible separation of water. The mass mixes readily with oils to form fluid varnishes which can be incorporated with black or other dark pigments, and can be ground between steel rollers without losing their uniformity and smoothness. Such preparations are suitable for coating upon brickwork, wood, metal, textile fabrics, paper or other surfaces.—E. W. L.

(B.)—PIGMENTS, PAINTS.

Dammara viticenis [Agathis viticenis] resin from Fiji.
Bull. Imp. Inst., 1909, 7, 274-275.

THE resin consisted of a large mass of uniformly yellowish-brown material, opaque, with occasional semi-transparent streaks. It had a slight odour of turpentine oil, and contained a few small pieces of reddish bark. The following values were obtained:—ash, 0.06 per cent.; m. pt. (of the powdered resin in a capillary tube), 110°–115°C.; acid value, 157. The resin was partially soluble in turpentine oil and in benzene, completely soluble in a mixture of turpentine oil and alcohol, almost insoluble in ether, chloroform and alcohol. The resin therefore somewhat resembles Manila and Macassar copals, and may conveniently be known as Fiji copal. Its commercial value when scraped and cleaned is estimated at 30s. to 35s. per cwt. The masses of resin should be broken up into roughly cubical pieces of 1 in. to 1½ in. side, each piece examined and impurities removed. Outside pieces should either be well scraped or else sorted out from the rest and sold separately. Any "small" or "dust" resin should also be sold separately.—E. W. L.

Oil of turpentine; Analysis of —by bromination, and a method of determining bromine by means of sodium formate. Mansier, Ann. Chim. analyt., 1909, 14, 417-421.

THE method described is intended principally for the detection and determination of petroleum spirit in oil of turpentine. To 1 c.c. of the sample dissolved in 5 c.c. of chloroform and contained in a stoppered vessel are added successive quantities of bromine-water (containing 3 per cent. of bromine); after each addition, the mixture is well shaken and the end point of the titration is taken when a slight yellow colour persists for one minute. Pure oil of turpentine requires 1.69 grms. of bromine, or from 50 to 60 c.c. of the bromine-water, according to the strength of the latter; samples containing petroleum spirit require proportionally less. The bromine-water may be standardised by titration against a standard solution of sodium formate in the presence of zinc oxide, the latter being necessary to remove the hydrobromic acid formed by the reaction. Two atoms of bromine combine with 1 molecule of sodium formate.—W. P. S.

PATENT.

Lacquering or otherwise coating [metallic] surfaces.
W. W. Vincent, Kenosha, Wis. U.S.A. Eng. Pat. 21,593, Oct. 12, 1908.

THE heat necessary for stoving the lacquer (alcoholic

solution of shellac—English lacquer) applied to metal pieces such as the parts of a bedstead, is generated, according to the invention, in the metal piece itself, by the passage through it of an electric current. The metal piece is mounted in a lathe-like apparatus, the two supports forming the electrode, and a suitable current is passed until the piece is raised to a temperature sufficiently high to evaporate the volatile constituent of the lacquer as it is applied, but not high enough to injure the lacquer. The piece is suitably rotated, and the lacquer is applied. The several coats which it is necessary to apply, when using English lacquer, can be rapidly superimposed without damaging the underlying coats in any way.—E. W. L.

(C.)—INDIA-RUBBER, &c.

Rubbers from Southern Nigeria. Bull. Imp. Inst., 1909, 7, 255-260.

(1) *Funtumia elastica rubber.* Three samples were examined. Sample A consisted of rough sheets, colour from light to dark brown, clean and well prepared, exhibiting good elasticity and tenacity. Sample B was similar to A, but rougher and darker in colour. Sample C was prepared by natives. The analyses and valuations are given in the table.

	Sample A.	Sample B.	Sample C.
	per cent.	per cent.	per cent.
Moisture....	1.6	7.1	8.4
Caoutchouc .	87.9	81.6	78.7
Resin	8.5	8.3	8.3
Proteids ...	1.6	2.3	2.8
Insoluble matter ...	—	0.7	1.8
Ash	0.4	0.40	0.63
Value (fine hard Para 4s. 6d.)...	3s. 2d. to 3s. 4d.	3s. to 3s. 2d.	2s. 8d. to 2s. 9d.

(2) *Benin lump rubber.* Two samples were examined. A consisted of two large lumps and one thick biscuit, dark in colour and dirty, but white, porous and very moist within. The rubber was soft, and had a very disagreeable odour; physical properties fairly good. This sample represents ordinary "Benin lump". Sample B—"Ugege tree and vine rubber"—consisted of lumps dark in colour and dirty. Some were fairly dry throughout, others were white and very moist internally. The sample which represents ordinary "dead" Benin lump was rather weak.

Benin rubber.

	Sample A.		Sample B.	
	Original.	Dry.	Original.	Dry.
Moisture	22.3	—	6.5	—
Caoutchouc	63.8	82.1	58.9	63.0
Resin	6.8	8.7	19.7	21.1
Proteids	5.1	6.6	7.2	7.7
Insoluble matter	2.0	2.6	7.7	8.2
Ash	0.63	0.82	1.57	1.68
Value (fine hard Para 3s. 5½d.)	1s. 16d. to 1s. 11d.	—	1s. 6d.	—

(3) "*Uhabikyan*" rubber (*Clitandra elastica*). Sample consisted of biscuits from 3 in. to 6 in. diameter, and ¾ in. to 1½ in. thick. These were covered with mould, were brown to black in colour, and many were white and moist inside when freshly cut. The rubber was free from stickiness, and showed good elasticity and tenacity.

(4) "*Marodi*" vine rubber. Sample, a thick rough

brown biscuit, dry, well-prepared, and with good physical properties.

"Ubabikpan" rubber. "Marodi" rubber.

	Original.	Dry.	Original.	Dry.
	per cent.	per cent.	per cent.	per cent.
Moisture	5.2	—	2.4	—
Caoutchouc	85.7	90.4	78.8	80.8
Resins	3.8	4.0	5.2	5.3
Proteids	3.0	3.2	9.3	9.5
Insoluble matter	2.3	2.4	4.3	4.4
Ash	0.40	0.42	0.63	0.68
Value	2s. 8d. to 2s. 10d. (Para 3s. 3½d.)	—	2s. 6d. (Para 3s. 1d.)	—

E. W. L.

Rubber from the Gambia; Ficus Vogelii —. Bull. Imp. Inst., 1907, 7, 260–262.

Two samples were examined: (1), a 15 lb. sample from the Kombo district, consisting of two large balls of pale brown scrap, very resinous, and of poor elasticity and tenacity; (2), an 81 lb. sample consisting of thick cakes very dark externally, slightly moist and reddish-brown within, very resinous, and of poor elasticity and tenacity. In spite of these defects, manufacturers' trials show that the rubber could be utilised, and would realise a fair price.

	Sample (1).		Sample (2).	
	Original.	Dry.	Original.	Dry.
	per cent.	per cent.	per cent.	per cent.
Moisture	4.4	—	7.3	—
Caoutchouc	58.0	60.6	61.2	65.9
Resins	33.8	35.4	29.5	31.8
Proteids	1.4	1.5	1.2	1.4
Insoluble matter	2.4	2.5	0.8	0.9
Ash	0.5	0.6	1.3	1.4
Loss on washing	7.1	—	6.2	—
Value (fine hard Para, 2s. 9d.)	1s. 7d.	—	1s. 11d.	—

—E. W. L.

Rubber from Seychelles; Valia —. Bull. Imp. Inst., 1909, 7, 262–263.

THE vine from which this rubber is obtained was introduced from Madagascar into Seychelles, where it grows luxuriantly. The cost of preparing the rubber in a clean form is, however, prohibitive. Sample No. 1 was obtained by "pounding the bark"; sample No. 2 by tapping. The physical properties of both samples were satisfactory. The analytical values obtained were as follows:—

	Sample No. 1.		Sample No. 2.	
	Original.	Dry.	Original.	Dry.
	per cent.	per cent.	per cent.	per cent.
Moisture	2.2	—	3.2	—
Caoutchouc	81.7	83.5	88.0	90.9
Resins	5.2	5.3	7.7	7.9
Proteids	1.8	1.8	0.8	0.8
Insoluble matter	9.1	9.4	0.3	0.4
Ash	1.1	1.1	0.3	0.3
Value (fine hard Para, 4s. 7d.)	3s.	—	4s. to 4s. 3d.	—

E. W. L.

Caoutchouc and gutta-percha. Condition of the industry in New Guinea. Verhandl. des Kolonial-Wirtschaftl. Komitees [Wirtschaftl. Ausschuss der Deutsch. Kolonialges.], 1909, No. 2, 34–44.

THE principal rubber plant cultivated in all the German

Colonies is *Hevea brasiliensis*, transplanted in the first instance from Ceylon. *Castilloa elastica* is only planted to a limited extent, as it is readily injured in tapping, whilst *Funtumia (Kickxia) elastica* is now only planted when sufficient *Hevea* cannot be obtained. On the other hand, the cultivation of the Ceara caoutchouc plant, *Manihot Glaziovii*, is extending in German East Africa, and the three new *Manihot* species, *M. dichotoma*, *pianhyensis*, and *heptaphylla*, appear to thrive in certain localities. The utilisation of the indigenous plants (*Kickxia*) by the natives is declining, and it is suggested that a system of instructing the natives and of premiums for the best plantations raised from seed might be instituted to check this decline. In the present condition of the market it might be profitable to extract the rubber from the latex of certain wild plants, such as "dead rubber," or *Gutta djeloton*, a member of the *Apocynaceae (Dyera)*, indigenous to the Malay Archipelago, although it only contains 10 per cent. of caoutchouc. In the forests near Alexishafen the yield of gutta-percha varies from 6 to 18 lb. per tree. The cause of the variation could not be determined. An expedition up the River Uaria reported the occurrence of gutta-percha trees in abundance. These were believed to be closely related to *Palaquium supfianum*, from which they differed, however, in having a paler and smoother bark. They also yielded less gutta-percha (5 lb. at most), and this was more resinous than the product of the other tree. The most economical method of tapping the trees was found to be by making a ring-formed incision with a hollow-ground gutta-percha knife. Caoutchouc trees were also plentiful in this district; they belonged to two species, *viz.*, *Parameria* and *Ficus*, the former yielding 0.5 to 0.75 lb. of caoutchouc, and the latter over 1 lb. per tree. The amounts of gutta-percha hitherto exported to Germany from New Guinea have been as follows:—

	Kilos.	Average price per kilo. Marks.
1907	660	2
1908	1510	1.70
1909	1830	2.30

The last consignments contained 30 and 31 per cent. of gutta-percha of the best quality, which was sold at 5.2 marks per kilo.—C. A. M.

Rubber production. Chem. Ind., 1909, 32, 694–695.

THE area planted with rubber trees in East Asia (Malaya, Ceylon, Java, Sumatra, Borneo and New Guinea, India, Burma) amounted to 495,000 acres in 1908 (this J., 1909, 99). By 1916 the production of rubber from this source will, it is estimated, amount to at least 50,000 tons. The total consumption of rubber if it increases at about the same rate as during the past 8 or 9 years will amount to 83,000 tons in 1916, after making allowance for regenerated rubber. The average production of rubber in Brazil during the years 1900–1907 amounted to 33,000 tons per annum, so that even if it does not increase, this supply, together with the 50,000 tons estimated production of East Asia, will cover the total estimated consumption in 1916. But rubber is now produced also in many other parts of Asia and America and in Africa, the total production from these sources being 25,000 tons at the present time. Even if this amount does not increase, the total production in 1916 would be 108,000 tons as compared with a consumption of 83,000 tons.—A. S.

PATENT.

Spongy rubber for tyres for wheels of carriages, motor-cars and cycles; Method of manufacturing —. E. Poizot. Fr. Pat. 401,303, July 17, 1908.

A MIXTURE of rubber (10 kilos.), sulphur (1 kilo.), and an alkali or ammonia solution (2.3 kilos.), with or without 10 kilos. of faktis (vulcanised oil), is heated in an autoclave for 1 hour under a steam pressure of 4 kilos. The proportion of alkali may be varied from 10 to 15 per cent. of the weight of the mixture according to the sponginess required.

—H. BR.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning; Theory of — W. Fahrion. *Z. angew. Chem.*, 1909, 22, 2083—2097, 2135—2144, 2187—2194.

The author considers that tanning depends upon chemical rather than physical processes, and that each tanning material has the chemical characteristic of an acid capable of forming peroxides in contact with air. The author has previously stated that, in every tannage, an oxidation of the hide fibre takes place and that leather should be termed "the salt of the oxidised hide-fibre," but at the same time suggested that further investigation should be made, and this article is the result of such further research. The subject is treated under four heads, *viz.*, chamois, aldehyde, vegetable, and mineral tannages, and the results of several experiments accompany the article.

Chamois tannage. The author defines chamois leather as the salt of the partially oxidised hide-fibre, as the base, with an unsaturated and partially oxidised fatty acid of fish oils. Referring to "Japan leather," which has been stated to owe its peculiar tannage to the action of a bed of almu underneath the river, in which the hides are treated (in Jakagimura, Japan), but which leather has been proved to contain only traces of alumina, and has been described as "leather without any tanning substance," the author states that "Japan leather" is similar to chamois, and that the tanning agent is the rape oil with which the hides are treated after immersion in the river. It might be assumed, that, because of its low iodine value, rape oil would possess very little leather-producing powers, but the author is convinced that it will form leather, and has shown by analysis of a pure rape oil and of an oil extracted from "Japan leather," that oxidation of the oil takes place in the process; he has further analysed the extracted oil, distinguishing several parts according to their solubility in alcohol, ether, and petroleum spirit. Experiments on the impregnation of hide with the fatty acids of various oils, showed that in the cases in which leather had been produced, the iodine value of the fatty acids had decreased and oxygen had been taken up. The author differentiates between fat-tannage and chamois-tannage by stating that in the former, the fat is worked mechanically into the pores of the fibre, whilst in the latter, oxidation of the tanning agent is necessary, and the more double linkages contained in the molecule of the tanning agent, the more intense the tanning. The author attributes the failure of a tanning experiment with turpentine oil to the absence of a carboxyl group and concludes by assuming salt-formation between the peroxy-acid of the fish oil and the hide substance, followed by oxidation of the hide fibre, in the chamois process.

Aldehyde tannage.—The author considers the aldehyde tannage analogous to chamois tannage, inasmuch as the basic group of the hide substance is primarily oxidised (perhaps only to a secondary amino-group) and then fixed.

Vegetable tannage.—The author's theory is that vegetable tanning materials are primarily oxidised to quinone-like substances, the latter being the real tanning agent, whilst the phlobaphenes have a filling and weight-giving effect.

Mineral tannage.—The author considers that the one-bath chrome tannage is neither a chemical process nor a colloidal precipitation process, but that the hide exerts a catalytic influence, whereby water is split off from the basic chromium salt in solution, thus leading to the formation of a slightly soluble anhydride which is precipitated in the hide. After neutralising the acid, the author continues, a chemical reaction takes place between part of the precipitated anhydride and the hide substance.

A good deal of the article is devoted to the criticism of the theories of other investigators, and the author discusses, in order, the physical and chemical properties of animal hides and of tanning materials and agents. He points out that hide has the power to adsorb colloids, without changing their chemical nature, to catalytically decompose water and to convert several oxygen-containing bodies into anhydride derivatives which are deposited upon the hide, immediately after their formation. The

presence of basic groups in hide substance enables it to form salts with acids and to undergo oxidation and condensation processes, similar to other amino-bodies. The author distinguishes between tanning materials and primary and secondary or "real" tanning agents, by stating that the tanning material may contain, besides the primary tanning agent, other matters which serve as "ballast," or influence the tannage in one way or another without being of chief interest. In many cases the primary tanning agent is changed into the secondary, by the oxygen from the air or water, the secondary agent reacting with the hide. The "real" tanning agent cannot be a colloid, as this would only act on the surface of the hide, and not penetrate to the interior. All tanning agents have one common characteristic; they contain oxygen atoms which form water with hydrogen atoms of other bodies. The author defines leather as animal hide which does not become hard and horny but remains soft and pliable after immersion in water and subsequent drying out; which does not putrefy in cold water, and does not form glue when boiled with water. He points out that although true tanning is mainly a chemical process, yet such physical processes as capillary attraction, diffusion, and adsorption are indispensable. In pseudo-tannage, which, though not a purely physical process, does not change the chemical nature of the hide, the hide substance acts as a dehydrating agent, changing the pseudo-tanning agent into amorphous anhydride derivatives, which are precipitated upon the hide. In conclusion the author reviews the methods and materials in use for the manufacture of the four above-mentioned classes of leather.—S. H.

Gelatin; A colour reaction of — R. E. Liesegang. *Z. Chem. Ind. Kolloide*, 1909, 5, 248.

WHEN a 40 per cent. solution of tricalcium phosphate and a 10 per cent. solution of copper chloride are allowed to diffuse through a gelatin film, and meet, a deep violet coloration, without any precipitate, is formed. When gelatin-jelly is added to a liquid containing precipitated copper phosphate, and allowed to stand overnight, the gelatin and the solution become violet, and the precipitate gradually becomes less in amount.—E. F.

Gelatin; Detection of traces of chlorides in — Lüppe-Cramer. *Z. Chem. Ind. Kolloide*, 1909, 5, 249—259.

SMALL amounts of chlorides in gelatin cannot be detected by the ordinary methods. If a 10 per cent. gelatin solution containing chlorides is allowed to solidify on a glass plate and a drop of 10 per cent. silver nitrate solution is then placed on the film, the portion of the film below the drop remains clear, but in the course of some hours an opalescent ring forms round the drop and becomes more and more opaque; it attains a diameter of 1 or 2 cm. In the presence of only 0.001 per cent. of sodium chloride, calculated on the dry gelatin, quite opaque white circles are obtained. If the resulting plate is afterwards exposed to the light, the white rings become greyish blue in colour and the colourless layer under the drop becomes reddish yellow, showing that silver chloride is present in both places, but in a very much more finely-divided form under the drop.—E. F.

PATENTS.

Leather; Dressing of — O. Silberrad. Buckhurst Hill, Essex. Eng. Pat. 22,869, Oct. 27, 1908.

THE leather is first thoroughly dried and then freed from all fatty matters by treatment with solvent-naphtha. It is then immersed in a 10 per cent. solution of rubber in solvent-naphtha for 24 hours. The leather is removed from the rubber solution, and when almost dry, the surface is freed from adhering rubber by rubbing with a cloth moistened with solvent naphtha, or by means of some suitable polishing machine.—H. BR.

Hides, skins, furs, etc.; Process of treating — H. R. Vidal. First Addition, dated Aug. 29, 1908, to Fr. Pat. 391,466, Aug. 29, 1907.

For the recovery of the paraffin wax resist employed

according to the main patent (see this J., 1908, 1150), the employment of carbon tetrachloride and carbon bisulphide as solvents is claimed. It is stated that the treatment with organic solvents imparts considerable suppleness to the hides or skins, whether these have been previously tanned or not.—A. S.

Tanning-drum arranged for suspending skins in a stretched condition. Vulcano Tanning and Machine Co. Fr. Pat. 400,940, March 17, 1909. Under Int. Conv., Nov. 17, 1908.

THE skins are suspended in a stretched condition from laths fixed in the periphery of the drum. The extremities, of the hide, which hang towards the centre of the drum are fastened by means of small hooks which project from the ends of the drum, thus keeping the hide in a stretched and fixed position throughout the tanning.—H. Br.

Hides, skins, and furs; Machine for the dressing and other treatment of —. F. E. Slocumb. Fr. Pat. 401,109, March 22, 1909. Under Int. Conv., Aug. 11, 1908.

THE machine consists of a perpendicular table, over which the hide to be treated is thrown. The table ascends between two brushes wetted with the liquid which it is desired to apply. The hide next meets a series of revolving plates which serve to impregnate the skin with the liquor, and finally a second pair of brushes which remove any surplus liquor.—H. Br.

Glue, its preparation and applications. C. Gillet. Fr. Pat. 400,831, June 26, 1908.

AN elastic glue may be obtained by adding glycerin to ordinary glue, or gelatin. The proportions vary according to the result required. The product can be used for giving flexibility to porous wood and also for gluing together strips of tissue.—H. Br.

Tannin; Treatment of organic extracts of —. E. W. Tillberg, Westervik, Sweden. Eng. Pat. 23,186, Oct. 30, 1908.

SEE Fr. Pat. 395,499 of 1908; this J., 1909, 804.—T. F. B.

Quebracho extract; Treatment of —. A. Redlich and J. Wladika, Vienna. U.S. Pat. 939,742, Nov. 9, 1909.

SEE Eng. Pat. 21,483 of 1908; this J., 1908, 1214.—T. F. B.

XV.—MANURES, &c.

Soil nitrogen of Nebraska prairies; Relation of native leguminous plants to —. F. J. Alway and R. M. Pinckney. J. Ind. Eng. Chem., 1909, 1, 771–772.

DETERMINATIONS of the nitrogen in the air-dried leguminous plants collected from a measured plot of land typical of the virgin upland prairie of Eastern Nebraska gave results corresponding to 8.56 lb. per acre, whilst the nitrogen in the non-leguminous plants corresponded to 28.31 lb. per acre. It was estimated that the after-growth of the leguminous plants and those that had died before the date of collection might have increased the annual production of nitrogen by the aerial parts of the plants to 10 lb. per acre. Data from the growth of alfalfa on Nebraska soil indicated that the nitrogen in the roots was probably equal to that derived from the soil by the entire plant, and on this assumption the amount of nitrogen fixed by symbiotic bacteria would be about twice that added to the soil by rain and snow. The amount fixed by the non-symbiotic bacteria in the non-leguminous plants was estimated at about 8 lb. per acre each year. From a consideration of all these points, it was concluded that the amounts of nitrogen added to the soil by the three agencies—precipitation, symbiotic bacteria, and non-symbiotic bacteria—were probably approximately equal. Determinations of the nitrogen in the soil of this prairie were also made. Samples taken from different places in one field to a depth of six inches contained from 0.25 to 0.317

per cent. (average 0.284 per cent.), whilst from seven inches to six feet in depth, the amounts ranged from 0.240 to 0.042 per cent. In other fields the amounts down to 1 foot in depth varied from 0.153 to 0.465 per cent., whilst the average amount of nitrogen in 29 samples of the black soil deposited by summer floods on the lowland soils was 0.23 per cent. It was estimated that the first two feet of the soil in the upland prairies of eastern Nebraska contained about 10,000 lb. of nitrogen per acre, and the conclusion was drawn that this accumulation of nitrogen might be attributed to any of the three agencies mentioned. In the authors' opinion equilibrium has long been attained, and accumulation of nitrogen is now only to be expected in places where the original amount has been reduced by cultivation or natural erosion.—C. A. M.

Beetroot; Fertilisers containing manganese applied to the cultivation of the —. H. Roussel. Bull. Assoc. Chim. Sucr. et Dist., 1909, 27, 348–353.

MANGANESE is widely distributed in the soil and in plants, and Bertrand has shown that it is present in laccase, the oxydase activity of the enzyme being proportional to its manganese-content. It would appear, therefore, that manganese, in small quantity, must possess fertilising power. According to Grégoire, Hendrick, and Corpianx, addition of manganese sulphate to soil treated with superphosphate, sodium nitrate, and kainite, causes a slight decrease in the yield of beetroots, and a corresponding increase in the sugar-content of the roots, the yield of sugar being unaltered. Garola has investigated the effect of adding manganese chloride or sulphate (3.5 grms. of manganese per sq. metre) to an upland clay soil, on the crop of beetroots: it was found that the chloride and sulphate increased the weight of roots by 46 and 24 per cent. respectively; the former salt decreased the sugar-content of the roots from 8.6 to 7.3 per cent., whilst the latter increased it to 10.6 per cent.; the yields of sugar per sq. metre were increased from 378 grms. (without manganese) to 475 and 586 grms. with the chloride and sulphate respectively. According to Stoklasa, a fertiliser containing manganese increased the yield of sugar by 15–20 per cent. According to Gillin, manganese carbonate was found to have an effect similar to that observed by Grégoire with manganese sulphate; it was noticed also, that the manganese appeared to retard the fertilising effect of the sodium nitrate. It would be premature to prescribe rules for the use of manganese fertilisers, though the experiments made hitherto have yielded satisfactory results on the whole. The various combinations of soil, fertilisers, plants, and climate, must be taken into account. The manganese pre-existent in the soil is in the stable and inactive state of oxide. Manganese fertilisers should be used, as far as possible, in non-acid soils, and without regard to the manganese-content of the latter. Of manganese compounds, the sulphate appears to be most satisfactory though comparative experiments with other fertilisers should be made. Fertilisers containing lime and a small quantity of manganese oxides have been offered for sale; the oxides of manganese are useless as fertilisers. Nagaoka has shown that excess of a manganese fertiliser (more than 25 kilos., calculated as Mn_2O_3 , per hectare) is useless, a great excess being injurious. The manganese fertilisers should be mixed with the ordinary fertilisers in order to insure a uniform distribution on the soil; the materials chosen for admixture must be such that they do not interact with the formation of injurious compounds; a mixture of superphosphate, sodium nitrate, and manganese carbonate, is satisfactory in this respect.—L. E.

Formation of calcium cyanamide. Foerster and Jacoby. See VII.

PATENT.

Artificial manure; Manufacture of — from offal. J. Lehbauer, Connah's Quay, Flint, S. Mear, Longton, Staffs., E. W. Hollinshead and H. E. Moody, Tunstall, Staffs. Eng. Pat. 21,630, Oct. 13, 1908.

THE process consists in digesting offal with steam and acid

(cf. Eng. Pat. 23,045 of 1904; this J., 1905, 979) in tanks from which any solid matter deposited at the bottom can be ejected at intervals by means of a steam blast. The liquid obtained is delivered into the "valley" between two slowly rotating, steam-heated rollers, one of which is mounted in a sliding bearing, and is kept in yielding engagement with the other by means of a weighted bell-crank lever. The dried manure is removed from the surface of the rollers by scrapers having the form of weighted bell-crank levers. To facilitate the clearing of the obstruction when the rollers become clogged with imperfectly digested material, etc., a sliding door is provided in the frame-work of the rollers at one end of the "valley." When a block occurs, the door is opened by means of a screw-spindle, the liquid is discharged, and the lumps can then be withdrawn.—E. W. L.

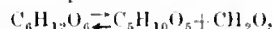
XVI.—SUGAR, STARCH, GUM, &c.

Juices [Sugar]: Action of lime on crude . . . H. Pellet.
Bull. Soc. Chim. Sier. et Dist., 1909, 27, 354—357.

ACCORDING to Herles, the decrease in the polarisation of crude juice caused by the action of lime is due to alteration in the optical activity of certain substances present in the juice, but according to some chemists, the decrease is due to formation of insoluble calcium sucrate (see this J., 1908, 1168; 1909, 32). The view that this substance is formed by the action of lime at a high temperature, was not, at one time, accepted by the author, on the ground that it is not formed in pure sugar solutions under these conditions, but he now finds that the impurities present in the crude juice facilitate the formation of insoluble calcium sucrate, and that the precipitate formed by the action of lime on the non-sugars, prevents the insoluble sucrate from redissolving. Hence, according to the density and quality of the juice, and to the amount of lime added, a greater or less quantity of sugar is precipitated. Consequently, in studying the action of lime and of carbonation on the polarisation of juices, the procedure adopted should be identical with that which obtains in practice. According to several chemists, there is actually no appreciable decrease in polarisation by the action of lime and carbon dioxide upon diffusion juices under practical conditions, i.e., carbonation does not cause a decrease in the polarisation which can account for certain untraceable losses observed in some sugar-houses. According to Deltour, cold carbonation of the juice does not occasion any decrease in the polarisation, whereas hot carbonation causes a slight decrease, amounting to 0.06—0.09 per 100 c.c. of juices containing 11—13 per cent. of sugar. The author offers the following explanation of this small loss:—A small quantity of sugar is carried away with the escaping vapours during hot carbonation (compare this J., 1906, 437), and the lime does act on certain non-sugars in the hot juice, these substances, which are present in small quantity, yielding a less dextro-rotatory product. Since sucrose is precipitated from crude juice in presence of lime, and in spite of the addition of a considerable quantity of basic lead acetate, it seems advisable to avoid the use of basic lead acetate in the determination of sugar in the muds.—L. E.

Sugars: Decomposition of the —. VI. Electrolytic reduction of dextrose. W. Löb. Biochem. Zeits., 1909, 22, 103—105.

IN the third communication of this series (this J., 1909, 535), the author advanced a scheme according to which, in the electrolysis of dextrose around a lead anode, the decomposition of the dextrose, and the formation of acids by oxidation, are regarded as primary and secondary processes respectively. It might be supposed that the formation of a pentose and formaldehyde is due to oxidation. Theories previously advanced concerning the reversibility of sugar-synthesis (this J., 1909, 1068), and other theories shortly to be published, necessitate experimental proof that the oxidising action at the anode only destroys the equilibrium.



and thus causes an accumulation of pentose and formaldehyde (these products, like the dextrose, becoming oxidised in part). The author has now furnished the proof. Dextrose was electrolysed under conditions similar to those previously described (*loc. cit.*, 535), save that the current was passed in the opposite direction, i.e., the leaden worm was made the cathode. Under these conditions, 0.0027—0.0097 gm. of formaldehyde and 0.15—0.17 gm. of pentose were obtained from 20 grms. of dextrose. The melting point and microscopic appearance of the osazone of the pentose were the same as those of the osazone of the pentose obtained with the lead as anode. Hence, both the hydrogen and the oxygen liberated in electrolysis, destroy the equilibrium above referred to, and cause an accumulation of pentose and formaldehyde.—L. E.

Formaldehyde: Supposed formation of — on boiling solutions of sucrose. C. H. La Wall. Amer. J. Pharm., 1909, 81, 394—396. (Chem. Zentr., 1909, 2, 1736—1737. (Compare Ramsay, this J., 1908, 1218.)

THE author finds that when solutions of sucrose are boiled under ordinary conditions, no formaldehyde is produced. Furfural is formed and this reacts in a similar manner to formaldehyde in Hehner's test (this J., 1895, 772; 1896, 382), but has no influence in Fimini's test (this J., 1898, 697, 1076). The presence of furfural was detected by means of aniline acetate solution (Bull. No. 110, U.S. Dept. Agric.), with which formaldehyde gives no reaction.—A. S.

Maple sugar and syrup: Suggested standards for—.
H. W. Cowles, jun. J. Ind. Eng. Chem., 1909, 1, 773—774.

MAPLE sap when concentrated to a syrup yields an insoluble deposit termed "nitre," which consists in the main, of calcium salts. The syrup separated from this deposit invariably contains over 0.45 per cent. of ash, and when further concentrated to sugar will yield an ash of about 0.65 per cent. calculated on the anhydrous substance. In certain samples prepared during the last season the "nitre" had not been removed, so that it was possible to add cane sugar to these and still have a sugar with an ash in excess of the U.S.A. standard of 0.65 per cent., but which on dilution and filtration would not give a syrup yielding the legal proportion of ash. The following results were obtained in the analysis of samples of pure maple sugar and of syrups prepared from them by the addition of 25 c.c. of water to 50 grms. of sugar, followed by filtration:—

	Moisture, per cent.	Ash.		Alkalinity of ash per 100 grms.	Ash on dry substance, per cent.	Ash on syrup basis 32 per cent. water), per cent.
		Total, per cent.	Insoluble in water, per cent.			
Maple sugar, New York	2.70	1.116	0.724	181.0	1.147	0.80
.. .. SYRUP	11.28	0.455	0.141	79.0	0.775	0.527
Maple sugar, Canadian	6.1	0.861	0.476		0.917	0.624
.. .. SYRUP	39.44	0.476	0.175	75.0	0.786	0.554

The following standards are suggested for these products :—Maple sugar is the solid product from the evaporation of maple sap or maple syrup. It should contain not less than 0.65 per cent. of maple sugar ash, calculated on the anhydrous substance, and yield a clarified solution of maple syrup containing not less than 0.45 per cent. of maple syrup ash. Maple syrup should contain not less than 0.45 per cent. of maple syrup ash, and not more than 34 per cent. of water.—C. A. M.

Potatoes ; Manufacture of starch from sweet — C. C. McDonnell. S. Carolina Agr. Exp. Sta., 1908. Bull. No. 136, 7—50.

THE varieties of the sweet potato (*Ipomoea Batatas*) richest in starch, contain, on the average, about 22 per cent. of this constituent. Of the varieties examined by the author, Providence, Southern Queen, and Triumph appear to be most suitable for the manufacture of starch. The author describes experiments on the extraction of starch from these, and a fourth variety—Red Nansemonde—and on the behaviour of the product towards bleaching agents. All the starch preparations were found to be of a good grade chemically, and the results of practical tests in laundry work, and in the textile industry, were satisfactory in every case. The residual pulp, which still contains a considerable quantity of starch, constitutes a good fodder for stock. The waste water from the settling tank, which contains all the soluble matter of the potato, including some nitrogenous organic matter and salts of phosphoric acid and of potash, could be used for irrigation purposes in many cases. It would no doubt, be more profitable, however, to mix the first wash water, which would contain practically the whole of the sugars, with the pulp, ferment the whole, and recover the alcohol by distillation. Further data will be required in order to settle the question as to whether the manufacture of starch from sweet potatoes can be made a commercial success. The present price of sweet potatoes would not permit it, but in growing the potatoes on the scale necessary to supply one or more starch factories, a number of expenses could be eliminated. The author suggests that the whole crop of potatoes should be taken over from the farmer by the factory. The best and even-sized potatoes should be sold for table use, or canned, whilst the small, over-sized, and ill-shaped potatoes should be worked up in the factory. The author also points out that a successful method has been devised for drying sweet potatoes. The desiccated potatoes will keep indefinitely, and may be sent long distances at comparatively small cost.—L. E.

Cassava starch from Fiji. Bull. Imp. Inst., 1909, 7, 271—272.

THE sample was of high purity, clean and white, and free from visible impurity, taste and smell. It contained starch, 84.8; moisture, 14.9; and ash, 0.2 per cent. Cassava starch appears to be unsuitable for laundry purposes, but quite suitable for glucose manufacture, for which purpose it would be worth not more than £8 per ton on the English market. It could also probably be employed as a substitute for sago, but not for potato-starch in sizing cotton yarns, and as a dressing or finish for fabrics. For general purposes, as a manufacturing starch, it would probably fetch about £14 to £15 per ton if placed on the English market in quantity.—E. W. L.

Fertilisers containing manganese applied to beetroot cultivation. Roussel. See XV.

PATENT.

Amalgamous materials ; Process for treating — A. Boidin, Seclin, France. Eng. Pat. 8447, April 7, 1909.

SEE Fr. Pat. 399,087 of 1908; this J., 1909, 997.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt ; Influence of various methods of mashing on the amount of extract yielded by — W. Windisch, E. Bieckhoff, and A. Stadel. Woch. f. Brau., 1909, 26, 593—598.

WHEN first selected as the standard method the "Congress"

process of determining the extract yielded by a malt gave values exceeding those obtained on the practical scale, and such values were spoken of as the "theoretical" yield of a malt. In recent years the brewhouse practice has advanced to such an extent that yields exceeding those of the Congress method are commonly obtained, and the latter are now spoken of as "laboratory" yield. Thus the figures obtained for the extract of a malt by the Congress method cannot nowadays be taken as the standard which the brewhouse should strive to emulate, and the authors have sought to devise a series of laboratory processes by which the highest possible extract of a malt can be secured. Eleven malts of various descriptions, ranging from very under-grown to well-modified, have been mashed by each of twelve methods, which include the standard Congress process and proteolytic mashing alone and in combination with 12 hours pre-mashing at ordinary temperature, and with three-quarters of an hour's heating under 2 atmospheres pressure. The results are given in tables and in curves which show that in every case the highest yield has been obtained by a combination of pre-mashing, proteolysis and heating under pressure carried out as follows: the malt is mashed with cold water, allowed to stand for 11—12 hours (overnight), heated and maintained for half an hour at 45° C., raised to 50° C. and, after half an hour, part of the liquid withdrawn; the mash is raised to 70° C. for conversion and afterwards heated for 30 to 35 minutes at 2 atmospheres pressure, and then cooled to 50° C. The wort withdrawn is now returned and the mashing completed according to the Congress method. This method is suggested, tentatively, as a workable substitute for the Congress process, as yielding values by which the brewhouse working could be checked.—R. L. S.

Pentosans ; The behaviour of — in malting and mashing. W. Windisch and G. Van Waveren. Woch. f. Brau., 1909, 26, 581—585.

THE question of the importance, or otherwise, of the pentosans in beer has been recently revived by the discussions that have arisen over the value, to the brewer, of the increased yield of extract obtainable from malt by pre-mashing methods. It has been shown that such methods increase the amount of pentosans extracted from malt, and as certain untoward results obtained with worts prepared by them have been ascribed to the increased content of pentosans, the authors have investigated the subject thoroughly. They find that barley loses during steeping a notable amount of pentosans dissolved from the husk. During malting an increase of the soluble pentosans occurs, so that well grown malt is richer in these substances than a poorly grown malt from the same barley. This difference persists in the worts from the two kinds of malt. Pre-mashing malt leads to the presence of more pentosans in the wort, but the wort prepared by ordinary methods from a well-grown malt contains more of them than does the wort yielded by pre-mashing a short grown malt from the same barley. During fermentation pentosans are not attacked and are recoverable quantitatively from the finished beer; they are flavourless substances, and, in the proportions in which they occur, cannot be regarded as detrimental. The authors conclude that the causes of the loss of character frequently observed when pre-mashing methods have been adopted must be sought elsewhere.—R. L. S.

Fermentation process ; Removal of infection in the continuous — E. Lühder. Z. Spiritusind., 1909, 32, 485—487, 496—497.

THE author has made experiments with the object of ascertaining whether the yeast-infection which occurs from time to time in a distillery working with continuous fermentation can be removed, so that renewal of the yeast may be avoided. Potato-mashes saccharified by malt were employed, and continuity of the fermentation was effected by mixing one-third of a fermenting mash with twice its amount of fresh mash, the remaining one-third of which was run into the already fermenting mash. In the first series of experiments, the normal acidity of the mash was increased by the addition of small proportions of sulphuric acid. The first mash yielded 9.9 per cent. of

alcohol and had a final acidity of 0.73°, whilst the sixth mash gave only 8.2 per cent. of alcohol and exhibited an acidity of 1.6°. An attempt to check the infection causing this increased acidity by adding an augmented proportion of sulphuric acid met with failure, the seventh mash yielding only 7.4 per cent. of alcohol and possessing a final acidity of 1.65°. One-third of this mash was then mixed with sufficient sulphuric acid to raise the total acidity to 2.85° and left for two hours at the ordinary temperature. This treatment resulted in the destruction of nearly all the bacteria present, whilst only 5–10 per cent. of the yeast-cells were killed. The use of the purified yeast in a new mash resulted in a yield of 9.3 per cent. of alcohol and no increase in the acidity. A similar purification of an infected yeast was effected by adding hydrochloric acid so as to bring the total acidity to the value 2.85°. The multiplication of the yeast, which is found to diminish with increase of infection, is about 3:1 under normal conditions, but with the yeasts purified by sulphuric and hydrochloric acids, it reached the values 5.24:1 and 3.87:1 respectively. In the continuous fermentation process, it is important that, after pitching, the mash should contain a large proportion of yeast. Purification of the yeast by means of sulphuric or hydrochloric acid should be undertaken as soon as a mash is found to exhibit an appreciable increase of acidity during the first 24 hours after the commencement of fermentation.—T. H. P.

Fermentation process; Continuous — with mineral acids.
Bücheler. Z. Spiritusind., 1909, 32, 511.

THE author describes a distillery system of continuous fermentation which has been in operation about a month and in which proportions of sulphuric acid are employed sufficient to raise the initial acidity of the mash from zero to 0.2°. The mash is pitched with only one-fifteenth or one-twentieth of the preceding mash, the proportion used by Lühder (see preceding abstract), namely, one-third, being regarded as unnecessarily large.—T. H. P.

Tartaric acid from residues of wine manufacture; Recovery of —. A. Janson. Chem. Ind., 1909, 32, 719–722.

GRAPE musts contain 5–8 per cent. of crude tartar, whilst the wine on an average contains only 2 per cent.; thus the residues from a hectolitre of wine contain about 600 grms. of crude tartar. A portion of this adheres to the sides and bottom of the fermentation and storage tuns as a very hard crust, which may be removed periodically. Some considerable care is necessary to remove this crust without injury to the tuns. Small quantities of tartar are recovered when the tuns are rinsed out, the waters being collected and the heavier tartar separated from the lighter suspended matter by settling. The tartar contains, besides potassium hydrogen tartrate, considerable proportions of calcium tartrate, depending on the origin and treatment (e.g., neutralising or "plastering") of the must. In Germany, the Main and Saale wines are particularly rich in calcium. In recent years the grape mares and yeast have been specially treated for the recovery of tartar. The mares contain 3–5 per cent.; they are richer in the more northern districts. As a rule it does not pay to treat mares which have been pressed out from the sweet musts before fermentation, but red wines are always fermented

with the mares. The recovery of tartar from the mares may be combined advantageously with the distillation of brandy. The hot vinasse may be separated as quickly as possible from the mares and allowed to cool slowly in vats. A higher yield of large crystals is obtained by diluting the liquid with water and boiling for some time, twigs or threads being suspended in the crystallising vats. The mares themselves should then be boiled with water (120 litres per 100 kilos. of mare) and pressed. According to another process the mares and vinasse are allowed to cool together; the clear liquid is run off and the mares are dried, the crystals of tartar being separated by threshing. A similar system may be employed for the liquors themselves, by straining them through cloths and drying the deposit thus collected. A further quantity of tartaric acid may be obtained from the clear mother liquors by neutralising with lime and collecting the precipitate of calcium tartrate. Another process consists in boiling the separated mares with hydrochloric acid, straining, and carefully neutralising the filtrate with lime. This process, however, gives a product highly contaminated with organic matter, and the residual mares are no longer available for fodder. The yeast also may be treated for the recovery of tartaric acid. It is pressed and, in some cases dried, before despatch to the chemical works. Well-pressed yeast contains, on the average, 25 per cent. of tartar, chiefly calcium tartrate. The yeast from sweet-pressed musts contains more than that from red wines. The recovery of tartaric acid from yeast, whether direct or after distillation, is best effected by boiling with acid; 600 grms. of crude hydrochloric acid are sufficient for the extraction of 1 kilo. of tartar. Lead-lined tanks are employed; the neutralisation of the acid filtrate must be effected with the greatest care to avoid either a deficiency or an excess of lime or chalk. The dried precipitate contains about 80 per cent. of calcium tartrate and the residual yeast is available for manure.—J. F. B.

Ethyl alcohol; Electrolytic oxidation of — to acetic acid. P. Askenasy, R. Leiser, and N. Grünstein. Z. Elektrochem., 1909, 15, 846–860.

THE authors have investigated the conditions necessary for obtaining the best yield of acetic acid by the electrolytic oxidation of alcohol, and consider that, with cheap power, using fermented beetroot juice as the source of alcohol, the process might successfully compete with the existing method of manufacturing acetic acid; a table showing details of the probable cost of production (in Germany) is given. Some aldehyde and ethyl acetate are formed during the process of electrolysis, the latter becoming hydrolysed as the alcohol is used up, and towards the end of the oxidation, acetic acid is decomposed with the evolution of carbon dioxide. In the experimental cell employed, no diaphragm was used, the electrodes being placed only 3 mm. apart, and a little sulphuric acid added to the diluted alcohol. The best results were obtained when about 2 grms. of chromium sulphate per litre of electrolyte were added as an oxygen carrier. Sodium acetate, contaminated only with sodium sulphate, was obtained by evaporating the neutralised electrolyte. The results are summarised in the following table:—

	Temperature C.	Current- density, ampères per sq. dm.	Potential, volts.	Current yield, per cent.	Yield of substance, per cent.	Kilowatt-hours per kilo. of acid.
Rectified spirit	12°–18°	19.3	4.7	73.0	—	11.2
" "	—	—	4.7	—	77.0	—
" "	about 30°	21.2	4.45	78.1	79.8	10.2
" "	—	—	4.0	78.1	79.8	9.1
" "	38–40	22.1	4.1	72.0	—	9.8
" "	38–40	22.1	4.0	72.5	—	—
" "	35°	21.0	4.0	78.4	80.6	9.1
" "	35°	12.2	3.8	46.7	82.2	14.5
Fermented beetroot juice	30°–35°	12.0	3.7	61.2	93.0	10.8
Fermented beetroot juice, with oxygen carrier	30°	12.0	3.7	73.7	93.8	8.9

PATENTS.

Mash tuns. H. Hunt, London. Eng. Pat. 772, Jan. 12, 1909.

In the mash tun described, the space between the bottom of the tun and the false bottom is divided into a number of compartments by means of partitions. Each compartment is provided with one or more draw-off cocks, the object being to draw off the wort uniformly, after it has percolated the grains on the false bottom, without using the usual long pipes in connection with the cocks.—W. P. S.

Distilling or rectifying wines, residuums of pressed grapes, brandy, various fermented worts, alcohols, petrols, essential oils, benzines, or other liquids; Apparatus for —. R. Vallat, Paris. Eng. Pat. 4604, Feb. 24, 1909. Under Int. Conv., Feb. 25, 1908.

See Fr. Pat. 387,558 of 1908; this J., 1908, 871.—T. P. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, AND DISINFECTANTS.

(A.)—FOODS.

Creatinine [in meat extracts, etc.]; Jaffé's colorimetric method for the determination of —. A. C. Chapman. Analyst, 1909, 34, 475–482.

The coloration produced when a solution of creatinine is added to a solution of sodium or potassium picrate containing an excess of alkali, is due to the reduction of the picric acid and not to the formation of creatinine picrate. The author shows that the reduction proceeds beyond the formation of aminodinitrophenol (picramic acid) and that the coloration is due to the presence of several reduction products; this applies when the picric acid is present in excess, but when creatinine is in excess, the picric acid is reduced completely to triaminophenol. A number of experiments carried out with the object of ascertaining what influence variations in the proportions of picric acid and alkali have on the determination, yielded results which confirmed the conclusions arrived at by Emmett and Grindley (this J., 1908, 87). The reacting solutions should be maintained at 20° C., or other convenient temperature, as the temperature factor is of considerable importance; up to a certain point, the colour is intensified with an increase of temperature, after which there is a reduction due to the formation of triaminophenol. Slight variations of the time during which the solutions of creatinine and alkaline picrate are allowed to interact have but little influence on the results, the tendency, however, being in the same direction as in the case of the temperature factor. The presence of dextrose is without appreciable effect. As regards the comparison solution used in the determination, the author favours the employment of a fixed standard, such as the bichromate standard. The following details are given for the application of the method to the determination of creatine and creatinine in meat extract: A 10 per cent. solution of the meat extract is prepared; several portions (10 c.c.) of this solution are then placed in small beakers, 10 c.c. of *N*/1 hydrochloric acid are added to each, and the beakers are then heated in an autoclave for 30 minutes at a temperature of 120° C. To the contents of one of the beakers, cooled to 20° C., 30 c.c. of a saturated solution of picric acid and 15 c.c. of a 10 per cent. solution of sodium hydroxide are added, and, after the lapse of 5 minutes, the coloured liquid is diluted to a volume of 500 c.c. This solution is then matched against 8 mm. of the standard bichromate in the cylinders of a Dubose colorimeter. From the reading obtained, a simple calculation will show approximately the volume to which the contents of another of the beakers must be diluted in order to give a reading in the colorimeter between 7 and 10 mm. The quantity of total creatinine is then readily ascertained. The creatinine present as such in the meat extract may be determined by ascertaining the dilution necessary for matching, by means of a preliminary reading, with an aqueous solution purposely made too strong.—W. P. S.

Milk; Decomposition of hydrogen peroxide by —. E. Kohn-Abrest. Ann. Chim. analyt., 1909, 14, 415–417.

RESULTS of experiments are given showing that milk, after having been exposed to the air for about 5 days, ceases to decompose hydrogen peroxide (as shown by the guaiacum test), but is still active at the end of 15 days when kept in a closed vessel. Milk curdled by the addition of lactic acid behaves similarly. The catalase is found in the serum of milk which has been curdled by means of lactic or acetic acids; the curd, after being washed, is practically inactive. Heat, the presence of alcohol or acids, contact with air, or storage under low pressure, all inhibit or interfere with the action of the catalase.—W. P. S.

Casein; Volumetric determination of — in milk. L. L. Van Slyke and A. W. Bosworth. J. Ind. Eng. Chem., 1909, 1, 768–771.

THE following method is recommended as being simpler and more rapid than that of Matthaïopoulos (Z. anal. Chem., 47, 492) whilst giving as accurate results:—A definite quantity (20 c.c.) of the milk is diluted with 80 c.c. of water, and neutralised with sodium hydroxide solution, using phenolphthalein as indicator. An excess of alkali may be avoided by comparing the tint with that of a colour standard prepared with 20 c.c. of skimmed milk and 80 c.c. of water, and coloured a faint but distinct pink with a dilute carmine ink. This may be preserved with mercuric chloride and kept for future comparisons. As a rule from 3 to 4 c.c. of *N*/10 alkali solution are sufficient to neutralise fresh milks. The neutralised liquid is next treated with *N*/10 acetic acid, added 5 c.c. at a time at a temperature of 18° to 24° C., and the flask is shaken at intervals. The amount of acid (A) required for complete precipitation of the casein is noted, the liquid made up to 200 c.c., and the precipitate filtered off. An aliquot portion (100 c.c.) of the clear filtrate is then titrated with *N*/10 sodium hydroxide solution, and the difference between the result (B) and half the amount of A, multiplied by the factor 1.0964, gives the percentage of casein. The results thus obtained should agree within 0.2 per cent. of those given by the official (Assoc. Official Agric. Chem., U.S.A.) method. Fresh milks preserved with mercuric chloride in the proportion of 1:1000 or 1:1500 give satisfactory results after having been kept for 2 or 3 weeks.—C. A. M.

Flour; Use of coal-tar oil in the examination of —. L. Loviton. Ann. Chim. analyt., 1909, 14, 412–413.

IF any flour be treated in a test-tube with benzol or other colourless coal-tar oil, the starchy portion of the flour is rendered so transparent that it seems to disappear, whilst the bran and other coloured constituents are seen floating in the liquid. This test will be found to be of use in comparing one flour with another, as the comparison is much more readily made than when the two flours are examined side by side without treatment. Five grms. of flour and 10 c.c. of benzol are convenient quantities to employ.—W. P. S.

Saccharin and other artificial sweetening agents; Detection of — in food and beverages. A. Bianchi and E. di Nola. Ann. des Falsific; through Bull. comm., 1909, 37, 479.

THE liquid under examination is freed by evaporation from any alcohol present; acidified with acetic acid, 20 drops for every 100 c.c., and treated with normal lead acetate solution in excess. After standing for 30 minutes, excess of a 1:5 solution of sodium sulphate containing the same amount of sodium phosphate is added, and the precipitated lead salts are removed by filtration. The filtrate is concentrated to a small volume on the water-bath, and acidified with dilute (1:2) sulphuric acid. It is then shaken with a mixture of equal volumes of ether and pure benzene. On evaporating the benzene-ether extract, saccharin and its ammonium compound, dulcitol or sucramine, will leave a sweet residue. If salicylic acid should accompany the saccharin, this

must be eliminated by oxidising the residue with permanganate and sulphuric acid. The oxidation liquid is then again shaken with the benzene-ether solvent. Saccharin, if present, remains unoxidised, and can be detected in the benzene-ether residue.—J. O. B.

Paint and varnish coatings as accelerators in corrosion of metals [equis for preserved fruits]. Walker and Lewis. See X.

Composition of fat of beef animals on different planes of nutrition. Moulton and Trowbridge. See XII.

Total nitrogen determination by the Kober method. Gill and Grindley. See XXIII. Org. Quant.

PATENTS.

Grain; Process and apparatus for the treatment of — [for increasing its suitability for baking purposes]. J. G. E. Dombach, Amsterdam. Eng. Pat. 25,193, Nov. 23, 1908.

A portion of the grain, such as wheat, rye, or oats, is subjected, before being ground, to a swelling process, which is stopped before actual germination commences. This treated portion is then added to the main bulk of the grain. The bulk of the grain is washed, dried and cooled, whilst the small portion, to be subjected to the swelling treatment, is washed in a number of vessels provided with discharge valves and sieves at their lower parts and also with means for supplying air under pressure below the mass of the grain. A number of these vessels are fitted up adjacent to each other so that grain in varying stages of swelling may be under treatment at the same time.—W. P. S.

Seed; Metabolism of —. J. von der Kammer, Washington, D.C., U.S.A. Eng. Pat. 8131, April 5, 1909. Under Int. Conv., June 12, 1908.

THE metabolism of seeds and the growth of plants therefrom may be accomplished without soil, by treating them in an anaerobic chamber (see Eng. Pat. 8130 of 1909) and moistening periodically with an artificial nutriment. An anaerobic gas, preferably nitrogen, is introduced into the chamber to assist the process. Plants so treated and used as stock food for cattle, produce a marked improvement in the quality of the meat.—H. Br.

Cream to be used in the production of butter; Process of improving the flavour of —. H. C. Buer, Cologne-Marienburg, Germany. Eng. Pat. 18,201, Aug. 6, 1909.

FROM 2 to 5 per cent. of lecithin is added to fresh cream and the mixture is kept at a temperature of from 12° to 15° C. for from 20 to 30 hours. The lecithin is reduced by bacterial action with the production of considerable quantities of "butter flavour or aroma."—W. P. S.

Milk; Process of utilising dried —. A. L. Just and B. Stolz, Executors of J. A. Just, Syracuse, N.Y. U.S. Pat. 939,138, Nov. 2, 1909.

A RECONSTITUTED milk may be prepared by dissolving dried milk in water, inoculating the solution with aroma-producing organisms, and keeping the mixture at a suitable temperature until an aroma like that of ordinary milk is developed. The action of the organisms is then arrested and a soluble calcium salt is added.—W. P. S.

Sweet cakes for feeding cattle; Manufacture of —. J. B. E. Fabre, London. Eng. Pat. 18,773, Aug. 14, 1909. Under Int. Conv., Jan. 28, 1909.

ONE or two parts of concentrated molasses or syrup water (95° to 98° Brix) are mixed with one part by weight of dry beetroot slices, malt grains, chopped fodder, or the like. The mixing is carried out in a suitable apparatus provided with a heating jacket, and the mass is then poured into moulds to cool. The foodstuff thus obtained consists approximately of: water, 8 to 10; albuminoids, 4 to 5; non-nitrogenous matter, 70 to 75 (of which 35 to 40 are sugar); cellulose, 8 to 9; mineral matter, 5 to 6; and fatty substances, 0.2 to 0.3 per cent.—W. P. S.

(B.)—SANITATION; WATER PURIFICATION.

Trade effluents; Treatment of —. Local Govt. Officer, Nov. 27, 1909. [T.R.]

THE discharge from the manufactories into the sewers continues to receive a considerable amount of attention by the Manchester Rivers Department, and much good has been done in this direction. In a number of cases manufacturers have been required to stop discharges of dangerous and potentially dangerous effluents, heated liquids, and discharges containing excessive solid matters in suspension. Offenders, in several instances, found compliance with the Committee's requirements very beneficial to themselves, as the precautions taken resulted in the detection of much avoidable waste. A striking case may be quoted of an effluent to which exception was taken by the Committee, and from which there is now recovered by the improved methods adopted nearly 40,000 galls. of oil per annum, which formerly entered the sewer. In achieving this result it has been found possible to reduce the working expenses sufficiently to pay, in a few years' time, for the new filtering arrangements, apart altogether from the value of the oil recovered. Some time ago, owing to the discharge from a chemical works of liquids containing sulphides in solution, a particularly offensive nuisance occurred in the city sewers, when several miles were filled with sulphuretted hydrogen. Upon being informed of its nature, the owners pleaded ignorance, and at once stopped the offending discharge. However, owing to the serious character of the offence, the Committee, in the public interest, had no alternative but to take proceedings, the result being the infliction of a fine.

PATENTS.

Water purifiers. E. C. R. Marks, London. From Oliver-Roche Co., New York. Eng. Pat. 27,270, Dec. 15, 1908.

THE apparatus consists essentially of a settling tank in which is placed a filtering chamber; the latter rests on beams placed across the bottom of the settling tank, and the bottom of the filter chamber is constructed of a galvanised iron screen. The latter supports a layer of granular carbon above which is placed a brass screen on which are spread layers of sand. The water enters the settling tank through a small chamber provided with a sieve which removes suspended matters from the water. It rises in the settling tank, and flows upwards through the screens and filtering materials and is drawn off from the filtering chamber at a point above the upper layer of sand. The iron and brass screens act as electrodes, the water itself being the electrolyte. As the filter becomes clogged, the level of the water rises in the settling tank and the increased pressure thus produced causes the filter to continue working. Several filter chambers may be placed in one settling tank, means being provided so that when one filter becomes clogged, the water is conducted to another unit. Chemical reagents may be added to the water as it enters the settling tank. (See also Eng. Pat. 27,271 of 1908; this J., 1909, 1161).

—W. P. S.

Water; Process of purifying —. J. W. Morrison, Assignor to Steam Appliance Manufacturing Co., Batavia, N.Y. U.S. Pat. 938,779, Nov. 2, 1909.

THE water is heated under pressure to a temperature exceeding 300° F., and the precipitated substances are then removed by filtration while the water is still at a high temperature. The hot, filtered water passes through a chamber where it yields up its heat to cold water which is being conducted to the heating vessel.—W. P. S.

Sewage water; Mechanical filtration of —. E. Geiger, Karlsruhe, Germany. Eng. Pat. 16,837, July 19, 1909.

IN order to separate the solid from the liquid part of sewage, a wheel, which is provided with sieve-like scoops, is fixed in the sewage canal and revolves in the opposite direction to the flow of the sewage. The solid matter is collected on the scoops and is gradually moved to the

centre of the wheel where it is discharged. Any mud which adheres to the sieve is swept off by means of brushes, and is also brought to the discharging device.—H. Br.

(C.)—DISINFECTANTS.

PATENT.

Cerium phenol compounds [disinfectants]; Manufacture of —. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 13,912, June 14, 1909.

SEE Ger. Pat. 214,782 of 1907; this J., 1909, 1221.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Cellulose [in lignified materials]; Methods for determination of —. M. Renker, Dissertation, Berlin, 1909, 1—106.

THE author's investigations fall under two heads: the determination of hygroscopic moisture in cellulose, and the determination of cellulose in lignified materials. There is no definite line of demarcation between the expulsion by heat of hygroscopic moisture and the expulsion of moisture owing to decomposition or dehydration of the cellulose itself. The former gradually merges into the latter as the temperature is raised, until visible discoloration takes place at about 150° C. The rate of decomposition varies with the nature of the cellulose and is lowest in the case of cotton. The term, "absolutely dry," is therefore more or less conventional, and is taken to represent the arrival at constant weight in a toluene drying oven at a temperature of 105°—107° C. At this temperature the degree of saturation of the external air has a slight influence, which is negligible for practical purposes. Contrary to Hofmann (this J., 1907, 942), the author was unable to detect any chemical change in sulphite wood pulp dried under these conditions, but cellulose which had been over-oxidised or otherwise altered by chemical treatments showed marked signs of decomposition. Cellulose spread out in a desiccator over phosphorus pentoxide arrives at the "absolutely dry" condition at the ordinary temperature after 3—4 weeks; the time of exposure may be curtailed to about 20 hours by maintaining a good vacuum. This is the best

The raw materials taken for the study of the methods for the determination of cellulose consisted of unbleached sulphite wood pulp, jute "half-stuff" prepared in a paper mill, thin shavings of white-lir wood, and raw cotton. These materials were further purified, before analysis, by extraction with boiling water and a mixture of alcohol and benzene. Of all the methods investigated none was found worthy to stand in comparison with Cross and Bevan's method of chlorination (see "Cellulose," p. 95; also J. Chem. Soc., 1882, 41, 105); many indeed did not yield cellulose at all. Nevertheless the chlorine method shows in a minor degree, the errors inherent in the other practicable processes, viz.: it is necessary to choose between an imperfectly purified cellulose on the one hand and a loss of cellulose, under the attack of the reagents used, on the other. This error is negligible in the case of not very highly lignified materials such as sulphite pulp, cotton, and even jute, but it becomes appreciable in the case of wood. The celluloses derived from the more highly lignified materials are also more sensitive to the attack of the reagents. The destruction of the cellulose may be curtailed by omitting the preparatory boiling with alkali, maintaining the temperature at 0° C., restricting the time of exposure to chlorine gas as far as possible, and immediately flooding the chlorinated material with a solution of sulphurous acid. The author found it impossible to prepare a pure cellulose from wood, with less than six chlorinations (compare Dean and Tower, this J., 1907, 988), and the cellulose undoubtedly suffered thereby. A pure jute cellulose prepared by a single chlorination, lost 2 per cent. in a second treatment and a further 0.9 per cent. in a third treatment. The method depending on oxidation by permanganate in presence of 5N-acetic acid yields very good results for the determination of pure cellulose in sulphite wood pulp and cotton, and even removes the whole of the lignin from jute; the yields are satisfactory but the cellulose is somewhat over-oxidised; the method is useless in the case of wood. H. Müller's bromine method yields fair results and a pure product, but is far too tedious for practical purposes. Schulze's method (see Henneberg, Annalen, 1868, 146, 130) and Hoffmeister's method (this J., 1888, 620) give very low yields of cellulose, and Cross and Bevan's nitric acid method ("Cellulose," p. 97) though extremely simple, cannot be used owing to the fact that the cellulose is profoundly attacked. A summary of the results obtained by the various methods with the same raw materials is contained in the following table:

Materials (all extracted).

Method.	Sulphite wood pulp.	Jute (prepared "half-stuff").	Wood.	Unbleached cotton.
	per cent.	per cent.	per cent.	per cent.
Glycerol-sulphuric acid (König)	74.15	—	—	—
Chlorine gas (Cross and Bevan)	97.9	84.5	60.55	97.85
Concentrated chlorine water	97.65	83.4	57.1	94.7
Dilute chlorine water	98.0	81.1	—	96.8
Bromine water (H. Müller)	98.1	83.3	37.95	97.1
" " (Klason)	96.6	80.8	51.85	95.45
Nitric acid and potassium chlorate (Schulze)	98.05	79.2	58.1	96.95
Hydrochloric acid and potassium chlorate (Hoffmeister)	98.25	82.5	57.15	96.15
Nitric acid (Cross and Bevan)	97.65	79.75	53.6	96.35
Nitrous acid (Ger. Pat. 204,460)	98.2	80.65	55.8	98.85
Nitric and sulphuric acids (Lüschütz)	—	—	43.35	—
Potassium permanganate and nitric acid (Zeisel and Stritar)	90.6	70.95	40.2*	93.25
Neutral potassium permanganate	98.5*	87.4*	—	—
Potassium permanganate and acetic acid	98.25	83.6	—	97.6
Potassium permanganate and hydrochloric acid	97.9	82.9	43.0	96.65
Hydrogen peroxide	96.05	—	—	96.55
Sodium hypochlorite	97.4	83.4	50.5	96.8
Phenol (Ger. Pat. 94,467)	90.75	79.4	51.9	94.2

* Product not a pure cellulose.

method for drying cellulose without heat, and the results are concordant. In a strong current of air, dried over phosphorus pentoxide, cellulose may be dried in 4 hours at 90° C., but retains about 0.8 per cent. of moisture in a slower current at 60° C. This method does not give concordant results, since its efficiency is influenced by the quantity of air and the temperature.

—J. F. B.

Paper pulp in French West Africa. P. Ammon. J. Offic. de l'Afrique occid. franç.; Paper Making, 1909, 28, 437.

THE author reports on experiments undertaken on behalf of the French Government with a view to the utilisation

of various fibrous materials of the West African colonies for paper pulp. The first experiments were carried out with sorgho, the dried stalks of which are now burnt on the fields. Attempts to grind these stalks for the preparation of a mechanical pulp having proved fruitless, attention was turned to their treatment by chemical processes. This treatment is most advantageously carried out on the stalks in the fresh condition; they then yield from 45 to 50 per cent. of a pulp superior in quality to the Continental straw pulps. The same process has been applied with success to maize stalks, which are also available in large quantities. Cotton-stalks and aloes are likewise amenable to the treatment. Two indigenous plants, growing in poor sandy soils, belonging respectively to the *Hibiscus* and *Abelmoschus* families have been investigated. The woody portions of the stems yield easily to chemical treatment, and give 50–60 per cent. of a cellulose pulp suitable for ordinary "news" papers or for mixing with esparto for the manufacture of imitation art paper. The bark tissues of *Hibiscus cannabinus* yield 35 per cent. of useful fibres, which may be mixed with esparto for printing papers. Ronier leaves yield fibres of a higher quality than sorgho pulp, but the treatment is not easy and the yield is only 30 per cent. The bark of the baobab tree gives 35 per cent. of excellent fibres, the qualities of which are well known. Lastly, the bark of the Baubinia tree yields a cotton-like fibre, but its treatment is too costly.—J. F. B.

Recovery of volatile liquids by cooling. Claude. See I.

PATENT

Paper; Process for producing translucent —. H. Kuhn, Rochester, N.Y. U.S. Pat. 938,877, Nov. 2, 1909.

PARCHMENT paper, prepared by treating a paper made from cotton with sulphuric acid, is washed, dried, and waxed. The waxed paper is rolled at a high temperature, and a matt surface is then produced on the paper by abrading the same.—W. P. S.

Paper, fabrics, and similar materials; Process for testing [thickness, weight, etc.], whilst in motion. G. C. Chaney. Fr. Pat. 402,225, Apr. 20, 1909.

THE instrument for controlling the weight or thickness of a web of paper or fabric travelling through a machine, is based on the principle that when radiant energy from a constant source (heat or light) passes from a transmitter to a receiver, with the travelling web between them, the variations in the energy transmitted are proportional to the quantities of matter interposed. When heat is employed, the source may be an electric lamp, connected with a constant supply of electricity, and the receiver a simple thermopile connected with a galvanometer. When light is employed, a receiver of selenium or tellurium is applicable. The indications of the instrument are to be referred, in all cases, to those obtained with a standard pattern of the paper or fabric to be controlled. The combination of transmitter and receiver consists of two parallel plates with rollers between them supporting the web of paper or cloth at a uniform distance from each.—J. F. B.

Decorated papers; Process and machine for manufacture of —. F. A. Broekhaus. Fr. Pat. 402,536, May 1, 1909.

THE process for printing and embossing coloured patterns e.g. laeas, etc., on paper, is performed by taking an impression of the article to be reproduced on a celluloid roller, making a galvanic reproduction of the impression and applying the sheet of metal so produced to the surface of a roller, so as to obtain a mould or matrix of the pattern. Another roller, coated with a plastic composition, is revolved in contact with this, and a corresponding pattern is obtained on it in relief. Colour is applied to the surface of the matrix roller, and the web of paper is passed between the two. In this way the pattern is stamped on the paper in uncoloured relief, whilst the main surface of the paper receives the colour. The effect may be varied by spraying colours on the embossed paper at different angles.—J. F. B.

Wood pulp for manufacture of artificial filaments and nitro-cellulose; Process for preparing —. E. Opfermann, E. Friedemann and Act.-Ges. für Maschinenpapierfabrikation. Fr. Pat. 402,462, Apr. 27, 1909. Under Int. Conv., Apr. 15, 1909.

WOOD pulp contains impurities which limit its application in the manufacture of artificial filaments and nitro-cellulose. These impurities are extracted by boiling the cellulose pulp under pressure with a solution of sodium carbonate at a concentration of 0.5–2 per cent., with the addition, if the case seems to demand it, of small proportions of alkali hydroxide or sulphide. Or else the pulp may be boiled with a solution containing 10 grms. of calcium oxide per litre.—J. F. B.

Cellulose; Manufacture of —. R. R. Hollins, London, and T. Taylor, Manchester. Eng. Pat. 23,192, Oct. 30, 1908.

IT is proposed to manufacture pure cellulose, suitable for conversion into artificial silk, gun cotton, collodion, etc., from the waste produced in the process of decorticating sansevieria, sisal, and similar fibrous plants. The waste is preferably treated on the spot, but may be treated away from the plantation if packed in hermetically sealed vessels, or boiled with dilute ammonia and dried, before packing. The coarse fibres and skin are separated from the fine fibres by washing and sifting, and the latter are collected and treated successively with ammonia, a solution of caustic soda and sodium carbonate, and then alternately with bromine and dilute ammonia until the fibres are perfectly white. Any residue of silicious matter is removed from the pure cellulose by treating with dilute hydrochloric and hydrofluoric acids.—F. M.

Cellulose acetate; Process for rendering soft and supple, products [films] manufactured from —. L. Lederer. Fr. Pat. 402,083, Apr. 15, 1909.

As softening agents for films, etc., prepared from cellulose acetate, the esters of phenols and polyphenols or their substitution derivatives are claimed. These agents have the advantage of being insoluble in water and consequently the films retain their elasticity after steeping and washing, e.g., in photographic processes. In particular the addition of 1–2 per cent. of resorcinol diacetate, calculated on the weight of cellulose ester, to the solution of the latter is specified.—J. F. B.

Celluloid; Non-inflammable —. E. F. Clement. Fr. Pat. 402,569, Apr. 29, 1909.

CELLULOID may be rendered non-inflammable by incorporating with it colloidal silica, in a compatible form, in proportions varying with the effect desired. A suitable mixture consists of 90 per cent. of a solution of pyroxilin and 10 per cent. of silica. The silica is best employed in the form of methyl or ethyl silicates, e.g. tetra-ethyl monosilicate, diethyl monosilicate, hexa-ethyl disilicate or diethyl disilicate, these being obtained by the partial hydrolysis of the normal silicic ester.—J. F. B.

Celluloid-like masses; Process for preparing —. C. F. Boehringer und Söhne. Ger. Pat. 214,902, Dec. 5, 1906.

IN making celluloid, the camphor may be entirely or partially replaced by the cyclic ethers obtained by condensing aldehydes or ketones with polyhydric alcohols of the general formula, $\text{CH}_2\text{OH}(\text{CHOH})_x\text{CH}_2\text{OH}$; the following are suitable:—methylene ethylene ether, ethylidene glycol ether, methyleneglycerol, acetonyleglycerol, benzylideneglycerol, erythri-diformal, diacetone-arabitol, and triacetone-mannitol.—T. F. B.

Viscose; Apparatus for manufacture of —. C. C. Leclair. Fr. Pat. 402,804, Sept. 7, 1908.

THIS invention relates to an arrangement by which all the operations in connection with the manufacture of viscose are carried out in a single vessel. For this purpose the pulp, or paper, serving as the raw material, is first torn into small fragments of the size of sawdust. This is charged into the machine, which consists of a large

spherical or elliptical vessel mounted on a hollow trunnion and geared so as to receive both a rotary and oscillating motion. The vessel contains balls to prevent the material from clogging together in a solid mass. It is provided with connections communicating with sources of gaseous pressure and vacuum, also with orifices for the introduction of reagents or water in the form of a spray, and is surrounded by a jacket for the circulation of a heating or cooling medium.—J. F. B.

Paper and fibrous materials; Process for the treatment of waste — in the preparation of paper pulp. L. Herz. Nürnberg, Germany. Eng. Pat. 24,131, Nov. 10, 1908.

SEE Fr. Pat. 397,576 of 1908; this J., 1909, 811.—T. F. B.

Cellulose acetate; Manufacture of sheets or objects from —. L. Lederer, Sulzbach-Oberpfalz, Bavaria. Eng. Pat. 8945, April 15, 1909.

SEE Fr. Pat. 402,083 of 1909; preceding.—T. F. B.

Rendering barrels liquid tight [with waste sulphite pulp liquor]. Eng. Pat. 5206. See I.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Quinine sulphate; Tests for the purity of —. F. Tatin. Pharm. Soc., Nov. 9, 1909. Pharm. J., 1909, 83, 600—604.

Nux vomica seeds; Alkaloidal standard for, and method of determination of alkaloids in — [in the German Pharmacopœia]. G. Weigel. Pharm. Zentralh., 1909, 50, 783—784.

THE minimum standard of 2.5 per cent. of total alkaloids, prescribed by the Ph. G. IV., is not attained by the undried commercial drug. By the Keller-Fromme method of determination, the percentage of alkaloids ranges from 2.1 to 2.25. Since *Nux vomica* seeds lose, as a rule, about 10 per cent. of moisture on drying, the dried drug would pass the official standard by this method. The method of determination given in the Ph. G. IV., is, moreover, incorrect, affording too high results, since a portion of the soap formed by the action of the alkali on the fat present in the seeds is weighed as alkaloid. It is suggested, therefore, that the Keller-Fromme method should be made official; and that the minimum content of alkaloids for the natural drug should be 2 per cent., the figure correctly given in the French Codex, 1908.

—J. O. B.

Quino-quino balsam from Myroxylon balsamum var. J. punctatum. C. Hartwich and A. Jama. Schweiz. Woeh. Chem. Pharm., 1909, 47, 625—630, 641—647.

Tolu balsam, Peru balsam, and Quino-quino balsam are all yielded by the same tree, but by distinct botanical varieties thereof. *Myroxylon balsamum* (L.) var. *a. genuinum* (Baill.) is the source of Tolu balsam. The variety *β. perierae* (Baill.) gives Peru balsam. The variety *J. punctatum* (Baill.) yields quino-quino balsam. The chemical differences of these closely allied products are thus tabulated:—

Myroxylon balsamum.

	Var. <i>A. genuinum</i> . Tolu balsam.	Var. <i>B. pereiræ</i> . Peru balsam.	Var. <i>J. punctatum</i> . Quino-quino balsam.
Acid value	114—158	68—80	8.03
Saponification value	155—187	over 245	134.09
Ester value	up to 73	at least 165	53.79
Cinnamein	7.5 per cent.	62—64 per cent.	5.83 per cent.
Benzyl benzoate in cinnamein	present in quantity	almost wholly	almost exclusively
Benzyl cinnamate in cinnamein	in small amount	in very small amount	only traces
Vanillin	0.05 per cent.	0.046—0.05 per cent.	0.044 per cent.
Free benzoic acid	only a small amount	none	the greater part
Free cinnamic acid	the greater part	exclusively	in minute quantity
Resin	80 per cent.	30 per cent.	78.5 per cent.
Free resin alcohol	none	none	at least 5.7 per cent.
Resinotannol	Tolu-resinotannol, $C_{17}H_{18}O_5$	Peru-resinotannol, $C_{18}H_{20}O_5$	Tolu-resinotannol, $C_{17}H_{18}O_5$
Benzoic acid in resin	small amount	very small amount	all
Cinnamic acid in resin	in predominant quantity	in predominant quantity	none

THE ammonia test as described in the French Pharmacopœia has been found to be more satisfactory than those described in other Pharmacopœias. The minimum amount of 10 per cent. ammonia which will yield a clear solution at 15° C. with 5 c.c. of a solution of pure quinine sulphate saturated at 15° C., is 4.4 c.c. The saturated solution is prepared by dissolving the salt in 30 c.c. of boiling water, cooling to 15° C. with shaking, then leaving at this temperature for 30 minutes with stirring. The requirements of the German, French and Dutch Pharmacopœias are either impossible of fulfilment or unnecessarily stringent. The author considers a minimum of 6.0 c.c. of ammonia to be reasonable. Variations in the basicity of quinine sulphate affect the amount of ammonia required. Salts which are basic appear less pure than is actually the case. Inorganic salts exercise a considerable influence on this test; in fact, the ammonia test can only be used with satisfactory results on quinine sulphate, and not on the other salts. The present B. P. test for cinchonine and cinchonidine is to be preferred to the ammonia test, as the former can be applied to any salt. This test is more delicate if “Æther Purificatus” be used in place of “Æther.” The ammonia test is the only means of detecting hydroquinine, apart from actually isolating this alkaloid, the presence of which, however, may be no drawback.—F. SHDN.

The quino-quino balsam examined was in reddish-brown irregular pieces, with a pleasant aromatic odour when warmed, like that of Tolu balsam. When melted and examined with the microscope when cold, it shows numerous crystals.—J. O. B.

Mace, Papuan; Detection of — [in Banda mace]. C. Griebel. Z. Untersuch. Nahr. Genussm., 1909, 18, 202.

THE arillus of *Myristica argentea*, a native of New Guinea, is met with in commerce under the names of Papuan or Macassar mace. It is less powerfully fragrant, and has a somewhat different aroma from that of true mace from *Myristica fragrans*, and it fetches a markedly lower price. The whole mace of *M. argentea* is readily distinguishable from that of *M. fragrans*, since the arillus is divided into four large bands only, which are entire, except at the upper portion, and are re-united at the apex. The colour is brighter, especially after powdering. The odour of powdered Papuan mace is peculiar, somewhat resembling that of saffras, possibly owing to the presence of safrol in the essential oil. The admixture of powdered Papuan with Banda mace cannot be detected microscopically. To detect the substitution or admixture, 0.1 gm. of the powder is extracted by agitation for one minute with 10 c.c. of light petroleum spirit, and filtered. Simultaneously, the same amount of genuine Banda mace

powder is similarly treated, as a control. About 2 c.c. of each filtrate are then mixed with an equal volume of acetic acid, and strong sulphuric acid is added to each, avoiding admixture. The extract of Banda mace will show a yellow ring of colour at the zone of contact; in the presence of Papuan mace, a reddish tint will be developed, more or less rapidly, the depth of the colour being proportional to the amount of adulterant present. If no such colour appears after 1 to 2 minutes, the absence of false mace may be assumed. Genuine mace begins to show a reddish tint after that time. More definite confirmation may be obtained by isolating the resinous constituents which give rise to this colour-reaction. The petroleum ether extracts are evaporated, and the essential oil is driven off. The residues are taken up with ether; free acids are removed by shaking the ether solution first with sodium carbonate solution, then six or eight times with 1 per cent. sodium hydroxide solution, until the alkaline liquid is no longer coloured on adding excess of sulphuric acid. The mixed alkaline extracts are acidified, and again shaken with ether. On evaporating the ether extracts, the residue of true mace gives at first a brown, and then a brownish-red colour with sulphuric acid. The residue from Papuan mace is immediately coloured bright raspberry red, passing to magenta.—J. O. B.

Camphor; Chinese —. Chem. and Drug. Nov. 27, 1909. [T.R.]

IN 1907 23,231 cwts., valued at £271,433, was exported from Foochow, while in 1908 the figures fell to 9,644 cwts., valued at £69,302. The average value per cwt., which rose from £11 15s. in 1906 to £13 15s. in 1907, fell in 1908 to £7 3s. 9d. The falling market is attributed to the speculation in 1907, when prices rose abnormally high. The inevitable collapse followed, partly due to the fact that it was feared synthetic camphor could be manufactured at lower prices than natural, but principally because the home markets were overstocked, the supplies at Foochow excessive, and speculators at both ends in a hurry to get rid of their stocks because of the declining rates. In addition to this, Formosa camphor was being sold at continually lower prices. Camphor oil was exported in 1908 to the amount of 99 cwts. (£119), against 10,345 cwts. (£20,805) in 1907.

Otto of rose, 1909. J. C. Umney. Chem. and Drugg., 1909, 75, 786.

THE characters of samples of different brands of otto of rose of the present season, are shown in the following table:—

Sp. gr. at 30°/15° C.	Refractive index at 25° C.	M. pt. ° C.	Alcohols, as C ₁₀ H ₁₈ O, per cent.	Odour.
0.861	1.4622	21—22	76.1	Very soft and lasting
0.860	1.4635	21—22	73.3	Very sweet
0.858	1.4630	21	74.1	" "
0.860	1.4620	21—22	73.7	Fine "
0.856	1.4620	21—22	72.5	Not very lasting
0.860	1.4640	21—22	75.1	Fair
0.857	1.4612	21	75.5	Strong and coarse
0.860	1.4630	21—22	78.2	Impure
0.862	1.4640	21	78.4	

NOTE.—The otto was placed on blotting paper, and the odour tried immediately, after one hour, and after 24 hours.

For the purposes of comparison the characters of otto of rose of the 1896 season, are given:—

Sp. gr. at 30°/15° C.	Crystallising point, ° C.	Alcohols, as C ₁₀ H ₁₈ O, per cent.	Quality.
0.8556	20.9	70.1	Fine
0.8599	20.4	72.3	
0.861	20.4	73.1	
0.859	20.6	72.3	
0.856	21.7	69.2	
0.863	19.4	75.6	Impure
0.868	18.7	77.6	
0.868	18.9	76.6	

It will be noticed that the percentage of alcohols in line otto of rose has risen appreciably since 1896. The fact that impure specimens of otto of rose agree more closely in specific gravity and congealing point with pure otto of rose than was the case in 1896, is probably due to the use, as adulterant, of otto of rose steoptene, large quantities of which are now produced in the manufacture of oil free from steoptene. The author concludes from his results that adulteration is now carried out much more skillfully than ten years ago; and that any samples which show characters much outside fairly well-defined limits may be at once condemned as impure. Samples with characters only slightly outside the limits of the season's otto should not be condemned if the odour is of the finest quality. The purity of a sample of otto of rose cannot be judged from the physical and chemical characters alone; the odour must also be taken into consideration.—A. S.

Oil of cloves; Composition of —. Aldehydic and ethereal constituents. H. Masson. Comptes rend., 1909, 149, 795–797.

FROM the portion of the oil boiling at 65°–90° C. under 15 mm. pressure, the author has isolated, by means of sodium bisulphite, α -methylfurfuraldehyde, and from the fraction boiling at 105°–120° C. under 15 mm. pressure, a dimethylfurfuraldehyde the constitution of which was not ascertained. The latter fraction contained also methyl salicylate.—J. C. C.

Essential oils. H. Haensel. Chem. Zentr., 1909, 2, 1556–1557.

Birch bud oil. A sample examined had the sp. gr. 0.9748 at 20° C., $[a]_D = -5.73^\circ$. It contained 47.1 per cent. of betulol in the free state and 29.6 per cent. in the form of esters (betulyl acetate and probably formate).

Ficaria oil. By steam-distillation of the plant, *Ranunculus ficaria*, L., there was obtained a dark-brown oil permeated with solid matter, and having a tobacco-like odour. The oil had the sp. gr. 0.9101 at 24° C. after filtration. It distilled between 150° and 310° C. It contained palmitic acid and reduced ammoniacal silver solution.

Macassar sandalwood oil. Sp. gr. 0.9723 at 18° C., $[a]_D = -16.92^\circ$; soluble in 2 parts or more of 70 per cent. alcohol; saponification value, 7.7; santalol content, 96 per cent.

New Caledonia sandalwood oil. Sp. gr. 0.9665 at 20° C., $[a]_D = -21.69^\circ$; soluble in two parts or more of 70 per cent. alcohol; saponification value, 6.1; santalol content, 95.5 per cent. The oil was yellow in colour and could not be distinguished from East Indian oil with regard to odour.

Asparagus root oil. 0.0108 per cent. of a dark brown oil with an intense sourish smell was obtained from dry asparagus roots. It contained palmitic acid, and had the sp. gr. 0.8777 at 23° C., acid value, 33; ester value, 68.

Spikenard (Valeriana celtica) oil was obtained with a yield of 0.1 per cent. It was a thick yellow oil with an odour resembling that of valerian and hazelwort oils. Sp. gr. 0.9693 at 20° C., $[a]_D = -42^\circ$, saponification value 62.5, ester value of oil after saponification and acetylation, 71.9. It was miscible in all proportions with 90 per cent. alcohol, and contained palmitic acid and a sesquiterpene with b.pt. about 255° C., sp. gr. 0.9359 at 20° C., and $[a]_D = -30.88^\circ$.—A. S.

Rhus Cotinus or Young Fustic; Essential oil of —. G. Perrier and A. Fouchet. Bull. Soc. Chim., 1909, 5, 1074–1075.

THE leaves and twigs of *Rhus Cotinus* or "Young Fustic" were subjected to steam-distillation, and the distillate extracted with ether. The ethereal solution when dried and distilled, left an oil, amounting to about 0.1 per cent. This oil is colourless and has a smell resembling that of turpentine. It has the sp. gr. 0.875 at 15° C., a refractive index of 1.4693, and $n_D = +13^\circ$ at 18° C.; it dissolves in all proportions in 94 per cent. alcohol. The solubility in 90 per cent. alcohol is 33, in 85 per cent. alcohol 10, and in 80 per cent. alcohol 6 per cent. The oil becomes resinified and yellow on exposure to the air. 1 gm. of the oil neutralises 6.1 mgrms. of potassium hydroxide, and when hydro-

lysed the same weight of the oil requires 34.3 mgrms. The free primary alcohols in 1 grm. of the oil correspond to 79 mgrms. of phthalic acid. F. SHDN.

Carvenene and "terpinene." Essential oils; Constituents of — F. W. Semmler. Ber., 1909, 42, 4171–4174.

THE author has made further experiments with carvenene obtained from carvenone (this J., 1909, 106). When oxidised with alkaline permanganate at the ordinary temperature, carvenene yields α,α' -dihydroxy- α -methyl- α -isopropyladipic acid, m.pt. 189° C., which can readily be converted into the dilactone, m.pt. 72°–73° C. Carvenene must be, therefore, $\Delta^1,3$ -dihydrocymene, which Wallach has described as α -terpinene (this J., 1909, 959). The author considers that carvenene prepared as above is practically pure.—F. SHDN.

Adrenaline; Iodic acid reaction of — L. Kranss. Biochem. Zeits., 1909, 22, 131.

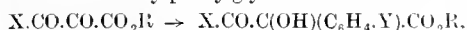
FRAENKEL and Allers have recently described (this J., 1909, 671) a reaction of adrenaline [adrenine] with iodic acid which had already been described by the author (*loc. cit.*, 1908, 1039). With the author's mode of procedure, the liberation of free iodine can be detected. Fraenkel and Allers, on the other hand, did not detect iodine at any stage of the reaction. The author finds, however, that the iodine may be detected in the following way:—A few drops of iodic acid solution (1:20) are mixed with a few drops of adrenaline solution (1:1000); on adding a few drops of starch solution, the characteristic blue colour appears.—Fraenkel and Allers mode of effecting the reaction is, however, more sensitive than that described by the author.—L. E.

Resorcinol; Characteristic reaction of — with copper sulphate and potassium cyanide solutions. Volcy-Boucher and J. Girard. Répertoire Pharm., 1909, 21, 433–434.

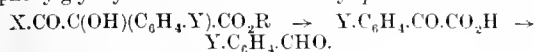
A FEW c.c. of the liquid to be tested are treated with a few drops of 10 per cent. solution of copper sulphate, followed by an equal volume of 10 per cent. potassium cyanide solution. On shaking, a reddish colour is developed; the mixture is then diluted with water to a reddish-yellow tint. When observed by reflected light it will show a very marked green fluorescence in the presence of resorcinol. This fluorescence is quite distinct with a dilution of 1 in 10,000.—J. O. B.

Aldehydes; New general methods of synthesising aromatic — A. Guyot. Comptes rend., 1909, 149, 788–790.

$\alpha\beta$ -Diketonic esters condense with phenols or tertiary amines to form acylphenylglycollic esters:



which when heated with sulphuric acid furnish aldehydes. As, however, the aldehydes produced are attacked by sulphuric acid, it is better first to boil the esters with an aqueous solution of a copper salt and to boil the resulting phenylglyoxylic acids with dimethyl-*p*-toluidine:



The same aldehydes can also be obtained by heating the acylphenylglycollic esters with aqueous potassium hydroxide and oxidising the resulting phenylglycollic acids with alkaline potassium ferricyanide. The mesoxalic esters, $CO_2R.CO.CO_2R$, can replace the diketonic esters in the above reactions.—J. C. C.

Xeroform (bismuth-tribromophenol); Determination of bismuth in — O. Schlenk. Pharm.-Zeit., 1909, 54, 538.

FROM 1 to 2 grms. of the compound are boiled with about 20 c.c. of 10 per cent. sodium hydroxide solution, with constant stirring, until the bismuth is entirely converted into oxide. The precipitate is then washed, on a filter, with hot dilute sodium hydroxide solution, until the filtrate contains no more tribromophenol. The precipitate is then washed with hot water, transferred to a crucible, and incinerated. The residue is moistened with dilute nitric

acid, and again gently incinerated. Treated in this manner xeroform should yield about 50 per cent. of bismuth oxide.—J. O. B.

Fat and wax of tubercle bacilli. Fontes. See XII.

Recovery of tartaric acid from residues of wine manufacture. Janson. See XVII.

PATENTS.

Substances for conferring on human beings and other animals immunity against disease; Production of — Kalle and Co., Akt.-Ges., Biebrich-on-Rhine, Germany. Eng. Pat. 1431, Jan. 20, 1909. Under Int. Conv., March 24, 1908.

IMMUNITY against a disease may be conferred upon a human being or an animal by injecting into the blood, disintegrated immune blood or organism cells, obtained from another human being or animal which has passed through the disease in question. The disintegration can be carried out by pouring the blood into a solution of common salt and utilising the clear liquid which separates. The mass which settles to the bottom of this liquid can be removed, ground in a mortar, and filtered. The filtrate contains immunity-conferring bodies. The disintegration can also be effected by physiological or mechanical means.—F. SHDN.

Pharmaceutical compounds [from chaulmoogra oil]; Preparation of new — P. A. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 1984, Jan. 27, 1909.

CHAULMOOGRA oil, obtained from the seeds of *Taraktogenos kurzii*, is hydrolysed, and purified by means of hot water or steam. The mixture of acids thus obtained is esterified and purified by distillation in a vacuum. The oil so obtained can be used for medicinal purposes.—F. SHDN.

Salve and ointment; Non-odorous phenol — N. Sulzberger, New York. U.S. Pat. 938,614, Nov. 2, 1909.

AN ester of a monohydric phenol with a fatty acid which has more than twelve carbon atoms, the melting point of which is above 40° C., is mixed with a sufficient quantity of an unguent to reduce its melting point to about body temperature. Phenyl stearate of m. pt. 52° C. may be used as the basis of the ointments, which are stated to be odourless and non-irritant.—T. F. B.

p-Aminophenylarsinic acid; New mercury salt of — J. Altschul, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 938,939, Nov. 2, 1909.

A MERCURY salt of *p*-aminophenylarsinic acid, of the composition, $NH_2.C_6H_4.AsO_4.H_2Hg$, is obtained by the action of an alkali salt of the acid on a mercury salt in presence of excess of alkali; it is soluble with difficulty in water, insoluble in alcohol and ether, and is decomposed by caustic soda solution, with formation of yellow mercuric oxide. It contains about 46 per cent. of mercury and 17 per cent. of arsenic. (Compare Eng. Pat. 8959 of 1908 and U.S. Pat. 914,408 of 1909; this J., 1909, 442.)—T. F. B.

Phenol halogen phthalein compound. W. R. Orndorff, Ithaca, N.Y., Assignor to Parke, Davis, and Co., Detroit, Mich. U.S. Pat. 939,075, Nov. 2, 1909.

HALOGENATED phenolphthaleins are obtained by heating phenols with halogenated phthalic acids in presence of dehydrating agents until solidification of the mixture takes place. The phthalein thus obtained from phenol and tetrachlorophthalic acid melts at about 316° C., is colourless, tasteless, and odourless; soluble in methyl and ethyl alcohols, acetone, ether, and acetic acid, and insoluble in water and petroleum spirit; it is also soluble in solutions of alkali hydroxides and carbonates, and is reprecipitated from these solutions by acids.—T. F. B.

Carbon chlorides; Process of utilising — H. Pichon and T. Truchelut. Fr. Pat. 402,235, April 20, 1909.

THE use of carbon tetrachloride and other chlorides of carbon has been restricted in many industries by their tendency to decompose, with the liberation of hydrochloric

acid, particularly when mixed with light petroleum. According to the present invention this tendency is entirely suppressed by adding to the carbon chloride from 1 to 5 per cent. of oil of turpentine or other hydrocarbon with a great affinity for oxygen.—J. F. B.

Tribromocatechol; Process for preparing —. Chem. Fabr. von Heyden A.-G. Ger. Pat. 215,337, July 19, 1908.

WHEN catechol is treated with three mols. of bromine, in presence of solvents other than acetic acid, tribromocatechol of m. pt. 138°–139° C. is obtained: it crystallises with 1 mol. of water. It is readily soluble in alcohol, ether, and acetone, but sparingly soluble in water, chloroform, and petroleum spirit. On methylation it is converted into tribromoveratrol, of m. pt. 85°–86° C. It possesses antiseptic properties. (On bromination in presence of acetic acid, catechol is converted into di- and tetra-bromo derivatives.)—T. F. B.

Alkyl ethers of phenols and other aromatic hydroxylic derivatives; Manufacture of —. A. Gerber, Bonn on Rhine, Germany. Eng. Pat. 17,834, July 31, 1909. Under Int. Conv., July 31, 1908.

SEE Ger. Pat. 214,783 of 1908; this J., 1909, 1223.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Burnt manuscripts rendered legible by photography. Reiss. Pharm. Zentralh., 1909, 50, 739.

THE burnt paper is carefully placed on a glass plate, and cautiously brushed over with varnish. Another sheet of glass is then superimposed and the whole is fastened in a printing frame. A photograph is taken of the burnt paper, using an orthochromatic plate and suitable colour screens if vegetable ink has been employed; in the case of inks with an iron base, or one of aniline colours, the negative may be taken in the ordinary way. In the case of pencil marks, the objective must be inclined on its axis, so that light reflected from the graphite marks may traverse it. The writing may sometimes thus be deciphered even on manuscripts which have been torn in pieces before being burnt.—J. O. B.

Detecting traces of chlorides in gelatin. Lüppe-Cramer. See XIV.

PATENTS.

Toning green by means of vanadium; Solid preparation for — and method of preparing it. Chem. Fabr. auf Actien vorm. E. Schering. Ger. Pat. 215,071, Jan. 16, 1909.

WHEN liquid vanadium chloride (500 grms.) is mixed with anhydrous oxalic acid (1310 grms.), a solid product is produced, which is readily soluble in water, and which can be compressed into tablets suitable for use in toning silver bromide prints green. A toning bath may be prepared by dissolving 3.8 grms. of the above product, 1.5 grms. of anhydrous oxalic acid, 1 gm. of ferrie oxalate, and 1 gm. of potassium ferriocyanide in 1 litre of water; in this solution the prints will be toned in from 3 to 5 minutes.—T. F. B.

Rendering soft and supple, products [films] from cellulose acetate. Fr. Pat. 402,083. See XIX.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives in the United States; Permissible —. J. A. Holmes. Mining World, Nov. 20, 1909.

THE following is a list of permissible explosives tested by the United States Geological Survey at Pittsburg, Pa.

Subject to the provisions named below, a permissible explosive is defined as an explosive which is in such condition that the chemical and physical tests do not show any unfavourable results; which has passed gas and dust gallery tests Nos. 1 and 3, as described in circular No. 1 (U.S. Geol. Survey, Explosives circular); and of which, in test No. 4, $1\frac{1}{2}$ lb. (680 grms.) has been fired into the mixture there described without causing ignition.

Aetna coal powder A.A. B. and C, Aetna Powder Co. Bituminite No. 1, Jefferson Powder Co. Black Diamond Nos. 3 and 4, Illinois Powder Manufacturing Co. Carbonite Nos. 1, 2, 3, 1-L.F., and 2-L.F., E. I. Du Pont de Nemours Powder Co. Coalite Nos. 1 and 2D, Potts Powder Co. Coal Special Nos. 1 and 2, Keystone Powder Co. Collier dynamite Nos. 2, 4, and 5, Sinamahoning Powder Mfg. Co. Giant A, B, and C low-flame dynamite, Giant Powder Co. Masurite M.L.F., Masurite Explosive Co. Meteor dynamite, E. I. Du Pont de Nemours Powder Co. Mine-ite A and B, Burton Powder Co. Monobel, E. I. Du Pont de Nemours Powder Co. Tunnelite Nos. 5, 6, 7, and 8, G. R. McAbee Powder and Oil Co.

Provided: (1) That the explosive is in all respects similar to sample submitted by the manufacturer for test. (2) That No. 6 detonators, preferably No. 6 electric detonators (double strength), are used of not less strength than 1 gm. charge, consisting by weight of 90 parts of mercury fulminate and 10 parts of potassium chlorate (or its equivalent), except for the explosive "Masurite M. L. F.," for which the detonator shall be of not less strength than $1\frac{1}{2}$ grms. charge. (3) That the explosive, if frozen, shall be thoroughly thawed in a safe and suitable manner before use. (4) That the amount used in practice does not exceed $1\frac{1}{2}$ lb. (680 grms.), properly tamped.

The above partial list includes all the permissible explosives that have passed these tests prior to Oct. 1, 1909.

Recovery of volatile liquids by cooling. Claude. See I.

PATENTS.

Pyroxylin; Process for preparing raw materials for the manufacture of —. E. Nowicki. Fr. Pat. 402,197, Apr. 19, 1909.

FLAX, hemp and ramie, or their wastes, are claimed as raw materials for nitration in the manufacture of pyroxylin, the fibres being bleached and purified and submitted to a mechanical preparation to bring them into a suitable state for the process. It is stated that since these fibres are devoid of cuticle, and when mechanically prepared, their central canals are open at both ends, they are far more amenable to the uniform action of the acid than cotton fibres. Moreover, the finished product may be compressed to a greater density than nitrated cotton. If desired, these fibres may be mixed with cotton or other cellulose fibres before nitration.—J. F. B.

Manufacture of cellulose. Eng. Pat. 23,192. See XX.

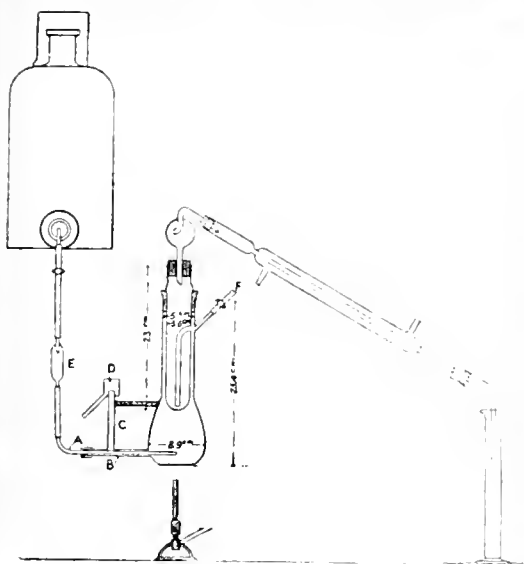
Preparing wood pulp for manufacture of artificial filaments and nitrocellulose. Fr. Pat. 402,462. See XIX.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Volatile acids in wines and vinegars; Apparatus for use in the determination of —. H. C. Gore. U.S. Departmt. of Agric. Aug. 18, 1909. Bureau Chem., Circular No. 44.

IN this modification of the Hortvet-Sellier apparatus, a copper flask is substituted for the outer glass flask and a constant feed device for the flask has been added; there are also two changes of a minor nature consisting in a small ridge blown in the inner flask to form a shoulder for the rubber gasket and the elimination, as unnecessary, of the dropping funnel. The constant water feed is operated by running the supply water through tube, A



(see fig.), which passes through tube, *b*. The overflow passes through *b*, and rises through tube, *c*, to the small basin, *d*, which is connected with the drain. Tube, *a*, is placed within tube, *b*, because steam is so prevented from passing out through *b*. Distilled water should be used which has been largely freed from carbon dioxide by passing a rapid stream of air through it for 20–30 minutes. The water should be admitted somewhat more rapidly than it is used. The rate of flow is conveniently regulated by comparing the rate of drip in the small sight tube, *e*, with that from the condenser. Experiments with the apparatus showed that when tap water was supplied to the generator there was an error due to the presence of carbon dioxide in the distillate, equal to about 0.3 c.c. of *N*/10 alkali in 100 c.c., phenolphthalein being used as indicator. When ordinary distilled water was used, the error was about 0.15 c.c. When distilled water was employed from which the greater portion of carbon

of the outer flask being open. All connections are made tight and tube, *f*, closed. In the case of wines, about 100 c.c. of the distillate are collected. In the case of vinegars, from 200 to 300 c.c. are required. The distillate is titrated with standard alkali free from carbonates, using phenolphthalein as indicator, and 0.05 c.c. is subtracted from the number of c.c. of alkali used, for each 100 c.c. of distillate. About fifteen minutes are required for a determination of volatile acid in wine and from thirty to forty-five minutes in the case of vinegar. The volume of liquid in the inner flask increases but very slowly during a determination.

PATENT.

Pyrometer. J. L. Zander, Newark, N.J. U.S. Pat. 938,934, Oct. 26, 1909.

THE claim is for a mechanical pyrometer comprising a casing provided with a dial and an index. The latter is actuated by the expansion of two rods of different materials, which are linked together, and are situated inside an expansion tube, which is fixed to the casing. The extremity of the one expansion rod is fixed to the free end of the expansion tube and the free end of the other expansion rod is connected by means of a "spring-controlled arbour" with a pinion and crank, the latter actuating the dial with the interposition of a suitable gearing arrangement. This comprises an arm, upon which is a toothed sector which engages with the pinion, a stem connected with the crank, a link connected with the stem, and a tubular element connected with the link.—O. R.

INORGANIC—QUALITATIVE.

Metals of the second group: New method for the qualitative detection of — without using sulphurated hydrogen and ammonium sulphide. E. Selvaen, Bull. Assoc. Chim. Suér. et Dist., 1909, 27, 361–367.

THE acid filtrate from the metals of the first group is treated with thioacetic acid, heated just to boiling, cooled and filtered. After washing, the mixture of sulphides is heated with concentrated nitric acid, the solution thus obtained, and the residual precipitate being treated as follows:—

The filtrate (arsenic, lead, bismuth, copper, cadmium) after expulsion of excess of nitric acid, is treated with excess of sodium hydroxide.

Precipitate (copper, bismuth, cadmium) is dissolved in nitric acid, the solution being precipitated with ammonia.

Filtrate (arsenic, lead) is treated with dilute sulphuric acid.

Precipitate, Bismuth.

Filtrate (copper, cadmium) is acidified with hydrochloric acid and treated with potassium thiocyanate.

Precipitate, Lead.

Filtrate, Arsenic.

Precipitate, Copper.

Filtrate, Cadmium.

The precipitate (tin, antimony, mercury, and some lead) is treated with alkaline ammonium tartrate which dissolves the lead sulphate. The residue is dissolved in *aqua regia*; after expelling excess of acid, the solution is treated with hydrazine hydrochloride or sulphate.

Precipitate, Mercury.

Filtrate, Tin, antimony.

—L. E.

dioxide had been removed by aeration, the error was but 0.05 c.c. The error is constant and may be subtracted from each determination. The apparatus is operated as follows: Place 10 c.c. of the sample in the inner flask, which should have been removed from the outer flask and should be quite cool. If the sample is noticeably charged with carbon dioxide, a current of air should be passed through it for a few minutes by attaching to the flask a stopper bearing a glass tube which is connected with suction. The air passes in through the side tube in the flask and washes out practically all the carbon dioxide in the sample, without removing appreciable quantities of volatile acid. Connect the flask with the distilling bulb and place in the outer flask, tube, *f*,

Arsenious acid: Detection of — in presence of arsenic acid, by means of electrolysis. E. Covelli, Chem.-Zeit., 1909, 33, 1209.

IN alkaline solution, arsenites, when submitted to electrolysis, evolve arsine at the cathode, whilst arseniates do not. To detect arsenites in presence of arseniates, 30 c.c. of the solution made alkaline by potassium hydroxide, are electrolysed in a U-tube, in the upper part of the cathode limb of which, a piece of paper impregnated with silver nitrate solution is suspended. In a very few minutes (10 minutes, if 0.01 mgrm. of arsenic trioxide be present) the paper is coloured deep brown if any arsenite be present.—J. T. D.

Detecting traces of chlorides in gelatin. Lüppo-Cramer. *See XIV.*

INORGANIC—QUANTITATIVE.

Lead; Volumetric determination of — with potassium permanganate. H. Bollenbach. *Chem.-Zeit.*, 1909, **33**, 1142—1143.

THE method depends upon the oxidation of an alkaline lead solution with permanganate. The course of the reaction has not been satisfactorily determined, but numerous experiments have shown that concordant and accurate results can be obtained. The permanganate is standardised with lead nitrate, 20 c.c. of a solution of permanganate containing about 3 grms. per litre being mixed in a 400—500 c.c. flask with 300—400 c.c. of hot distilled water, about 5 c.c. of $N/2$ sodium hydroxide solution, and 2—5 grms. of potassium nitrate (to accelerate the settling of the precipitate produced subsequently). A solution of lead nitrate of known lead-content is now run in from a burette, the mixture being shaken vigorously and allowed to settle after each addition, until the pink colour disappears. The actual determination is carried out in a similar manner, the alkaline lead solution being treated with excess of permanganate, and the excess titrated with the lead nitrate solution. A. S.

Determining sulphurous acid in the gas from sulphur furnaces. Pellet. *See VII.*

Analysis of nitrates. Sanin. *See VII.*

Determining colloids in clays. Endell. *See IX.*

Determining titanio acid in ilmenite. Röer. *See X.*

Determining cuprous oxide in copper and its alloys. Greaves. *See X.*

Determination of zinc and analysis of zinc ores. Voigt. *See X.*

Analysis of oil of turpentine by bromination and determining bromine by means of sodium formate. Mansier. *See XIII B.*

PATENT.

Process of assaying for silver. U.S. Pat. 939,413. *See X.*

ORGANIC—QUALITATIVE.

Colour reaction of gelatin. Liesegang. *See XIV.*

Detecting saccharin and other artificial sweetening agents in foods and beverages. Bianchi and di Nola. *See XVIII A.*

Tests for purity of quinine sulphate. Tutin. *See XX.*

Detection of Papan mace [in Banda mace]. Griebel. *See XX.*

Iodic acid reaction of adrenaline [adrenin]. Krause. *See XX.*

Reaction of resorcinol with copper sulphate and potassium cyanide. Volcy-Boucher and Girard. *See XX.*

ORGANIC—QUANTITATIVE.

Total nitrogen determination by the Kober method. F. W. Gill and H. S. Grindley. *J. Amer. Chem. Soc.*, 1909, **31**, 1249—1252.

ON determining the total nitrogen of several organic substances by the Kober aeration method, it was found that in the cases of cottonseed meal, wheat bran, rice bran, and linseed oil meal, the result was lower than the figure obtained by the official distillation procedure. These four substances contain respectively, in the order named, 6.9, 6.6, 6.4, and 5.9 per cent. of magnesium,

and 15.0, 13.5, 11.4 and 8.1 per cent. of phosphorus; whereas the average content of seventeen other vegetable substances is 1.6 per cent. of magnesium and 2.74 per cent. of phosphorus. The authors conclude that in the cases named, magnesium ammonium phosphate is formed, thereby preventing the removal of the nitrogen. The difficulty can be overcome by keeping the aerating solutions in the Kjeldahl flasks warm during the entire period of aeration. The Kober aeration procedure has the advantage over the official method in that it requires no attention when once started and no heat is used for distillation, save in the cases above specified. The Kober method is carried out in the following manner. After the usual digestion of the organic material in the Kjeldahl flasks with 25 c.c. of concentrated pure sulphuric acid, mercury, and potassium sulphate, the liquids are cooled, and from 90 to 95 c.c. of distilled water free from ammonia are then added to each of the flasks. After cooling to room temperature, the flasks are connected to 16-ounce bottles, each of which contains a measured excess of standard sulphuric acid plus 130 c.c. of water for absorption of the ammonia. The Kjeldahl flasks are also connected to vessels, from which is drawn through a widened tube, by the air current, the necessary amount of caustic soda-sodium sulphide solution. After the alkaline solution has been drawn into the flasks, wash-bottles containing the dilute sulphuric acid for rendering the air for aeration free from ammonia, are attached in place of the vessels which contained the caustic alkali solution. The rapid, but not violent, aeration of the solutions in the Kjeldahl flasks is continued for at least one and a half hours. — H. H. S.

Analysis of asphaltum. Bornemann. *See III.*

Examination of asphaltic material. Parr and others. *See III.*

Analysis of oil of turpentine by bromination. Mansier. *See XIII B.*

Influence of method of mashing on amount of extract yielded by malt. Windisch and others. *See XVII.*

Determining creatinin [in meat extracts, etc.]. Chapman. *See XVIII A.*

Determining casein in milk. Van Slyke and Bosworth. *See XVIII A.*

Determination of cellulose. Renker. *See XIX.*

Alkaloidal standard for, and determination of alkaloids in Nux vomica seeds. Weigel. *See XX.*

Determination of bismuth in xeroform (bismuth tribromophenol). Schlenk. *See XX.*

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Acetylene; Action of metallic magnesium on —. J. Novák. *Ber.*, 1909, **42**, 4209—4213.

THE product obtained by heating metallic magnesium in acetylene gas consists of a mixture of bodies the nature of which is not yet definitely determined. On treating the reaction-product with water, acetylene and allylene gases are evolved and may be separated by their varying behaviour towards an ammoniacal solution of cuprous chloride containing excess of ammonium chloride; copper acetylide is insoluble in the reagent, whereas copper allylenide is soluble. The reaction may be advantageously used for the preparation of allylene. Other hydrocarbons and also alcohols and wood charcoal when heated with magnesium yield similar products.—J. L. H.

Tobacco fermentation. F. W. J. Boekhout and J. J. Ott de Vries. *Zentralbl. f. Bakter. u. Parasitenk.*, 1909, II. Abt., 24, 496—511. *Chem. Zentr.*, 1909, 2, 1583.

TOBACCO leaves are oxidised by oxygen at 33° C., and more rapidly at 100° C., oxygen being combined and carbon dioxide liberated. The action is greater in presence of water. Besides carbon dioxide, other volatile compounds are produced; the quantity of non-nitrogenous extractive matter, including pentosans, is reduced, and furfural is formed. According to the authors the "fermentation" of tobacco is a chemical process due to the action of the oxygen of the air, the iron present in the plant probably acting as a catalyst. Dutch tobacco contains 6—9 mgrms. of ferric oxide per 10 grms. of leaves. —A. S.

Patents Act, 1907; Decisions under the —. Times, Nov. 27 and 30, 1909.

THE Comptroller-General of Patents has refused to revoke a patent of 1900, at present owned by De Dion Bouton (Limited), relating to improvements in valve-operating mechanism. Revocation was applied for on the ground that the patented article is manufactured mainly or exclusively outside the United Kingdom. It was admitted by the applicants that the patent was of little or no value, but it was alleged that the patentees had abused their monopoly rights. The Comptroller, however, came reluctantly to the conclusion that he was unable on that ground to revoke the patent. He gave the patentees 15 guineas costs.

The Comptroller has also refused to revoke letters patent of 1904 for a method and apparatus for cutting plates and other metal articles by means of a blow-pipe or burner. Revocation was applied for on the ground that the manufacture of the patented article was carried on mainly or exclusively abroad; but the owners of the patent, the British Oxygen Company, alleged that at the date of the hearing there was a substantial manufacture in this country.

there are concise descriptive paragraphs of introductory character, with descriptions of analytical methods. The subdivisions are the following:—(1) Water. (2) Assaying. (3) Fends. (4) Sulphuric acid. (5) Alkali. (6) Bleaching powder. (7) Nitre and explosives. (8) Ceramics. (9) Glass. (10) Mortar and cement. (11) Illuminants. (12) Starch and sugar. (13) Fermentation industries. (14) Fats and oils. (15) Essential oils and perfumery. (16) Tanning agents. (17) Textile fibres and paper. (18) Photography. (19) Dyestuffs and colours. (20) Physiological chemical analysis. IV. Appendix. Various recipes, etc. The subject matter fills 580 pages.

THE PREVENTION OF INDUSTRIAL ACCIDENTS. No. 1. General Pamphlet. Prepared by FRANK E. LAW, M.E., and WILLIAM NEWELL, A.B., M.E., of the Staff of the Fidelity and Casualty Company of New York. Published by the Fidelity and Casualty Company of New York, 92 to 94, Liberty Street, and 97 to 103, Cedar Street, New York, 1909. Price 25 c.

8vo volume (pamphlet), containing 185 pages of subject matter, and 72 illustrations. There is an alphabetical index of subjects, and the directions in which both employers and employed are warned and admonished of danger are comprised as:—I. General items of care on the part both of employer and employed: (i.) Physical surroundings. (ii.) Insufficient lighting. (iii.) Overcrowding of machinery. (iv.) Slippery floors. (v.) Ignorance. (vi.) Carelessness. (vii.) Unsuitable clothing. (viii.) Failure to use safeguards provided. (ix.) Overwork. (x.) Ventilation. (xi.) Intoxicants. (xii.) Supervision and management. (xiii.) Rules. (xiv.) Inspections. But the safety devices themselves treated of and described in the work are grouped under the following heads:—I. Steam boilers. II. Engines. III. Electrical apparatus. IV. Elevators. V. The factory. VI. Wood-working machinery.

VAN NOSTRAND'S CHEMICAL ANNUAL, 1909. A Handbook of Useful Data for Analytical, Manufacturing, and Investigating Chemists, and Chemical Students. SECOND ISSUE. Edited by JOHN C. OLSEN, A.M., Ph.D. Constable and Company, Ltd. London, 1909. Price 12s. 6d. D. Van Nostrand Company, New York.

8vo volume, containing 576 pages of subject matter, and the alphabetical index. The early part of the work, consisting chiefly of tables, comprises the International atomic weights for 1909, Mendeleeff's periodic system of the elements, Specific gravity of gases, Tables of physical constants of the elements, Gravimetric factors and their logarithms, Factors for the calculation of indirect gravimetric analyses, Molecular and atomic weights and their logarithms. Next follows a series of tables for the calculation of volumetric analyses. VIII. Basicity of acids with various indicators according to R. T. Thompson. IX. Value of normal solutions of acids and bases. X. Value of normal solutions of oxidising and reducing agents. XI. Value of normal solutions of precipitation reagents. XII. Physical and chemical constants of oils (Seeker). XIII. Physical and chemical constants of fats and waxes (Seeker). XIV. Physical constants of lubricating oils (Lewkowitsch). XV. Physical and chemical constants of representative samples of lubricating oils (Seeker). XVI. Temperature correction for refractive indices of oils. XVII. Temperature correction for specific gravity of oils and fats. XVIII. Conversion of acid value into oleic acid. XIX. Table for calculating the specific gravity of oils at 15.5° C. XX. Polenske value of butter fat. XXI. Conversion of butyro-refractometer readings to indices of refraction. XXII. Reduction of gas volumes to 0 and 760 mm. XXIII. Corrections of barometer readings for temperature. XXIV. Coefficient of expansion of gases. XXV. Density of nitrogen (Dietrich). XXVI. Density of carbon dioxide (Parr). XXVII. Logarithm tables. XXVIII. Physical constants of inorganic compounds. XXIX. Physical constants of organic compounds (E. Emmet Reid, Ph.D., M.A.). XXX. Physical constants of alcohols (A. Seidl). XXXI. Physical and chemical

Books Received.

CHEMIKER-KALENDAR, 1910. Ein Hilfsbuch für Chemiker, Physiker, Mineralogen, Industrielle, Pharmazeuten, Hüttenmänner, u.s.w. Von Dr. RUDOLF BUDERMANX. Einunddreissigster Jahrgang. In zwei Teilen. Julius Springer's Verlag, Monbijouplatz 3, Berlin, 1910. Price M. 4. Bound in leather, M. 4.50.

PART I.—Arranged as a pocketbook, strongly bound in waterproof cloth. It contains an almanack for 1910, together with a table of the more frequently used atomic weights and their multiples. The general text refers principally to matters of purely chemical interest. I. Atomic and molecular weights. II. Different properties of chemical substances. III. Gas and vapour densities. Specific gravities. (1) Alkalis. (2) Acids. (3) Salts. (4) Alcohols, &c. IV. Solubility. V. Analysis. VI. Volumetric analysis. VII. Electrochemical analysis. VIII. Gas analysis. IX. Spectrum analysis. The matter in these various groups is chiefly composed of tables (Hilfstabellen). A notebook calendar with blank pages for notes, is arranged for the different days of the year. The subject matter, exclusive of the calendar and the blank pages for notes, fills 385 pages. A tabular arrangement of the relative coinage values of the world now follows. One side of the external cover of the little volume is utilised as a centimetre scale measure.

PART II.—This supplementary volume is in size similar to the pocketbook, but is unbound, and is more directly concerned with chemical technology. It contains tables relating to:—I. Physics and physical chemistry. II. Mineralogy. III. Technical chemical analysis and investigation. Besides the tabulated matter, however,

constants of essential oils (A. F. Secker). XXXII. Melting point and composition of fusible alloys. XXXIII. Degrees Baumé (American standard) and specific gravity at 60° F. XXXIV. Sulphuric acid. Specific gravity, degrees Baumé and Twaddell. XXXV. Fuming sulphuric acid (T. Winkler). XXXVI. Sulphuric acid (Lunge and Isler). XXXVII. Fuming sulphuric acid (Gnehm). XXXVIII. Nitric acid. (W. C. Ferguson). XXXIX. Nitric acid (Lunge and Rey). XL. Hydrochloric acid (W. C. Ferguson). XLI. Hydrochloric acid (Lunge and Marchlewski). XLII. Acetic acid at 15° (Oudemans). XLIII. Phosphoric acid at 17.5° (Hager). XLIV. Aqua ammoniac (W. C. Ferguson). XLV. Sodium hydroxide solution at 15° (Lunge). XLVI. Potassium hydroxide at 15° (Lunge). XLVII. Sodium carbonate solution (Lunge). &c. LII. Alcohol by volume and weight, per cent. (Gilpin, Drinkwater, and Squibb). LIII. Methyl alcohol (Dittmar and Fawsitt). LIV. Specific gravity of aqueous solutions of chemically pure glycerine (Gerlach and Skälweit). These tables run up to LXXXIV., when a series appears of tables with the fundamental equivalents of metric and U.S. weights and measures, and also of conversion of British Imperial to metric weights and measures. A chapter of Thermochemistry is now approached, and tables LXXXIX to XCIX are devoted to THERMOCHEMICAL UNITS. Heat of combustion of various substances; anthracite coal; bituminous coal; oven coals; lignites; wood; petroleum; natural gas; coal gas; water gas. REVIEW OF CHEMICAL LITERATURE. A classified list now follows of the more important articles that have been published since July, 1906, under Analytical chemistry. General inorganic chemistry. Industrial chemistry. Organic chemistry. Physical chemistry. Radio-activity. NEW BOOKS. List of more important works published since 1906. American and English books. Foreign books, mostly German.

ZUR KENNTNISS DES GERBPROZESSES. [Dissertation.] Von Dr. JOHANN VON SCHROEDER. Sonderausgabe aus den Kolloidchemischen Beiheften, Monographien zur reinen und angewandten Kolloidchemie. Herausgegeben von Dr. WOLFGANG OSTWALD. Band 1. Theodor Steinkopff's Verlag, Dresden, 1909. Price M. 1.50.

Svo pamphlet, containing dedication, introduction, and subject matter filling 57 pages. The matter is classified as follows:—I. The adsorption of tannin by charcoal, alumina, and hide powder. II. Adsorption of tannin by charcoal and alumina from alcoholic solution. III. Course of alteration of concentration of a tannin solution in contact with hide powder. IV. Behaviour of sterilised hide powder-tannin mixture. V. Change of the hide powder during the action of the tannin. VI. Influence of alkali on the adsorption of tannin by hide powder. VII. Adsorption of tannin in alcoholic solution by hide powder. VIII. Precipitation of gelatin by tannin. Influence of acids on the precipitation. I Adsorption of tannin by gelatin. X. Adsorption by gelatin-gel. Influence of salts. Influence of acids. XI. On the nature of the gelatin solution. XII. Similarities in behaviour of hide powder and gelatin. XIII. Theory of tanning. XIV. Summary.

BULLETIN OF THE IMPERIAL INSTITUTE. VOL. VII. No. 3. Price 1s.

This issue contains the results of investigations as to rubbers from Southern Nigeria, Gambia and the Seychelles, goat's hair and mohair from Uganda, tobaccos from Nyasaland, ebony from the East Africa Protectorate, economic products from Fiji, chromite ore from the Transvaal, laterites from the Central Provinces of India, also notes on the occurrence and utilisation of tungsten ores, on iron ores of the Crown Colonies and Protectorates of the British Empire, on the cultivation and utilisation of the soy bean, on agricultural work in Nyasaland, on ylang-ylang oil in the Philippines, on the pearl fisheries of Mergui (Burma), on carnotite from South Australia, etc.

BRITISH AND FOREIGN TRADE AND INDUSTRY. STATISTICAL TABLES AND CHARTS RELATING TO BRITISH AND FOREIGN TRADE AND INDUSTRY (1854—1908.) (IX continuation of certain Tables and Charts contained in the Returns Cd. 1,761 of 1903 and Cd. 2,337 of 1904; with Additions.) [Cd. 4,954.] Wyman and Sons, Fetter Lane, E.C. Price 5s. 2d.

The present return continues and brings up-to-date a number of statistical tables and charts relating to British and foreign trade and industrial conditions, which were included in two volumes prepared by the Board of Trade, and presented to Parliament in 1903 and 1904. (Cd. 1,761 and Cd. 2,337.)

*New Books.

Biltz, Heinr.: Qualitative Analyse anorganischer Substanzen. 3. Aufl. (III., 64 S. m. 8 Fig.) gr. 8°. Leipzig, Veit and Co. 1909. Geb. in Leinw. M. 2.40.

Bornbaum, Prof. K.: Leitfaden der chemischen Analyse. 8., verb. u. verm. Aufl. Bearb. v. Prof. E. Dieckhoff. (XII., 198 S.) 8°. Leipzig, J. A. Barth. 1909. M. 4; geb. in Leinw. M. 4.80.

Bornmann, Prof. Geo.: Stöchiometrie. Grundzüge der Lehre v. den chem. Berechnn. Mit 59 durchgerechneten Beispielen u. 265 Aufgaben. (VIII., 192 S. m. 1 Taf.) 8°. Leipzig, S. Hirzel. 1909. Geb. in Leinw. M. 4.

Boydton, C. W.: Portland cement sidewalk construction. 2nd Edition. Chicago. Universal Portland Cement Co. 1909. c. 708. 7-61 p. il. tabs., diagrs., O. pap. (Add. publs. for price.)

Dictionary of chemical and metallurgical machinery, appliances and material manufactured or sold by advertisers in *Electrochemical and Metallurgical Industry* N.Y., Electrochemical Publishing Co., 239 W. 39th Street, New York. 1909. c. 4+182 p. 12°, cl., 50 c.

Festschrift. Otto Wallach, zur Erinnerung an seine Forschungen auf dem Gebiete der Terpene in den J. 1884—1909 überreicht v. seinen Schülern. (IV., 684 S. m. 3 Taf.) gr. 8°. Göttingen, Vandenhoeck und Ruprecht. 1909. M. 12.

Gambinus. Deutscher Bran- u. Malzmeister-Kalender 1909/10. Hrsg. v. Versuchsstat.- u. Brauer- u. Mälzersch.-Dr. Paul Dreverhoff. 2. Jahrg. (156 u. 49 S. m. Fig.) kl. 8°. Leipzig, Weller und Winkler. Geb. in Leinw., M. 1.50.

Greinacher, Dr. Heinr.: Die neueren Strahlen (Radium-(α , β , γ)-Strahlen, Kathoden-, Kanal-, Anoden-, Röntgenstrahlen.) In leichtfassl. Einzeldarstellgn. (VIII, 130 S. m. 66 Abbildgn.) Lex 8°. Stuttgart, F. Enke. 1909. M. 4.—

Handbuch der anorganischen Chemie in 4 Bdn. Hrsg. v. Drs. R. Abegg u. Fr. Auerbach. III. Bd. 2. Abtlg. Die Elemente der 4. Gruppe des period. Systems. (XII., 921 S. m. 64 Fig.) Lex. 80°. Leipzig, S. Hirzel. 1909. M. 25.—; geb. M. 27.—

Jahrbuch f. Photographie u. Reproduktionstechnik. f. d. J. 1909. Unter Mitwirkg. hervorrag. Fachmänner; hrsg. v. Dr. Jos. Maria Eder. 23. Jahrg. Mit 201 Abbildgn. u. 19 Kunstbeilagen (VII., 621 S.) 8°. Halle, W. Knapp. 1909. M. 8.—; geb. in Leinw. M. 9.50.

Jahresbericht über die Fortschritte der Chemie u. verwandter Teile anderer Wissenschaften. Begründet v. J. Liebig u. H. Kopp, hrsg. v. W. Kerp u. J. Thoege. Für 1902. 10 Hefte. (2360 u. XCVII S.) gr. 8°. Braunschweig, F. Vieweg und Sohn. 1909. M. 124.—

Kallenberg, L.: Outlines of Chemistry; a Text Book for College Students. N.Y., Macmillan, 1909. 20+548 p. il. 8°, cl., \$2.60 net.

Kellas, A. M.: Introduction to Practical Chemistry for Medical, Dental and General Students. (Oxford Medical Publications.) London, 1909. Svo, pp. 270. H. Frowde, Net. 3s. 6d.

Kipping, F. S., and Perkin, W. H.: Inorganic Chemistry. Part I. London, 1909. Cr. Svo, pp. 320. Chambers. 3s. 6d.

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* Compiled by H. Grevel & Co., 33, King Street, Covent Garden, London, W.C., from whom all the works and dissertations in foregoing lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

26,406. Macfarlane. Electrically-driven centrifugal drying machines. Nov. 15.

26,642. Barlow and Lord. Filtering and filters. Nov. 17.

26,696. Rollin and Hedworth Barium Co. Manufacture of anhydrous compounds from crystallised compounds. Nov. 17.

26,726. Sefton-Jones (Rogers). Separation of given substances from mixtures. Nov. 17.

26,938. Soc. Anon. Métallurgique Proc. de Laval. Obtaining a homogeneous mixture of a pulverised material and a gas. [Swed. Appl. Nov. 21, 1908.]* Nov. 19.

26,979. Thwaites. Externally heated kilns. Nov. 20.

27,318. Marie. Apparatus for concentrating liquids. Nov. 24.

27,406. Best. Manufacture of heat insulating material. [Addition to No. 15,829 of 1907.]* Nov. 25.

- 27,457. Garde. Rotary pump for liquids or gases. [Ger. Appl., Jan. 2, 1909.]* Nov. 25.
 27,506. Bone, Wilson, and McCourt. Heating media. Nov. 26.
 27,582. Alexander (Reinhardt). Centrifugal separators. Nov. 26.
 27,599. Lehmann. Composite filtering apparatus.* Nov. 26.

COMPLETE SPECIFICATIONS ACCEPTED.

- 24,528 (1908). Köddewig. Annular kilns. Nov. 24.
 24,937 (1908). Schönmann. Apparatus for introducing gases into liquids. Nov. 24.
 26,910 (1908). Sheppee. Thermostats. Dec. 1.
 6012 (1909). Felten and Guillaume. Lahnweywerke. Mixing devices. Nov. 24.
 8541 (1909). Boulton (Bradley). Drying apparatus for peat, etc. Dec. 1.
 16,615 (1909). Irwin, and Johnson and Co. Filter-presses. Nov. 24.

H.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 26,408. Orson. Treatment of low-quality coking coals before carbonising.* Nov. 15.
 26,428. Jones. Treatment of gases from coke ovens or gas retorts. Nov. 15.
 26,432. Pudney and Sadler. Incandescent gas mantles. Nov. 15.
 26,858. Stewart and Stewart. Gas producers and their working. Nov. 19.
 27,051. Stone. Fuel. Nov. 22.
 27,157. Whittaker. Apparatus for extracting tar or other impurities from coal gas, etc. Nov. 23.
 27,158. Whittaker. Apparatus for cooling and washing coal gas or other gases. Nov. 23.
 27,232. Barnett. Calcium carbide cartridges. Nov. 23.
 27,310. Chaney. Manufacture of gas. Nov. 24.
 27,311. Gibbons Bros., Ltd., and others. *See under IX.*
 27,420. Stewart and Stewart. Gas producers and their working. Nov. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

- 17,619 (1908). Fuller. Manufacture of refractory electric conductors. Dec. 1.
 25,299 (1908). Boulton (Bradley). Preparation and treatment of peat. Dec. 1.
 26,475 (1908). Koller. Gas producers. Nov. 24.
 2292 (1909). Blau. Liquefaction of illuminating gas by pressure. Nov. 24.
 2389 (1909). British Thomson-Houston Co. (General Electric Co.). Treatment of electric lamp filaments. Dec. 1.
 9901 (1909). Williams. Gas producers. Dec. 1.
 11,315 (1909). Fisk. Incandescent gas mantles. Nov. 24.
 11,639 (1909). Oswald and Oswald. Suction or pressure gas producer plants. Nov. 24.
 15,078 (1909). Jones. Coke ovens. Dec. 1.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

- 26,936. Wassmer. Preparation of certain hydrocarbon bodies. Nov. 19.
 27,116. Tanne and Oberländer. Separating solid carbonated hydrogen from residues of mineral oil and tar.* Nov. 22.

COMPLETE SPECIFICATION ACCEPTED.

- 7427 (1909). Coulson. Treatment of tar. Nov. 24.

IV.—COLOURING MATTERS AND DYESTUFFS. APPLICATIONS.

- 26,700. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of azo dyes directly dyeing cotton. Nov. 17.
 27,029. Newton (Bayer and Co.). Manufacture of vat dyestuffs. [Addition to No. 7819 of 1909.] Nov. 20.
 COMPLETE SPECIFICATIONS ACCEPTED.
 25,477 (1908). Newton (Bayer and Co.). Manufacture of azo dyestuffs. Dec. 1.
 27,098 (1908). Newton (Bayer and Co.). Manufacture of anthracene derivatives and their use in dyeing and printing. Dec. 1.
 3276 (1909). Newton (Bayer and Co.). Manufacture of dyestuffs of the anthracene series. Dec. 1.
 6086 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of monoazo dyestuffs. Nov. 24.
 20,649 and 20,650 (1909). Chem. Fabr. vorm. Sandoz. Manufacture of substantive disazo dyestuffs. Nov. 24.
 22,200 (1909). Kalle and Co. Manufacture of pure nitro-o-oxazo dyestuffs. Nov. 24.

V. PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

- 26,497. Longbottom and Ratcliffe. Producing patterns or effects on textile fabrics. Nov. 15.
 27,028. Newton (Bayer and Co.). Dyeing and printing. Nov. 20.
 27,066. Clegg, Hartley, and Slingsby. Apparatus for use in dyeing felt. Nov. 22.
 27,431. Cox. Extracting moisture from cops, cheeses, warps, cotton, wool, etc., after bleaching, dyeing, etc.* Nov. 25.
 27,432. Cox. Apparatus for bleaching, dyeing, or otherwise treating textile materials.* Nov. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

- 24,842 (1908). Cartwright. *See under VII.*
 24,922 (1908). Crombie and Schubert. Apparatus for obtaining fibres from solutions. Nov. 24.
 25,813. (1908) Schirp. Device for dyeing, bleaching, etc., textile materials. Nov. 24.
 27,098 (1908). Newton (Bayer and Co.). *See under IV.*
 7734 (1909). Ransford (Cassella and Co.). Production of print effects on fabrics. Dec. 1.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

- 26,452. Falding. Apparatus for making sulphuric acid. [U.S. Appl., Dec. 31, 1908.]* Nov. 15.
 26,696. Rollin and Hedworth Barium Co. *See under I.*
 26,868. Mines de Manganèse de Las Cabesses. *See under XV.*
 27,126. Wetter (Riedel). Manufacture of alkali carbonates.* Nov. 22.
 27,168. Hargreaves. Manufacture of soda. Nov. 23.
 27,231. Humann and Teisler. Production of sodium-aluminium fluoride.* Nov. 23.
 27,576. Read. Apparatus for forming solidified carbonic acid gas. Nov. 26.
 27,650. Reese. *See under XV.*

COMPLETE SPECIFICATIONS ACCEPTED.

- 16,924 (1908). Radcliffe. Purification of ammoniac spent liquor. Nov. 24.
 24,842 (1908). Cartwright. Obtaining solutions or pseudo-solutions of ferric oxide, etc., for use in dyeing, etc. Nov. 24.
 1148 (1909). British Cellulose Synd., Ltd., and Merz. Producing a solution of ammoniacal cupric oxide. Nov. 24.
 4465 (1909). Barton. Manufacture of certain lead oxides. Nov. 24.

4872 (1909). Chem. Fabr. Bettenhausen. Production of a permanent ammoniacal solution of cupric oxide. Nov. 24.

6115 (1909). Peniakoff. Manufacture of sodium bicarbonate. Nov. 24.

6822 (1909). Pearlman and Pearlman. Recovery of zinc compounds and ammonia. Dec. 1.

7633 (1909). Jaubert. Manufacture of salts derived from peroxides. Nov. 24.

15,995 (1909). Serpek. Production of compounds of aluminium and nitrogen. Nov. 24.

18,923 (1909). Boulton (Ladd). *See under IX.*

11,263 (1909). Pezzolato. Treatment of pyrite ashes. Nov. 24.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

27,127. Thompson. Manufacture of glass from cheap material. [Addition to No. 8974 of 1909.] Nov. 22.

27,253. Kalmykoff. Decorating pottery, glass, etc. Nov. 23.

27,630. Crush. Treatment of china clay. Nov. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

11,633 (1909). Heller and Baumgartl. Manufacture of ceramic ware. Dec. 1.

18,923 (1909). Boulton (Ladd). *See under IX.*

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

26,681. Waxin. *See under XIII.*

26,693. Earle. *See under XIII.*

27,311. Gibbons Bros., Ltd., Masters, and Van Marle. Refractory bricks and the construction of walls of gas retorts, regenerators, etc., with said bricks. Nov. 24.

COMPLETE SPECIFICATION ACCEPTED.

18,923 (1909). Boulton (Ladd). Treatment of clay, bauxite, kaolin, etc. Nov. 24.

X.—METALS AND METALLURGY.

APPLICATIONS.

26,410. Witter. Separation of zinc and lead from mixed sulphides.* Nov. 15.

26,551. Johnson. Production of steel. Nov. 16.

26,588. Soc. Anon. Electro-Métallurgique (Proc. P. Girod). Refining steel. [Fr. Appl., May 6, 1909.]* Nov. 16.

27,003. Soc. Anon. Electro-Métallurgique (Proc. P. Girod). Refining steel. [Addition to No. 26,588 of 1909.]* Nov. 20.

27,132. Johnson (Chem. Fabr. Griesheim-Elektron). Melting and casting magnesium and its alloys. Nov. 22.

27,201. Allison (International Metal Products Co.). Iron manufacture.* Nov. 23.

27,364. Wynne. Treatment of ores, etc. Nov. 24.

27,558. Lockwood. Treatment of auriferous and argentiferous ores. Nov. 26.

27,609. Brown. Annealing steel of the high-speed or self-hardening type. Nov. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

24,590 (1908). Borchers. Treatment of titaniferous iron ores. Nov. 24.

24,845 (1908) and 8842 (1909). Simpson and Oviatt. Direct production of steel or steel alloys from the ore. Nov. 24.

24,846 (1908) and 5802 (1909). Simpson and Oviatt. Direct production of iron from its oxides or oxide ores. Nov. 24.

5675 (1909). Boulton (Newell Manufacturing Co.). Metal-lising non-metallic articles. Dec. 1.

12,565 (1909) Crispo. Extraction of copper from copper residues. Nov. 24.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

26,649. New Ignition Synd., Ltd., and Sandy. Electro-lyte for use in electric batteries. Nov. 17.

26,844 and 26,845. Helfenstein. Electric furnaces.* Nov. 18.

27,674. Petersson. Charging electric resistance furnaces. [Swed. Appl., Jan. 7, 1909.]* Nov. 27.

COMPLETE SPECIFICATION ACCEPTED.

2641 (1909). Marino. Treatment of wood for use in storage batteries. Dec. 1.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

27,141. Wild. Manufacture of soap for toilet and other uses. Nov. 22.

27,133. Greer. Compound lubricant. Nov. 25.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS, PAINTS.

APPLICATIONS.

26,681. Waxin. Stone preserving paint.* Nov. 17.

26,693. Earle. Priming or paint especially for use on plaster or cement.* Nov. 17.

26,729. Eckford. Manufacture of paints. Nov. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

4465 (1909). Barton. *See under VII.*

8686 (1909). Profes. Paints. Dec. 1.

8967 (1909). Luciani and Battesti. Apparatus for making artificial ultramarine. Dec. 1.

13,848 (1909). Carrick and Pattison. Black magnetic iron hydrate for use as a pigment. Nov. 24.

17,697 (1909). Schott. Waterproof and preserving paints. Nov. 24.

(C).—INDIA-RUBBER.

APPLICATIONS.

27,005. Bloxam (Callender). Manufacture of artificial india-rubber. Nov. 20.

27,130. Dreyfus, Friedl, Bentley, and Clayton Aniline Co. Manufacture and purification of india-rubber. Nov. 22.

27,385 and 27,386. Bradley. Production of artificial rubber. Nov. 24.

27,398. Black and Morton. *See under XX.*

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

27,536. Beaulieu. Machine for earrotting hides. [Fr. Appl., Dec. 16, 1908.]* Nov. 26.

27,573. Greaves. Tanning hides or skins. Nov. 26.

XV.—MANURES, &c.

APPLICATIONS.

26,867. Mines de Manganèse de Las Cabesses. Stimulant manure. [Fr. Appl., Nov. 21, 1908.]* Nov. 19.

26,868. Mines de Manganèse de Las Cabesses. Manufacture of suboxides of manganese for use as manures. [Fr. Appl., Nov. 21, 1908.]* Nov. 19.

27,650. Reese. Organic phosphates. Nov. 27.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATION.

26,557. Epstein. Treatment of sugar or the residue thereof. Nov. 16.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

- 26,849. Epstein. Treatment of lactobacilline or para-lactic culture or fermentation. Nov. 18.
 27,360. Braasch. Production of yeast. [Addition to No. 10,458 of 1909. Ger. Appl., Nov. 24, 1908.]* Nov. 24.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

- 26,691. Fairweather (Jensen). Preservation of food-stuffs and the like. Nov. 17.
 26,927. Blenkinsop. Treatment of flour. Nov. 19.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

- 26,842. Wetter (Riedel). Softening water.* Nov. 18.
 27,155. Coplans. Rapid preparation of potable water. Nov. 22.
 27,164 and 27,165. Andrews. Water purifying and softening plant.* Nov. 23.
 27,607. Candy and Candy. Apparatus for use in purifying water. Nov. 27.

COMPLETE SPECIFICATION ACCEPTED.

- 11,471. (1909) Didelon and Brant. Apparatus for rendering soluble and nitrifying sewage, &c. Nov. 24.

(C.)—DISINFECTANTS.

APPLICATION.

- 27,006. Little. Manufacture of a cleansing fluid for use as a sheep dip or for disinfecting. Nov. 20.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

- 26,657. Parkin and Williams. Non-inflammable celluloid or celluloid substitute. Nov. 17.
 27,102. Panthoier. Manufacture of new acetyl derivatives of cellulose. Nov. 22.

COMPLETE SPECIFICATIONS ACCEPTED.

- 19,735 (1908). Meyer. Treatment of acetyl- and nitro-cellulose for making a plastic material. Dec. 1.
 24,343 (1908). Herz. Apparatus for obtaining pulp from waste paper, etc. Nov. 24.

- 24,811 (1908). Brandenberger. Treatment and application of cellulosic films. Nov. 24.

- 26,573 (1908). Pearson and Stoneham. Manufacture of paper, etc. Nov. 24.

- 8175 (1909). Rinman. Treatment of waste liquors from soda pulp mills. Dec. 1.

- 15,555 (1909). Meister, Lucius, und Brüning. Manufacture on the paper machine of paper having relief-like effect. Dec. 1.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

- 26,814. Johnson (Boehringer und Söhne). Preparation of pharmaceutical compounds.* Nov. 18.

- 27,030. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Nov. 20.

- 27,357. Chem. Fabr. auf Actien, vorm. E. Schering. Manufacture of curative agents. [Addition to No. 24,505 of 1909. Ger. Appl., Nov. 28, 1908.]* Nov. 24.

- 27,397. Black and Morton. Production of substances of the terpene series. Nov. 24.

- 27,398. Black and Morton. Production of plastic and elastic substances of the terpene series. Nov. 24.

COMPLETE SPECIFICATION ACCEPTED.

- 25,433 (1908). Jensen (Goldschmidt). Manufacture of anhydrides of fatty acids, especially acetic anhydride, from fatty acid salts. Dec. 1.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

COMPLETE SPECIFICATION ACCEPTED.

- 14,502 (1909). Kogel. Method of preparing photographic prints. Dec. 1.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATION.

- 27,067. Noad. Manufacture of matches and tapers. Nov. 22.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATION.

- 27,131. Lichtenstein. Instruments for estimating, comparing, or matching tints or colours. Nov. 22.

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No. 21, Vol. XXVIII.

Official Notices.

NEW HON. FOREIGN SECRETARY AND VICE-PRESIDENT.

Dr. Rudolf Messel has been appointed Hon. Foreign Secretary of the Society in the place of the late Dr. Ludwig Mond, F.R.S.

Prof. A. Liversidge, F.R.S., has been appointed a Vice-President of the Society in the place of Dr. R. Messel, appointed Hon. Foreign Secretary.

CLASSIFICATION OF JOURNAL AND PATENT LITERATURE.

After January 1st, 1910, the Journal and Patent Literature will be classified and entitled as follows:—

1. General Plant; Machinery.
2. A. Fuel; Gas; Mineral Oils and Waxes;
B. Destructive Distillation; Heating; Lighting.
3. Tar and Tar Products.
4. Colouring Matters and Dyes.
5. Fibres; Textiles; Cellulose; Paper.
6. Bleaching; Dyeing; Printing; Finishing.
7. Acids; Alkalis; Salts; Non-metallic Elements.
8. Glass; Ceramics.
9. Building Materials.
10. Metals; Metallurgy, including Electro-Metallurgy.
11. Electro-Chemistry.
12. Fats; Oils; Waxes.
13. Paints; Pigments; Varnishes; Resins.
14. India-Rubber; Gutta-Percha.
15. Leather; Bone; Horn; Glue.
16. Soils; Fertilisers.
17. Sugars; Starches; Gums.
18. Fermentation Industries.
19. A. Foods;
B. Water Purification; Sanitation.
20. Organic Products; Medicinal Substances; Essential Oils.
21. Photographic Materials and Processes.
22. Explosives; Matches.
23. Analytical Processes.
24. Miscellaneous Abstracts.

CHARLES C. CRESSWELL, *Secretary*.

Birmingham Section.

Meeting held at Birmingham University on Thursday,
October 21st, 1909.

DR. T. SLATER PRICE IN THE CHAIR.

MODERN DEVELOPMENTS OF THE GAS INDUSTRY.

BY WM. B. DAVIDSON, PH.D., D.S.C., F.I.C.

On the 9th of June, 1810, the Bill promoting the incorporation of the Gas Light and Coke Company of London, the first public gas undertaking, received Royal Assent. The actual inventor of gas lighting, William

Murdoch, was an engineer in the employment of the famous firm, of Boulton and Watt, Soho, Birmingham. Whilst in their service he found time to bring to a successful issue experiments on the distillation of coal which he had begun in his youth. In 1792 he installed gas lighting in his house at Redruth. In 1803 part of the Soho works was lighted by gas, but it was not till 1807 that a distinct advance was made when the large cotton mill of Messrs. Phillips and Lee, Manchester, was fitted with a complete gas installation. Progress was naturally very slow at first. Presently other pioneers, notably Clegg and Winsor, entered the field. The latter was the principal mover in the formation of the first gas company. During the past half century the development has been very remarkable, and to-day the proportions of the industry have attained huge dimensions.

A rough estimate of the annual production of gas, coke, and residuals by the gas-works of the United Kingdom is given below:—

	Quantity.	Value.
		£
<i>Materials used—</i>		
Coal for gas making	tons 16,000,000	10,000,000
Oil	galls. 60,000,000	700,000
Oxide for purification	tons 70,000	80,000
Lime	?	?
<i>Products sold—</i>		
Gas	cubic ft. 190,000,000,000	24,000,000
Coke, breeze and dust	tons 8,000,000	5,000,000
Ammonia as sulphate	" 165,000	1,800,000
Tar (coal and C.W. gas)	" 900,000	900,000
Sulphur in spent oxide	" 70,000	100,000
Cyanogen as sodium prussiate	" 3,000	90,000
Spent lime	" ?	Practically nil.
Retort carbon	" 5,000	7,500

Approximately 11 per cent. of the gas made is carburetted water gas.

On the Continent, the magnitude of the gas industry, relative to the population, is much smaller. The total quantity of coal carbonized for gas in Germany is only 5½ million tons per annum, 25 per cent. of which comes from England. Coal in Germany costs on an average about 20s., whilst coke is sold at 25s. a ton.

In the United States carburetted water gas bulks more largely in the public supply than coal gas. I have not been able to obtain definite estimates of the gas-making materials used in that country.

During the eighties and nineties the rate of increase in the output of gas in this country was seven or eight times the rate of increase in the population. Naturally this extraordinary development could not be maintained for very many years, and so it is not surprising that the last decade has witnessed a considerable slackening in the demand for town gas.

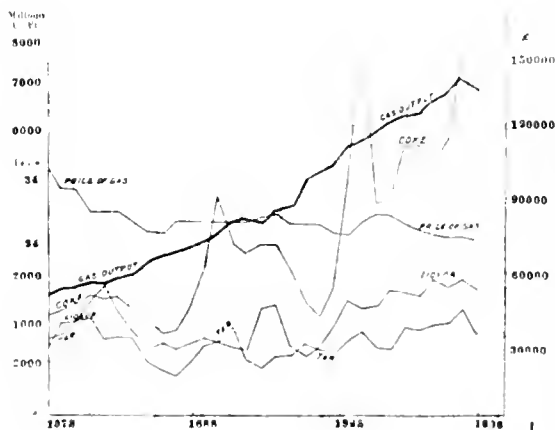
I have compiled from "Field's Analysis" the gas outputs for 24 of the largest gas undertakings in the United Kingdom for the years 1888, 1898, and 1908, together with the decennial percentage increments for the two intervals in question.

The Metropolitan companies, it will be observed, are making less rapid progress than the provincial undertakings, whilst London suburban companies shew an abnormally high rate of increase. This is only what might have been expected. It is gratifying from the manufacturer's point of view that in spite of economies in the consumption of gas for lighting purposes, the ever-growing competition of electricity for the supply of light and power, and the introduction of producer-gas plants in large factories, the average rate of increase in the output of gas is still more than double the rate of increase of the population.

Gas output of 24 of the largest undertakings of the United Kingdom.

Name.	Millions of cubic feet.			Decennial percentage increase.	
	1888.	1898.	1908.	1888—1898.	1898—1908.
Gas, Light & Coke Co.	18610	22400	23740	20.4	6.0
South Metropolitan Co.	5800	9825	12790	66.8	30.2
Birmingham Corporation	3722	5531	7328	48.6	32.5
Glasgow Corporation	2705	5355	7034	98.0	31.3
Manchester Corporation	3046	4158	5779	36.5	39.0
Commercial Co.	1989	2614	3369	31.4	28.0
Sheffield Co.	1649	2424	3474	47.0	43.3
Newcastle-on-Tyne Co.	1668	2519	3350	51.0	33.0
Brentford Co.	1031	1658	2866	60.8	72.9
Bristol Co.	1348	1798	2684	33.4	49.2
Nottingham Corporation	1405	1697	2109	20.8	24.2
Leicester Corporation	900	1451	2062	61.2	42.1
West Ham Co.	579	1009	1903	74.2	88.6
Salford Corporation	843	1346	1716	59.7	27.5
Dublin Corporation	1233	1447	1555	17.4	7.5
Tottenham Co.	279	525	1495	87.5	185.9
Oldham Corporation	810	1094	1471	35.0	34.5
South Suburban Co.	717	1121	1293	50.9	15.3
Portsea Co.	565	764	1384	35.2	81.2
Croydon Co.	389	673	1293	73.0	92.1
Brighton Co.	821	1027	1261	25.1	22.8
Wandsworth Co.	311	631	1105	102.9	75.1
Plymouth Co.	508	836	1096	64.6	31.1
Bolton Corporation	629	885	1022	40.7	15.5
Totals	51677	72786	93179	40.8 aver.	28.0 aver.

If we analyse the figures for individual years we find that the weather is the most important factor to be considered as affecting the consumption. In particular the presence or absence of fogs has a marked effect. Now that a very considerable proportion of town gas is used for industrial purposes we also find a reflection of the state of trade in the annual records of the gas-works. Thus it may happen that a curve representing the annual output of gas for a given town may be somewhat irregular and may even exhibit an occasional fall. The incomes from the different by-products are subject to the market fluctuations which are sometimes rapid and unforeseen. The cost of coal and oil also varies from time to time and thus the selling price of gas is subject to frequent alteration. The case of Birmingham will serve to illustrate these fluctuations. The following diagram indicates the progress made during the last 30 years, the curves representing (1) the output of gas, (2) the price of gas, (3) the income from coke, (4) the income from ammoniacal liquor, (5) the income from tar.



The following figures are compiled from "Field's Analysis" for the year 1908 for 27 gas undertakings representing 50 per cent. of the total gas industry of the United Kingdom. It permits of an interesting comparison of materials carbonized, capital employed, price of gas, quality of gas prescribed and supplied and the burner used for testing purposes.

For the year 1908.						
Name.	Coal carbonized.	Oil for C.W. Gas.	Capital employed.	Sale price of gas.	Illuminating power of gas.	
				Average Pence per 1000 cb. ft.	Standard.	Supplied.
	Thous. tons.	Thous. galls.	Thous. £		Candles.	
Gas, Light and Coke	6710	11167	13856	32.9	16½	16.9½
South Metropolitan	1183	—	5519	26.6	14½	16.6½
Birmingham*	572	2579	2909	23.9	15½	16.2½
Glasgow†	739	—	2360	27.7	16½	18.5½
Manchester†	421	2769	2741	27.4	—	17.5½
Commercial	292	2525	1426	29.2	14½	15.1½
Sheffield	327	—	973	15.0	10½	17.4½
Leeds	189	665	1871	24.8	14½	15.5½
Newcastle	301	64	2214	21.4	15½	16.2½
Brentford	182	2609	1118	32.6	14½	15.0½
Bristol	280	—	1411	23.3	14½	16.0½
Nottingham†	194	65	1156	30.3	12½	16.3½
Edinburgh and Leith†	176	500	1633	34.4	20½	20.4½
Bradford	204	—	1188	23.4	15½	17.0½
Leicester	180	—	1309	24.2	11½	15.8½
West Ham	101	1678	1134	31.9	14½	14.7½
Salford†	167	—	942	29.5	18½	19.3½
Dublin	77	3430	1218	42.5	16½	16.5½
Tottenham	83	1268	617	29.0	14½	15.5½
Oldham†	119	368	607	23.6	14½	20.3½
South Suburban	130	—	629	30.4	14½	15.2½
Portsea	113	897	473	31.1	11½	14.2½
Croydon	82	1031	691	38.2	14½	14.6½
Brighton	71	1199	711	36.1	15½	15.5½
Wandsworth	71	822	361	23.8	14½	14.9½
Plymouth†	55	1133	400	21.7	14½	14.8½
Bolton†	100	—	800	29.5	16½	18.2½
Totals ...	8020	37,709	50,297	(Aver.) 28.3		

* Year ending 31st March, 1909.

† " " 31st May, 1908.

‡ " " 31st March, 1908.

§ " " 15th May, 1908.

¶ By flat flame burner.

‡ By London Argand burner, No. 1.

§ By 15 Hole Argand burner.

¶ By Metropolitan Argand burner, No. 2.

GAS LIGHTING.—The introduction of the upright incandescent mantle by Auer von Welsbach about the year 1886 for a time threatened to have a prejudicial effect on the development of coal gas just as the modern metallic filament lamp has given electricity undertakings cause for alarm. In the one case the duty of one cubic foot of gas was increased from 3 to 20 candles, in the other the efficiency as compared with the carbon filament lamp has been trebled. The Welsbach mantle, however, has proved a blessing to the gas industry in the later days of competition. The last decade has seen the introduction of the inverted mantle which gives a higher efficiency than the upright, is easier to handle, and lends itself to more artistic arrangement of the fittings. Inverted burners are now much used in small units of 10 to 30 candles, a further economy in the lighting of small rooms being thus effected.

With gas at 2s. 6d. per 1,000 cubic feet giving an efficiency of 20 candles per cubic foot, 1,000 candle-hours cost, for gas only, 1.50d., whilst with electricity at 3½d. per unit and Osram lamps giving an efficiency of 0.90 candle per Watt the same amount of light costs, for electricity only, 3.90d.

Much ingenuity has been expended in the improvement of burners and mantles, and new devices are continually

appearing on the market. We would seem to be within measurable distance of the ideal burner which can be turned on or extinguished by tap or switch without the aid of by-pass. Incandescent gas lighting can only be rendered reliable, however, by attention to the burners, maintenance of a uniform gas-pressure of two to three inches (water gauge) and fairly uniform calorific value. Flat flame burners, on the other hand, do not require a greater pressure than two or three-tenths of an inch. Some gas companies now undertake maintenance of the burners of consumers in the belief that a little attention of this kind is more appreciated than a small reduction in the price of gas. The increase of pressure in the gas mains has not proved to be a cause for alarm so far as leakage is concerned.

Street lighting and the illumination of large rooms is accomplished most effectively by high-pressure gas consumed in burners of special construction fitted with strong mantles. There has been considerable development along this line during the last five years. This would have been much greater had it not been for the additional expense entailed by the erection of compressing plants for the different installations. When high-pressure gas is supplied from the gas-works in special mains such as are being laid in Birmingham and some other towns, no extra outlay on the consumer's part will be necessary and he will thus be able to derive immediate benefit, whilst the streets will have the full advantage. The best type of high pressure burner has an efficiency of 60 candles per cubic foot, that is, three times as much as the ordinary burner. The pressure required is about 50 inches (water gauge) or 2 lb. per square inch. The cost for gas only at 2s. per 1,000 cubic feet (assuming a lower price for gas in bulk), is thus only 0.40 of a penny per 1,000 candle-hours. To equal this figure electricity must be supplied with flame arcs (efficiency, three candles per watt) at 1½d. per unit. So successful has high pressure gas proved itself for street lighting that electric arc lighting already installed has had, in a large measure, to give way to it. Berlin, which is looked upon as the foremost city in Europe in the matter of street illumination has decided in favour of the inverted high-pressure gas-lamp, and it would appear that London is going to follow suit judging from the fact that a deputation of the Streets Committee, after visiting and carefully examining the systems of lighting in some of the principal Continental cities, recommended in July last "that high-pressure incandescent gas-lamps with inverted burners should be adopted as the illuminant; but where gas is impracticable, electricity with open arc and flame arc lamps should be installed." I think this must be looked upon as a great victory for gas lighting.

GAS HEATING.—Hitherto the gas fire has not been regarded as an economical means of heating a room, however convenient it may be, and owing to defects of construction in older types it had acquired somewhat of an evil reputation. Within the last year or two, however, great improvements have been made.

It has been generally recognised that radiation must play an important part in the heating of a room, and the capacious bed of "fuel" has been abandoned in favour of single-row tubular pyramid "fuel." An elaborate piece of research on a gas fire of the modern type referred to has been carried out at Leeds University. The results were published in June last, and the conclusions are as follows:—1. The total radiation from an open gas fire is about 32 per cent., and this is unaffected by the amount of ventilation through the room. 2. No carbon monoxide escapes under ordinary conditions into the room, and very little is ever found in the flue. 3. About 30 per cent. of the heat generated in the stove passes directly into the flue. This figure varies with the volume of air passing through the stove flue. 4. There is no necessity for products of combustion to enter the room and cause discomfort. 5. Reflectors may be usefully employed to produce a sensible increase of radiation into the region where it is most wanted.

A thermal efficiency of 70 per cent. (half by radiation, half by convection) is probably more than three times as much as that of a good coal fire. Gas of a nett calorific

value of 540 B.Th.U. per cubic foot at 2s. 6d. per 1,000 cubic feet gives 18,000 heat units for a penny, whereas coal of a calorific value equal to 14,000 heat units per lb. at 18s. 8d. per ton (1d. for 10 lb.), gives 140,000 units, or eight times as much. On this basis a gas fire is more than twice as costly as a coal fire. Nevertheless, just as the special advantages of electric power under certain circumstances outweigh the doubling or trebling of the cost per brake horse power as compared with gas or steam, so the convenience, cleanliness and labour-saving of the gas fire recommend its use to the average householder. With reductions in the price of gas and further improvements in the appliances, it is not too much to hope that gas fires will be more generally used in the future. From the point of view of smoke abatement this is a consummation devoutly to be wished.

Mr. Onslow, Superintendent of the Gas Factory, Royal Arsenal, Woolwich, a pioneer of high pressure gas lighting, has done much to bring into prominence the utility of high pressure gas for rapid heating and high temperature. The advantages of pressure gas over the ordinary blowpipe lie in the simplicity of the fittings and the ease with which the pressure can be altered at will. The furnaces now used with high pressure gas for annealing shells, &c., in the Arsenal are of the simplest construction, and work with coal gas at 2½ lb. pressure. Temperatures of 1600° C. can be attained without much difficulty in small furnaces and thus most metals can be melted. There is reason for believing there will be important developments in this branch of the industry before long.

GAS FOR COOKING.—In most well-equipped households the gas-cooker is regarded as a necessary adjunct of the kitchen. The fitting of a thermometer through the side of the oven—not a usual practice, but one to be recommended—and the use of a quadrant or slow movement tap, render it easy to regulate the oven-temperature to a nicety without opening the door, thus ensuring complete success every time—a great consideration with both manufacturer and consumer. Attempts to effect economy by preheating the air required for combustion by means of the waste products have hitherto proved only partially successful. Stoves fitted with appliances for hot water circulation are now on the market.

Some years ago slot or prepayment meters for both lighting and cooking were introduced. In this class of business it is the usual practice to supply meter and fittings free, but to charge the gas at a higher rate. In many towns prepayment consumers are in the majority. The system has been a powerful agent in popularising gas lighting and cooking amongst the working classes.

GAS FOR MOTIVE POWER.—Some 30 years ago the indicated thermal efficiency of the best gas engines was only 16 per cent.; to-day it is 37. To show the position of gas as regards cost of motive power the following estimates of the cost of a brake horse power hour, and the data on which they are based, for steam, gas, and electricity, may be useful:—

	Thermal efficiency,		Cost per B.H.P. hour,
	per cent.		d.
Steam . . .	6	Fuel, 14,000 B.Th.U.'s per lb., at 7s. 6d. per ton	0.16
Gas	30	Gas, 540 B.Th.U.'s per cu. ft., at 18s. 8d. per 1000 cu. ft.	0.31
Electricity	86	1d. per unit	0.65

The above figures only include fuel, solid or gaseous, and electric energy. Labour costs are not reckoned. The fuel required with a suction gas plant is said to work out at only one-tenth of a penny per B.H.P. hour, but in this case the cost of gas manufacture must be added. Without entering into a discussion of the relative merits of different sources of motive power, suffice to say that the perfecting of the gas engine has greatly stimulated the demand for town gas for power purposes in recent years.

So multiform are the applications of gas that *gas supply* has become quite a science in itself, apart from *gas manufacture*. This has been recognised by the City and Guilds of London Institute whose examination papers are now set year by year since 1908 in *gas supply* as well as in *gas engineering*.

QUALITY OF GAS.—Throughout the country the proportion of gas sent out during daylight hours has continued to increase in a satisfactory manner. To-day not a few gasworks boast of a day load exceeding 50 per cent. of the total, and as only a small proportion of the nightly output is consumed in flat flame burners one may well ask the question: "What is the utility of the test of illuminating power in such cases?" Gas engineers are in the habit of complaining of the injustice of the tests and restrictions imposed on town-gas. Some have expressed the view that gas should be as untrammelled in this respect as electricity. This opinion represents one extreme. You will find the other in the words of Prof. A. E. Armstrong, quoted from his presidential address delivered to the Chemical Section of the British Association at Winnipeg last August. Speaking of the gas industry he said: "On the engineering side it had been carried to a high pitch of perfection, but on the chemical side it had ever fallen, year after year, to a lower state. The quality of coal gas was such, especially since the withdrawal of the sulphur clauses from Acts of Parliament by which the industry was regulated, that gas was almost unusable. Had not chemists entirely unconnected with the gas industry vastly improved the methods of burning it, gas would long since have fallen into disuse."

Let us look at this question for a moment. The very rich coal gas of 30 years ago is no longer required. In those times it was not practicable to make anything but rich gas because of the low temperatures of carbonization that were available. There is no disputing the assertion, however, that town-gas has been on the down-grade for some years, in respect to both illuminating power and calorific value, which to a certain extent go hand in hand. The Metropolitan has always been looked to for a lead in these matters. Gas referees were established in London by the Act of 1868. At the same time Sugg's No. 1 London Argand burner was adopted for testing the gas for candle-power. The gas was burnt at the rate of 5 cubic feet an hour on a bar-photometer and tested against the standard given by two candles. This method continued in use in London until 1898 when the table photometer and ten-candle pentane standard were introduced to give greater refinement in testing. The gas was now not consumed at the rate of five cubic feet an hour, but at a variable rate so as to give a light equal to 16 candles. The sulphur clauses were abolished by the London Gas Act of 1905, and the ammonia tests were given up. Previously the limit to sulphur other than in the form of sulphuretted hydrogen had been 17 grains per 100 c. ft. in summer, 22 in winter; the limit for ammonia being 4 grains per 100 c. ft. At the same time the No. 1 Argand burner, which at the time of its inception was supposed to be capable of obtaining the highest possible duty from the gas, was discarded in favour of a superior contrivance, the Metropolitan Argand Burner, No. 2, which, chiefly by virtue of an air-damper, gets about 10 per cent. better value out of 16 candle coal gas, and still more out of lower-grade gas or mixed gas. The South Metropolitan Co. and the Commercial Co. received the further privilege of a reduction in standard from 16 to 14 candles. Testing for calorific value was inaugurated, but no restriction was imposed. Quite recently the Gas Light and Coke Co. obtained Parliamentary sanction for the absorption of the West Ham Co. and a reduction in standard from 16 to 14 candles as tested by the new burner. The Gas Company did not get things all its own way, however, and an additional restriction in the form of a calorific value test was imposed. The gas undertaking is now bound to supply town gas of a calorific value not less than 496 British Thermal Units per cubic foot, nett, but will only be penalised when the figure falls below 446½. Most gasworks, I take it, would gladly submit to these dual tests in preference to their present exacting illuminating power standard. Table III. gives one some idea of the variety

of the methods in present use for ascertaining candle-power. In addition to those mentioned there are several types of flat flame and 15-hole Argand burners in use. The difference between two tests with different burners may be as much as six candles. Differences of two candles may be obtained by artificially altering the atmospheric conditions of a badly-constructed photometer-room. It is no wonder then that the relegation of the illuminating power test to a subsidiary position will be welcomed by both engineer and chemist.

Tests for sulphuretted hydrogen and ammonia do not intimidate the gas manufacturer. In these days of perfected mechanical appliances and methods, the escape of sulphuretted hydrogen into the town mains is a very rare occurrence; ammonia, on the other hand, is too valuable to lose.

One of the questions of the hour in the gas industry is: "What quality of gas is called for?" Regard must of course be had to modern conditions of high carbonizing temperatures, vertical retorts, chamber-ovens, and other improved gas-making plant, and to the fact that high candle-power as tested by flat-flame or Argand burner is no longer a necessity. A conference of 40 German gas-chemists answered the question in May last as follows:—(1) A standard calorific value of 544 B.Th.U. per cubic foot, gross value, say, 450 nett. (This is the standard observed by the Berlin municipal gas undertaking, it may be remarked.) The calorific value, they further state, should be as uniform as possible, and should not fall below 524 gross, or say 472 nett. (2) Tests of illuminating power are superfluous. (3) A proportion of 25 per cent. of carbon monoxide is permissible in mixed gas. (4) The gas must always be completely purified from sulphuretted hydrogen, but seeing there is at present no process which can be applied on a practical scale for the removal of other sulphur compounds, which exist only in minute quantities in the purified gas as usually supplied, no limit can be fixed for this. (5) Restrictions of the amounts of ammonia, cyanogen, naphthalene, carbon dioxide, oxygen, nitrogen, and of the specific gravity are unnecessary.

I think I should be giving expression to the opinion of gas chemists in this country by saying we agree with all the above conditions but No. 2. In the use of town gas a luminous flat or round flame is sometimes absolutely necessary, and as the manufacture of a non-luminous gas of the required calorific value is not an impossibility, it is advisable to stipulate an easy standard of, say, 12 candles with the No. 2 Argand burner. By the way, this burner is not the very best obtainable. The Grafton burner of similar type is slightly better. Either will suit the purpose, however. The volume percentages of the different non-essential ingredients in gas of average quality, as now generally supplied, not purified by lime, are as follows:—Carbon dioxide, 2 per cent.; nitrogen, 2 to 16 per cent.; oxygen, 0.6 per cent.; naphthalene, 0.001 per cent.; hydrocyanic acid, 0.03 per cent.; carbon bisulphide 0.02 per cent.

GAS MANUFACTURE. Under no real obligation to produce gas of high candle power, and with strong competition to face on all sides, the gas engineer has set himself to reduce costs of gas manufacture by every means in his power. The various methods that have been adopted to this end may be briefly reviewed:—

1. *Working with smaller retort charges* or lengthening the period of distillation gives greater yield of gas per ton of coal, but labour costs increase and this method is not to be recommended.

2. *A higher temperature of distillation* affords a ready means of increasing the output of gas, and has been resorted to quite generally throughout the country. Iron retorts were discarded in favour of clay retorts many years ago; while direct firing is now to be found only in some small works.

Heating by means of producer gas generated under the retorts and the use of the regenerative effect instituted by Siemens came into general use twenty years ago. In this way not only was the yield of gas increased but the consumption of fuel was greatly diminished. Coal which formerly produced 9,500 c. ft. per ton gave 11,000

or more. The fuel used per 100 lb. of coal carbonized with direct fires is about 25 lb., with generators 18, and with generators constructed with regenerators, 15. There were some disadvantages however. Capital and maintenance charges were largely increased. Naphthalene, a high temperature product of destructive distillation, made its presence felt, as there were now insufficient heavy hydrocarbon vapours present to hold this substance in solution when condensation took place. Naphthalene trouble kept the distribution department at its wits end for some years. The symptoms were numerous blockages in the small pipes or services and the stoppage of the gas supply. These occurred principally in the summer and autumn. In aggravated cases, mains on the works were also blocked. The fact that stoppages occurred more frequently in July, August, and September is accounted for by there being a wider range of temperature during these months as between day and night. Gas saturated or nearly saturated with naphthalene at summer heat was sent out during the day and deposited its naphthalene as the pipes cooled down in the chilly evening. The amount of naphthalene in gas saturated at 60° F. does not exceed 0.008 per cent. by volume, whilst the average amount present in town gas is less than one-sixth of this, and this of it is carried forward to the burner to be consumed. Naphthalene, however, forms very voluminous crystals: as small a quantity as three grains may occupy a volume of one cubic inch. The stoppages were detrimental in three ways. They entailed a great deal of expense in removal; they curtailed the consumption of gas; and they gave gas a bad name. After years of suffering two or three reliable cures were at length discovered. One consisted in washing the gas on the works with a heavy oil—creosote or anthracene oil—so as to remove the great bulk of the naphthalene, and another in adding the vapours of suitable oils to the gas without removing any naphthalene on the works, the oil only taking effect when condensation commenced. The former method depreciates the quality of the gas to a serious extent unless 4 or 5 per cent. of benzol be previously added to the oil.

A combination of the two methods, whereby the gas is washed so as to cause the removal of a small portion of the naphthalene and rendered sufficiently rich in the vapours of oils of the necessary vapour tension, is probably the most economical and reliable way of dealing with the naphthalene difficulty. The oil most suitable for vaporizing has been found to be crude naphtha, distilling to the extent of 90 per cent. between 140° and 260 °C. Less expensive oils such as light kerosene, first runnings from the distillation of carburetted water gas tar, or even carburetted water gas tar itself, have been found more or less effective. With a little attention, a complete cure can be effected and maintained at an expense which is trifling when one takes into account the enriching value of the oil added.

Some idea of the extent of the trouble and the completeness of the cure may be gathered from the figures for Birmingham, where the curative process was begun in 1906.

Naphthalene complaints.

1904.	1905.	1906.	1907.	1908.
16,646	22,748	530	95	46

Another difficulty which became intensified was "stopped pipes." This trouble is rendered the more acute the higher the temperature, the older the coal, that is the less volatile matter it contains, and the lighter the charge. It entails loss of gas and considerable labour costs. It has been overcome by increasing the size of the ascension pipes, by a proper system of augering the same, and by introducing a small quantity of steam or a drip of water.

As very high temperatures were attained the defects of fireclay material also became a source of trouble, a portion of the retort setting not infrequently giving way.

Greater attention has therefore had to be given to the quality of fireclay goods. Steps have already been taken by those interested in the fireclay industry with a view to improving and standardising refractory material for use on gas-works.

3. *A combination of large charges with high temperatures* represents the acme of perfection of modern methods of carbonization. Under similar conditions of temperature and exhaust the make of gas per ton is not so great in this case as with smaller charges but the quality is decidedly better. The effect of putting a large charge into the retort is to diminish the free space above the coal and to lessen the degree of degradation of the hydrocarbons to carbon and hydrogen. The carbonizer finds he can use more exhaust to bring the gas down to standard, hence the prevalent erroneous idea that heavy charges give a larger yield of gas per ton of coal. An analysis of the gases will show an increase in nitrogen.

Possessing the advantage of a 14 candle standard with No. 2 Argand burner, some gas engineers have been at a loss to know how to manufacture gas of this low illuminating power with the plant at their disposal. The simplest way of doing it is by "over-pulling," but this can only be done at the expense of the calorific value of the gas. One occasionally hears in these days of abnormally high makes of 12,500 to 13,000 c. ft. per ton from ordinary coal carbonized in horizontal retorts, and the success is sometimes erroneously attributed to the marvellous working of mechanical devices such as retort-house governors, dry hydraulic-main, or steam in the ascension pipe. I think it is much to be deplored that gas-engineers have found themselves compelled to resort to dilution of the gas by "over-pulling." The percentage of nitrogen has gone up very considerably in many large towns in England—not in Birmingham, I may say. In some cases it is as high as 16 per cent. This is one way of making low-grade gas—it is assuredly not the best way. The accepted practice in this country is to carbonize at level gauge, that is, to maintain the gases in the retorts at atmospheric pressure on the average. Working with a retort-house governor and a dry hydraulic main this gives a gas containing 4 to 7 per cent. of nitrogen, which might be regarded as permissible—the theoretical amount is always less than two per cent. The German gas engineer goes to the other extreme and instead of "over-pulling" maintains an average pressure in the retorts of about one inch (water column). The gas then contains about three per cent. of nitrogen, but there is undoubtedly considerable loss through leakage into the furnace.

4. *NEW PLANT.* Manufacturing costs have been appreciably reduced not only by higher production of gas but also by new machinery. A great deal of mechanical ingenuity has been expended in the construction of stoking appliances. Two of the best known of the older types are the "West" machine working with compressed air and the "Arrol-Foulis" working with hydraulic power. Of the latest machines the "De Brouwer projector" which throws the coal off a revolving belt and the "Fiddes-Aldridge" machine which fills and empties the retort at one stroke are among the most successful. Both the last-named are as a rule electrically driven. The machine most in demand for modern carbonizing practice is one that can almost completely fill the retort, the discharge being effected by a "pusher."

Inclined retorts were introduced into England in 1885. They are usually set at an angle of 32° and dispense with stoking machinery. There are difficulties in charging them satisfactorily. Much depends on the nature and size of the coal and as a rule they take only the normal charge of six to seven cwt. A few settings of retorts have been set at 45°, at which angle it is possible to work with full charges.

Vertical retorts. A great advance in carbonizing has been made by Dr. Buch of Dessau who brought out the vertical retorts in 1906. The main advantages of the Dessau system over the horizontal and inclined retorts in common use may be enumerated as follows:—1. Higher yield of gas per ton of coal, and per unit of ground area. 2. Gas is nearly free from naphthalene. 3. The yield of ammonia is considerably increased. 4. The tar is thinner

and contains less free carbon. 5. The coke is large and dense. 6. Steam may be admitted with advantage at the end of the carbonization period to make a certain amount of water gas. 7. The work is easier for the men.

There are now over 4,000 Dessau retorts in use on the continent. Some are four metres in height and take charges of 10 cwt. of coal every ten hours. Others are five metres long and take a corresponding larger charge. An installation of sixty Dessau retorts, the first of its kind in England, has just been completed in Sunderland.

English engineers have not been idle meanwhile. Theirs is the higher ambition to perfect a continuous process of charge and discharge in vertical retorts. This is an ideal system of distillation which will no doubt achieve ultimate success. At present only a few retorts of this type are at work—some on the "Woodall-Duckham" and some on the "Glover-West" system. The mechanical difficulties have been largely overcome, but so far the carbonizing results are somewhat disappointing.

Chamber-ovens. Attention is now being turned to the adaptation of the large coke-oven to gas-making. Chamber-ovens are already competing with vertical retorts. Here again we have to thank our German friends for the innovation. The original Munich chamber-ovens were inclined, but they are also being built horizontally and vertically. The charge in the largest size is about seven tons. Their advantages over vertical retorts are:—1. Still lower carbonizing costs. 2. Superiority of coke and elimination to a great extent of night work. No accurate information is so far available with regard to gas, liquor and tar. It is safe to say that want of uniformity in the gas made must militate against their adoption on small works.

The following is a rough comparison of the carbonizing costs (charging, drawing and firing) per ton of coal for the different systems.

	Old machinery, labour, horizontals.	Inclined retorts.	New machinery, horizontals.	Verticals.	Chamber- ovens.
pence.	pence.	pence.	pence.	pence.	pence.
32	18	12	8	4	2

RESIDUALS. Let us now briefly consider what progress has been made in the production of residuals.

Coke, Breeze and Dust. The sale of coke has been encouraged by paying strict attention to the sizing. It is now the usual practice to screen the coke so as to produce large coke, small coke, one inch breeze, breeze, pea breeze and dust to suit the requirements of different classes of customers. There is a steady sale of considerable quantities of "small coke" for household use. Coke-dust formerly sent to the tip is now sold for use in boiler-furnaces where special fire-bars and forced draught are used. At some works, particularly in Germany, coke dust is mixed with tar and converted into briquettes which find a ready sale.

In 1907 patents were taken out for the manufacture of what was described as a new smokeless fuel called Coalite. The material is now produced on a fairly large scale by the British Coalite Company at Wednesfield and Plymouth. This fuel is the product of coal carbonized at a temperature of 1000° F. as against 1800° for ordinary gas coke. In the process of manufacture the gas made per ton of coal is only about 5000 cubic feet, half of the total volatile matter of the coal remaining in the coke. The tar obtained is about 20 gallons and is of a light nature and particularly rich in paraffins. The yield of ammonia is 70 per cent. of that produced at high temperature. Coalite ignites more readily than ordinary gas coke and burns with more flame, but it is only slightly better in heating efficiency.

In view of its greater efficiency and smokelessness, as compared with coal, coke merits a much larger sale for household purposes than it at present enjoys.

Ammoniacal liquor.—There is little to be said regarding this residual. Synthetic nitrogenous manures, such as

nitrolime, have hitherto failed to prejudicially affect the sale of ammonium sulphate. A considerable quantity of gas-liquor is now converted into strong ammonia both in this country and on the continent. This is found to be much more remunerative at present prices. Quite a large number of gas works possess a sulphate plant which in its improved modern construction is easily controlled. The extraction of ammonia from crude coal gas in these days of perfected mechanical appliances is very complete indeed. In the final washing with a rotary washer of up-to-date construction one may confidently expect an efficiency of 99 per cent.

Tar. Since the discovery and development of the aniline dyes, coal tar has had an attraction for the young research chemist. The unfortunate fact remains that 30 years ago tar fetched nearly double the price that it does to-day. The cause of the fall in price is the usual one—the supply is greater than the demand. Quotations depend largely on the market for pitch. As a dressing for roads a new use has been found for gas-works tar. It is said to preserve the surface of the road from disintegration and suppress the dust nuisance. Its use is accompanied by diminution in the expenditure on road cleansing, watering and maintenance. Carburetted water gas tar is of slightly less value than coal-tar. Special use has been found for it in the manufacture of naphthalene solvent. It yields a good kind of pitch which finds a use in the manufacture of special varnishes.

Spent oxide.—One of the troubles in purifying the gas by means of oxide of iron has been "back-pressure" caused by the oxide settling down in a compact mass, and thus offering excessive resistance to the passage of the stream. This has been remedied in a large measure by alterations in the design of the grids supporting the material. Various kinds of oxide ore are employed, but they are being displaced to quite a large extent by "artificial oxide" prepared from the burnt spent oxide. This material is inactive towards sulphuretted hydrogen immediately after coming from the kilns but after exposure to the action of air and water for a prolonged period and treatment with a little lime and copperas it is able to do its work satisfactorily, especially when lightened by the addition of sawdust or similar material. Nearly all the spent oxide of the gas-works is used for the manufacture of sulphuric acid. A small proportion is bought by a few chemical works for the extraction of Prussian-blue and sulphocyanide. This is said to be a profitable business only when the oxide contains at least 5 per cent. of the former ingredient. Lime for purification has been largely discarded, especially in the South of England.

Cyanogen extraction.—Ten or 12 years ago and occasionally since then prussiate of soda crystals were quoted at 4½ and 5 pence per lb. The price has been dwindling down for some time and during the present year it has stood at threepence. At the former figure a handsome profit could be made if the plant was sufficiently large to treat at least two million cubic feet of crude gas per day. At the present time few are bold enough to erect expensive appliances for the sake of cyanogen recovery. In the absence of a cyanogen recovery plant the impurity (only 0.2 per cent. by volume of hydrocyanic acid) is removed to the extent of about 80 per cent. by the oxide through which it has to pass. Prussiate processes on the Foulis, Davis-Neill, or similar systems are now in operation at seven or eight large gas-works in England.

A description of the various processes would carry us too far. Suffice it to say that ferrous hydrate, sulphide, or carbonate mud is the essential ingredient, the base being either ammonia, soda, or lime, or a combination of these. One of the great difficulties experienced has been to find a suitable washer to deal with a heavy sludge. The Holmes brush rotary washer is employed with success when the mud is thin but troubles ensue when the sludge is inclined to be gritty or thick. The highly ingenious washer patented by Feld in 1906, though not so high in efficiency as one would like, gets over this difficulty very satisfactorily.

It is more profitable to treat the gas before removing the ammonia. On the continent the Bueb prussiate process is very generally employed in the larger works. The

method consists simply in running a strong solution of copperas from time to time into a rotary washer. The sludge containing soluble and insoluble prussiate is sold to chemical works.

The British Cyanides Company's patented process of extraction has been in operation at a number of moderate-sized works for some years. In this process sulphur is added to strong ammonia liquor in a suitable washer to form polysulphide which takes up the hydrocyanic acid to give sulphocyanide. The resultant product is sold in the form of liquor to the chemical works.

DEVELOPMENTS IN PURIFICATION.—*Carbon bisulphide.* Under the old restrictions of the sulphur clauses, lime had to be employed on a large scale. This was sulphided so as to remove the carbon bisulphide as thiocarbonate. At the same time a large proportion of the carbon dioxide present was eliminated. With the repeal of the clauses the use of lime became no longer necessary except where no better means could be found of maintaining the illuminating power. It is possible to gain one "candle" by removing all the carbon dioxide, but all things considered it has generally been found unprofitable to do so. When the sulphur clauses were enacted the incandescent burner was not known. The diminution in the consumption of gas for a given candle power with incandescent burner was thought to be good cause for removal of the sulphur restrictions. Nevertheless the elimination of organic sulphur, as it is called, would be a welcome gain to the gas industry, for there is no gainsaying that the formation of even minute quantities of sulphuric acid in a room cannot but be harmful to furniture as it is to metallic fittings.

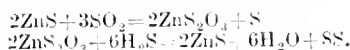
It is not likely that lime purification will again be resorted to on account of its tediousness, high cost, and uncertainty, and the difficulty of removing the malodorous product. Some hope of success is held out by the large scale experiments of Mr. Hall, of Portland, Oregon, the results of which have been recently published. Mr. Hall has adopted the expedient recommended by Mr. Vernon Harcourt 50 years ago of simply heating the gas leaving the purifiers to a temperature of 700° to 900° C. The probable reaction that takes place is represented by the equation $\text{CS}_2 + 2\text{H}_2\text{O} = 2\text{H}_2\text{S} + \text{CO}_2$. The heating takes place in brick chambers and the gas is afterwards purified a second time with iron oxide. The great bulk of the organic sulphur is said to be removed in this way, but nothing is known as to costs.

Liquid purification.—Seeing that a purifier-box must be opened more or less frequently with attendant dangers of firing of the oxide by rapid revivification, the loss of gas and the subsequent admixture of a large quantity of air when the box is again put to work, a process of liquid purification in closed vessels has been much sought after by gas manufacturers. Partially successful attempts to solve the problem were made in the eighties by Hills, Claus, and Holgate. The processes then experimented with depended on the action of purified ammonia, obtained by the distillation of the gas liquor, in absorbing hydrogen sulphide and carbon dioxide. The experimental plants that were erected were discarded one by one. Their failure was due to the following causes:—1. Loss of ammonia; 2. incompleteness of the reactions; and 3. the costly nature of the plant and the supervision necessary.

Two or three years ago Dr. Feld launched a scheme for condensing and purifying coal or coke-oven gas. The gas was to be taken as hot as possible, say at 200° C., from the retorts and treated in a series of centrifugal washers. The tar was to be fractionated by hot washing into pitch, dry heavy tar and dry light tar. It was intended to extract ammonia in two washers and sulphuretted hydrogen in another set of two. One washer was to be used as a cooler. Thus it was proposed to perform the whole process of condensation and purification in one small building under the supervision of one man. Attempts have been made to work the process in Germany, but so far as I can gather, without complete success. There have been naphthalene and other troubles. The idea is brilliant and, I think, well worthy of a sustained effort to put into execution.

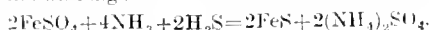
In the extraction of sulphuretted hydrogen Feld makes use of its reaction with sulphur dioxide. He at first used

certain oils as the medium for carrying the sulphur dioxide and sulphur, the latter of which eventually crystallised out. This method has been abandoned in favour of a process which has been in operation on a small scale at Königsberg and has just been started on a larger scale at one of the Hull gas-works, where 1½ million cubic feet per day are being dealt with. The active agent is zinc thiosulphate solution, made in the first instance by the action of sulphur dioxide on zinc sulphide formed from zinc oxide and sulphuretted hydrogen. Two Feld washers are used in the process and the reactions that take place are represented by the equations:—



The most recent proposal by Feld is one that ensures a very complete extraction of ammonia to form sulphate simultaneously with the removal of sulphuretted hydrogen. It necessitates an elaborate chemical plant, however. The process is explained by the following equations:—

1. First washing:



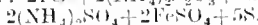
2. Regeneration of iron liquor:



3. Second and further washings:

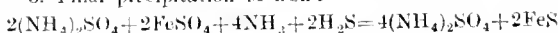


4. Oxidation: $2\text{FeS} + 2(\text{NH}_4)_2\text{S}_2\text{O}_3 + 3\text{SO}_2 + 4\text{O}$



Then follows the filtration of the sulphur.

5. Final precipitation of iron:



Then follows the filtration of ferrous sulphide, leaving a pure solution of ammonium sulphate.

NEW APPLIANCES.—*Gas washers.*—Professor Burstall of Birmingham University, who also has a scheme for the fractional separation of tar, has recently devised and patented a gas-washer and a fan tar-extractor the ingenuity of which appeals to everyone.

Among the washers that have been introduced in recent years may be mentioned the Holmes brush washer, the Feld vertical centrifugal washer already referred to, and the new vertical centrifugal washer of Messrs. Kirkham, Hulett, and Chandler. The last named is very similar in its action to the Feld washer.

Gas governors.—In the works the retort-house governor is coming into general favour. It ensures greater uniformity of gas. The use of district governors to regulate the pressure to consumers' meters is also being extended with beneficial results.

Gas calorimeters.—The "Boys" calorimeter was introduced by the Metropolitan Gas referees in 1905. It agrees closely in results with the Junkers and Simmance-Abady instruments and possesses peculiar advantages of its own.

Pyrometers.—Of new instruments the Wanner electrical pyrometer is largely used in Germany. The Féry radiation pyrometer is in greater favour in England and France. The latest modification is the Féry radiation spiral pyrometer—a very simple and compact mechanism capable of taking temperatures of combustion chambers and retorts with the greatest convenience and celerity.

Recorders.—*Pressure.*—In a gas-works it is highly desirable to have a record of pressure or vacuum at inlet of retort-house governor, inlet of exhauster, inlet of purifiers and outlet of holder. Every well-equipped works takes daily records of this kind.

Carbon Dioxide.—Daily records of carbon dioxide in the waste gases from boiler furnaces, in crude carburetted water gas, or even in waste gases from retort settings, are of great assistance in controlling manufacture. Several ingenious contrivances for this purpose are now supplied.

Calorimetry.—One of the latest advances is the recording calorimeter. Junkers' firm supply an elaborate and accurate calorimeter recording gross value. Messrs

Parkinson and Cowan supply a very simple mechanism which records nett value. These instruments are of immense value to the gas-manufacturer as they promptly indicate any want of uniformity in the quality of the gas made, and this affords opportunity of rectifying a defect without delay. This is all the more important in these days when the uniformity of calorific value is so essential.

Carburetted water gas.—In most gas-works possessing a carburetted water gas plant this auxiliary to coal-gas is only used either as a stand-by or as an enriching agent. That it is much cheaper to manufacture than coal gas is, I believe, the general opinion of the outsider. With oil at a comparatively high figure, as it has been for some years, carburetted water gas is probably on an average slightly dearer than coal gas, candle for candle.

One cannot say that any important improvements in water-gas manufacture have been made in the last ten years.

Research work.—There have been no contributions of great practical importance to our knowledge of the chemistry of carbonizing.

Improvements have been mainly physical and mechanical. The reactions that take place in the retort are as yet but little understood.

I would remind you of the bold experiment made by the Birmingham Gas Department in erecting five years ago as a test-plant a complete gas-works carbonizing 24 tons of coal per day. Hitherto we have not published any results, chiefly for commercial reasons. I may confidently say, however, that the remarkable improvement in the carbonizing results of the different works of the Department is in large measure attributable to the test-works, and justifies the considerable expense of its erection and working.

DISCUSSION.

After some remarks by Dr. R. LESSING,

Mr. H. T. PINNOCK said he was pleased to see in the town gas industry that it was found necessary to use producer-gas for heating the retorts. For lighting purposes town gas held pride of place; but for power and heating purposes the claims of Mond gas must be considered. His experience was that suction gas did not come fully up to expectations; while the cost of labour and water, associated with such a plant, and the waste of time in starting up, took away much of the efficiency of the plant. He desired to know whether the new Fery spiral pyrometer was as accurate as the thermo-couple type.

Dr. DAVIDSON: Very nearly; they agree closely.

Mr. PINNOCK, continuing, said he regarded the recording calorimeter as a useful invention. His firm were unfortunately situated, in that they had an apparatus which no one else had. No one was able to work it, except the professor who made it. It was made to satisfy the requirements of the Board of Trade, in order that the gas might be tested at any time; and when an official came he would probably be unable to use it. He was much interested in Professor Burstall's new tar extracting fan. He understood a test had been made and that the fan brought out the last traces of tar from the gas.

Mr. N. P. BOOTH asked how to detect minute traces of carbon monoxide in air—this being a problem with which he was recently faced?

Mr. R. B. BATTY said he regarded Victoria Square, Birmingham, as the experimental lighting area and supposed it was the show place of what could be produced at Saltley. A friend of his, who knew Europe well, looked upon that part of Birmingham as the best gas lighted area he had ever seen. Alluding to the observations as to the naphthalene trouble the gas experts were to be congratulated upon getting rid of the nuisance. In the statistical record on the prices of gas Dr. Davidson was not ashamed to state the price charged at Sheffield. He was glad to hear that high pressure gas would be

given without any great cost or inconvenience to the gas department.

Mr. WALTER asked whether it was necessary to use specially designed retorts where, as in Germany, a higher working pressure was maintained in order to bring down the percentage of nitrogen in the gas; also whether the ordinary fire-clay retorts could be used in the above case.

Dr. DAVIDSON, in reply, said in the coal gas industry the best return to be obtained from ordinary gas-coal was a conversion of 25 per cent. of the calorific value from the solid into gaseous form. With regard to producer gas 75 per cent. could be obtained. It had been suggested that towns should be supplied with producer gas, rather than coal gas, by reason of the lower cost of production. One important consideration, however, was the heavy cost of distribution, as huge holders and mains were necessary for distributing producer gas. He was not aware of a satisfactory calorimeter for accurately testing producer gas. As to the retorts in use in Germany where a comparatively high pressure was maintained, they were of the ordinary fireclay type, as used in this country, and there was found to be a certain leakage into the furnace and therefore loss of gas. The test for carbon monoxide was iodine pentoxide; the particulars being given in the *Journal of Gas Lighting* of June 22nd, 1909, p. 823. With reference to street lighting in Birmingham he was rather ashamed of it, with the exception of that in Victoria Square. They were very much behind Continental towns. In Germany where there was a lower grade gas incandescent lighting was far better. There the organisation and supervision of the lighting were superior, and the gas itself showed greater uniformity. When the new 24 in. main was laid in Birmingham the central streets would be much better lighted than they were to-day. On the question of price, Sheffield, which had a lower figure than Birmingham, was favourably situated, being near the coal mines. They paid three to four shillings per ton less for their coal than the Birmingham Corporation. They were also able to obtain a great deal of cheap slack. Sheffield was not however the lowest in price although it was the lowest in the list of the twenty-four largest towns. Widnes supplied gas at 1s. per 1,000 c. ft.

Canadian Section.

Meeting held at Montreal on Friday, October 22, 1909.

DR. MILTON HERSEY IN THE CHAIR.

ETHYL ALCOHOL FROM SAWDUST AND OTHER WOOD WASTE.

BY PROF. R. F. RUTTAN, M.D.

The action of the zymase of yeast upon glucose and certain other fermentable sugars is the one source of the ethyl alcohol of commerce. It therefore follows that the problem of how to produce ethyl alcohol in a more economic manner can only be solved by finding a new and cheaper method of obtaining solutions of fermentable sugars.

The fermentable sugars employed in the preparation of alcohol have been derived hitherto from a number of sources, which may be generally stated to be (1) the products of the hydrolysis of starch and allied substances by means of an amylase; (2) solutions of sugar obtained directly from fruits, &c., and the non-crystallizable by-products of sugar works, &c.

The cost of alcohol from these sources is much too great to enable it to compete with other products in many fields where it could be used to great advantage. This is due, not so much to the cost of manufacture as to the cost of the raw material from which the fermentable sugar is obtained. The most economical source of starch on this Continent is Indian corn, yet this raw material costs at

present \$21.60 per ton. One ton of corn gives about 90 gallons of alcohol of 94 per cent. at a cost of 24 cents per gallon for raw material. About two gallons of raw molasses produce 1 gallon of 94 per cent. alcohol, and this raw material costs 21—22 cents. The raw material of German alcohol has been estimated to cost 20 to 21 cents per gallon of alcohol of this strength.

There is a process in which a waste product of nominal commercial value is the raw material from which fermentable sugars can be obtained. The actual cost of sawdust and other wood waste to any industry is difficult to estimate. In some localities, where the quantity of waste is not great, a local market for it has been established, and in most forms it has been disposed of at a small profit. The larger mills, now that electricity is of such general application, have in many cases increased their power and find an economic outlet for all forms of wood waste as fuel for generating this power. There remain, however, the great majority of the large sawmills of this continent where the wood waste has either to be disposed of by sawdust burners at a cost of about 20 cents per ton, or allowed to accumulate in heaps upon the land, or is turned into an adjoining stream to be a nuisance and an injury for many years, if not for generations.

Any industry employing wood waste situated in the vicinity of a large mill of the last-mentioned class, should be able to obtain waste for the cost of transportation and handling which under moderately favourable conditions should not exceed 30—50 cents per ton.*

As I shall later explain, one ton of sawdust or other comminuted wood waste calculated to a dry basis can be made to yield about 20 gallons of alcohol of 94 per cent. This then reduces the cost of raw material from 20—24 cents to 2 or 2½ cents per gallon of alcohol.

That fermentable sugar can be produced from wood has been known to chemists for nearly a century. Braconnet as early as 1819, by heating wood cellulose with sulphuric acid, produced a pulp which contained glucose. The sulphuric acid, however, could not be economically removed. Since then no process has been devised until quite recently for hydrolysing cellulose and allied bodies economically.

Numerous attempts have been made to solve this problem and the list of patents on the subject is a large one. Prior to 1900, when the Classen patents were taken out, the hydrolysing effect of many acids on starch and the celluloses had been studied and the processes patented. C. Pope, for instance, in 1898 obtained a patent for hydrolysing starch and obtaining fermentable sugar by sulphuric acid, and Einar Simonsen in 1898 a patent to make sugar or glucose from sawdust by the action of dilute sulphuric acid (see this J., 1898, 365, 481, 1164). Sulphurous acid had long been used to make wood pulp from comminuted wood before these patents; it was also well known that when sulphurous acid was heated with wood, sulphuric acid was always formed which took part in the reaction, and its action was prevented in pulp-making by the use of calcium bisulphite, the sulphuric acid combining with the calcium as it was produced.

Dr. Alexander Classen of the Polytechnic School of Aachen, stated in 1900 that sulphurous acid in aqueous solution under pressure converted the cellulose of wood into glucose and that the product could be fermented in the usual way yielding ethyl alcohol. He patented this process all over the world, but the original methods as stated in the patent proved to be crude and unworkable. The claim is as follows:—

"The process of converting cellulose into sugar, which consists in heating the cellulose in a closed vessel at a temperature of 120°—145° C. with a solution of sulphurous and sulphuric acids substantially as described." (This J., 1900, 1028; 1901, 734, 1908.)

After successful experiments in a test plant erected by Classen in Aachen, a similar plant on a larger scale was erected at Highland Park near Chicago, to demonstrate to American capitalists its possibilities. The results were so satisfactory that a larger plant on a commercial scale was

erected at Hattiesburg, Miss. The plant included the following elements:—

1. An acid apparatus where the solution of sulphurous acid was prepared and where the excess of sulphur dioxide after use could be re-absorbed and saved for further utilisation.

2. A revolving cylinder, 30 feet long, and about 36 inches in diameter, which formed the converter or digester.

3. An exhausting battery consisting of a series of tanks in which the sugar was washed from the partly converted sawdust by hot water.

4. Neutralising vats in which the various acids remaining in the saccharine liquid were neutralised by calcium carbonate.

5. Fermentation vats, and a still, where the process was completed as in an ordinary distillery.

The wood waste was introduced into the digester (which it nearly, but not completely filled), made of iron lined with lead to prevent action of the sulphuric acid, and surrounded by a steam jacket by which it was heated. This revolving cylinder had a capacity of about two tons. To the charge of wood waste was added a weight of a nearly saturated solution of sulphur dioxide corresponding to about one-third of the raw material. The drum was closed air-tight and steam turned into the jacket while the whole slowly revolved. The temperature of the interior was thus slowly raised to 290°—300° F., and the pressure to about one hundred pounds. After from four to six hours the sulphurous acid and steam were blown off into the absorbing tanks and the sulphur dioxide thus partially recovered. The cover was removed and the contents emptied looking then very like finely ground coffee. This finely divided, treated wood was conveyed to the exhaustion batteries and the sugar extracted. The liquid obtained, contained from 350—400 lb. of sugar for each ton of raw material treated. The next steps were to neutralise the acid liquid, allow it to clear by subsidence, pump it into the fermentation vats, ferment it by yeast and distil the product in the usual way. It was claimed for the process that each ton of wood waste gave about 18—20 gallons of absolute alcohol.

The history of the original Classen process is an excellent example of how a process which will give very good results on a laboratory scale, and good results even on a larger experimental scale, will just fail to succeed when magnified to a size necessary for working on a commercial basis. Even the strongest supporters of the original Classen process do not now believe it to be a success as a money-making proposition.

The difficulties in the way to success for this process are explained to be: (1) The length of time necessary to convert 1½ to 2 tons of wood, this requiring from 4 to 6 hours; (2) the quantity of acid required; (3) the prolonged action of so much acid and water in the rotating converter reduced the wood to a very fine powder and formed much sulphuric acid which, acting on the sugar and other substances, produced gums and caramels, and so made the complete extraction of the sugar from the residue very tedious and expensive. (4) The buckling and breaking of the lead lining of the converter, which had to be repaired after every two or three operations, and proved a very great source of delay and expense.

The plant built in the United States, which is reported to have cost for building and working for a year about \$250,000, has not been used for some time. Two chemical engineers, Malcolm F. Ewen and G. H. Tomlinson, who were associated with the Classen process, both in Germany and the United States, finding the original process unlikely to prove a commercial success, obtained substantial financial aid from a Chicago engineer, Mr. J. M. Ewer, and in 1904 began experimenting along new lines to overcome the difficulties which prevented the old process from being a success. The result of their researches and experiments has been to shorten the time of the hydrolysis in the converter from six hours to 40 or 45 minutes, to obtain the treated wood waste in a form which could

* Tenders have been offered to deliver, 200 yards away, 200 tons of sawdust, etc., per day at 25 cts. per ton.

be quickly and efficiently extracted, to devise a converter which is not in the least degree affected by the process, to reduce the quantity of acid employed, and to obtain a very uniform and large yield of fermentable sugar from wood waste.

This process, by the courtesy of the patentees, I was enabled to study in June, 1909, at Chicago Heights, about 20 miles from the city of Chicago. The plant was erected by the Wood Waste Products Company, now called the Standard Alcohol Company, which has control of the Ewen-Tomlinson patents. This experimental plant was composed of units of commercial capacity, and was set up in workshops in the grounds of a large machinery manufactory. It consisted of the same elements as those required for the older process, *viz.*, the acid generating and recovery apparatus, a converter or digester, a battery of diffusion cells to extract the sugar, neutralising and storage tanks, fermentation vats, and a distillery.

The converter in use at Chicago was a revolving cylinder, 12 feet by 8, of steel, lined with fire-brick, and set in a cement of lead oxide and glycerin. It had a capacity of about two tons of shavings or three of sawdust. The wood waste, sawdust, shavings, or small chips, are dumped into the converter, which is completely filled, and is then closed air tight. Gaseous sulphur dioxide in measured quantity, only about 1 per cent. by weight of the dry wood, is introduced through a perforated tube passing through the trunnions of the cylinder and thus through the centre of the revolving mass of the sawdust. When the required quantity has been added the sulphur dioxide is turned off and live steam is introduced through the same tube till a pressure of about 100 lb. is reached. It takes from 10 to 15 minutes to get the contents of the digester heated up to the required temperature. The steam is then cut off and the digester revolves slowly for another 40 to 45 minutes, the temperature and pressure being kept constant, when the hydrolysis is complete. The steam, carrying with it the terpenes, the excess of sulphur dioxide, and some acetic acid, is then discharged into the absorption tank. The manhole is again opened and the coffee-coloured chips and sawdust discharged into a V-shaped bin which supplies the conveyors going to the diffusion cells.

In the plant now being built for the Du Pont Powder Company at Georgetown, S.C., it is probable there will be three or four converters, egg-shaped or spherical, and capable of taking four to five tons at one charge. These are to be so arranged that when the digestion in one is completed the steam and acid may be directly discharged into a second digester already filled with wood waste, thus saving time and expense in recovering the acid of each charge.

From the converter the treated wood is conveyed to the extraction battery where it is rapidly and effectively exhausted by hot water, the acid liquid neutralized with slaked lime and carbonate, allowed to settle in the settling tank, and then pumped to the distillery, fermented and distilled.

In the tests I made of the plant two charges of the converter were used. The first contained 3623 lb. of shavings from Chicago Mills, air dry and almost entirely pine. This carried 18.61 per cent. of moisture, making the dry wood equivalent 2948.8 lb. The second charge consisted of 2992 lb. of shavings and 2105 lb. of wet hardwood sawdust, consisting chiefly of oak but with some pine. The total weight of the second charge was 5097 lb. with a dry wood equivalent of 3058 lb. This second charge was made with a view of testing the effect of the process on sawdust carrying a very high percentage of moisture. The sawdust gave on analysis 70.4 per cent. moisture.

The product of the action of steam and sulphur dioxide on the first charge of shavings was a friable brown product resembling tan bark or coffee, with a fragrant aromatic odour and strongly acid. Analysis of this gave:

	per cent.
Moisture	32.23
Total reducing sugars	13.70
Calculated to dry basis	20.20
Total acidity (as sulphuric acid, H_2SO_4)	1.23
Sulphuric acid (H_2SO_4)	0.418
Reducing sugars, fermented	10.70
Unfermented sugars, xylose, etc.	3.00

The wood waste in the second charge after treatment resembled the heated shavings, but was finer and had a powerful aromatic odour and gave the following results:

	per cent.
Moisture	34.63
Total reducing sugars	14.28
Calculated to dry basis	24.18
Total acidity	1.12
Sulphuric acid	0.353
Reducing sugars, fermented	10.97
Non-fermented matter, xylose, etc.	3.21

The total weight of waste wood in the form of sawdust and shavings in these two charges was 8760 lb., or calculated to a dry basis, 6007.1 lb.

The treated wood was then exhausted with hot water in the extraction battery. The liquid containing the sugar from these two charges was collected in one storage tank and occupied a volume of 2984 gallons, or 26,150 lb. in weight. The mingled liquors contained 5.6 per cent. of reducing sugars calculated to dextrose.

The total acidity was 0.64 per cent. calculated to sulphuric acid; of this 0.21 per cent. was sulphuric acid and the balance was composed of acetic acid, a little sulphurous acid, and aromatic compounds of the type of pyrogallol. The presence of the polyphenols and tannin bodies was most obvious. On neutralizing this solution with lime and calcium carbonate it blackened rapidly and when ready for fermentation had an inky colour due to the oxidation of the aromatic salts. The liquid also contained a considerable amount of furfural. As there is little or no nitrogenous material suitable for yeast food in the liquor it does not ferment well alone, hence before adding the yeast about half a bushel of malt sprouts was added to a vat of 3000 gallons as food for the yeast.

In this experimental plant various forms of yeast have been tried. The problem as to which particular breed of yeast will give the best results was, in June last, still unsolved. The yeast used in my experiment was brewers' yeast from a neighbouring lager beer brewery which was found to give constant and regular fermentations, but not more than 75 to 80 per cent. of the theoretical yield of alcohol was obtained. The fermentation occupied about three days, when the liquid was handed over to the gauger and distiller who was an employee of the United States Government, and placed in charge of the distillery. From the 2984 gallons of fermented fluid, corresponding to 6007.1 lbs. of dry wood the gauger reported 115.92 gallons of proof spirit or 61.66 gallons of 94 per cent. alcohol.

This will be seen to be equivalent to 20.55 gallons per ton of wood waste calculated to a dry basis, or 14.14 gallons per ton of wood waste including the wet sawdust which contained over 70 per cent. of moisture. This alcohol when rectified to 94 per cent. is of a potable spirit, crystal white, and carries no trace of odour or flavour of wood. It contains no trace of methyl alcohol or of the higher alcohols such as fusel oil but, gives the reaction for traces of furfural and aldehyde.

At present there has been little or nothing done towards utilizing or indeed determining the quantity and value of the by-products resulting from the manufacture of ethyl alcohol by this process. The Standard Alcohol Company have contented themselves with manufacturing a very cheap and pure ethyl alcohol and have left the working out of the by-products to the future.

The wood waste left behind after complete extraction is a friable cellulose and represents about 65% of the original wood, of which only about one-third is rendered soluble and extracted by the process. This material, according to the present plan, is to be squeezed between rollers, dried partly by waste heat from the boilers and used as fuel. Turpentine and acetic acid are found in the absorption tanks after blowing in the steam from the converter and will no doubt be recovered.

In France there is in operation another process for the manufacture of ethyl alcohol from wood waste. I know nothing of this process beyond an account of it which appeared in the General Electric Review of September, 1909, by G. U. Borde. The claims for this process are interesting and extraordinary. Finding the Classen process

unworkable on a commercial scale the company who controlled those patents for France are reported to have so modified the process as to largely increase the value of the by-products, chiefly the acetic acid and the solid tailings, and can still produce about 20 gallons of alcohol per ton. The raw material is treated in a Classen converter with a solution of sulphurous acid at a pressure of 100 lb. Neither the time required—a most important item—nor the form of the converter nor yet the quantity of acid used are stated in the report. From the profound change effected in the character of the wood, however, the process must be greatly prolonged and the sulphuric acid formed given ample opportunity to attack the cellulose. The digested mass is allowed to partly cool in the digester when it is found to have shrunk about 25 per cent. The sulphurous acid is recovered and the material from the digester passed over to a separator in which the acetic acid is recovered by vapourizing it with steam. The whole mass, without any attempt at separating the sugar, is then neutralized, made into a mash, which is fermented and distilled in the same way as an ordinary grain mash is handled in a whisky distillery.

The tailings from the still are compressed and dried as in the previous process by waste gases from the boilers. This material is claimed to be useful as a stock food, or can be briquetted or mixed with magnesia to form artificial stone of value. In an experiment conducted by the writer I am quoting, he obtained from 3200 lb. of refuse wood 21½ gallons of 94 per cent. alcohol, 76 lb. of acetic acid and 1800 lb. of stock food. The value of this he estimates as follows:

Alcohol at 40 c. per gall.	\$ 8.60
Acetic acid at 6 c. per lb.	4.56
Stock food at \$23 per ton	17.25
	<hr/> \$30.41
Estimated cost of production	7.00
Net profit	<hr/> 25.41
	<hr/> \$30.41

If this be a true estimate of the value of the products obtained from a ton and a half of sawdust it is much more profitable than the process I have reported upon. The ethyl alcohol produced according to the above is of secondary importance both commercially and economically to the manufacture from sawdust of a food-stuff for stock of greater value than Indian corn. The description of the process does not convince one that the inherent difficulties of the Classen process have been removed. The exaggerated value placed upon the stock food is obvious. There is no reason, however, why a prolonged digestion of wood at a high temperature should not greatly increase the yield of acetic acid and might produce a substance from cellulose by the hydrolysing effect of sulphuric acid which might have a food value, but necessarily a very low one after the extraction of the sugar. It is known that the partial hydrolysis of keratin (horn, hoof, hair, etc.), renders such substances digestible. If the process be carried so far as this, however, it seems very probable that the sulphuric acid formed would destroy much of the sugar and thus lower greatly the yield of alcohol. In the Ewen-Tomlinson process which I have studied, it was found that the more rapidly the contents of the digester could be raised to the required temperature the shorter was the time required to produce the maximum yield of sugar; a gradual elevation of temperature, as occurs in the Classen process, induces secondary reactions and a lower yield of fermentable sugar. This rapid heating of the contents of the converter is only possible by the Ewen-Tomlinson method of introducing live steam into the interior of the mass by the perforated tube in the axis of the converter.

All will watch with interest the development of these two offsprings of the Classen process in America. A plant is being erected to use this French process at Hadlock, Wash., and another is proposed for some place in Ontario.

As to the cost of production of ethyl alcohol by the Ewen-Tomlinson process, a very close estimate has been made, based upon tenders and the experience of the

patentees in the Classen plant. Broadly speaking, the cost is about the same as that required to produce alcohol from grain or any other starchy material. Outside the converter itself there is nothing used in the plant which is not quoted on the market and made for other purposes. Without going into details, a plant capable of handling 100 tons of dry sawdust in a ten hour day, or working continuously, 200 tons per day, including buildings of a simple character and of cheap substantial construction, was estimated at \$99,500. The daily cost of maintenance, including interest, depreciation, labour, and material, allowing 50 cents per ton for the sawdust or other wood waste, would amount to \$217, i.e., \$217 for 100 tons, or \$2.17 for 20 gallons of alcohol, 90 per cent., or a net cost of 10.8 cents per gallon. No allowance is here made for fuel, save the cost of drying the unused portion of the sawdust. This estimate further is made on a plant not smaller than 100 tons.

When one considers the possible value of the by-products from a large plant, and the fact that quite 20 per cent. of the available sugar was not fermented in the experiments made last June, it would appear that cheap industrial alcohol has at last arrived.* Ethyl alcohol from grain, 94 per cent., averages about 52 cents to the consumer without the Government tax, and denatured alcohol from 45 to 60 cents. Alcohol made from refuse wood should not cost the consumer more than 20 to 25 cents.

Quite apart from its economic aspect, the manufacture of fermentable sugar from wood by this process is intensely interesting to the chemist. The process is essentially one of hydrolysis analogous to the conversion of starch to sugar by the amylolytic ferments. The celluloses are, like starch, polysaccharides of unknown constitution. They are generally represented as having the same percentage composition and empirical formulae, and just as we can represent the hydrolysis of starch to maltose and dextrose, so we can show how by the assimilation of water the cellulose can give rise to maltose and dextrose. It is assumed that it is the cellulose element in the wood which gives rise to the sugar.

I was much struck by the regular action of sulphurous acid upon the sawdust, a constant quantity, about 35 to 40 per cent. of the wood, only being attacked. We know from the studies of numerous chemists, such as Hugo Müller, Sachs, Cross and Bevan, and others, that wood freed from adventitious constituents such as the tannins, colouring matters, resins, &c., is strikingly uniform in the composition of its fundamental tissues, notwithstanding the great variety in structural complexity, and this uniformity in composition is not confined to species, but is found to embrace all sorts and varieties of woody tissue. The average composition of wood from all sources may be said to be, water 11 per cent., cellulose 50 per cent., soluble in water 3.5 per cent., non-cellulose 35.5 per cent. Lignum vitae and ebony are exceptions, being very low in cellulose and high in non-cellulose.

In the Classen patents and in one of the Ewen-Tomlinson patents it is the cellulose which is claimed to be converted into fermentable sugars. It seems more than a coincidence that the quantity of material hydrolysed in the Ewen-Tomlinson process should be so constant and should correspond so closely to the proportion of non-cellulose found in woods. In all processes of hydrolysis the non-cellulose or lignone complex is the first to break down whether the hydrolysis occurs in an acid or an alkaline medium. There is every evidence that here the lignone complex is broken down. The presence of hydroxy-derivatives of benzene, of pentoses, acetic acid, and furofural in quantity is obvious in the liquid extract of the treated wood. It seems probable that the lignone complex in woods is attached to a certain proportion of cell cellulose (hemi-cellulose) as well as to the oxy-cellulose and perhaps to the true fibre cellulose.

The material left after treatment consists of cellulose which is found on being again submitted to steam and sulphur dioxide to yield but a trace of sugar. True fibrous

*The Standard Alcohol Company claim to be able to produce this alcohol at a cost of 7 cents per gallon in a large plant.

cellulose (absorbent cotton) in another experiment remained unattacked. Its physical as well as its chemical properties were practically unchanged.

Under the conditions of the process a small quantity of sulphurous acid is employed for a short time only and very little sulphuric acid is formed. It would seem that the acid acts here as a catalyser inducing a rapid hydrolysis of the lignone complex and of a proportion of easily attacked cellulose. The oxy-cellulose for the most part and the true cellulose present are not seriously altered chemically. It would seem possible that, authorities to the contrary notwithstanding, the lignone complex is capable of yielding a certain amount of fermentable sugar. Should this, on further study, prove to be the case, it might be possible to treat pulp wood by this process as a preliminary to its conversion into pulp, and then by a second treatment to produce pulp fibre from the unattacked residue.

There is little doubt that in the original Classen process there was, owing to the larger proportion of acid and the prolonged action, a more profound action on the cellulose and the lignone complex, as well as probably a secondary action on the carbohydrates produced.

In a lumber producing country like Canada, any industry that can utilise waste wood and give it commercial value should receive encouragement. If this be the "revolutionary discovery," which the Department of Agriculture at Washington has pronounced it to be, it will add much to the wealth of nations. It will not only open up new fields for the use of industrial alcohol, but will liberate for use as food the million of bushels of grain now used up in the manufacture of ethyl alcohol, 90 per cent. of which is used as a luxury in life and regarded by many as a distinct evil in the community.

Liverpool Section.

Meeting held at the University on Wednesday, November 10th, 1909.

MR. MAX M'SPRATT IS THE CHAIR.

A RAPID METHOD FOR THE DETERMINATION OF ZINC IN THE PRESENCE OF IRON.

BY JAMES M. TAYLOR.

The published volumetric methods for the determination of zinc in the presence of iron require a preliminary treatment to obtain a pure zinc solution. This usually means the separation of copper, lead, and bismuth by hydrogen sulphide. The excess of hydrogen sulphide is boiled off, and iron oxidised. Precipitation by ammonia or ammonium acetate, in the presence of ammonium chloride, throws down ferric hydroxide with varying amounts of zinc; this is dissolved in acid, and reprecipitated by ammonia, the process being repeated till the filtrate is free from zinc. In most methods it is also necessary to remove manganese before estimation of zinc. The precipitation of zinc sulphide in the presence of chloroacetic acid is not complete if chlorides are present. These separations require too much time, and methods involving them were not useful on that account. A method of titrating zinc in the presence of iron seemed, therefore, a necessity.

Zinc sulphide is precipitated when hydrogen sulphide is passed into a dilute neutral solution of a zinc salt, with the liberation of an equivalent of acid. Ferrous salts,

under similar conditions, are unaffected. An endeavour was made to utilise these facts, by titrating the free acid liberated with caustic soda, using methyl orange as indicator.

Hydrogen sulphide was added to a mixture of zinc and iron sulphates, and normal caustic soda run in from a burette; towards the end of the titration "clots" of ferrous hydroxide were formed where the caustic soda dropped into the liquor, which did not readily dissolve. The white zinc sulphide first obtained darkened when the neutral point was reached. The further addition of about 0.2–0.3 c.c. of caustic soda gave an almost black coating of ferrous sulphide. The results were not satisfactory.

Sodium carbonate was tried instead of caustic soda, with some success, and pointed to the possible additional advantage of using bicarbonate. The latter was adopted with immediate success, and concordant results were obtained.

The use of methyl orange as indicator was abandoned, and the point when all zinc was precipitated and ferrous sulphide commenced to be thrown down, giving a greyish chocolate colour to the precipitate, was taken as the end point.

The following is the method employed for the determination of zinc in solutions containing ferrous salts, supposing them to be free from lead and copper—5 or 10 c.c. of the liquor are measured into a 600 c.c. flask 20 c.c. of a saturated solution of ammonium chloride, and a drop of methyl orange solution are added, and the solution neutralised with $N/2$ sodium bicarbonate. About 100 c.c. of water saturated with hydrogen sulphide are added, and then $N/2$ sodium bicarbonate is run from a burette, at first at the rate of about 2 or 3 drops per second. The contents of the flask must be well shaken throughout the titration. Each drop of sodium bicarbonate as it touches the liquor gives a black precipitate which *instantly* dissolves. Should the black precipitate of ferrous sulphide not form, it is a sign that insufficient hydrogen sulphide is present. When the zinc sulphide commences to turn grey, the sodium bicarbonate is added more slowly, shaking for four or five seconds after the addition of every 0.1 c.c. Finally, one drop will change the colour to a decided chocolate, when the titration is finished. 1 c.c. of $N/2$ sodium bicarbonate solution is equivalent to 0.016 gm. of zinc. The sodium bicarbonate solution is made by dissolving 42 grms. of bicarbonate in water and diluting to one litre. The solution is stable, but it is advisable to titrate a known amount of zinc alongside the sample till the operator becomes accustomed to the end point, taking the sample to the same depth of colour. The bicarbonate solution is standardised as follows:—0.15–0.25 gm. of zinc is measured into a 600 c.c. flask, and 20 c.c. of saturated ammonium chloride solution and about 0.1 gm. of ferrous sulphate are added. The solution is neutralised, treated with hydrogen sulphide, and titrated as described above for the actual determination of zinc. The end point is more distinct if the ferrous sulphate is added about 0.5 c.c. before the finish.

One, or at the most two drops of sodium bicarbonate solution cause a distinct darkening that is not materially increased by the addition of a further cubic centimetre.

In carrying out the determination of zinc by this method, the following points must be noted:—

(A) Copper, lead, and bismuth, unless present only in traces, must be removed by means of iron gauze or hydrogen sulphide in acid solution.

(B) Iron should be present in the ferrous state, otherwise the neutral point is obscured. Heating with iron wire or sulphurous acid speedily accomplishes this.

(C) The volume of solution should be about 150 c.c. after adding hydrogen sulphide water, when the zinc is 0.1–0.3 gm. If the zinc is present in small quantity, say 0.1 gm., a sharper end reaction is given if the volume does not exceed 70 or 80 c.c.

(D) As in the case of most zinc titrations, the conditions should be as near alike as possible in sample and check test.

Although designed primarily for the rapid determination of zinc in ferrous liquors, the method is capable of wider application if the prescribed conditions are adhered to. Unlike most well-known methods, iron and manganese are not detrimental: in fact, the former is necessary.

The following experiments were made to show the effect of various metals on the zinc assay:

Weight of zinc taken.	Iron.	Manganese.	Cobalt.	Nickel.	Aluminium.	Zinc found.
grms.	grms.	grms.	grms.	grms.	grms.	grms.
0.25	0.02*	—	—	—	—	0.2498
0.25	0.50	0.1	—	—	—	0.2464
0.25	0.02	0.1	—	—	—	0.2504
0.15	0.02	—	—	—	—	0.1504
0.15	0.02*	—	—	—	—	0.1496
0.15	0.02	0.15	—	—	—	0.1496
0.15	0.02*	—	0.015	—	—	0.1500
						0.1472
0.15	0.02	0.15	0.15	—	—	0.1516
0.15	0.02	0.15	—	0.015	—	0.1510
0.10	0.10	—	—	—	—	0.0956
0.10	1.00	0.10	—	—	—	1.000
0.10	0.10	0.10	—	—	—	1.004
0.10	0.02	—	—	—	0.02	0.1020
0.01	0.01	—	—	—	—	0.0104

It will be seen from the above that the amount of iron has very little effect on the result. Cobalt, nickel, and aluminium, if not more than 5 per cent. to 10 per cent. of the zinc present, do not interfere. Manganese has a beneficial influence, causing the end point to be more distinct.

In the absence of metals of the second group and ferric salts, the whole operation can be completed in 5 or 6 minutes.

If desired, the chocolate coloured precipitate, consisting of the whole of the zinc as sulphide, together with a small amount of ferrous sulphide, may be filtered off; and after washing with water to remove manganese, cobalt, nickel, and iron, dissolved in hydrochloric acid followed by bromine. One precipitation with ammonia will suffice to separate the whole of the zinc present. A rapid means is thus afforded of obtaining a pure zinc solution, on which a check analysis may be made by some other method.

These experiments were carried out in the central Laboratory of the United Alkali Co., Ltd. I am indebted to the courtesy of Dr. Raschen and the directors of the company for permission to publish these results.

DISCUSSION.

Mr. E. CAREY asked what the author considered the limit of error in the assays. The results were very interesting, but he felt a little disappointed at the want of definiteness with regard to the point at which the indicator would show black; it was evidently a test which required a considerable amount of practice.

Prof. F. G. DONNAN asked if the concentration of iron was likely to produce an error. Example No. 2 in the table, which showed a considerable error, gave the iron as present in large excess.

Mr. TAYLOR in reply, said he could not give examples of the limit of accuracy other than those in the table, which were the results of experiments on known amounts of zinc. The probable error would be about 1 per cent. of the zinc present, but with practice, should be much less. He could not explain why in one case where the iron was twice that of the zinc, the zinc found was 0.2464 gm. instead of 0.25 gm.; in one case the zinc found by titration was exactly the amount introduced, though the amount of iron present was 10 times that of the zinc.

* In these experiments the ferrous sulphate was added near the end of the titration.

London Section.

Meeting held at Burlington House, on Monday, November 1st, 1909.

DR. J. LEWKOWITZ IN THE CHAIR.

THE MANUFACTURE OF ARTIFICIAL STONE FROM SAND AND LIME.

BY J. C. STEAD.

The manufacture of artificial stone blocks from mixtures of sand and lime has been carried on for some years with more or less success, but little appears to have been published as to the results of actual work, although German and American literature referring to silica and sand-lime bricks is fairly plentiful.

With slaked lime, bricks and also satisfactory blocks of artificial stone which have upwards of 25 cubic feet content are produced. For either brick or stone the proportion of lime used varies from 4 to 10 per cent., and both, when finished, are usually capable of sustaining fairly high compressive loads.

The stone with which this paper deals was made of a mixture of sand and quick lime filled into moulds, subjected to the action of steam or hot water under a pressure gradually raised to, and maintained at, 9 to 10 atmospheres, then cooled, removed from the moulds, and used without further treatment. However, although it is possible thus to make perfect blocks of, say, 6 feet in diameter and 3 feet deep, yet so far there have been considerable difficulties as to uniformity of output.

When working with plain moulds, with a mixture containing from 12 to 14 per cent. of lime, the finished blocks were found to contain globular masses of stone quite distinct from the exterior cylindrical shell. The division between the two coincided apparently with the points or lines where the pressures developed by the resistance of the mould to the expansion of its contents (due to the slaking of the lime) were equalised, and became uniform. This necessitated some modification of the rigid mould employed, and in the next and all succeeding experiments a cushion of sand surrounding the whole of the mixture contained in the mould was introduced in order to neutralise these pressures to a certain extent. The globular formation within the stones then ceased to be produced. The sand layer or cushion appeared also to have a further advantage, in that it assisted the diffusion of the water or steam throughout the mass of the stone mixture, besides facilitating the removal of the stone from the mould at the completion of the process and cooling.

With a mixture containing 13 to 14 per cent. of lime, stone as that marked S3 in the table resulted. This was very hard, and although excellent in all other respects, was rather too dense for ordinary building purposes.

In the next series 10 per cent. of lime was used, the other conditions remaining the same. The stone from this was cracked at right angles to its greatest dimension, and was evidently of insufficient strength to withstand the stresses set up within its mass.

A return to 13 to 14 per cent. of lime gave unsatisfactory results with blocks 3 feet deep, owing apparently to dusty sand being used. The penetration of the water into the mass of the contents of the mould was in many instances bad, portions of the blocks were not thoroughly hardened, and the stone formation was incomplete. Cracks encircled and crossed the imperfect parts and also radiated therefrom; but in those portions which were well penetrated by water the stone was of good quality, free from flaws when cut up, and generally remained so when exposed in the yard.

On diminishing the vertical thickness, stones up to 2 ft. thick showed no flaws, and their texture was uniform throughout, the water having evidently diffused equally

and quickly in all directions. These last blocks were made at a time when the temperature varied considerably. The slabs into which the blocks were cut, soon developed cracks at right angles to their greatest dimensions, but not extending to the circumference. Sound slabs of stone made during the summer months did not so crack, although exposed in the yard immediately after sawing onwards and also during the winter months to alternating damp and frosty weather. The winter-made blocks, which were of good uniform hardness when cut, when exposed, laid flat, just as natural stone would lie upon its bed, became softer and ultimately cracked up in all directions. The porosity of the newly made stone obviously favoured the absorption of moisture from mist and rain which, alternating with hard frosts, had the usual disintegrating effect.

All of the series were made with sand containing 98.3 per cent. of silica, and quicklime titrating upon an average 92.4 per cent. of calcium oxide.

The general characteristics of typical specimens of the stone produced are given in the accompanying table.

The first six of the following are samples of the stone referred to in the foregoing:—

Number of mark on block.	When made.	Per cent. of CaO in mixture used as per titration.	Appearance of the stone produced.	Porosity 20/5/09. The numbers rising as the porosity increases.	Load on bed under which stone failed, lbs. per sq. in. The tests were made with 3-in. cubes rubbed dead true.	Remarks.
S 3.....	Oct., 1907	13.4	Very close and fine; arrises sharp and good.	1	9,485	Full sized block = 6 ft. diam. by 3 ft. 6 in. deep approximately. Stone excellent throughout.
S VIII.....	May, 1908	11.0	Somewhat coarse; arrises not sharp.	7	1,038	Full sized block. Stone uniform throughout. Cracked vertically.
S XIV.....	June, 1908	17.2	Close; arrises good.	2	8,879	Full sized block. Penetration of water imperfect; block contained patches of badly formed stone.
S XXX.....	Aug., 1908	14.0	Close; arrises good.	3	5,535	As S XIV.; in this case central portion badly formed.
S XXX.....	Aug., 1908	15.7	Close; arrises good.	4	6,24	Full sized block; had but few faults; was generally good.
SL VIII.....	Dec., 1908	14.27	Close; arrises good.	8	4,683	Block of diminished depth; well penetrated by water, and stone good.
E.....	Prior to July, 1907	6.8	Somewhat coarse; arrises not good.	6	4,815	
III. (made with slaked lime)	April, 1908	9.3	Somewhat coarse; arrises not good.	5	3,612	

The figures as to porosity and resistance to crushing are not comparative, the specimens not being of uniform age. They, however, show the effect of different proportions of lime and of varying age.

The results obtained indicate at least four considerations which require to be constantly borne in mind. They are:—

(1) The proportion of lime used must be such that the resulting stone be sufficiently strong to withstand the stresses set up.

(2) The whole of the mass of the dry mixture contained in the mould *in situ* in the hardening cylinder must at the commencement of the process be thoroughly and as nearly as possible simultaneously saturated with steam or water.

(3) The contents of the mould must not be subjected to excessive pressure.

(4) The stone, particularly when made during a season of low temperatures and variable climatic conditions, requires some period for maturing and that preferably in a suitable atmosphere, e.g., one containing carbon dioxide, for the purpose of diminishing its porosity before use.

The first two conditions are not obtained without considerable attention to detail. A mixture of sand and lime containing, say, 10 per cent. of lime is easily and quickly

permeable to water, but the resulting stone lacks strength and is liable to crack during or immediately after formation. A mixture titrating 13 to 14 per cent. of lime yields stone which is strong enough, but which may be cracked owing to the unequal and imperfect penetration of the water or steam. It would seem that this is not solely due to the increase in the proportion of lime *per se*; but in part to the silica dust contained in the sand. The fine particles favour a more intense reaction with the increased lime, which is to a certain extent cumulative and tends to seal off portions of the block. These are not necessarily the central portions, since the imperfect stone due to bad water or steam penetration is sometimes found to be annular or horse-shoe shaped, the centre of the block being hard and perfect. If the sand be very dusty or dirty it may of itself impede or stop the diffusion of water or steam. Sound stone can be produced by the means indicated from a mixture containing a certain percentage of lime, and ordinarily uniform procedure with uniform temperate climatic conditions produces uniform results.

I am indebted to the directors of Ford Stone, Limited, for their kind permission to publish the foregoing notes,

DISCUSSION.

Mr. W. F. REID said he did not like to criticise this paper in the absence of the author and would only remark that he seemed to think that pressure and high temperature were unsuitable for producing this stone, but it was a well-known fact that sand lime-stone was made successfully in large quantities under such conditions. It was stated that the temperature must be raised simultaneously throughout the mass; and other conditions were laid down without any indication of how they were to be fulfilled.

Mr. WATSON SMITH referred to the extraordinary results obtained by Messrs. Parr, Ernest and Williams in the United States, in the use of finely divided silica mixed with lime (see this J., 1909, 1131). They stated that by the high-pressure steaming of briquettes (150 lb. per sq. in.) made by moulding 80 per cent. of finely divided silica with 20 per cent. of lime, blocks were obtained which had a tensile strength of 278 lb. to the sq. in. These on subsequent heating to various degrees, showed great and singular variations. Thus heated to:—

400° C.	a tensile strength of	0 lb. per sq. in. (i.e., a fall to zero)
600° C.	" "	131 " " " "
750° C.	" "	27 " " " "
800° C.	" "	71 " " " "
1330° C.	" "	263 " " " "

Large rise, but not as high as strength at 20° C.

Meeting held at Burlington House on Monday, December 6th, 1909.

DR. J. LEWKOWITZ IN THE CHAIR.

THE ARTIFICIAL SILK INDUSTRY.

BY W. P. DREAPER, F.R.C.

In the French Exhibition of 1889 Count de Chardonnet exhibited his now well-known process of manufacturing filaments of nitrocellulose by squirting collodion under suitable conditions into the air. The progress from this early production of highly inflammable filaments, to the present production of the large output of artificial silk manufactured by this process, which exhibits none of these inflammable properties, and resists the disintegrating action of water has been achieved by careful research. To-day the production of the material by the original method, starting with a solution of gun-cotton, has met with signal success; and even in the absence of any competing process would have led to the building up an industry of a permanent nature, from which the textile industry generally would have derived much benefit. This process of manufacture may in time go the way of most original processes, and give way to the more direct methods of later date. At present it is responsible for about 50 per cent. of the world's output. I have been informed in the Elberfeld-Barmen district, where 500,000 kilos. are worked up every year, that for some manufacturers the nitro-product is absolutely essential, while for others the newer products are of more value. If time proves that this is a normal condition, then the mere cost of production will not be the only determining factor in the situation.

Any way it is patent to all those interested that great economies have been effected in this process, more especially in the recovery of the solvents, and their re-use; in the rapidity of production; and in other ways of which no one outside the actual works can have definite knowledge.

Of the processes which have survived to this industrial stage, the three systems called, respectively, the nitro-cellulose, the cuprammonium, and the viscose ones may be specially mentioned. These have been so controlled, that they now produce a marketable product, which is in such demand that delivery can only be obtained for the second half of next year at the earliest. This latter point is an important one, for it is an indication that the newly-founded industry is based on a genuine demand.

These yarns, which range in size from 100 deniers upwards, are not adapted to the manufacture of such materials as are prepared from ordinary silk fibres of from 15 to 32 deniers, or even upwards; but they enter into a whole range of articles, and have had a profound influence on certain manufacturers, such as the braid industry, and given employment to a large number of hands. The new uses which are being found almost daily for these products also indicate a steady and increasing demand for the yarns in the future. For example, it is possible to manufacture a heavy cloth from these high denier yarns.

The early samples of the nitrocellulose product were extremely brittle and inflammable, and lost 50–70 per cent. of their strength on wetting. They were, however, extremely brilliant, and this satisfactory factor certainly led to further research and improvements in other directions, which gradually decreasing these objectionable features, caused such a demand for the yarn in comparison to the possible supply, that the price of this artificial silk for a time actually exceeded that of the real material. The extreme brightness of the goods made from it, and their peculiar feel, was undoubtedly the cause of this. With this state of affairs there is no wonder that the industry in France and Germany expanded, and several companies were undoubtedly formed to work processes which had little chance of commercial prosperity. The patent list of these times also indicated the gradual expansion of the experimental work which naturally followed, and was destined to give to these countries an absolute monopoly of manufacturing, which they have

held to all purpose until the last year or so; and also to give to the textile manufacturers of these countries a first call on this important and novel product. The absence of the yarn itself in this country, was one of the chief factors causing our neglect of this matter. The many difficulties of the process were emphasised by the failure of the English Company (starting to manufacture under the Chardonnet rights) due, it was then said, to local atmospheric conditions, the actual solution prepared in France refusing to spin at the Coventry factory.

Dr. Lehner demonstrated his process in London, but it was in Switzerland that he built up the enormous business which is associated with his name, and which to-day turns out such large quantities of the nitro-product. Chardonnet had to work with very high pressures, but Lehner, by modification of the solution, was able to squirt at very low ones. He also squirted into water, and in this way recovered the major portion of the solvent. The threads of nitro-cellulose were wound on to bobbins and dried.

Factories producing such a product were destined, sooner or later, to come under the notice of the insurance companies. Serious fires took place, and were unpreventable. It was found that the nitro-cellulose yarn in the dry state, like silk, became highly charged with electricity, and that self-ignition took place. The risks were subsequently modified by keeping the yarn in a wet state until it entered the "denitrifying" bath. There was still the alcohol-ether to be reckoned with, and it is, I believe, still impossible to insure such a factory. This mattered little, however, to companies making such profits. The Tubize Company rebuilt part of its factory a few years ago out of the year's income and still paid a good dividend.

Great speculation in shares; high and fluctuating prices for the yarn; fire at the works—but, most important of all, an increasing demand for the product, characterised the early days of the industry, the slow and steady progress of which was assured and never in doubt.

HISTORY OF THE INDUSTRY.

In 1845 the well-known French investigator Reaumur suggested the production of what might be termed artificial silk, and in 1885 Audemars patented the production from a nitro-cellulose base, but nothing more was heard of the process. In 1884 Count de Chardonnet deposited with the Académie des Sciences a sealed document which was opened on November 7, 1887; it bore the title "Sur une matière textile artificielle ressemblant à la soie." He had sufficiently worked out his process of manufacture to obtain a Grand Prix at the Paris Exhibition of 1889 for his product. He lodged his first patent on November 17, 1884 (Fr. Pat. 165,349). The first apparatus actually used for trials is shown in a photograph published in a work published by T. Foltz in 1903 (*Fabrication de la soie artificielle parisienne*).

In 1889 Dr. Vivier produced a product termed "Soie de France," but except in small details the production, and product, was very similar to that of Chardonnet. In 1892 Lehner patented his modification of the Chardonnet process (Fr. Pat. 221,991, May 25, 1892).

As a result of these early inventions the following centres have produced this nitrocellulose product in large quantities. Works at Besançon, in France; at Tubize and Droogenbosch-Ruysbroeck, in Belgium; at the four factories of the Vereinigte Kunstseide Fabriken, of Frankfurt; at Kelsterbach S.M., at Robinson near Augsburg; Glatbrugg and Spreitenbach, near Zurich; at Padua in Italy, and in Hungary.

The first patent connected with the production of artificial silk from cellulose dissolved in a cupro-ammonia solution was that of Despeissis (Fr. Pat. 203,741, Feb. 12, 1899). The only remaining record of this appears in a French publication, as under the French law of that date the specification was not printed, and being abandoned, owing, I believe, to the untimely death of this investigator, is not available for reference. Nothing more was heard of this process until Pauly in 1897 patented a process on very similar lines. The English specification has since been restricted by amendment so that the original suggestion of Despeissis, viz., the addition of a proportion of

some albuminoid substance to the solution, has been omitted in the latter specification. In 1899 (Eng. Pat. 6556, 1899), Fremery and Urban took out their first patent, dealing with details in the manufacture. In the same year (Eng. Pat. 18,260, 1899), Brounert patented his first improvement in connection with the direct solution of cellulose, although he had previously, in 1886 (Eng. Pat. 6858) taken out a patent for improvements connected with the nitrocellulose process.

Pauly, Brounert, Fremery, and Urban are for ever associated with the industrial application of the copper-ammonia process on the large scale: they have through their investigations led to the development of the celebrated Glanzstoff Company, which to-day employs over 7,000 hands, and manufactures such large quantities of this product. Their headquarters are at Elberfeld, and works at Niedermorschweiler and Oberbrück in Germany, and they are also interested in works at Givet, and at Izieux, in France (Messrs. Gillet et Fils). I believe that a Spanish Company, the Socio-lad Espanola de seda Parisien, has ceased working. The British Glanzstoff Co., Ltd., has recently started works at Flint, which it is said will give ultimately employment to 2,000 hands. It is understood also that works will shortly be erected in Russia.

In 1902 Thiele took out his first patent for improvements which enabled much finer filaments to be spun than heretofore. This and subsequent patents suggested a possible development in the industry (Fr. Pat. 320,446) in competition with the natural article.

Since that date the patents registered in connection with this copper-ammonia process have been very numerous. Only time will demonstrate their respective merits. In some cases copper carbonate in ammonia is used to dissolve the cellulose. Many patents deal with the use of different precipitating solutions, and details in the process, such as, for instance, the preliminary mercerising of the cotton.

In the early days there were in this country several investigators of note working on the subject of artificial filaments, amongst whom may be mentioned Crookes, Swinburne, Wynne and Powell, and Swan; also the first patent for a direct process of manufacturing from allulose was taken out by two Englishmen in 1884. It was not until six years after this date that Despeissis took out his first patent, which formed the basis for the early working of the cuprammonium process. It remained for France and Germany to bring this industry to a successful issue. However, having recently reached a state of manufacturing efficiency, as at the Coventry Viscose Works, we have made up for lost time.

It was natural that France, with the silkworm industry so firmly established in the south, should look with greater interest upon the possible manufacture of an artificial product, which might supplement the natural supply. The fact that Pasteur was instrumental in saving that industry from decay may also have had an influence in intensifying the belief that the problem was capable of commercial realisation through the aid of scientific research.

PROCESSES OF MANUFACTURE.

Charbonnat Process.—The original plant at Besançon started with an output of 50 kilos, a day in 1891; it had reached 1500 kilos, in 1904, and 1800 to 2000 kilos, in 1907, and seems to remain at that figure in 1909. The breaking-strain is given at 1.5 grm. per denier, and the elasticity at about 15 per cent. Whether elasticity is quite the term to use in the case of artificial silk is perhaps open to question. It is doubtful if the "stretching before breaking" which takes place can be compared with the actual elasticity of the real fibre.

Great precautions are necessary in the production of the solution or gun-cotton. The polariscope is used in determining the correct state of solution. The jets through which the colloid is squirted are accurately regulated by micrometric measurement. The process of denitration is, of course, a reducing one, and the details remain a secret. Temperature of the bath is a consideration, and the great aim is to reduce the loss of strength to a minimum.

Years of study have greatly improved this operation, and have produced a thread which varies very little in this respect from day to day.

The statement is made that in 1907 2,500,000 litres of alcohol were consumed in the Besançon works, so that each kilo. required between 4—5 litres of alcohol in its manufacture. A kilo. of 100 denier thread of this silk contains 90,000 metres in length, or nearly 2 millions metres of single filament as squirted from the jets. The selling price of this product has been given as 30 fr. per kilo. in 1896, 26.50 fr. in 1897, and 21.75 fr. in 1898; in 1903 it reached the price of 10 fr. per kilo., and it may be taken at 20 fr. to-day.

Zinc chloride process.—The first patented invention dealing with the production of artificial filaments by the direct solution of cellulose in aqueous solution and without the intervention of the nitrating process was made by Wynne and Powell in 1881 (Eng. Pat. 16,805 of 1884). These investigators seem to have confined their attention to the industrial production of electric light filaments, and this process has proved itself of great value in this direction and is in use to-day.

In conjunction with H. K. Tompkins, I took out further patents in 1897 dealing with details. In one of these patents the advantage obtained by "drying of the fibres or threads in a considerably stretched condition" was emphasised. This practice has since found a place in all the artificial silk processes dealing with the direct solution of cellulose which have since reached the industrial stage; and without it, it is impossible to obtain yarns of the maximum brilliancy.

Brounert in 1899 patented the preliminary mercerising of the cellulose and claimed that the solution was correspondingly facilitated. A good deal of work was done in this country by the Cellulose Silk Syndicate, Ltd., in connection with this process, and also by Brounert on the Continent; but in spite of statements to the contrary, I do not think that this process has ever been worked on a very large scale.

The cupro-ammonium method.—As before mentioned, this originated with the Despeissis patent (Fr. Pat. 203,741, Feb. 12th, 1890). Nothing was, however, done with the process until Pauly re-patented the process in 1897 (Eng. Pat. 28,631 of 1897). The cellulose is dissolved in an ammoniacal solution of a copper salt. The details of this method are, of course, not made public, but after filtering a satisfactory solution may be obtained. The coagulating solution may be a 15 per cent. solution of sulphuric acid, copper sulphate and ammonium sulphate being produced, and the cellulose is precipitated in the thread form, and wound on suitable winders, which are usually made of glass. The newly-formed fibre is then washed on these holders with fresh water.

E. Brounert (Eng. Pat. 18,884 of 1899) claims the treatment of cellulose with caustic soda, and then copper sulphate is added. When ammonia is added to the resulting mixture of cupric hydrate cellulose and sodium sulphate, a solution of the cellulose is obtained. Many patents have since been taken out, and it is obviously impossible to disclose the exact procedure in any works, even if they are known.

The recovery of the solvent materials is mentioned later. Fremery, and Urban have observed (Eng. Pat. 20,630 of 1899), that it is advisable to dry the product in two stages: first at 104° F., and afterwards at a higher temperature. If the yarn be submerged in water at a temperature of 158° to 212° F. they claim that a dehydrating action takes place with beneficial results.

Viscose Process.—In the year 1892, Cross, Bevan, and Beadle (Eng. Pat. 8700 of 1892) patented their method of bringing cellulose into solution for industrial purposes, but it was not until 1903 that Stearn (Eng. Pat. 1,020 of 1898), disclosed a commercial method of preparing filaments by precipitating this solution in the required manner by means of a solution of ammonium salts. This process was found to offer special difficulties, but to-day they have been overcome; and as a result of the initial work and first experiments at Kew, works have been erected at Coventry by Messrs. Samuel Courtauld and Co., Ltd., where this product is being produced in

increasing quantity. The process is also being worked at Sydowsauc, near Stettin, in Germany (Kunstseide und Acetatwerke Fürst Henckell Donnersmærk), in France, at Arc-la-Bataille, near Dieppe (Société Française de la Viscose), and in Italy.

Further important work has been done in this country on this process by Courtauld and Wilson (Eng. Pat. No. 21,405 of 1907), who suggested the addition of glucose to the precipitating bath, and Topham (Eng. Pat. 23,158 of 1900) who applied the turbine method of collecting the threads to these artificial fibres, an extension, I believe, of its previous use in the spinning of very short-fibred yarns, such as asbestos. Many patents have been taken out by other investigators, which deal with the preparation of the solution, methods of squirting, and subsequent treatment of the yarn, but they are too numerous to mention here. It is interesting to note in passing that the jets used for squirting in this process are made of platinum.

An extension has been granted to the original inventors for their patent rights in this country, so that although the patent dates from the year 1892 the rights are still in operation.

Cellulo silk process.—This product is manufactured under the Thiele patents at the English works at Great Yarmouth. Yarn is being produced down to 35 denier, or even lower. The process is a modified copper-ammonia one but there are many secret details connected with the manufacture. In spite of the relative fineness of the yarn, the number of filaments is greatly in excess of other makes which are on the market at the present time.

Cellulose acetate process.—Several patents have been taken out in this direction, notably by the Bayer Co., the Badische Co., and the Donnersmærk Co. They chiefly deal with the control of the methods of preparing the cellulose acetate. The question of a suitable solvent seems to present a great difficulty, although it is stated that there are many derived acetates, and that some of these are soluble in alcohol, or pyridine; but chloroform seems to be the chief solvent. Quite recently (Eng. Pat. 6654 of 1909), it has been claimed that formic acid is a satisfactory solvent. If this is so, a distinct advance has been made.

Gelatin and Casein Processes.—Very little has been done in this direction from the commercial point of view. In 1897 Millar patented a gelatin process (Eng. Pat. 2,713 of 1897); in 1907 Mugnier used vegetable albumins with the addition of borax, and Jannin patented the use of a solution of gelatin, glycerin, and formaldehyde in 1904 (Fr. Pat. 342,112). Casein was used by Chatelineau and Fleury, Timpe, and Todtenhaupt, but little has been heard of these processes.

Recovery of solvents.—The recovery of raw materials used as solvents is an important step in the nitrocellulose and copper-ammonia processes. It is, so far as I know, of small importance in the manufacture of viscose silk. In the first case, the recovery of alcohol, ether, or acetone from the air is important from the cost point of view, but is a difficult operation. Exactly what proportion is recovered in practice has not been disclosed.

Quite recently the Tubize Company have patented the absorption of the alcohol and ether vapour in sulphuric acid of 62° B. at 20° C.

In the copper-ammonia process both the copper and the ammonia can be recovered by known means. When the precipitating liquid is of an acid nature, electrolytic methods are available for the removal of the copper, leaving the ammonia behind in solution. This solution may be used for manuring purposes, or the copper may be precipitated as sulphide.

Recently applications of the known reducing action of glucose has been brought forward in the case where the precipitating solution is of an alkaline or caustic nature. The addition of glucose to the precipitating bath throws the copper out of solution almost immediately, and the precipitating solution has a much longer life. This process works well in practice.

These few remarks will indicate some of the methods

adopted in different cases, dealing with this important branch of the manufacture.

Machinery.—Each process has its special requirements as regards the machinery employed, and these have been naturally met in various ways. Companies working the same process in different countries differ materially in actual methods. In addition to this there is a mass of detail, which in many cases is not protected in any other way than that of secret working, and may be confined to the working of a single factory. Under these conditions I can only indicate one or two cases which may illustrate the methods adopted in the manufacture of these threads.

The first case is that of the original Chardonnet apparatus. This is of interest as showing in the original patent (Eng. Pat. 2211 of 1886) the amount of detail already available in those early days. The thread passed from the jet, which had a bore of 1/20 to 1/5th in., through a very short column of water and then on to the winder. When a thread broke, the broken end was seized by pincers and carried over guides to the reel to be wound. The pinions still ascending are cleaned by a rapidly revolving brush, before they descend again to pick up any more broken ends. This movement is repeated several times a minute. Air heated to 85° to 90° F. is passed by supply and discharge conduits through the outer chamber. The vapours carried by the air might be "condensed and removed by cooling" and the air after warming returned to the apparatus. The so-called Topham turbine system of collecting and spinning the threads at the same time (Eng. Pat. 23,158 of 1900) is a good illustration of the methods adopted to overcome the difficulties in manufacture. The squirted thread passes over a roller and thence into a rapidly rotating box. The fibres or threads as they are fed in are twisted together and are caused by the centrifugal force to form a compact coil around the interior of the box and to be formed into hanks or skeins. If the boxes are deep, a longitudinal reciprocating movement can be given to either the box or the funnel to make sure of the even coiling of the thread in the skein form. I have seen this apparatus at work on the Continent, and it certainly illustrates a very ingenious method of combining the skiving and twisting in one operation. It is, or has been largely used in the manufacture of artificial silk. It reduces the strain on the newly formed threads to a minimum.

A third example is that of one of the more recent patents dealing with modifications in the Thiele "two-solution" process of spinning. (Dreaper, Eng. Pat. 21,872 of 1908; see this J., 1909, 1246.) In this case arrangements are made so that the freshly squirted thread comes in contact with a precipitating solution which acts comparatively slowly, and then passes into a stronger one.

PROPERTIES OF THE FIBRES.

Recognition of artificial silk yarns.—The nearer these yarns approach real silk in their physical properties, the more important will it become to have a satisfactory method for distinguishing between them. The qualitative and quantitative estimation of these different fibres has been studied by Saget and Süvern (Bull. Soc. d'Encouragement, 1906, 540), in comparison with real silk.

The ash in these products is under 2 per cent. Natural silk contains 17 per cent. of nitrogen as compared with the following figures for artificial silk:

Nature of Yarn.	Per cent.
Pauly make (Cuprammonium)	13
Chardonnet (Nitrocellulose) French	15
do, do, German	16
Lehnert do,	17
Nitrocellulose	9.15 to 14.14

It must therefore be the different state rather than the amount, in which the nitrogen is present in the (reduced) nitrocellulose products which determines its effect in dyeing with basic dyes, if this is the real cause of this phenomenon.

Diphenylamine sulphate is the ready test for artificial silk, and give the following reactions:

Silk	Brown colouration.
Tussah silk	do. (intense).
Chardonnet and Lehner (Nitrocellulose) ..	Intense blue.
Pauly, Viscose or Yarmouth silks	No reaction.

Strength on wetting.—This loss in strength has introduced a serious factor into the manufacture of textiles, but under present conditions this defect is gradually decreasing, and may in time be eliminated. This is seen by comparing figures published in 1900–1901 with more recent figures which are available.

In the year 1900 an isolated test (Bronnert, Bull. Soc. Ind. Mulhouse, 1900) gave a loss of 77 per cent. for Chardonnet silk in strength on wetting.

In the year 1901 Strehlenert gave the following figures:—

Yarn.	Dry strength.	Wet strength.	Loss per cent.
China silk	53.2	46.7	14.1
French (ecrue)	50.4	40.9	18.8
Chardonnet silk	14.7	1.7	89.6
Lehner	17.1	4.3	74.8
Viscose (old)	11.4	3.5	70.0
Do. (new)	21.5	3.5	84.0
Glanzstoff	19.1	3.2	83.0

These figures give an average loss of 82.8 per cent. on wetting for the artificial products.

In 1903 Hassack gave the figures, from which the strength per denier has been calculated, as follows:

Quality.	Denier.	Breaking strain in grms.	Do. per denier in grms.	Elasticity, per cent.
Genuine silk	23	57.5	2.5	21.8
Chardonnet silk* ..	80	74.2	0.93	8.0
Fismis*	100	71.7	0.71	11.6
Walston*	120	151.4	1.26	7.9
Lehner*	120	171.8	1.43	7.5
Pauly	120	197.6	1.64	12.5
Gelatine	100	63.0	0.63	3.8

* Nitrocellulose products.

Recent figures given by the testing department of the Manchester Chamber of Commerce show the following results:—

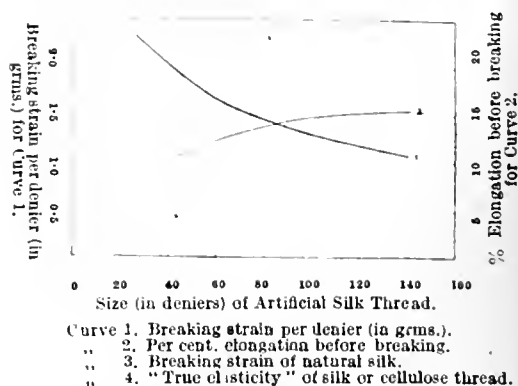
Yarn.	Dry strength.	Wet strength.	Loss per cent.
Glanzstoff	92.5	31	66
Cellulo silk	75.5	33	56

According to these figures the Glanzstoff product now loses 17 per cent. less "on wetting" than in 1901. The Cellulo Silk product loses still less. The present-day strength (dry) is given by Cross and Bevan at 1.0–1.4 grms. per denier, against 2.0–2.5 grms. for real silk. I think this figure should now be extended to 1.6 grms. for the artificial silk product. The "extensibility under breaking strain" at 13 per cent. to 17 per cent. for the artificial product against 15–25 per cent. for real silk. The average loss in strength on wetting is given at 70 per cent. for all varieties (Escalier).

I have recently received a sample of a 25 denier artificial thread containing 60 filaments, which has a breaking strain of 58.5 grms. This shows a breaking strain of 2.3 grms. per denier. This is quite as strong as some natural silks. A pound of this silk would contain 176,000 yards, which would contain 10,560,000 yards of filaments, or six times the length which a corresponding weight of natural silk of the same size would contain.

Strength factor and size of threads.—The following figures indicate for the same make of silk an important increase in strength for the finer sizes per unit weight of

thread (denier) and with it a decrease in "elongation before breaking." This latter figure does not mean that the elasticity is less. The fact that the number of filaments remains constant for the sizes tested is probably the cause of this phenomenon. They were as nearly as possible made under standard conditions, and from the same solution of cotton. The results are shown in the curve from the actual figures obtained.



Dyeing properties.—No two makes of artificial silk dye in exactly the same way. All the makes on the market dye with the direct, or cotton dyes, as might be expected. The general procedure is to dye at a low temperature, but I have seen artificial silk in mixtures dyed at the ordinary temperature for silk, after a "boiling off" in 1 per cent. soap solution for 1½ hours. Ingrain colours do not seem to give fast results on this product; the reason for this is unknown. Difficulties have been experienced in dyeing some dark shades satisfactorily in the past, but these have been overcome.

The cellulose acetate product stands alone in its dyeing properties; it is stated that a dye-bath containing alcohol greatly facilitates this operation.

The nitro-product is not capable of standing the "Lancashire bleach," but samples of cellulo silk have stood it fairly well. Real silk would go into solution under the treatment.

Waterproofing.—The lack of strength in the finished yarn in the wet state has as mentioned been a source of great complaint in the past. Great improvements have taken place in this respect and there are indications that with time this defect may be altogether overcome. Naturally all manufacturers have been engaged in the problem of preventing this degradation of the fibre when wet, due to the hydration of the reprecipitated cellulose. No known process of waterproofing by the application of waterproof materials in a suitable solvent is applicable, or of any real value. An attempt on altogether different lines has been made by Escalier (Monit. Scient., 1908, 13, and patents), who claims that he brings about a condensation of the cellulose molecule by treatment with formaldehyde. The recently published results of the strength of yarn in the dry and wet state, certainly indicates a specific action, and that this treatment reduces the tendency for the thread substance to return to the jelly state in the presence of water.

Some years ago the application of formaldehyde for this purpose was patented by Strehlenert (Eng. Pat. 22,540 of 1896) but it was only claimed for nitrocellulose products and was applied to the solution of that substance before squirting.

The only alternative to some such process seems under present conditions to be the use of a raw material which will not hydrate in the presence of water. This material is undoubtedly present in acetylcellulose, and if the working of this material becomes amenable to commercial conditions, any special treatment will be unnecessary. However, cellulose acetate is so waterproof that it will not absorb dyes from aqueous solution. Silk itself has the advantage of not losing its strength in the wet state, yet it is easily dyed.

The loss in strength on wetting is a temporary defect. It is entirely regained on drying. For example, fabrics of artificial silk and silk in mixture were boiled in 1 per cent. soap solution for 1½ hours in order to discharge the silk gum from the silk. They have suffered little, if any deterioration from that process. Care is needed in the handling in the wet state, but it is not beyond the scope of modern dyeing and finishing to meet the necessary conditions, even with very fine counts.

Any further small reductions in the loss on wetting will materially decrease the difference which exists to-day between the relative strength of these yarns and silk, and bring nearer the time when they may be equal in this, and other respects.

Scroup.—The peculiar rustle which silk possesses when dried out of solution of acid is imitated when these artificial fibres are treated in the same manner. So that in this respect the behaviour of the two fibres is identical. This fact may, on investigation, give some more definite explanation as to the cause of this phenomenon.

The brilliancy of the fibre in the coarse counts is greater than that of real silk. In the processes dealing with the production of these yarns directly from cellulose, the chief factor in obtaining this is the method of stretching the yarn during drying. The nitrocellulose product, if properly denitrated, is very brilliant, owing to the surface condition of the fibres and as in other makes the continuous nature of the filaments.

Size of individual filaments.—The 120-denier thread of to-day varies in the number of the individual filaments, but it may be said not to exceed 25 in number; so that the size of the individual filament may be taken at from 5 to 8 denier. Actual silk averages 2.75 denier per filament. The fine denier Cellulose silk (30 to 50 denier) may contain 45 to 60 filaments, so that here the size is about 0.5 to 1.1 denier. The fineness of real silk has been exceeded in this case. In the sample produced of a 15 denier artificial silk thread (Yarmouth make), the individual filaments are 0.33 denier, or roughly 1/8th of the size of those of real silk. This is the first time that such a thread has been exhibited.

WORLD'S OUTPUT OF ARTIFICIAL SILK.

This has been recently given at about 3,000,000 kilos per annum at the present rate of production, against 1,700,000 kilos in 1906, and 600,000 kilos. in 1896. These figures indicate an increase of 500 per cent. in 13 years.

The nitrocellulose product still heads the list with an output of between 1,300,000 and 1,600,000 kilos. The "copper-ammonia" process accounts for 1,100,000 to 1,300,000 kilos. The production of Viscose silk now amounts to 500,000 kilos.

These figures are large, but that will be greatly exceeded in the future. Within three years the viscose production may be doubled, as it is the intention to establish large works in America and elsewhere.

Output of natural silk.—The total returns for 1908 of the 24 European conditioning houses amounted to 51,445,000 lb. These figures show an increase of 30 per cent. in a decade (the average for the years 1896-8 being 34,929,400 lb.) to which all the three great producing centres, viz., Europe, the Levant, and the Far East, have contributed. It is, however, significant that the increase in Europe is only 20 per cent., against 50 per cent. for the Far East, and 100 per cent. for Asia Minor. This last increase is said to be entirely due to the efforts of the Silk Institute at Broussa; and the consequent introduction of scientific methods. In France the production of cocoons has not increased during the last years, in spite of large sums paid in State bounties, amounting to over £150,000 a year.

In 1906, 227 spinning mills spun 1,732,018 lb. of silk in France. A comparison of these figures with those of the present production of artificial silk which has also been given elsewhere at 5,000 tons per annum, is instructive.

There is no indication that the large production of artificial silk is materially affecting the gradual and increasing production of the real article; especially as the present production is practically confined to high

denier sizes (100 and above). These have a use which may be stated generally to be specific to the artificial product. Exactly what influence the finer counts will have on the production of the real product is a matter which must be left to the future.

It is obvious that an enormous industry must spring up before any appreciable result is noticed in the direction of a restricted output of real silk. One can only speculate on the effect of such a revolution, if the finer artificial silk is manufactured down to 15 denier, and ultimately equals in strength the natural product. A rough opinion may be formed as to the future of the industry on the statement made in a report by the United States Consul at Lyons that already 39,000 hands are employed in this industry. If this figure is correct—and it may not be very far from the mark—this industry will in the future give employment to a great number of hands, and become an increasingly important branch of the textile industry.

It is interesting in passing, to examine the position taken up by some authorities in this country, that there is an advantage in letting other nations work out new processes, and then establishing a position on the market with their early experience, and failures before us. The manufacture of this material under the conditions reviewed starts here with a financial handicap, for the leading Continental firms have already written down their works, plant, and rights, to a nominal amount, out of the abnormal profits in the past; they have a trained staff and great experience at their disposal. So that this must be set against any security arising out of such an assured position. On the other hand, it is claimed that in the two processes working to-day in this country, at Coventry and Yarmouth, respectively, the details of manufacture have been more successfully worked out here than on the Continent. The Viscose process is working on a large scale at Coventry, and there are indications that the Yarmouth research works may lead to an equally important development in the production and marketing of finer counts. The Flint Works is not yet producing yarn.

RELATIVE VALUE OF DIFFERENT MAKES TO ONE ANOTHER AND TO SILK.

However interesting many of the products may be, from the scientific standpoint, after all their commercial value and adaptability is of first importance. It is too early to attempt to define their relative values either from the point of view of cost, or their respective physical or chemical properties.

I would suggest, with all reserve, that up to the present time this so-called artificial silk has hardly come into direct competition with the natural product; and that this has been an important factor in favour of its development in the past. It has created and is creating uses for itself. Its selling price bears little relation in its fluctuations to that of real silk; but with the demand in excess of the supply this is not in itself conclusive evidence in this direction, but it tends to confirm other known facts.

With the material now being introduced in finer counts, it may certainly enter into direct competition with silk. The substitute must then chiefly claim advantage on the grounds of price value. With an improvement in strength in both the dry and wet state, competition must increase, as it has done in the past between the natural and artificial indigo, and alizarin products, and be governed by the relative conditions of supply. The last 15 years have seen a marked improvement in strength and so-called elasticity. There is no evidence that the limit has been reached, or even approached.

There is also the question of the relative "covering power" of the yarns when woven. The ordinary makes of artificial silk have only 60 per cent. of the covering power of natural silk. With an increase in the number of filaments in each thread a corresponding improvement in this respect naturally follows, as in the cellulose silk product. The limit to-day may be put at 60-75 per cent. of that of real silk. So that there is still room for improvement in this direction. The density of the cellulose substance

is about 10 per cent. in excess of silk, so that a covering power of 90 per cent. may be regarded as the maximum under equal conditions.

This is hardly the occasion to do more than point out the financial gain which has ultimately come to those who have carried this industry to its present state on the Continent. Notices which occur in the textile journals from time to time, indicate this in detail. The leading companies have paid steady and increasing dividends up to 50 per cent., or more (See Dreaper, *J. Soc. Dyers and Col.*, 1907, p. 5 and Dreaper and Davis, *ibid.* 1908, p. 294).

The manufacture of yarns by a process entailing the solution of the raw material as a preliminary step has, therefore, become a reality. It is evident that the future will see an extension of output, due to the growing appreciation of the value of these yarns, and the consequent extension of its uses.

DISCUSSION.

The CHAIRMAN said, as Mr. Dreaper had referred to certain matters being kept secret, he wished to emphasise that it was not intended to induce specialists to reveal their secrets in these general papers. These papers were rather to be of a general character. Although they would appeal in the first instance to specialists, and would also interest those grown up in other industries, these general papers were chiefly meant for the benefit of the younger members who wished to gain wide technological information. He would leave the discussion of specific points of this industry to those mainly interested in it, and therefore best qualified to speak; but he hoped there would be some general questions asked by those who were not actually engaged in the artificial silk industry. As Mr. Dreaper had mentioned the 1889 Exhibition and incidentally also quartz fibres, he vividly recalled the Chardonnet spinning-machine stowed away in a side alley of the Machinery Hall, and working without any attention; he was able to bring some of the fibres back with him to show to Professor Boys, who had at that time been producing quartz fibres, and was naturally interested in obtaining of the thinnest possible fibres for his modification of the Cavendish experiment. With regard to the question of the recovery of the solvents, which was only shortly referred to, could the author give any information as to the method of recovering the alcohol and ether by cooling to very low temperatures? Was it merely an idea that had been patented, or was it an actual process? He would like to mention Chardonnet's German patent 207,554; therein the absorption of vapours by means of sulphuric acid or by fats and oils was rejected, and substituted by absorption in aliphatic alcohols or their neutral esters.

Concerning the action of zinc chloride on cellulose, they knew that zinc chloride acted as a condensing agent on oils and fats, but very little was known of the rationale of the reaction. He should like to know how the process was controlled so as not to lead to the throwing down, as in the case of cellulose, of a horn-like or parchment-like product.

Mr. HENRY BRONNERT said the artificial silk industry had developed year by year in special ways which nobody had anticipated. At first, everybody thought that artificial silk would compete with natural silk, but it very soon proved to be an article quite by itself, and adapted also to entirely new articles which, in a great measure, it was the means of creating, *e.g.*, for ladies' wear, for trimmings, for ladies' hats, &c., all industries in which silk had not previously been used. There were now quite a number of new industries using this yarn, and the new factories which were being opened would be sure to find a good demand for their products. There were, without doubt, still further new fields in which artificial silk could be used to advantage.

Mr. E. F. CROSS considered that the paper was an opportune *exposé* of the present position and progress of this

remarkable industry. It was not the case that there was only so much business to go round, and a new factor appearing displaced so much of the old product. In the case of artificial silk, new classes of textiles had been introduced: the market showed that consumption was far from the limit, and he could increase Mr. Dreaper's total figures as stated, *viz.*, 3,000 tons, to 5,000 tons per annum; and further the demand was so far in excess of the supply that most factories were "sold forward" several months. Mr. Dreaper's insistence on his interesting new product of low deniers, down to a 15-denier thread, was justified as a technical forecast, but at present there was no demand outside the ordinary range of 100–130 deniers.

Mr. JULIUS HÜBNER asked Mr. Dreaper if he had any experience as to the specific gravity of the different kinds of artificial silk. He should think the difference in the dyeing properties of, say, different types of enpro-ammonia silk, would be most likely due to the after-treatment. It was well known that in the case of mercerised cotton, the affinity for the direct dyeing colouring matters changed very considerably if the cotton was dried before dyeing, as compared with cotton which had not been dried. The commonly accepted explanation for that was that the so-called water of hydration was removed by dyeing. If that was correct, the water of hydration could be got rid of very readily indeed, because he found that the dyeing property of cotton which had been treated with mercerising liquids, could also be altered by pressure. It was now possible to produce two—and more—colour effects on cotton fabrics if, after being treated with mercerising liquids and before drying, they were compressed in an ordinary embossing calendar. With regard to Mr. Cross's remark, that at present the market was not yet ripe for the finer deniers of artificial silk, he had a somewhat different experience, because the fine counts could be used for warps, &c., for which purposes the coarser deniers could not conveniently be employed.

Dr. J. C. CAIS said an important paper had recently been read before the French Academy on the recovery of waste alcohol and ether. The process there described was said to be remarkably economical, and consisted in compressing the air containing the volatile vapours under four atmospheres, passing it up a large tower, and cooling it gradually from the bottom, until at the top its temperature was about that of liquid air. By this means the water was eliminated at first, and there was none of the usual difficulty of freezing in the pump. He believed the yield was about 95 per cent. of the volatile vapours in the air. With regard to the suggestion of an alternative name instead of "artificial silk," in view of the fact that cellulose became "viscose," he ventured to suggest the name of "Celvis."

The CHAIRMAN said he thought that name would not do, because there was already a cloth called "Selvyt."

Mr. W. F. REID said there was one matter he should like a little more information about, as it interested him more particularly because the material produced was much nearer in chemical composition to silk than any of those spoken about that evening. He referred to Millar's gelatin silk. All those who had experimented with that knew that it was weak, but it had a most extraordinary lustre; and, although it could be made insoluble in water, yet it swelled in that liquid and became weaker still, so that it was quite unfit in that state for any fabric. He thought the future would bring some surprises in this connection; and, if they were once able to treat material like bone, cartilage, feathers, or wool in the same manner that they now treated cotton, they would get a product much nearer in its chemical composition and general properties to silk, and probably also in its elasticity and strength. He might also ask whether any filaments had been made in the way described for fishing purposes, which was the chief use for the silk of the silk-worm, next to that in textile industries. There was another matter

which had not been referred to, that of artificial bristles, and he should like to know if any information could be given about the actual use of these fibres for that purpose. Many years ago, when making experiments on these products, he found that the nozzles were very difficult to procure. The way he proceeded was, to make a carbon fibre, enclose it in a glass tube, and fuse the glass tube; the carbon fibre determined the diameter, and all the tubes were exactly the same. Then he burnt out the carbon, and had the nozzle. It was a very crude system, but efficient. He believed there were methods now of obtaining nozzles of exactly the diameter required; but he would like to hear any further information on that point, because it was very difficult indeed, considering that the orifices were invisible, to get them accurate.

Mr. O. GUTTMANN regretted that the author had not given more up-to-date information about the manufacture. It was incorrect to state that in 1855 Réaumur made artificial silk.

Mr. DREAPER said Réaumur was the first man to suggest the idea, and another man carried it out.

Mr. GUTTMANN said that as a fact Réaumur did suggest it in about 1730; but it was Adam Millar of Glasgow who, in 1855, produced artificial silk out of gelatin. He must also correct what he thought was an error in one of the tables. Mr. Dreaper had certainly succeeded in reducing the loss of strength due to moisture absorbed by artificial silk; but the loss in the case of cellulose silk was not 46 but 56 per cent. In speaking about the Chardonnet Factory at Besançon, he said that 2,600 hands produced one ton a day; that factory produced a good deal more than two tons a day. In fact, there were several Chardonnet factories which exceeded that figure. That was shown by the quantity of alcohol consumed, because the use of 4 kilos. of alcohol for 1 kilo. of artificial silk was, on the face of it, too much. He further stated that the Chardonnet silk contained from 9 to 14 per cent. of nitrogen. But nitro-cellulose, with 14 per cent. of nitrogen, had not so far been made; and Chardonnet's had only about 11 per cent. The recovery of the ether and the alcohol from artificial silk had been several times proposed and attempted, but unsuccessfully, until about six months ago. The recovery by means of low temperatures was, at present, at least, not practicable; it cost an enormous sum, as must be evident when it was borne in mind that in a spinning-room there were millions of cubic feet of air drawn out from which a very minute percentage of solvent had to be separated. What had been tried was to absorb the solvent, chiefly the ether, in sulphuric acid; and there were also other processes which had a large amount of success before them, namely, to absorb it in solutions of high boiling point, such as calcium chloride. The absorption with sulphuric acid had some prospect; but there was a difficulty in recovering the ether from the sulphuric acid again; there were by-products formed, which at present militated somewhat against the process—though no doubt these difficulties might be overcome. He would suggest "Lustrose" for the name of the product.

Dr. STEVENS said that whilst the majority of the fibres had smooth faces, he noticed that the fibre of the finer counts was irregular on the surface; it had some peculiar flattening and loops in places. Could the author account for that, and say whether it affected the quality and the properties of the silk?

Mr. F. J. FARRELL said he could confirm what had been said by Mr. Hübner, that there was a considerable demand for the finer counts for warp purposes; and, further, the supply of fine counts would create a demand. It was no use at present getting out patterns which it would be impossible to produce on a manufacturing scale. With regard to the recovery by condensation, he knew the recovery of benzene, at very low temperatures, from mixtures of air and benzene had not been successful. He also confirmed the statements that the production of artificial silk had created an entirely new class of fabrics; except in a few cases, it had not taken the place of natural silk at all. It seemed to him, although the all-artificial fabrics

shown were of considerable interest, that it was unlikely to become, for some time, of practical value by itself. It must depend for its use on the mixing with other fibres for the production of particular effects, but the amount which could be used in that way was very large. The producers need not be afraid, even if it were found impossible to produce fabrics entirely of artificial silk; it was very useful in conjunction with real silk, because of the possibility of obtaining two-colour effects, such as had been shown. With regard to the production of fine denier silk, it must be borne in mind that the finer the denier, the greater the covering power; and, as it was principally used for the purpose of effect, it was not the weight, but the covering power or the appearance, which had to be considered. He congratulated the author on the production of the 15-denier silk, which was a very notable achievement.

Dr. J. N. GOLDSMITH asked whether experiments had been made on the viscosities of the solutions which were to be squirted; and whether there was any relation between the viscosity and the breaking strength of the thread? Lehner's patent claimed that a solution of diminished viscosity was produced by the action of acetic and other acids; and he noticed that the Lehner thread had a breaking strain of 171.8, which was interesting in comparison with the Chardonnet of 74.2. They had been told that the Chardonnet process required very high pressures, and he concluded from that that the solution was of very high viscosity. *A priori*, one would suppose that a high viscosity would lead to a thread of high breaking strength. In a well-known book on textile fibres, reference was made to the difficulty of removing air bubbles from the thick solutions to be squirted. If there were air bubbles there were breaks in the thread. It was stated in this book that the air-bubbles were removed by applying high pressure to the solution, which was scarcely what one would expect.

Mr. W. P. DREAPER, in reply, said he could not, from personal knowledge, add to the remarks made concerning the process of cooling as a possible mode of recovering the alcohol and ether. It was a fact that within the last year a process had been patented by the Tubize Company in which sulphuric acid of a certain density was proposed; and this might be taken as an indication that certain improvements were being looked for, and that they might hope for a better process than the one in use to-day. It was not an easy thing to dissolve cellulose in zinc chloride, which would give a thread. There were certain secret manipulations which were necessary, and these had taken years to work out before a satisfactory conclusion had been arrived at. He agreed with Mr. Cross that artificial silk did not compete with the natural product. It might be a fact that the market was not ripe for the sizes under 100 deniers. The people who used these finer deniers were, generally speaking, not at all interested in the coarser counts; it appealed to a different class of manufacturer altogether; but there was certainly an increasing demand and inquiry for these fine counts. He had done no work himself on the specific gravity, but simply quoted the figures to which Mr. Guttmann had also probably referred, in which it was stated that this was about 10 per cent. denser than real silk, with the exception of the gelatin threads, which were said to be about the same as silk itself. With regard to this gelatin silk, to which Mr. Reid had called attention, he had certainly noticed its extreme brilliancy; but at the same time it would not be possible to weave or work up this product in competition with other makes.

As regarded the output, Mr. Cross mentioned that this was 5,000 tons per annum, and he believed that was correct. He had quoted figures recently published, when he said the output was 3,000,000 kilos.; but he thought it was an under-estimate. With regard to the irregular markings on the fine denier cellulose silk filament exhibited, they were not always present; they might be due to irregularities in the solution itself, or to the special conditions under which it was squirted, giving rise to surface tension effects or to some other causes of an indefinite

nature. Concerning viscosity and its influence, if any, he should say that it was only one of a very large number of factors controlling the manufacture. There were many ways of getting rid of air-bubbles, but he had never heard that external pressure was one of them; whether it would work or not, he should not like to say.

Nottingham Section.

Meeting held at Nottingham on Wednesday, November 17th, 1909.

MR. S. J. PENTECOST IN THE CHAIR.

THE AMOUNT OF SKIN SUBSTANCE DISSOLVED IN FELLMONGERS' COLLECTING LIMES.

BY J. T. WOOD AND S. R. TROTMAN.

In the *Leather Trades' Review*, of June 9, 1909, Mr. Seymour-Jones drew attention to various causes of looseness in sheep skins. By "looseness" is meant that condition of the skin fibres in which, instead of being compact and close like a piece of felt, they are loosely united like the texture of a blanket. In a short introduction the editor remarks:—"It is not too much to say, perhaps, that the matter of sheep pelt improvement is almost of national importance, for the demand existing to-day for high grade sheep pelts can hardly be met, whilst, on the other hand, common stock can hardly find a purchaser at remunerative prices."

Amongst the causes of looseness, a prominent place is given to the loss of skin substance caused by the condition of the lime liquor in which the pelts are collected in fellmongers' yards before being sent in to the leather dresser or tanner. The common practice is to throw the fellmongered pelts into an old lime, which is claimed to be a weak one. Some yards clean the lime-pits out after each lot of pelts and others after a few lots have been through, others every six or twelve months, and in one case they never remember cleaning out the limes, but they were freshened up from time to time. Here we have cases—and they are but too numerous—where fellmongers, not through carelessness, but through want of knowledge, keep the old limes for storing up the pelts pending sale.

Lime alone is capable of dissolving the interfibrillar substance of the skin, but in its fresh condition it will not attack the actual skin fibres. Out of each lot of pelts the lime dissolves a certain quantity of the interfibrillar substance, and this affords nutriment for bacteria, with which the pulled pelts are swarming. This bacterial lime is now capable of attacking the fibres of the skin, and thus taking out valuable substance, which should be made into leather. A new lime is antiseptic, and if pelts, after pulling, are washed in clean water and put into such a lime, they are practically sterilised for the time being, and will keep intact until the lime has dissolved out sufficient skin substance to act as nutriment for bacteria. It is these bacteria which produce the ammonia compounds, and which effect the solution of the skin substance.

The presence of dissolved skin substance in the limes may be demonstrated by placing 50 c.c. of the filtered lime liquor in a 100 c.c. cylinder, adding 10 c.c. of glacial acetic acid, and filling up to 100 c.c. with a saturated solution of common salt; the dissolved skin will be precipitated and float to the top. This method has been proposed by Gordon Parker and others, and has been in practical use in the tan-yard for many years.

In the Trent Bridge Laboratory, we have used hydrochloric acid in excess, and saturated the solution with salt. In this way somewhat more skin substance is

precipitated than by the method mentioned by Seymour-Jones (*"Leather Trades' Review,"* June 9, 1909) in which the solution is made only slightly acid, and not completely saturated with salt. In the article referred to the number of c.c. occupied by the skin in the tube after standing for one hour are termed "degrees," and for works use this is a convenient way of expressing it.

At Trent Bridge Works, Nottingham, we have made a number of analyses of fellmongers' collecting limes, and by permission of Sir John Turney, we are able to give the results of these analyses. The limes were obtained from districts as far separated as Scotland and Cornwall, and thus represent a fair sample of the condition of fellmongers' limes in this country.

The following are the details of the analytical methods employed. The liquors were filtered through a thick plug of cotton wool for analysis. The total alkalinity was determined by titrating 10 c.c. of the filtered lime liquor with N/10 hydrochloric acid, using phenolphthalein as indicator. A portion of the filtered liquor was boiled in a Kjeldahl apparatus, the expelled ammonia being collected in excess of decinormal acid and titrated (see foot note). The residue in the flask was titrated with phenolphthalein and decinormal acid, the acid used being calculated to lime. Soda, if present, was of course included in this figure, but there was in no case reason to suspect its presence.

The dissolved hide substance was obtained from the total nitrogen by multiplying by the factor 5.62. In determining the total nitrogen, the liquor was first acidified and concentrated, the ammonia already present being assumed to be derived from hide substance. This is undoubtedly the case, since the degradation of the skin under the influence of putrefactive bacteria rapidly passes the peptone stage with the production of amines and ammonia. A dilute solution of gelatin free from ammonia when incubated with a drop of lime liquor gave reactions for ammonia in three days.

The following is a further analysis of lime liquor 17* in which the nitrogen has been differentiated:—

Percentage of nitrogen present as hide substance.....	35.5
Percentage of nitrogen present as ammonia and bodies capable of yielding ammonia when boiled with alkali.....	21.4
Percentage of nitrogen present as peptone	43.1

The nitrogen as albumose or hide substance after the first stage of hydrolysis was determined by precipitation with zinc sulphate. Ammonia and ammonia-yielding compounds were obtained by direct distillation, and the difference between the sum of these and the total nitrogen was assumed to be peptone nitrogen.

The results on the table are of interest, as we believe they show for the first time in what a bad condition many of these limes are. In general, the older the lime the more skin substance it contains in solution, but the factors of temperature and quantity of skins put through cause this to vary. If it can impress upon fellmongers, and those who have to deal with pelts, what waste is going on in this direction, it may be pointed out that an amount of skin substance equal to a good pelt, weighing 7 lb., is dissolved in every 20 litres (about two buckets) of sample No. 4. For the mean of all the limes examined, such a pelt is contained in every 63 litres of liquor. The minimum shows one pelt in 300 litres (sample 8), but this is practically dirty water through which the skins have been drawn.

As to the nature of the skin substance dissolved in the limes, Van Lier (see this J., 1909, 1150) has shown that the true interfibrillar substance of skin is totally extracted by means of weak lime solution (about 0.7 gm. of lime per litre) in from 8 to 28 days, according to the nature of the skin (eight days for cow and horse; 28 days for calf), but this is for quite fresh lime solution renewed every 24 hours. The alkalinity of such a solution is 2.25 c.c. N/1 per 100 c.c. In the limes shown in the table it will be seen that the alkalinity in one case reached 12.8 c.c.

* The more accurate method of estimating ammonia in lime liquors of Procter & McCandlish (this J., 1906, p. 254), was not used, as we considered the distillation method sufficiently accurate for works control.

In addition to this excessive alkalinity, a microscopical examination shows the presence of numerous bacteria in these limes, which undoubtedly attack the actual fibre of the skin, and take out substance which should be made into leather.

In a paper entitled "Recent progress of tanning as a chemical industry" (this J., Nov. 30, 1903, p. 1274) one of us has already suggested that the role of bacteria in the liming process ought to be studied in our research laboratories in the same way that the bacteria in tan liquors, bates, and drenches have been investigated by Andreasch, Becker, and Wood. The various species growing in the liquors should be isolated and their life history and action on skin worked out. In such a way the process of liming as carried out in practice would be thoroughly illuminated.

Approximately 0.2 per cent. of nitrogen corresponding to 1.12 per cent. of skin substance is equivalent to 7.6 of Seymour-Jones' degrees, so that when the skin substance passes this amount it is no longer possible to distinguish between the limes, as the whole tube is filled with a mass of separated skin.

In conclusion, we recommend the following limits for a lime in which pelts are collected:—Lime in solution not to be less than 0.1 gm. of CaO per 100 c.c. The alkalinity should not exceed 6 c.c. N/1 per 100 c.c. To attain this standard the pelts would require to be well washed in clean water after pulling, and the lime pit cleaned out and renewed after two lots of pelts have been put through.

We would suggest that the Fellmongers' Association might advise fellmongers gratis as to these conditions, the ascertainment of which is of a very simple character.

Analysis of fellmongers' limes, used for collecting sheep pelts (grms. per 100 c.c.)

No. of analysis.	Lime (CaO) in solution.	Alkalinity as c.c. normal acid per 100 c.c.	Ammonia.	Total nitrogen by Kjeldahl's method.	Dissolved hide substance.
1	0.030	6.08	0.039	0.230	1.292
2	0.100	6.80	0.022	0.148	0.822
3	0.034	6.40	0.065	0.165	0.971
4	0.061	12.80	0.090	0.600	3.370
5	0.039	6.56	0.033	0.224	1.260
6	0.076	6.04	0.025	0.126	0.708
7	0.112	5.32	0.035	0.161	0.905
8	0.088	3.88	0.008	0.023	0.129
9	0.039	4.90	0.23	0.187	1.050
10	0.072	10.60	0.041	0.196	1.102
11	0.117	8.84	0.038	0.406	2.280
12	0.090	4.20	0.014	0.134	0.753
13	0.109	5.90	0.028	0.117	0.657
14	0.103	6.00	0.031	0.157	0.882
15	0.086	6.06	0.026	0.098	0.550
16*	0.091	4.50	0.022	0.126	0.710
17*	0.100	8.40	0.029	0.168	0.940
18*	0.100	5.10	0.021	0.096	0.539
19*	0.140	7.12	0.036	0.168	0.944
Min. . .	0.030	3.88	0.008	0.023	0.129
Max. . .	0.140	12.80	0.090	0.600	3.370
Mean . .	0.083	6.50	0.033	0.185	1.043

* Nos. 16 and 19 are collecting pits for linings. Nos. 17 and 18 are the spent pits from pelts limed for splitting.

Obituary.

LUDWIG MOND.

Dr. Ludwig Mond, F.R.S., born on March 7th, 1839, at Cassel, Germany, was a son of the late Moritz B. Mond, a merchant in that town. He attended the Polytechnic School there, and subsequently studied at the Universities of Marburg and Heidelberg, where he was the pupil of Bunsen. After leaving Heidelberg he held several appointments in chemical works in Germany. He came to England in 1862 with the object of introducing a process for the recovery of

sulphur from alkali waste, and became associated with Mr. John Hutchinson, of Widnes, at whose works he perfected his system. Two years later he undertook the erection and management of a Leblanc alkali works at Utrecht, Holland. In 1867 he settled definitely in England, and installed his sulphur recovery process in a number of British and foreign alkali works. He met early in 1872 Ernest Solvay, of Brussels, who had carried out successfully near Charleroi his new process for the manufacture of soda by the saturation of brine with carbon dioxide and ammonia. Solvay gave Mond the fullest opportunity to examine his process, and the latter was so struck with its possibilities that he entered into an agreement with Solvay for its introduction into the United Kingdom. In conjunction with Mr. (now Sir) John T. Brunner he established in 1873 the firm of Brunner, Mond & Co., and erected works near Northwich for carrying out the Solvay process, works which have grown until they have become the largest alkali manufactory in the world.

Another question to which he applied himself was that of the economical utilization of fuel; and the outcome of his work on this subject, which began about 1879, was the invention of the system of producing power-gas known by his name. At every stage of the process the most ingenious arrangements were introduced to utilize the thermal energy and prevent waste, and the volume of power-gas produced from each ton of fuel is stated to be about 150,000 cubic feet, sufficient to develop about 2,000 indicated horse-power hours when consumed in gas engines.

Many experiments were also made by him in the hope of utilizing Grove's gas battery for the production of electricity on an industrial scale; and though they did not enable him to achieve success in this particular object, they incidentally led him to the discovery of a valuable process for the extraction of nickel from its ores. Being anxious to use the hydrogen contained in producer-gas for the purposes of the battery, he sought for some means of removing the accompanying carbon monoxide; and in the course of the work, in which Carl Langer and Friedrich Quincke took part, it was noticed that the latter gas combined with nickel to form a substance now known as nickel carbonyl, which is remarkable as being a volatile compound formed at a temperature below a red heat, and which affords a means by which nickel can be separated from other metals. This compound, which was first described in 1890, was the first representative of an entirely new group of compounds, other members of which Mond subsequently discovered in the shape of iron, cobalt and other carbonyls. On the basis of these observations a large experimental plant for the reduction of nickel from its ores was erected at Smethwick in 1892, and in time the process was developed into the successful form in which it is now worked by the Mond Nickel Company at Swansea.

His connection with the Society of Chemical Industry lasted from its first inception to the end of his life. In January, 1880, he took the chair at a meeting held in Liverpool to establish a "Lancashire Chemical Society," and in the following April, at Manchester, it was he who advocated the extension of this local society into a national one devoted strictly to the interests of applied chemistry. When this society was founded in 1881 he was appointed Hon. Foreign Secretary, a post which he continued to hold, with one short interval, for the rest of his life. That short interval was spent as President and Vice-President of the Society. In August, 1881, he undertook the arrangements for the foundation of the JOURNAL, and to him it owes its general plan and order, which are substantially the same to-day. The contract for printing was drawn up by him in conjunction with the late Mr. George E. Davis and Mr. Watson Smith, and he guaranteed the cost until the JOURNAL should prove self-supporting.

In 1888 he was elected President. His address in 1889 was devoted primarily to the consideration of the

various methods of ammonia production, and incidentally to cyanides and power gas. In 1906 he was awarded the Society's medal for his conspicuous services to Applied Chemistry by his researches, discoveries, and improvements in processes. He was chairman of the Chemical Section of the British Association at the Liverpool meeting in 1886. He was the chief promoter and supporter of the International Congress of Applied Chemistry held in London last May. His generous hospitality will long dwell in the memories of those who were present.

He was a munificent benefactor of scientific research. It was through him that the Royal Society was enabled to bring out its international catalogue of scientific papers, and he made generous contributions in aid of the investigations carried out at the Royal Institution. Further, he transferred to the managers of the latter body, under a trust endowment, the freehold of the house adjoining its premises in Albemarle Street, for the purposes of a laboratory for research in pure and applied science, to be known as the Davy-Faraday Laboratory of the Royal Institution. This laboratory, which was formally opened by King Edward (then Prince of Wales) in 1896, he not only furnished with the most modern apparatus, but he also placed in the hands of the managers of the Royal Institution an ample annual endowment sufficient to maintain it in a state of thorough efficiency.

For some years past he had been in delicate health, and was accustomed to winter in Rome. He would have been President of the Chemical Society this year but had to decline office from this cause.

In November he became seriously ill, and died at his house in Avenue Road, Regent's Park, on December 11th, in his seventy-first year. He was buried in a mausoleum designed by himself in St. Pancras Cemetery, East Finchley, on December 14th, and his remains were followed to the grave by six past Presidents of the Society of Chemical Industry, and other members, with many other representatives of science.

List of Papers contributed to the Journal of the Society.

- "Ammonia Soda Process, Origin of the," 1885, 527.
- "Carbonyls, Metallic," 1892, 750. Abstract.
- "Chlorine, History of Manufacture of," 1896, 783.
- "Development of Voltaic Electricity by Atmospheric Oxidation of Combustible Gases," 1890, 42.
- "Nickel Carbon Oxide and its Application in Arts and Manufactures," 1891, 836. Abstract.
- "Nickel Extraction Process, History of," 1895, 915.
- "Patent Laws as applied to Chemical Inventions" (First Proceedings, 1881, 53).
- "Patent Laws Committee, Report of," 1882, 252.
- "Presidential Address," 1889, 505.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Drying dissolved leather, concentrated or coagulated blood, paints or pigments and other semi-solid substances: Apparatus for — K. Hofmann and J. J. Main, Leicester. Eng. Pat. 25,216, Nov. 23, 1908.

IN drying apparatus in which the material to be dried is fed upon the upper surface of a pair of cylinders heated internally, and rotated in contact in opposite directions, trouble often arises owing to the material accumulating at the ends of the spaces between the upper surfaces of the cylinders, passing on to the bearings and frame, and clogging the action. This defect is sought to be overcome by increasing the length of the axes of the cylinders so as to provide a space at each end between the cylinders and the frame. Further, plates, movable in the direction of the axes of the cylinders and supported from above, are pressed by springs against the ends of the cylinders so as to form ends to the space between the upper surfaces of the cylinders. One of the rotating cylinders is supported on ball bearings in movable journal-boxes, kept in position by springs, which allow the cylinders to separate slightly should an unusually large piece of material be fed on to the surface.—W. H. C.

Extraction of grease or oil from condensed water: Process for the — E. Hatschek, London. Eng. Pat. 26,228, Dec. 1, 1908.

THE claim is for the use, as filtering material, of a layer of precipitated calcium carbonate resulting from the manufacture of caustic soda from sodium carbonate. The layer of calcium carbonate is spread over the surface of the filtering apparatus and allows the water to pass

through, but prevents the passage of the grease, which accumulates on the surface and is removed from time to time.—W. H. C.

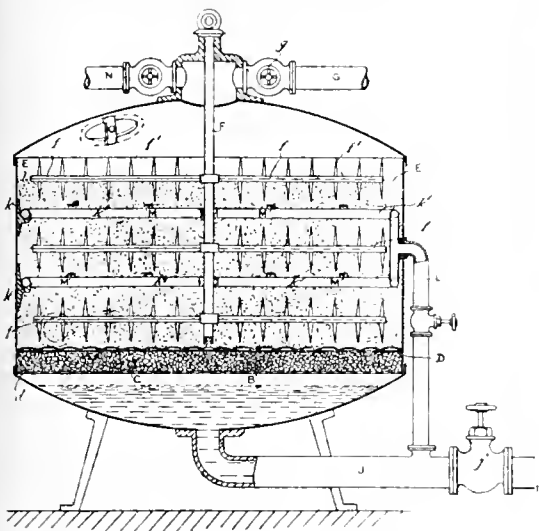
Separating solids of different densities: Machines for — R. S. Baxter, Broughty Ferry, N.B. Eng. Pat. 2544, Feb. 3, 1909.

THE mixture of solid bodies of different densities is placed in a V-shaped trough, one of the sides of which is formed of vibratory bars. An oscillatory motion is imparted to the bars by any suitable means, and the shaking which ensues causes the materials to arrange themselves in two layers. The lighter particles are discharged over the edge of the trough and the heavier ones through doors near the bottom, which are controlled by springs.—W. H. C.

Water distribution devices specially adapted for use in cooling towers. D. E. Morison, Hartlepool. Eng. Pat. 18,402, Sept. 2, 1908.

THE water is fed into a tank placed on the top of the tower and flows into the latter through a number of vertical nozzles which pass through the bottom of the tank. The nozzles consist either of vertical earthenware pipes with a conical bore or of cast iron cylindrical pipes with an earthenware nozzle or jet at the lower end. The upper ends of the pipes, which project slightly above the bottom of the feed-tank, are enlarged, or are cut away at one side, in order to obtain a "solid" jet of water from the nozzle. The jets of water impinge upon spraying saucers or trays placed within the tower directly below each of the nozzles. The trays have upturned, serrated edges which may be varied as to inclination and height in order to vary the angle at which the spray is projected from their upper surfaces.—W. H. C.

Filtering apparatus. F. Sheard, Dewsbury, Eng. Pat. 20,140, Sept. 2, 1909.



THE liquid to be filtered enters through the pipe, G, and passes through the sand, E, which rests on the perforated plate, D. The perforations in this plate have domed covers, *d*, pierced with small holes. Below D, is a layer of pebbles, C, supported on the perforated plate, B. After passing through the sand and pebbles, the liquid is discharged through the pipe, J. When it is necessary to cleanse the sand, the supply of water is shut off by the tap, *g*, and clean water is forced through the pipe, L, into the annular pipes, *k*, and the radial pipes, *k*¹; the latter have perforations, M, closed by non-return valves which open only by pressure from within. At the same time the wedge-shaped agitator blades, *f*, provided with pointed, wedge-shaped projections, *f*¹, are rotated by the shaft, F, so as to stir up the sand with the washing water. The latter flows away through the pipe, N, carrying the impurities with it.—W. H. C.

Filter for viscous liquids. L. Morane. Fr. Pat. 403,107, May 17, 1909.

A SERIES of circular filter-frames provided with central holes is arranged in a vertical cylinder and held in position by a hydraulic cylinder below. The liquid to be filtered enters the vertical cylinder, and after filtration, leaves the apparatus by means of the tube formed by the central holes of the frames, which communicates with an exit pipe on the cover of the cylinder. Each frame consists of two discs, one of which is provided with radial ribs forming channels to carry the filtrate to the central tube, while both are pierced with holes. The surfaces carrying the filtering material, which is secured by wires, are slightly conical. A balanced cover on the top of the cylinder, enables the frames and press-cakes to be easily removed.—J. W. H.

Filter-press for laboratory use. C. C. Leclaire. Fr. Pat. 403,115, May 18, 1909.

THE claim is for a compact filter-press for laboratory use, in which the liquid to be filtered does not come into contact with the pump. A circular disc filter-frame is mounted at the top of a receiver containing the liquid to be filtered. An agitator in the conical base of this receiver, and connected with the lever of the hand pump, prevents settling of the precipitate. Compressed air from the pump enters the receiver and forces the liquid through a vertical tube into the filter-frame. Provision is made for washing the press-cake and for working with vacuum. Screw-down valves are used in place of cocks.—J. W. H.

Evaporating apparatus. J. Parker, Assignor to Kestner Evaporator Co., Philadelphia, Pa. U.S. Pat. 940,473. Nov. 16, 1909.

THE evaporator consists of a steam chamber, containing a number of vertical tubes. Liquid is fed into the base of the tubes. A chamber enclosing the upper end of the steam chamber, and in open communication with the upper ends of the tubes, receives the vapour, and also the entrained liquid. Centrifugal devices are provided for separating the entrained liquid from the vapour, the former being then led to a point of discharge below the level of the top of the tubes, whilst the latter is removed at a point below the liquid-outlet.—G. W. McD.

Dissolving salts; Apparatus for —. E. Nitschke. Ger. Pat. 215,823, March 4, 1908.

THE apparatus is of the type in which the outlet in the bottom of the dissolving vessel for the discharge of the undissolved residue, serves also as a filter for the saturated solution. The outlet is provided with a conical or cylindrical perforated pipe, which projects upwards to such a distance that its upper part is above the level of the undissolved substance. Below this level, the pipe is provided with a valve, which is closed whilst the dissolving operation is proceeding, the solution being discharged through the portion of the perforated pipe below the valve. When the operation of dissolving is completed, the valve is opened, so that the solution can be withdrawn rapidly. The valve is then again closed, and suction applied to the outlet pipe, in order to drain the undissolved substance.—A. S.

Kilns; Annular —. H. Köddewig, Bochum, Germany. Eng. Pat. 24,528, Nov. 14, 1908.

SEE Fr. Pat. 396,233 of 1908; this J., 1909, 476.—T. F. B.

Mixtures; Process for obtaining intimate —. E. Dor-Delattre, Liege, Belgium. U.S. Pat. 939,989, Nov. 16, 1909.

SEE Eng. Pat. 24,958 of 1907; this J., 1908, 492.—T. F. B.

Straining apparatus; Continuous centrifugal —. A. J. Ericsson, Stocksund, Assignor to Aktiebolaget Separator, Stockholm. U.S. Pat. 939,993, Nov. 16, 1909.

SEE Eng. Pat. 16,047 of 1908; this J., 1909, 356.—T. F. B.

Separator. J. M. Seaver, Boston. U.S. Pat. 940,076, Nov. 16, 1909.

SEE Eng. Pat. 12,958 of 1909; this J., 1909, 1113.—T. F. B.

Retort-furnace. E. Schmatolla, London. U.S. Pat. 940,199. Nov. 16, 1909.

SEE Eng. Pat. 10,155 of 1908; this J., 1908, 931.—T. F. B.

Concentrating solutions; Apparatus for —. E. Monti, Turin, Italy. U.S. Pat. 940,644, Nov. 16, 1909.

SEE Fr. Pat. 357,770 of 1905; this J., 1906, 113.—T. F. B.

Separating the constituent elements of gaseous mixtures; Apparatus for —. E. Mazza, Turin, Italy. U.S. Pat. 940,885, Nov. 23, 1909.

SEE Eng. Pat. 7421 of 1906; this J., 1906, 841.—T. F. B.

ERRATUM. This Journal, Dec. 15, 1909, page 1239, col. 2, line 19 from bottom, for "Diamond" read "Diamand."

II.—FUEL, GAS, AND LIGHT.

Illumination; Needs of —. S. P. Thompson. Inaugural Address to the Illuminating Engineering Soc., Nov. 18, 1909. J. Gas Lighting, 1909, 108, 535–536.

THE author pointed out the importance of getting international agreement as to the unit of light, and as to what shall be taken as the requirement for the illumination of a surface. There is, at present, no agreement in the standard of illumination. In England, it is the custom to

deal with illumination in terms of the candle-foot—meaning the intensity of illumination on a surface situated at a distance of 1 foot from a light of 1 candle. Reading is impossible with illumination so small as $\frac{1}{10}$ candle-foot, and is fatiguing at $\frac{1}{2}$ candle-foot. It is, however, comfortable with $1\frac{1}{2}$ or 2, 3, or 4 candle-foot. If the illumination exceed 8 candle-foot, the glare is too great. Very seldom in any ordinary room does the artificial illumination exceed 3 candle-foot. By day, on a writing-table placed near a north window, or, in fact, near any window receiving direct illumination, there will be from 3 to 4 candle-foot. "Well lit" was at one time vague; now there are exact terms for expressing it. For a writing-table one must have at least $1\frac{1}{2}$ candle-foot. In school-rooms on the desks, the illumination should not be less than 1 candle-foot.

There are three distinct things a photometer may be employed to measure. First, the intrinsic brightness or the effulgence of a source of light, the amount of which is expressed by saying it has a power equal to so many candles. Secondly, photometry is wanted for illumination at the surface, to be expressed in terms of candle-foot, candle-metre, or lux. Illumination is independent of the nature or colour of the substance on which the illumination falls. Photometers are needed to measure not how much light looks on a surface, but how much light falls upon it. Thirdly, photometry is wanted to measure the luminosity or the specific brightness of a surface. The amount of light given off from an illuminated surface, per square inch, varies enormously. It will depend upon the quantity of light thrown by the source, and upon the surface itself. The photometry of the specific brightness of an illuminated surface has been very little studied. It is, however, of great importance; and accurate figures are needed. It should be possible to say just how much a certain wallpaper or a certain coloured paint will throw back the light that it receives.

With a standard of illumination, and simple portable photometers with which to measure the illumination, there can be no excuse for ignorance in respect of the lighting of any place. The Home Office, the author considers, ought to thoroughly look into the subject of illumination, and place the illumination of factories and workshops on a proper scientific basis. At present, all they ordain is that such a building must be "adequately lighted." There are various views as to what constitutes adequate illumination; and the employer should be given proper regulations, and made to give proper illumination. In Holland, an adequate lighting standard for ordinary factories is prescribed at from 10 to 15 candle-metres, or rather more than 1 candle-foot.

PATENTS.

Liquid fuel; Utilization of the vapours or gases derived from — in the heating of steam boilers and the like. J. Wilson and R. Prescott, Ulverston, Lancs. Eng. Pat. 26,248, Dec. 4, 1908.

THE patent relates more especially to the use of liquid fuels for heating the steam generators of steam-driven motor-cars. To permit of the use of benzene, coal-tar naphtha, paraffin oil, and other fuels liable to form deposits owing to incomplete combustion, the following process is adopted. The fuel is first passed through a coil in which it is vaporised at a comparatively low temperature, superheated steam from a second coil is mixed with the vapour, and the mixture is passed through a strongly heated coil in which gasification takes place. The mixture is next forced through a nozzle so as to draw in air, and the combustible mixture is finally led to the burner orifice.—A. T. L.

Illuminating gas; Process and apparatus for the continuous manufacture of —. Martin und Pagenstecher Ges. m.b.H. and K. Meitzler. Ger. Pat. 214,661, Jan. 6, 1906.

THE gas is manufactured in a vertical retort, consisting of an upper portion constructed of refractory material, resting on a lower portion which is constructed of metal, and surrounded by conduits through which the secondary

air supply is passed; the air serves to cool the coke and is itself preheated. Dampers are provided in the heating flues, so that the supply of heat to the middle and upper portions of the retort can be controlled. The middle portion of the retort is heated most strongly. A movable pipe passes down through the top of the retort and extends to the zone between the middle and upper portions of the retort; the distillation gases are withdrawn through this pipe, so that the gases evolved in the earlier and later stages of distillation respectively are withdrawn together, but do not mix inside the retort. At the lower end of the retort there is a coke-breaking device, and a jet through which a steam blast is injected during the discharge of the coke. The steam is directed against the discharge outlet, so as to prevent entry of air.—A. S.

Gas purification; Apparatus for —. S. Chandler, London. Eng. Pat. 27,841, Dec. 22, 1908.

THE patent relates to wet washer-scrubbers of the type in which a series of rotating wheels or other scrubbing devices is mounted on a horizontal shaft, each scrubbing device working in a separate compartment of the apparatus, and the gas passing successively through each compartment, and flowing radially from the centre to the circumference, and *vice versa*, in alternate compartments. In order to utilise the whole surface of the scrubbing devices, these do not dip into the washing liquor, but a sump is arranged below each compartment, and pumps are provided for circulating the liquor and spraying it on to the scrubbing devices at their highest point. The sumps are connected with one another in cascade fashion, and water is introduced into one of the end sumps, strong liquor being drawn off at the other end. The sumps may be in the form of separate tanks connected to the scrubber by piping, when it is desired to convert existing scrubbers. The bosses of the scrubbing devices may be hollow as described in Eng. Pat. 28,387 of 1907 (this J., 1909, 83).—A. T. L.

Ammonium sulphate; Process of extracting — from distillation gases. Gewerkschaft der Steinkohlenschee "Mont Cenis." Fr. Pat. 403,050, May 14, 1909. Under Int. Conv., May 15, 1908.

IT is proposed to use acid directly as the absorbing liquid for the extraction of ammonia from distillation gases (e.g., in coke and gas works). The gases are cooled to a temperature of 15°–20° C., which causes the condensation of tar, water vapour, and about one-fifth of the ammonia, and are then made to pass into a solution of ammonium sulphate, preferably of 29°–35° B., containing about 5 per cent. of free sulphuric acid, the ammonia extracted from the condensed ammoniacal liquor being passed into the same solution. The heat produced by neutralisation prevents possible dilution of the absorbent by the condensation of water vapour from the gas, and ammonium sulphate, free from tar, separates continuously.—F. SOBN.

Illuminating gas; Liquefaction of — under pressure. H. Blau, Augsburg, Germany. Eng. Pat. 2292, Jan. 30, 1909. Under Int. Conv., Jan. 31, 1908.

SEE Fr. Pat. 398,839 of 1909; this J., 1909, 1026.—T. F. B.

Coal-gas and carburated water-gas; Process of manufacturing —. W. Thomas, Vancouver, B.C. U.S. Pat. 940,289, Nov. 16, 1909.

SEE Eng. Pat. 16,498 of 1906; this J., 1907, 861.—T. F. B.

Distillation of bituminous coal or similar carbonaceous substances. T. Parker, Ironbridge. U.S. Pat. 941,352, Nov. 23, 1909.

SEE Eng. Pat. 14,169 of 1908; this J., 1909, 879.—T. F. B.

Gas washer. W. Feld, Hünningen on Rhine, Germany. U.S. Pat. 940,103, Nov. 16, 1909.

SEE Eng. Pat. 15,683 of 1908; this J., 1909, 1239.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Mineral oils in Greece; Customs duties on ——. See XII.
PATENTS.*

*Dehydrating liquids [tar, etc.]; Apparatus for ——. Soc.
du Gaz de Paris. Fr. Pat. 402,917, May 11, 1909.*

THE apparatus consists of an oil-bath containing a serpentine coil leading into an expansion chamber containing baffle-plates. The oil, tar, or other liquid to be treated is fed into the serpentine coil, where it becomes heated to a temperature above the boiling point of water before being discharged on to the baffle-plates in the expansion chamber. The steam generated is carried away to a condenser by means of one pipe, while the dehydrated liquid flows away by another.—J. W. H.

Bitumen from lignites; Process for the purification of ——. Montanwachs-Fabrik Ges.m.b.H. Ger. Pat. 216,281, June 4, 1907.

THE crude bitumen from lignites cannot be purified by treatment with sulphuric acid in the ordinary manner, owing to the great amount of decomposition, and the difficulty of recovering the solvent used for dissolving the bitumen. It has now been found that if the "resin" be removed from the crude bitumen, of which it forms from 15 to 25 per cent., the difficulties mentioned are avoided. The process claimed consists in dissolving the crude bitumen in hot petroleum spirit (benzene), and allowing the solution to cool, whereupon the "resin" remains dissolved, whilst the "wax" separates and can be subsequently purified by treatment with sulphuric acid, &c., in the usual manner. The "resin" may be recovered from the benzene solution: it has a reddish-brown colour and softens at 50°–60° C.—A. S.

Tar, tar-oils, pine-oils, and allied distillation products; Process for the purification of ——. O. Sprenger, Bremen, Germany. Eng. Pat. 3074, Feb. 8, 1909.

SEE Fr. Pat. 399,760 of 1909; this J., 1909, 932.—T. F. B.

Artificial resins from pyroligneous products. Fr. Pat. 402,907. See XIII.B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Fluorescent substance derived from physostigmine. Gaubert. See XX.

PATENTS.

Azo dyestuffs; Production of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1397, Jan 20, 1909.

THE dyestuffs are produced by combining in acid solution the diazo compounds of alkyl or aryl ethers of 5-nitro-2-aminophenol or their derivatives or substitution products with derivatives of 2-amino-8-naphthol-6-sulphonic acids alkylated or arylated in the amino group. For example 168 parts of 5-nitro-2-aminoanisole are dissolved in 1000 parts of 20 per cent. hydrochloric acid and 700 parts of water. The solution is boiled and diazotised by adding 69 parts of sodium nitrite. The diazo-solution is filtered and treated with sodium acetate and then, while still cooled, is stirred with an aqueous solution of 315 parts of 2-phenylamino-8-naphthol-6-sulphonic acid and 136 parts of crystallised sodium acetate. The dyestuff produced in this way gives on wool from an acid bath, black shades fast to light and milling.—S. H. H.

Anthracene derivatives; Production of new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 403,205, May 21, 1909. Under Int. Conv., June 25, 1908, and March 4, 1909.

1-AMINOANTHRAQUINONES or their derivatives are con-

densed with epichlorhydrin and the product is sulphonated. Example: A mixture of 150 parts of 1:4-diaminoanthraquinone, 1500 parts of glacial acetic acid and 375 parts of epichlorhydrin is heated at 30°–35° C. for several days until the mixture becomes blue. The product is filtered, dried, and 30 parts are warmed with 500 parts of concentrated sulphuric acid at 30° C. until a sample is soluble in water. The mixture is thrown on ice, and the dyestuff salted out and separated by filtration. It gives pure blue shades on wool.—J. C. C.

Disazo dyestuffs; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 403,208, May 21, 1909. Under Int. Conv., June 30, 1908.

DISAZO dyestuffs are obtained by combining the tetrazo compounds of *m*- or *p*-diaminodiphenylurea or their homologues with one molecule of a *m*-phenylenediamine-sulphonic acid or *m*-aminophenolsulphonic acid, or their homologues or analogues, and one molecule of *m*-phenylenediamine, *m*-tolylendiamine, *m*-aminophenol, resorcinol or their derivatives which do not contain a sulphonic acid group. An example is given in which *m*-diaminodiphenylurea is tetrazotised and combined with one molecule of *m*-phenylenediaminesulphonic acid and one molecule of *m*-phenylenediamine. The dyestuff gives orange yellow shades on cotton which, on development with diazotised *p*-nitraniline, become rich yellowish brown.—J. C. C.

Anthracene vat dyestuffs; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 403,259, May 22, 1909. Under Int. Conv., Nov. 7, 1908.

VAT dyestuffs are obtained by condensing *p*-aminoalkoxyanthraquinones with halogenated anthraquinones, or *p*-halogenated alkoxyanthraquinones with aminoanthraquinones. They furnish vats which yield fast Bordeaux to violet shades. Example: A mixture of 30 kilos. of 1:4-aminomethoxyanthraquinone, 30 kilos. of 2-chloroanthraquinone, 4 kilos. of cuprous chloride, 25 kilos. of anhydrous sodium acetate, and 300 kilos. of naphthalene is boiled for 6 hours. The dyestuff is precipitated by benzene, and washed with benzene, glacial acetic acid, and water. It produces a Bordeaux shade on cotton.—J. C. C.

Diphenyl-naphthylmethane dyestuffs; Process for preparing acid chrome ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 216,305, Oct. 22, 1908.

THE disulphonic acids of 2-hydroxy-1-naphthaldehyde (e.g., the 3:6- or 3:7 disulphonic acids) are condensed with two mols. of salicylic or *o*-cresotinic acid to form leuco-compounds which, when oxidised, are converted into diphenyl-naphthylmethane dyestuffs. They dye wool from acid baths, and the shades produced are rendered deeper and faster by subsequent chroming.—T. F. B.

Vat [indigo] dyestuff; Brown — and process of making same. G. Engi and H. Kappeler, Assignors to Soc. Chem. Ind. in Basle, Basle, Switzerland. U.S. Pat. 940,586, Nov. 16, 1909.

4:4'-DIAMINOINDIGO is treated with halogenating agents. The resulting substances dye cotton brown shades from alkaline vats. The dyestuff obtained by brominating the diaminoindigo, which is specifically claimed, dyes cotton reddish-brown shades.—T. F. B.

Anthracene; Production of a series of new derivatives and dyestuffs from ——. Badische Anilin und Soda Fabrik. Twelfth Addition, dated April 30, 1909, to Fr. Pat. 349,531 of Dec. 21, 1904.

THE dyestuffs described in the ninth addition to the chief patent (this J., 1907, 251) when halogenated, yield new dyestuffs. The dyestuff prepared by chlorinating isoviolanthrene (obtained from monohalogenated benzanthrone) either by means of sulphuryl chloride or chlorine, is the dichloro-derivative and gives a blue vat, dyeing vegetable fibres in blue shades, which when

was-hed and dried, become bright reddish violet. Bromination of isoviolanthrene leads to the dibromo-derivative which also gives a blue vat dyeing vegetable fibres in blue shades which become bluish violet on washing and drying.—J. C. C.

Vat dyestuffs of the anthraquinone series; Process for preparing —. Badische Anilin und Soda Fabrik. Ger. Pat. 215,182, Dec. 10, 1908.

NEW vat dyestuffs of the anthraquinone series are produced by the action of one mol. of a diamine of the benzene or naphthalene series on two mols. of a halogenide of anthraquinone-2-carboxylic acid or one of its derivatives. The dyestuffs dye bright yellow to brownish-orange shades from the vat, which are fast to washing, chlorine, sulphur, potting, and light.—T. F. B.

Anthraquinone; Process for preparing —. Chem. Fabr. Grünau, Landshoff und Meyer A.-G. Ger. Pat. 215,335, May 26, 1908. Addition to Ger. Pat. 207,170, Feb. 2, 1908.

THE reaction described in the principal patent for preparing aromatic nitro-compounds by the use of the compounds of zinc or copper oxide with nitrogen oxides (this J., 1909, 360), can be utilised for the oxidation of anthracene, if carried out at high temperatures, e.g., 250°–350° C.; a stream of air or oxygen is passed through the reacting mixture, at ordinary or reduced or increased pressure. It is probable that a *meso*-nitro-dihydroanthranol is at first formed (as when anthracene is treated with nitrous gases in acetic acid solution) and the nitrogen is eliminated during the reaction.—T. F. B.

Vat [thioindigo] dyestuffs; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 216,224, July 23, 1908.

THIOINDIGO or halogen-derivatives of thioindigo are nitrated, and the products are treated with halogens or halogenating agents, or they may be first reduced and then halogenated. The dyestuffs dye from the vat, grey-black or violet-black shades, which are faster than those obtained with the dyestuffs produced by merely nitrating (or nitrating and reducing) thioindigo.—T. F. B.

Azoxybenzene and azobenzene; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 216,246, Oct. 1, 1907.

WHEN nitrobenzene is reduced by means of alkali sulphides in strong solutions of alkali hydroxide, only traces of aniline are formed, the product consisting of either azoxybenzene or azobenzene, according to the amount of sulphide used and the duration of the reduction. The yields of the two substances amount to 90 per cent. of the theoretical yield.—T. F. B.

Dianthraquinone oxides; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 216,268, Oct. 14, 1908.

WHEN hydroxyanthraquinones are heated with halogen derivatives of anthraquinone in presence of sodium acetate or salts of other weak organic acids, dianthraquinone oxides are produced. For example, the condensation of α -chloroanthraquinone with β -hydroxyanthraquinone furnishes α - β -dianthraquinone oxide, which is insoluble in water and in dilute acids and alkalis. These oxides may be used for the preparation of dyestuffs.—T. F. B.

Monazo dyestuff; Process for preparing a — insoluble in water. Act.-Ges. f. Anilinfabr. Ger. Pat. 216,417, July 1, 1908.

NITROCHLORO-*m*-ANISIDINE ($\text{OCH}_3 : \text{NH}_2 : \text{Cl} : \text{NO}_2 = 1 : 3 : 4 : 6$) is diazotised and combined with β -naphthol; an insoluble, orange dyestuff is produced, which is especially suitable for making lakes. These lakes, which are fast to light, can be prepared by effecting the combination in presence of alumina, barium sulphate, or other substratum.—T. F. B.

Monazo dyestuffs; Manufacture of —. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 6086, March 13, 1909.

SEE Fr. Pat. 401,006 of 1909; this J., 1909, 1120.—T. F. B.

Colouring matters of the anthracene series; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7931, April 2, 1909.

SEE Twelfth Addition to Fr. Pat. 319,531; preceding.—T. F. B.

Azine dyestuff and process of making same. P. Ott, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elbertfeld, Germany. U.S. Pat. 940,354, Nov. 16, 1909.

SEE Fr. Pat. 394,357 of 1908; this J., 1909, 239.—T. F. B.

Azo dyestuff and process of making same. C. O. Müller, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Main, Germany. U.S. Pat. 941,088, Nov. 23, 1909.

SEE Ger. Pat. 208,968 of 1908; this J., 1909, 517.—T. F. B.

Vat [thioindigo] dyestuff and process of making same. H. Kraft, Assignor to Soc. Chem. Ind. in Basle, Basle, Switzerland. U.S. Pat. 941,152, Nov. 23, 1909.

SEE Ger. Pat. 213,505 of 1908; this J., 1909, 1083.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

Bleaching and dyeing works and cotton cloth printing works. Statutory Rules and Orders, 1909, No. 1370. [T.R.]

AN order has been issued, applying the provisions of Sec. 116 of the Factory and Workshop Act, 1901, with modifications, to bleaching and dyeing works, and works in which the printing of cotton cloth is carried on. The order relates to the furnishing of workers with particulars as to their work and wages, and to the penalties liable to be imposed for divulging trade secrets.

Chemicals for use in textile factories in Uruguay. Board of Trade J., Dec. 9, 1909. [T.R.]

THE "Diario Oficial" of Uruguay for the 28th October, contains a Decree adding "Gibet" glue, potassium sulphate and cyanide, and crystallised sodium sulphate to the list of articles which may be imported on payment of duty at the rate of 5 per cent. *ad val.* for use in washing and dyeing processes carried out in yarn and tissue manufactures.

PATENTS.

Nitrocellulose; New solvent for —, for the production of artificial threads, films, &c., J. M. Sauverzac. Fr. Pat. 402,950, Sept. 12, 1908.

THE nitrocellulose is dissolved in the solution of a metallic chloride in alcohol. A solution of 10 grms. of aluminium chloride in 100 c.c. of alcohol dissolves 50 grms. of nitrocellulose, and the mixture may be diluted with as much as 80 per cent. of water. The threads spun from this solution are said to be very supple and elastic. (See also Eng. Pat. 1858 of 1896; this J., 1897, 335.)—F. M.

Artificial silk; Apparatus for spinning — and "lustring" natural silk and other textile fibres. B. Loewe. Fr. Pats. 403,242 and 403,243, Sept. 18, 1908.

UPON a vertical frame a reservoir is mounted from which the cellulose solution is fed, under pressure, to a pipe carrying a number of spinnerets. The thread issuing from each spinneret is wound upon a bobbin to which a to and fro motion is imparted. Or, upon leaving the spinneret,

the thread may be led into a box, in the centre of the bottom of which there is a fine orifice, through which the thread is drawn and then wound upon the bobbin. When the bobbin is full, it is removed and the thread is drawn off through a bath in which the coagulation is completed, and wound upon a reel. In "lustreing" natural silk or other fibres, these are passed through a special form of spinneret, in which they are "sized," and traverse a similar spinneret in which they receive a coating of artificial silk, the covered threads being then treated as above described.—F. M.

Artificial silk; Improving the elasticity and resistance to water of —. J. Gebauer. Fr. Pat. 403,264, May 22, 1909.

The improvement consists in producing a thread of artificial silk and caoutchouc, the latter ingredient being subsequently vulcanised. A solution of caoutchouc may be added to the spinning solution, or the thread or tissue of artificial silk may be passed through the caoutchouc solution. Vulcanisation is carried out in the ordinary way with sulphur chloride.—F. M.

Artificial silk; Manufacture of "animal" —, and its applications. H. du Boistesselin and C. Gay. Fr. Pat. 403,193, May 21, 1909.

CASEIN or fish glue is dissolved in an excess of soda lye, and dilute hydrochloric acid is slowly added. Excess of acid is avoided and the product which is precipitated if filtered off, pressed and dissolved in water. The aqueous solution can be coagulated with strong acids, common salts or salts of iron and yields threads which are supple, unaffected by water, and possess the properties of natural silk. Incorporated with animal or vegetable fibres, the product is suitable for working up into artificial leather, and with the alkaline-earth yields products which are hard and capable of taking a high polish.—F. M.

Wool; Carbonisation of —. V. Floquet. Fr. Pat. 402,847, May 8, 1909.

By leaving the woollen material to soak for some time in the acid bath, before carrying out the process of carbonising proper, the disintegration of the vegetable matter is assisted. It is claimed that the effect is more energetic if an oxidising agent (hydrogen peroxide) be added to this acid bath, or if oxygen gas be passed through it during the period of immersion.—F. M.

Bleaching of textile materials. A. Margotin. Fr. Pat. 403,245, Sept. 18, 1908.

The invention relates to the bleaching of textile materials by means of potassium permanganate and of hydrogen or other peroxides and the subsequent action of sulphur dioxide on the material. The impregnation with the oxidising material takes place in the ordinary way, but the treatment with sulphur dioxide is carried out in an apparatus of special construction. This consists of a vertical cylinder provided with a removable cover for the admission of the textile material and with a manometer to register the pressure. A perforated pipe passes down the centre of the cylinder and is connected underneath the apparatus, by means of a three-way cock to (1), a supply of sulphur dioxide gas; (2), a vacuum pump; and (3), an air compressor. By means of a series of valves, the material placed in the cylinder can therefore be submitted to a partial vacuum and to an atmosphere of sulphur dioxide; finally the sulphur dioxide can be expelled from the apparatus by the admission of compressed air. The exhaust gases are made to pass through a tube in the side of the cylinder into a vessel containing an alkali solution to absorb the sulphur dioxide.—S. H. H.

Colouring yarns for the manufacture of carpets and other fabrics. J. Bright and Bros., Ltd., and R. E. Oldroyd, Rochdale. Eng. Pat. 15,341, July 1, 1909.

This invention relates to the production of two or more colours in the same yarn by dyeing. The yarn is first dyed one colour, then another colour is dyed over the first, and if necessary yet another colour is applied.

The dyed yarn is submitted in parts to the action of chemical agents which destroy one or more of the colours with which the yarn is dyed. This can be carried out by dipping, saturating or steaming the parts under different conditions. For example a yarn is dyed first scarlet with Erythrosin and then dark crimson by further dyeing with Azofuchsin. On treating the yarn now, in parts, with sodium hydrosulphite solution the Azofuchsin is destroyed. Also a suitable brown colour made up of red, blue and yellow dyestuffs may be discharged in different parts of the yarn to give a variety of shades; the red, blue and yellow dyestuffs may be separately discharged by suitable reagents.—S. H. H.

Half-dyeing apparatus. F. Bauer, West Orange, N.J. U.S. Pat. 938,738, Nov. 2, 1909.

The apparatus comprises a semi-cylindrical tank provided with a longitudinal rotating shaft mounted in bearings on the end walls of the tank. A cylindrical wire screen is mounted around the shaft, being connected, at its ends, to the latter by means of radial spokes. The wire cylinder which rotates within and close to the tank, has, in one side, a longitudinal door, through which a perforated drip-board can be inserted, so as to divide the cylinder into two compartments of approximately equal size.

—A. S.

Dyeing textile fabrics; Apparatus for —. E. de Journo. Fr. Pat. 403,013, May 13, 1909.

The dyeing is effected by projecting a jet of dye-liquor on to both sides of the cloth. The cloth passes from one batch to another over five small rollers arranged somewhat in the form of the letter W and situated above the dye-liquor in the dye-bath. The middle roller is contained in a small box which is connected with a centrifugal pump by means of a tube which proceeds vertically downwards through the dye-bath and then horizontally to the pump. The pump is also connected directly with the liquor in the dye-bath, and, further, by means of a pipe which is a continuation of the pipe proceeding from the box mentioned, it supplies dye-liquor to another receptacle placed directly over that box. This receptacle has a perforated bottom and is made to fit the contour of the cloth passing over the middle roller; the arrangement is similar to the ordinary humidifier. The dye-liquor passing through the perforations mentioned, penetrates the cloth on the roller and is held for a time by a concentric semi-cylindrical envelope placed under the roller, so that the latter revolves for a time in the dye-liquor, and the lower surface of the cloth is impregnated. The dye-liquor then proceeds to the pump and round again in circulation.—S. H. H.

Dyeing silk yarn; Apparatus for —. E. de Journo. Fr. Pat. 403,014, May 13, 1909.

The apparatus consists of a bath containing the dye-liquors in which, suspended from a series of rods, hang the skeins of silk or other textile material. These rods are rigidly connected to another series of rods directly below them, inside the separate series of skeins, and just above the dye-liquor. By means of mechanism these lower rods are caused to revolve during the dyeing operation and thus to "turn" the skeins which are being dyed; the lower rods revolve to a position above the first-mentioned rods and back again, carrying the skeins round with them, and ensuring an equal time of immersion of all parts of the skeins in the dye-liquor. The upper rods are placed in notches on a frame which is fixed over the dye-bath. Above this frame there is an arrangement to secure the transference of the skeins from one side of the dye-bath to the other. The upper part of this device consists of a rack and pinion and gear wheels which cause the whole arrangement to move from one side of the bath to the other. This upper part is connected by a chain to the lower arrangement, which consists of a chain running on cog-wheels over and at right angles to the rods which hold the skeins. Hooks are attached to the links of the chain and as the chain revolves, these hooks catch the rods carrying the skeins and carrying them along, deposit the

rods and skeins at the other side of the dye-bath. During the transference the "turning" of the sticks referred to above takes place. Thus the skeins are periodically lifted outside of the dye-liquor from one side of the dye-bath to the other and at the same time "turned."—S. H. H.

Chemical treatment of textiles mounted on bobbins; Apparatus for the —. T. Robatel, J. Buflaud et Cie. Fr. Pat. 493,148, May 18, 1909.

THE core of each bobbin is surrounded by a cylinder containing many slits throughout its length. The thread is wound on this cylinder, which can be readily removed from the bobbin, and the thread dried or after-treated apart from the bobbin. The bobbin, cylinder, and thread are placed in an enclosing bobbin which has perforated ends, and series of these bobbins are then placed on end vertically in the bath which contains the chemical with which it is intended to treat the threads. By a mechanical device the series of bobbins is caused to revolve so that each series moves in a different direction from its neighbour.

—S. H. H.

Dissolved substance for use in making artificial threads and the like; Process for the production of a —. P. Friedrich, Berlin. Eng. Pat. 7617, March 30, 1909. Under Int. Conv., March 30, 1908. Addition to Eng. Pat. 4104 of 1909, dated Feb. 19, 1908.

SEE Addition of March 23, 1909, to Fr. Pat. 400,321 of 1909; this J., 1909, 1121.—T. F. B.

Dyeing or otherwise treating yarns; Machines for —. C. Corron, St. Chamond, France. Eng. Pat. 25,441, Nov. 25, 1908.

SEE U.S. Pat. 915,939 of 1909; this J., 1909, 422.—T. F. B.

Dyeing, bleaching, and so on of textile materials; Device for the —. H. Schirp, Barmen, Germany. Eng. Pat. 25,813, Nov. 30, 1908.

SEE Fr. Pat. 397,252 of 1908; this J., 1909, 792.—T. F. B.

Dyeing heavy and close fabrics, such as twills, drills, and the like with Turkey-red, and apparatus therefor. W. Müller-Holtkamp, Eitorf, Germany. Eng. Pat. 8976, Apr. 15, 1909.

SEE Fr. Pat. 402,032 of 1909; this J., 1909, 1194.—S. H. H.

Nitrogen derivatives of aldehyde-bisulphites. Ger. Pats. 216,072 and 216,073. See XX.

Nitrogen derivatives of formaldehyde-sulphoxylic acid. Ger. Pats. 216,074 and 216,121. See XX.

VII.—ACIDS, ALKALIS, SALTS, AND NON-METALLIC ELEMENTS.

Hypophosphoric, phosphorous, and hypophosphorous acids; Determination of — in presence of each other and of phosphoric acid. A. Rosenheim and J. Pinsker. Z. anorg. Chem., 1909, 64, 327–341.

HYPOPHOSPHORIC acid may be accurately titrated by permanganate, and it reacts also with uranyl nitrate solution, giving a yellow precipitate, according to the equation, $2\text{NaH}_2\text{P}_2\text{O}_7 + \text{UO}_2(\text{NO}_3)_2 = \text{UO}_2(\text{HPO}_3)_2 + 2\text{NaNO}_3$, but it is not affected by heating with iodine solution. Phosphorous and hypophosphorous acids, on the other hand, are oxidised both by permanganate and by iodine, but give no precipitate with uranyl salts. The following methods of determining these acids in the presence of each other are, therefore, available and have been found satisfactory. (a). *Hypophosphate and phosphite or hypophosphite.* Titration with uranyl nitrate is followed by oxidation with standard permanganate. (b). *Phosphite and hypophosphite.* The acids are oxidised by standard iodine or permanganate, and the total phosphate produced by oxidation with nitric acid is determined. (c). *Hypophosphate, phosphite, and hypophosphite.* The first is determined with uranyl nitrate solution and

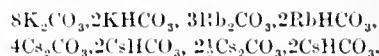
the others as in (b). (d). *Phosphate, hypophosphate, phosphite, and hypophosphite.* The total phosphorus, as phosphate, is determined after oxidation with nitric acid; the last three acids are then oxidised in another portion by standard permanganate, in a third portion phosphite and hypophosphite are oxidised by iodine solution, and a fourth portion is titrated with uranyl nitrate solution. Representing the quantities of the

acids respectively by x , y , z , and t : $x = \frac{2l+2k-n}{2a_1}$, $y = \frac{n-2k}{a_2}$, $z = \frac{k+2m-2l-n}{a_3}$, and $t = \frac{2l+n-2m}{2a_4}$, where

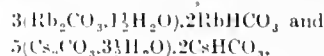
$a_1 = 1/\text{H}_3\text{PO}_4$, $a_2 = 1/\text{H}_2\text{P}_2\text{O}_7$, $a_3 = 1/\text{H}_3\text{PO}_3$, $a_4 = 1/\text{H}_2\text{P}_2\text{O}_5$, $m = 2g_1/\text{Mg}_2\text{P}_2\text{O}_7$ (g_1 = weight of magnesium pyrophosphate obtained), $n = 5g_2/\text{KMnO}_4$ (g_2 = weight of permanganate required), $k = g_3/21$ (g_3 = weight of iodine required), and $l = q\text{S}/\text{P}_2\text{O}_5$ (S = c.c. of uranyl nitrate solution used; 1 c.c. = q grms. of phosphoric oxide). The oxidation by permanganate is effected by slightly acidifying an approximately $N/10$ solution of the salt with sulphuric acid, adding a few c.c. of $N/10$ permanganate, and heating to $80^\circ\text{--}90^\circ\text{C}$; any red colour remaining is removed by titrating with oxalic acid, and permanganate is then again added, and the warming and titration with oxalic acid are repeated, permanganate being added in decreasing quantities until oxidation is complete. In oxidising by means of iodine, a 10 per cent. solution of hydrochloric acid and a known volume of $N/20$ iodine solution are added to a measured volume of the liquid, the mixture is heated for 2–3 hours on the water-bath in a closed flask, and the excess of iodine is titrated with thiosulphate in the presence of sodium bicarbonate, after allowing the solution to stand for several hours.—F. SODN.

Alkali-metal bicarbonates. De Forcrand. Comptes rend., 1909, 149, 825–829.

DILUTE solutions of the normal carbonates of potassium, rubidium, and cesium were exposed to the air for some weeks; they were found to absorb carbon dioxide up to a limit corresponding to the formulæ,



Dilute solutions of the bicarbonates were boiled in silver vessels, the bulk of the liquid being kept constant. In the case of the potassium salt, after a week's boiling the liquor was concentrated and cooled, when crystals separated. The crystals had the composition corresponding to the formula, $5\text{K}_2\text{CO}_3, 7\frac{1}{2}\text{H}_2\text{O}, 4\text{KHCO}_3$, or $5(\text{K}_2\text{CO}_3, 1\frac{1}{2}\text{H}_2\text{O}), 4\text{KHCO}_3$, whilst the mother-liquor was of the same composition as that attained by the normal carbonate solution through absorption of carbon dioxide. The bicarbonates of rubidium and cesium rapidly lost all their excess carbon dioxide, and were converted into normal carbonates; but on continuing the boiling, they slowly absorbed carbon dioxide again, and on concentrating and crystallising, yielded crystals of the formulæ,



respectively. The latter salt, when kept for a day on the water-bath, loses water, and becomes converted into the compound, $5(\text{Cs}_2\text{CO}_3, 2\text{H}_2\text{O}), 2\text{CsHCO}_3$; this hydrate of the normal carbonate has not before been isolated, though the other three have. No compounds containing a number of molecules of bicarbonate equal to or in excess of those of the normal carbonate, comparable to the natural *natrons*, have yet been produced in this manner. The thermo-chemistry of these compounds indicates that they are all very unstable; it is probable that a series of similar compounds exists, the composition of which is determined by dilution, temperature, and perhaps the content of carbon dioxide of the atmosphere.

—J. T. D.

Calcium silicides, and their capacity for absorbing [atmospheric] nitrogen. A. Kolb and R. Formhals. *Z. anorg. Chem.*, 1909, **64**, 342—367.

By melting together metallic calcium and pure silicon in an atmosphere of hydrogen, two silicides have been obtained, to which the formulae, $\text{Ca}_6\text{Si}_{10}$ and $\text{Ca}_{11}\text{Si}_{10}$, are assigned (compare Tamaru, this J., 1909, 526 and Hackspill, this J., 1908, 684); the powdered compounds were purified by washing with sugar solution at 0°C. and then with a little cold water. The former substance is obtained as bluish grey, very hard crystals, melting at about 1200°C.; it readily reacts with the halogens and, as a powder, burns when heated in the air; it is attacked with difficulty by cold water, but hot water, dilute alkalis, acetic acid, and hydrochloric acid decompose it with the liberation of hydrogen; it is scarcely affected by lime-water. When boiled with hydrochloric acid in the absence of light and in a current of carbon dioxide, a yellow crystalline silicone, $\text{Si}_{10}\text{H}_{10}\text{O}_8$, is obtained, which is very unstable when dry and is decomposed by boiling with water or alkalis, though fairly stable in the presence of acids; light converts it into a colourless "leucone." The second silicide is a crystalline powder, readily decomposed by boiling water, dilute acetic acid, or hydrochloric acid, which gives a white or pale yellow silicone, $\text{Si}_8\text{H}_7\text{O}_{13}$ or $\text{Si}_8\text{H}_8\text{O}_{13}$. Both silicides absorb nitrogen on heating, and very stable compounds are formed, special interest attaching to the reaction as providing a new method of utilising atmospheric nitrogen. With the compound, $\text{Ca}_6\text{Si}_{10}$, rapid absorption begins at 1010°C. and the temperature suddenly rises by 80°—100°C.; powdering the product and repeating the treatment gives a white substance, containing 26.73 per cent. of nitrogen (determined as ammonia by fusion with alkali) and smelling faintly of ammonia. The reaction takes place apparently according to the equation, $\text{Ca}_6\text{Si}_{10} + 14\text{N} = 2\text{CaSi}_2\text{N}_3 + 2\text{Ca}_2\text{Si}_2\text{N}_4$. The product is very slowly decomposed by boiling water with the liberation of ammonia. The second silicide behaves in a very similar way, but the reaction with nitrogen, which is probably represented by the equation, $\text{Ca}_{11}\text{Si}_{10} + 10\text{N} = \text{Ca}_{11}\text{N}_{10}\text{Si}_{10}$, is less vigorous; the product is dark grey and contains 14.84 per cent. of nitrogen; it is slowly decomposed by water, and completely by hydrochloric acid, giving a greenish-yellow silicone, according to the equation, $\text{Si}_{10}\text{Ca}_{11}\text{N}_{10} + 24\text{H}_2\text{O} = \text{H}_6\text{Si}_{10}\text{O}_{13} + 10\text{NH}_3 + 11\text{CaO} + 12\text{H}$. The nitrogen compounds are said to act as valuable manures and exert no poisonous action; they constitute an economical source of nitrogen in the soil, the nitrogen being liberated very slowly. Sodium cyanide may be obtained by fusing these compounds with sodium carbonate or with a mixture of sodium carbonate and carbon.

—F. SOEX.

Stannic acid; Isomerism of —. W. Mecklenburg. *Z. anorg. Chem.*, 1909, **64**, 368—374.

THE author explains the existence of isomeric *a*- and *b*-stannic acids by regarding these as colloidal modifications of hydrated stannic oxide, differing from each other in the size of their particles, and each retaining its individuality in the coagulated state. *a*-Stannic acid is believed to consist of relatively small and *b*-stannic acid of relatively large particles, and this view is supported by the fact that the *a*-acid has a greater adsorptive power than the *b*-acid and is more reactive; also, when stannic acid is prepared from colloidal tin solutions, the *a*-acid is always obtained, and this readily enters into colloidal solution again, whereas the *b*-acid is more readily precipitated from colloidal solution than the *a*-acid. The supposed salts of *b*-stannic acid are looked upon as hydrated stannic oxide containing adsorbed acids or alkalis.—F. SOEX.

Mercurous chloride; Duty on — in Switzerland. Board of Trade J., Dec. 2, 1909. [T.R.]

THE import duty on mercurous chloride has been fixed at 10 frs. per 100 kilos.

Salt for use in zinc chloride factories; Exemption of — from excise duty in the Netherlands. Board of Trade J., Dec. 2, 1909. [T.R.]

A DUTCH Royal order, dated Nov. 5, 1909, grants, under certain conditions, exemption from excise duty in the case of salt for use in zinc chloride factories.

PATENTS.

Alkalis and salts; Simultaneous electrolytic manufacture of —. C. A. Girard. Fr. Pat. 493,360, May 26, 1909.

A SOLUTION of an alkali or alkaline-earth salt, more or less concentrated, is electrolysed in a vessel forming a diaphragm, the latter containing also a soluble anode which, by solution, forms the required salt. The diaphragm is placed in an outer vessel containing water, in which the negative pole, consisting of a metallic plate unattacked by alkalis, is immersed. Instead of a soluble metal, ores, treated or not, may be used as the anode, and may be conductors or non-conductors of electricity, but in the latter case the ore is contained in a vessel which is itself a good conductor of electricity.—B. N.

Lead oxide; Manufacture of —. W. Eckford, Rhyl, Wales. Eng. Pat. 26,257, Dec. 4, 1908.

To prevent the escape of minute particles of lead oxide into the atmosphere during manufacture, separate closed melting and settling chambers are employed, which are connected by inlet and outlet pipes. A fan placed between the chambers draws the air and "floury" lead oxide over into the settling chamber, where most of the latter settles, the air returning to the melting chamber by means of the second connecting pipe. A small fan is used for withdrawing air from the settling chamber to produce and maintain a slightly reduced pressure within the apparatus and prevent leakage of the fine lead oxide. Means are provided for replenishing the air when necessary.—F. R.

Burning lime; Process of —, and apparatus therefor. H. L. Doherty, New York. U.S. Pat. 938,587, Nov. 2, 1909.

IN the process of calcination of limestone, a portion of the gases evolved is mixed with air which has been heated by a portion of the heat of the gases, and the mixture is converted into producer gas in a producer charged with carbonaceous fuel. The producer gas is mixed with another portion of the gases produced in the calcination, and the mixture is burnt in contact with the incandescent lime by means of air which has been heated by using it for cooling the burnt lime. The composition of the mixture of producer gas and calcination-gases is so regulated that the temperature developed on burning is not sufficient to cause the impurities present in the limestone to combine chemically with the lime.—A. S.

Potassium salts present in the residual liquors (calcium tartrate mother liquors) from the manufacture of tartaric acid; Process of extracting —. A. Alberti. Fr. Pat. 492,925, May 10, 1909. Under Int. Conv., May 14, June 25, and Aug. 12, 1908, and April 9, 1909.

THE process is for the recovery of the potassium chloride and sulphate contained in the calcium tartrate mother liquors obtained in the manufacture of tartaric acid. The liquor is treated with excess of lime, filtered, and transferred to suitable vats, in which it is agitated with bleaching powder, or with chlorine in the presence of a base (lime), for some hours, in order to oxidise most of the organic matter present, the quantity of hypochlorite required being established by a preliminary experiment with permanganate. When the liquor is decolorised, the precipitated calcium carbonate and sulphate are removed by filtration, and the liquor, after neutralisation with hydrochloric acid, is concentrated in some form of continuous vacuum evaporator, and the potassium salts recovered by crystallisation.—K. SOEX.

Burnt pyrites; Process for separating from — most of the heterogeneous materials present, so as to render it soluble in sulphuric acid of 52° B., with the object of preparing ferrous sulphate and separating any contained copper. A. Pezzolato. Fr. Pat. 402,939, May 12, 1909. Under Int. Conv., May 14, 1908.

Burnt pyrites, mixed with about 2 per cent. of charcoal, is heated to a red heat and cooled out of contact with air; it then acquires the property of being attracted by a magnet, and the whole of the iron may be extracted by a magnetic separator, in a form such that it dissolves in sulphuric acid (52° B.) to give ferrous sulphate. Any ferric sulphate formed during the action is reduced by acidifying the solution and adding metallic iron, which serves to concentrate the solution and precipitate any copper that may be present. An excess of carbon must not be used.—F. SODX.

Sodium-alum free from iron; Process for the preparation of —. F. O. Kauffmann. Ger. Pat. 216,934, Oct. 22, 1905.

AN excess of solid powdered sodium sulphate or bisulphate is added, at 25°–50° C., to a faintly acid solution of aluminium sulphate of sp. gr. at least 1.25, and the pulverulent sodium alum produced is separated in a centrifugal machine. Or, solid aluminium sulphate may be added to a concentrated solution of sodium bisulphate or sulphate. Crystalline sodium-alum may be obtained directly from the hot concentrated solution containing excess of sodium sulphate, by cooling it rapidly so as to produce a supercooled solution. From the latter the sodium-alum separates directly as crystals, without forming the amorphous magma obtained in the ordinary crystallisation process.—A. S.

Shaving cream [depilatory]; Process for the preparation of a —. J. Lütje. Ger. Pat. 216,250, Nov. 25, 1908.

A MIXTURE of a sulphide of an alkali or alkaline-earth metal with starch and water is heated until the starch is gelatinised. The product is stated to remove hair without having any irritating effect on the skin.—A. S.

Hydrogen cyanide and cyanogen compounds; Process for the preparation of —. C. Beindl. Ger. Pat. 216,264, Aug. 12, 1908.

HYDROGEN cyanide or other cyanogen compounds are produced by passing a mixture of a gaseous nitrogen compound, e.g., ammonia, and a gaseous hydrocarbon, either alone or in presence of nitrogen or hydrogen, or of a mixture of the two, over a contact substance. The essential feature of the process is the use of a contact substance of wire gauze or other similar form. Various metals may be used as contact substances. The temperature required varies with the nature of the contact substance and with the nature and velocity of the reacting gases. With copper gauze as catalyst, cyanogen is formed at 480° C., from a mixture of acetylene and ammonia.—A. S.

Carbide and method of manufacturing same. H. L. Hartenstein, Constantine, Mich., Assignor to Continental Investment Co., Duluth, Minn. U.S. Pat. 938,581, Nov. 2, 1909.

THE improvement claimed consists in partially cooling, and solidifying, a portion of the mass of molten carbide produced in the usual manner, and then building up a block or ingot by successive additions to the portion first solidified. The carbide is agitated whilst it is being cooled.—A. S.

Hydrogen peroxide solution; Process for the preparation of pure —. O. Dony-Hénault. Fr. Pat. 403,294, May 24, 1909.

SODIUM peroxide is mixed with dilute sulphuric acid, containing 4–5 per cent. of alcohol, in a vessel of earthenware, glass, or lead, fitted with a stirrer and cooling

worm; a further quantity of alcohol is then added (e.g., so as to bring the total to 35 per cent.), and the temperature is reduced to about –10° C., which causes almost complete deposition of the sodium sulphate present; the solution is separated from the crystals by decantation and the use of a filter-press, the plates of which are cooled by internal circulation of a refrigerating material; finally the alcohol is removed by distillation *in vacuo* at 30°–40° C. in glass or lead retorts. This process allows the direct production of concentrated solutions of hydrogen peroxide, and the yield is almost theoretical, since the peroxide is remarkably stable in the medium employed for the decomposition. Sodium peroxide is superior to barium peroxide for the purpose, in that it is purer, and contains double the proportion of active oxygen; also its decomposition by sulphuric acid is instantaneous and complete. The percentage of salts in the finished product is no higher than when barium peroxide is used.—F. SODX.

Hydrogen peroxide solutions; Process for rendering stable. E. Merck. Ger. Pat. 216,263, Apr. 27, 1909. Addition to Ger. Pat. 203,019, Nov. 7, 1907 (this J., 1908, 1204).

THE slight solubility of uric acid, which is used as a preservative for hydrogen peroxide solutions, is a disadvantage in some cases: it is now proposed to utilise barbituric acid, which is much more soluble, and which has the same preservative properties as uric acid.

—T. F. B.

Hydrogen; Production of —. Consortium für Elektrochem. Ind. Ges. m. b. H., Nürnberg, Germany. Eng. Pat. 21,032, Sept. 14, 1909. Under Int. Conv., Nov. 9, 1908.

BY the addition of lime, or calcium compounds that form lime, nearly the full theoretical quantity of hydrogen is rapidly liberated on heating silicon in an aqueous solution of caustic alkali. The process may be carried out in an iron generator fitted with stirrers.—C. J. G.

Bicarbonate of soda; Manufacture of —. D. Peniakoff, Brussels. Eng. Pat. 6115, March 15, 1909.

SEE Fr. Pat. 400,241 of 1909; this J., 1909, 1034.—T. F. B.

Ammonia; Production of —. F. W. Frerichs, St. Louis, U.S.A. Eng. Pat. 23,889, Nov. 7, 1908.

SEE U.S. Pat. 905,415 of 1908; this J., 1909, 21.—T. F. B.

Ammoniacal solution of cupric oxide; Process for the production of a permanent —. Chem. Fabr. Bettenhausen Marquart und Schulz, Cassel-Bettenhausen, Germany. Eng. Pat. 4872, Feb. 27, 1909. Under Int. Conv., March 25, 1908.

SEE Fr. Pat. 399,911 of 1909; this J., 1909, 938.—T. F. B.

Salts derived from the alkaline, alkaline earthy, and earthy peroxides; Process for the manufacture of —. G. F. Jaubert, Paris. Eng. Pat. 7633, March 30, 1909. Under Int. Conv., April 29, 1908.

SEE Fr. Pat. 399,720 of 1908; this J., 1909, 938.—T. F. B.

Pyrite ash; Treatment of —. A. Pezzolato, Rome. Eng. Pat. 11,263, May 12, 1909.

SEE Fr. Pat. 402,939 of 1909; preceding.—T. F. B.

Extracting ammonium sulphate from distillation gases. Fr. Pat. 403,050. See 11.

VIII.—GLASS, POTTERY, AND ENAMELS.

PATENTS.

Clays, porcelain earth and the like or mixtures thereof; Process for making slip from —. E. Weber, Schwepnitz, Saxony. Eng. Pat. 6560, Mar. 18, 1909.

IN order to render liquid by the addition of alkalis, those clays and earths which tend to gelatinise, and in which

the addition of humic acid or the like is not effectual. sufficient lime, or barium oxide, peroxide, hydroxide, or carbonate, or other suitable material, is added to render the interfering sulphate or carbonates insoluble. For example, 450 kilos. of a dry mixture of a fat refractory (Stourbridge) clay and coarse chamotte (fireclay) material with 350 grms. of barium hydroxide, 120 litres of water, and 600 grms. of caustic soda form a mass which can be readily cast.—F. R.

Ceramic objects, especially cooking utensils; Process for obtaining adherent conducting deposits on —. S. Heller and C. Baumgertl. Fr. Pat. 493,074, May 15, 1909.

THE articles are coated with a mixture of an alcoholic solution of celluloid, tar, unsaturated hydrocarbons, and a salt of gold absorbed in graphite, and are then fired in a muffle.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

PATENTS.

Wood; Process and apparatus for the impregnation of —. Pagès, Camus et Cie., and P. Bardy. Fr. Pat. 403,022, Sept. 14, 1908.

THE pores of the wood are opened, and the sap is removed, by heating the wood in vapours or gases which contain solvents, for wood oils, such as formaldehyde and acetone, and render these oils soluble in the impregnating liquids. The impregnating liquids are then forced into the wood under pressure and at a high temperature. In the case of creosoting, the wood is heated in a current of wood-gas containing ketones and aldehydes, then in a current of vapour of light wood-oils or some similar product, and finally impregnated, under pressure, with hot heavy wood oils. The light and heavy wood oils may be replaced by light and heavy coal-tar oils. The process is carried out in a closed vessel provided inside with a grid, and also with inlets and outlets, controlled by suitable cocks, for the gases, the light products, and the heavy products which constitute the actual impregnating substances.—W. C. H.

Cement-kiln. T. A. Edison, Orange, N.J. U.S. Pat. 939,817, Nov. 9, 1909.

CERTAIN of the sections which form a rotary cement-kiln, are provided at the ends with flanges extending outwards, which engage and form a loose fit with other flanges extending inwards from a stationary casing surrounding the kiln at one or more of the sections. Water is sprayed on to the kiln inside the casing, the excess passing off through a trap at the bottom. Any steam generated in the casing is removed by means of a fan, which also induces a current of air through the loose joints between the kiln and the casing.—W. C. H.

Composition for paving, flooring, and like purposes; Making a — and method of laying same. J. H. Amies, Philadelphia, U.S.A. Eng. Pat. 9929, April 27, 1909. SEE U.S. Pat. 929,813 of 1909; this J., 1909, 984.—T. F. B.

Paving brick or block; Vitrified —. K. Langenbeck, Boston, U.S.A. Eng. Pat. 13,091, June 3, 1909.

SEE U.S. Pat. 937,822 of 1909; this J., 1909, 1250.—T. F. B.

X.—METALS AND METALLURGY.

Special steels. L. Guillet. Int. Congr. for Testing of Tech. Materials, Copenhagen, 1909. Z. Elektrochem., 1909, 15, 893—894.

SPECIAL or alloy steels can be conveniently arranged in four groups according to their importance, viz., (1) Nickel and nickel-chromium-steels; (2) vanadium-steels;

(3) silicon-containing steels, also called manganese-silicon-steels; and (4) tungsten-steels. Only those possessing a pearlitic structure corresponding to that of ordinary carbon steel, are available for general use. The objects sought in the manufacture of these alloy steels are first, improvement in mechanical properties, remarkably illustrated by the use of vanadium (of which 0.2 to 0.3 per cent. suffices to increase very materially the tensile strength and elastic limit of the steel), and in a less degree by use of silicon and chromium; and second to simplify the heat treatment, by rendering less rigid the requirements as to maintenance of exact temperatures and conditions of cooling. A nickel-vanadium-steel, for instance, containing nickel 7, vanadium 0.2, carbon 0.2, and manganese 0.3 per cent., needs only a single hardening in water from a very wide temperature-range. Many nickel-steels can be treated by air-cooling alone—steels showing martensitic structure are especially suitable for this treatment. The following are examples of the composition of such air-hardening steels:—

Carbon.	Nickel.	Chromium.	Manganese.	Silicon.
per cent.	per cent.	per cent.	per cent.	per cent.
0.75	3.82	1.28	0.52	0.17
0.252	5.43	0.52	0.33	0.22
0.366	4.76	0.92	0.41	—

Where the steel has to withstand much friction, a high carbon-content is desirable, though chromium in a lesser degree exhibits the same tendency. The best results are in general obtained with steel containing 0.4 per cent. of carbon, though with silicon steels the carbon may be advantageously raised to 0.6 per cent. J. T. D.

Iron; Retardation of the acidation of — by chromium trichloride. P. Rohland. Z. Elektrochem., 1909, 15, 865—866.

CHROMIUM chloride solution greatly retards the rate of oxidation of iron; this protective action is exercised in presence of acetic acid, but not when a highly dissociated acid, such as hydrochloric, sulphuric, nitric, or oxalic acid is added. In a mixed solution of sodium, potassium, or calcium chloride with chromium chloride, iron is still protected, but oxidation occurs in a solution of ferric chloride and chromium chloride. In the presence of sulphates, chromium chloride exerts a protective action, but not in the presence of nitrates. Similar protective action is exerted by chromates or bichromates; and iron, in its turn, exerts a similar influence on the rate of oxidation of copper. The protective effect of chromium compounds is possibly due to a temporary deposition of metallic chromium on the iron. The author gives an explanation of the foregoing results in accordance with the theory of electrolytic dissociation.—J. T. D.

Copper; Requirements to be satisfied by — for its technical applications. L. Guillet. Int. Congr. for Testing of Technical Materials, Copenhagen, 1909. Z. Elektrochem., 1909, 15, 897.

THE author summarises the replies received from members of the Commission on this subject. As far as the mechanical properties of the metal are concerned, a small content of arsenic is said to be advantageous, whilst silver, cadmium, zinc, silicon, lead, phosphorus, and less than 0.1 per cent. of oxygen are not harmful. Bismuth, antimony, nickel, tellurium, and sulphur must be avoided. With regard to electrical conductivity, bismuth, antimony, sulphur, and oxygen are not of great moment, but arsenic and phosphorus are very injurious. Even for its electrical uses, however, the mechanical properties of the metal are of at least as great importance as its purely electrical ones. For further research, an improvement in the method of determining oxygen in copper is greatly to be desired; it may make considerable difference whether oxygen be present as cuprous oxide or carbon monoxide. The influence on the metal of various gases also requires to be investigated.—J. T. D.

Colloidal solutions: Preparation of — by disintegration of metals by means of ultra-violet rays. T. Svedberg. Ber., 1909, 42, 4375—4377.

THE author has succeeded in preparing colloidal solutions of metals by the application of the observation of Lenard and Wolf (Ann. Phys. Chim., 1889, 37, 443) that certain substances, especially metals, are dis-integrated when exposed to ultra-violet rays. Pieces of metal, the surfaces of which had been carefully freed from oxide, were placed in a shallow dish containing a dispersion-medium, and exposed to the rays from a Heraeus quartz mercury arc lamp placed a few centimetres above. After a few minutes colloidal solutions were obtained from silver, copper, tin, and lead, but platinum, aluminium, and cadmium remained practically unaffected. The action was especially marked in the case of lead, which yielded a colloidal solution in ethyl alcohol, and a milky liquid, probably containing colloidal lead hydroxide, in water. Experiments with silver and lead in water, ethyl alcohol, isobutyl alcohol, ether, acetone, ethyl acetate, and amyl acetate showed that the nature of the dispersion-medium had a great influence on the results. It is possible to prepare solutions by this method, the colloidal particles of which are very small, and of practically uniform size.

—A. S.

Aluminium-copper alloys: Electrical properties of — W. Broniewski. Comptes rend., 1909, 149, 853—855.

THE author has determined, for a series of 22 aluminium-copper alloys of composition varying from 100 per cent. of aluminium to 100 per cent. of copper, the specific conductivity, the temperature-coefficient of resistance, the thermo-electric power compared with copper between 0° and 100° and 0 and -80° C., and the electromotive force, with respect to a carbon electrode depolarised by manganese dioxide in a saturated solution of ammonium chloride. All the determinations, except those of electromotive force, were made on chilled and annealed specimens of each alloy. The curves plotted from the tables of results indicate the existence of four compounds, having the formulae, Al_2Cu , AlCu , Al_2Cu_3 , and AlCu_3 ; the third of these has not before been indicated. Annealing, in the case of most of the alloys, increases their conductivity, but reduces that of the compound, AlCu_3 , by half; the change occurs at a temperature above 500° C., and is possibly due to the polymerisation on cooling of the variety stable at a high temperature into a variety stable at the ordinary temperature and of higher specific resistance.—J. T. D.

Mineral production of Tasmania. Board of Trade J., Dec. 2, 1909. [T.R.]

THE following figures show the mineral production of Tasmania during the years ended 30th June, 1908 and 1909:—

	1907-8.		1908-9.	
	Quantity.	Value.	Quantity.	Value.
Gold .. ozs.	65,436	277,957	48,406	205,619
Silver-lead ore .. tons	68,107	450,348	77,463	230,125
Blister copper ..	8,715	650,359	8,845	608,535
Copper and copper ore ..	659	11,483	1,783	17,074
Tin ore ..	4,586	453,187	4,374	401,109
Iron ore ..	3,800	1,700	1,800	700
Coal ..	63,775	54,209	59,660	50,710
Woolfram ..	35	3,465	14	1,206
Bismuth ..	—	102	54	1,222
Total value	—	1,902,810	—	1,616,390

Gold and silver production of the United States. U.S. Geol. Survey, 1908. [T.R.]

THE production of gold in the United States in 1908 was 4,574,340 fine oz. valued at \$94,560,000 and the pro-

duction of silver was 52,440,800 fine oz., with the commercial value (at the average price for the year) of \$28,030,600. As compared with the figures for 1907, the above shows an increase in the gold product of \$4,124,300 and a decrease in the silver product of 4,073,900 fine oz.

PATENTS.

Air for metallurgical operations: Diccication of —. L. Sterne, London. From L. Block, New York. Eng. Pat. 23,529, Nov. 3, 1908.

IN an apparatus for the removal of moisture from the air blast used in blast-furnaces, by first compressing the air to an extent considerably in excess of that required for the blast and subsequently cooling it, and allowing it to expand (see Eng. Pat. 24,647 of 1905; this J., 1907, 206), a preliminary drying is now effected. The incoming air is caused to pass through pipes arranged within the chamber in which the previously compressed air is allowed to partially expand, the resulting cooling causing the deposition of a considerable proportion of the water contained in the air before the latter enters the compressors.

—F. R.

Iron: Process and apparatus for the introduction of solid reducing agents into molten slag floating on molten —. O. Tichl. Ger. Pat. 213,479, April 10, 1908.

IN order to protect the reducing agent from the oxidising action of the furnace-gases, whilst it is being introduced into the molten slag (containing iron oxide) floating on the molten iron, some molten slag is introduced at the same time, so as to form a protecting layer above the reducing agent. For this purpose, the inlet pipe is provided with a pipe for the introduction of the reducing agent in addition to the funnel through which the molten slag is introduced.—A. S.

Calcium-silicon alloys, etc.: Method of manufacturing —. H. Goldschmidt and O. Weil, Assignors to T. Goldschmidt, Essen on Ruhr, Germany. U.S. Pat. 938,758, Nov. 2, 1909.

THE content of alkaline-earth metal in alloys of the same with silicon can be increased by melting the alloys with iron. The process is specially useful for increasing the calcium content of calcium-silicon alloys.—A. S.

Antimony sulphide ores: Treatment of — for the production of metallic antimony, its oxides, sulphides, and oxysulphides. A. Germot. First Addition, dated Sept. 7, 1908, to Fr. Pat. 379,143, June 22, 1907 (this J., 1907, 1204).

A PART or the whole of the blast of air or oxygen (*loc. cit.*) is directed on the surface of the molten ore, to which, also, antimony oxide produced in previous operations is added.—J. W. H.

Titaniferous iron ores: Process of treating —. W. Borchers, Aix-la-Chapelle, Germany. Eng. Pat. 24,590, Nov. 16, 1908.

SEE U.S. Pat. 930,344 of 1909; this J., 1909, 986.—T. F. B.

Steel or steel alloys: Direct production of — from the ore. W. S. Simpson and H. Oviatt, London. Eng. Pats. 24,845, Nov. 18, 1908, and 8812, March 10, 1909.

SEE U.S. Pat. 913,382 of 1909; this J., 1909, 527.—T. F. B.

Iron: Direct production of — from its oxides or oxide ores. W. S. Simpson and H. Oviatt, London. Eng. Pats. 24,846, Nov. 18, 1908, and 5802, March 10, 1909.

SEE U.S. Pat. 913,381 of 1909; this J., 1909, 527.—T. F. B.

Copper: Process for extracting — from copper residues. D. Crispo, Antwerp. Eng. Pat. 12,565, May 27, 1909. Addition to Eng. Pat. 6730, March 20, 1907.

SEE U.S. Pat. 936,762 of 1909; this J., 1909, 1141.—T. F. B.

Flux for use in soldering. W. Ackermann, Berlin. U.S. Pat. 940,111, Nov. 16, 1909.

SEE Fr. Pat. 400,132 of 1909; this J., 1909, 1034.—T. F. B.

Tin; Process of recovering — from waste. A. Nodon, Bordeaux, France. U.S. Pat. 940,471, Nov. 16, 1909.

SEE Fr. Pat. 386,499 of 1907; this J., 1908, 692.—T. F. B.

Detinning tin-plate by means of chlorine; Process of —. H. von Schütz, Wetzlar, Germany. U.S. Pat. 940,898, Nov. 23, 1909.

SEE Fr. Pat. 395,999 of 1908; this J., 1909, 480.—T. F. B.

Treatment of burnt pyrites, and separating any contained copper. Fr. Pat. 402,939. See VII.

Producing insulating layers of oxide or hydroxide on metallic wires. Fr. Pat. 403,234. See XI.A.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Lead accumulator-plates; Rapid formation of —. G. Just, P. Askenasy, and B. Mitrofanoff. Z. Elektrochem., 1909, 15, 872—892.

SMOOTH lead plates were first formed in pure sulphuric acid by Planté's method, their rate of increase of capacity and curves of charge and discharge being determined during the course of the process. Similar plates, formed in acid to which potassium nitrate had been added, showed a much more rapid rise of capacity, and a change in the form of the curves of charge and discharge. As the concentration of the nitrate was increased, the coating showed a greater tendency to fall away from the plate; having regard both to this tendency, on the one hand, and to the increased rapidity of formation on the other, an acid containing 218 grms. of sulphuric acid and 30 grms. of potassium nitrate in the litre is most advantageous. When nitrate is used, the first effect is the formation of a white coating of lead sulphate on the positive plate; this is thinner and more adherent, and is sooner converted completely into peroxide, according as the nitrate-concentration is lower. Attempts to prevent the scaling-off of the formed coating with high nitrate-concentration were unsuccessful. With grooved or cellular plates, higher nitrate-concentrations could be used, and capacities suitable for technical use attained very rapidly, whilst the coatings were still sufficiently adherent and durable.

J. T. D.

PATENTS.

Insulating layers of oxide or hydroxide; Production of — on polished metallic wires. Spezialfabrik für Aluminium-Spulen und -Leitungen Ges.m.b.H. Fr. Pat. 403,234, May 22, 1909. Under Int. Conv., Feb. 5, 1909.

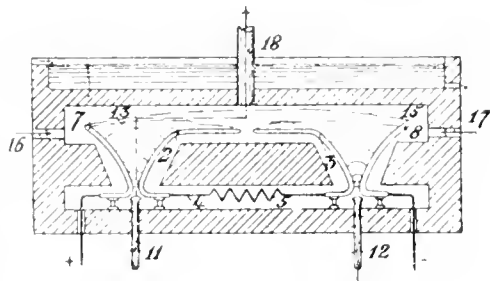
THE metallic wire or ribbon, in the form of bundles, or wound on bobbins, is introduced into a liquid capable of bringing about oxidation, and the material is afterwards dried artificially or by exposure to air. The air contained in the interior of the bobbins is rarefied, and the oxidising liquid forced into the bobbins by an increase of pressure.—B. N.

Electrodes; Manufacture of — composed of oxides, or electrode masses with great internal cohesion, for primary and secondary elements. R. Pörsche. Fr. Pat. 403,276, May 24, 1909.

THE process consists in the application of the thermite process to the production of electrodes. An oxide, such as copper oxide, is mixed with a finely-divided metal such as iron or aluminium, and heated to incandescence. The oxide yields oxygen to the finely-divided metal, and the heat which is developed during the action produces a sintering of the oxides, and a partial welding of the metal. The oxide formed is removed by appropriate

treatment, e.g., by the aid of the electric current in an alkaline electrolyte or by the action of mineral acids, thus producing a porous electrode. The lower oxide or the metal which remains after disengagement of oxygen, may be afterwards completely reoxidised by heating or by the action of the electric current. In a variation of the process, the oxide formed by the action of oxygen on the finely-divided metal is left in the finished electrode, and only the oxide supplying the oxygen, or the reduced metal, is removed by appropriate means.—B. N.

Electric furnace for the treatment of gases. Salpetersäure-Ind. Ges.m.b.H. Ger. Pat. 216,090, Aug. 26, 1908.



THE apparatus is shown in the accompanying figure. Besides the two chief electrodes, 7 and 8, auxiliary electrodes, 2, 3, are provided, which do not quite meet at their upper ends, but are connected below by a conductor, 4, and a resistance, 5. Streams of the gas to be treated are forced in through the nozzles, 11, 12, in order to assist the electro-dynamic action, and carry upwards the flames produced between the two pairs of electrodes, until they unite to form the long stable flame, 13, 15. The main quantity of the gas to be treated enters through the openings, 16, 17, and the reaction-products leave through 18. Should the flame, 13, 15, be quenched during working, flames are again produced between the inner and outer electrodes, and these rise and form another stable flame.—A. S.

Mica; Process for softening —. Siemens-Schuckert Werke Ges.m.b.H. Ger. Pat. 216,404, March 20, 1908.

NATURAL mica is frequently too hard to be used for various purposes in electrical apparatus. According to the present patent it is softened by packing it in layers between metal plates in a metal box, heating it to a relatively low temperature, and then quenching in water.—A. S.

Insulating media; Process for producing transparent, flexible, infusible —. K. Winkler, Zürich, Switzerland. Eng. Pat. 24,597, Nov. 16, 1908. Under Int. Conv., Nov. 18, 1907.

SEE Ger. Pat. 208,753 of 1907; this J., 1909, 529.—T. F. B.

Electrolyte for use in electric batteries. W. J. L. Sandy, London. U.S. Pat. 940,734, Nov. 23, 1909.

SEE Fr. Pat. 396,905 of 1908; this J., 1909, 610.—T. F. B.

Electrolytic manufacture of alkalis and salts. Fr. Pat. 403,360. See VII.

(B.)—ELECTRO-METALLURGY.

PATENTS.

Iron oxide scale; Electrolytically removing —. C. W. Danforth and N. Jones, Sharon, Pa. U.S. Pat. 939,223 and 939,224, Nov. 9, 1909.

THE iron or steel is subjected to the action of an electric current, the density of which is not less than seven amperes per square foot, whilst immersed in an electrolyte consisting of a solution, in water or dilute sulphuric acid, of an alkali bisulphate at a temperature of not less than 40° C.—B. N.

Metals; Process for extracting and refining — J. H. Reid. Fr. Pat. 403,033, May 11, 1909. Under Int. Conv., Sept. 23, 1908.

THE mineral or material to be treated is mixed with a reagent which forms, with the metals to be extracted, compounds from which the metals can be recovered by electrolytic deposition. This mixture is allowed to fall down a vertical column consisting of chambers provided with electrodes and forming a vertical series of electric arc furnaces. The temperature of each chamber corresponds with the point of volatilisation of a compound contained in the mixture or produced therein as the material falls. The vapours given off in each chamber are withdrawn by means of pipes into condensing vessels containing water. The contents of the condensers are treated electrolytically for the separation of the metals.

—J. W. H.

Furnace; Electric induction — A. Hiorth. Fr. Pat. 403,038, May 14, 1909. Under Int. Conv., May 15, 1908.

THE furnace comprises a bath of metal, in the form of two circular channels united at one side, forming the secondary, with two vertical limbs of an iron core passing through the circular channels. The primary of the furnace consists of four bobbins in the form of discs surrounding the vertical limbs, two being placed below, and two suitably suspended above the circular channels. The furnace is mounted on a pivot, so as to be oscillating in character, whilst the core of iron is fixed and mounted independently of the furnace. —B. N.

Zinc; Process and apparatus [electric furnace] for the extraction of — from its ores. A. L. J. Queneau. Fr. Pat. 403,048, May 14, 1909.

THE process consists in using a rotary electric furnace, into which the ore, previously heated and mixed with a reducing agent, is charged. The furnace consists of a cylindrical iron casing lined with refractory material and provided with annular rings for support and an annular gear wheel for rotation. Each end of the furnace is provided with an annulus of graphite blocks by which the current is carried to the contents of the furnace. A fluid resistor of any convenient substance (*e.g.*, iron) and of suitable volume is charged into the furnace on commencing work. Condensers for the zinc are fixed to the end covers of the furnace and rotate with it. —J. W. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Fats; Melting and solidifying points of — 1., *Binary mixtures and II., ternary mixtures of stearic, palmitic, and oleic acids.* E. Carlinfanti and M. Levi-Malvano. *Gaz. chim. ital.*, 1909, 39, II., 353–385.

THE authors have applied the methods used in the thermal examination of metallic alloys to mixtures of fatty acids, using an apparatus similar to that employed for cryoscopic determinations. The oleic acid used in the experiments had the iodine value, 90.5. The results obtained are given in tables and curve-diagrams. In the case of mixtures of stearic and palmitic acids, the fusion-curve shows a distinct "break" at a point corresponding to a mixture of equimolecular proportions of the two acids and a temperature of 56° C. The whole curve may thus be divided into two portions. The first corresponds to mixtures of stearic acid and the addition-compound, $C_{18}H_{36}O_2$, $C_{16}H_{32}O_2$; this is a smooth curve, the mixtures solidifying as a series of solid solutions. The second portion, corresponding to mixtures of the addition-compound and palmitic acid, shows a maximum at 56.25° C. (about equal parts by weight of palmitic and stearic acid) and a minimum at 54.75° C. (about 70 per cent. of palmitic acid), but as neither of these points corresponds to a mixture of the two acids in stoichiometrical proportions, the authors conclude that the addition-compound and palmitic acid form three different series of solid solutions. Mixtures of stearic and oleic acids and of oleic and palmitic acids give smooth fusion-

curves, indicating the formation, in each case, of a simple series of solid solutions. Starting from pure stearic acid or palmitic acid, the solidifying point falls at first slowly and then more rapidly on addition of oleic acid, the curves being markedly convex. In the case of mixtures of the three acids—stearic, palmitic, and oleic—the temperature rises by 1°–1.5° C. when the fused mixture begins to solidify, and then falls, slowly until solidification is complete, and more rapidly afterwards. In no case is there any retardation of the rate of cooling; hence only one solid phase, consisting of a solid solution of the three acids, is present. The solidifying points (beginning of crystallisation) of 50 ternary mixtures of the three acids in different proportions are shown in the following table:—

Stearic acid.	Palmitic acid.	Oleic acid.	Solidifying point.
Per cent.	Per cent.	Per cent.	° C.
74.5	13	12.5	62.30*
60	17	17	60.15*
61	19.5	19.5	58.80*
51	24.5	24.5	55.60*
29	35.5	35.5	48.05*
12	44	44	45.15*
80	3	17	64.10*
74	4	22	62.80*
69	4.5	26.5	61.65*
63.5	5.5	31	60.40*
57.5	6.5	36	58.05*
51.5	7.5	41	56.90*
46	8	46	55.10*
41	7.5	51.5	53.30*
91.5	7.5	1	65.60*
80	17.5	2.5	63.00*
69	27.5	3.5	60.10*
57	38	5	56.30*
46	48	6	54.60*
34.5	58.5	7	53.80*
27.5	64	8.5	52.70*
23	68.5	8.5	52.70*
12	78.5	9.5	55.05*
40.5	55	4.5	54.80*
58.5	19.5	22	58.10*
47	31	22	53.70*
41	36.5	22.5	52.00*
39	39	22	51.65*
35	43	22	51.65*
31	47	22	51.30*
27.5	50.5	22	50.90*
24	54	22	50.30*
19.5	58.5	22	50.10*
15.5	62	22.5	50.70*
8	70	22	53.30*
40.5	13.5	46	52.55*
32.5	21.5	46	48.20*
29	25	46	46.50*
27	26.5	46.5	46.10*
21.5	32	46.5	45.40*
16.5	37.5	46	44.70*
5.5	48.5	46	47.30*
24.5	8	67.5	44.95*
19.5	12.5	68	40.85*
14.5	18	67.5	38.20*
10	22.5	67.5	36.90*
3.5	20	67.5	38.85*
5.5	77.5	19.5	54.85*
8	66	26	52.40*
20	30.5	49.5	44.55*

These results are given graphically in an equilateral triangle, the three corners of which represent the three acids, and isothermal curves are traced within the triangle. With the aid of such a diagram the composition of a mixture of the three acids can be ascertained directly, in most cases, if the solidifying point and either the proportion of oleic acid (from the iodine value) or that of stearic acid (by Hehner and Mitchell's method, *Analyst*, 1896, 321) be determined. —A. S.

Castor oil bean in the Sudan; Experiments in the production of — Board of Trade J., Dec. 2, 1909. [T.R.]

THE Monthly Report of the Sudan Central Economic Board for October states that experiments were carried on at Kassala during the season 1908–9 with the cultivation of the castor oil plant, Java and Indian seed being used. The seed was sown early in September and the harvest took place about the middle of January. The

beans were sold in Hull at about £11 per ton. The cost of cultivation and the yield per acre were as follows:—

	Cost of cultivation per acre.	Yield per acre.
	£	lbs.
Java seed	4.41	1,750
Indian seed	3.67	1,640

The results of an examination, at Khartoum, of samples of the beans produced, were as follows:—

	Java.	Indian.
Percentage of oil	51.48	48.68
Weight of 100 seeds in grms.,	42.6	25.2

The samples were both stated to be of good quality, that grown from Java seed especially so.

China bean oil for candle making in Australia; Denaturation of —. Board of Trade J., Dec. 2, 1909. [T.R.]

THE regulation for the denaturation of China bean oil for free importation into Australia, when for use for the manufacture of candles, is now amended as follows:—To each 100 gallons of oil contained in a vat fitted with a heating appliance, there shall be added not less than four per cent. of sulphuric acid of strength not less than 1.77 sp. gr. at 60 deg. Fahr., and the whole heated to a temperature exceeding 230 deg. Fahr. for at least 30 minutes. Treatment of the oil with dilute sulphuric acid before denaturing may be allowed. (See this J., 1909, 250.)

Beeswax, mineral oils, etc., in Greece; Customs duties on —. Board of Trade J., Dec. 2, 1909. [T.R.]

THE import duties on wax and mineral oils and their derivatives have been modified as shown in the following statement:—

No. of the Tariff.	Tariff Classification.	Rate of Duty.	
		Former.	Fixed by the Law.
8	Yellow beeswax, in cakes or pieces	Drachme (metallic). Per 100 okes. 70-00	Drachme (metallic). Per 100 okes. 170-00
9	Yellow beeswax, in tapers of every kind, or otherwise prepared	125-00	225-00
61h	Residues of distillation of mineral oils, having a blackish or chestnut colour and a melting point not higher than 48°C. and containing not less than 10 per cent. of mineral oils (those of a whitish colour and having a higher melting point and containing a smaller quantity of oils, besides organic substances, being subjected to duty under Tariff No. 99)	(Not specified)	50-00
62	Mineral oils (except petroleum, the importation of which is forbidden as a State monopoly) ...	50-00	100-00
98	(a) Sealing wax	120-00*	120-00
	(c) White wax in cakes		220-00
99	Kerosene, paraffin, stearin, and all artificial waxy substances (without deduction for tare)	120-00	220-00

*White wax in cakes and pieces and sealing wax.

The Law further provides that the use of colophony and resinous substances in general in the manufacture of wax or tapers is prohibited, and that import duty will be returned upon the exportation of paraffin in cakes or tapers manufactured of the residues of mineral oils referred to in No. 61 (h) of the Tariff, and having paid the duty fixed for that number.

PATENTS.

Oliver oil; Apparatus for the continuous extraction of —. J. de Acuna y Gomez de la Torre. Fr. Pat. 402,015, May 13, 1909. Under Int. Conv., May 14, 1908.

OLIVES or other oleaginous materials are introduced under pressure, in a continuous process, into an annular space between two concentric cylinders with perforated walls. Meanwhile a current of liquid (e.g. water) is introduced under pressure into the interior space in such a way as to give a rotatory motion to the mass, and carry with it the expressed oil through the perforations in the outer cylinder. The residual material is discharged automatically.

—C. A. M.

Soap; Apparatus for making —. W. A. Grant, East Orange, N.J., Assignor to Royal Solvent Co., New York. U.S. Pat. 939,906, Nov. 9, 1909.

THIS apparatus comprises a converter provided with an outlet below and connected with containers above, whence the materials are introduced into the converter. Air under pressure is admitted both into the containers and the converter. The latter may be constructed with its central axis in a vertical line, and may contain a rotatable shaft and frame provided with arms.—C. A. M.

Soap; Manufacture of —. W. A. Grant, East Orange, N.J., U.S.A. Eng. Pat. 8674, April 10, 1909.

SEE U.S. Pat. 939,906 of 1909; preceding.—T. F. B.

Soaps containing solvents of fat; Process of making —. A. Welter, Krefeld-Linn, Germany. Eng. Pat. 8982, April 15, 1909.

SEE Fr. Pat. 402,172 of 1909; this J., 1909, 1211.—T. F. B.

Soap powder; Process for the production of —. W. Lüring, Hanover, Assignor to Gebr. Körting, Körtingsdorf, Germany. U.S. Pat. 940,398, Nov. 16, 1909.

SEE Eng. Pat. 26,133 of 1908; this J., 1909, 992.—T. F. B.

Treatment of sugar cane, and useful products [wax] therefrom. Eng. Pat. 2219. See XVI.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A).—PIGMENTS; PAINTS.

PATENTS.

Paint for use as an anti-fouling composition for ships. E. A. Palk, Totton, Hants., and H. F. Basset and W. Nash, London. Eng. Pat. 21,627, Nov. 16, 1908.

A PAINT prepared by mixing acetone and gold size with a pigment, varnish and turpentine oil, in proportions which are varied according to the colour and thickness of coating required, is found to prevent the adherence of vegetable and animal growths to ships' bottoms.—J. A.

Pigments with a basis of antimony; Manufacture of — and obtaining of by-products. A. Vietti. Fr. Pat. 403,017, Sept. 14, 1908.

ANTIMONY pigments are obtained by injecting solutions of sulphantimonates of metals of the alkali or alkaline-earth groups and also a solution of sodium sulphate into flues conveying sulphurous fumes from the roasting of sulphides, etc. The sulphate is reduced to sulphide, which reacts with the sulphantimonate to

form antimony sulphide and alkali thiosulphate. The latter may either be purified or used in the preparation of antimony vermilion from antimony chloride.—C. A. M.

Ultramarine; Apparatus for the manufacture of —. L. Royer. Fr. Pat. 403,077, May 17, 1909.

CLAIM is made for the use of a furnace, together with its connected pipes and vessels, constructed of carborundum.—C. A. M.

Ultramarine blues; Process and apparatus for the manufacture of —. J. Luciani. Fr. Pat. 403,247, Sept. 19, 1908.

A FURNACE, intended for the oxidation of ultramarine or, in general, for all reactions in which material at a high temperature is treated with gases, is described. It consists essentially of an annular space between two cylinders of brick of special construction. The material is placed in this space, air is admitted through holes in the inner brick cylinder, and the gaseous products of the reaction pass through openings in the bricks in the outer cylinder into a flue above. The furnace is charged from wagons above, and is emptied through openings in the lower part of the annular space.—C. A. M.

Drying paints, pigments, etc. Eng. Pat. 25,216. See I.

Monoazo dyestuff [for lakes]. Ger. Pat. 216,417. See IV.

(B.)—RESINS, VARNISHES.

PATENTS.

Rosin; Method of bleaching —. L. C. Minor, Cincinnati, Ohio. U.S. Pat. 939,733, Nov. 9, 1909.

THE melted rosin is subjected to the action of artificially produced ultra-violet rays in a vessel, the inner sides of which reflect light.—C. A. M.

Artificial resins; Process and apparatus for the manufacture of — from pyroigneous products, with the production of acetates as by-products. Pagès Camus et Cie and P. Bandy. Fr. Pat. 402,907, Sept. 9, 1908.

CLAIM is made for a process of obtaining artificial resins by the interaction of the "phenolic oils," "aldehydic oils" and "aldehydic residues" formed in the distillation of wood or analogous products, preferably in the presence of an acid or alkaline condensing agent. Thus the pyroigneous vapours from the distillation are mixed together at a temperature below 250° C. (acid condensation). The vaporised products are then treated with a substance with alkaline reaction, and the resulting resins dissolved (alkaline condensation). Finally, the solution is neutralised with suitable acids. The three stages may be carried out successively so as to obtain the different kinds of resins formed in the different condensations, and special types of apparatus for the different modifications of the process are described. An alternative process claimed is to render alkaline the mother liquors from the crystallisation of pyroigneous solutions, and to submit them to the general methods of condensation mentioned above, thus obtaining resins, acetates, and a new source for higher fatty acids (butyric acid, etc.). Apparatus for this process is also described. Another alternative is to treat the pyroigneous vapours with an insoluble neutral salt (e.g., calcium carbonate), which is not acted on by phenols but is decomposed by acids. The crude acetates resulting from this process may then be separated and purified.—C. A. M.

Oils; Process for heating (boiling) — for the preparation of varnishes and polymerised oil products. A. Genthe. Ger. Pat. 215,348, June 13, 1908.

TO avoid loss of oil by evaporation during "boiling," and also to prevent oxidation by the air, the vessel in which the boiling is performed is provided with a float, which is of a slightly smaller size than the inner wall of the vessel, so as to leave a small space for the escape of

steam or volatile substances. The vessel is preferably made of aluminium, and it may be protected from damage by flame, by an iron jacket.—T. F. B.

Resins, lacquers, varnishes, and driers; Process for the preparation of transparent coloured —. M. Schwarz. Ger. Pat. 215,549, April 11, 1908.

RESINS or resin-acids when heated to temperatures of from 150° to 420° C., are capable of dissolving dyestuffs of the indanthrene and "algal" classes; and the products may be used for the preparation of coloured lacquers, varnishes, driers, etc.—A. S.

Lacquers containing nitrocellulose; Process for preparing —. B. G. Buchstab. Ger. Pat. 216,307, Jan. 31, 1909.

NITROCELLULOSE is dissolved in a suitable solvent (e.g., is used as collodion) and treated with air, oxygen, ozone, or gases containing oxygen until the solution is a brownish-yellow colour. The thick liquid thus obtained is diluted to suitable consistency with methyl or ethyl alcohol. For preparing paint-oils, etc., the solution is mixed with suitable non-drying or semi-drying oils, and for preparing lacquers, with resins, glycerin, etc. The products may be rendered incombustible by adding lactic acid or a lactate, especially strontium lactate. In place of using nitrocellulose for the process, materials containing nitrocellulose, such as celluloid, may be employed.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Rubber; Influence of protein on the determination of — as tetrabromide. D. Spence. Gummi-Zeit., 1909, 24, 212–213. (See this J., 1909, 1149.)

THE part played by the protein of raw rubber in the Budde method of estimation of rubber as tetrabromide has so far been largely ignored. The author has therefore studied the behaviour of protein, derived from the latex of *Funtumia elastica*, towards bromine under various conditions. The protein was isolated in the following way:—100 c.c. of acid *F. elastica* latex were diluted with 800 c.c. of distilled water in a separating funnel. On standing for 3 hours, the liquid separated into two layers, of which the lower, aqueous serum contained the protein. The serum was drawn off, saturated with ammonium sulphate, and the finely flocculent precipitate obtained filtered off and dissolved in 200 c.c. of distilled water. The solution was filtered, and dialysed against running water for three days. The dialysed solution was saturated with ammonium sulphate, and the purification process repeated, dialysis being finally conducted against distilled water for one day. From this purified solution the solid protein was obtained, (1) by precipitation with three times its own volume of absolute alcohol, washing with 80 per cent. alcohol, and drying *in vacuo*; (2) by evaporation to dryness *in vacuo* over sulphuric acid. Both products gave the following results:—(1) an aqueous solution gave no precipitate on addition of bromine-water. The bromine was completely absorbed, and no protein was precipitated when alcohol was subsequently added; (2) when bromine water was added to a solution of the protein which had been rendered opalescent by the addition of alcohol, the opalescence vanished, and protein could no longer be precipitated from the solution. Protein from *F. elastica* latex therefore yields bromine derivatives which are soluble both in water and in alcohol. 0.156 gm. of dry, finely-divided protein was suspended in 50 c.c. of carbon tetrachloride, the mixture was cooled in ice-water, and 50 c.c. of Budde's bromine solution were slowly added. The liquid was allowed to stand for 24 hours. The small quantity of undissolved protein remaining was filtered off, and the filtrate evaporated to dryness in a current of carbon dioxide. The brown syrupy mass obtained, weighed 0.128 gm. and contained about 16 per cent. of bromine. The undissolved protein was also found to contain bromine, but the amount was not estimated.—E. W. L.

Rubber [*ebonite*]; *Hard vulcanised* — G. Hübener.
Gummi-Zeit., 1909, 24, 213–214.

(1). *A simple method of estimation of sulphur of vulcanisation.*—In the method previously described (this J., 1909, 251) a determination of sulphur in the ash, in addition to determinations of “free” sulphur (including sulphur in sulphides and soluble sulphates) and of total sulphur, was necessary in the presence of insoluble or sparingly soluble sulphates. By proceeding in the following manner instead of employing Henriques’ method for the determination of total sulphur, the first determination becomes unnecessary. To 1 gm. of the finely-rasped ebonite in a 100 c.c. Erlenmeyer flask, 15 c.c. of concentrated nitric acid are carefully added. The flask is then heated first on a sand-bath, and finally on a water-bath in order to drive off the excess of nitric acid. The residue is diluted with water, 3 c.c. of bromine are added, and the flask is again heated until the excess of bromine is removed. The liquid is poured through a filter, and the sulphuric acid in the filtrate precipitated and determined as barium sulphate. The difference between the amount of sulphur thus found, and the “free” sulphur (see above) represents combined sulphur (sulphur of vulcanisation). The author points out that results obtained by the new method are appreciably higher than those obtained by the soda-fusion method (Henriques). This is due to the fact that barium sulphate is appreciably soluble in concentrated solutions of potassium, sodium, calcium and magnesium salts. This solubility is clearly shown by the results of a special series of determinations, in which barium sulphate was fused with sodium carbonate, the melt extracted with water and filtered from barium carbonate, and the sulphate in the filtrate precipitated with barium chloride, whilst the barium carbonate was dissolved in hydrochloric acid, and the barium precipitated with dilute sulphuric acid. The results were as follows:—

	(a) per cent.	(b) per cent.
(1) Sulphate precipitated by barium chloride.....	90.35	93.2
(2) Barium precipitated by sulphuric acid.....	97.55	97.67

The barium sulphate obtained in (2b) was treated in a similar manner, with the following results:

	per cent.
Sulphate precipitated by barium chloride.....	91.69
Barium .. sulphuric acid	99.75

In (1b) and (2b) the proportion of sodium carbonate employed was higher than in (1a) and (2a).

(2). *Investigation of the phenomena of hot vulcanisation.*—Results obtained by the author, in the case of ebonite, by his method of analysis already described (this J., 1909, 251), confirm those obtained by Hinrichsen and Stern, who studied vulcanisation in naphthalene solution (this J., 1909, 1050). The results are as follows, in the case of samples vulcanised under similar conditions:—

No.	Rubber, per cent.	Sulphur, per cent.	Combined sulphur, per cent.
1.....	36.23	22.60	3.62
2.....	29.01	24.39	3.52
3.....	26.58	24.44	3.01
4.....	19.21	22.96	2.88

The author concludes from the results that in mixings containing equal percentages of rubber, the amount of combined sulphur increases with the quantity of sulphur added, and that in mixings containing equal percentages of total sulphur, the amount of combined sulphur increases with the percentage of rubber.—E. W. L.

PATENTS.

Rubber; *Apparatus for cleaning and devulcanising* — M. C. Clark, Providence, R.I., U.S.A. Eng. Pat. 12,250, May 24, 1909.

THE waste rubber is cracked and screened, then treated in an acid bath, washed, devulcanised by means of steam,

disintegrated, and dried. The chief improvements claimed in the apparatus for carrying out the process, are as follows:—(1). The washing tanks are provided with overflow arrangements, each of which includes an inclined screen having a vertical foot-piece at its lower end, whereby any rubber carried by the overflowing liquid is retained. (2). For the operation of devulcanisation, the rubber is packed in a cylindrical car divided into compartments by movable perforated horizontal shelves, and one side wall of which consists of curved sectional plates, to allow of charging the car one compartment at a time; the car is open at the top and has a perforated floor through which steam passes from the devulcanising chamber. (3). The drying apparatus for the disintegrated devulcanised material comprises two superposed endless belts in a casing through which hot air is passed. The material is fed on to the moving upper belt until this is filled; the belt is then stopped for a time, after which the partially dried material is transferred to the lower belt, which moves in an opposite direction to the upper one. The lower belt, when filled, is left at rest until the material is completely dry.—A. S.

Indiarubber (whether vulcanised or not) and similar products; *Process for the recovery or regeneration of* — G. Capelle, Liege, Belgium. Eng. Pat. 27,567, Dec. 18, 1908.

SEE Fr. Pat. 398,583 of 1908; this J., 1909, 895.—T. F. B.

Improving elasticity and resistance to water of artificial silk. Fr. Pat. 403,264. See V.

XIV.—TANNING, LEATHER, GLUE, SIZE.

PATENTS.

Tannin-extracts; *Process for decolorising* — Deutsche Versuchsanstalt für Lederindustrie und H. Arnoldi, Freiberg, Germany. Eng. Pat. 19,804, Aug. 30, 1909. Under Int. Conv., Sept. 7, 1908.

TANNIN-EXTRACTS are decolorised by treating them with “activated aluminium,” prepared by treating aluminium scrap with caustic alkali solution, rinsing with water, and then treating with mercury chloride and again washing. The tannin-extract is well mixed with the activated aluminium, the mixture heated, agitated, then allowed to cool and settle, and the clear liquid separated and concentrated. The process is said to be specially suitable for the treatment of mangrove-bark, maleto-bark, and quebracho-wood extracts, and the treated extracts produce leather which becomes but little darker under the action of light, and is free from the red shade usually characteristic of leather prepared with these extracts.—A. S.

Horn waste and similar substances; *Process for converting — into plastic materials.* C. Claessen, Ger. Pat. 216,214, Aug. 31, 1906.

THE horn waste or the like is treated with phenols, or aniline, or their derivatives, then mixed with binding agents, such as resins, carbohydrates, glue, casein, etc., and if desired, with glycerin, oil, vulcanised oils, etc., and the mass heated to 120°–150° C. and compressed. A. S.

Drying dissolved leather, etc. Eng. Pat. 25,216. See I.

Manufacture of “animal” artificial silk. Fr. Pat. 403,193. See V.

Purification of sulphite-cellulose liquors. Ger. Pat. 216,284. See XIX.

XV.—MANURES, &c.

Calcium silicides, and their capacity for absorbing [atmospheric] nitrogen. Kolb and Fournhals. See VII.

Decomposition of nitrites by micro-organisms. Franzen and Löhmann. See XVIII.B.

PATENT.

Dyeing dissolved leather, congealed blood, &c. Eng. Pat. 25,216. See I.

XVI.—SUGAR, STARCH, GUM, &c.

Hexosephosphate formed by yeast juice from hexose and phosphate. Young. See XVII.

PATENTS.

Sugar cane; Treatment of — and manufacture of useful products therefrom. A. and S. Wynberg, Amsterdam. Eng. Pat. 2219, Jan. 29, 1909.

THE wax and other bodies adhering to the rind of the sugar cane are removed by a system of mechanically operated brushes, which, since the cane is irregular both in size and shape, are so mounted as to be elastic and flexible. The dust removed by the brushes is carried off by an air-blast and collected for further treatment. The juice obtained from cane brushed in this way is found to give better results in filtration and crystallisation than the juice from untreated cane.—J. A.

Beet slices; Continuous extraction apparatus for —. W. Bock. Ger. Pat. 213,021, Aug. 25, 1906.

THE apparatus comprises a series of vertical cylindrical receptacles disposed one above the other. A hollow shaft extends centrally through the receptacles and, near the bottom of each receptacle, is provided for a short distance with a projecting helix, so as to act as a screw conveyor; immediately below each helix the receptacle is contracted, so that the beet slices become compressed and practically impervious to liquid, thus closing communication between adjacent receptacles. In the remaining portion of each receptacle the beet slices remain loose, and come into intimate contact with the extracting liquid. The beet slices are introduced at the top and pass downwards through each receptacle in succession. The extracting liquid passes through the lowest receptacle first, then through the next higher one, and so on, but in each receptacle its direction of flow may be the same as, or opposite to, that of the beet slices. Pipes are provided for conveying the extracting liquid from one receptacle to the next.—A. S.

Starch; Soluble —. A. E. Militz, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 941,159, Nov. 23, 1909.

SEE Fr. Pat. 383,902 of 1907; this J., 1908, 415.—T. F. B.

Beetroot syrup for the cultivation of yeast. Fr. Pat. 402,855. See XVII.

XVII.—BREWING, WINES, SPIRITS, &c.

Yeast-juice; The hexosephosphate formed by — from hexose and phosphate. W. J. Young. Proc. Roy. Soc., 1909, 81B, 528–545.

IT has been shown by Harden and Young that the rate of fermentation of glucose by yeast-juice is temporarily greatly increased by the addition of a soluble phosphate, and that during this period of increased activity, the phosphate undergoes an alteration, so that at the end of the time it is no longer precipitable by magnesium citrate mixture (this J., 1906, 490, 1111; 1907, 62; 1908, 824). They suggested that a combination of the phosphate with the sugar, to form a phosphoric acid ester, had taken place. The present paper embodies work on this substance which has been isolated through the medium of its lead salt. The compound formed during fermentation is the salt of an acid which probably has the formula,

$C_6H_{10}O_4(PO_4H_2)_2$. The free acid, which is obtained in solution by decomposing its lead salt with sulphuretted hydrogen, is very unstable and readily decomposes on keeping, or at ordinary temperature *in vacuo* over sulphuric acid, with formation of a reducing substance and phosphoric acid. The hexose-phosphoric acid reduces Fehlings' solution very slowly in the cold, but rapidly on boiling, whilst no osazone or hydrazone has been obtainable from it. The same hexose-phosphoric acid is obtained from glucose, fructose or mannose, and on hydrolysis by boiling, yields phosphoric acid and fructose; no other hexose could be identified. The salts of lead, barium, silver, and calcium have been prepared.—R. L. S.

Yeast; Distribution of phosphoric acid in — and its alteration during storage. Heinzelmann. Jahrb. Versuchs- u. Lehranst. f. Brau., 1909, 12, 123–124.

EXPERIMENTS with two top-fermentation distillery yeasts, Races XII and M (mixed races) showed that during storage, the amount of inorganic phosphoric acid increases at the expense of the organic phosphoric acid. This increase amounted to 29.4 per cent. of the total phosphoric acid of the yeast in 18 days at 15° C., in the case of Race M, and to 21.8 per cent. in 64 days at 7° C. in that of Race XII. The change is attributed to the action of the yeast peptase (endotryptase), which produces decomposition of the yeast-protein, with formation of phosphoric acid or inorganic compounds of the same from organic phosphorus compounds.—A. S.

Yeast; Action of oxygen on quiescent —. M. Delbrück and F. Hayduck. Jahrb. Versuchs- u. Lehranst. f. Brau., 1909, 12, 34–38.

COMPARATIVE experiments were made as to the effect of treatment with air, on the one hand, and with carbon dioxide, hydrogen or other inert gas, on the other, on the properties, especially the stability, of quiescent yeast. It was found that in general, aeration renders the yeast more resistant to high temperatures, i.e., less liable to liquefy as the result of autodigestion. The favourable action of air is probably due to the repression of the destruction of the protein substance of the yeast by the yeast peptase (endotryptase). It is not yet clear whether the oxygen exerts a direct restraining effect on the peptase, or whether it has a favourable influence on the whole "physiological condition" of the cell (see this J., 1907, 60, 1104; 1908, 1170), such that the synthesising actions overbalance the decomposing actions. From the technical standpoint the results show the importance of aerating quiescent yeast which has to be transported, especially in summer.—A. S.

PATENTS.

Beetroot syrup for the cultivation of yeast; Preparation of —. K. Kruis. Fr. Pat. 402,855, May 10, 1909.

BEETROOT juice, obtained by the processes current in sugar manufacture, is evaporated to a density of 76° Brix. If the beet juice be combined with the juice of potatoes or with a proportion of molasses, the yeast nutrient thus introduced, lowers the coefficient of purity to such an extent that the syrup shows no tendency to crystallise. This syrup, suitably diluted with water, then serves as a medium for the manufacture of pressed yeast. It is stated that yeast thus cultivated in sucrose media is superior to that obtained from maltose worts.—J. F. B.

Alcohols and other volatile liquids; Distilling —. A. G. Waterhouse, Good Ground, N.Y. U.S. Pat. 939,361, Nov. 9, 1909.

THE principle of the process consists in heating the liquid to a degree sufficient to cause the vaporisation of substantially all the alcohol contained in it, maintaining the temperature approximately at this point, and controlling the introduction of fresh liquid by the temperature of that under distillation. The cold fresh liquid is caused to absorb the heat from the outgoing hot spent liquid to such a point that the alcohol in the first is partly vaporised and the vapours so produced control the inflow of alcoholic liquid and the discharge of exhausted liquid.—J. F. B.

Recovery of tartrates. Fr. Pat. 402,999. See XX.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

PATENTS.

Cuttle food; Process of manufacturing a — from sulphite-cellulose waste liquors. A. Stutzer. Fr. Pat. 402,871, May 10, 1909.

THE main object of the process is to remove sulphurous acid from the liquors and for this purpose the latter are treated with formaldehyde, about 0.5 kilo. of 40 percent. formaldehyde solution being added to every 100 litres of the sulphite liquor. The mixture is then neutralised by the addition of calcium carbonate, and concentrated. The excess of formaldehyde added is partly carried away by the carbon dioxide evolved during the neutralisation, and the remainder may be eliminated by the addition of small quantities of ammonia or of substances, such as molasses, containing ammonium salts.—W. P. S.

Butter-aroma [in cream]; Process for the artificial production of — J. Müller. Fr. Pat. 403,388, May 27, 1909.

SEE Eng. Pat. 18,201 of 1909; this J., 1909, 1268.—W. P. S.

(B.)—SANITATION; WATER PURIFICATION.

Nitrates; Decomposition of — by micro-organisms. H. Franzen and E. Löhmann. Z. physiol. Chem., 1909, 63, 52—102.

THE authors have investigated the action of various bacteria on nitrates, and have determined the extent to which the nitrate is attacked in cases where such action has taken place. The experiments were made on potassium nitrate dissolved in peptone broth and to which cultures of the organisms were added. At the end of the experiments both the nitrate and nitrite present in the solutions were determined by the method described by Busch (this J., 1906, 499). From the results obtained the bacteria may be classified as follows:—(1). Those which decompose nitrate with the production of nitrite: these include *B. Plymouthensis*, *B. prodigiosus*, *B. Kiliensis*, *Proteus vulgaris*, *B. coli communis*, and *B. typhi murium*. (2). Those which attack the nitrate but without the formation of nitrite; *B. pyocyaneus* belongs to this class. (3). Such bacteria as *B. fluorescens liquefaciens* which does not reduce nitrates. The bacteria which reduced the nitrate did so to the extent of from about 60 to 100 per cent. of the quantity of nitrate present: *B. typhi murium* appeared to be the most active, reducing the whole of the nitrate in 2 days. In the case of *B. pyocyaneus*, the reduction did not result in the evolution of nitrogen. Other observers have stated that *B. fluorescens liquefaciens* readily reduces nitrates, but the authors are unable to confirm this; they used two different cultures of the organism in their experiments and in neither case could any action on the nitrate be observed. It has also been stated that *B. Kiliense* forms only small quantities of nitrite, but it was found that this organism produced in the same length of time larger amounts of nitrite than did *B. Plymouthensis*, *B. prodigiosus*, and *Proteus vulgaris*.—W. P. S.

PATENTS.

Waters; Process for the purification of calcareous —. J. P. Lajoie. Fr. Pat. 403,172, Sept. 17, 1908.

A PORTION of the water flowing along a main, such, for instance, as the supply pipe of a boiler, is caused to pass through a side tube and vessel containing crystals of potassium acid oxalate. A small quantity of the latter is dissolved and the water is then conducted back to the main. By regulating the flow of water through the side tube, the quantity of oxalate necessary to precipitate the calcium salts in the water is dissolved.—W. P. S.

Testing air or gas by means of colour changes of one or several reagents carried on threads or the like. M. Arndt. Ger. Pat. 211,893, Jan. 10, 1908.

TWO or more threads, or strands, or ribbons, each serving as a vehicle for a reagent, are brought together (by crossing, by winding together, etc.) in such a manner that the reagents come into intimate contact. For example, the proportion of carbon dioxide in the air of a room can, it is stated, be determined approximately by making a thread moistened with lime water cross uniformly and continuously a thread impregnated with an alcoholic solution of phenolphthalein, and observing the depth of the coloration produced.—A. S.

Water; Process for purifying —. C. W. Schultze. Buffalo, U.S.A. Eng. Pat. 5676, March 9, 1909.

SEE U.S. Pat. 914,887 of 1909; this J., 1909, 438.—T. F. B.

Water; Apparatus for separating foreign substances from —. V. Antoine, Lambertmont, Belgium. Eng. Pat. 8593, April 8, 1909. Addition to Eng. Pat. 19,288 of 1907, dated Aug. 28, 1906.

SEE Addition of April 2, 1909, to Fr. Pat. 374,040 of 1907; this J., 1909, 1220.—T. F. B.

Sewage and other waste solid and liquid matters; Apparatus for rendering soluble and nitrifying —. C. Didelon and A. Braut, Paris. Eng. Pat. 11,471, May 14, 1909. Under Int. Conv., June 29, 1908.

SEE Fr. Pat. 409,981 of 1908; this J., 1909, 1101.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

PATENTS.

Sizing and coating machines chiefly for use in sizing and coating paper. S. Milne, Edinburgh. Eng. Pat. 16,327, Aug. 1, 1908.

A SINGLE large cylinder or a series of smaller cylinders is arranged to receive the paper as it leaves the coating cylinder and rollers. The paper is guided and supported, before passing on to the cylinder, by a series of devices arranged in a curved path, and by means of a series of rolls and curved bars it is extended to its greatest width. By this stretching during the subsequent drying a greater width of paper may be treated without risk of damage than was previously practicable. Around the outside of the large cylinder and covering about one-half of it, there is a concentric envelope or hood confining a current of hot air moving in an opposite direction to the paper. The cylinder itself is heated by steam if necessary, and any further heating is supplied by a supplementary series of rollers which receive the paper after it passes off the cylinder. But the distance between the coating brushes and the cylinder, and the size of the cylinder itself, are arranged so that the paper comes off the cylinder dry. This drying machine is particularly suitable for the treatment of paper sized with starch.—S. B. H.

Paper pulp; Preparation of —. M. Nerson, sen. Fr. Pat. 403,023, Sept. 14, 1908.

THE process, especially applicable to the treatment of straw with milk of lime, consists in digesting the material in the ordinary form of rotary boiler, at a suitable temperature, under a pressure obtained by means of compressed air. In this way the pressure is obtained independently of the temperature, and the latter may be reduced to such a point that the fibre is not injured by the process. Besides maintaining the pressure necessary for the proper penetration of the material, the compressed air also effects an energetic agitation of the mass.—J. F. B.

Paper pulp from all kinds of plants; Manufacture of —. A. W. Audibert. Fr. Pat. 403,151, May 19, 1909.

ACCORDING to this specification, all kinds of plants, particularly the parasitic plants of the forests of the Landes, are converted into paper pulp by digestion with a filtered extract of ashes of any kind, but preferably

those resulting from the combustion of resinous materials. The ash solution is first boiled with rosin and the liquid thus obtained is used for the digestion of the vegetable materials by boiling in a closed vessel for 12–15 hours.

—J. F. B.

Sulphite-cellulose liquors; Process for the purification of —. A. Kumpfmüller. Ger. Pat. 216,284. Sept. 14, 1907.

THE waste liquors from the manufacture of sulphite-cellulose are freed from sulphurous acid and calcium sulphite by evaporation in a vacuum apparatus, and are then treated with a solution of alum. The precipitate produced is separated. The solution thus obtained is suitable for use as a filling material in tanning and leather-dyeing.—A. S.

New solvent for nitrocellulose. Fr. Pat. 402,950. See V.

Lacquers containing nitrocellulose. Ger. Pat. 216,307. See XIII B.

Cattle food from sulphite-cellulose waste liquors. Fr. Pat. 402,871. See XVIII A.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, & EXTRACTS.

Harmaline, a substitute for quinine. J. A. Gunn. Roy. Soc. Edin., Nov. 22, 1909. Chem. and Drug., 1909, 75, 808.

HARMALINE is the more important of two alkaloids found in the seeds of *Peganum harmala*, a plant which grows wild over a large area of Southern Europe, Egypt, and Asia. The seeds were used medicinally by the ancient Greeks, as they are to this day in India. The author finds that harmaline belongs to the group of protoplasmic poisons of which the best known alkaloid is quinine, and the actions of harmaline and quinine are practically the same, so that it is possible that harmaline may come to be used as a substitute for quinine.

p-Hydroxyphenylethylamine; Isolation and synthesis of —, an active principle of ergot, soluble in water. G. Barger. Chem. Soc. Trans., 1909, 95, 1123–1128.

IN addition to ergotoxine (see this J., 1907, 483), the author and Dale (Biochem. Zeits., 1907, 2, 286) have suggested that ergot contains another active principle which is soluble in water. *p*-Hydroxyphenylethylamine has now been detected in the aqueous extract of ergot, and the presence of this base satisfactorily accounts for such of the physiological activity of pharmaceutical preparations of ergot as is not due to the small quantities of ergotoxine present. The base was isolated by adding sodium carbonate to the concentrated aqueous extract of ergot, and then extracting with amyl alcohol. The crude base was separated from the large quantities of inactive substances accompanying it, by a complicated method of purification, including treatment with mercuric chloride in alcoholic solution, and was finally isolated by utilising its slight solubility in ether. It was purified by means of its dibenzoyl-derivative.

As only very small quantities of the base could be isolated, it was prepared synthetically by the reduction of *p*-hydroxyphenylacetonitrile with sodium in alcoholic solution. The base is best purified by distillation (b. pt. 161°–163° C. at 2 mm.; 175°–181° C. at 8 mm.). When crystallised from alcohol it forms hexagonal leaflets melting at 161° C. It is soluble in about 10 parts of boiling alcohol, somewhat less soluble in boiling water, much less in boiling xylene, and hardly soluble at all in cold xylene. Xylene is the most suitable solvent for purifying the base by recrystallisation. By the methylation of *p*-hydroxyphenylethylamine with methyl iodide, a quarternary iodide is obtained, which is identical with the methiodide of hordenine, the alkaloid present in malt culms (see Léger, this J., 1906, 133).—A. S.

p-Hydroxyphenylethylamine; Further syntheses of —. G. Barger and G. S. Walpole. Chem. Soc. Trans., 1909, 95, 1720–1724.

p-HYDROXYPHENYLETHYLAMINE, a physiologically active principle of ergot, has been prepared previously by the reduction of *p*-hydroxyphenylacetonitrile (see preceding abstract). Two new methods of preparation have now been devised. (1) Benzoyl-*p*-nitrophenylethylamine, prepared by nitrating benzoylphenylethylamine with fuming nitric acid below 5° C., was reduced with tin and hydrochloric acid, and the amino-compound was converted into benzoyl-*p*-hydroxyphenylethylamine by treating its boiling solution in dilute sulphuric acid with sodium nitrite. This compound, when hydrolysed by heating with 20 per cent. hydrochloric acid at 140° C., yielded *p*-hydroxyphenylethylamine. (2) Anisaldehyde was condensed with ethyl acetate by means of finely-divided sodium (compare Perkin and Robinson, this J., 1907, 864), and the resulting *p*-methoxyphenylpropionic acid was converted first into the chloride and then into the amide. The latter, when heated with bromine and sodium hydroxide (Hofmann's reaction) yielded *p*-methoxyphenylethylamine, from which the methyl group was removed by heating with hydrobromic acid.—A. S.

Physostigmine; Fluorescent substance derived from —. P. Gaubert. Comptes rend., 1909, 149, 852–853.

AN aqueous solution of physostigmine is allowed to stand for some months till its colour has become dark blue. On adding hydrated phthalic acid, the liquid at once exhibits a strong blood-red fluorescence, much stronger than that shown by any known fluorescent substance. The crystals of this new substance are dark blue, and silk, cotton, alcohol, ether, crystals of meconic acid, etc., coloured by it are also blue, but show no fluorescence. The aqueous solution of the crystals, however, even when diluted so as to be almost colourless by transmitted light, shows by reflected light a colour comparable with that of the finest rubies.—J. T. D.

Coumarin; Influence of anæsthetics and of frost on plants containing —. E. Heckel. Comptes rend., 1909, 149, 829–831.

GUIGNARD and Mirande have recently shown (Comptes rend., 1909, 149, 91 and 140) that cold and anæsthetics (ether and chloroform) determine the decomposition of glucosides in plants which contain them, and that this effect is produced by plasmolysis, with an extrusion of water from the cytoplasm and an exosmosis of this water charged with various substances which react on one another outside of the cells. The author has examined the effect of the same agencies on plants yielding coumarin, but which give no odour of coumarin until they are dried—*Anthoranthum odoratum*, *Liatris odoratissima*, *Angraecum fragrans*, in which the coumarin is free, and *Melilotus officinalis*, in which it is combined. In all cases, at once or after a very short time of exposure, a dew or hoar frost forms on the surface of the leaves (with or without blackening, according to the plant and the odour of coumarin is strongly apparent; and in all cases the phenomena are accompanied by plasmolysis. Similar experiments with certain crucifers showed an equally rapid formation of mustard oil.—J. T. D.

Ajuga reptans. U. Ponti. Gaz. chim. ital., 1909, 39, II., 349–353.

Ajuga reptans or "fever-herb," a plant of the order Labiate, grows abundantly in Sardinia, and is stated to be a remedy for malarial fever. By steam distillation of the dry herb, a very small quantity of a greenish oil was obtained, which had a characteristic, aromatic, pungent odour. No indication of the existence of alkaloids in the herb could be obtained by the usual tests. By boiling the finely divided herb with milk of lime and filtering, an orange-red solution was obtained, from which after acidifying with hydrochloric acid, diluting, and saturating with ammonium chloride, there was separated by extraction with ether, a substance which, after purification, formed fine long colourless needles, melting at

170° C.; the yield of the crude substance was about 1 part per 1000 of dry herb. This substance, on examination, proved to be identical with ferulic acid, $C_6H_5(OH)(OCH_3).CH:CH.CO_2H$ (see Bamberger, this J., 1892, 365; Power and Tutin, this J., 1907, 635). Ferulic acid is easily soluble in alcohol and ethyl acetate, and soluble with difficulty in benzene and petroleum spirit.
—A. S.

Lemon oil; Occurrence of pinene in —. E. M. Chace. U.S. Dept. Agric., Bureau of Chem., Circular No. 46, Oct. 30, 1909.

DURING May, 1907, certain lots of lemon oil imported from Sicily were found at New York to possess abnormal physical constants and to contain substantial amounts of pinene. The Board of Food and Drug Inspection regarded them as adulterated in consequence. In order to settle the dispute which arose over the oils in question, the author was sent to Sicily to collect authentic samples of the oil and examine their physical constants and to determine whether pinene was normally present or not in such oils. Samples of the oil were taken from the bowls of the workmen in factories situated in different parts of Sicily, and compared with samples drawn from the manufacturers' stock and with samples of the oils regarded as adulterated in 1907 owing to the presence of pinene. Comparison was also made with oils imported in 1907, which were found to be free from pinene. The oils were examined for sp. gr. at 15.5° C., optical rotation at 20° C., and refractive index at the same temperature. 50 c.c. of the oil were then distilled as described in Schimmel and Co.'s Report for 1898, p. 41, and the optical rotation of the distillate determined at 20° C. The distillate was mixed with an equal volume of glacial acetic acid and placed in a freezing mixture. 10 c.c. of ethyl nitrite were then added, followed by 2 c.c. of a mixture of hydrochloric acid and water (2:1). The crystals were filtered off after 15 minutes, dissolved in chloroform and re-precipitated with methyl alcohol. The crystals were mounted in olive oil and examined under a microscope with a magnification of 100. Pinene nitrosochloride is easily detected, as the crystals are broad with irregular pyramidal ends, whilst limonene nitrosochloride crystallises in needles (this J., 1908, 1174). The citral was determined by the fuchsine sulphite colorimetric method. No trace of pinene was found in 15 samples of lemon oil made under the author's supervision; nor in 130 samples collected from the workmen's bowls. The physical constants of these oils were, on the whole, normal. 33 samples obtained from dealers in Sicily were, with one exception, free from pinene. This one specimen showed the presence of pinene, but was normal in all other respects. The author concludes that the presence of pinene in lemon oil, if shown by the above test, is proof of adulteration, even if the physical constants are normal or otherwise.—F. SIDDON.

Lemon oil; The pinene question. E. J. Parry. Chem. and Drugg., 1909, 75, 875—876.

THE author criticises the report published by the U.S. Dept. Agric. on the presence of pinene in lemon oil (see preceding abstract). In 1907 the Department refused admission to the United States of about 100,000 lb. of lemon oil, which was subsequently accepted. Outside the U.S.A. the general opinion seems to have been that the oil in question was pure. Schimmel and Co. in their "Report" for 1897 regarded lemon oil containing pinene as adulterated. Burgess and Child in 1902 stated that pinene was a normal constituent of pure lemon oil. In October, 1908, Schimmel and Co. published in their "Report" the results of an examination of 36 authentic samples of Sicilian lemon oil, and pinene was found to be present in each. The sp. gr. and optical rotation of lemon oil vary with the circumstances of the pressing of the oil. After examining Chace's figures for the optical rotation of the oils alleged to be adulterated, and of the authentic samples, the author considers that there cannot have been more than 3 per cent. of turpentine present. Wallach has shown (Annalen, 252, 106; 270, 174) that

limonene yields an α - and a β -nitrosochloride, which differ in their crystalline form. The author does not consider the microscopic test for pinene to be sufficient evidence of adulteration.—F. SIDDON.

Iodine and acetone; Dynamics of the reaction between —. H. M. Dawson and M. S. Leslie. Chem. Soc. Trans., 1909, 95, 1860—1870.

ACETONE solutions of iodine, alone or in presence of iodide, become strongly acid on keeping, and the iodine concentration is considerably reduced. The reaction is reversible, since, for a solution of a given concentration, a definite end-point appears to be attained. In presence of moderate concentrations of hydrogen ions the reaction proceeds with measurable velocity at the ordinary temperature, but in absence of added acid, the reaction is very slow at first, the velocity increasing as hydriodic acid is gradually produced. In solutions of acetone in carbon tetrachloride, methyl alcohol, methyl acetate, benzene, and nitrobenzene, and in the case of anhydrous acetone, the action of the iodine is much less complete than in aqueous solution, but proceeds much more rapidly. When 50 c.c. of each of the solvents mentioned were mixed with 5 c.c. of acetone and 0.5 gm. of iodine, the amount of unchanged iodine left when the reaction was complete, was as follows for the different solvents: carbon tetrachloride, 72; benzene, 72; methyl acetate, 62; nitrobenzene, 57; and methyl alcohol, 47 per cent. Under similar conditions the proportion of unchanged iodine in an aqueous acetone solution was only 0.35 per cent. In the case of aqueous solutions the results can be best explained by accepting Lapworth's view (Chem. Soc. Trans., 1904, 85, 30) that the reaction between halogens and acetone takes place in two stages, viz., the transformation of the ketonic form of acetone into the enolic form, which is accelerated by acids; and the interaction of iodine and enolic acetone, the velocity with which this takes place being relatively so great that this second stage is practically without influence on the rate at which the iodine disappears.—A. S.

Determining hypophosphoric, phosphorous, and hypophosphorous acids in presence of each other and of phosphoric acid. Rosenheim and Pinsker. See VII.

PATENTS.

Compounds [of eugenol-albumin and iso-eugenol-albumin] for internal use. H. Belart, Huddersfield, and Digit Disinfectant Co., Ltd., London. Eng. Pat. 26,075, Dec. 3, 1908. Addition to Eng. Pat. 9246 of 1908, dated June 15, 1907.

THE eugenol-albumin and isoeugenol-albumin compounds mentioned in the chief patent (this J., 1908, 998) when treated with salts of iron, mercury, arsenic and the like, form metallic compounds suitable for use in medicine.

—J. A.

Fluorine-albumin compound; Process for preparation of a —. F. A. V. Klopfer. Ger. Pat. 216,216, March 7, 1908.

THE protein of wheat, freed from nuclein and purine compounds, is treated with aqueous hydrofluoric acid at the ordinary temperature. The product, which is insoluble in water, is stated to be of therapeutic value, especially in the treatment of diabetes.—A. S.

Benzoates; Process of making —. E. O. Barstow, Assignor to The Dow Chemical Co., Midland, Mich. U.S. Pats. 939,584, 939,940, and 939,941, Nov. 9, 1909.

(1) HOMOLOGUES of benzene are oxidised to benzoic acid by treatment with bleaching powder in presence of water and sufficient lime to neutralise the acid formed by the reaction. (2) Sodium hypochlorite and sodium hydroxide may also be utilised for the purpose, as may other alkali hypochlorites and hydroxides. (3) "Partially oxidised oxygen-containing products of members of the benzene series" are oxidised to benzoates by means of bleaching powder and lime as in (1).—T. F. B.

Tartrates; Process for the recovery of — from materials containing the same. J. A. Jude. Fr. Pat. 402,999, May 13, 1909.

THE object of the invention is the recovery of the whole of the tartaric acid present in musts, wines, mares, lees, tatars, vinasses, etc. in the form of potassium bitartrate. The process consists in first acting on the material with hydrochloric acid, sulphuric acid, chlorides, sulphates, or other suitable reagent, or any mixture of these, employed simultaneously or successively, with the object of bringing about solution, and, after the separation of insoluble matter and any precipitate produced, adding a potassium salt (such as the chloride) and a carbonate (such as that of sodium), simultaneously or in succession, so as to obtain a precipitate very rich in potassium bitartrate. The process does not in any way interfere with the recovery of alcohol which is preferably removed afterwards. Claim is also made for the use of a potassium salt and any carbonate, in the place of potassium carbonate, in manufacturing processes generally.—F. SOUX.

Organic dithio-acids (carbothioacids); Process for preparing —. I. Bloch and F. Höhn. Ger. Pat. 214,888, Oct. 27, 1908.

ORGANIC dithio-acids, $R.CSSH$, such as dithiosalicylic acid, are obtained by the action of hydrogen persulphide on aldehydes in presence of condensing agents, and treating the products with alkalis. This process is a general one, whereas the sole method hitherto known (action of carbon bisulphide on organo-magnesium compounds) had only a limited application.—T. F. B.

p-Nitrobenzyl alcohol; Process for preparing —. O. Dieffenbach. Ger. Pat. 214,949, March 28, 1907.

p-NITROTOLUENE is oxidised to *p*-nitrobenzyl alcohol by treatment with lead peroxide and concentrated sulphuric acid; artificial cooling must be resorted to, if necessary, to prevent the oxidation proceeding too far.—T. F. B.

Compounds containing sulphur (thiozonides); Process for preparing —. P. Koch. Ger. Pat. 214,950, March 19, 1908.

ALCOHOLS or esters of the terpene series, or essential oils containing considerable proportions of these substances, such as pine-needle oil or oil of lavender, are converted into sulphur derivatives (thiozonides) by heating with sulphur, either alone, or in closed vessels in presence of alcohol. The compounds formed contain three atoms of sulphur to each double-linkage of the terpene molecule, except with linalool esters, in which case the double-linkage adjacent to the alcohol group is inactive. The products are soluble in ethyl acetate and in essential oils, and also in alcoholic solutions of sodium thiozionate, Na_2S_4 . They are suitable for use in pharmacy.—T. F. B.

Arsinosalicylic acid ($OH:COOH:AsO_3H_2=1:2:4$); Process for preparing —. W. Adler. Ger. Pat. 215,251, Nov. 6, 1907.

o-TOLUIDINE is fused with arsenious acid, the product is acetylated, and the methyl group of the resulting 1-amino-2-methylbenzoic-4-arsinic acid is oxidised to a carboxylic acid group by means of alkaline permanganate solution. Arsinoanthranilic acid, obtained by saponifying the resulting substance, is diazotised and the diazo solution boiled, when arsinosalicylic acid crystallises out on cooling. It is less toxic than sodium *p*-aminophenylarsinate, and can be utilised in place of the latter in pharmacy.—T. F. B.

Mercuric iodide-iodofatty acid compounds; Process for preparing —. J. D. Riedel A.-G. Ger. Pat. 215,664, May 1, 1908.

COMPOUNDS of mercuric iodide with iodo-derivatives of higher fatty acids (see Ger. Pat. 202,790; this J., 1908, 1223) are obtained by the action of mercuric oxide and hypo-iodous acid on elaeomargaric acid, or on saponified

wood oils containing this acid, or on the fatty acids from wood oils. The products are dark and unctuous, insoluble in water, and soluble in alcohol, benzene, and acetone; they are stated to be of therapeutic value.—T. F. B.

Chlorobenzyl alcohols; Process for separating o- and p- —. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 215,704, May 21, 1908. Addition to Ger. Pat. 207,157, June 26, 1907. (See Fr. Pat. 389,750 of 1908; this J., 1908, 1041).

o-CHLOROBENZYL alcohol has a boiling point of $230^\circ C$, and the *p*-compound about 5° higher; the separation of mixtures of the two isomerides can therefore be effected by careful fractionation, preferably *in vacuo*, and subsequent crystallisations. It is preferable to cool the melted mixture of alcohols to about $40^\circ C$. (the melting point of a mixture of equal parts of the two isomerides), and then to fractionate the portion remaining liquid.—T. F. B.

Thiosinamine solutions; Process for preparing concentrated —. E. Merck. Ger. Pat. 215,789, Feb. 27, 1909. Addition to Ger. Pat. 163,804, Dec. 13, 1904.

CONCENTRATED solutions of thiosinamine may be rendered stable by adding substances which have both basic and acidic properties, e.g., alkali biphosphates, alkali benzoates, alkali cinnamates, glycecol, or urethane.—T. F. B.

Aldehyde-bisulphites; Process for preparing nitrogen derivatives of —. Chem. Fabr. von Heyden. Ger. Pats. 216,072 and 216,073, Sept. 15 and Oct. 1, 1908.

THE salts of iminodimethylsulphurous acid, $NH(CH_2.O.SO_2H)_2$, are obtained by the action of one mol. of ammonia on two mols. of formaldehyde-bisulphite, or by the action of one mol. of ammonia on less than two mols. of formaldehyde-bisulphite and distilling the resulting product to decompose the aminomethylsulphite which is also formed. Primary amines may be used in place of ammonia, and other aldehyde-bisulphites may be employed. When one mol. of ammonia is heated with three mols. of an aldehyde and three mols. of a bisulphite, salts of nitrosoaldehyde-sulphurous acids, e.g., $N(CH_2.O.SO_2H)_3$, are produced. The above processes are suitable for use with aldehydes, the bisulphite compounds of which are not easily decomposed by ammonia in the cold (e.g., formaldehyde and acetaldehyde).—T. F. B.

Formaldehyde-sulphoxylic acid; Process for preparing nitrogen derivatives of —. Chem. Fabr. von Heyden. Ger. Pats. 216,074 and 216,121, Sept. 15 and Oct. 7, 1908.

WHEN the salts of iminodimethylsulphurous acid, obtained as described in Ger. Pat. 216,072 (preceding), are reduced by means of finely-divided metals, with or without acids, corresponding nitrogen derivatives of formaldehyde-sulphoxylic acid are obtained. The calcium salt reduces acidified indigo-carmin solution in the cold. The salts of nitrilomethylene-sulphurous acid (Ger. Pat. 216,073, preceding) can also be similarly reduced to nitrilomethylene-sulphoxylates, e.g., $N(CH_2.O.SONa)_3$; these salts also reduce indigo-carmin solutions in the cold. Mixed reducing agents can be obtained by reducing mixtures of iminodimethylsulphites and nitrilomethylene-sulphoxylates.—T. F. B.

Antimony-calcium lactate from calcium lactate; Process for preparing —. Chem. Werke Schuster und Wilhelmy A.-G. Ger. Pat. 216,158, June 2, 1906.

ANTIMONIOUS fluoride solutions are treated in the cold with $2\frac{1}{2}$ mols. of calcium lactate dissolved to a neutral solution in water saturated with calcium sulphate; the solutions are then filtered and evaporated to obtain the double lactate. The product is readily soluble in water without addition of lactic acid, and has the formula, $Sb(C_3H_5O_3)_3.Ca(C_3H_5O_3)_7$.—T. F. B.

Dibromophenylglycine-o-carboxylic acid: Process for preparing —. Act.-Ges. I. Anilinfabr. Ger. Pat. 216,266, March 20, 1908.

By brominating phenylglycine-o-carboxylic acid in mineral acid solution (e.g., in 50 per cent. sulphuric acid), a dibromo-derivative is obtained, which contains both the bromine atoms in the benzene nucleus.—T. F. B.

Alkali salts of mercury compounds of hydroxybenzoic-sulphonic acids and their homologues: Process for preparing — soluble in water. Chem. Fabr. von Heyden A.-G. Ger. Pat. 216,267, April 26, 1908.

MERCURY derivatives of the sulphonic acids of hydroxybenzoic acids or their homologues, prepared, for example, by heating the acid with water and mercuric oxide, are sparingly soluble or insoluble in water. They can be converted into soluble compounds by treatment with alkalis; no precipitation of mercury takes place. The new products are of therapeutic value, and are especially adapted for intramuscular injection.—T. F. B.

Tuberculosis: Process for the preparation of a preventive of, and remedy for —. Rosenbach. Ger. Pat. 216,310, March 18, 1908.

Trichophyton fungi, especially *T. holocricum album*, are cultivated on an active culture of living virulent tubercle bacilli on a suitable medium, and after 8–12 days, the fungus culture is separated in the usual manner, ground, and extracted with glycerin-phenol solution. The solution is freed from bacteria by filtration and concentrated *in vacuo*.—A. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Colour photography: Manufacture of a screen for —. C. Späth, Steglitz, Germany. Eng. Pat. 3601, Feb. 13, 1909.

A LAYER of gelatin is sensitised with bichromate and exposed to light under a black and white screen; it is then dyed in a solution containing two dyestuffs, one of which dyes only unaltered gelatin and the other only altered gelatin; for example, a solution of Ponceau BO and Brilliant Azurine may be used, in which case the gelatin which has been affected by light only absorbs the former, whilst the unaltered gelatin only absorbs the blue. The gelatin sheet is now washed and again sensitised and exposed under the screen, which is this time placed at an angle of about 45° to its former position; the gelatin is washed for a short time and immersed in a solution of a yellow dyestuff (e.g., Flavazine) which will only dye the parts of the gelatin unaffected by light. There is thus obtained a screen coloured red, blue, and green. The process may be modified by washing out a portion of one of the first dyestuffs after the second exposure, and then dyeing the colourless areas.—T. F. B.

Cinematograph films and waste portions of the same: Process for recovering the material of the support of — and the metallic silver of the pictures. H. Danzer, Paris. Eng. Pat. 14,407, June 19, 1909.

OLD or broken cinematographic films are treated with preparations containing soluble or living ferments, to

dissolve away the gelatin; the silver compound is then washed off the residue, which is again worked up. Such ferments as pepsin, trypsin, or papain may be used, and also various liquefying bacteria.—T. F. B.

Photographic plates for use with Röntgen rays. H. Baer. Ger. Pat. 215,649, June 18, 1907.

PHOTOGRAPHIC plates are rendered much more sensitive to Röntgen rays if the emulsion is incorporated with lead glass, or some other material which readily absorbs the rays; lead glass may also be used as support for the emulsion with the same result.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Perchloric acid esters. K. A. Hofmann, A. Zedtwitz, and H. Wagner. Ber., 1909, 42, 4390–4394.

THE mono-perchloric ester of monochlorhydrin, $\text{ClO}_4\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{Cl}$, was prepared by dissolving 10 c.c. of epichlorhydrin in 40 c.c. of ether, and adding gradually, at 0°–5° C., 16 grms. of perchloric acid of sp. gr. 1.72 (containing 62–63.2 per cent. of perchloric acid). After 1–2 hours the reaction-product was shaken with 50 c.c. of water, and the ethereal solution separated, dried with anhydrous sodium carbonate, and evaporated *in vacuo*. The ester was thus obtained as a heavy colourless oil; yield, 11 grms. It explodes violently on heating, and more readily than nitroglycerin on percussion; with gun-cotton it yields gelatins which burn more vigorously than those prepared with nitroglycerin. It is, however, useless for technical purposes owing to the ease with which it is decomposed in contact with water. The mono-perchloric ester of glycol, $\text{ClO}_4\text{C}_2\text{H}_4\text{O.C}_2\text{H}_4(\text{OH})$, prepared in a similar manner from ethereal solutions of ethylene oxide and perchloric acid, has similar properties to the chlorhydrin ester, but is somewhat more resistant to water.—A. S.

Cartridge manufacture. Statutory Rules and Orders, 1909, No. 1337. [T.R.]

An order dated Nov. 15, 1907, applies the provisions of Sect. 116 of the Factory and Workshop Act, 1901, with modifications, to factories in which the manufacture of cartridges (and also of tobacco, chocolates, and sweet-meats) is carried on. It relates to the furnishing of workers with particulars as to rates of wages and work to be done, and also to the penalties which may be imposed in case of the disclosure of a trade secret.

PATENTS.

Explosives. E. H. Harris, London. Eng. Pat. 28,012, Dec. 23, 1908.

THE explosive is prepared by mixing together pulverised potassium perchlorate and carbon, which are then incorporated with a hydrocarbon, such as naphthalene or benzene, or both, and with nitro-derivatives of naphthalene and benzene in granular form. Five per cent. of paraffin oil and not more than 1 per cent. of castor oil are also added, to act as a lubricant and to facilitate the making of cartridges, the method of doing this being also claimed. The following mixtures are given as illustrations:—

	Potassium perchlorate.	Carbon.	Naphthalene.	Nitronaphthalene.	Nitrobenzene.
(1.) Deep mines, bad ventilation, hard	84.5	4.3	4.0	7.2	0.0
(2.) " " " soft	83.4	1.3	4.0	3.6	3.0
(3.) Shallow mines, medium	83.4	5.0	4.0	5.4	2.2
(4.) Surface, hard	82.3	4.0	6.0	7.2	0.0
(5.) Surface, soft	78.0	10.0	5.0	3.6	4.4

The mixture in each case should contain sufficient oxygen to oxidise the carbon to carbon monoxide or dioxide as well as to form steam with the hydrogen present.

—C. J. G.

Explosives; Plastic ammoniacal saltpetre — Vereinigte Köln-Rottweiler Pulverfabr. A.-G., Berlin, Germany. Eng. Pat. 3937, Feb. 17, 1909.

AMMONIUM nitrate explosives hitherto obtainable commercially suffered from the necessity of using larger bore-holes for them as compared with nitroglycerin explosives. To increase their density, a solution of "nitro-semi-cellulose" (see Eng. Pat. 5126 of 1904; this J., 1904, 560) in nitrobenzene, nitrotoluene, or nitroxylenes is prepared, and 6 to 15 per cent. of this is mixed with 78–85 per cent. of ammonium nitrate, with or without the addition of potassium nitrate. This mixture may be used in place of ammonium nitrate in the preparation of explosives of known kinds. Aniline metallic salt compounds may also be added. —C. J. G.

Explosives; Mixing machine for — H. Talley, Joplin, Mo. U.S. Pat. 940,216, Nov. 16, 1909.

THE machine is of the ordinary type, for the manufacture of high explosives, with the exception that the mixing pan, in which the stirrer-blades work, can be held in position, or can be either lowered or raised, by hydraulic pressure. —G. W. McD.

Explosive. C. U. Buck, Wellshoro, Pa., Assignor to Buck Explosive Co., Coudersport, Pa. U.S. Pat. 940,580, Nov. 16, 1909.

TRINITROPHENOL and dinitrophenol are melted together, soluble gun-cotton is then added, and the mass is heated to 350° F., and incorporated with a mixture of melted paraffin and barium nitrate and with carbon.

—G. W. McD.

New solvent for nitrocellulose. Fr. Pat. 402,950. See V.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Melting points; Apparatus for the determination of — and of the solubility of small quantities of substances. H. Stoltzenberg. Ber., 1909, 42, 4322–4324.

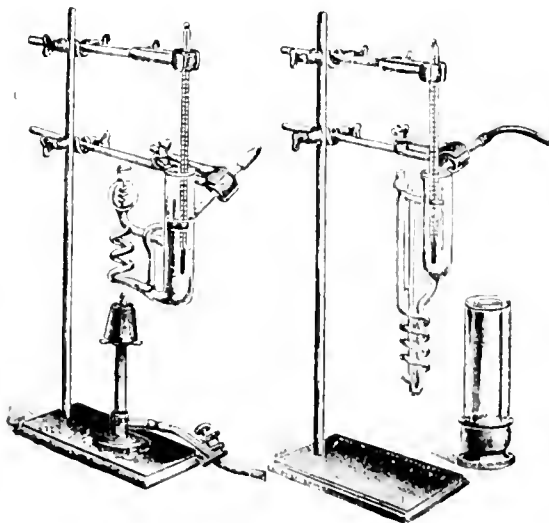


FIG. 1.

FIG. 2.

THE apparatus, which is, in principle, a small "Mammoth-pump," is shown in the accompanying diagram (see Fig. 1). The thermometer and melting-point tube are placed in the wide observation tube, which contains the heating liquid, and the latter is kept in circulation by means of bubbles of an inert gas (e.g., carbon dioxide), passed in at the bottom of the heating coil through the narrow tube. The bulb at the top of the heating coil is provided with a bubble-pricker. High temperatures can be quickly reached, and then on removing the burner from below the heating coil, the heating liquid can be rapidly cooled again. For solubility determinations, the substance is placed on a piece of wire gauze or a glass-wool plug in the observation tube. For determining solubilities at low temperatures, the apparatus shown in Fig. 2 is used, the spiral being placed in a refrigerating mixture. —A. S.

PATENT.

Testing fluids; Apparatus for — H. B. Bishop, Assignor to General Chemical Co., New York. U.S. Pat. 940,850, Nov. 23, 1909.

SEE Fr. Pat. 394,107 of 1908; this J., 1909, 222. —T. F. B.

INORGANIC—QUANTITATIVE.

Iodine; Simple method for the determination of — E. Winterstein and E. Herzfeld. Z. physiol. Chem., 1909, 63, 49–51.

THE method proposed consists in acidifying the solution containing the iodine or iodide with phosphoric acid, adding hydrogen peroxide, and heating the solution while a current of air is drawn through it. The air is then passed through a condenser and through two wash-bottles containing a solution of potassium iodide. The iodine carried over with the air is absorbed in the potassium iodide and is subsequently titrated in the usual way. —W. P. S.

Determining hypophosphoric, phosphorous, and hypophosphorous acids in presence of each other and of phosphoric acid. Rosenheim and Pinsker. See VII.

PATENT.

Testing air or gas by means of colour changes of reagents carried on threads. Ger. Pat. 241,893. See XVIII B.

ORGANIC—QUANTITATIVE.

Influence of protein on the determination of rubber as tetrabromide. Spence. See XIII C.

Hard vulcanised rubber. [Determination of sulphur of vulcanisation.] Hübener. See XIII C.

Trade Report.

Netherlands Customs Tariff; Proposed increase of — Board of Trade J., Dec. 2, 1909.

A BILL has been presented to the Second Chamber of the Dutch States General, in which it is provided that from the 1st January, 1910, the Netherlands Customs Tariff is, with certain exceptions, to be increased by 30 per cent.

The exceptions include the following:—

The import duties levied on sugars in virtue of the Sugar Law of the 29th January, 1897, and of the 24th July, 1903, are to remain unchanged.

In the case of the following articles the proposed new rates of duty are as shown below:—

Article.	Rate of Duty.			
	Present.		Proposed.	
Vinegar, including pyro-ligneous acid and acetic acid, crystallised or liquid—	<i>Fls.</i>	<i>cts.</i>	<i>Fls.</i>	<i>cts.</i>
When of a strength of less than 100 grammes of acetic acid per litre, containing no water.....	Per hectolitre.		Per hectolitre.	
	3	00	3	20
When of a strength of 100 grammes of acetic acid per litre, containing no water.....				
	3	50	3	75
If of higher strength proportionately more.				
Acetate of soda—	Per 100 kilograms.		Per 100 kilograms.	
Containing no water....	25	60	28	50
Containing water.....	15	40	17	15
Acetate of calcium—				
Containing no water....	26	60	29	60
Containing water.....	23	80	26	50
	Per hectolitre.		Per hectolitre.	
	3	00	3	50
Beer, including malt extract	Per 100 kilograms.		Per 100 kilograms.	
Salt, refined, and residue of	4	00	4	30

The import duties on chloral hydrate, sulphuric ether, chloroform, acetic ether, sweet spirit of nitre, and all other similar substances prepared from or with alcohol, are to remain unchanged.

British South African trade. Chem. and Drug., Dec. 4, 1909.

THE total imports of drugs, chemicals, &c., into British South Africa during the first six months of 1909 amounted to £379,166, or practically £19,000 more than in the corresponding period last year. Among the items were unenumerated drugs and chemicals £39,267, sodium cyanide 5,389,793 lb. against 3,776,794 lb., caustic soda £7,934, disinfectants £13,683. Glycerin for manufacture advanced from 3,562,997 lb. (£79,262) to 6,063,911 lb. (£130,637), this increase being one of several factors accounting for present famine prices. Sheep-dip is another expanding item, imports having risen in value from £30,757 to £49,145, but toilet soap showed a slight decline of £1,450, the quantity imported being 386,716 lb. The value of explosives imported into the Transvaal advanced from £295,000 to £351,000.

Import Duties of Servia—Minimum rates. Board of Trade J., Dec. 9th, 1909.

A SERVIAN Royal Decree dated the 14th Nov. establishes minimum rates of import duty for certain articles, many of them chemical, which are not covered by any of the commercial treaties which Servia has concluded with other countries. The reduced duties came into force on the 4 17th Nov. and are applicable to the products of the United Kingdom, the British Colonies, and all countries entitled to most favoured nation treatment. A detailed comparative statement of the duties is given.

Books Received.

COAL-TAR AND AMMONIA. By G. LUNGE, Ph.D., Dr. Ing., Prof. Emer. of Technical Chemistry in Federal Polytechnicum, Zürich. Fourth and enlarged edition. Gurney and Jackson, 10 Paternoster Row, London, E.C. 1909. Price 42s. net.

THE work is issued in two 8vo. volumes, containing 1152 pages of subject matter, alphabetical indexes of authors' names and of subjects, and 305 illustrations. Part I. contains:—(1). Introductory. (2). Processes for obtaining coal-tar. (3). Properties of coal-tar and its constituents. (4). Applications of coal-tar without distillation. (5). First distillation of coal-tar. (6). Pitch.

(7). Anthracene oil. (8). Creosote oil. Part II. contains:—(9). Carbofic acid and naphthalene. (10). Light oil and crude naphtha. (11). Working up the light naphtha into final products. (12). Sources from which ammonia is obtained. (13). Composition and analysis of ammoniacal liquor, and properties of its constituents. (14). Working up of ammoniacal liquor. (15). Other technically important ammonium salts. In an appendix there are given tables for reducing specific gravity to normal temperature; for comparing degrees of Baumé's, Cartier's, and Beck's hydrometers with corresponding specific gravities; and for comparing degrees of centigrade and Fahrenheit thermometers.

MANUFACTURE OF SULPHURIC ACID AND ALKALI WITH THE COLLATERAL BRANCHES. Vol. II. SULPHATE OF SODA, HYDROCHLORIC ACID, LEBLANC SODA. By G. LUNGE, Ph.D., Dr. Ing., Prof. Emer. of Technical Chemistry in Federal Polytechnicum, Zürich. Third edition, much enlarged. Gurney and Jackson, 10, Paternoster Row, London, E.C. 1909. Price 42s. net.

THE work is issued in two 8vo. volumes containing 991 pages of subject matter, 335 illustrations, and an alphabetical index. The text is divided as follows:—Part I. Introduction. (1). Properties and occurrence in nature of the raw materials and products of the alkali industry. (2). Analysis of the raw materials and products of the alkali manufacture. (3). Manufacture of sulphate of soda from common salt and sulphuric acid. (4). Manufacture of sulphate of soda by the process of Hargreaves and Robinson. (5). Various methods for the manufacture of sulphate of soda. (6). Purification of sodium sulphate (Glauber's salt); applications. (7). Condensation of the hydrochloric acid produced in the manufacture of sulphate of soda. (8). Manufacture of hydrochloric acid by other than the ordinary methods. (9). Weak acid; control of condensation; yields, costs, purification, pumping and conveyance of hydrochloric acid. Part II. (10). General and historical notes on alkali manufacture; theory of the Le-blanc process. (11). Manufacture of black-ash. (12). Black ash and tank-liquor. (13). Manufacture of finished soda and bicarbonate. (14). Yield and costs. (15). Caustic soda. (16). Tank-waste.

FOOD INSPECTION AND ANALYSIS. By A. E. Leach, S.B. Second edition, revised and enlarged. J. Wiley and Sons, New York. Chapman and Hall, Ltd., London. 1909. Price 31s. 6d. net.

LARGE 8vo volume containing 929 pages of subject matter with 120 illustrations and 40 plates, and an alphabetical index. The text is divided as follows:—(1). Food analysis and official control. (2). The laboratory and its equipment. (3). Food, its functions, proximate components, and nutritive value. (4). General analytical methods. (5). The microscope in food analysis. (6). The refractometer. (7). Milk and milk products. (8). Flesh foods. (9). Eggs. (10). Cereals and their products, legumes, vegetables and fruits. (11). Tea, coffee, and cocoa. (12). Spices. (13). Edible oils and fats. (14). Sugar and saccharine products. (15). Alcoholic beverages. (16). Vinegar. (17). Artificial food colours. (18). Food preservatives. (19). Artificial sweeteners. (20). Flavouring extracts and their substitutes. (21). Canned and bottled vegetables, relishes, and fruit products.

DIAMONDS. By SIR W. CROOKES, LL.D., D.Sc., F.R.S. Harper Bros., London and New York. 1909. Price, Cloth, 2s. 6d.; Leather, 3s. 6d. net.

SMALL 8vo volume containing 140 pages of subject matter, 24 illustrations, and an alphabetical index. The chapter-headings are as follows:—(1). Preliminary. (2). Kimberley and its diamond mines. (3). Kimberley mines at the present day. (4). Collecting the gems. (5). The diamond office. (6). Noteworthy diamonds. (7). Bort, carbonado, and graphite. (8). Physical and chemical properties of the diamond. (9). Genesis of the diamond (including production of artificial diamonds). (10). Natural formation of the diamond. (11). Meteoric diamond.

THE UNIVERSAL STANDARD GRADING OF SCRAP RUBBER.
By ALFRED W. LESLIE, 119, Stoke Newington Road,
London, N. Price 2s. 6d.

Small 8vo volume of 46 pages, subdivided as follows:
(1.) The rise and progress of the rubber industry. (2.)
Scrap rubber generally. (3.) The present position of the
scrap rubber market. (4.) The various grades of scrap
rubber. (5.) Description of the various grades of scrap
rubber. (6.) The prospects of the rubber industry.

DIE ELEKTROMOTORISCHEN KRÄFTE DER POLARISATION,
UND IHRE MESSUNG MIT HILFE DES Oszillographen.
Von M. Le BLANC. Abhandlungen der Deutschen
Bunsen-Ges., Nr. 3. Verlag von W. Knapp, Halle a. S.,
Germany. 1910. Price M.3.

8vo. volume containing 79 pages of subject matter and
88 illustrations.

BEITRÄGE ZU EINER KOLLOIDCHEMIE DES LEBENS. Von
R. E. LIESEGANG. Verlag von T. Steinkopf, Dresden,
Germany. 1909. Price M. 4; bound, M.5.

The work consists mainly of discussions of and deductions
from, the phenomena due to diffusion, chemical reactions
and physical actions in jellies.

COMPLETE SPECIFICATIONS ACCEPTED.

- 24,483 (1908). Grossmann. Centrifugal apparatus for
separating solids from liquids. Dec. 22.
26,152 (1908). Hommel, and Metals Extraction Cor-
poration. Apparatus for use in solution and precipitation
processes, particularly for extracting zinc. Dec. 15.
26,381 (1908). Down. Process and apparatus for mixing
substances. Dec. 15.
26,537 (1908). Suzuki. Continuous evaporators for
liquids which deposit crystals. Dec. 8.
26,577 (1908) and 13,338 (1909). Traut. Manufacture of
vessels capable of resisting chemical action. Dec. 15.
26,684 (1908). Sprague. Treatment of corrosive gaseous
fumes or smoke. Dec. 15.
779 (1909). Brucke. Distilling, evaporating, heating,
or cooling liquids. Dec. 8.
1,650 (1909). Delporte. Agglomerating or hardening
pulverulent, finely-divided, and friable substances. Dec. 8.
6,561 (1909). Friedrich. Regenerative reverberatory
furnaces. Dec. 8.
9,146 (1909). Cie. Indus. des Alcools de l'Ardeche.
Use of treated sawdust as an absorbent. Dec. 22.
9,158 (1909). Weeks. *See under X.*
20,215 (1909). Brun. Lined preparations for use in
steam generators. Dec. 8.
22,163 (1909). Hodgkinson. *See under VII.*

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 27,828. Pringle and Richards. Carbonisation of coal and
other carbonaceous material. Nov. 29.
27,829. Pringle and Richards. Production of smokeless
briquettes from coal. Nov. 29.
27,960. Lake (Hite). Manufacture of coal briquettes.*
Nov. 30.
28,048. Franke. Manufacture of briquettes of porous
hygroscopic fuels. [Ger. Appl., April 26, 1909.]* Dec. 1.
28,054. Moores. Composition for purifying gas from
oils and spirits.* Dec. 1.
28,467. Dieker (Underfeed Stoker Co.). *See under*
XXIII.
28,692. Dukes (Ges. f. Verwertungs Chem. Produkte).
Manufacture of metallic incandescent bodies for electric
lamps. Dec. 8.
28,868. Radcliffe. Recovery of ammonia from distilla-
tion gases. Dec. 10.
29,029. Lake (Hydrocarbon Converter Co.). Manufac-
ture of gas from hydrocarbon oils, &c.* Dec. 11.
29,125. Johnson (Maschinen u. Armaturen Fabr. vorm.
Breuer und Co.). Apparatus for making gas by dis-
tilling coal.* Dec. 13.
29,149. Radcliffe. Purification of condensation products
from producer gas manufacture. Dec. 14.
29,313. Smith and Shaw. Vertical gas retorts. Dec. 15.
29,328. Ruthenberg. Distillation of coal and like
material. Dec. 15.
29,559. Stephen. Manufacture of artificial fuel. Dec. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

- 23,044 (1908). Wilton. Gas generators, producers, or
refuse destructors. Dec. 8.
23,263 (1908). Meunier. Gas manufacture. Dec. 8.
26,146 (1908). Lemonli, and Poulenc freres. *See under*
XXIII.
26,387 (1908). Garzón. Apparatus for utilising tar as
liquid fuel. Dec. 5.
27,718 (1908). Variens. Production of a gas under
pressure for motive power. Dec. 22.
27,755 (1908). Zdanowich. Incandescent mantles.
Dec. 22.
2113 (1909). Davis. Gas washers. Dec. 8.
2495 (1909). Chapman. Gas producers. Dec. 22.
3981 (1909). Gutensohn. Manufacture of combustible
briquettes. Dec. 15.
6958 (1909). Korthing, Jaentsch, and Sauer. Manufacture
of peat bricks, &c. Dec. 8.

Patent List.

Where a Complete Specification accompanies an Application, an
asterisk is affixed. The dates given are (i) in the case of Applica-
tions for Patents, the dates of Application, and (ii) in the case of
Complete Specifications Accepted, those of the Official Journals
in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to
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within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 27,938. Clark (Ges. der Tentelwischen Chem. Fabr.).
Process and apparatus for cooling water.* Nov. 30.
28,047. Franke. Manufacture of plastic articles of
hygroscopic materials.* Dec. 1.
28,242. Miller. Filters. [U.S. Appl., Jan. 22, 1908.]*
Dec. 3.
28,302. Vialleix and Perrin. *See under VII.*
28,360. Abresch. Device for filtering and purifying
liquids.* Dec. 4.
28,625. Justice (Binney). *See under X.*
28,720 and 28,721. Brown and Fawns. Utilisation of
ammonia as a motive power source of energy, &c. Dec. 8.
28,798. Breakell. *See under X.*
28,829. Glass. Forming materials into briquettes.
Dec. 9.
28,836. Boulton (Low). Centrifugal separating appara-
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29,104. Edmonds. Hydro-extractors. Dec. 13.
29,360. Willey Mining Machinery Co., and Roberts.
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29,445. Drucker. Continuous slimes vacuum filter.
Dec. 16.
29,549. Macfarlane. Centrifugal drying machines.
Dec. 17.
29,698. Scott and Co., Ltd., and Pooley. Evaporating
apparatus. Dec. 18.

12,363 (1909). Koppers. Coking and gas generating ovens. Dec. 15.

16,328 (1909). Weber. Manufacture of electric incandescent lamp filaments. Dec. 15.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

27,714. Fabbri. Treatment of mineral and like oils. Nov. 29.

COMPLETE SPECIFICATION ACCEPTED.

26,296 (1908). Lodigiani. Obtaining strong aqueous solutions of creosote. Dec. 8.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

27,773. Newton (Bayer and Co.). Manufacture of vat dyestuffs. [Addition to No. 7,819 of 1909.]* Nov. 29.

28,042. Johnson (Badische Anilin und Soda Fabrik). Production of halogen derivatives of indigo. Dec. 1.

28,043. Newton (Bayer and Co.). Manufacture of vat dyestuffs. [Addition to No. 7,819 of 1909.] Dec. 1.

28,170. Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. [Addition to No. 16,584 of 1907. Ger. Appl., Dec. 24, 1908.]* Dec. 2.

28,171. Meister, Lucius, und Brüning. Manufacture of penta- and hexa-halogenised indigos. [Comprised in No. 3,019 Feb. 8, 1909.] Dec. 2.

28,716 and 28,717. Newton (Bayer and Co.). Manufacture of azo dyestuffs. Dec. 8.

28,718. Newton (Bayer and Co.). Manufacture of polyazo dyes. Dec. 8.

29,112. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of thio-derivatives of diarylamines, their homologues and analogues. Dec. 13.

29,138. Newton (Bayer and Co.). Manufacture of anthracene derivatives. [Addition to No. 2,702 of 1909.] Dec. 13.

29,139. Newton (Bayer and Co.). Manufacture of derivatives of the anthraquinone series. Dec. 13.

29,458 and 29,459. Newton (Bayer and Co.). Manufacture of azo dyestuffs. Dec. 16.

29,674. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of a yellow monoazo dyestuff for wool. Dec. 18.

29,675. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of a monoazo dyestuff and colour lakes therefrom. Dec. 18.

COMPLETE SPECIFICATIONS ACCEPTED.

26,023 (1908). Newton (Bayer and Co.). Manufacture of azo dyestuffs. Dec. 8.

5,383 (1909). Newton (Bayer and Co.). Manufacture of azo dyestuffs. Dec. 8.

5,558 (1909). Imray (Meister, Lucius, und Brüning). Manufacture of leuco-bodies of dyestuffs, containing sulphur. Dec. 22.

7,819 (1909). Newton (Bayer and Co.). Manufacture of vat dyestuffs. Dec. 15.

8,438 (1909). Dreyfus, Tompkins, and Clayton Aniline Co. Manufacture of halogenated compounds of indigo and indigoid bodies. Dec. 15.

17,265 (1909). Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. Dec. 8.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

27,731. Heap. Machinery for washing, bleaching, dyeing, and drying yarn. Nov. 29.

27,738. Denman. Colour printing on fabrics, &c. Nov. 29.

28,126. Schiffers. Machines for dyeing, bleaching, &c., textile fabrics or goods.* Dec. 2.

28,256. Friedrich. Production of fine artificial threads. [Ger. Appl., Dec. 3, 1908.]* Dec. 3.

28,791. Stark. Preparing brittle vegetable fibres for spinning and dyeing of capoe, akone kalotropis procera and the like. Dec. 8.

28,737. Turner and Maxwell. Bleaching processes. Dec. 8.

28,828. Mitchell. Manufacture of printed felts. Dec. 9.

29,209. Jacques, Filburn, and Abrahams. Rendering flannelette and other fabrics non-inflammable. Dec. 14.

29,266. Bauartikel-Fabr. A. Siebel. Manufacture of waterproof materials. [Ger. Appl., Mar. 3, 1909.]* Dec. 14.

29,314. Appleyard. Dyeing and printing with vat-dyeing colours. Dec. 15.

COMPLETE SPECIFICATIONS ACCEPTED.

27,123 (1908). Claviez. Manufacture of a material adapted to be spun. Dec. 22.

28,042 (1908). Hardman and Edmondson. Bleaching cotton and other vegetable fibres. Dec. 8.

1,227 (1909). Newton (Bayer and Co.). Production of black shades on cotton. Dec. 22.

6,554 (1909). Schloss, and Fürst Guido Donnersmarck'sche Kunstseiden- u. Acetatwerke. *See under XIX.*

8,744 (1909). Allsop and Sibson. Dyeing and washing machine. Dec. 8.

11,729 (1909). Chem. Fabr. Griesheim Elektron. Treatment of mercerised cotton goods. Dec. 8.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

27,826. Häusser. Manufacture of nitrogen oxides.* Nov. 29.

28,302. Vialleix and Perrin. Condensing acid vapours. [Fr. Appl., Dec. 4, 1908.]* Dec. 3.

28,364. Radcliffe. Purification of ammonia waste liquid. Dec. 4.

28,391. Burkhardt. Forming semi-liquid quartz.* Dec. 6.

28,609. Glaser and Müller. Refining salt and recovering its impurities.* Dec. 7.

28,610. Teed, Sulman, and Picard. Recovery of sulphur from gases. Dec. 7.

28,629. Lead Products Synd., and Thompson. Manufacture of lead oxide. Dec. 7.

28,665. Laverty. Lime-burning and lime-gas producing kilns. Dec. 8.

28,703. Güntersohn. Treatment of nitric cake. Dec. 8.

28,755. Von Schlippenbach. Recovering gases rich in sulphur dioxide from gases poor therein in roasting and oxidising processes. [Ger. Appl., May 24, 1909.]* Dec. 8.

29,294. Greenwood. Extraction of arsenic from arsenical residue. Dec. 15.

29,385. Friedrich. Manufacture of a copper salt specially suited for preparing ammoniacal copper oxide. [Ger. Appl., Dec. 15, 1908.]* Dec. 15.

29,491. Chem. Fabr. Griesheim Elektron. Manufacture of anhydrous caustic soda. [Ger. Appl., Dec. 23, 1908.]* Dec. 16.

29,494. Chem. Fabr. Griesheim Elektron. Manufacture of anhydrous caustic potash. [Addition to No. 29,491 of 1909. Ger. Appl., March 26, 1909.]* Dec. 16.

29,669. Von Schmoll. Production of a solution of water glass.* Dec. 18.

COMPLETE SPECIFICATIONS ACCEPTED.

23,385 (1908). Salpetersäure. Ind. Ges. Manufacture of nitric acid from mixtures of nitrogenous gases and water. Dec. 15.

23,676 (1908). Sarason. Increasing the keeping quality of compounds containing unstable oxygen. Dec. 15.

23,689 (1908). Vourasos. Decomposition of metal chlorides. Dec. 15.

26,258 (1908). Eckford. *See under XIII.*

- 26,720 (1908). Hazard-Flamand. Dividing air into its elements by fractional distillation. Dec. 15.
 26,826 (1908). British Thomson-Houston Co. (General Electric Co.). *See under X.*
 28,112 (1908). Behrens. Separating carbonic acid from gas mixtures. Dec. 8.
 1585 (1909). Carulla. Manufacture of ammonium salts and iron oxide from ferrous liquors. Dec. 22.
 10,591 (1909). Aktiebolaget Swedish Nitric Syndicate. Continuous concentration of acids. Dec. 22.
 14,835 (1909). Erbslow and Condron. *See under XIII.*
 17,690 (1909). Coulier. Manufacture of alkaline earth sulphates. Dec. 8.
 22,163 (1909). Hodgkinson. Apparatus for evaporating brine or other solutions. Dec. 8.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATION.

- 29,694. Westacott. Treatment of china clay. Dec. 18.
 COMPLETE SPECIFICATIONS ACCEPTED.
 18,322 (1909). Quertinmont. Apparatus for making sheet or plate glass. Dec. 8.
 18,323 (1909). Quertinmont. Manufacture of glass. Dec. 8.
 18,713 (1909). Voelker. Forming bodies of semi-liquid quartz and like material. Dec. 22.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATION.

- 28,798. Breakell. *See under X.*
 COMPLETE APPLICATIONS ACCEPTED.
 118 (1909). Stein. Producing granulated slag from refuse for artificial stone. Dec. 22.
 1,844 (1909). Poulson. Manufacture of refractory bricks and treatment of moulders' sand. Dec. 22.
 11,637 (1909). Tabourin. Manufacture of flag-stones, tiles, &c., of cement. Dec. 15.
 15,165 (1909). Metzger. Machines for treating blast-furnace slag in making cement. Dec. 8.

X.—METALS AND METALLURGY.

APPLICATIONS.

- 27,806. Ramage. Recovery of iron from ores and preparing iron alloys.* Nov. 29.
 28,099. Bliss. Drying air for metallurgical furnaces. Dec. 2.
 28,131. Coslett. Treatment of iron or steel to prevent oxidation or rusting. Dec. 2.
 28,487. Imbert Process Co. Extraction of zinc from zinc ores. [Fr. Appl., Dec. 24, 1908.]* Dec. 6.
 28,608. Rübel. Manufacture of a metal of low specific weight. Dec. 7.
 28,611. Hommel and Durant. Extraction of zinc and copper from ores. Dec. 7.
 28,612. Sulman and Picard. Treatment of oxidised ores, &c. Dec. 7.
 28,625. Justice (Binney). Filters for metallurgical and other uses. Dec. 7.
 28,798. Breakell. Apparatus for pulverising ores, cement, phosphates, &c. Dec. 9.
 28,901. Beauchamp. Using sulphurous gases directly on ores. Dec. 10.
 28,933. Sulman, Picard, and Ballot. Concentration of ores. Dec. 10.
 29,076. Reynolds. Manufacture of crucible steel. Dec. 13.
 29,286 and 29,287. McKechnie and Beasley. Separation of metals from ores, residues, &c. Dec. 14.
 29,331. Gutensohn. Treatment of zinc lead ore. Dec. 15.
 29,332. Gutensohn. Production of briquettes from metal oxides and ore. Dec. 15.

- 29,364. Sulman and Picard. Flotation treatment of ores. Dec. 15.
 29,365. Buderus'sche Eisenwerke. Apparatus for atomising liquid slag. [Ger. Appl., Dec. 28, 1908.]* Dec. 15.
 29,392. Bradley and Williams. Extraction of metals from ores. Dec. 15.
 29,482. Reynolds. Manufacture of steel.* Dec. 16.
 29,597. Girod. Hardening projectiles or other steel articles. [Fr. Appl., Jan. 23, 1909.]* Dec. 17.
 29,616. Sulman and Picard. Flotation treatment of ores. Dec. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

- 18,175 (1908). Hodgkinson and Peck. Production of copper alloys. Dec. 8.
 21,759 (1908). Hommel, and Metals Extraction Corporation. Extraction of zinc from its ores or compounds. Dec. 22.
 21,837 (1908). Junqueras. Treatment of minerals for the extraction of metal. Dec. 22.
 22,873 (1908). Siemens und Halske A.-G. Production of tantalum. Dec. 8.
 23,179 (1908). De St. Seine, and Thwaites Bros. Furnaces for smelting ores, residues, &c., to obtain copper and other metals. Dec. 8.
 26,152 (1908). Hommel, and Metals Extraction Corporation. *See under I.*
 26,264 (1908) and 8,287 (1909). Lockwood and Samuel. Oils and oily liquids for use in treating ores, and also the treatment of ores. Dec. 8.
 26,380 (1908). Landenberger. Manufacture of alloys. Dec. 15.
 26,711 (1908). Williams and Bradley. Obtaining zinc and copper from complex ores, &c. Dec. 22.
 26,826 (1908). British Thomson-Houston Co. (General Electric Co.). Silicon alloys. Dec. 8.
 26,831 (1908). Williams. Lixivation processes for the extraction of metals. Dec. 15.
 27,353 (1908). Bloxam (Cie. des Forges de Chatillon Commeny et Neufves-Maisons). Pickling metals. Dec. 22.
 28,003 (1908). Soc. Anon. La Néo-Metallurgie. Manufacture of commercially pure carburetted manganese. Dec. 22.
 1,365 (1909). Barclay and Rodgers. Alloys known as German silver. Dec. 15.
 8,778 (1909). Schoop. Welding objects of aluminium or aluminium alloys. Dec. 8.
 9,158 (1909). Weeks. Apparatus for calcining, desulphurising, and sintering ores and like materials.* Dec. 8.
 16,229 (1909). Lockwood and Samuel. Treatment of ores. Dec. 8.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

- 27,972. Hay. Electric furnaces. [U.S. Appl., June 19, 1909.]* Nov. 30.
 28,552. Hartmann. Purification of liquids by electricity.* Dec. 7.
 28,813. Wassmer. Electric furnaces. Dec. 9.
 29,214. Cowper-Coles. Electrodeposition of iron. Dec. 14.
 29,228. Soc. Ind. de l'Accu-Mixte l'Energique. Manufacture of accumulator plates. [Fr. Appl. Dec. 14, 1908.]* Dec. 14.
 29,671. Vogel. Electric furnaces.* Dec. 18.

COMPLETE SPECIFICATIONS ACCEPTED.

- 27,107 (1908). Skelton. Ozonisers. Dec. 22.
 7,338 (1909). Nya Aekumulator Aktiebolaget Jungner and others. Active mass for negative electrodes of electric elements with alkaline electrolyte. Dec. 22.

16,225 (1909). Bunet and Badin. Apparatus for producing electric arcs for the formation of compounds of oxygen and nitrogen. Dec. 15.
 17,342 (1909). Aktiebolaget Elektrometall. Electric furnaces. Dec. 15.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

APPLICATIONS.

27,899. Higgins and Spensley. Drying or stoving soap. Nov. 30.
 28,098. Tweedale. Soap. Dec. 2.
 28,436. Von Romocki. Manufacture of soaps and the like. Dec. 6.
 29,113. Muller. Manufacture of Soap. Dec. 13.
 29,438. McDonald. *See under* XVIII.4.

COMPLETE SPECIFICATIONS ACCEPTED.

26,264 (1908) and 8,287 (1909). Lockwood and Samuel. *See under* X.
 27,083 (1908). Buchanan. Manufacture of soap. Dec. 22

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

APPLICATIONS.

28,490. Rehkop. Burning ultramarine in crucibles adapted to be closed by coverlets.* Dec. 6.
 29,675. Bloxam (Act.-Ges. f. Anilinfabr.). *See under* IV.

COMPLETE SPECIFICATIONS ACCEPTED.

26,258 (1908) and 15,423 (1909). Eckford. Manufacture of red lead. Dec. 15.
 14,835 (1909). Erbslow and Condron. Manufacture of white lead. Dec. 8.

(C.)—INDIA-RUBBER.

APPLICATIONS.

27,908. Woltereck. *See under* XX.
 28,613. Grist. Production of rubber. Dec. 7.
 28,788. Matthews and Strange. Synthetic manufacture of caoutchouc, &c. Dec. 9.
 28,878. Prestwich. Cellular india-rubber substitute. Dec. 10.
 29,277. Lilley. Production of a synthetic rubber or rubber-like material. Dec. 14.
 29,565. Matthews and Strange. Manufacture of compounds analogous to caoutchouc. Dec. 17.
 29,566. Matthews and Strange. Manufacture of caoutchouc. Dec. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

27,688 (1908). Wallace and Reynaud. Manufacture of elastic or plastic products similar to caoutchouc. Dec. 22.
 4154 (1909). Commercial Products Co. (Berend). Production of a plastic and elastic substance. Dec. 15.
 8062 (1909). Dogny, Henri, and Veil-Pickard. Manufacture of products from india-rubber or similar material. Dec. 8.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATION.

28,297. Utley. Clarifying and decolorising gelatin and glue liquors. [U.S. Appl., Dec. 12, 1908.]* Dec. 3.

COMPLETE SPECIFICATIONS ACCEPTED.

18,411 (1909). Cave-Brown-Cave. Treatment of leather, fur skins, and the like. Dec. 22.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATION.

28,742. Wolf. Production of artificial honey liquid, refined sugar or fructose, and white sugar from beet, raw, or crude sugar. [Ger. Appl., Dec. 8, 1908.]* Dec. 8.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

27,713. Fabbri. Obtaining a greater production of ethyl alcohol from maize, grain, molasses, coal, &c. Nov. 29.
 27,831. Kuhn. Manufacture of grape beer. [Fr. Appl., Dec. 2, 1908.]* Nov. 29.
 27,977. Epstein. Treatment of lactobacilline or paracetic culture or fermentation or the like. Nov. 30.
 28,561. Berliner A.-G. f. Eisengiesserei. Malt drums. [Ger. Appl., Dec. 8, 1908.]* Dec. 7.
 29,114. Braasch. Production of yeast. [Addition to No. 10,458 of 1909. Ger. Appl., Dec. 21, 1908.]* Dec. 13.
 29,232. Epstein. Treatments of fermentation or culture or the like. Dec. 14.
 29,379. Sureties. Solidifying brewers' yeast. Dec. 15.
 29,534. Parkhurst and West. Treatment of liquids during fermentation. Dec. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

24,592 (1908). Barr. Production of ferments. Dec. 22.
 24,300 (1909). Smith. Process of making extract of hops. Dec. 15.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(A.)—FOODS.

APPLICATIONS.

27,722 and 27,723. Bond and Collett. Utilising whey for dietetic purposes. Nov. 29.
 27,775. Johnson (Chem. Fabr. vorm. Goldenburg, Geromont, und Co.). Manufacture of baking powder.* Nov. 29.
 27,798. Henri, Helbronner, and von Recklinghausen. Sterilising water and other liquids and ferments. Nov. 29.
 28,150. Gottsleben. Production of a soluble powder from egg yolks. Dec. 2.
 28,371. Stohr. Manufacture of milk-food preparations.* Dec. 4.
 29,438. MacDonald. Manufacture of feeding cakes for animals and extracting oil from the seeds used. Dec. 16.

COMPLETE SPECIFICATIONS ACCEPTED.

23,585 (1908). Sleeman. Digestive ferments and method of preparing them. Dec. 15.
 25,501 (1908). Yeo, Hall, and Goskar. Aeration of liquids and manufacture of mineral waters. Dec. 8.
 26,939 (1908). Soc. Anon. des Tabacs Desintoxiqués. Removing nicotine from tobacco. Dec. 22.

(B.)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

28,516. Grossmann. Drying sewage sludge. Dec. 7.
 29,032. Guy. Bacteria beds or filter beds. Dec. 11.
 COMPLETE SPECIFICATIONS ACCEPTED.
 23,044 (1908). Wilton. *See under* II.
 27,226 (1908). Ozonair, Ltd., and Joseph. Sterilisation of water by ozonisation. Dec. 15.
 7464 (1909). Leigh. Treatment of fluids in filter beds. Dec. 15.
 12,246 (1909). Marks (Desceniss und Jacobi). Freeing water from iron. Dec. 8.

NIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

- 27,950. Wilbuschewitsch. Making paper or cardboard from the husks of cotton seeds.* Nov. 30.
 28,165. Pearson and Stoncham. Manufacture of fibre board. Dec. 2.
 28,343. Leachman. Finishing paper and like materials. Dec. 4.
 29,480. Kuess. Manufacture of paper pulp from the fruit of trees of the coconut tribe. [Appl. in Tunis, April 8, 1909.]* Dec. 16.
 29,514. Hankey. Preparation and treatment of drawing paper. Dec. 16.
 29,553. White and Gray. Towers for bleaching paper pulp.* Dec. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

- 6554 (1909). Schloss, and Fürst Guido Donner-smarek'sche Kunstseiden u. Acetatwerke. Manufacture of solutions of cellulose acetate. Dec. 8.
 15,281 (1909). Brandenberger. Manufacture of cellulose films. Dec. 15.

XX.—FINE CHEMICALS, ALKALOIDS,
ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

- 27,908. Wolterreck. Production of isoprene. Nov. 30.
 28,044 and 28,045. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Dec. 1.
 28,166. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Dec. 2.
 28,182. Neumann. Treatment of hæmoglobin.* Dec. 2.
 28,361. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-aminophenylarsinic acid. Dec. 4.
 28,383. Wootton. Preparation of alkyl and aryl amino-derivatives of camphoric acid. Dec. 4.
 28,618. Criquebeuf and Helbronner. Production of a liquid rich in methyl acetate. Dec. 7.
 28,715 and 28,719. Newton (Bayer und Co.). Manufacture of pharmaceutical products. Dec. 8.
 29,247. Merck. Preparation of concentrated solutions of thiosinamine. [Addition to No. 22,533 of 1905. Ger. Appl., Feb. 27, 1909.]* Dec. 14.
 29,439. Richter. Alkaline salts of acetylsalicylic acid.* Dec. 16.
 29,647. Kipping. Synthesis of organic compounds. Dec. 18.

COMPLETE SPECIFICATIONS ACCEPTED.

- 26,708 (1908). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of camphor. Dec. 15.

- 1561 (1909). Wellcome and Barger. Synthesis of a physiologically active base. Dec. 8.
 12,745 (1909). Wetter (Hoffmann-La Roche und Co.). Manufacture of guaiacolsulphonic acid and its salts. Dec. 22.

XXI.—PHOTOGRAPHIC MATERIALS AND
PROCESSES.

APPLICATIONS.

- 27,818. Tauleigne and Mazo. Photography in colours. Nov. 29.
 29,273. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Manufacture of polychrome surfaces for colour photography. [Fr. Appl., Feb. 6, 1909.]* Dec. 14.
 29,460. Newton (Bayer und Co.). Transfer pictures. Dec. 16.

COMPLETE SPECIFICATIONS ACCEPTED.

- 27,233 (1908). Mansell and Mansell. Production and reproduction of bleached images. Dec. 15.
 7932 (1909). Rieder. Photographic powdering process. Dec. 22.
 14,243 (1909). Ives. Sensitised plates for use in three-colour photography. Dec. 22.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

- 28,237. Gabbett-Fairfax, Sankey, and Smith. Explosives. Dec. 2.
 28,600. Hale. Manufacture of explosives. Dec. 7.
 28,929. Delvigne. Explosives. [Belg. Appl., April 2, 1909.]* Dec. 10.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATION.

- 28,467. Dieker (Underfeed Stoker Co. of America). Analysis of gas.* Dec. 6.

COMPLETE SPECIFICATION ACCEPTED.

- 26,146 (1908). Lemoult, and Poulenc frères. Apparatus for determining the calorific power and composition of gaseous combustibles. Dec. 15.
 26,561 (1908). Hinman. Means for measuring or analysing mixtures. Dec. 8.

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Editor.

Watson Smith, 34, Upper Park Road, Haverstock Hill, London, N.W.

LIST OF MEMBERS.

THE MEMBERSHIP ON FEBRUARY 27, 1909 = 4258.

NOTE: "O.M." MEANS "ORIGINAL MEMBER."

A

1908. Abelli, Dr. Modesto, Avigliana, Torino, Italy, Director of Nobel Explosive Works.
1903. Abraham, Herbert, 13, West 80th Street, New York City, U.S.A., Chemist.
1902. Acker, Chas. E., 1, West 121st Street, New York City, U.S.A., Manufacturer.
1903. Ackermann, Franz W., Hudson Heights, N.J., U.S.A., Chemist.
1909. Acott, Richard H., c/o Porter Fibre Bottle Co., Lewiston, N.Y., U.S.A., Chemist.
1903. Acton, J. Rowland, India Store Depot, Belvedere Road, London, S.E., Civil Servant.
1907. Adam, Wm. A., c/o Mauder Bros., Wolverhampton, Chemist.
1892. Adams, Arthur, Kelvin House, Edgbaston Road, Smethwick, near Birmingham, Science Lecturer.
1897. Adams, Thos. H., Endon Villa, Victoria Avenue, Borrowash, near Derby, Analyst.
1895. Adamson, G. P., c/o The Baker and Adamson Chemical Co., Easton, Pa., U.S.A., Manufacturing Chemist.
1891. Adcock, S. R., St. Helens Smelting Co., Atlas Court, St. Helens, Lancashire, Analytical Chemist.
1901. Addison, Leonard, c/o Messrs. Burt, Boulton, and Haywood, Selzaete, Belgium, Chemist.
1898. Adgate, M., Nangatuek, Conn., U.S.A., Chemist.
1896. Adler, Dr. Leon N., Adler Colour and Chemical Works, 100, William Street, New York City, U.S.A., Manufacturing Chemist.
1907. Adley, Geo. S., Storer's Wharf, Poplar, London, E., Varnish Manufacturer.
1888. Adriance, Dr. John S., The Union League Club, New York City, U.S.A., Analytical Chemist.
1899. Adrot, Léon, Woodside, Long Island, N.Y., U.S.A., Chemist.
1891. Airedale, Rt. Hon. Lord, Gledhow Hall, and (Jnls.) Monkbridge Iron and Steel Co., Ltd., Leeds, Iron and Steel Manufacturer.
1886. Aitken, J. B., Gerard's Fold Chemical Works, Widnes, Chemical Manufacturer.
1884. Akitt, Thos., Parkhill, Bishopston, Renfrewshire, Chemist.
1883. Albright, G. S., Bromesberrow Place, Ledbury, Chemical Manufacturer.
- O.M. Albright, W. A., 29, Frederick Road, Edgbaston, Birmingham, Chemical Manufacturer.
1906. Alcock, Frank H., 9, Broad Street Corner, Birmingham, Analyst.
1907. Alcock, J. E., 51, Gill Street, Moston Lane, Blackley, Manchester, Chemist.
1902. Alden, Frederick W., 500, Madison Street, Waukesha, Wis., U.S.A., Chemist.
1898. Alden, John, Chemical Laboratory, Pacific Mills, Lawrence, Mass., U.S.A., Chemist.
1906. Alder, H. W., Hacienda Cartavio, Trujillo, Peru, Works Chemist.
1900. Aldrich, Roger C., c/o Franklin H. Kalbfleisch Co., Elizabeth, N.J., U.S.A., Mechanical Engineer.
1890. Aldrick, Edwin John, 53, Alpha Road, West Ferry Road, Millwall, E., Works Sub-Manager.
1899. Alexander, D. Basil W., 1020, Date Street, Los Angeles, Cal., U.S.A., Chemist.
1900. Alexander, Jerome, c/o National Gum and Mica Co., 502-510, West 45th Street, New York City, U.S.A., Chemist.
1883. Alexander, W. T., Crummock, Eccles, Manchester, Drysalter.
1906. Allan, David, c/o Price's Patent Candle Co., Ltd., Belmont Works, Battersea, S.W., Chemist.
1891. Allan, F. H., Tielke, Ellesmere, Robin Hood, near Wakefield, Analytical Chemist.
1898. Allan, John, 77, Northen Grove, West Didsbury, near Manchester, Chemist.
1907. Allard, M. L., c/o Gutta Percha and Rubber Manufacturing Co., O'Hara Avenue, Toronto, Canada, Chemist.
1902. Allbright, Wm. B., 5139, Lexington Avenue, Chicago, Ill., U.S.A., Chemical Engineer.
- O.M. Aldred, C. H., 8, St. Margaret's Road, Plumstead Common, Kent, Analytical Chemist.
1907. Allely, W. S., 3, Regent Street, Birmingham, Metal Merchant.
1903. Allen, Chas. A., 295, Blackburn Road, Darwen, Lancashire, Chemist.
1908. Allen, Geo. V., c/o British American Dyeing Co., Montreal, Canada, Manager.
- O.M. Allen, J., 164, Upper North Street, Poplar, E., Manufacturing Chemist.
1907. Allen, J. Fenwick, 147, Withington Road, Whalley Range, Manchester.
1889. Allen, R. L., Hillside, and (Journals) c/o Brunner, Mond and Co., Ltd., Sandbach, Cheshire, Analytical Chemist.
1908. Allen, Simeon C., 81, Lake Avenue, Rochester, N.Y., U.S.A., Consulting Chemist.
1900. Allen, Wilfrid T., Allington, Bexley, Kent, Director.
1904. Allen, Wm. R., c/o Watson, Jack and Co., Bell Telephone Building, Montreal, Canada, Chemical Manufacturer.
1893. Allerton, Rt. Hon. Lord, F.R.S. (Journals), Allerton Hall, near Leeds; and c/o W. L. Jackson and Sons, Ltd., Buslingthorpe, Leeds, Tanner.
- O.M. Allusen, A., Gateshead-on-Tyne, Chemical Manufacturer.
1886. Allibon, G. H., Mayfield, Balmoral, Belfast, Ireland, Chemical Works Manager.
1887. Alliot, J. B., Messrs. Manlove, Alliot, and Co., Ltd., Nottingham, Mechanical Engineer.
1895. Allison, Wm. O., 100, William Street, New York City, U.S.A., Publisher of "Oil, Paint and Drug Reporter."
1905. Allpass, Jas., c/o The Clayton Aniline Co., Ltd., Clayton, Manchester, Secretary.
1889. Alpiar, Agop, Smyrna, Asia Minor, Morphia Manufacturer.
1899. Alsop, Wm. K., Ridgway, Pa., U.S.A., Chemist.
1904. Alton, W. Lester, 11, Briar Walk, Putney, S.W., Chemist.
1905. Amory, L. H., c/o Messrs. J. Heathcoat and Co., Tiverton, Devon, Lace Manufacturer.
1900. Anderson, Jas. W., The Paddock, Lower Halling, near Rochester, Kent, Analytical Chemist.
1889. Anderson, Robt. T. R., 42, Roslea Drive, Dennistoun, Glasgow, Technical Chemist.
1894. Anderson, Dr. W. Carrick, 7, Scott Street, Garnet Hill, Glasgow, Consulting Chemist.

1905. Andrae, Dr. E. P., Crestalta, Champion Hill, London, S.E., Chemist.
1907. Andrews, Chas. T., Estação de Miguel Burnier, E.F.C.B., Minas Geraes, Brazil, Chemist.
1889. Andrews, Clement W., c/o The John Crerar Library, Wabash Avenue and Washington Street, Chicago, Ill., U.S.A., Librarian.
1904. Andrews, Geo. D., c/o J. & J. Colman, Ltd., Carrow Works, Norwich, Chemist.
1903. Andrews, Wm. H., 79, Tonawanda Street, Buffalo, N.Y., U.S.A., Manager (Varnish Works).
1903. Aniloff, N. A., St. Vincent's, Orsett Road, Grays, and (Journals) Central Wharf, Bow, E., Chemist.
- O.M. Angell, J., 6, Beaconsfield, Derby Road, Withington, Manchester, Chemical Lecturer.
1892. Annandale, C. J. R., 126, Earnsdale Road, Darwen, Lancs., Paper Maker.
1883. Annandale, Jas. H., Polton Paper Works, Midlothian, N.B., Paper Maker.
1894. Ansbacher, L. A., 253, Broadway, New York City, U.S.A., Colour Manufacturer.
1902. Anthony, John, 82, Bay Street, Toronto, Canada.
1899. Appleby, C. W., Farnworth, near Widnes, Lancashire, Pith and Size Manufacturer.
1904. Appleby, Jos., Farnley, Moor Lane, Great Crosby, Liverpool, Flour Miller.
1895. Appleby, Prof. W. R., 911, 5th Street S.E., Minneapolis, Minn., U.S.A., Professor of Mining and Metallurgy.
1907. Appleton, Francis H., jun., P.O. Box 815, Franklin, Mass., U.S.A., Rubber Manufacturer.
1894. Appleton, H. A., 63, Rosedale Road, Forest Gate, E., Analytical Chemist.
1900. Appleyard, Geo. H., 4, Ash Grove, Beverley Road, Hull, Chemist.
1905. Appleyard, Jas. R., Royal Technical Institute, Salford, Lecturer.
- O.M. Archbutt, Leonard, The Yews, Madeley Street, Derby, Analytical Chemist.
1899. Archdale, T. Henry, 77, Queen's Road, Blackburn, Manager of Tar and Ammonia Works.
1904. Archdale, Wm., 21, Oldham Road, Miles Platting, Manchester, Manager of Chemical Works.
1901. Ardagh, Edw. G. R., Faculty of Applied Science, University of Toronto, Canada, Chemist.
1900. Arden, Edw., Greengates, Davyhulme, Urnston, Manchester, Chemist.
1907. Armstrong, Chas. F., Champarun Sugar Factory, Barrah Chakiah P.O., Tirhoot State Railway, India, Technical Chemist.
1902. Armstrong, Edward E., Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Manufacturing Chemist.
1905. Armstrong, Dr. E., Frankland, 98, London Road, Reading, Works Chemist.
1899. Armstrong, Richard, Saul Street Soap Works, Preston, Lancashire, Soap Manufacturer.
1905. Armstrong, Theodore, 115, Chestnut Street, Philadelphia, Pa., U.S.A., President, Penn. Salt Manufacturing Co.
1905. Arnold, Frank L., 32, School Street, North Woburn, Mass., U.S.A., Chemist.
1901. Arnold, G. Edmund, 6, Kingsfield Terrace, Faversham, Kent, Manager (Cotton Powder Co., Ltd.).
1899. Arnott, Dr. G. W. Campbell, c/o Fertiliser Manufacturers' Association, 79, Mark Lane, London, E.C., Agricultural Chemist.
1903. Arnott, J. S., Moros, 42, 2^a, Gijon, Spain, Chemist and Metallurgist.
1901. Arndel, Arthur S. D., 43, Pixmore Avenue, Letchworth, Herts, Chemical Engineer.
1901. Asano, K., 25, Kitachonyachō, Kyobashi, Tokyo, Japan, Mining Chemist.
1906. Ash, Chas. S., 180, Townsend Street, San Francisco, Cal., U.S.A., Chemist.
1908. Ashbury, J. W., c/o John Brown and Co., Ltd., Laboratory, Atlas Works, Sheffield, Chief Chemist.
1903. Ashley, Frank R., P.O. Box 1605, Denver, Colo., U.S.A., Manufacturing Chemist.
1900. Ashton, Jas., Rhodes Farm, Whitefield, Manchester, Chemist and Manager.
1890. Ashton-Bost, W. D., *See* Bost, W. D. Ashton.
1885. Ashwell, J. H., 117, Waterloo Crescent, The Forest, Nottingham, Bleacher and Dyer.
1894. Ashworth, Arthur, Feinhill Chemical Works, Bury, Lancs., Chemical Manufacturer.
1908. Ashworth, D. Irving, P.O. Box 38, Wappingers Falls, N.Y., U.S.A., Chemist.
1908. Asmus, Grover E., 4011, Hindson Boulevard, West Hoboken, N.J., U.S.A., Chemist.
1907. Aspey, Urban, jun., New Station Soap Works, School Close, and (Journals) 11, Neville Street, Leeds, Works Manager and Chemist.
1898. Aspinall, Thos., 62, Gilnow Road, Bolton, Analytical and Manufacturing Chemist.
1900. Aston, Bernard C., Agricultural Department, Wellington, New Zealand, Chemist.
1891. Atkins, C. E., Teigngrace, Bycullah Park, Enfield, N., Chronometer Maker.
1885. Atkinson, A. J., 44, Stuart Street, Cardiff, Analytical Chemist.
1900. Atkinson, Jno. W., Betteravia, Cal., U.S.A., Chemist.
1905. Atteaux, F. E., 176, Purchase Street, Boston, Mass., U.S.A., Dyestuff Importer.
- O.M. Attfield, Dr. J., F.R.S., Ashlands, Watford, Herts.
1900. Atwood, Frank W., 216, Milk Street, Boston, Mass., U.S.A., Chemist.
1895. Auchterlonie, Wm., c/o Clark Thread Co., Newark, N.J., U.S.A., Dyeworks Manager.
1907. Auchu, Henry, Emporium, Pa., U.S.A., Explosives Manufacturer.
1901. Auden, Dr. H. A., Westwood, Grassendale, Liverpool, Chemist.
1897. Auger, Chas. L., 425, Park Avenue, Paterson, N.J., U.S.A., Silk Dyer.
1902. Austin, J. H., Allscott, Wellington, Shropshire, Analytical Chemist.
1901. Auty, Albert M., c/o John Smith and Sons, Ltd., Field Head Mills, Bradford, Works Chemist.
1902. Avery, D., Working Men's College, Melbourne, Vic., Australia, Teacher of Chemistry.
1890. Aykroyd, H. E., Scatcliffe, Queen's Road, Ilkley, Yorks, Dyer.
1899. Aylsworth, Jonas W., 223, Midland Avenue, East Orange, N.J., U.S.A., Chemist.

B

1904. Babb, Edward E., 41, Central Wharf, Boston, Mass., U.S.A., Food Analyst.
1908. Babington, Fred. W., Customs Lab., Customs Dept., Ottawa, Canada, Analyst.
1895. Bacon, Nathaniel T., Peace Dale, Rhode Island, U.S.A., Chemical Engineer.
1897. Bacon, Wm., 4, New Court, Lincoln's Inn, W.C., Chemist.
1897. Badock, Stanley H., Holmwood, Westbury on Trym, near Bristol, Smelter.
1898. Baekeland, Dr. Leo, Snug Rock, North Broadway, Yonkers, N.Y., U.S.A., Manufacturing Chemist.
1902. Baer, Dr. Samuel H., 212, South 7th Street, St. Louis, Mo., U.S.A., Consulting Chemist.
1903. Bailey, Prof. E. H. S., The Library, Kansas State University, Lawrence, Kas., U.S.A., Professor of Chemistry.
1885. Bailey, Edwin M., Almond Hill, Pumphreston, Mid Calder, N.B., Technical Chemist.
1908. Bailey, F. W., Overstone, Robertson Road, Buxton.
1883. Bailey, Dr. G. H., Marple Cottage, Marple, Cheshire, Chemical Lecturer.
1903. Bailey, Harold J., Maritime Coke Works, Pontypriidd, S. Wales, Chemist.
1906. Bailey, Ralph W., 66, Cherry Street, Elizabeth, N.J., U.S.A., Chemist.
1888. Bailey, Dr. T. Lewis, 13, St. Alban's Road, Swansea, H.M. Inspector of Alkali Works.
1888. Bailey, Walter P., Empresa de Gas, 13, San Roque, Seville, Spain, Chemical Engineer and Manager.
1902. Bain, Prof. Jas. Watson, Faculty of Applied Science, The University, Toronto, Ont., Canada, Chemist.

1890. Baird, H. Harper, 14, Cross Street, Hatton Garden, London, E.C., Laboratory Furnisher.
1902. Baird, Dr. Julian W., Massachusetts College of Pharmacy, Boston, Mass., U.S.A., Professor of Chemistry.
1908. Baird, M. M., 18, Jedburgh Avenue, Rutherglen, Glasgow, Analytical Chemist.
1891. Baird, Wm., c/o Lewis Berger and Sons, Ltd., Homerton, N.E., Technical Chemist.
1895. Baird, W. Raymond, 271, Broadway, New York City, U.S.A., Patent Lawyer.
1890. Bairstow, John, Burley, Queen's Park, Chester, Chemical Works Manager.
1903. Baker, Arthur, 2, Carlton Avenue, Horns Cross, Greenhithe, Kent, Chemist.
1902. Baker, Chas. F., Technical College, Sunderland, Lecturer in Chemistry.
1901. Baker, F. Guy Stirling, Marryatt's Lodge, The Forest, Snaresbrook, Essex, Student.
1883. Baker, Harry, Epworth House, Moughland Lane, Runcorn, Analytical Chemist.
1899. Baker, H. Fenimore, c/o Thomsen Chemical Co., Baltimore, Md., U.S.A., President.
1904. Baker, John T., c/o J. T. Baker Chemical Co., Phillipsburg, N.J., U.S.A., Manufacturing Chemist.
1892. Baker, Julian L., Stainesbury Holt, Kingston Road, Staines, Brewing and Sugar Chemist.
1886. Baker, Theodore, Fabr. Nacional de Polyoro Piquete, Est. de Sao Paulo, Brazil, Analytical Chemist.
1898. Baldwin, Abram T., Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Manufacturer.
1903. Baldwin, F. H., Bergenport Chemical Works, Bayonne, N.J., U.S.A., Superintendent.
1903. Baldwin, Dr. H. B., 927, Broad Street, Newark, N.J., U.S.A., Chemist (Dept. of Public Health).
1903. Ball, S. F., Hull Avenue and 209th Street, New York City, U.S.A., Analytical Chemist.
1889. Ballantyne, Horatio, 75, Chancery Lane, London, W.C., Analytical and Consulting Chemist.
1903. Ballantyne, W. H., 111, Hatton Garden, London, E.C., Patent Agent's Assistant.
- O.M. Ballard, Edw. G., Greenfield Cottage, Hoole Village, Chester, Alkali Works Inspector.
1891. Ballinger, Jno., Free Library, Cardiff, Librarian.
- O.M. Bamber, H. K., 9, Victoria Street, London, S.W., Consulting Chemist.
1894. Bamber, H. K. G., Ingress House, Greenhithe, Kent, Cement Works Chemist and Manager.
1898. Bamford, Harry, 70, Duckworth Terrace, Bradford, Yorks, Dyer.
1905. Bampton, Geo. F., 39, Oliver Street, Boston, Mass., U.S.A., Chemist.
1906. Bancroft, John, Wilmington, Del., U.S.A., Bleacher and Dyer.
- O.M. Banister, H. C., Elmhurst, Blundellsands, near Liverpool, Chemical Works Manager.
1890. Banks, Jno. H., c/o Ricketts and Banks, 104, John Street, New York City, U.S.A., Mining Engineer.
1895. Bannan, John F., 59, Court Street, North Andover, Mass., U.S.A., Chemist (Woollen Mill).
- O.M. Bannister, R., 59, Tregunter Road, South Kensington, S.W., Analytical Chemist.
- O.M. Bannister, W., Burvale, Watford, Herts, Manufacturing Chemist.
1908. Barber, Percy S., Premier Portland Cement Co., Ltd., Irthlingborough, Wellingborough, Chemist.
1901. Barber, Capt. René R., Georgetown, Ont., Canada, Analytical Chemist.
1892. Barden, Alf., Far Bank, Shelley, near Huddersfield, Glue and Size Maker.
1907. Bardorf, C. F., c/o St. Lawrence Sugar Refining Co., Maisonneuve, P.Q., Canada, Chief Chemist.
1895. Bardwell, Fred L., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Assistant Professor of Chemistry.
1902. Barker, Hugh S., 32, Cumberland Avenue, Sefton Park, Liverpool, Laboratory Furnisher.
1895. Barlow, Clinton W., 103-105, Greene Street, New York City, U.S.A., Merchant.
1908. Barlow, Lt.-Col. Sir Hilary W. W. Bart., R.A., 84, Shooter's Hill Road, Blackheath, S.E., Superintendent (Royal Laboratory, Woolwich).
1901. Barlow, John J., 177, Manchester Road, Acerington, Calico Printer's Chemist.
1899. Barlow, Wm., 2, Delamere Street, Higher Openshaw, Manchester, Analytical Chemist.
1906. Barnes, A. G., Grassmoor Collieries, Chesterfield, Colliery Proprietor.
1891. Barnes, Edward A., Sandalen, Aasenijorden, Norway, Technical Chemist.
1901. Barnes, Fred., 1, Richmond Villa, London Road, Milton Regis, Sittingbourne, Kent, Paper Mill Chemist.
1905. Barnes, F. V., 44, Lucknow Avenue, Nottingham, Gas Works Chemist.
1884. Barnes, H. J., Phoenix Chemical Works, Hackney Wick, N.E., Manufacturing Chemist.
1884. Barnes, Jonathan, 301, Great Clowes Street, Manchester, Analytical Chemist.
- O.M. Barnes, Jos., Green Vale, Westhoughton, near Bolton, Lancashire, Analytical Chemist.
1902. Barnett, Marcus S., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Sugar Works Chemist.
1897. Barnett, Robt. E., 9, Virginia Road, Leeds, Headmaster (Leeds Technical School).
1901. Baron, Wm. Briscoe, c/o The Fuel Saving and Water Treating Co., Ltd., 2, Booth Street, Albert Square, Manchester, Chemist.
- O.M. Barr, J., Dinting Vale, Dinting, near Manchester, Chemical Manager.
1905. Barraclough, C. E., 2, Wood View Terrace, Manningham, Bradford, Chemist.
1890. Barraclough, Wm. H., Beechwood, Mortomley, near Sheffield, Analytical Chemist.
1896. Barratt, J. Treeby, Bronheulog, Mostyn, North Wales, Chemist and Manager.
1890. Barrett, Arthur A., 30, Endwell Street, Brockley, S.E., Manufacturer of Essential Oils.
1907. Barrett, John H., 215, Carlton Street, Toronto, Canada, Superintendent.
1907. Barrett, Maurice, The Leeds Fireclay Co., Ltd., Burmantofts Works, Leeds.
1890. Barrie, D. McLaurin, P.O. Box 193, Germiston, Transvaal, Metallurgist.
1900. Barrow, Jos., 13, The Grove, Beblington, Cheshire, Chemist.
1906. Barrs, Chas. E., 20, Carlingford Road, Hampstead, N.W., Analyst.
1905. Barry, Eugene, Ayer, Mass., U.S.A., Leather Manufacturer.
1893. Barton, G. E., c/o Whitall, Tatum, and Co., Flint Glass Works, Millville, N.J., U.S.A., Technical Chemist.
1903. Bartripp, Geo. F., 20, Grove Road, Wanstead, Essex, Analytical Chemist.
1905. Baruch, Edgar, 945, South Olive Street, Los Angeles, Cal., U.S.A., Chemical Engineer.
1895. Baskerville, Dr. Chas., College of the City of New York, New York, U.S.A., Professor of Chemistry.
1884. Bassett, H., 26, Belitha Villas, Barnsbury, N.
1908. Bassett, Henry, jun., Chemical Department, University of Liverpool, Assistant Lecturer.
1899. Bassett, Wm. H., 146, Litchfield Street, Torrington, Conn., U.S.A., Chemist.
1890. Bate, William, Upton Villa, Hayle, Cornwall, Technical Chemist (National Explosives Co., Ltd.).
1903. Bateman, A. H., 34, Bridge Avenue, Hammersmith, W., Chemist.
1885. Batty, R. B., Wharncliffe, Erdington, near Birmingham, Nickel Works Manager.
1903. Baty, E. J., 130, Edmund Street, Birmingham, Chemist.
1903. Bauer, Geo. W., 632, Sacramento Street, San Francisco, Cal., U.S.A., Vice-President and Chemist (Hop and Malt Co.).
1900. Baur, Jacob, 67, Wells Street, Chicago, Ill., U.S.A., Liquid Carbonic Acid Manufacturer.
1898. Baxter, John G., Riverview, Burch Road, Rosherville, Gravesend, Kent, Chemist.

- O.M. Baxter, W. H., Nuthurst, High Road, Streatham, S.W., Brewery Director.
1899. Bayly, Francis W., Church Cobham, Surrey, Assayer.
1904. Bayly, Harold G., Moatside, Bedford, Analytical Chemist.
1908. Bayly, Percival G. W., Mines Dept. Lab., Spring Street, Melbourne, Victoria, Government Metallurgical Chemist.
1897. Beadle, Alec A., Wenden, Dawlish, South Devon, Electro-Chemist.
1886. Beadle, Clayton, Halewood, Sidcup, Kent, Consulting Chemist.
1909. Beal, J. H., Scio, Ohio, U.S.A., Professor of Pharmacy.
1908. Bealey, Herbert C., c/o A. C. Bealey and Son, Radcliffe, near Manchester, Bleacher and Chemical Manufacturer.
- O.M. Beanes, E., Moatlands, Paddock Wood, Kent, Manufacturing Chemist.
1908. Beardmore, Walter W., Acton West, Ont., Canada, Leather Tanner.
1907. Beardsley, Dr. Alling P., 165, Minerva Street, Derby, Conn., U.S.A., Chemist (New Haven Gas Co.).
1908. Beasley, Fred. G., 44, Green Street, Smethwick, near Birmingham, Metallurgical Chemist.
1905. Beasley, Jno. K., c/o The Broomassie Mines, Ltd., Broomassie, Gold Coast Colony, W. Africa, *via* Lekondi, Metallurgical Chemist.
1883. Beaven, E. S., 5, Boreham Terrace, Warminster, Wilts, Maltster.
1897. Beaver, Chas. J., Holme Lea, Ashley Road, Hale, Cheshire, Chemist.
1905. Beckers, Dr. Wm., 117, Hudson Street, New York City, U.S.A., Chemist.
- O.M. Beckett, G. H., Hartford, 35, South Beach Avenue, Ardrossan, Scotland, Analytical Chemist.
1898. Beckett, Jos. H., 41, Serpentine Road, Egremont, Cheshire, Analytical Chemist.
1899. Bedford, Alf. C., 26, Broadway, New York City, U.S.A., Chemical Merchant.
1891. Bedford, Chas. S., Rocella, Weetwood, Headingley, Leeds, Manufacturing Chemist.
1891. Bedford, Jas. E., Messrs. Wood and Bedford, Airedale Chemical Works, Leeds, Manufacturing Chemist.
- O.M. Bedson, Prof. P. Phillips, Armstrong College, Newcastle-on-Tyne, Professor of Chemistry.
1901. Beevers, Clifford J., c/o Brotherton and Co., Ltd., Holmes Street, Dewsbury Road, Leeds; and (Jnls.) 12, Parish Ghyll Road, Ilkley, Yorks, Analyst.
1899. Behr, Dr. Arno, 432, Arlington Court, Pasadena, Cal., U.S.A., Chemist.
1903. Behrend, F., 54, Front Street, New York City, U.S.A., Importer of Chemical Stoneware.
- O.M. Beilby, Dr. George T., F.R.S., 11, University Gardens, Glasgow, Chemical Engineer.
1906. Belden, A. W., Fuel Testing Plant, U.S. Geological Survey, Denver, Colo., U.S.A., Coke Expert.
1906. Bell, H. N., Tay Street, Invercargill, New Zealand, Company Manager.
1884. Bell, Sir Hugh, Bart., Middlesbrough-on-Tees, Soda and Iron Manufacturer.
1900. Bell, Hugh P., 17, Tothill Street, Westminster, S.W., Chemist.
- O.M. Bell, J. Carter, Bank House, The Cliff, Higher Bronghton, Manchester, Public Analyst.
1886. Bell, J. Ferguson, Derby Gas Light and Coke Co., Derby, Gas Engineer.
1907. Bell, Marcus, Explosives Dept., 423, Flinders Lane, Melbourne, Victoria, Chemist.
1905. Bell, Miss M. M., Tulane University Library, New Orleans, La., U.S.A., Librarian.
1903. Bell, P. Carter, Millburn, N.J., U.S.A., Chemical Manufacturer.
1902. Bement, Alberto, 2114, Fisher Building, Chicago, Ill., U.S.A., Consulting Mining Engineer.
- O.M. Bendix, D., 371, Romford Road, Forest Gate, E., Managing Chemist, British Alizarin Co., Ltd.
1897. Benfey, Dr. Hans, 65, Birchfields Road, Rusholme, Manchester, Manufacturing Chemist.
1907. Bengough, Guy D., The University, Liverpool, Lecturer on Metallurgy.
1903. Benham, Keith, Deans Hill, Stafford, Analytical and Consulting Chemist.
1902. Benjamin, Albert, Springbrook Works, Middleton Road, Oldham, Bleach and Dyeworks Manager.
- O.M. Benjamin, Dr. M., Smithsonian Institution, Washington, D.C., U.S.A., Consulting Chemist.
1908. Benkert, Arthur L., c/o Cassella Color Co., 182, Front Street, New York City, U.S.A., Chemist and Salesman.
1904. Benn, R. H. D., 16, Springfield Avenue, Westmount, Montreal, Canada, Analytical Chemist.
1899. Bennett, Alex. H., c/o G. H. Ogston & Moore, Catania, Sicily, Chemist.
1901. Bennett, Arnold, c/o Montreal Steel Works, Ltd., St. Patrick Street, Montreal, Canada, Chemist.
1907. Bennett, H. Garner, Leather Industries Dept., The University, Leeds, Leather Chemist.
1902. Bennie, P. McN., P.O. Box 29, Niagara Falls, N.Y., U.S.A., Consulting Chemist.
1909. Benson, George F., Edwardsburg Starch Co., 164, St. James Street, Montreal, Canada, President and Managing Director.
1906. Benson, Richard W., c/o Geo. Craddock & Co., Wakefield, Yorks, Analytical Chemist.
1905. Bentley, Prof. W. B., 42, Morris Avenue, Athens, Ohio, U.S.A., Professor of Chemistry.
1901. Bentley, Wm. H., 12, Cromwell Terrace, Irlam, near Manchester, Technical Chemist.
1890. Bentz, Ernest, 107, Shaw Lane, Dinting, near Manchester, Lecturer on Dyeing.
1905. Berge, Henry vom, c/o Schoellkopf & Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Manager.
1884. Beringer, J. J., Basset Road, Camborne, Cornwall, Metallurgist.
1893. Berk, Fred. W., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.
1907. Berk, Paul F., 1, Fenchurch Avenue, London, E.C.,
1908. Berlinerblau, Dr. Joseph, 8, Szpitalna Street, Warsaw, Russian Poland, Industrial Chemist.
1900. Bermingham, Jno., jun., Room 317, Union Trust Building, San Francisco, Cal., U.S.A., Superintendent.
1889. Bernard, Jas., jun., Ranipet, North Arcot, Madras Presidency, India; and (Jnls.) c/o Chas. Hadfield, Viaduct House, Dinting, near Manchester, Chemical Works Manager.
1897. Berry, Albert E., Ontario, Snarebrook, Essex, Works Manager.
1906. Berry, Arthur J., 5, University Gardens, Glasgow, Student of Chemistry.
1883. Berry, E. E., Bordighera, Italy, and (Journals) c/o C. H. Grinling, 17, Rectory Place, Woolwich, S.E., Technical Chemist.
1889. Berry, G. F., 9, Musgrove Road, Jerningham Road, New Cross, S.E., Chemical Works Manager.
1903. Berry, W. G., 329, West 83rd Street, New York City, U.S.A., Chemist.
1909. Beskow, K. J., Skanska Superfosfat och Svofvelsyre Fabriks A.B., Helsingborg, Sweden, Head Engineer.
1886. Best, Dr. T. T., Hardshaw Brook Chemical Works, St. Helens, Lancashire, Technical Chemist.
1907. Bettermann, Heinrich, Doemitz-on-Elbe, Germany, Explosives Works Manager.
1901. Betts, Anson G., Troy, N.Y., U.S.A., Chemist.
- O.M. Bevan, E. J., 4, New Court, Lincoln's Inn, London, W.C., Public Analyst and Consulting Chemist.
1900. Bevan, Jno. W., Risedale, St. James' Crescent, Swansea, Manager of Metallurgical Works.
- O.M. Beveridge, Jas., c/o Miramichi Pulp and Paper Co., Ltd., Chatham, N.B., Canada, Pulp and Paper Manufacturer.
1909. Bewick, R. M., c/o United Alkali Co., Ltd., 30, James Street, Liverpool, Traveller.
1898. Bhattacharyya, Haripada, Gun and Shell Factory, Ishapore, Bengal, India, Chemist.

1902. Biach, Dr. Ludwig K., 223, Central Avenue, Norwich, Conn., U.S.A., Chemist and Colorist.
1907. Bianchi, Harold, c/o L. M. Booth Co., 136, Liberty Street, New York City, U.S.A., Analytical Chemist.
1896. Bibby, John, c/o J. Bibby & Sons, Formby Street, Liverpool, Chemist.
- O.M. Bickerdike, W. E., Bryer's Croft, Wiltshire, near Blackburn, Manufacturing Chemist.
1907. Bickerstaffe, Robt., c/o Thomas and Green, Ltd., Soho Mills, Woodburn Green, S.O., Bucks., Chemist.
1901. Bielecki, Dr. Jan, 66, Krakowski Przedmieście, Warsaw, Poland, Chemist.
1908. Bierbaum, E. C., Monona, Iowa, U.S.A., Assayer.
1903. Bierwirth, L. W., P.O. Box 863, Rio de Janeiro, Brazil, Civil Engineer.
1884. Biggart, J. Wm., 29, Cathcart Street, Greenock, N.B., Analytical Chemist.
1891. Biggart, Wm. L., Rossarden, Kilmalcolm, N.B., Public Analyst.
- O.M. Biggs, B., 110, Cannon Street, London, E.C., Chemical Merchant.
- O.M. Billing, H. S., 42, Kingsley Road, Mutley, Plymouth, Analytical and Managing Chemist.
1896. Billings, Edgar F., 178, Freeport Street, Dorchester, Mass., U.S.A., Manufacturing Chemist.
1896. Billington, Chas., jun., Heimath, Porthill, Longport, Staffordshire, Metallurgist.
1903. Binns, John H., Thornfield, Mystic Pond, Methuen, Mass., U.S.A., Dyer and Finisher.
1896. Bird, Arthur W., c/o S. Berger & Co., Bromley-by-Bow, E., Works Engineer.
1907. Bird, Charles S., jun., East Walpole, Mass., U.S.A., Paper Maker.
1896. Bird, Jno. B., Minver House, 61, Bateman Street, Cambridge, Manure Manufacturer.
1907. Bird, Dr. R. M., University of Virginia, Charlottesville, Va., U.S.A., Professor of Chemistry.
1895. Bird, Wm. R., (communications) 125, Goddard Avenue; (Journals) Laboratory, G.W.R. Works, Swindon, Wilts, Analytical Chemist.
1902. Bird, W. Robt., 217, Newport Road, Cardiff, Oil Merchant.
1885. Birley, R. K., c/o Chas. Macintosh and Co., Ltd., Cambridge Street, Manchester, India-rubber Manufacturer.
1883. Bishop, A. Conway, Three Mills Lane, Bromley-by-Bow, E., Manufacturing Chemist.
1884. Bishop, Fred, c/o Burmah Oil Co., P.O. Box 67, Rangoon, Burmah, Technical Chemist.
1903. Bishop, Howard B., 609, Greene Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1903. Bishop, J. T. F., Chemical Club, Victoria Hotel, Manchester, Secretary.
1905. Bixby, Willard G., 194, Hester Street, New York City, U.S.A., Blacking Manufacturer.
1905. Bjerregaard, August P., Box 322, Las Cruces, New Mexico, U.S.A., Farmer.
1904. Black, J. Wyclif, 20, Mardale Crescent, Edinburgh, Analytical Chemist.
1902. Black, W. Geoffrey, St. John's House, Christchurch Road, Norwich, Chemist.
1908. Blackhall, Bertram, 48, Frontenac Street, Kingston, Ontario, Canada, Manufacturing Chemist.
1894. Blackmore, H. S., 612 F. Street, N.W., Washington, D.C., U.S.A., Industrial Chemist.
1896. Blagden, Victor, 50-51, Lime Street, London, E.C., Chemical Merchant.
1883. Blagden, W. G., The Manor House, Harting, near Petersfield, Chemical Merchant.
1897. Blair, Andrew A., 406, Locust Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
1884. Blake, Jas., Thames Sugar Refinery, Silvertown, E., Manager.
1890. Blakey, A. J., Dudbridge Mills, Stroud, Gloucestershire, Dyer.
1893. Blears, John, c/o Langworthy Bros. and Co., Ltd., Greengate Mills, Salford, Dyer and Calico Printer.
- O.M. Bles, A. J. S., 32, Chorlton Street, Manchester, Chemical Merchant.
1908. Blichfeldt, S. H., Cross Deep, Osterley Park Road, Southall, Middlesex, Bacteriologist and Fermentation Chemist.
1905. Bliss, H. J. W., c/o The Thames Varnish Co., Island Wharf, Rainham, Essex, Chemist.
1889. Bloeder, Victor G., Station D., Baltimore, Md., U.S.A., Manufacturing Chemist.
1908. Blomeley, Adam Y., Canada Sugar Refinery, Ltd., Montreal, Canada, Chemist.
1891. Bloomer, Fred. J., Penpont, Clydach, R.S.O., Glamorgan, Nickel Works Manager.
1886. Blount, Bertram, Laboratory, 76 and 78, York Street, Westminster, S.W., Analytical Chemist.
1888. Bloxam, A. G., 105, Birkbeck Bank Chambers, Holborn, W.C., Chemist and Patent Agent.
1890. Bloxam, W., Popplewell, Clothworkers Research Laboratory, The University, Leeds, Research Chemist.
1903. Blumenthal, Lionel, The Lindens, Stanley Road, Broughton Park, Manchester, Chemist.
1886. Blundstone, E. R., 77, York Street, Westminster, S.W., and (Journals) Heathfield, Park Road, Hampton Hill, Middlesex, Consulting Chemist.
1908. Blyth, Jas. R., c/o Penketh Tannery Co., Penketh, near Warrington, Leather Trades Chemist.
1906. Blyth, M. Wynter, The Lodge, Ardsley, near Barnsley, Yorks, Analytical and Consulting Chemist.
1905. Blyth, Thomas R., Uphall Chemical Works, Ilford, Essex, Analytical Chemist.
1908. Blythe, Fred. C., Holland Bank, Church, Lancashire, Chemical Manufacturer.
- O.M. Boake, A., Warton Road, Stratford, E., Manufacturing Chemist.
1888. Boake, Edmund J., Aberffraw, Nursery Road, Loughton, Essex, Manufacturing Chemist.
1899. Boehm, Fred., 16, Jewry Street, London, E.C., Chemical Agent and Merchant.
1898. Bogert, Prof. Marston T., Department of Organic Chemistry, Columbia University, New York City, U.S.A., Instructor in Organic Chemistry.
1903. Boissevain, Chas. E. H., 92, van Eeghenstraat, Amsterdam, Holland, Chemical Manufacturer.
1903. Bolam, Dr. H. W., 2, Summerfield, Leith, N.B., Lecturer on Chemistry.
1907. Boley, Walter, Uerdingen am Rheiu, Germany, Manufacturing Chemist.
1901. Bolton, E. Richards, 16, Flanchford Road, Ravenscourt Park, W., Manufacturing Chemist.
1905. Bond, John, Crowlands, Southport, Engineer.
1905. Bond, Josiah, Patagonia, Arizona, U.S.A., Mining Engineer.
1905. Bone, Dr. W. A., F.R.S., West House, Lidgett Park Road, Roundhay, Leeds, Lecturer in Chemistry and Metallurgy.
1892. Bookman, Dr. S., 9, East 62nd Street, New York City, U.S.A., Chemist.
1888. Boor, Leonard G., 21, Mincing Lane, London, E.C., Chemical Merchant.
1896. Boot, John C., Engineer's Office, Delft, Holland, Chemist.
1908. Booth, Jos. W., Atlantic Mills, Providence, R.I., U.S.A., Superintendent.
1904. Booth, N. Parr, Laboratory, Cadbury Bros., Ltd., Bournville, near Birmingham, Chemist.
1894. Booth, Robt., 110, Cannon Street, London, E.C., Engineer.
1891. Boothby, Chas., Box 1127, G.P.O., Sydney, N.S.W., Chemist.
1903. Boral, Robin, Rhodes Mount, Rhodes, near Manchester, Works Manager.
1897. Borland, C. R., P.O. Box 683, Concord, Mass., U.S.A., Smokeless Powder Manufacturer.
- O.M. Borland, W. D., Beacon Lodge, Bean, via Dartford, Kent, Manufacturer of Explosives.
1906. Bornett, S., Andreaskloster 12, Köln, Germany, Technical Chemist.
1903. Boroschek, Dr. L., 24, West 82nd Street, New York City, U.S.A., Chemist.
1908. Bose, R., 92/5, Upper Circular Road, Calcutta, India, Chemical Works Manager.

1903. Bossi, Dr. Arnold L., Arnold Print Works, North Adams, Mass., U.S.A., Assistant Manager.
1890. Bost, W. D. Ashton, Cartvale Chemical Works, Paisley, N.B., Chemical Manufacturer.
- O.M. Bothamley, C. H., Weston-super-Mare, Somerset, County Director of Technical Instruction.
1890. Bott, Dr. W. Norman. *See* Norman-Bott, Dr. W.
1884. Böttger, Dr. H. T., Elberfeld, Germany; and (subs.) c/o The Bayer Co., Ltd., 19, St. Dunstan's Hill, E.C., Colour Manufacturer.
1901. Bottomley, Dr. J. Frank, c/o The Thermal Syndicate, Ltd., Neptune Road, Wallsend-on-Tyne, Consulting Chemist.
1906. Bottomley, W., c/o The United Alkali Co., Ltd., Fleetwood Salt Works, Fleetwood, Engineer.
- O.M. Boulton, H. E., 64, Cannon Street, London, E.C., Chemical Manufacturer.
- O.M. Boulton, Sir Samuel B., Bart., 64, Cannon Street, London, E.C., Chemical Manufacturer.
1883. Boulton, T. S., 14, Freegrove Road, Caledonian Road, N., Manager.
1905. Bourne, Lyman M., 820, Nostrand Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1906. Boutwell, Arthur T., c/o Smith & Dove Manufacturing Co., Andover, Mass., U.S.A., Bleacher and Dyer.
1904. Bowden, Thos., 87, Todmorden Road, Littleborough, Lancs., Dyer and Chemist.
1905. Bowen, Henry, 28, Norwood Avenue, Buffalo, N.Y., U.S.A., Secretary.
1906. Bowen, Ralph A., c/o National Aniline & Chemical Co., 36, Purchase Street, Boston, Mass., U.S.A.
1885. Bowen, S. B., Brickfield Chemical Works, Llanelli, South Wales, Chemical Manufacturer.
1888. Bower, Frank, Brewery House, Spitalfields, E., Analytical Chemist.
1897. Bower, Wm. H., 29th Street and Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemical Manufacturer.
1906. Bowers, H. L., Port Hope, Ontario, Canada, Chemist and Metallurgist.
1892. Bowes, Harry, Staveley, Broomfield Road, Heaton Moor, Stockport, Analytical Chemist.
1889. Bowing, Juo., Church Walk, Wandsworth, S.W., Consulting Chemist.
1883. Bowley, Jos. John, Wellington Works, Battersea Bridge, and (Journals) 64, Redcliffe Gardens, London, S.W., Chemical Manufacturer.
1899. Bowley, J. Plunkett, 63, Beaufort Mansions, Chelsea, London, S.W., Varnish Manufacturer.
1883. Bowman, Dr. F. H., 4, Albert Square, Manchester, Chemical Manufacturer.
1908. Bowman, Fred. C., c/o Nichols Chemical Co., Tweed, Ont., Canada, Chemist.
1894. Bowman, Jas. H., 509, Ontario Street, London, Ont., Canada, Chemist.
1884. Bowman, R., c/o Bowman's Ltd., Lytchgoe's Lane, Warrington, Chemical Manufacturer.
1907. Bowman, Richard S., The Cerebos Works, Greatham, *via* Stockton-on-Tees, Chemist.
1896. Bowman, Walker, 39, Cortlandt Street, New York City, U.S.A., Chemist.
1904. Boyce, Framroze H., near Fire Brigade Station, Fort, Bombay, India, Technical Chemist.
1893. Boyce, Frank, c/o Goodall, Backhouse, and Co., White Horse Street, Leeds, Technical Chemist.
- O.M. Boyd, W., Mine Office, Frankfort, Pilgrim's Rest, Transvaal, Technical Chemist.
1899. Boyes, Herb. J., c/o Boyes & Kirk, Fabrica de Tecidos, Belemzinho, Sao Paulo, Brazil, Chemist.
1905. Brabrook, G. Hale, Box 333, Taunton, Mass., U.S.A., Manufacturer.
1906. Bracegirdle, Harold W., 13, Alan Road, Withington, Manchester, Chemist.
1885. Bradburn, J. A., 311, Montgomery Street, Syracuse, N.Y., U.S.A., Manufacturing Chemist.
1902. Bradbury, S., Ferncliffe, Milton Grove, Glebelands Road, Ashton-on-Mersey, Chemist.
1895. Bradford, Henry, Pampas Cottage, Goodwood, Chichester, Analytical Chemist.
1896. Bragg, Everett B., 1838, Chicago Avenue, Evanston, Ill., U.S.A., Manufacturing Chemist.
1891. Braithwaite, Isaac, Holly Croft, Kendal, Westmoreland, Drysalter.
1897. Braithwaite, Jno. O., Holme Lacey, Warren Road, Chingford, Essex, Pharmaceutical Research Chemist.
1903. Brance, J. S. S., 67, Coleraine Road, Blackheath, S.E., Demonstrator in Chemistry.
- O.M. Brannham, W., Bank Chambers, 300, Mare Street, Hackney, N.E., Chemical Engineer.
- O.M. Bramwell, G. H., Cowley Hill, St. Helens, Lancashire, Alkali Manufacturer.
1904. Brandeis, R., Oesterreichischer Verein f. Chem. und Metall. Produkte, Aussig, Austria, Chemical Manufacturer.
1902. Branegan, Jas. Aug., 555, North 16th Street, Philadelphia, Pa., U.S.A., Chemical Salesman.
- O.M. Branson, F. W., Wynneholme, Far Headingley, Leeds, Pharmaceutical Chemist.
1903. Brassard, Fred. A., 46, Vicar Lane, Bradford, Yorks, Aniline Dyestuff Importer.
1901. Brearley, Harry, c/o The Amalgams Co., Ltd., Attercliffe Road, Sheffield, Analytical Chemist.
1906. Breckenridge, John E., American Agricultural Chemical Co., Carteret, N.J., U.S.A., Chemist.
1888. Breffitt, Wm., Glasshoughton, Castleford, Yorks, Glass Manufacturer.
1908. Bregowsky, Ivan M., c/o Crane Co., 519, South Canal Street, Chicago, Ill., U.S.A., Chemist.
1905. Brettell-Vaughan, E., 22, Vardens Road, Battersea, S.W., Storage Battery Analyst.
1900. Brewis, E. T., 31, Belgrave Road, Leyton, E., Chemist.
1894. Breyer, Theodor, 603, Central Avenue, Wilmette, Ill., U.S.A., Chemist.
1885. Briant, L., 24, Holborn Viaduct, London, E.C., Analytical Chemist.
1890. Brierley, J. T., Highfield, Golden Hill, Leyland, near Preston, Lancs., Analytical Chemist.
1894. Briggs, J. Burnett, Vauxhall Soap Works, 6, Blackstock Street, Liverpool, Soap Manufacturer.
1893. Briggs, J. F., 2, Frankfort Road, Herne Hill, S.E., Technical Chemist.
1885. Briggs, T. Lynton, 188, Central Avenue, Flushing, Long Island, N.Y., U.S.A., Technical Chemist.
1905. Bristol, Dr. H. Stanley, U.S. Dept. of Agriculture, Forest Service, Washington, D.C., U.S.A., Chemist.
1886. Bristow, G. W., c/o Walter J. Crook, 10, Eastcheap, London, E.C., Chemical Manager.
1887. Broadbent, H., c/o Goodall, Backhouse, and Co., Sovereign Street, Leeds, Chemist.
1896. Broadhurst, W. Homer, 290, Lafayette Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1889. Brock, Arthur, Firework Factory, Sutton, Surrey, Firework Manufacturer.
- O.M. Brock, J., Gwern-Tyno, Colwyn Bay, North Wales, Chairman of United Alkali Co., Ltd.
1896. Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer.
1900. Brooke, Jno. R., Government Laboratory, Singapore, S.S., Chemist.
1884. Brookes, E. A., c/o The Chilian Mills Co., Ltd., Chiguayante, Concepcion, Chile, Chemist.
1895. Brookman, Fred. W., 6, West Street, Rochdale, Manure Works Manager.
1906. Brooks, Cecil J., c/o The Borneo Co., Ltd., Kuching, Sarawak, Metallurgist.
1907. Broome, James S., 18, Seedley Park Road, Pendleton, Manchester, Science Lecturer.
1901. Broome, Jos., 5, Webster Terrace, Roselle Park, N.J., U.S.A., Chemical Engineer.
1909. Brothers, Wm., S. Mayfield Road, Kersal, Salford, Chemical Manufacturer.
- O.M. Brotherton, E. A., M.P., Commercial Buildings, Leeds, Ammonia Distiller.
1884. Brown, Prof. A. Crum, F.R.S., S. Belgrave Crescent, Edinburgh, Professor of Chemistry.
1905. Brown, Prof. Adrian J., West Heath House, Northfield, near Birmingham, Professor of Brewing.

1892. Brown, A. H. M., 133, Kent Street, London, Ont., Canada, Metallurgist.
1891. Brown, Cesar R., 23, Gower Road, Forest Gate, E., Works Foreman.
- O.M. Brown, D., 93, Abbey Hill, Edinburgh, Chemical Manufacturer.
- O.M. Brown, D., Donaghmore, Tyrone, Ireland, Soap Manufacturer.
1890. Brown, Edw. Hilton, c/o W. Ropes and Co., St. Petersburg, Russia, Analytical Chemist.
1903. Brown, Frank C., P.O. Box 211, Framingham, Mass., U.S.A., Foreman.
1908. Brown, Francis Hammar, Wootton Wawen, Warwickshire, Engineer.
1894. Brown, Geo. E., c/o "The British Journal of Photography," 21, Wellington Street, Strand, London, W.C., Chemist.
1906. Brown, Harry E., Room 917, Du Pont Building, Wilmington, Del., U.S.A., Chemist.
1905. Brown, Hawthorne J., 507, Mansion House Chambers, Queen Victoria Street, London, E.C., Paper Maker.
- O.M. Brown, Henry, Benskin's Brewery, Watford, Herts., Brewing Chemist.
1899. Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.
- O.M. Brown, Dr. Horace T., F.R.S., 52, Neven Square, Kensington, S.W., Brewing Chemist.
1905. Brown, Hugh B., c/o Jas. Robertson & Sons, Ltd., Thrushgrove Works, Paisley, Chemist.
- O.M. Brown, Dr. J. Campbell, 8, Abercromby Square, Liverpool, Professor of Chemistry.
1891. Brown, J. Henry, Minas d'Aljustrel, Alemtejo, Portugal, Technical Chemist.
1901. Brown, Jos., Ashleigh House, Saville Town, Dewsbury, Manufacturing Chemist.
1905. Brown, Nicol, 4, The Grove, Highgate, N., Mining Director.
1906. Brown, Percy S., c/o Western Electric Co., West and Bethune Streets, New York City, U.S.A., Chemist.
1892. Brown, Reginald B., c/o Badische Co., Ltd., 2, Samuel Ogden Street, Manchester, Technical Chemist.
1889. Brown, Robt., The Firs, Hartford, Northwich, Engineer.
1901. Brown, Samuel B., Ruthven, Bowden Lane, Marple, Cheshire, Calico Printer.
- O.M. Brown, Walter, c/o Jas. H. Dennis and Co., Ltd., Widnes, Technical Chemist.
1900. Brown, Walter B., Victor Chemical Works, 89, Board of Trade Building, Chicago, Ill., U.S.A., Chemist and General Superintendent.
1901. Browne, Dr. Arthur L., 213, Cortland Street, Baltimore, Md., U.S.A., Analytical Chemist.
1906. Browne-Cave, E. J. C., "Strathallan," Bootle, Liverpool, Works Chemist.
1905. Browning, Prof. K. C., Medical College, Colombo, Ceylon, Professor of Chemistry.
- O.M. Browning, W., Broad Oak, Accrington, Calico Printer.
1901. Brownlie, David, 31, India Street, Alexandria, Dumbartonshire, Chemist.
1902. Brownrigg, Marcus P., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1902. Brownson, Dr. H. W., King's Norton Metal Co., Ltd., Abbey Wood, Kent, Works Chemist.
1902. Bruce, Alex., Laboratory, Hyde Park Corner, Colombo, Ceylon, Chemist.
1908. Bruce, Robert, 44, High Street, Leven, Fifeshire, Works Chemist.
1900. Bruce, Wm. T., 3, Lombard Court, London, E.C., Director.
1892. Bruckmann, G. T., 109, 22nd Street, West New York, N.J., U.S.A., Chemical Engineer.
1905. Bruinier, A. G., 534, Canal Street, New York City, U.S.A., Agent for Kalle and Co.
- O.M. Brunner, H., Holly Mount, Tarboek Road, Huyton, near Liverpool, Chemical Manufacturer.
1894. Brunner, H. Bertram, The Hollies, Hartford, Cheshire, Chemist and Electrician.
1887. Brunner, J. F. L., M.P., c/o Brunner, Mond and Co., Ltd., 39, Victoria Street, London, S.W., Chemical Manufacturer.
- O.M. Brunner, Sir J. T., Bart., M.P., Silverlands, Chertsey; and (Journals) c/o Brunner, Mond and Co. Ltd., Northwich, Cheshire, Chemical Manufacturer.
1902. Brunner, Roscoe, The Winnington Hall Club, Winnington, Northwich, Alkali Manufacturer.
1894. Bruntun, J. Dixon, Wire Mill, Musselburgh, N.B., Wire Manufacturer.
1904. Bryant, Arthur P., c/o Clinton Sugar Refining Co., Clinton, Iowa, U.S.A., Chemist.
1903. Bryant, V. Seymour, Trelawne, Crowthorne, Berks., Analytical Chemist.
1908. Bryce, Chas. C., 43-45, Great Tower Street, London, E.C., Merchant.
1905. Bryce, Clarence H., c/o Benj. Moore and Co., 244, Water Street, Brooklyn, N.Y., U.S.A., Factory Superintendent.
1894. Bryce, Thos., Tharsis Mines, Huelva, Spain, Chemist.
1897. Bryson, Jas., Pumphorston Oil Works, Midcalder, N.B., Oil Works Manager.
1892. Buchanan, D. G., (Subs.) 40, St. Vincent Place, Glasgow, and (Journals) c/o La Asociacion Salitrera de Propaganda, Iquique, Chili, Analyst.
1908. Buchanan, Duncan G., 24, Gwynne Avenue, Parkdale, Toronto, Canada, Chemist (Rubber Works).
1904. Buchanan, E. F., 128, East Crescent Street, Marquette, Mich., U.S.A., Chemist.
1888. Buchanan, Jas., Caledonia Foundry, Brasenose Road, Liverpool, Engineer.
1904. Buchanan, John L., 3, The Wiend, Lower Bebington, Cheshire, Analytical Chemist.
1901. Buchanan, Joshua D., c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Chemist.
1897. Buck, Chas. A., 521, Locust Street, South Bethlehem, Pa., U.S.A., Chief Chemist (Bethlehem Iron Co.).
1906. Buckie, Robert H., c/o West Virginia Paper and Pulp Co., Mechanicville, N.Y., U.S.A., Works Chemist.
1909. Buggy, Thos., Butte, Montana, U.S.A., Assayer and Chemist.
1900. Bull, Dr. Benjamin S., 104, Humber Road, Blackheath, S.E., Technical Chemist.
1902. Bull, Irving C., 100, Maiden Lane, New York City, U.S.A., Chemist.
1899. Bull, Herbert J., 18, Billiter Street, London, E.C., Chemist.
1907. Bult, Stanley R., 18, Billiter Street, London, E.C., Chemist.
- O.M. Bumby, H., Coltness Ironworks, Newmains, N.B., Ironworks Manager.
- O.M. Bunker, H. E., 19, Napier Street, Toronto, Ont., Canada, Technical Chemist.
1901. Bunting, Henry H., Oficina de Ensayes F. C. C. del P., Callao, Peru, Analyst.
1894. Bunting, W., Lightfoot, Forest Bank, Crawshawbooth, near Manchester, Calico Printer.
1893. Burbridge, Jas., India-rubber Mills, Tottenham, N., India-rubber Manufacturer.
1886. Burdekin, G., jun., 10, Clifton Terrace, St. Helens, Lancashire, Chemical Works Manager.
1896. Burford, Samuel F., Beechworth, Stoneygate Road, Leicester, Analytical Chemist.
1889. Bürger, Dr. J. L., Birch Avenue, Talbot Road, Old Trafford, Manchester, Technical Chemist.
1901. Burgess, Prof. C. F., University of Wisconsin, Madison, Wis., U.S.A., Electro-chemical Engineer.
1889. Burgess, Geo., Pitville, Hale Road, Ditton, Widnes, Chemist.
1889. Burgess, Wm. T., 26, Priory Road, Bedford Park, London, W., Analytical Chemist.
1902. Burkard, Dr. Ernst, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1899. Burkhardt, Dr. G. A., c/o Bohrgesellschaft Erkelenz, Erkelenz, Rheinland, Germany, Chemist.
1897. Burland, Lt.-Col. Jeffrey H., 824, Sherbrooke Street, Montreal, Canada, Paper and Card Manufacturer.

1897. Burls, Frank B., 4, Dyer's Hall Road, Leytonstone, Essex, Chemist.
1898. Burls, Herbert T., (Journals) c/o Royal Societies Club, St. James Street, S.W., and (communications) c/o H. S. King & Sons, Cornhill, E.C., Mechanical Engineer.
1901. Burnand, Sydney, Manbié Saccharine Co., Ltd., Hammermith, W., Manager.
- O.M. Burnard, R., Plymouth Chemical Works, Plymouth, Chemical Manufacturer.
1891. Burnet, Henry K., North Brook Vitriol Works, Bradford, Yorks., Sulphuric Acid Maker.
1897. Burnet, Jno. Jas., 18, University Avenue, Glasgow, Architect.
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1893. Burnham, J. C., Cordite Factory, Aruvankad, Nilgiri Hills, India, Analytical Chemist.
1900. Burnside, Chas. F., Du Pont Building, Wilmington, Del., U.S.A., Chemist.
1900. Barr, Edmund C., 1722, Vallejo Street, San Francisco, Cal., U.S.A., Manufacturer.
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1906. Burrough, Ernest J., Cale Distillery, Hutton Road, Lambeth, S.E., Rectifier.
1892. Burrough, Horace, jun., 509, West Lombard Street, Baltimore, Md., U.S.A., Technical Chemist.
1888. Burrows, Edw., Home Villa, Low Fell, Gateshead-on-Tyne, Alkali Works Manager.
1903. Burton, Alf., 44, York Street, Toronto, Canada, Dyer and Finisher.
1905. Burton, Jas. K., Grand and 20th Avenues, Nashville, Tenn., U.S.A., Consulting Chemist.
1903. Burton, Jno., 2, Green Street, Bethnal Green, E., Dye and Chemical Manufacturer.
1904. Burton, T. R., c/o Scott, Greenwood and Son, S. Broadway, Ludgate Hill, London, E.C., Technical Journalist.
1889. Burton, Wm., The Hollies, Clifton Junction, near Manchester, Potter's Chemist.
1897. Burwell, A. W., Box 1193, Helena, Montana, U.S.A., Consulting Chemist.
1906. Busby, Fred. E., Arnold Print Works, North Adams, Mass., U.S.A., Chemist.
1897. Bush, J. M., c/o W. J. Bush and Co., Ltd., Ash Grove, Hackney, E., Manufacturing Chemist.
1897. Butler, David B., 41, Old Queen Street, Westminster, S.W., Cement Expert.
1903. Butler, Fredk., Ditchfield Road, Hough Green, near Widnes, Manager (Ditto Copper Works).
1890. Bntler, Paul, Lowell, Mass., U.S.A., Ammunition Manufacturer.
1885. Butler, Samuel, The Cedars, Compton, Wolverhampton, Brewer.
1905. Butler, T. H., Chamwood, Cotham Park, Bristol, Chemical Student.
1886. Butler, W. W., c/o Mitchells & Butlers, Ltd., The Brewery Library, Cape Hill, Birmingham, Brewer.
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1897. Butters, Charles, 54, New Broad Street, London, E.C., and (Journals) Roselawn, Berkeley, Cal., U.S.A., Metallurgist.
1900. Butterworth, Elwell R., c/o Reversible Collar Co., 111, Putnam Avenue, Cambridge, Mass., U.S.A., Chemist.
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1899. Byrnes, Dr. Eugene A., 918, F. Street N.W., Washington, D.C., U.S.A., Patent Lawyer.
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1889. Cadett, Jas., Ashtead, Surrey, Chemical Engineer.
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1905. Calder, Prof. Edwin E., Long Meadow, R.I., U.S.A., Professor of Chemistry.
1897. Calder, W. A. S., Ormidale, Little Moor Hill, Smethwick, Birmingham, Chemical Manufacturer.
1908. Caldwell, Robert J., The Poplars, Bowes Road, New Southgate, N., Chemist and Works Manager.
1888. Caldwell, Wm., Murray Street, Paisley, N.B., Drysalter.
1902. Calm, Dr. Chas. E., 41-43, Warren Street, New York City, U.S.A., Manufacturing Chemist.
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1904. Cameron, Walter S., 239, West 136th Street, New York City, U.S.A., Manufacturing Perfumer.
1908. Cameron, Wm., Balik Papan, Dutch East Borneo, Sugar Refinery Manager.
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1906. Carey, William G., c/o Clinical Research Assoc., Watergate House, Adelphi, London, W.C., Chemist.
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1907. Carlitz, Joseph S., 1017, Callowhill Street, Philadelphia, Pa., U.S.A., Chemist.
1896. Carmichael, Herbert, Bureau of Mines, Victoria, British Columbia, Public Analyst and Assayer.
1884. Carmody, Prof. Patrick, Government Laboratory, Port of Spain, Trinidad, Analytical Chemist.
1897. Carnell, Wm. C., c/o Tacony Chemical Works, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.
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1900. Carpenter, Frank B., 11, South 12th Street, Richmond, Va., U.S.A., Chemist.
1900. Carpenter, Harry B., c/o Lister's Agricultural Chemical Works, Newark, N.J., U.S.A.
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1905. Carter, Robert A., c/o Roessler and Hasslaicher Chemical Co., Box 68, South Amboy, N.J., U.S.A., Chemist.
1895. Carter, Stewart F., Glenlyon Dyeworks, Saylesville, R.I., U.S.A., Technical Chemist.
1903. Carter, Thomas, 322, Scarr Hill, Bradford, Yorks, Works Chemist.
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1889. Carulla, F. J. R., 84, Rose Hill Street, Derby, Chemical Manufacturer.
1906. Carveth, Dr. H. R., Niagara Electrochemical Co., Niagara Falls, N.Y., U.S.A., Works Manager.
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1895. Catlin, Chas. A., 133, Hope Street, Providence, R.I., U.S.A., Chemist (Rumford Chemical Works).
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1902. Cerasoli, Albarto, c/o Dr. L. Mond, 18, Avenue Road, Regent's Park, N.W., Engineer.
1891. Chadwick, Walter M., Thorneycroft, Westoe, South Shields, Chemical Works Manager.
1894. Chaloner, G. W., 26, Eagle Wharf Road, Hoxton, N., Chemical Manager.
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1907. Chancy, Walter, The Gas Works, Neechells, Birmingham, Gas Engineer.
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1906. Chaplin, Wm. H., 13, Penywern Road, Earl's Court, London, S.W., Wine Merchant.
1890. Chapman, Alf. Chaston, 8, Duke Street, Aldgate, E.C., Analytical Chemist.
1906. Chapman, Arthur J., Baronsmere, Stanhope Avenue, Church End, Finchley, N., Analytical Chemist.
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1903. Chapman, Geo. W., Swift Fertilizer Works, 912, Prudential Building, Atlanta, Ga., U.S.A., Superintendent.
- O.M. Chapman, Spencer, 36, Mark Lane, E.C., Chemical Manufacturer.
1894. Charlier, A. C. J., 6, Talbot Road, South Tottenham, N., Consulting Chemist.
1902. Charlton, Thos., 252, Irvington Place, Denver, Colo., U.S.A., Manufacturing Chemist.
1900. Chase, March F., c/o Mineral Point Zinc Co., Depue, Ill., U.S.A., Chemist.
1889. Chase, R. L., Arnold Printworks, North Adams, Mass., U.S.A., Manager.
1898. Chattock, Herbert E., 23, Apsley Road, Clifton, Bristol, Oilcake Manufacturer.
1905. Cheesman, Frank P., 100, William Street, New York City, U.S.A., Paint Manufacturer.
1901. Cheetham, Howard, 18, St. Ann Street, Manchester, Chartered Patent Agent.
1894. Cheney, J. P., c/o Cheney Bros., South Manchester, Conn., U.S.A., Silk Manufacturer's Chemist.
1905. Chick, Oliver, 52, High Street, Hornsey, N., Analytical Chemist.
1907. Chickering, H. C., c/o E. I. du Pont de Nemours Powder Co., Lewisburg, Ala., U.S.A., Chemist.
1893. Cholerton, A. F., 40½, Belgrave Gate, Leicester, Manufacturing Chemist.
1890. Chorley, Jno. C., Bewsey, Oxford Road, Birkdale, Lanes., Analytical Chemist.
- O.M. Christie, J., Leventfield, Alexandria, N.B., Dyer and Printer.
1903. Christie, John, c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Analytical Chemist.
1908. Christie, Malcolm, Ardenlea, Portland Road, Hamilton, N.B., Analytical Chemist.
1898. Christison, Geo., 13, Cambridge Drive, Glasgow, Engineer.
1907. Christopher, George, Walkden Works, Verney Road, South Bermondsey, S.E., Consulting Chemist.
1907. Christopher, J. E., Solvay Coke Works, Kirkless, Wigan, Assistant in Charge.
- O.M. Chrystal, W. J., 7, West George Street, Glasgow, Chemical Manufacturer.
1908. Chrystall, E. R., c/o Curtis's & Harvey, Ltd., Cliffe at Hoo, Kent, Research Chemist.
1904. Chubb, H. M., Wharfedale Villas, Tadcaster, Yorks., Brewery Chemist.
- O.M. Church, Professor A. H., F.R.S., Shelsley, Kew, Surrey, Professor of Chemistry in the Royal Academy.

1890. Church, Elihu D., jun., 63, Wall Street, New York City, U.S.A., Soda Manufacturer.
1906. Church, Sumner R., c/o Barrett Manufacturing Co., 17, Battery Place, New York City, U.S.A., Chemical Engineer.
1907. Churchill, Wm., Corning Glass Works, Corning, N.Y., U.S.A., Chemist.
1896. Cladlin, Alan A., (Communications) 88, Broad Street, Boston; and (Journals) Littleton, Mass., U.S.A., Manufacturing Chemist.
1900. Clamer, Guiliam H., 46, Richmond Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Clanahan, H. C., 79, Mosley Street, Manchester, Chemical Merchant.
1901. Clapham, Henry E., 15, St. Julian's Road, Kilburn, N.W., Technical Chemist.
1905. Clapp, Geo. A., 503, Walnut Street, Newtonville, Mass., U.S.A., Chemist.
1891. Clapp, Ralph R., c/o Standard Ammonia Co., Ltd., Sussex Wharf, East Greenwich, S.E., Manager.
1889. Clapperton, J., jun., Analytical Chemist.
1903. Clare, Henry, Hepscott, Morpeth, Northumberland, Schoolmaster.
1905. Clark, Alfred N., Box 168, Wallaceburg, Ont., Canada, Technical Chemist and Engineer.
1906. Clark, Allan J., c/o Homestake Mining Co., Lead, South Dakota, U.S.A., Metallurgist.
1904. Clark, Arthur W., c/o Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemist and Bacteriologist.
1908. Clark, Chas. T., P.O. Box 422, Sault Ste. Marie, Ont., Canada, Manufacturing Chemist.
1896. Clark, Donald, School of Mines, Bendigo, Victoria, Australia, Director.
1904. Clark, Prof. Friend E., Central University of Kentucky, Danville, Ky., U.S.A., Professor of Chemistry.
1900. Clark, Jno., Broadway Works, Millwall Dock, London, E., Manufacturing Chemist.
1906. Clark, M. H., c/o Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1902. Clark, Robt. M., 138, Bath Street, Glasgow, Chemist.
1906. Clark, Wm. B., 42, Robertson Street, Greenock, Chemist.
1907. Clark, Wm. H., 78, Warrington Road, Elswick Road, Newcastle-on-Tyne, Analytical Chemist.
1903. Clark, Dr. W. Inglis, 104, South Canongate, Edinburgh, Manufacturing Chemist.
1904. Clarke, Alfred R., 613-617, Eastern Avenue, Toronto, Canada, Leather Manufacturer.
1908. Clarke, Arthur F., 13, Sloane Street, London, S.W., Analytical Chemist.
1908. Clarke, Dr. Latham, Boylston Hall, Harvard University, Cambridge, Mass., U.S.A., Instructor in Chemistry.
1903. Clarke, Robt. W., 3, Aberdeen Villas, Chase Road, Southgate, N., Analyst.
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1895. Clayton, Dr. G. C., Etonfield, Wavertree, Liverpool.
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1900. Clifford, Wm., Sewage Outfall Works, Wolverhampton, Sewage Works Manager.
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1891. Clutton, J. H., Poste Restante, Lastours (Aude), France, Assayer.
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1904. Coblenz, Lambert, 1708, Sutter Street, San Francisco, Cal., U.S.A., Chemist.
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1891. Colby, Albert L., 447, Lehigh Street, South Bethlehem, Pa., U.S.A., Metallurgical Engineer.
1899. Colby, E. A., Baker Platinum Works, Newark, N.J., U.S.A., Metallurgical Chemist.
- O.M. Colby, W. H., Carreg-wen, Aberystwith, Wales.
1893. Coleman, W. H., 18, Egerton Road, Fallowfield, Manchester, Tar Works Chemist.
- O.M. Collens, E., Vinegar Works, Stourport, Worcestershire, Manager.
1905. Collett, John H., Hillfield, and (Jnls.) The Librarian, Free Library, Gloucester, Chemical Manufacturer.
1887. Collett, J. M., Hillfield, Gloucester, Chemical Manufacturer.
1901. Colley, Bernard T., c/o Velardena M. and S. Co., Velardena, Durango, Mexico, Assayer.
1908. Collier, F. C., 437, Lansdowne Avenue, Westmount, Montreal, Canada, Analytical Chemist.
1903. Collier, Pierre, Companhia Industrial Pernambucoana, Pernambuco, Brazil, Civil Engineer.
1893. Collin, Dr. C. A., Ferguslie Threadworks, Paisley, N.B., Textile Chemist.
1898. Collingridge, Frank, 73, Fountain Road, Edgbaston, Birmingham, Chemist.
1883. Collins, J. H., Crinnis, Par Station, Cornwall, Technical Chemist.
1899. Collins, S. Hoare, Armstrong College, Newcastle-on-Tyne, Agricultural Chemist.

1888. Collins, W. Hepworth, c/o Edw. Wihl & Co., 17, Nicholas Street, Manchester, Analytical Chemist.
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1900. Comey, Arthur M., 424, East 13th Street, Chester, Pa., U.S.A., Technical Chemist.
1906. Compton, Miss N. J., Library, University of Nebraska, Lincoln, Neb., U.S.A., Librarian.
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1901. Connah, Jas., Laboratory, Custom House, London, E.C., Government Analyst.
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1883. Connor, C. C., 10, College Gardens, Belfast, Ireland, Chemist.
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1906. Conrau, Oliver, Dansk Svøfvelsøye och Superfosfatfabrik, Mandelstrup, Denmark, Administrator.
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1899. Cook, Robt. A., New Brunswick, N.J., U.S.A., Chemist.
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1899. Cook, Walter G., 9, Hendon Lane, Finchley, N., Analytical Chemist.
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1898. Duisberg, Dr. Carl, The Bayer Co., Ltd., (Journals) Elberfeld, Germany; (subscriptions) 19, St. Dunstan's Hill, London, E.C., Chemist.
1905. Dukes, Bernhard, 1, Great James Street, Bedford Row, London, W.C., Patent Agent.
1888. Dukes, T. William, Box 10, Vryheid, South Africa, Merchant.
1906. Dunnealfe, Roger, Forge Mills, Bestwood Colliery, Nottingham, Glue Manufacturer.
1889. Duncan, Arthur W., 1, Trafalgar Road, Higher Bentcliffe, Pendleton, Manchester, Analytical Chemist.
1904. Duncan, Robert A., P.O. Box 500, Honolulu, Hawaii, Chemist.
1908. Duncan, Prof. Robert Kennedy, University of Kansas, Lawrence, Kansas, U.S.A., Prof. of Industrial Chemistry.
1906. Dunford, Jno. H., Trent Side Bone Works, Nottingham, Assistant Manager.

1898. Dunham, Dr. E. K., 35, East 68th Street, New York City, U.S.A., Professor of Bacteriology and Hygiene.
1905. Dunlop, Harry, c/o R. R. Tatlock & Thomson, 156, Bath Street, Glasgow, Chemist.
1892. Dunn, Fred., 193, Collins Street, Melbourne, Victoria, Australia, Analytical Chemist.
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1908. Dünscmann, Dr. Max, c/o Meister, Lucius, und Brüning, Ellesmere Port, Cheshire, Manager.
1901. Dunsford, Geo., Laboratory, Wigan Coal and Iron Co., Ltd., Wigan, Analytical Chemist.
1907. Dunstan, A. E., Technical College, East Ham, E., Head of Chemical Department.
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1899. Duryea, Chester B., c/o Edwardsburg Starch Co., Cardinal, Ont., Canada, Starch Manufacturer.
1906. Dushman, Saul, Faculty of Applied Science, University of Toronto, Canada, Electrochemist.
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1907. Dyes, Dr. W. A., 18, Exchange Street, Manchester, Seller of Patents and Processes.
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1902. Dyson, George W., 89, Cowlishaw Road, Sheffield, Analyst.
1892. Dyson, Septimus, 44, Fairmile Avenue, Streatham, S.W., Manufacturing Chemist.
- E**
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1899. Eamshaw, Edward H., 763, Broad Street, Newark, N.J., U.S.A., Chemist.
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1884. Eastick, C. E., 7, King Edward Street, Whitechapel, E., Sugar Works Manager.
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1885. Eastwood, Edw., 7, Bolton Road, Port Sunlight, Birkenhead, Soapmaker.
1902. Eastwood, Robert F., 90, Peel House Lane, Widnes, Chemist.
1906. Eaton, B. J., Institute of Medical Research, Kuala Lumpur, Selangor, Fed. Malay States, Government Chemist.
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1901. Eddy, W. Clifton, 55, High Street, Woodbury, N.J., U.S.A., Chemist.
1885. Edge, Anthony, 79, Milton Street, Readville, Mass., U.S.A., Chemist.
1909. Edge, J. Harold, "Great Marld," Smithills, Bolton, Lancashire, Technical Chemist.
1902. Edison, Thos. Alva, Edison Laboratory, Orange, N.J., U.S.A., Inventor and Manufacturer.
1908. Edmunds, Wm. T., Church Road, Burry Port, Carmarthenshire, Assayer.
1909. Edwards, George M., 241, Pine Avenue West, Montreal, Canada, Paintworks Manager.
1902. Edwards, H. Seaton, 19, Park Road, Port Sunlight, Cheshire, Analyst.
1906. Egleson, J. E., Capelton, Quebec, Canada, Chemist.
1895. Ehrenfeld, Prof. Chas. H., York Collegiate Institute, York, Pa., U.S.A., Professor of Chemistry.
1896. Ehrhardt, Ernest F., Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany, Research Chemist.
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1901. Elkins, Arthur W., 520, Park Avenue, East Orange, N.J., U.S.A., Civil Engineer.
1884. Elliott, Dr. A. H., Consolidated Gas Co., 4, Irving Place, New York City, U.S.A., Chemist.
1907. Elliott, George K., c/o Lankenheimer Co., Cincinnati, Ohio, U.S.A., Chief Chemist.
1896. Elliott, Dr. J. F., c/o Grimwade and Co., 6, Trinity Square, E.C.; and (Journals), O'Connell Street, Sydney, N.S.W., Manufacturing Chemist.
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1893. Ellis, E. Victor, 7, Hillside Crescent, Edinburgh, Analytical Chemist.
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1907. Elms, Jas. W., c/o E. I. du Pont de Nemours Powder Co., Haskell, N.J., U.S.A., Chemist.
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1902. Emery, Arthur L., c/o Smith, Emery and Co., 651, Howard Street, San Francisco, Cal., U.S.A., Chemical Engineer.
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1907. Emmons, Frank W., c/o Washburn Crosby Co., Minneapolis, Minn., U.S.A., Chemist.
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1905. Evans, Geo. A., 832, Yonge Street, Toronto, Canada, Pharmacist.
1905. Evans, Jacob V. R., Ridgway, Pa., U.S.A., Chemist.
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1908. Favre, A., 21, Mincing Lane, London, E.C., Laboratory Furnisher.
1884. Fawsitt, C. A., Atlas Chemical Works, East Nelson Street, Glasgow, Chemical Manufacturer.
1903. Fawsitt, Dr. Chas. E., The University, Sydney, N.S.W., Australia, Prof. of Chemistry.
1906. Feeley, Edward J., 88, Broad Street, Boston, Mass., U.S.A., Aniline Colour Dealer.
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1905. Felton, Herbert L., 524, East Second Street, South Boston, Mass., U.S.A., Distiller.
1900. Ferguson, Geo. A., 121, West 42nd Street, New York City, U.S.A., Professor of Analytical Chemistry.
- O.M. Ferguson, Prof. J., The University, Glasgow, Professor of Chemistry.
1896. Ferguson, J. Hart, Loch Katrine Distillery, Camlachie, Glasgow, Distillery Manager.
1907. Ferguson, Wm., 34, St. Peter Street, Montreal, Canada, Chemical Agent.
1902. Fergusson, Donald M., c/o Acadia Sugar Refining Co., Halifax, N.S., Canada, Analytical Chemist.
1883. Fergusson, H., Prince Regent's Wharf, Victoria Docks, E., Technical Chemist.
1908. Fernbach, Dr. R. Livingston, 97, Warren Street, New York City, U.S.A., Chemist.
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1893. Fiebing, John H., 644, 28th Street, Milwaukee, Wis., U.S.A., Leather Trade Chemist.
1885. Field, E. W., Cloud House, Sandiacre, near Nottingham, Brewer.
1887. Field, S. S., 3, Glenhuce Road, Blackheath, S.E., Manufacturing Chemist.
1891. Field, Wm. Eddington, Martin Street, Elsternwick, Melbourne, Victoria, Chemist.
1900. Fillis, Frank, Brookland, London Road, Neath, South Wales, Cement Works Manager.
1907. Finch, Archibald M., Vitriol and Chemical Works, Cwmbran, R.S.O., Monmouthshire, Chemical Manufacturer.
1904. Finch, Martin L., Vitriol and Chemical Works, Cattedown, Plymouth, Chairman of Directors.

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1905. Findlay, Dr. Alex., The University, Birmingham. Lecturer on Physical Chemistry.
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1904. Finn, Cornelius P., Hemsworth Colliery, Hemsworth, near Wakefield, Yorks., Technical Chemist.
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1903. Fish, Chas. C. R., 10, Park Square, Boston, Mass., U.S.A., Chemist.
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1900. Fisher, Henry, 57, East 83rd Street, New York City, U.S.A., Teacher of Chemistry.
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1900. Fitz-Randolph, R. B., State Laboratory of Hygiene, Trenton, N.J., U.S.A., Bacteriologist and Chemist.
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- O.M. Fletcher, F. W., c/o Fletcher, Fletcher & Co., Ltd., Holloway, N., Manufacturing Chemist.
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1895. Forbes, Paul R., 15, William Street, New York City, U.S.A., Chemist and Assayer.
1893. Ford, J. B., jun., Michigan Alkali Co., Wyandotte, Mich., U.S.A., Secretary and Treasurer.
1889. Ford, Jno. S., Abbey Brewery, Edinburgh, Analyst.
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1899. Forel, Geo., 212, Route de Vienne, Lyon (Rhône), France, Chemist.
1885. Formoy, J. Arthur, Oil Expert.
1904. Forrest, Chas. N., Maurer, N.J., U.S.A., Chemist.
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1890. Forrester, A. M., c/o Richmond Guano Co., Richmond, Va., U.S.A., Analytical Chemist.
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1902. Forstall, Alf. E., 58, William Street, New York City, U.S.A., Consulting Gas Engineer.
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1902. Forster, Ferdinand E. P., c/o Messrs. Bass and Co., 19, Guild Street, Burton-on-Trent, Chemist.
1907. Forster, Francis, Tyne Lead Works, Hebburn-on-Tyne, Lead Manufacturer.
1899. Forster, Dr. M. O., F.R.S., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.
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1888. Foster, Wm., St. Martin's Terrace, Newton Park, Leeds, Manufacturing Chemist.
1903. Fotheringham, John, Lochaber, Lake Takapuna, Auckland, New Zealand, Chemist.
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1891. Fowler, Dr. Gilbert J., Broad Oak, Urnston, near Manchester, Consulting Chemist (Manchester Corporation Rivers Committee).
1898. Fowler, Theo. V., P.O. Box 168, Buffalo, N.Y., U.S.A., Chemical Works Manager.
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1898. Fox, Jno., Varuna, Grappenhall, Cheshire, Analyst.
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- O.M. Francis, W. H., 6F, Bickenhall Mansions, Gloucester Place, London, W., Wholesale Druggist.
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1898. Fulmer, Elton, Pullman, Wash., U.S.A., Professor of Chemistry.
1896. Fulton-Smith, L., 20, Bold Street, Warrington, Brewer.
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1897. Galletly, J. C., Technical College, Glasgow, Assistant to Professor of Chemistry.
1901. Gallivan, Dr. Frank B., 184, Summer Street, Boston, Mass., U.S.A., Chemist.
1903. Gallum, Albert F., Milwaukee, Wis., U.S.A., Tanner.
1901. Gallup, W. Arthur, Arnold Printworks, North Adams, Mass., U.S.A., Printer.
1901. Galpin, Harry T., 55, West 57th Street, New York City, U.S.A., Chemist.
1891. Galt, Hugh Allen, Columbia Chemical Co., Barberton, Ohio, U.S.A., Works Manager.
1887. Gamble, Jas. N., The Laboratory, Procter and Gamble Co., Ivorydale, Ohio, U.S.A., Soap Manufacturer and Oil Refiner.
1894. Gane, Eustace H., 95, Fulton Street, New York City, U.S.A., Pharmaceutical Chemist.
1888. Gans, Adolf, Farbenfabrik von L. Cassella & Co., Frankfurt a/Main, Germany, Dye Works Manager.
1901. Gansser, Dr. A., c/o Messrs. Lepetit, Dollfus & Gansser, Gressio-Ponte (Provincia di Cuneo), Italy, Chemical Engineer.
1896. Gardair, Aimé, 51, Rue St. Ferréol, Marseilles, France, Director of Chemical Co.
1907. Gardner, Edward, 70, Parliament Hill Mansions, Highgate Road, London, N.W., Metallurgical Chemist.
1905. Gardner, Franc E., 633, North Western Avenue, Chicago, Ill., U.S.A., President, Gardner-Barada Chemical Co.
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1897. Garfield, Jos., Thackley, Bradford, Yorks., Civil Engineer.
1888. Garibabli, Joachim A., 21, Church Place, Gibraltar, Chemist.
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1904. Garner, G. Lester, Monticello, Sullivan Co., N.Y., U.S.A., Superintendent of Leather Works.
1890. Garrett, Dr. F. C., Armstrong College, Newcastle-on-Tyne, Teacher of Science.
1900. Garrigues, W. E., Foot of Lieb Street, Detroit, Mich., U.S.A., Chemical Engineer.
1906. Garroway, Major John, 58, Buchanan Street, Glasgow, Chemist.
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1908. Garton, Joseph, 42, South John Street, St. Helens, Lancashire, Analytical Chemist.
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1904. Gazdar, J. J., 5, Wroxham Mansions, 38, Canfield Gardens, South Hampstead, N.W., Barrister-at-Law.
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1906. Gerkenmeyer, Henry H., 109, South Eastern Avenue, Joliet, Ill., U.S.A., Chemist.
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1903. Gibbings, Wm., Woodside, Halebank, Widnes, Works Manager.
1902. Gibbon, Edw., Belyedere, Park Road, Clydach, R.S.O., Glam., Works Chemist.
1904. Gibbs, A. E., Wyandotte, Mich., U.S.A., Manufacturing Chemist.
1883. Gibbs, D. Cecil, Soap Manufacturer.
- O.M. Gibbs, Wm. P., Cyanamidfabriken, Odda, Hardanger, Norway, Analytical Chemist.
1893. Gibbs, W. T., Buckingham, Prov. Quebec, Canada, Manufacturing Chemist.
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1905. Gibson, John, Victorian Portland Cement Works, Burnley Street North, Richmond, Vic., Australia, Manager.
1906. Gibson, Robt. R., Boise, Idaho, U.S.A., Chemist.
1905. Gibson, Wm. F., 18, Bushy Park, Totterdown, Bristol, Works Chemist.
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1903. Gilby, Joseph W., c/o Brotherton and Co., Ltd., Haigh Park Chemical Works, Stourton, Leeds, Works Chemist.
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1884. Gilchrist, Peter S., Charlotte, N.C., U.S.A., Chemical Engineer.
1900. Gildersleeve, W. H., Middleshoro', Ky., U.S.A., Chemist.
- O.M. Giles, W. B., The Grange, Leyton, Essex, Chemical Manufacturer.
1886. Gill, Dr. Aug. H., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Assoc. Professor of Technical Analysis.
1901. Gill, Wm. S., c/o Farquhar and Gill, North of Scotland Colour Works, Aberdeen, Colour and Varnish Manufacturer.
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1901. Gilles, Wm. S., The Cottage, Bocking, near Braintree, Essex, Technical Chemist.
1906. Gillies, Donald B., Apartado 125, Chihuahua, Mexico, Mining Engineer.
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1891. Ginningham, Edw. A., Croyland, Clapton Common, N., Electrician.
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1905. Glover, Nathan H., 355, River Street, Mattapan, Boston, Mass., U.S.A., Gum Manufacturer.
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1896. Goetz, Isidore, 5, Brondesbury Park, London, N.W., Mine Manager.
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1898. Golding, Jno., Ashby Road, Kegworth, Derby, Agricultural Chemist.
1909. Goldman, M. Leon, The Crown Cock and Seal Co., 1511, Guilford Avenue, Baltimore, Md., U.S.A., Chemical Engineer.
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1899. Goldsmith, Dr. Jno. N., 55, Chancery Lane, London, W.C., Chemist.
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1906. Goodhue, Leonard H., c/o Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
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1898. Goodrich, Chas. C., 2, Rector Street, New York City, U.S.A., Rubber Manufacturer.
1884. Goodwin, C. C., Racefield, St. Margaret's Road, Altrincham, Cheshire, Soapmaker.
1894. Goodwin, Dr. W. L., The School of Mining, Kingston, Canada, Professor of Chemistry.

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1898. Gordon, Colin, Storers' Wharf, Wharf Road, Poplar, E., Chemical Engineer.
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1908. Gordon, Read, c/o Gordon and Dillworth, 563-5, Greenwich Street, New York City, U.S.A., Food Manufacturer.
1905. Gorsline, Wm. H., 242, Culver Road, Rochester, N.Y., U.S.A., Secretary and Manager.
1891. Gorvin, Jno. C., 29, Bryn Road, Swansea, Assayer.
1897. Gossage, W. Winwood, Widnes, Lancashire, Soap Manufacturer.
1904. Gotthelf, August H., Hastings-on-Hudson, N.Y., U.S.A., Chemist.
1890. Goulding, Sir Wm. J., Bart., North Wall, Dublin, Manure Manufacturer.
1903. Govers, F. X., 250, Main Street, Owego, Tioga Co., N.Y., U.S.A., Manager and Chemist.
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1906. Graesser, Norman H., Argoed Hall, Llangollen, N. Wales, Manufacturing Chemist.
1883. Graesser, R., Cefn, near Ruabon, North Wales, Manufacturing Chemist.
- O.M. Graham, Prof. C., The Reculvers, Hastings, Consulting Chemist.
- O.M. Graham, C. C., Oriel House, Scarborough, Yorks., Technical Chemist.
1908. Graham, Chas. W., 142, Bloor Street West, Toronto, Canada, Chemist.
1883. Grandage, H., City Chambers, 2, Darley Street, Bradford, Dyer.
1897. Granger, Dr. J. Darnell, 25, All Saints Street, Nottingham, and (Journals) Thelottstrasse 4, Augsburg, Germany, Analytical Chemist.
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1896. Graves, Geo. H., c/o General Chemical Co., Bridgeport, Conn., U.S.A., Manufacturing Chemist.
1896. Graves, Walter G., 1950, East 90th Street, Cleveland, Ohio, U.S.A., Chemist.
1884. Gray, G. Watson, 8, Inner Temple, Dale Street, Liverpool, Consulting Chemist and Assayer.
1907. Gray, Henry M., Broompark, Duffield, Derby, Engineer.
1904. Grav, Jas., Heymann's Laboratory, P.O. Box 3427, Johannesburg, Transvaal, Chemist.
1901. Gray, J. Campbell, Glengoyt, Strines, near Stockport, Printworks Chemist.
1886. Gray, Jno., 3, Victoria Drive, Rock Ferry, near Birkenhead, Technical Chemist.
1903. Gray, Jno. Lathrop, c/o Tide Water Oil Co., East 22nd Street, Bayonne, N.J., U.S.A., Assistant Superintendent (Paraffin Works).
1896. Gray, Dr. Thos., The Technical College, Glasgow, Professor of Technical Chemistry.
1905. Gray, W. B., Messrs. Lever Bros., Balmain, Sydney, N.S.W., Australia, Analytical Chemist.
1903. Gray, Wm. S., 76, William Street, New York City, U.S.A., Chemical Merchant.
1908. Gray, Wm. T., Port Credit, Ontario, Canada, Starch Manufacturer.
1901. Greaves, Albert E., c/o P. Spence and Sons, Ltd., Goole Alum Works, Goole, Yorks., Works Chemist.
1891. Greaves, I. A. R., Morton, Gainsborough, Brewer.
1894. Greaves, Wm., Coppee Coke Ovens, Pinxton, Alfreton, Chemical Engineer and Chemist.
1894. Greeff, R. W., 20, Eastcheap, London, E.C., Chemical Agent.
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1907. Green, Clarence, c/o Nicholson and Co., Beaumont Works, St. Albans, Herts., Chemist.
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1896. Green, Jno. Wilberforce, 22, Alwyne Mansions, Wimbledon, S.W., Technical Chemist.
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1908. Green, Dr. W. Heber, Chemical Laboratory, University, Melbourne, Australia, Lecturer in Chemistry.
- O.M. Greenaway, A. J., The Orchard, Chertsey, Surrey, Sub-Editor of Chemical Society's Journal.
1906. Greene, George M., c/o Colgate and Co., Jersey City, N.J., U.S.A., Chemist.
1884. Greenhalgh, Jas. Herbert, Whitebirk, Green Mount, Bury, Lancs., Assistant Manager of Printworks.
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1906. Guess, Geo. A., c/o Tennessee Copper Co., Copperhill, Tenn., U.S.A., Chemist.

1898. Guess, Harry A., c/o Federal Lead Co., Flat River, Mo., U.S.A., Chemist and Manager.
1899. Guild, Frank N., University of Arizona, Tucson, Arizona, U.S.A., Professor of Chemistry.
1906. Gulline, Percy, Merrimack Manufacturing Co., Lowell, Mass., U.S.A., Printworks Superintendent.
1904. Gundlach, Walter, 370, St. Nicholas Avenue, New York City, U.S.A., Superintendent of Colour Works.
1905. Gundlach, Dr. Charles, c/o Thorium Chemical Co., Maywood, N.J., U.S.A., Technical Chemist.
1908. Gunn, Andrew, c/o Gunn's, Ltd., West Toronto, Canada, Pork Butcher.
1903. Gunn, Gilbert, 181, Bury New Road, Heywood, Lancs., Paper Mill Chemist.
1900. Günther, Chas. E., Liebig's Extract of Meat Co., Ltd., 4, Lloyd's Avenue, London, E.C., Merchant.
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1894. Gurney, J. Clare, Fundición de Plomo de D. Miguel Zapata, Portman, Prov. de Murcia, Spain, Analytical Chemist.
1899. Gutcher, Wm., Singapore Oil Mills, Singapore, S.S., Superintendent Engineer.
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1892. Guttman, Oscar, 60, Mark Lane, London, E.C., Consulting Chemical Engineer, M.Inst.C.E.
1904. Gyr, Dr. K. H., Zug, Switzerland, Analytical Chemist.
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- O.M. Hadkinson, R., Smyrna, Asia Minor, Oil Refiner.
1904. Hadley, Geo., 58, Halesowen Street, Blackheath, Staffs., Spelter Works Manager.
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1887. Haig, Robert, Dollarfield, Dollar, N.B., Chemical Engineer.
1904. Haigh, B. Wilson, By-Product Coke Oven Dept., Barnsley Main Colliery, Barnsley, Yorks., Chemical Engineer.
1896. Haigh, De Lagnel, 39, Hill Crest, Summit, N.J., U.S.A., Chemist.
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1897. Hambly, Fred. J., Buckingham, Quebec, Canada, Chemist.
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1905. Hanna, W. W., 109, North Water Street, Philadelphia, Pa., U.S.A., Aniline Colour Manufacturer.
1905. Hanson, H. Norman, Field Head, Brighouse, Yorks., Research Assistant.
1908. Hanson, W. G., c/o United States Glue Co., Milwaukee, Wis., U.S.A.
1905. Hareourt, Prof. R., Ontario Agricultural College, Guelph, Ont., Canada, Professor of Chemistry.
1904. Hard, Dr. James M. B., 2A, del Canadá, Colonia de Sta. Julia, Mexico, D.F., Chemist and Pathologist.

1901. Hardecastle, G. Fred., 29, Normanton Road, Leicester, Teacher of Science and Technology.
1894. Harden, Dr. Arthur, F.R.S., 2, Marlborough Road, Richmond, Surrey, Lecturer in Chemistry.
1908. Hardman, Benj., c/o British Leather Cloth Manufacturing Co., Newton, near Hyde, Lancashire, Analytical Chemist.
1900. Hardwick, W. Roscoe, 13, Batavia Buildings, Hackins Hey, Liverpool, Chemist.
1905. Hardy, Chas. H., c/o Reekitt & Sons, Ltd., Hull, Chemist.
1907. Harfeld, Louis E., 10, Elsworth Terrace, London, N.W., Merchant.
1906. Hargreaves, Frank, c/o The Electrolytic Alkali Co., Ltd., Middlewich, Cheshire, Chemist.
1896. Hargreaves, Jas., May Villa, Peel House Lane, Widnes, Lancashire, Chemical Engineer.
- O.M. Hargreaves, Jno., Widnes, Alkali Manufacturer.
1904. Harker, Dr. George, Chemist.
1893. Harlock, E. B., Newton House, Middlewich, Chemical Manufacturer.
1898. Harman, Edw. A., Gas Works, Huddersfield, Gas Engineer, M.Inst.C.E.
1905. Harper, Dr. Henry W., University of Texas, 2208, San Antonio Street, Austin, Texas, U.S.A., Professor of Chemistry.
1893. Harris, Arthur, 22, Marsh Gate Lane, Stratford, E., Soap Maker.
1885. Harris, Booth, jun., Beeleigh, Victoria Road, Buckhurst Hill, Essex, Soap Maker.
- O.M. Harris, David, F.R.S.E., Lyncombe Rise, Prior Park Road, Bath, Chemical Manufacturer.
1897. Harris, Fred. W., Corporation Chemical Department, 26, John Street, Glasgow, Public Analyst.
1907. Harris, John B., Danforth Avenue, Toronto, Canada, Manufacturer of Glues and Fertilisers.
1906. Harris, Jonathan W., c/o Western Electric Co., 463, West Street, New York City, U.S.A., Chemist.
1900. Harris, L. A., 18, North 18th Street, East Orange, N.J., U.S.A., Chemist.
1907. Harris, Thos. E., c/o The Union Acid Co., 17, Cooper Street, Manchester, Chemical Merchant.
1906. Harris, Wm. G., jun., 25, William Street, Toronto, Canada, Metallurgist.
- O.M. Harrison, A., Thames Sugar Refinery, Silvertown, London, E., Sugar Works Chemist.
1905. Harrison, E. P., Langholm, Edgar Road, South Croydon, Analytical Chemist.
1883. Harrison, G. Herbert, Hagley, Stourbridge, Chemist.
1904. Harrison, H. E., 1688, Buckingham Place, Chicago, Ill., U.S.A., Chemist.
1892. Harrison, Prof. John B., C.M.G., Government Laboratory, Georgetown, British Guiana, Government Analyst.
1907. Harrison, W., 14, Devonshire Place, Ardwick, Manchester, Chemist.
1898. Harrison, Wm. H., Coimbatore, India, Agricultural Chemist (Government of Madras).
1896. Hart, Bertram, c/o Tennants and Co., Clayton, Manchester, Analyst.
1886. Hart, Bertram H., Rosslyn, High Street, Sidemp, Kent, Analytical Chemist.
- O.M. Hart, Dr. E., Gayley Hall, Lafayette College, Easton, Pa., U.S.A., Professor of Chemistry.
1905. Hart, George Adam, Sewage Engineers' Office, Municipal Buildings, Leeds, Civil Engineer.
1890. Hart, H. W., 5, Cambridge Road, Ainsdell, Lytham, Lancashire, Analytical Chemist.
1897. Hart, Wm. Beaumont, Manchester Laboratory, 8, Exchange Street, Manchester, Consulting Chemist.
1908. Hartley, Bernard C., 3, Seafield Road, New Ferry, Cheshire, Analytical Chemist.
1883. Hartley, Joseph, Technical Chemist.
1889. Hartley, R. Kent, Springwood House, Middleton Junction, near Manchester, Chemical Works Manager.
- O.M. Hartley, Prof. W. N., D.Sc., F.R.S., Royal College of Science, Dublin, Professor of Chemistry.
1897. Hartmann, Ernest E., c/o United Club, No. 4, Yokohama, Japan, Chemist.
1905. Hartshorne, Wm. D., 40, Pleasant Street; and (Journals), Arlington Mills, Methuen, Mass., U.S.A. Agent.
1901. Hartwell, S. Warren, 119, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Chemist.
1901. Hartzell, Harry S., 126, North 4th Street, Allentown, Pa., U.S.A., Chemist.
1908. Harvey, Arthur J., 39, Burges Road, East Ham, E., Chemist.
1885. Harvey, Ernest W., Stoneleigh, Grove Road, Clapham Park, S.W., A.R.S.M., Engineer.
1908. Harvey, John G., 474, Gerard Street, East Toronto, Canada, Manufacturing Chemist.
1891. Harvey, Sidney, South-Eastern Laboratory, Canterbury, Analytical Chemist.
1899. Harvey, Thos. F., 84, Henry Road, West Bridgford, Nottingham, Analyst (Drug Co.).
1883. Harvey, T. H., Cattedown, Plymouth, Chemical Manufacturer.
1908. Harvey, Wm. Ross, c/o R. Lehmann and Co., Ltd., Peninsular House, Monument Street, London, E.C., Starch Manufacturer.
1903. Hasenclever, Max, Chemische Fabrik Rhenania, Aachen, Prussia, Chemical Manufacturer.
1906. Haskell, Walter E., 234, Bridge Street, Westbrook, Maine, U.S.A., Textile Chemist and Colourist.
1900. Haslwanter, Chas., 447, Spruce Street, Richmond Hill, Long Is., N.Y., U.S.A., Analytical Chemist.
1897. Hasslacher, Jacob, P.O. Box 1999, New York City, U.S.A., President, Boessler-Hasslacher Chemical Co.
1903. Hatschek, Emil, c/o S. Barnett and Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Engineer.
1887. Hatton, Wm. P., c/o W. R. Hatton and Sons, Wormwood Scrubs, W., Starch Works Manager.
1906. Hattrick, J. M., 7, Bridge Street, Sydney, N.S.W., Australia, Local Manager (Potash Syndicate).
1900. Havens, Dr. F. S., 5822, Ashland Avenue, Philadelphia, Pa., U.S.A., Silk Conditioner.
1906. Havercroft, Arthur E., Glenholme, Burton Road, Horsea, Yorks., Chemist.
1899. Hawdon, H. S., Cleadon, near Sunderland, Manager.
1895. Hawker, E. W., Gladstone Chambers, Adelaide, South Australia, Metallurgist.
1902. Hawkins, Clement C., c/o The Texas Co., Port Neches, Texas, U.S.A., Chemist.
1897. Hawkins, Ernest M., Watling Chambers, Canterbury, Chemist.
1905. Hawkins, Henry, Moyola Villa, Lansdown, Limerick, Ireland, Gas Engineer.
1893. Hawkins, J. Dawson, c/o U. S. Reduction and Refining Co., Colorado Springs, Colo., U.S.A., President and General Manager.
1887. Hawliczek, Josef, c/o United Alkali Co., Sullivan Works, Widnes, Consulting Chemical Expert.
1899. Haworth, Dr. Edw., Sunnyside, Norman Road, Runcorn, Cheshire, Chemist.
1903. Haworth, Herbert, Crown Works, Appley Bridge, near Wigan, Director (Grove Chemical Co.).
1904. Hawthorn, J. H., Municipal Technical School, Leicester, Head Master.
1895. Hay, Alex. B., Kelyindock Chemical Works, Maryhill, Glasgow, Manufacturing Chemist.
1904. Hayman, Jack V. J., c/o Société Anon. des Ciments, Massarah, Lignede Belouan, Cairo, Egypt, Chemist.
1894. Haynes, David O., 90, William Street, New York City, U.S.A., Proprietor, "Pharmaceutical Era."
1902. Hays, E. F., c/o E. R. Squibb and Sons, 80, Beekman Street, New York City, U.S.A., Chemist.
1906. Hayworth, W. P., 47, Highfield Road, Dartford, Kent, Chemist.
1905. Hazard, Fred. R., P.O. Box 2, Syracuse, N.Y., U.S.A., President (Solvay Process Co.).
1903. Hazen, Chas. R., 258, Prince Albert Avenue, Westmount, Quebec, Canada, Chemist.
1894. Heul, Carlton, Dalston House, Dumfries, N.B., Tamer.

1903. Heald, Henry I., Hove House, Adwick Road, Mexborough, near Rotherham, Yorks., Manager of Earthenware Factory.
- O.M. Heath, R. C., Myton Grange, near Warwick, Chemical Manufacturer.
1905. Heathcote, Henry L., Warwick Avenue, Earlsdon, Coventry, Research Chemist.
1904. Heaton, Noel, 20, Baker Road, Harlesden, N.W., Colour Manufacturer.
1895. Hebdon, Jno. C., P.O. Box 465, Providence, R.I., U.S.A., Works Manager and Chemist.
1905. Heberlein, Dr. Edw., c/o H. T. Enthoven & Sons, Ltd., 247, Rotherhithe Street, London, S.E., Works Manager.
1889. Hecht, Jos. L., Bettendorf Metal Wheel Co., Davenport, Iowa, U.S.A., Analytical Chemist.
1900. Heckman, J. Conrad, Larkin Soap Manufacturing Co., Seneca Street, Buffalo, N.Y., U.S.A., Chemist.
1885. Hedley, Armorer, Durrant House, Bournemouth, Hants.
1902. Heebner, Prof. Chas. F., Ontario College of Pharmacy, Toronto, Canada, Professor of Pharmaceutical Chemistry.
1903. Hegeman, John W., 102, Barbey Street, Brooklyn, N.Y., U.S.A., Chemist.
1906. Hehner, Charles, 155, Dunn Avenue, Parkdale, Toronto, Canada, Assistant Manager.
- O.M. Hehner, Otto, 11, Billiter Square, London, E.C., Analytical and Consulting Chemist.
1908. Heilmann, Dr. Ernst, Güstrow, Mecklenburg, Germany, Chemical Manufacturer.
1887. Hellier, E. A., Avonside Varnish Works, St. Philip's Marsh, Bristol, Varnish Manufacturer.
1885. Hellon, Dr. R., 40, New Lowther Street, Whitehaven, Analytical and Consulting Chemist.
1903. Helps, D. H., c/o Reading Gas Co., King's Road Works, Reading, Engineer and Manager.
1908. Helps, James W., Gas Works, Waddon, Croydon, General Manager, Gas Co.
1898. Hemingway, Frank C. R., 133, Front Street, New York City, U.S.A.
1883. Hemingway, H., 9, Albemarle Mansions, Hampstead, N.W., Chemical Manufacturer.
1884. Hempleman, F. S., 39, Brunswick Terrace, Hove, Sussex, Manure Manufacturer.
1903. Hemstreet, George P., Hastings-on-Hudson, N.Y., U.S.A., Mechanical Engineer.
1883. Henderson, Prof. G. G., The Technical College, George Street, Glasgow, Professor of Chemistry.
1902. Henderson, Prof. Jas. A. Russell, Chihli Provincial College, Paotingfu, North China, Professor of Chemistry and Physics.
1900. Henderson, J. Brownlie, Government Analyst's Office, Brisbane, Queensland, Government Analyst.
1902. Henderson, J. C. A., 120, Bishopsgate Street Within, London, E.C.
1894. Henderson, Jos., Eskbank Ironworks, Lithgow, N.S.W., Australia, Blast Furnace Manager.
1894. Henderson, Norman M., Broxburn Lodge, Broxburn, N.B., Oil Works Manager.
- O.M. Henderson, W. F., Moorfield, Claremont Gardens, Newcastle-on-Tyne.
1893. Hendrick, Jas., Marischal College, Aberdeen, Lecturer on Agricultural Chemistry.
1906. Henius, Dr. Max, 327, Fullerton Avenue, Chicago, Ill., U.S.A., Secretary, Brewers' School.
1904. Henley, Hon. F. R., 9, Beaufort Gardens, London, S.W., Brewers' Chemist.
1889. Hennin, Alphonse, Portoferraio, Isola d'Elba, Italy, Metallurgical Chemist.
1905. Henning, Albert, 92, Harrow Road, Leytonstone, N.E., Chemical Manufacturer.
1906. Henning, C. I. B., c/o E. I. du Pont de Nemours Powder Co., Haskell, N.J., U.S.A., Chemist.
1894. Henshaw, Sam., Glenlithorne, Wolstanton, Stoke-on-Trent, Chemical Works Manager.
1908. Henzell, Chas. G., 19, Cardigan Road, Leeds, Waterworks Engineer.
1906. Herig, Harry W., 35, Rose Avenue, Jersey City, N.J., U.S.A., Chemist.
1891. Heriot, T. H. P., 37, Church Crescent, Muswell Hill, N., Analytical Chemist.
1908. Herlin, Chas., Nitroglycerin Aktiebolaget, Stockholm 2, Sweden, Chemical Engineer.
- O.M. Herman, W. D., Holm Lea, Rainhill, Lancashire, Glass Works Chemist.
- O.M. Heron, John, 110, Finchurch Street, London, E.C., Brewing Chemist.
1903. Herreshoff, J. B. F., 40, West 69th Street, New York City, U.S.A., Chemical Engineer.
1887. Herriot, Wm. Scott, Ravenswood, Partickhill, Glasgow, Mechanical Engineer.
- O.M. Herrmann, R. W., 59, Mark Lane, London, E.C., Chemical Merchant.
1891. Hersam, Ernest A., University of California, Berkeley, Cal., U.S.A., Assistant Professor of Metallurgy.
1898. Hersey, Dr. Milton L., P.O. Box 554, Montreal, Canada, Consulting Chemist.
1901. Hershey, Aldus N., c/o Sharpe and Dohme, Baltimore, Md., U.S.A., Chemist.
1903. Herstein, Dr. Bernard, Dept. of Agriculture, Bureau of Chemistry, Washington, D.C., U.S.A., Technical Chemist.
1906. Herty, Prof. Chas. H., University of N. Carolina, Chapel Hill, N.C., U.S.A., Professor of Chemistry.
1906. Herz, Dr. Albert, Rosemount, Hipperholme, Halifax, Yorks., Chemist.
1885. Hess, Dr. Adolph, Kirkstall Road, Leeds, Chemical Manufacturer.
1907. Hess, Arthur F., c/o A. Hess & Bro., Ltd., Kirkstall Road, Leeds, Oil Distiller.
1904. Hess, H. W., c/o Libbey Glass Co., Toledo, Ohio, U.S.A., Chemist.
1905. Hesse, Dr. Bernhard C., 90, William Street, New York City, U.S.A., Chemist.
1891. Hetherington, Dr. Albert E., Ammonia Soda Works, Fleetwood, Lancashire, Analytical Chemist.
1904. Heinrich, Christian, 1307, New Hampshire Avenue N.W., Washington, D.C., U.S.A., Brewer.
1894. Hewitt, A. H., The Green Island Cement Co., Ltd., Hong Kong, China, Engineer.
- O.M. Hewitt, Dr. D. B., Grove Mount, Davenham, Cheshire, Alkali Manufacturer.
1903. Hewitt, H. R., 18, Meade Street, Longsight, Manchester, Chemical Works Manager.
1896. Hewitt, Dr. J. Theo., 14, The Avenue, Surbiton, Lecturer.
1890. Hewlett, John C., 40-42, Charlotte Street, Great Eastern Street, London, E.C., Manufacturing Chemist.
1907. Hewson, Geo. W., 22, Palmer Street, Jarrow-on-Tyne, Analytical Chemist.
1893. Hey, Harry, 2, Ash Terrace, Savile Town, Dewsbury, Dyer.
1906. Heyes, Charles H., 124, Yonge Street, Toronto, Canada, Consulting Chemist.
1881. Heyes, W. E., Llanberis, Bushey Hall Road, Watford, Consulting Engineer.
1906. Hibbert, John C., 6, Victoria Road, West Bridgford, Nottingham, Chemist.
1901. Hiby, Dr. Walter, 4, Southampton Row, London, W.C., Chemical Engineer.
1906. Hicking, W. Norton, Queen's Road Works, Nottingham, Lace Dresser.
1906. Hickman, T. Moore, Holmdale, Penn Road, Wolverhampton, Analyst.
1897. Hicks, Edwin F., 4837, Fairmount Avenue, Philadelphia, Pa., U.S.A., Analytical Chemist.
1893. Hicks, Jas. A., c/o Sir Boyerton Redwood, 4, Bishopsgate Street Within, London, E.C., Analytical Chemist.
- O.M. Higgin, W. H., Hollywood, Lostock, near Bolton-le-Moors, Chemical Manufacturer.
1886. Higgins, C. L., 79, Bedford Street South, Liverpool, Manufacturing Chemist.
1905. Higgins, Dr. Eric, 5, Rolleston Drive, Wallasey, Cheshire, Chemist.
1905. Higgins, John M., 39, Queen Street, Melbourne, Vic., Australia, Consulting Metallurgist.

1908. Higgins, S. H., Luncarty Bleachfield, Perth, N.B., Chemist and Asst. Manager.
1907. Hikida, Keitaro, Tokyo Higher Technological School, Asakusa, Tokyo, Japan.
1908. Hill, A. Bostock, 14, Temple Street, Birmingham, Public Analyst.
1908. Hill, A. Clarence, c/o Pinchin, Johnson, & Co., Ltd., Minerva House, Bevis Marks, London, E.C., Managing Director.
1903. Hill, Chas. Alex., 64, Park Street, Southwark, S.E., Chemist.
1897. Hill, George, Barton-on-Humber, Chemical Works Manager.
1897. Hill, Dr. Herbert M., University of Buffalo, N.Y., U.S.A., Professor of Chemistry and Toxicology.
1907. Hill, James A., 70, York Street, Runcorn, Cheshire, Technical Chemist.
1908. Hill, J. H. F., c/o Broken Hill Proprietary Co., Broken Hill, N.S.W., Australia, Mining Engineer.
- O.M. Hill, J. K., 13, Osborne Place, Copland Road, Govan, near Glasgow, Manufacturing Chemist.
1892. Hill, Sydney, Eastholme, Prince's Avenue, and (Journals) c/o Blundell, Spence & Co., Ltd., Hull, Analytical Chemist.
1903. Hill, W. Basil, Foss Islands Tannery, York, Tanner.
1902. Hill, Wm. G. H., jun., American Rubber Co., East Cambridge, Mass., U.S.A., Chemist.
1898. Hill-Jones, Thos., Invicta Mills, Bow Common Lane, London, E., Manufacturing Chemist.
- O.M. Hills, C. H., Anglesea Copper Works, Low Walker, Newcastle-on-Tyne, Copper Smelter.
1894. Hills, Harold F., Commercial Gas Works, Stepney, London, E., Analytical Chemist.
- O.M. Hills, W., 225, Oxford Street, London, W., Pharmaceutical Chemist.
1899. Hinchley, J. W., 85, Gracechurch Street, London, E.C., Chemical Engineer.
1904. Hinekey, J. F., c/o Jones Bros., Pearl and Water Streets, Brooklyn, N.Y., U.S.A., Chemical Engineer.
- O.M. Hindle, J. H., 8, Cobham Street, Accrington, Dye-works Manager.
1899. Hinks, Percy J., Danger Building Dept., Royal Laboratory, Woolwich Arsenal, S.E., Chemist.
1891. Hinman, Bertrand C., 48, Sydenham Hill, Sydenham, S.E., Metallurgical Chemist.
1892. Hinshelwood, Thos., Glasgow Oil and Paint Works, Glenpark Street, Glasgow, Oil Refiner.
1905. Hiorns, A. H., Riga, Gravely Hill, near Birmingham, Science Teacher.
1903. Hirshfield, E., c/o United Chemical Co., 52, Broadway, New York City, U.S.A., Chemist.
1895. Hirst, H. Reginald, Bank House, Staincliffe, Batley, Yorks, Works Chemist.
1907. Hirt, Wilhelm B., c/o Cuming, Smith & Co., Ltd., Yarra Junction, Vic., Australia, Analytical Chemist.
1907. Hirtz, Dr. Heinrich, c/o Dr. L. Mond, F.R.S., 18, Avenue Road, London, N.W., Chemist.
1896. Hislop, Geo. R., (Journals) Gas Works, (communications) Greenhill House, Underwood Road, Paisley, N.B., Gas Engineer and Manager.
1900. Hobbs, Alex. F., c/o The United States Finishing Co., Box A, North Station, Providence, R.I., U.S.A., Printworks Superintendent.
1900. Hobbs, Dr. Perry L., Western Reserve Medical College, and (Journals) 2047, East 9th Street, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1906. Hobsbaum, Isaac B., c/o Lockett Bros. and Co., Iquique, Chile, Analytical Chemist.
1905. Hobson, Alfred, Dantzic Brewery, Imperial Street, Regent Street, Leeds, Brewer and Wine Manufacturer.
1907. Hochstetter, Robt. W., Oak and Bellevue Avenues, Mount Auburn, Cincinnati, Ohio, U.S.A., Superintendent.
1894. Hodge, Andrew, Brookfield House, Whaley Bridge, near Stockport, Printworks Chemist.
1890. Hodges, Harry B., Long Island Railroad Co., Long Island City, N.Y., U.S.A., Chemical Engineer.
- O.M. Hodgkinson, Dr. W. R., 89, Shooters Hill Road, Blackheath, S.E., Professor of Chemistry.
- O.M. Hodgson, Chris., 33, Oakdale Road, Nether Edge, Sheffield, Metallurgical Chemist.
1897. Hodgson, Matthew, Ardmore, Church Hill, Wicklow, Ireland, Technical Chemist.
1890. Hodgson, Wm., 66, Deansgate, Manchester, Oil and Colour Broker.
1906. Hogarth, Julius W., The University, Sydney, N.S.W., Australia, Demonstrator of Chemistry.
1886. Hogben, W., Post Office, Port Talbot, South Wales, Chemical Expert (Celluloid, Ltd., etc.).
- O.M. Hogg, T. W., c/o John Spencer and Sons, Newburn Steelworks, Newcastle-on-Tyne, Metallurgical Chemist.
1905. Holcroft, Harold, Parkdale, Wolverhampton, Iron-founder.
1899. Holden, Archie Neill, c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Chemist.
1887. Holden, G. H., Manchester Oxide Co., Ltd., Canal Street, Miles Platting, Manchester, Chemist.
1904. Holden, Norman N., c/o Hardman and Holden, Ltd., Colliery Lane, Clayton, Manchester, Manufacturing Chemist.
1902. Holdsworth, Ernest T., 10, Merton Road, Bradford, Dyer.
1904. Holgate, Arthur, c/o Wm. Holgate and Sons, Ltd., 15, Earle Street, Liverpool, Corn Miller.
1885. Holgate, T. E., 173, Hollins Grove, Darwen, Lancashire, Metallurgist.
1884. Holgate, Thos., 5, Victoria Street, Westminster, S.W., Gas Engineer.
- O.M. Holland, Philip, 22, Taviton Street, Gordon Square, London, W.C., Analytical Chemist.
1892. Holland, Philip H., 546, Sherbrooke Street West, Montreal, Canada, Merchant.
1901. Hollick, Herbert, 304, The Robeson, Camden, N.J., U.S.A., Chemical Engineer.
1902. Holliday, Lionel B., Lunelough Hall, Huddersfield, Chemical Manufacturer.
1896. Hollings, J. Spencer, Vrondeg, near Wrexham, North Wales, Works Manager.
1903. Hollinshead, Peter, 19, The Hollow Way, Runcorn, Cheshire, Chemist.
1900. Hollinshead, Dr. W. H., Wingrove Avenue, Nashville, Tenn., U.S.A., Teacher of Chemistry.
1904. Holloway, E. G., c/o Jas. S. Kirk and Co., 360, North Water Street, Chicago, Ill., U.S.A., Chemist.
1890. Holloway, G. T., 57-58, Chancery Lane, London, W.C., Analytical and Consulting Chemist.
1883. Holmes, Ellwood, Wyncote, Jesmond Park East, Newcastle-on-Tyne, Colour Manufacturer.
- O.M. Holmes, F. G., Northcroft, Tewitwell Road, Harrogate, Yorks., Technical Chemist.
1907. Holmes, Wm. E., Glenholme, Sandal, Wakefield, Yorks., Chemist.
1900. Holthouse, Harold B., 12, Melton Grove, West Bridgford, Notts., Chemist.
1902. Holton, Alf. L., Chemical Dept., Gas Works, Bradford Road, Manchester, Chemist.
1892. Holton, E. C., 601, Canal Road N.W., Cleveland, Ohio, U.S.A., Chemist.
1893. Holzapfel, Max, Milburn House, Newcastle-on-Tyne, Manufacturer.
1893. Homfray, D., The Hugs, Misterton, near Gainsborough, Analytical Chemist.
1905. Hook, Arthur Harry, c/o Tintie Smelting Co., Silver City, Utah, U.S.A., Chemist.
1904. Hooker, A. H., c/o The Development and Funding Co., Niagara Falls, N.Y., U.S.A., Manufacturing Chemist.
- O.M. Hooper, E. Grant, 16, Royal Avenue, Sloane Square, S.W., Chemist.
1889. Hooper, Ernest F., c/o Brotherton and Co., Ltd., Wear Tar Works, South Dock, Sunderland, Technical Chemist.
1888. Hope, Jas., The Nickel Co., Kirkintilloch, N.B., Nickel Works Manager.
1901. Hopewell, Fredk., 86, Yonville Square, Montreal, Canada, Manager.

1892. Hopkins, Erastus, Ocala, Fla., U.S.A., Consulting Chemist.
1905. Hoppenstedt, A. W., c/o Elk Tanning Co., Ridgway, Pa., U.S.A., Chemist.
1895. Horne, Dr. W. D., 175, Park Avenue, Yonkers, N.Y., U.S.A., Consulting Chemist.
1904. Hoinsey, J. W., Room 1026, 25, Broad Street, New York City, U.S.A., Chemical Engineer.
1900. Horsfall, Jno., 1 Grange Avenue, Rawtenstall, Manchester, Analytical and Consulting Chemist.
1902. Horsfall, L. H., c/o Bunny and Co., Madras, India, Chemist.
1901. Horton, Edw., jun., 10, Smith Street, Chelsea, S.W., Student.
1906. Hosenon, Jas. H., Sun Buildings, Bridge Street, Manchester, Chemical Manufacturer.
1902. Hosford, Roger F., 15, Dey Street, New York City, U.S.A., Chemical Engineer.
1890. Hoskins, A. Percy, Clonke, Rosetta Park, Belfast, Ireland, Analytical Chemist.
1899. Hoskins, Wm., Room 54, 81, South Clark Street, Chicago, Ill., U.S.A., Chemist.
1905. Hough, Warwick M., 902, Rialto Building, St. Louis, Mo., U.S.A., Attorney-at-Law.
1899. Houlder, Bertram E., 50, Lady Margaret Road, Southall, Middlesex, Chemist.
1892. Houston, John, 26, Princess Street, Manchester, Drysalter.
- O.M. Howard, A. G., Burnt House, Chigwell, Essex, Chemical Manufacturer.
1901. Howard, Bernard P., Quantocks, Montalt Road, Woodford Green, Essex, Chemist.
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1887. Howard, D. Lloyd, City Mills, Stratford, E., Chemical Manufacturer.
1907. Howard, G. C., University Club, Salt Lake City, Utah, U.S.A., Chemist.
1898. Howard, Henry, 36, Amory Street, Brookline, Mass., U.S.A., Chemical Engineer.
1902. Howard, Nelson A., c/o General Chemical Co., Hegewisch, Ill., U.S.A., Chemist.
1904. Howard, T., 38, Bulstrode Road, Hounslow, W., Chemist.
- O.M. Howard, W. D., H. Cornwall Terrace, Regent's Park, London, N.W., Chemical Manufacturer.
1906. Howe, Chester A., 124, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1903. Howe, Jas. Lewis, Washington and Lee University, Lexington, Va., U.S.A., Professor of Chemistry.
1905. Howe, Roland E., 15, Highland Street, Concord Junction, Mass., U.S.A., Explosives Chemist.
1904. Howell, Walter L., Room U, Custom House, New Orleans, La., U.S.A., Chemist.
1899. Howles, Fred., c/o McDougall Bros., 66-68, Port Street, Manchester, Chemist.
1889. Howorth, F. Wise, 46, Lincoln's Inn Fields, W.C., Technical Chemist and Chartered Patent Agent.
1907. Howroyd, Richard R., c/o Calder Mersey Extract Co., Ltd., Ditton, near Widnes, Chemist.
1906. Hoyler, Fritz, 49, Market Street, Perth Amboy, N.J., U.S.A., Chemist.
1896. Hoyte, Percy S., Gas Works, Coxside, Plymouth, Gas Engineer.
1900. Hübner, Julius, Ash Villa, Cleidle Hulme, Cheshire, Director of Dyeing and Papermaking Departments (Municipal School of Technology).
1902. Hudson, C. Edward, c/o E. G. Jepson and Co., Albion Walk Chambers, Leeds, Drysalter.
1899. Hudson, Dr. Edw. J., c/o Pioneer Iron Co., Marquette, Mich., U.S.A., Chemist.
1905. Hudson, O. F., The University, Edgbaston, Birmingham, Lecturer on Metallurgy.
- O.M. Hughes, J., 79, Mark Lane, London, E.C., Agricultural Chemist.
1898. Hughes, Raymond M., Miami University, Oxford, Butler Co., Ohio, U.S.A., Professor of Chemistry and Physics.
1908. Hughes, Wm. E., Chemical Laboratory, Messrs. W. Canning and Co., Great Hampton Street, Birmingham, Electro Chemist.
1906. Hulme, Robert B., Bureau of Chemistry, Room D. 15, Produce Exchange, New York City, U.S.A., Chemist.
1905. Hulton, H. F. E., 11, Colinet Road, Putney, S.W., Chemist.
1905. Humel, Edward J., Lake Avenue, cor. Edward Street, Lakewood, Cleveland, Ohio, U.S.A., Chemist.
1893. Humphrey, Chas., Hilderstone, Hartford, Cheshire, Alkali Works Manager.
1902. Humphrey, Rich. L., 1001, Harrison Building, Philadelphia, Pa., U.S.A., Civil Engineer.
1903. Humphreys, A. C., 165, Broadway, New York City, U.S.A., Engineer.
1908. Humphries, Albert E., Coxes Lock Mill, Weybridge, Surrey, Flour Miller.
- O.M. Humphrys, N. H., Gasworks, Salisbury, Wilts, Gas Engineer.
1895. Hunicker, Dr. H. Aug., 3532, Victor Street, St. Louis, Mo., U.S.A., Prof. of Applied Chemistry.
1900. Hunt, Arthur V., 284, New Chester Road, Port Sunlight, Cheshire, Analytical Chemist.
- O.M. Hunt, Bertram, 709, Mills Building, San Francisco, Cal., U.S.A., Technical Chemist.
- O.M. Hunt, Chas., 17, Victoria Street, Westminster, London, S.W., Gas Engineer.
1883. Hunt, J. S., Appleton, Widnes.
1903. Hunt, P. C., Holmes, Metropolitan Gas Co., Flinders Street, Melbourne, Vic., Australia, Gas Engineer.
- O.M. Hunt, W., Hampton House, Wood Green, Weynesbury, Staffordshire, Chemical Manufacturer.
1903. Hunter, H. B., Denney Factory, St. Lucia, West Indies, Sugar Works Manager.
1902. Hunter, Hy. Blount, Hunter Chemical Co., Norfolk, Va., U.S.A., Industrial Chemist.
1893. Hunter, Prof. Matthew, Rangoon College, Rangoon, Burmah, Professor of Chemistry.
- O.M. Huntington, Prof. A. K., King's College, Strand, London, W.C., Professor of Metallurgy.
1902. Huntly, Geo. X., 96, Gower Street, London, W.C., Analytical and Consulting Chemist.
1904. Huntzinger, Alfred, Route de Condette, Pont de Briques, Pas de Calais, France, Chemist and Colourist.
1903. Hurlburt, Allen S., c/o General Chemical Co., Camden, N.J., U.S.A., Chemist.
1904. Hurren, F. H., c/o The Rover Co., Ltd., Coventry, Analytical Chemist.
1894. Hurry, E. H., Goodwyns, Haslemere, Surrey, Mechanical Engineer.
- O.M. Huson, C. W., 18, Batavia Buildings, Hackins Hey, Liverpool, Analytical Chemist.
1908. Hutcheson, John, c/o Farbenfabriken of Elberfeld Co., 14, Front Street East, Toronto, Canada, Local Manager.
1894. Hutcheson, Jno. F., 22, St. Enoch Square, Glasgow, Chemical Manufacturer.
1906. Hutchings, W. Maynard, Easedale, Elmfield Road, Gosforth, Newcastle-on-Tyne, Metallurgist.
- O.M. Hutchinson, C. C., 3, Harcourt Buildings, Temple, E.C., Barrister-at-Law and Chemical Engineer.
1900. Hutchinson, E. George, Gas Works, Stockport, Gas Engineer.
- O.M. Hutchinson, T. J., Aden House, Manchester Road, Bury, Analytical and Consulting Chemist.
1901. Hutton, Dr. Robt. S., West Street, Sheffield, Lecturer on Electro-Chemistry.
- O.M. Huxley, Jas. H., c/o Vickers, Son and Maxim, Ltd., River Don Works, Sheffield, Metallurgical Chemist.
1906. Huyett, Miles C., 608, Morgan Building, Buffalo, N.Y., U.S.A., Mechanical Engineer.
1897. Hyams, Godfrey M., 312, Sears Building, Boston, Mass., U.S.A., Mines Manager.
1902. Hyde, Austin T., Box 98, Rumford Falls, Maine, U.S.A., Chemical Engineer.
1897. Hyde, B. T. Babbitt, 82, Washington Street, New York City, U.S.A., Soap Manufacturer.
1899. Hyde, Fred. S., 215, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Research Chemist.

1899. Hyde, Wm. Grantley, Garden Wharf, Church Road, Battersea, S.W., Assayer.
 1901. Hyman, Leonard W., 342, South Pearl Street, Albany, N.Y., U.S.A., Analytical Chemist.

I

1898. Ibbotson, E. C., jun., A. B. Electrostat, Trollhattan, Sweden, Metallurgist.
 1900. Ichioka, Tajiro, 19, Maruyama Shinmachi, Hongo, Tokio, Japan, Chemist (Imperial Japanese Navy).
 1906. Iddings, Richard P., Arlington Mills, Lawrence, Mass., U.S.A., Chemist.
 1885. Idris, T. H. W., M.P., 120, Pratt Street, Camden Town, N.W., Mineral Water Manufacturer.
 1902. Ihart, John P., 373, West 35th Street, New York City, U.S.A., Technical Chemist.
 1900. Imrie, John, 83, Horndean Road, Firth Park, Sheffield, Producer Gas and By-Products Plant Manager.
 1900. Ingalls, Walter R., (Communications) 505, Pearl Street, New York City; and (Journals) Bement Avenue, West New Brighton, Staten Is., N.Y., U.S.A., Mining Engineer and Metallurgist.
 1889. Ingle, Dr. Harry, Creskeld, Balwearie Road, Kirkcaldy, Fifehire, Organic Chemist.
 1891. Ingle, Herbert, 33, City Road, Edgbaston, Birmingham, Agricultural Chemist.
 1909. Ingleby, G. W., c/o John L. Seaton & Co., Ltd., Sculcoates, Hull, Director.
 1906. Inglis, Dr. Jno. K. H., University College, Reading, Berks., Lecturer.
 1884. Inglis, R. A., Culrain, Bothwell, N.B., Analytical Chemist.
 1900. Innes, R. Faraday, 4, Beech Terrace, Tarbock Road, Huyton, near Liverpool, Chemist.
 1906. Innes, Dr. W. Ross, 6, Griffiths Road, Wimbledon, S.W., Chemist.
 1904. Irlam, H. A., Long View Villa, Hitchin Road, Luton, Beds., Manager and Chemist.
 1884. Irving, J. M., 17A, Dickinson Street, Cooper Street, Manchester, Chemical Merchant.
 1906. Irwin, John T., Cledford, Middlewich, Cheshire, Manufacturing Chemist.
 O.M. Irwin, W., Inglehurst, Stand, near Manchester, Analytical Chemist.
 1893. Isaac, J. F. V., Research Chemist.
 1901. Isakovics, Alois von, Synfleuer Scientific Laboratories, Monticello, N.Y., U.S.A., Manufacturing Chemist.
 1900. Ittner, Dr. Martin H., c/o Colgate and Co., Jersey City, N.J., U.S.A., Soap and Essential Oil Chemist.
 1908. Ives, Herbert, 125, Pearl Street, Boston, Mass., U.S.A., Manager (Dyestuffs, etc.).

J

1890. Jackman, E. J., 60, Belgrave Road, Hford, Essex, Technical Chemist.
 1898. Jackson, Alf. George, 65, Ann Street, Brisbane, Queensland, Electro-Chemical Engineer.
 1906. Jackson, Arthur A., 672, East 43rd Street, Chicago, Ill., U.S.A., Chemist.
 1903. Jackson, Dr. D. H., 95, Abbey Road, St. John's Wood, N.W., Chemist.
 O.M. Jackson, Edward, Ravens Clift, Oxford Road, Moseley, Birmingham, Alkali Works Inspector.
 1904. Jackson, Ernest W., 3, Leven Street, Salthum, Yorks., Analytical Chemist.
 1891. Jackson, F., Smedley Bridge Works, Cheetham, near Manchester, Bleacher and Dyer.
 1883. Jackson, Frederick, 14, Cross Street, Manchester, Laboratory Furnisher.
 1886. Jackson, John, 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.
 1901. Jackson, Percy G., c/o National Boiler and General Insurance Co., 22, St. Ann's Square, Manchester, Chemist.
 1800. Jackson, Saml., c/o Binny and Co., Madras, India, Analytical Chemist.
 1902. Jackson, Samuel, c/o Wm. Metcalf, Ltd., Church, near Accrington, Director (Tar Distillery).
 1898. Jackson, Thos., Thornton View, Clayton, Manchester, Chemical Manufacturer.
 1900. Jackson, Victor G., 21, Frankfort Road, Herne Hill, S.E., Chemist.
 1903. Jackson, Wm. D. N., 29, Woodbine Avenue, Wallsend-on-Tyne, Analytical Chemist.
 1900. Jackson, Dr. W. Hatchett, Radcliffe Library, Oxford, Librarian and Science Tutor (Keble College).
 1893. Jackson, Rt. Hon. W. L., F.R.S., *See* Allerton, Rt. Hon. Lord.
 1899. Jackson, W. Morton, c/o British Oxygen Co., Ltd., Great Marlborough Street, Manchester Manager.
 O.M. Jackson, W. P., Saxilby, near Lincoln, Chemical Works Manager.
 1901. Jacobsen, Rudolph C., 154, Lake Street, Chicago, Ill., U.S.A., Editor of "Hide and Leather."
 1900. Jacoby, Areli H., c/o American Dyewood Co., 84, William Street, New York City, U.S.A., Chemist.
 1897. Jacqué, Manrice, "La Cantabrica," Galdacano, cerca Bilbao, Spain, Chemical Engineer.
 1901. Jadhava, Khasberao B., Nausari, Bombay, India, Collector and District Magistrate.
 1900. Jäger, B. M., c/o Geo. Jäger and Sons, 77, Burlington Street, Liverpool, Sugar Chemist.
 1886. Jago, Wm., 1, Garden Court, Temple, London, E.C., Barrister-at-Law.
 1883. James, E. T., British Alizarin Co., Ltd., Silvertown, Victoria Docks, E., Secretary.
 1885. James, Dr. J. Wm., Aylmer House, Weston-super-Mare; and (Journals) 29, Redcliffe Street, Bristol, Chemical Lecturer.
 1893. James, Lawrence S., 32, Hawley Street, Boston, Mass., U.S.A., Gas Inspector.
 1905. James, Oscar S., 227, George Street, Toronto, Canada, Analytical Chemist.
 O.M. Japp, Dr. F. R., F.R.S., The University, Aberdeen, Professor of Chemistry.
 1906. Jardine, S., Dallyn, Jardine, & Co., 23, Scott Street, Toronto, Canada, Chemical Merchant.
 1890. Jarmain, Geo. S., Dalton Lodge, Huddersfield, Wool Extractor.
 O.M. Jarmay, G., Hartford Lodge, Hartford, Cheshire, Alkali Manufacturer.
 1900. Jarvie, Jas., Ferndale, Kennmure Ave., Bishopbriggs, N.B., Chemist.
 1907. Jatar, S. B., 219, Upper Brook Street, C. on M., Manchester, Student.
 O.M. Jayne, Dr. H. W., c/o Barrett Manufacturing Co., Frankford, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
 1908. Jeffery, John H., 10, Daysbrook Road, Streatham Hill, London, S.W., Chemist and Metallurgist.
 O.M. Jekyll, J., Castle Moat House, Lincoln, Chemical Manufacturer.
 1892. Jenkin, W. A., 5, Bella Vista, Minas de Rio Tinto, Provincia de Huelva, Spain, Metallurgical Chemist.
 1905. Jenkins, Chas. D., 8, Grove Street, Winchester, Mass., U.S.A., Chemist.
 1894. Jenkins, John H. B., Laboratory, G.E.R. Works, Stratford, E., Analytical Chemist.
 1894. Jenks, Robt. L., Kasauli, Punjab, India, Chemist.
 1908. Jennison, George, Derby House, Heaton Chapel, Stockport, Chemist.
 1905. Jennison, Jas., Mountfield, London Road, Greenhithe, Kent, Chemist.
 1907. Jensen, Chas. W. L., "Lauriston," Grand Avenue, Southbourne, Bournemouth, Brewer and Maltster.
 1904. Jepson, John Elliott, Star House, Feniscowles, near Blackburn, Chemist.
 1899. Jordan, Dr. David S., Temora, Colinton, Midlothian, Chemist (Gelatin Works).
 1899. Jessop, Louis V., Holmlea, Woodville Road, Leytonstone, Essex, Chemist.
 1904. Jewson, F. T., Earith, near St. Ives, Hunts., Chemist.
 1896. Job, Robt., Ambler, Pa., U.S.A., Analytical Chemist.

1906. John, David, Haileybury, Ontario, Canada, Chemist.
 1908. Johnson, Arthur, 2, Maple Street, Nursery Street, Pendleton, Manchester, Chemist.
 1886. Johnson, A. E., Claremont, Lyndhurst Road, Wolverhampton, Analytical Chemist.
 1904. Johnson, Cedric, Field House, Winnington, Northwich, Chemical Engineer.
 1906. Johnson, Chas. C., Tunstall Bay, *via* Vancouver, B.C., Canada, Chemical Engineer.
 1905. Johnson, Chas. F., Avery Chemical Co., Littleton, Mass., U.S.A., Superintendent.
 1891. Johnson, Edmond E., The Gales, Roding Lane, Woodford Bridge, Essex, Chemical Engineer.
 1900. Johnson, Edw., c/o Herdeiros Bowman, Ltd., Caixa 57, Pernambuco, Brazil, Sugar Works Manager.
 1908. Johnson, Dr. Edw. S., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Chemist.
 1902. Johnson, Emil F., 96-98, Maiden Lane, New York City, U.S.A., Consulting Chemist.
 1901. Johnson, Dr. F. M. G., 286, Peel Street, Montreal, Canada, Chemist.
 1904. Johnson, G. B., 7, Church Street, Liverpool, Wholesale Chemist.
 1906. Johnson, Dr. Harold, 5 and 6, Fowkes' Buildings, Great Tower Street, London, E.C., Chemist.
 1907. Johnson, H. Finnis, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Sales Manager.
 1908. Johnson, Horton, Ridgway, Pa., U.S.A., Tanner.
 O.M. Johnson, J. E., 40, Idmiston Road, Stratford, E., Manufacturing Chemist.
 1895. Johnson, Jesse F., Vaudreuil Station, P.Q., Canada, Chemical Engineer.
 1900. Johnson, John, c/o John Johnson and Co., 37th Street and Second Avenue, Brooklyn, N.Y., U.S.A., Chemical Engineer.
 1900. Johnson, Jno. W. H., York House, Thornhill, Dewsbury, and (Journals) West Riding Rivers Board, Wakefield, Yorks., Chemist.
 1906. Johnson, Oliver L., c/o The Aspinook Co., Jewett City, Conn., U.S.A., Dye Works Manager.
 O.M. Johnson, S. H., Warren Hill House, Loughton, Essex, Chemical Engineer.
 1904. Johnson, S. Hearon, 7, Church Street, Liverpool, Wholesale Chemist.
 1907. Johnson, Walter M., Box 376, Penns Grove, N.J., U.S.A., Chemist.
 1895. Johnston, Alex. R., 18, Percy Street, Ibrox, Glasgow, Analytical Chemist.
 1906. Johnston, A. McA., Box 108, Germiston, Transvaal, Metallurgical Chemist.
 1894. Johnston, G. Lawson. *See* Lawson-Johnston, G.
 1904. Johnston, J. H., 8, Leopold Road, Wimbledon, S.W., Chemist and Bacteriologist.
 1889. Johnston, Thos., Nobel's Explosives Co., Ltd., 195, West George Street, Glasgow, Manager.
 1904. Johnston, Thos. J., 4, Garrioch Drive, Maryhill, Glasgow, Chemist.
 1890. Johnston, Wm. A., The S. S. White Dental Manufacturing Co., Princess Bay, Staten Island, N.Y., U.S.A., Dental Enamel Manufacturer.
 1894. Johnston, W. E. Lawson. *See* Lawson-Johnston, W. E.
 O.M. Johnston, Wm. G., Anchor Chemical Works, 1005, Garngad Road, Glasgow, Technical Chemist.
 O.M. Johnstone, Jas., Shawfield Works, Rutherglen, Glasgow, Technical Chemist.
 1905. Johnstone, J. Swanston, National Distilleries Co., Bond Street, Durban, Natal, Distiller.
 1903. Johnstone, S. J., 15, Springfield Road, New Southgate, N., Research Chemist.
 O.M. Johnstone, W. G., Chemist.
 1907. Jolliffe, Ernest H., 16, Maitland Street, Toronto, Canada, Works Chemist.
 1905. Jolliffe, Frank, 27, Roseldine Street, Honor Oak Park, S.E., Chemist.
 1908. Jones, Andrew U., 334, Notre Dame Street West, Montreal, Canada, Mechanical Contractor.
 1904. Jones, Arthur B., Gardeng City, N.Y., & U.S.A., Superintendent.
 1902. Jones, David R., Standard Chemical Co., Deseronto, Ont., Canada, Chemical Engineer.
 1908. Jones, D. Trevor, c/o Brotherton and Co., Ltd., Litherland, Liverpool, Works Chemist.
 1902. Jones, E. Strangways, Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Australia, Metallurgical Chemist.
 1909. Jones, E. Willis, Coleshill Terrace, Llanelly, South Wales, Chemical Manufacturer.
 O.M. Jones, E. W. T., 10, Victoria Street, Wolverhampton, Analytical Chemist.
 1897. Jones, Fred. W., 39, Pembury Road, Clapton, N.E., Technical Chemist.
 1896. Jones, G. Cecil, 41, London Road, Forest Hill, S.E., Consulting Chemist.
 1905. Jones, Harold, Morro Velho, Villa Nova de Lima, Minas Geraes, Brazil, Analyst and Assayer.
 O.M. Jones, H. Chapman, Royal College of Science, South Kensington, S.W., Senior Demonstrator in Chemistry.
 1907. Jones, Henry Williams, Earlsdon Lane, Styvechale Avenue, Coventry, Manufacturing Chemist.
 1893. Jones, Herbert. *See* Sefton-Jones, H.
 1901. Jones, Herbert J., c/o Brechfa Chemical Co., Ltd., Nantgareidig, R.S.O., South Wales, Chemist.
 1905. Jones, J. E. Stacey, Masonic Buildings, Coventry, Consulting Chemist and Metallurgist.
 1904. Jones, J. Shirley, Moscow, Idaho, U.S.A., Chemist.
 1899. Jones, Llewellyn J. W., Metallurgist.
 1894. Jones, M. W., The Cottage, Brislington, Bristol, Manager (Oil and Colour Works).
 1887. Jones, T. Tolley, Australian Explosives and Chemical Co., Ltd., 138, Queen Street, Melbourne, Victoria, Australia, Explosives Manufacturer.
 O.M. Jones, Walter Norris, Lancashire Metal Works, Widnes, Technical Chemist.
 1903. Jones, Wm. App., c/o Boston Artificial Leather Co., Metropolitan Building, New York City, U.S.A., Chemist.
 1905. Jones, W. Ellis, 80, Arundel Avenue, Liverpool, Sugar Refiner.
 1904. Jordan, Stanley, 100, William Street, New York City, U.S.A., Importer of Chemicals.
 1908. Joselin, Percy H., 81, Bennerley Road, New Wandsworth, S.W., Chemist.
 1905. Joseph, A. F., Ceylon Technical College, Colombo, Ceylon, Lecturer on Chemistry.
 1900. Josephson, Edgar, c/o Pantazote Leather Co., Passaic, N.J., U.S.A.
 1906. Joshua, Dr. Walter P., 45, Belsize Avenue, Hampstead, N.W., Chemist.
 1891. Joslin, Omar T., 3223, Spring Grove Avenue, Cincinnati, Ohio, U.S.A., Chemical Engineer.
 1887. Jouët, Dr. C. H., Roselle, Union Co., N.J., U.S.A., Technical Chemist.
 1889. Journaud, Louis, 8, Place St. Maurice, Vienne (Isère), France, Technical Chemist.
 1904. Jowett, Dr. H. A. D., Phoenix Mills, Dartford, Kent, Chemist.
 1903. Joyce, Clarence M., c/o Arlington Co., Arlington, N.J., U.S.A., Chemist.
 1887. Jürgensen, Dr. Rolof, Karlasse 5, Prag-Zizkov, Austria, Chemist.
 O.M. Justice, P. M., 55-56, Chancery Lane, London, W.C., Patent Agent.

K

1896. Kalbfleisch, Franklin H., Metropolis Building, Broadway and 16th Street, New York City, U.S.A., Chemical Manufacturer.
 1908. Kalenski, Edmund, 27, rue Cité Derrière, Lausanne, Switzerland, Chemist.
 1908. Kaliski, Dr. Maximilian S., 101, West 130th Street, New York City, U.S.A., Technical Chemist.
 1884. Kalle, Dr. Wm., Biebrich-am-Rhein, Germany, Colour Manufacturer.
 1901. Kauder, Dr. E., c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.
 1903. Kauffman, Milton H., American Smelting and Refining Co., Durango, Colo., U.S.A., Chemist.
 1892. Kaufmann, Dr. Herbert M., c/o Mutual Chemical Co., Jersey City, N.J., U.S.A., Chemist.

1904. Kaus, Dr. Emil, c/o Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.
1904. Kawai, I., 54, Shirokane, Shiba, Tokyo, Japan, Chemist (Camphor Monopoly).
1885. Kawakita, Prof. Michitada, Imperial Engineering College, Tokio, Japan, Professor of Applied Chemistry.
- O.M. Kay, Wm. E., The Thorns, Prestwich Park, near Manchester, Printworks Chemist.
1905. Kaye, Frederick, 20, Birchwood Avenue, Muswell Hill, N., Research Chemist.
1904. Kaye, Thos., Westerfield, Perth, Scotland, Analytical Chemist.
1905. Kayser, Edwin Cuno, Chemist.
1884. Keane, Dr. Chas. A., Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C., Principal.
- O.M. Kearns, H. W., Baxenden, near Accrington, Dyer.
1897. Kearns, Jno. S., Cowpe Mills, Waterfoot, near Manchester, Chemist and Dyer.
1894. Kebler, Lyman F., Department of Agriculture, Bureau of Chemistry, Washington, D.C., U.S.A., Chief of Drug Laboratory.
1908. Keeble, A. J., Wreham Hall, Stoke Ferry, Norfolk, Land Owner.
1908. Keiller, P. A., c/o Colombo Commercial Co., Ltd., Colombo, Ceylon, Agricultural Analyst.
1886. Keiser, Prof. E. H., Washington University, St. Louis, Mo., U.S.A., Professor of Chemistry.
1908. Keith, Jas. W., c/o C. Tennant and Co, Carnoustie, Forfarshire, Analytical Chemist.
1900. Kelf, Henry C., 51, Preston Road, Leytonstone, N. E., Sugar Chemist.
1907. Keller, Dr. Edward, P.O. Box 363, Perth Amboy, N.J., U.S.A., Chemist and Metallurgist.
1905. Keller, Robt. J., 88, Broad Street, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.
1885. Kellner, Dr. Wm., 135, Victoria Road, Old Charlton, S.E., Chemist to War Department.
1908. Kellogg, H. W., c/o National Electrolytic Co., Niagara Falls, N.Y., U.S.A., General Manager.
1908. Kemp, Edw. S., 131, Belvoir Street, Hull, Analyst.
1889. Kempson, John F., Pye Bridge Chemical Works, near Alfreton, Derbyshire, Chemical Manufacturer.
1907. Kendall, G. F., Chemical Works, Stratford-on-Avon, Chemical Manufacturer.
1901. Kennedy, Alex., Kennill House, Bothwell, N.B., Rosin Distiller.
1903. Kenyon, Percy S., Park House, Cheadle Hulme, Cheshire, Drysalter.
1889. Kenyon, Thos., The Shrubbery, Hilton Park, Prestwich, near Manchester, Manufacturing Chemist.
1906. Kepner, S. H., 149, 12th Street, Long Island City, N.Y., U.S.A., Superintendent.
1888. Ker, Alan D., 14, Wilton Mansions, Glasgow, Chemical Manufacturer.
1899. Kern, Walter P., 275, Lafayette Avenue, and (Journals) c/o General Chemical Co., Dundee Works, Passaic, N.J., U.S.A., Chemist.
1906. Kerr, Charles H., 70, West 10th Avenue, Columbus, Ohio, U.S.A., Ceramic Engineer (Carborundum Co.).
1890. Kerr, Saml. T., 516, North Delaware Avenue, Philadelphia, Pa., U.S.A., Salt Manufacturer.
1897. Kerr, Wm. M., c/o General Chemical Co., 608, Philadelphia Bourse, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1896. Kershaw, Jno. B. C., West Lancashire Laboratory, Waterloo, Liverpool, Analytical Chemist.
1902. Kessler, Henry W., 317, Electric Building, Cleveland, Ohio, U.S.A., Manufacturing Chemist.
1903. Kessler, Raphael, Pittston, Pa., U.S.A., Chemical Manager.
1893. Kestner, Paul, 7, Rue de Toul, Lille, France, Chemist.
1898. Keswick, Wm., M.P., 3, Lombard Street, London, E.C., Merchant.
1900. Kewley, Jas., Arbory Road, Castletown, Isle of Man, and (Journals) Balik Papan, Dutch Borneo, Technical Chemist.
1890. Keys, W. H., Hall End Works, West Bromwich, Oil and Chemical Manufacturer.
1892. Kibble, W. Oakes, Charlotte, N.C., U.S.A., Chemical Engineer.
1900. Kilgore, Benj. W., Raleigh, N.C., U.S.A., Chemist.
1901. Kilmer, Fred. B., c/o Messrs. Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemical Manufacturer.
1905. Kimball, Herbert S., 46, Cornhill, Boston, Mass., U.S.A., Mill Engineer.
- O.M. Kinch, E., Royal Agricultural College, Cirencester, Professor of Chemistry.
1905. King, Capt. Alex. E., R.A., Egyptian Army Citadel, Cairo, Egypt, and (Journals) c/o Cox & Co., 16, Charing Cross, London, W.C., Inspector of Explosives.
- O.M. King, A. J., M.P., (Journals) Ingersley Vale, and (communications) Rock Bank, Bollington, near Macclesfield, Bleacher and Finisher.
1907. King, C. A., c/o The Farnley Iron Co., Farnley, near Leeds, Technical Chemist.
1884. King, Col. C. M., Campsie Alum Works, Lennoxtown, N.B., Alum Manufacturer.
1905. King, Frank E., 75, Gracechurch Street, London, E.C., Analytical Chemist.
- O.M. King, J. Falconer, 30, Chambers Street, Edinburgh, Consulting Chemist.
1887. King, Col. Robt., 115, Wellington Street, Glasgow, Chemical Manufacturer.
1907. King, Robt. J., c/o Merrimac Chemical Co., North Woburn, Mass., U.S.A., Chemist.
1895. King, Sidney J., Hazeldene, Avenue Road, Bexley Heath, Kent, Colour and Dyestuff Traveller.
- O.M. King, Walter R., 16, Mincing Lane, London, E.C., and (Journals) Holford Lodge, Trinity Avenue, Southend-on-Sea, Chemical Manufacturer.
1905. King, Warren C., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Salesman.
1903. King, William, South Coast Junction, Natal, S. Africa, Analytical Chemist.
1896. Kingdon, Holman, c/o Joseph Crosfield and Sons, Warrington, Technical Chemist.
1908. Kingsbury, Percy C., c/o S. Pearson and Son, Ltd., Minatitlan, Mexico, Civil Engineer.
1883. Kingsford, T. P., Oswego, N.Y., U.S.A., Starch Manufacturer.
- O.M. Kingzett, C. T., Newlands, St. George's Avenue, Weybridge, Surrey, and (Journals) Sanitas Co., Ltd., Locksley Street, Limehouse, E., Technical Chemist.
1906. Kinnertley, H. W., Branscombe, Merry Hill Road, Bushey, Herts, Chemist and Manufacturer.
1892. Kinnicutt, Professor L. P., 77, Elm Street, Worcester, Mass., U.S.A., Professor of Chemistry (Worcester Polytechnic Institute).
1897. Kipping, Dr. F. Stanley, F.R.S., University College, Nottingham, Prof. of Chemistry.
1908. Kirkhope, T. Bertram, c/o Mrs. Wade, Connor-downs, Hayle, Cornwall, Explosives Works Chemist.
1898. Kirkland, Archd., 78, High Street, Irvine, N.B., Baker.
1905. Kirkland, John, 105, Holmdene Avenue, Herne Hill, S.E., Technical Instructor.
1897. Kirkland, Robt., Hawthorne, Newmains, Lanarkshire, N.B., Chemist.
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1890. Luthy, Edmund O., 2419, Ohio Avenue, Cincinnati, Ohio, U.S.A., Distiller.
1884. Lüthy, Otto, P.O. Box 63, Maywood, N.J., U.S.A., Analytical Chemist.
1895. Luxmoore, Dr. Chas. M., Central Technical Schools for Cornwall, Truro, Lecturer on Chemistry.
1899. Luxton, Thos., 116, North Boulevard, Hull, Teacher of Chemistry.
1903. Lye, Ernest B., Legrave Hall, near Luton, Beds., Straw Plait Dyer and Bleacher.
1885. Lye, W. T., Legrave Hall, near Luton, Beds., Straw Dyer.
1884. Lyle, James, Ardesco, Plaistow Wharf, Victoria Docks, E., Sugar Refiner.
1885. Lyle, Jno., 21, Mincing Lane, London, E.C., Sugar Refiner.
1902. Lyle, Robert F., Berry Yards Sugar Refinery, Greenock, N.B., Analytical Chemist.
1896. Lynn, Arthur H., 71, College Road, Bromley, Kent, Chemical Works Manager.
1906. Lynch, W. D., 10, Pinckney Street, Boston, Mass., U.S.A., Analytical Chemist.
1899. Lynn, R. Rankine, 7, Highburgh Terrace, Dowanhill, Glasgow, Chemical Engineer.
1902. Lyon, Edwd. H., 520, West 27th Street, New York City, U.S.A., Manufacturing Chemist.
- O.M. Lyon, J. G., The Aire Tar Works, Knottingley, Yorks., Tar Distiller.
1906. Lyons, Robert H., Emporium, Pa., U.S.A., Chemist.
- O.M. Lytle, A. M., North of Ireland Chemical Co., Ltd., 34, Victoria Street, Belfast, Ireland, Chemical Manufacturer.
1891. Macadam, Herbert E., Dalkeith, Glengall Road, Woodford Green, Essex, Manure Works Manager.
1894. Macadam, Stevenson, 55, York Place, Edinburgh, Analytical Chemist.
1891. Macallan, J., 3, Rutland Terrace, Clontarf, Dublin, Analytical Chemist.
1894. McAlley, Robt., Bankside, Falkirk, N.B., Paint Works Manager.
1892. Macara, Thos., jun., 30, Oakfield Road, Stroud Green, N., Chemist.
1889. McArthur, Jno., 262, Trinity Road, Wandsworth Common, S.W., Chemist.
1887. McArthur, J. B., Price's Patent Candle Co., Limited, Bromborough Pool, near Birkenhead, Chemist.
- O.M. McArthur, J. S., 74, York Street, Glasgow, Consulting Chemist and Metallurgist.
1901. MacArthur, Jno. S., 15, St. John's Road, Pollokshields, Glasgow, Paint and Varnish Manufacturer.
1892. McArthur, Thos., Tower Building, Water Street, Liverpool, Drysalter and Dyewood Extractor.
1905. McCallum, A. L., Queen Building, Halifax, N.S., Canada, Analytical and Consulting Chemist.
1898. MacCallum, D. A., 389, Central Chambers, 93, Hope Street, Glasgow, Chemist.
- O.M. McCallum, J. M., Southdeane, Paisley, N.B., Soap Manufacturer.
1894. McCann, Owen, 19, Oriel Street, Vauxhall Road, Liverpool, Printing Ink Manufacturer.
1908. McCarter, Fred. W., 17, Lewis Wharf, Boston, Mass., U.S.A., General Manager.
1909. McCarthy, Harold H., 20, Forbes Street, Bombay, India, Chemist and Druggist.
1905. McCaw, Major W. D., Library, Surgeon General's Office, Washington, D.C., U.S.A., Officer, Medical Department, U.S. Army.
1905. McCleary, Wm., 61, Station Road, Pendlebury, near Manchester, Finisher.
1907. McCombie, Chas., 8, Hartley Road, Leytonstone, N.E., Chemist.
1907. McConnan, Dr. Jas., Chemical Laboratory, Frigorifico, Campana F.C.R., Argentina, Chemist (River-Plate Fresh Meat Co.).
1903. McCourt, Cyril D., 13, Malwood Road, Balham Hill S.W., Research Chemist (Morgan Crucible Co.).
- O.M. McCowan, W., Essex Wharf, Narrow Street, Limehouse, E.
1897. McCrae, Dr. John, Government Laboratories, P.O. Box 1080, Johannesburg, Transvaal, Government Analyst.
1898. McCreath, Wm. D., c/o Quantock Vale Cider Works, North Petherton, Bridgewater, Cider Manufacturer.
1900. McCulloch, John, Glencoe, Lostock Gralam, Cheshire, Chemical Engineer.
1903. McCully, R. E. J., 65, Pelham Road, Gravesend, Kent, Analytical Chemist.
1909. McCune, W. H., American Sheet and Tin Plate Co., Vandergrift, Pa., U.S.A., Chief Chemist.
- O.M. McDaniel, J. J., Woodlands, Bandon, Ireland, Distiller.
- O.M. Macdonald, A., 72, Great Clyde Street, Glasgow.
1907. MacDonald, G. Mac., c/o Union Metallic Co., Bridgeport, Conn., U.S.A., Mechanical Engineer.
1897. MacDonald, G. W., Geddes House, Burch Road, Gravesend, Kent, Explosives Chemist.
- O.M. Macdonald, J. W., Cleveland, The Glebe, Blackheath, S.E., Analytical Chemist.
1902. Macdonald, Peter, jun., c/o Mazapil Copper Co., Ltd., Concepcion del Oro (Apartado No. 5), Saltillo, Zacatecas, Mexico, Analytical Chemist.
1899. MacDonald, S. Fremont, c/o Ashtabula Hide and Leather Co., Ashtabula, Ohio, U.S.A., Tanner.
- O.M. McDonald, T. McG., Wallabo Estate, St. Vincent, West Indies, Sugar Chemist.
1906. Macdougald, Geo. D., City Laboratory, 13, Shore Terrace, Dundee, Analyst.
1895. McDougall, Isaac, jun., 68, Port Street, Manchester, Chemical Manufacturer.
1890. McDougall, J. T., Dunolly, Morden Road, Blackheath, S.E., Manufacturing Chemist.

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1908. Maas, Milton A., 100, William Street, New York City, U.S.A., Manufacturing Chemist.
1887. Mabery, Prof. Chas. F., Case School of Applied Science, Cleveland, Ohio, U.S.A., Professor of Chemistry.

1907. McDougall, R. K., Glenar buck, Bowling, Scotland, Analytical Chemist.
1906. McDowall, Wm., Oficina Anita, Pampa Central, Antofagasta, Chile, South America, Analytical Chemist.
1906. McDowell, Alex. H., 373, West 123rd Street, New York City, U.S.A., Chemist.
1889. MacEwan, Peter, 64, Southwood Lane, Highgate, N., Editor of "Chemist and Druggist."
1891. McEwen, Atholl F., 40, Handen Road, Lee, S.E., Analytical Chemist and Assayer.
1901. McEwen, Duncan C., Astor House Hotel, Seoul, Korea, Metallurgical Chemist.
1902. McFarland, Alan R., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.
- O.M. Macfarlane, R. F., Tharsis Copper Works, East Moors, Cardif, Works Manager.
1901. McFarlane, Walter, Sunnyside, Thornliebank, Renfrewshire, Printworks Manager.
1890. McFarlane, W. W., East 20th Street, Chester, Pa., U.S.A., Dyeworks Manager.
1893. McGhie, T. Burns, c/o Quirk, Barton and Co., Normandy Wharf, Rotherhithe, S.E., Analytical Chemist and Assayer.
1904. McGill, A., 317, Queen Street, Ottawa, Canada, Analytical Chemist.
1899. MacGillivray, Wm. A., c/o Swansea Safety Fuse Co., Pipe House Wharf, Swansea, Analytical Chemist.
1887. McGlashan, John, Cawnpore Sugar Works, Cawnpore, India, Technical Chemist.
1902. McGovney, Chas. S., 722, East 19th Street, Indianapolis, Ind., U.S.A., Chemist.
1884. McGowan, John, Ash House, Talke, near Stoke-upon-Trent, Colliery Manager.
1906. McGregor, Russell, 20, Havelock Square, Sheffield, Analytical Chemist.
1905. McGrigor, G. D., Perran Mine, Marazion, Cornwall, Mine Owner.
1896. McIlhiney, Dr. Parker C., 7, East 42nd Street, New York City, U.S.A., Chemist.
1894. McIlwaine, Alf. W., Stoneferry, Hull, Oil Manufacturer.
- O.M. MacIndoe, G. D., Ness Street, Invercargill, New Zealand, Public Analyst and Consulting Chemist.
1903. Macintire, Benj. Conid, U.S. Geological Survey, 40th and Butler Streets, Pittsburg, Pa., U.S.A., Chemist.
1888. MacKean, Wm., 208, Bedford Hill, Balham, S.W., Technical Chemist.
- O.M. McKechnie, D., Heath House, Runcom, Copper Extractor.
- O.M. McKechnie, D. M., The Grange, Halewood, near Liverpool, Copper Extractor.
1904. McKechnie, R. D., Minas de Rio Tinto, Provincia de Huelva, Spain, Chemist.
1887. McKellar, W. G., c/o United Alkali Co., Ltd., St. Rollox Works, Glasgow, Technical Chemist.
1895. McKenna, Dr. Chas. F., 50, Church Street, New York City, U.S.A., Chemist.
1899. McKenzie, Alex. H., 17, North Street, North Adams, Mass., U.S.A., Colour Mixer.
1909. Mackenzie, Kenneth G., The New York Testing Laboratory, Maurer, N.J., U.S.A., Chemist.
1893. McKerrrow, C. A., Wingfield, Wilmslow, Cheshire, Consulting Chemist.
1905. McKerrrow, W. J., 12, Chadwick Road, Leytonstone, N.E., Analytical Chemist.
1893. McKesson, John, 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.
1891. Mackey, W. McD., Victoria Chambers, Leeds, Analytical Chemist.
1900. McKillop, George F., Broxburn Oil Works, Broxburn, N.B., Works Chemist.
1890. McKillop, Jno., 93, Brook Green, London, W., Metallurgist.
1902. McKim, Wm., 37, Fairview Street, Yonkers, N.Y., U.S.A., Colour Maker.
1908. McLaren, Alex., 11, Willowdale Road, Fazakerley, Liverpool, Analytical Chemist.
1908. McLaren, Alex. W., 3, Hayfield Terrace, Langside, Glasgow, Analytical Chemist.
1898. McLaurin, Robt., 414, Sauchiehall Street, Glasgow Chemist.
1905. McLellan, Basil G., c/o Rowntree & Co., Ltd., The Cocoa Works, York, Analytical Chemist.
1908. Macleod, Alex., Mount Pleasant, Old Kilpatrick, N.B., Analytical Chemist.
1892. McLeod, Jas., Gas Works, Greenock, N.B., Manager.
1903. MacMahon, F. W., 31, Marler Road, Forest Hill, S.E., Chemist (Oxychlorides, Ltd.).
1896. McMaster, Daniel, Bemis, Albert Road, Falkirk, N.B., Paper Mill Manager.
1894. Macmillan, Arch., c/o Dr. Crombie, Main Street, Mechanicville, N.Y., U.S.A.
1907. McMillen, Russell H., c/o American Vanadium Co., Bridgeville, Pa., U.S.A., Chemist.
1903. McMullan, Charles, 4, William Street Chambers, Belfast, Ireland, Chemist.
1904. McMullen, Alan, 108, James Street, Dublin, Ireland, Brewer.
1889. McMurtrie, J. M., 320, Maxwell Road, Pollokshields, Glasgow, Brass Founder.
1900. McMurtrie, Dr. Wm. T., 480, Park Avenue, New York City, U.S.A., Chemist.
1895. McMurtry, G. C., Mount Street, Nelson, New Zealand; and (Subscriptions) c/o C. H. Izod, 84, Queen Victoria Street, London, E.C., Manager.
- O.M. Macnab, W., 10, Cromwell Crescent, London, S.W., Analytical Chemist.
1907. McNaughton, Wm. G., Port Edwards, Wis., U.S.A., Chemist.
1907. Macpherson, Robert, 24, King William Street, London, E.C., Managing Director (Sapon, Ltd.).
1908. McQueen, James, jun., Clyde House, Uddingston, N.B., Analytical Chemist.
1894. McVitie, Robt., Biscuit Works, Willesden, N.W., Biscuit Manufacturer.
1901. Maertens, Emile, P.O. Box 1002, Providence, R.I., U.S.A., Engineer.
1895. Magnus, Isidor, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1901. Magruder, Egbert W., Department of Agriculture, Richmond, Va., U.S.A., Chemist.
1906. Maguire, Peter, 5, King's Bench Walk, Temple, London, E.C., Chemist and Colourist.
1885. Mahon, R. W., N.Y. Central and Hudson River Railroad, West Albany, N.Y., U.S.A., Chemist.
1898. Main, Wm., Piermont, N.Y., U.S.A., Chemist.
1904. Mair, William, 7, Comiston Road, Edinburgh, Chemist.
1905. Major, Ernest, Day Street, Drummoyne, Sydney, N.S.W., Australia, Paint Works Manager.
- O.M. Major, J. Lewis, Welton Garth, Brough, East Yorks., Tar Distiller and Chemical Manufacturer.
1886. Mallinckrodt, Edw., Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Manufacturing Chemist.
1897. Mallory, J. Halsey, Drawer 69, Columbia, S.C., U.S.A., Assistant Chemist (The American Cotton Oil Co.).
1908. Manahan, Paul R., 14, Newbury Street, Boston, Mass., U.S.A., Salesman.
1908. Mander, C. Arthur, The Mount, Wolverhampton, Varnish Manufacturer.
1896. Mann, E. A., Government Laboratory, Perth, Western Australia, Government Analyst.
1893. Mann, Harold H., Agricultural College, Poona, Bombay, India, Research Chemist.
1899. Mann, Jas. S., 19, Stopford Road, Upton Manor, Essex, Analyst.
1891. Mann, John C., Ash Villa, Thynne Street, West Bromwich, Staffs., Chemist.
1903. Mannhardt, Hans, 1653, Briar Place, Chicago, Ill., U.S.A., Chemical Engineer.
- O.M. Mannington, H. T., Marshlea, Beaconsfield Road, Farnworth, Widnes.
1892. Mansbridge, Wm., 4, Norwich Road, Wavertree, Liverpool, Chemist.
1909. Mantius, Otto, 618, Fidelity Mutual Building, Philadelphia, Pa., U.S.A., Engineer.
1904. Marekworth, O. S., Ohio Testing Laboratory, 25 and 26, Board of Trade, Columbus, Ohio, U.S.A., Analytical Chemist.

1883. Markel, Dr. K., Tower House, Bewsey, Warrington, Technical Chemist.
1905. Marland, Percy, c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Yorks., Chemist.
1905. Marlatt, Wilbur T., Oakville, Ont., Canada, Leather Manufacturer.
1902. Marriott, F. Grant, 14, Selby Street, Toronto, Canada, Chemical Student.
1904. Marris, H. C., The Russian Steam Oil Mills Co., 32, Kourlandski Street, St. Petersburg, Russia, Analytical Chemist.
1901. Marsden, Dr. Fred., St. James' Terrace, Woodside, Horsforth, Leeds, Chemist.
1906. Marsden, Oliver, Manor Road Mill, Victoria Road, Leeds, Cashier.
- O.M. Marsh, J. T., Ammonia Soda Works, Fleetwood, Lancashire, Chemist.
1883. Marsh, W., Union Alkali Co., Soho Works, Ancoats, Manchester, Chemical Manufacturer.
1895. Marshall, Arthur, Naini Tal, India, Chief Chemical Examiner.
1895. Marshall, Francis G., 91, Bewick Road, Gateshead, Technical Chemist.
1891. Marshall, Dr. Hugh, 12, Lonsdale Terrace, Edinburgh, Professor of Chemistry.
1908. Marshall, John, Cudbear Street, Hunslet, Leeds, Dyeware Manufacturer.
1901. Marshall, Jos. W., Science Lecturer.
1896. Marshall, Percy S., Union Laboratory, Half Moon Street, Huddersfield, Assistant Chemist.
1883. Marshall, Wm., Carlsbrook, Queen's Road, Cheadle Hulme, Cheshire, Dyer.
1884. Marshall, Wm., Barkley, Teddington, Middlesex, Analytical Chemist.
1904. Marston, John P., 247, Atlantic Avenue, Boston, Mass., U.S.A., Merchant.
1894. Martin, Alex. M., Hillview, Twechar by Glasgow, Analytical Chemist.
1895. Martin, Chas. H., 40, Bolton Road, Pendleton, Salford, Oil and Soap Works Manager.
- O.M. Martin, N. H., Ravenswood, Low Fell, Gateshead-on-Tyne, Manufacturing Chemist.
1899. Martin, Wm. E., c/o Kynoch Ltd., Arklow, Co. Wicklow, Ireland, Chemist.
1887. Martineau, Sydney, Streatham Grove, Norwood, S.E., Sugar Chemist.
1907. Martius, Dr. C. A. von, Voss Strasse 12, Berlin, Germany, Chemist.
1894. Martyn, T. Graham, II, Stratton Terrace, Truro, Cornwall, Metallurgist.
1905. Marx, Dr. Emil, Ruckerstrasse 17, Schweinfurt a/Main, Bavaria, Germany, Research Chemist.
1905. Marx, Dr. Max, 81, Shanley Avenue, Newark, N.J., U.S.A., Manufacturing Chemist.
1908. Mason, Douglas H. C., 477, Sherbourne Street, Toronto, Canada, Manufacturer.
1904. Mason, Dr. Edward D., 22, George Road, Edgbaston, Birmingham, Scientific Apparatus Dealer.
1906. Mason, Frederic S., 90, Beekman Street, New York City, U.S.A., Manufacturing Chemist.
1904. Mason, Glen F., c/o H. J. Heinz Co., Pittsburg, Pa., U.S.A., Chemist.
1887. Mason, J. Francis, Eynsham Hall, Witney, Oxon.
1906. Mason, M. Edgar, 93, Orleans Street, Chicago, Ill., U.S.A., Chemist.
1906. Massa, Corradino, Castelnello Parmense, Parma, Italy, Sulphuric Acid and Fertiliser Manufacturer.
- O.M. Masson, Prof. D. Orme, University of Melbourne, Victoria, Australia, Professor of Chemistry.
1908. Masson, R. Duncan, c/o Messrs. R. Silcock and Sons, Stanley Hall, Union Street, Liverpool, Analytical Chemist.
1904. Masson, Victor E., Pleasant Valley Wine Co., Rheims, Steuben Co., N.Y., U.S.A., Chemist.
1902. Masujima, Prof. Bunjiro, c/o K. Takebe, 25, Gazenbocho, Azabuku, Tokyo, Japan, Prof. of Applied Chemistry.
1902. Masury, Fred L. M., Lock Box 144, Sharon, Pa., U.S.A., Explosives Manufacturer.
- O.M. Mather, J., Blaydon Chemical Works, Blaydon-on-Tyne, Manager.
1904. Mather, J. Cecil, The Slide, Runcorn, Cheshire, Works Chemist.
1900. Mather, Wm., Westlea, Queen Street, Alexandria, Dumbartonshire, Chemist.
1907. Matheson, A. Greville E., c/o Matheson & Grant, 13, Walbrook, London, E.C., Engineer.
1890. Matheson, W. J., c/o Cassella Colour Co., 182, Front Street, New York City, U.S.A., Chemical Merchant.
1901. Mathew, W. E. B. de Vere, Dinham, Hillside Gardens, Wallington, Surrey, Analytical Chemist.
1900. Mathews, Dr. Jno. A., c/o Halcombe Steel Co., Syracuse, N.Y., U.S.A., Works Manager and General Superintendent.
1898. Mathewson, E. P., Anaconda, Mont., U.S.A., Metallurgist.
1888. Mátyos, Louis J., 101, North 19th Street, East Orange, N.J., U.S.A., Chemist.
1896. Matsui, G., c/o Japan Sugar Refinery Co., Onagigawa, Tokio, Japan, Chemical Engineer.
- O.M. Matthews, Chas. G., 31, Stapenhill Road, Burton-on-Trent, Brewing Chemist.
1907. Matthews, Dr. F. E., 6, Hillcroft Crescent, Ealing, W., Technical Chemist.
1899. Matthews, Dr. J. Merritt, 3, Bow Street, Taunton, Mass., U.S.A., Professor of Chemistry and Dyeing.
1889. Mawdsley, W. H., c/o Gold Mining Co., Ltd., Mount Morgan, Queensland, Chemist.
1906. Mawson, Fred. E., 88, Broad Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1903. Maxim, Hudson, 698, St. Mark's Avenue, Brooklyn, N.Y., U.S.A., Chemist and Mechanical Engineer.
1894. Maxwell, Jno., Solway Chemical Works, Silloth, and (communications) English Street, Carlisle, Cumberland, Chemical Manure Manufacturer.
1903. Maxwell, Orin P., Piedmont, Mineral Co., West Va., U.S.A., Chemist.
1897. May, George H., c/o Fabrikoid Co., Newburgh, N.Y., U.S.A., Assistant Chemist.
1884. Mayenfeld, Dr. E. von Salis. *See* Salis-Mayenfeld, Dr. E. von.
1903. Mayer, Andrew, jun., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.
1908. Mayer, Frederick J., c/o Didier-March and Co., 50, Church Street, New York City, U.S.A., General Manager.
1896. Mayfield, A. S., Thirlmere, Newland, Hull, Analyst.
1892. Mayfield, H. E., Normanhurst, Mundy Street, Heanor, near Nottingham, Dyer.
1885. Mayhew, E. W. A., High Street, Freemantle, Western Australia, Manufacturing Chemist.
1907. Maynard, Geo. W., 20, Nassau Street, New York City, U.S.A., Mining Engineer.
1900. Maywald, F. J., 1028, 72nd Street, Brooklyn, N.Y., U.S.A., Technical Chemist.
1907. Meade, Geo. P., National Sugar Refinery, Yonkers, N.Y., U.S.A., Chemist.
1902. Meade, Richd. K., Nazareth, Pa., U.S.A., Chemist.
1904. Meads, Charles J., 19, Park Place West, Sunderland, Inland Revenue Officer.
1898. Meeds, Alonzo D., 2424, Harriet Avenue, Minneapolis, Minn., U.S.A., Analytical Chemist.
1896. Meggitt, Loxley, Wheatstef Works, Alexandrina, Sydney, N.S.W., Australia, Analytical Chemist.
1901. Meier, Dr. Franz, c/o Society of Chemical Industry in Basle, Basle, Switzerland, Chemist.
1888. Meikle, Jno., 8, Melrose Street, Great Western Road, Glasgow, Journalist.
1902. Melcher, Arthur C., 58, Bowen Street, Newton Centre, Mass., U.S.A., Research Chemist.
- O.M. Meldola, Prof. R., F.R.S., 6, Brunswick Square, London, W.C., Professor of Chemistry.
1901. Meldrum, Dr. And. N., Chemical Department, The University, Manchester, Lecturer on Chemistry.
- O.M. Mellon, W. W., Woodlands, Blackrook, Co. Dublin, Ireland, Manufacturing Chemist.
- O.M. Mellor, S., Magnesium Metal Co., Patricroft, Manchester, Metal Refiner.

1884. Melville, D., 2, Melville Avenue, Delray, Detroit, Mich., U.S.A., Chemical Works Manager.
1893. Mensching, Dr. C., Mersey Chemical Works, Bromborough, Cheshire, Chemist.
- O.M. Menzies, R. C., Inveresk Mills, Musselburgh, N.B., Paper Maker.
1892. Mercer, C. A., 31, Camomile Street, London, E.C., Chemical Apparatus Maker.
1886. Mercer, J. B., 4, Tabley Road, Knutsford, Cheshire, Chemist.
1890. Merck, Dr. E., Darmstadt, Germany, Manufacturing Chemist.
1905. Merck, George, Merck and Co., University Place, New York City, U.S.A., Manufacturing Chemist.
1899. Merrill, Frank H., 2424, Ocean View Avenue, Los Angeles, Cal., U.S.A., Factory Superintendent.
1906. Merrills, Fred. J., 25, Figtree Lane, Sheffield, Analytical Chemist.
1909. Merriman, H. J., 244, Victoria Park Road, South Hackney, N.E., Research Chemist.
1905. Merrin, A. C., 44, Bishopgate Street Without, London, E.C., Assistant Editor and Analyst.
1904. Merry, Jno. B., 112, Greenfield Road, Harborne, Birmingham, Metallurgical Chemist.
1903. Mersan, Ferdinand de, Fairfield, Chestnut Avenue, Boston Spa, Yorks., Chemist.
1905. Merz, Eugene, P.O. Box 216, Newark, N.J., U.S.A., General Superintendent, Heller and Merz Co.
1905. Merzbacher, Aaron, Hotel Monaca, Monaca, Pa., U.S.A., Chemist.
1897. Meslans, Prof. M., 59, Quai de la Baronnie, Ablon (Seine et Oise), France, Professor of Chemistry.
- O.M. Messel, Dr. R., 147, Victoria Street, London, S.W., Chemical Manufacturer.
1899. Metcalf, Howard F., Farr Alpaca Co., Holyoke, Mass., U.S.A.
1886. Metcalf, Jno., Moorfield Chemical Works, Altham, near Acreington, Tar Distiller.
1908. Metcalfe, Ernest D., 3, Gracechurch Street, London, E.C., Secretary.
1905. Methley, Bernard, 1, Es-la-forde, Doncaster Road, Rotherham, Yorks., Engineering Chemist.
1898. Metz, Herman A., P.O. Box 753, New York City, U.S.A., Chemical Merchant.
1905. Metzis, Josef, Angliacia Petroleum Co., Drohobycz, Galicia, Austria, Manager of Refinery.
1900. Mewborne, Robt. G., c/o Kentucky Tobacco Products Co., Louisville, Ky., U.S.A., Chemist.
1907. Meyer, Dr. Erwin, c/o Morgan and Wright, Detroit, Mich., U.S.A., Chemist.
1898. Meyer, Dr. Franz, c/o R. Wedekind und Co., Uerdingen a/Rhein, Germany, Metallurgical and Chemical Engineer.
1900. Meyer, Karl, Sortedams Dossering 95A, Copenhagen, O., Denmark, Technical Chemist.
1904. Meyer, Prof. Dr. Richard, Technische Hochschule, Braunschweig, Germany, Professor of Chemistry.
1902. Meyrick, L. J., 137, City Road, Birmingham, Assistant Analyst.
1907. Micklethwait, Miss Frances M. G., Penhein, Chestow, Mon.; and (Journals) Royal College of Science, London, S.W., Chemist.
1904. Mighill, Dr. Thos. A., 15, Exchange Street, Boston, Mass., U.S.A., Chemist.
1896. Miles, G. Wellington, 29, Central Street, Boston, Mass., U.S.A., Analytical Chemist.
1889. Milestone, W. C., 7, Heathfield Road, Wandsworth Common, S.W., Chemical Works Manager.
1899. Millar, Jas. H., P.O. Box 120, Durban, Natal, Manufacturing and Analytical Chemist.
1897. Millard, Edgar J., 40-42, Charlotte Street, London, E.C., Chemist and Manager.
1903. Millen, J. Dunlop, Mount Bischoff Mine, Waratah, Tasmania, Assistant General Manager.
1883. Miller, Dr. A. K., Kilvert's Buildings, Withy Grove, Manchester, Analytical Chemist.
- O.M. Miller, E. V., Sugar Works, Chelsea, Auckland, New Zealand, Sugar Works Chemist.
1889. Miller, Geo., Clydesdale, Groes Road, Cressington, Liverpool, Technical Chemist.
1893. Miller, Dr. Harry E., 305, Palm Avenue, Oakland, Cal., U.S.A., Chemist.
1883. Miller, Dr. H. von, Beatrixgasse 32, Wien, Austria, Chemical Manufacturer.
1904. Miller, Jas., Pharmacist.
1894. Miller, Dr. John A., 44-45, Lewis Block, Buffalo, N.Y., U.S.A., Consulting Chemist, State Analyst.
1908. Miller, John B., 98, Wellesley Street, Toronto, Canada, Lumber and Iron Manufacturer.
1894. Miller, J. Carlile, 188, St. Vincent Street, Glasgow, Manufacturing Chemist.
1888. Miller, J. Hopkins, 5, Catherine Street, Parliamentary Road, Glasgow, Dyeworks Chemist.
1889. Miller, Jno. Poynter, Sandilands Chemical Works, Aberdeen, Technical Chemist.
1907. Miller, R. H., c/o The Flavell Co., Box 924, Asbury Park, N.J., U.S.A., Chemical Manufacturer.
1901. Miller, Stuart B., c/o E. I. du Pont de Nemours Powder Co., Marquette, Mich., U.S.A., Chemical Engineer.
1904. Miller, William Exley, c/o The Arizona Copper Co., Ltd., 29, St. Andrew Square, Edinburgh, Secretary.
1901. Miller, Dr. W. Lash, 50, St. Alban Street, Toronto, Canada, Associate Professor of Physical Chemistry.
1884. Miller, W. M., Caledonia Estate, Prov. Wellesley, Penang, S.S., Sugar Chemist.
1902. Milligan, R. E., New York Continental Jewell Filtration Co., 15, Broad Street, New York City, U.S.A., Chemical Engineer.
1904. Millroy, Alfred T., c/o Lyman, Sons & Co., St. Paul Street, Montreal, Canada, Laboratory Furnisher.
- O.M. Mills, Prof. E. J., F.R.S., 64, Twyford Avenue, West Acton, W., Emeritus Professor of Technical Chemistry and Consulting Chemist.
1901. Mills, Dr. J. E., University of North Carolina, Chapel Hill, N.C., U.S.A., Associate Professor of Chemistry.
1905. Mills, Wm. Henry, 45, Wall Street, New York City, U.S.A., Merchant.
1906. Mills, Wm. Hobson, Northern Polytechnic Institute, Holloway, London, N., Lecturer in Chemistry.
1905. Milne, Thomas, c/o The Gas Light and Coke Co., Ltd., 4, Fenchurch Avenue, London, E.C., Chemical Products Salesman.
1903. Milnes, Cresswell, Arlesey, near Hitchin, Herts., Cement Works Manager.
1887. Milnes, Edmund, Seedfield, Bury, Lancashire, Dyeing Extract Maker.
1902. Milnes, Ernest E., c/o Joseph Smithson, Ltd., India Buildings, Halifax, Yorks., Chemist.
1895. Miner, Harlan S., c/o Welshbach Light Co., Gloucester City, N.J., U.S.A., Technical Chemist.
1889. Miniati, T. K., Penketh, near Warrington, Chemist.
1907. Minns, J. E., 32, North Street, Taunton, Somerset, Analytical Chemist.
1895. Mitchell, Chas. A., c/o Beaufoy and Co., South Lambeth Road, S.W., Analyst.
1901. Mitchell, Frank H., c/o Dill and Collins, Richmond and Tioga Streets, Philadelphia, Pa., U.S.A., Tutor in Chemistry.
1898. Mitchell, G. D. H., c/o S. S. White Dental Manufacturing Co., Prince's Bay, Staten Island, N.Y., U.S.A., Chemist.
1906. Mitchell, Oswald H., c/o Basil Turner, Woolwich, Sydney, N.S.W., Australia, Assayer.
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1894. Mole, Herbert B., The Croft, Shepton Mallet, Somerset, Brewer.

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1906. Moller, Emil A., 18, Teresa Place, Stapleton, Staten Is., N.Y., U.S.A., Manager (Sanitas Co.).
1901. Mond, Dr. Albert L., 416-418, Birkbeck Bank Chambers, Holborn, London, W.C., Chemical Engineer.
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1906. Monier-Williams, G. W., The Lammas, Esher, Surrey.
1908. Monk, Chas. W., 102, Bloomfield Road, Plumstead, Kent, Chemist.
1909. Monro, Irwin W., c/o W. E. Smith and Co., Ltd., Madras, India, Manufacturing Chemist.
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1903. Mooney, F. M., 118, Pembroke Road, Dublin, Chemical Manure Manufacturer.
1903. Mooney, Geo. A., 310, St. Paul Street, Montreal, Canada, Chemical Merchant.
1902. Mooney, Luke, 36, West 52nd Street, Bayonne, N.J., U.S.A.
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1907. Moore, Ernest P., Burlington, Ont., Canada, Chemist.
1902. Moore, Fred., Victoria Chemical Co., Ltd., Victoria, B.C., Canada, Manufacturing Chemist.
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1892. Moore, Dr. Geo. D., 201, Salisbury Street, Worcester, Mass., U.S.A., Professor of Chemistry.
1905. Moore, Leslie R., 173, Oakleigh Road, Newton, Mass., U.S.A., Chemist.
1899. Moore, Quintin, jun., c/o Wm. Beardmore & Co., Ltd., Parkhead Forge, Glasgow, Works Manager.
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1899. Moore, Dr. Russell W., 25, East 30th Street, New York City, U.S.A., Chemist (U.S. Appraiser's Office).
1890. Moore, Thos., Laboratoire du Service Local, Noumea, New Caledonia, Analytical Chemist.
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1903. Moran, Geo. A., 6, Reservoir Terrace, Lawrence, Mass., U.S.A., Chemist.
1890. Mordle, F. Dare, Guilderoy, Matlock Bath, Derbyshire, Starch Manufacturer.
1902. More, Andrew, 61, Quarrendon Street, Fulham, S.W., Analytical Chemist.
1906. Morewood, C. Darcy, Frodingham Ironstone Mines, Scunthorpe, near Doncaster, Analytical Chemist.
1908. Morfev, Harold, Mitchell Main Colliery Co., Ltd., Wombwell, near Barnsley, Manager of By-Products Works.
1901. Morgan, Dr. Gilbert T., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.
1905. Morgan, Prof. Jerome J., College of Hawaii, Honolulu, Hawaiian Islands, Teacher.
890. Morgan, J. Jas., Laboratory, Cammell, Laird and Co., Workington, Cumberland, Assayer.
1907. Morgan, Leonard P., United States Mint, Philadelphia, Pa., U.S.A., Electro-Chemist.
1906. Morgan, Thos., "Meirion," Dovedale Road, Mossley Hill, Liverpool, Manufacturing Chemist.
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1898. Morris, Edgar F., c/o Cornbrook Chemical Co., Ltd., Colour Works, Stockport, Research Chemist.
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1890. Morris, Herbert N., Gorton Brook Chemical Works, Manchester, Technical Chemist.
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1897. Morton, Jno., North Road, St. Helens, Lancashire, Analytical Chemist.
1902. Mosbaugh, F. R., c/o Anglo-Canadian Leather Co., Huntsville, Ont., Canada, Chemist.
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1887. Moul, Frank, Akdersgate Chemical Works, Southall, Technical Chemist.
1901. Moule, Jno. W., c/o The Chillagoe Co., Ltd., Chillagoe, Queensland, Metallurgist.
1884. Moul, J., Underhill, Low Fell, Gateshead-on-Tyne, Secretary.
1898. Moulton, Prof. Chas. W., Vassar College, Poughkeepsie, N.Y., U.S.A., Professor of Chemistry.
1905. Moulton, Rt. Hon. Sir J. Fletcher, F.R.S., 57, Onslow Square, London, S.W., Lord Justice of Appeal.
1892. Mount, Edw., Oaklands, Aughton, near Ormskirk, Assistant Secretary (United Alkali Company).
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1907. Mueller, Dr. Carl, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1890. Muir, Jas. Stanley, 8, Westminster Gardens, Glasgow, W., Chemist.
1894. Muir-Smith, W., c/o A. B. Fleming and Co., Ltd., Caroline Park, Edinburgh, Oil Works Manager.

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1896. Mundy, Lionel, 27, Merton Road, Kensington, W., Importer of Unfermented Wines.
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1900. Munsell, Dr. Chas. E., c/o Devoe and Reynolds Co., 110, Horatio Street, New York City, U.S.A., Colour Chemist.
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1906. Murphy, Frederic W., Standard Sugar Refinery, Granite Street, South Boston, Mass., U.S.A., Chemist.
1901. Murray, Benjamin L., c/o Merck and Co., University Place, New York City, U.S.A., Chemist.
1903. Murray, Chas. B., 407, Perry Payne Building, Cleveland, Ohio, U.S.A., Chemist.
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1909. Murray, John C., 313, Confederation Life Building, Toronto, Canada, Editor (Canadian Mining Journal).
1898. Murray, Rd., c/o Brotherton and Co., Ltd., Ammonia Works, Holmes Street, Leeds, Analyst.
1908. Murray, Dr. Thos. J., The University, Birmingham, Lecturer on Chemistry.
1905. Murray, Wm. Wallace, c/o Union Abattoir Co., Baltimore, Md., U.S.A., Chemist.
1905. Murrill, Dr. Paul I., P.O. Box 986, Wilmington, Del., U.S.A., Representative, E.I. du Pont Co.
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1907. Musso, Louis A., Department of Agriculture, 140, George Street North, Sydney, N.S.W., Australia, Assistant Viticulturist.
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1895. Muirling, I. J. R., 117, Hudson Street, New York City, U.S.A., Dyestuff Importer.
1891. Myers, Dr. Wm. S., 71, Nassau Street, New York City, U.S.A., Director.
1904. Napper, Sidney S., c/o S. Comtauld & Co., Ltd., Foleshill Road, and (Journals) 57, Barras Lane, Coventry, Chemist.
1903. Nash, A. Douglas, 280, State Street, Flushing, N.Y., U.S.A., Glass Manufacturer.
1897. Nash, Leonard M., Westlands, Princess Road, Finsbury Park, N., Works Chemist.
1905. Nash, W. A., Corn Exchange Bank, New York City, U.S.A., President, Corn Exchange Bank.
1908. Nasmith, M. E., 66, Jarvis Street, Toronto, Canada, Baker.
1900. Nathan, Lt.-Col. Sir Frederic L., R.A., Royal Gunpowder Factory, Waltham Abbey, Essex, Superintendent.
1907. Nauckhoff, Sigurd, c/o Nitroglycerin Aktiebolaget, Vinterviken, Stockholm, Sweden, Chemical Engineer.
1892. Naylor, Wm., 3, Garstang Road, Fulwood, Preston, Lancs., Chemist.
- O.M. Naylor, W. A. H., 38, Southwark Street, London, S.E., Manufacturing Chemist.
1899. Neate, Percy J., "Belsize," 5, Watts Avenue, Rochester, Kent, Director of Cement Co.
1902. Neave, Dr. Geo. B., Technical College, Montrose Street, Glasgow, Assistant to Professor of Chemistry.
1905. Neech, Herbert R., 20, Colegrave Street, Lincoln, Chemical Engineer.
1905. Needham, Edward R., 48, Paton Street, Glasgow, Manufacturing Chemist.
1905. Neff, Robert W., 22, India Square, Boston, Mass., U.S.A., Chemical Manufacturer.
1906. Neil, Dr. Archibald A., 82, Eccles Old Road, Manchester, Chemical Engineer.
1898. Neil, Jas. Millar, 97, Ontario Street, Toronto, Canada, Technical Chemist.
1890. Neill, Geo. D., Drumslea, Greenock, N.B., Sugar Refiner.
1898. Neilson, Alex. McG., Umbilo, Durban, Natal, Analytical Chemist.
1903. Neiman, Howard S., 122, Hudson Street, New York City, U.S.A., Manufacturing Chemist.
1902. Neish, Dr. Arthur C., Columbia University, New York City, U.S.A., Chemist.
1897. Nelson, Walter, Emscote Mills, Warwick, Gelatin Manufacturer.
1906. Nestell, Raymond J., 237, Lenox Avenue, New York City, U.S.A., Analytical Chemist.
1901. Neufville, Dr. Rudolf de, c/o Metallurgische Gesellschaft, Frankfurt a/M., Germany.
1902. Neumann, Dr. Edgar, 7 and 8, Idol Lane, London, E.C.
1903. Neumann, Dr. Max, Capellenstrasse 51, Wiesbaden, Germany.
- O.M. Newall, F. S., Washington Station R.S.O., Co. Durham, Chemical Manufacturer.
1905. Newall, Joseph, Rosedale, Norman Road, Runcorn, Cheshire, Chemist.
1889. Newberry, Spencer B., Sandusky Portland Cement Co., Sandusky, Ohio, U.S.A., Manager.
1909. Newbert, Alonzo M., 88, Broad Street, Boston, Mass., U.S.A., Dyewood Extract Merchant.
- O.M. Newlands, B. E. R., 2, St. Dunstan's Hill, London, E.C., Analytical and Consulting Chemist.
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- O.M. Newton, Jno., Manor Works, Rotherhithe New Road, London, S.E., Manure Manufacturer.
1901. Nibelius, Axel W. T., c/o Emporium Powder Co., Emporium, Pa., U.S.A., Chemist.
1904. Nichols, C. W., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
1905. Nichols, E. Remington, 25, Broad Street, New York City, U.S.A., Treasurer (Nichols Chemical Co.).
1884. Nichols, J. A., Stanley Mount, New Mills, near Stockport, Teacher of Science.
1888. Nichols, Dr. Wm. H., 25, Broad Street, New York City, U.S.A., Chemical Manufacturer.
1905. Nichols, W. H., jun., 25, Broad Street, New York City, U.S.A., President, San Carlos Copper Co.

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1897. Nicholson, Wm. J., Ardeer, Stevenston, Ayrshire, N.B., Chemist.
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1900. Nield, J. H., c/o General Chemical Co., P.O. Box 8, Edgewater, N.J., U.S.A., Superintendent.
1906. Nielsen, Dr. Carl, Chemist.
1898. Nightscapes, Geo., 37, Jalland Street, Hull, Oil Merchant.
1899. Nihoul, Dr. Edw., Warenume, Belgium, Director of the Liège Tannery School.
- O.M. Nimmo, Jas., Penshurst, 8, Lawrence Road, South Norwood, S.E., Analytical Chemist.
1907. Nims, H. E., c/o The Fiberloid Co., Indian Orchard, Mass., U.S.A., Chemist.
1885. Nishigawa, T., 12, Yamamoto Dori, Nichome, Kobe, Japan, Director of Sulphuric Acid and Soda Works.
1898. Nishikawa, T., c/o Nippon Seimikaisha, Onoda, Nagato, Japan, Chemist.
1908. Noble, Sir Andrew, Bart., F.R.S., Jesmond Dene House, Newcastle-on-Tyne.
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1905. Norden, Julius, 44, Farringdon Street, London, E.C., Chemical Manufacturer.
- O.M. Norman, F. J., Lyndhurst, Higher Runcorn, Cheshire, Chemical Manufacturer.
1900. Norman, Geo. M., Chemist.
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1903. North, Henry A., 427, Elm Street, Chicago, Ill., U.S.A., Chemist.
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1905. Norton, Arthur L., 36, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
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- O.M. Norton, Dr. S. A., 363, East Town Street, Columbus, Ohio, U.S.A., Professor of Chemistry (Ohio State University).
1887. Norton, Dr. T. H., c/o Wm. Bryce, 54, Lothian Street, Edinburgh, U.S. Consul.
1899. Noyes, Henry, c/o J. C. Lanyon and Sons, Coronation House, Lloyd's Avenue, London, E.C., Engineer.
1901. Noyes, Prof. Wm. A., University of Illinois, Urbana, Ill., U.S.A., Editor (J. Amer. Chem. Society).
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1900. O'Brien, Frederick, 87, Dongola Road, Horfield, Bristol, Analytical Chemist.
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1905. Oburg, W. F., 33, Broad Street, Boston, Mass., U.S.A., Assistant Treasurer (Merrimac Chem. Co.).
1902. Oekel, Reinhold, Baesrode, chez Ternoude, Belgium, Technical Chemist.
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1908. O'Day, John, 32, India Street, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.
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1888. Oddy, Robert W., Abbey Street, Toad Lane, Rochdale, Chemist.
1888. Ogata, Saburo, Nippon Ginko, Tokyo, Japan, Assayer.
1901. Ogden, Richard L., 314, North Main Street, Bethlehem, Pa., U.S.A., Chemist (U.S. Navy).
1906. Ogilvie, Alex. M., 9, Belmont Drive, Giffnock, Renfrewshire.
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1896. Ogilvy, D. J., 1403, State Avenue, Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
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1905. Ohliger, Willard, c/o F. Stearns & Co., Detroit, Mich., U.S.A., Chemist.
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1901. Olivier, Dr. Louis, 18, Rue Chauveau-Legarde, Paris, 8^e, Director (Revue Générale des Sciences).
1905. Ollenbach, D. S., Cordite Factory, Aruvankad, Nilgiris, India, Assistant Government Surgeon.
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1907. Oppen, Wm. A., Vera Chemical Co., Stoneham, Mass., U.S.A., Chemist and Superintendent.
1898. Ormerod, Dr. Ernest, Star Life Buildings, 30, Cross Street, Manchester, Consulting Chemist.
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- O.M. Orr, J. B., Crossacres, Woolton, Liverpool, Chemical Manufacturer.
1899. Orr, Thos. W., Esperanza Nitrate Co., Taltal, Chile, and (communications), c/o W. Orr, 50, Wellington Street, Glasgow, Chemist.
1907. Ortvad, Niels C., c/o Hiram Walker & Sons, Ltd., Walkerville, Ont., Canada, Chemist and Fermentologist.
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1900. O'Shaughnessy, Francis R., Ilomo Farm, Tyburn, Birmingham, Chemist.
1885. O'Shea, Prof. L. T., Dept. of Applied Science, St. George's Square, Sheffield, Professor of Applied Chemistry (University of Sheffield).
1908. Osland, Clarence R., c/o R. W. Hunt and Co., 614, Canadian Express Building, Montreal, Canada, Chemist.
1883. O'Sullivan, J., High Bank, Burton-on-Trent, Brewing Chemist.
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1898. Oushkoff, John P., c/o P. K. Oushkoff and Co., Moscow, Russia, Chemical Manufacturer.

1904. Owen, Halsall, Newholme, Latchford; and (Journals) c/o W. H. Smith and Son, 76, Sankey Street, Warrington, Engineer.
1906. Oxley, Horace F., c/o British Algin Co., and (Journals) Bryn Derwen, Holywell, North Wales, Chemist.
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1887. Palmer, Thos. C., 98, Commercial Road East, London, E.; and (Journals) Westlington, Hatch End, Middlesex, Engineer.
1907. Palmer, Wm. J., c/o United Turkey Red Co., Ltd., Alexandria, N.B., Analytical Chemist.
1906. Papazzoni, Chas. F., c/o Keystone Powder Manufacturing Co., Box 314, Emporium, Pa., U.S.A., Chemist.
1906. Parke, Jas., Sturgeon Falls, Ont., Canada, Chemist.
1888. Parker, Chas. E., Penketh, Warrington, Tanner.
1898. Parker, Charles H., 106, Tottenhall Road, Wolverhampton, and (Journals) c/o British Coalite Co., Ltd., Wednesfield, Staffs., Chemist.
1891. Parker, Edw., Laburnum House, Rushford Park, Levenshulme, Manchester, Analytical Chemist.
1906. Parker, Elias G., 238, Grafton Avenue, Newark, N.J., U.S.A., Chemist.
1894. Parker, Dr. J. Gordon, Herold's Institute, Drummond Road, Bermondsey, S.E., Head of Tanning School.
1897. Parker, Prof. Matthew A., University of Manitoba, Winnipeg, Canada, Professor of Chemistry.
1901. Parker, Richard H., 231, West 134th Street, New York City, U.S.A., Analytical Chemist.
- O.M. Parker, Thos., Severn House, Ironbridge, Salop, Electrical Engineer.
1894. Parker, Thos. J., 25, Broad Street, New York City; and (Journals) Bayonne, N.J., U.S.A., Chemical Works Manager.
1903. Parker, Wm. B., 96, Murray Road, Rugby, Chief Chemist (British Thomson-Houston Co., Ltd.).
1901. Parker, Dr. Wm. Huntington, 177, State Street, Boston, Mass., U.S.A., Chemist (U.S. Appraisers).
1901. Parkes, Albert E., 43, Whitehorse Street, Stepney, E., Analytical Chemist.
1905. Parr, Prof. S. W., University of Illinois, Urbana, Ill., U.S.A., Professor of Applied Chemistry.
1898. Parrish, Saml., 80, Grange Avenue, Chapeltown Road, Leeds, Teacher of Chemistry.
1901. Pass, James, Onondaga Pottery Co., Syracuse, N.Y., U.S.A., Pottery Manufacturer.
1909. Passmore, Dr. Francis W., 63, Queen Victoria Street, London, E.C., Consulting Chemist.
1902. Patch, Prof. Jas. A., Syrian Protestant College, Beirut, Syria, Professor of Chemistry.
1897. Patehett, Col. Jas., Oakworth, Hadley, Wellington, Salop, Ironmaster.
1884. Paterson, John, Belle Isle Place, Workington, Cumberland, Mechanical Engineer.
1887. Paton, J. M. C., Messrs. Manlove, Alcott and Co., Ltd., Nottingham, Mechanical Engineer.
1886. Paton, W. Grant, Airlie, Huyton, near Liverpool, Alkali Works Manager.
1901. Patterson, Chas. A., c/o E. I. du Pont de Nemours Powder Co., Pinole, Cal., U.S.A., Analytical Chemist.
- O.M. Patterson, Geo., c/o The Manbré Saccharine Co., Ltd., Fulham Palace Road, Hammersmith, W., Technical Chemist.
1893. Patterson, Harry J., College Park, Prince George's Co., Md., U.S.A., Agricultural Chemist.
- O.M. Patterson, T. L., Maybank, Finnart Street, Greenock, N.B., Sugar Works Manager.
1902. Patterson, Wm. Hamilton, Heriot Watt College, Edinburgh, Technical Chemist.
- O.M. Pattinson, John, 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.
- O.M. Pattison, Jas., Drimnamona, Kilmalcolm, N.B., Chemical Merchant.
1889. Pattison, Percy J., St. Budeaux, Devonshire Road, Hornchurch, Essex, Technical Chemist.
1909. Patton, H. G., c/o Fred. Rueping Leather Co., Fond du Lac, Wis., U.S.A., Chemist.
1904. Patz, E. O., 215, Water Street, New York City, U.S.A., Manager, Berlin Aniline Works.
1908. Paul, David M., c/o Curtis and Harvey, Ltd., Cliffe at Hoo, Kent, Explosives Chemist.
1891. Paul, Jas. H., 11, Glenluce Road, Blackheath, S.E., Analytical Chemist.
1900. Paul, Dr. L. Gordon, Market Hall Chambers, King Street, Huddersfield, Consulting Chemist.
1904. Payne, A. G. C., 63, Plassey Street, Penarth, near Cardiff, Chemist.
- O.M. Payne, J. B., 13, Mosley Street, Newcastle-on-Tyne, Manufacturing Chemist.
1906. Payne, J. H., Box 153, Fordwick, Va., U.S.A., Chemical Engineer.
1898. Pearce, Edw. D., Messrs. T. P. Shepard and Co., P.O. Box 977, Providence, R.I., U.S.A., Manufacturing Chemist.
1894. Pearce, Jas. Stanley, Clements, Snaresbrook, Essex, Chemical Manufacturer.
1897. Pearce, Richard, Eddlewood, Weybridge, Surrey, Metallurgist.
1883. Pearce, W. M.P., Chemical Works, Bow Common, London, E., Chemical Manufacturer.
1903. Pearcey, A. C., 8, Albemarle Mansions, Hampstead, N.W., Director, Explosives Co.
1903. Pears, Thos., The Laboratory, Soap Works, Isleworth, Soap Manufacturer.
1904. Pease, Fred N., P.O. Box 503, Altoona, Pa., U.S.A., Chemist.
- O.M. Pechiney, A. R., Villa Les Roehers, Hyères (Var), France, Chemical Engineer.
1898. Peek, Dr. Ernest L., 18, Woodhey Road, Rock Ferry, Cheshire, Chemist.
1898. Peckham, Stephen F., 127, Franklin Street, New York City, U.S.A., Chemist.
1894. Peden, Jno., 30, Ardgowan Street West, Greenock, N.B., Analytical Chemist.
- O.M. Pedler, Sir Alexander, C.I.E., F.R.S., 28, Stanhope Gardens, Queen's Gate, London, S.W., Director of Public Instruction (retired).
1886. Pedler, J. R., 47, Tregunter Road, South Kensington, S.W., Clerk.
1905. Peet, Wm. J., Stockyards Station, Kansas City, Kas., U.S.A., Superintendent.
1903. Pepper, Harry C., c/o Aluminium Co. of America, East St. Louis, Ill., U.S.A., Manufacturing Chemist.
1906. Peile, Henry, Millburn House, Newcastle-on-Tyne, and (Journals) c/o Andrew Short, Patent Ovens Dept., Ottovale, Blaydon-on-Tyne, Colliery Owner.
1899. Pell, A., 7, Elphinstone Circle, Bombay, India, Chemist.
1897. Pellaw, Chas. E., Columbia University, New York City, U.S.A., Adjunct Professor of Chemistry.
1904. Pelly, Russell George, 63, Rowan Road, Brook Green, Hammersmith, W., Analytical Chemist.
1896. Penney, Mulgrave D., 11, High Street, Hull, Analytical Chemist.

1890. Pennock, J. D., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Technical Chemist.
1906. Pennymore, Percy G., Runswick, Dudley Road, Brierley Hill, Staffordshire, Chemist and Blast Furnace Manager.
1885. Pentecost, S. J., Alexandra Mount, Mapperley Hill, and (Journals), Sherwood Hill Works, Sherwood Rise, Nottingham, Lace Dresser.
1887. Pentermann, H. T., 37, Clifton Crescent, Peckham, S.E., Brewing Chemist.
1892. Peploe, D. H. T., Underriver House, Sevenoaks, Kent.
1899. Peppel, S. Vernon, 1538, North High Street, Columbus, Ohio, U.S.A., Chemist.
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1898. Perkin, Dr. F. Mollwo, Borough Polytechnic Institute, Borough Road, S.E., Head of Chemical Department.
1887. Perkin, Dr. W. H., F.R.S., Fairview, Wilbraham Road, Fallowfield, Manchester, Professor of Chemistry.
1903. Perkins, Frank G., 211, North La Fayette Street, South Bend, Ind., U.S.A., Starch Manufacturer.
1893. Perkins, T. S., 30, Tiffany Place, Brooklyn, N.Y., U.S.A., Chemist.
1899. Perks, Walter G., Rothsay, Teddington Park, Teddington, S.W., Manufacturer.
1906. Perrow, Mosley G., Lynchburg, Va., U.S.A.
1901. Perry, Chas. M., Greene, Kent County, R.I., U.S.A., Bleach and Dyeworks Chemist.
1887. Perry, D., Norwood, Lenzie, N.B., Manufacturing Chemist.
1895. Perry, Jos. H., 276, Highland Street, Worcester, Mass., U.S.A., Teacher of Chemistry.
1903. Perry, M. J. T., Australian Drug Co., O'Connell Street, Sydney, N.S.W., Australia, Manufacturing Chemist.
1903. Perry, Robt. Swain, c/o Harrison Bros. and Co., Inc., 35th Street and Grays Ferry Road, and (Journals) Station D., Philadelphia, Pa., U.S.A., President.
1901. Persons, Ashton C., 74, Oak Street, Willimantic, Conn., U.S.A., Chemist.
1897. Peter, Dr. A. H., Hastings on Hudson, N.Y., U.S.A., Chemist.
1908. Peters, John M., 184, Front Street, New York City, U.S.A., White Lead Manufacturer.
1893. Pethybridge, Walter, 3, Rhodesia Road, Clapham Rise, S.W., Chemist and Assayer.
1909. Petrie, A. Swanston, c/o Gibbs and Co., Iquique, Chile, S. America, Anal. Chemist.
1903. Petrie, Dr. Jas. M., The University, Sydney, N.S.W., Australia, Chemist.
1902. Petsche, B. W., 60, Glenwood Avenue, Yonkers, N.Y., U.S.A., Chemist.
1906. Pettee, Chas. L. W., c/o Hartford Laboratory Co., Hartford, Conn., U.S.A., Chemist.
1892. Pettigrew, Robert, c/o Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Electro-Chemist.
1902. Pettitt, Alf., 457, State Street, Brooklyn, N.Y., U.S.A., Chemist.
1906. Peuchen, Arthur G., Standard Chemical Co., Ltd., 509, Manning Chambers, Toronto, Canada, Chemical Manufacturer.
1905. Peuchot, A., 129, Crosby Street, New York City, U.S.A., Chemical Manufacturer.
- O.M. Peyton, E. P., Chemical Works, Lister Street, Birmingham, Chemical Manufacturer.
1900. Peyton, Wm. C., c/o Peyton Chemical Co., Room 657, Mills Building, San Francisco, Cal., U.S.A., Chemist.
1888. Philip, Arnold, Chemical Laboratory, H.M. Dockyard, Portsmouth, Electro-Metallurgist and Electrical Engineer.
1908. Philip, Dr. James C., Imperial College of Science and Technology, Stn. Kensington, S.W., Chemist.
1903. Philipp, Herbert, 84, High Street, Perth Amboy, N.J., U.S.A., Chemist and Electrochemical Engineer.
1886. Phillips, A. G., 11, Essex Villas, Phillimore Gardens, Kensington, W., Barrister-at-Law.
1891. Phillips, G. Brinton, (Journals) 622, Rose Street; and (communications) 2007, De Lancey Place, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
- O.M. Phillips, Hareourt, Lynwood, Turton, Lancs., Analytical Chemist.
1895. Phillips, S. Chas., 47, Cannon Street, London, E.C., Chemical Engineer.
1904. Phillips, V. C., c/o Brotherton and Co., Ltd., Haigh Park Chemical Works, Leeds, Chemist.
1898. Phillips, Wm. H., 100, Milton Avenue, East Ham, E., Soap Works Chemist.
1894. Picard, Hugh F. K., 44, London Wall, London, E.C., Metallurgist.
1907. Pick, Dr. Hans, c/o Compagnie Liebig, Longue Rue des Claires, Antwerp, Belgium, Analytical Chemist.
1904. Pickard, Glenn H., c/o The Spencer-Kellogg Co., Buffalo, N.Y., U.S.A., Chemist.
1905. Pickard, Greenleaf W., Amesbury, Mass., U.S.A., Electrical Engineer.
1902. Pickard, R. H., Isca, Merlin Road, Blackburn, Teacher and Analyst.
1904. Pickett, Chas. E., 26, East 33rd Street, Bayonne, N.J., U.S.A., Superintendent, Borax Refinery.
1904. Pickup, Edgar H., 348, Great Clowes Street, Higher Broughton, Manchester, Calico Printer.
1888. Pilkington, G., 9, Knowsley Street, Bury, Lancashire, Analytical Chemist.
1893. Pilley, Thos. W., 33, Grove Hill Road, Denmark Hill, S.E., Analytical Chemist.
1894. Pilling, John E., 229, Hornby Road, Blackpool, Chemist.
1906. Pineott, Emile S., 222, St. James Street, Montreal, Canada, Manager (Nichols Chemical Co. of Canada, Ltd.).
1905. Pinnock, H. T., 29, Victoria Road, Tipton, Staffs., Chemist.
1883. Pipe, Jas., Woodburn, Irvine, N.B., Chemical Manufacturer.
1896. Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1907. Pitman, Brig.-Gen. John, 167, Berkeley Avenue, Orange, N.J., U.S.A., U.S. Army (retired).
- O.M. Pitt, T., c/o Burgoyne and Co., High Street South, East Ham, E., Manufacturing Chemist.
1902. Pittard, Jno., 30, Mansfield Road, Hford, Essex, Chemical Manufacturer.
1884. Pittuck, F. W., 19, Stratford Grove, Heaton, Newcastle-on-Tyne, Technical Chemist.
1899. Pizey, Jas. H., Bella Vista 19, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1894. Platten, Frank, 12, Montague Road, Edgbaston, Birmingham, Metallurgical Chemist.
1890. Platts, Jno. C., 12, Alton Terrace, Fairfield, Manchester, Metallurgical Chemist.
1896. Plaut, Albert, 120-128, William Street, New York City, U.S.A., Wholesale Druggist.
1888. Playfair, David J., 7, Victoria Crescent, Dowanhill, Glasgow, Manufacturing Chemist.
1907. Playter, Geo. H., 803, Beacon Building, Boston, Mass., U.S.A., Mining Engineer.
1908. Plows, G. H., 14, Regent Park Avenue, Headingley, Leeds, Tar Distiller.
1891. Pocklington, Hy., 11, Regent Park Terrace, Leeds.
1907. Poetschke, Paul, 26, West Spruce Street, Corona, N.Y., U.S.A., Chemist.
1901. Pollard, Wm., Museum, Jermyn Street, London, S.W., Chemist (H.M. Geological Survey).
1904. Pollitt, Dr. Geo. P., Winnington, Northwich, Cheshire, Chemist.
1902. Pollitt, Jas. C. T., 7, Grosvenor Road, Handsworth, Birmingham, Managing Chemist.
1893. Pollitt, R. B., c/o Compania Nacional de Dinamita y Explosivos, Dinamita (vía Noé), Durango, Mexico, Civil Engineer.
1883. Pollock, A., Kirkland, Bonhill, Dumbartonshire, Dyeworks Manager.
1890. Pomeroy, Dr. Chas. T., 55, Broad Street, Newark, N.J., U.S.A., Ink Manufacturer.

1909. Pond, Francis J., 86, Valley Road, Montclair, N.J., U.S.A., Assoc. Professor of Chemistry.
1896. Pond, Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.
- O.M. Pond, J. A., 99, Queen Street, Auckland, New Zealand, Analytical Chemist.
1906. Pont, A. Felix du, Box 31, Wilmington, Del., U.S.A., Explosives Manufacturer.
1895. Pont, Pierre S. du, Wilmington, Del., U.S.A., Explosives Manufacturer.
- O.M. Pope, S., 6, Heywood Street, Moss Side, Manchester, Chemical Works Manager.
1899. Pope, Thos. H., The University, Birmingham, Chemist.
1900. Pope, Prof. W. J., F.R.S., University Chemical Laboratory, Cambridge, Professor of Chemistry.
1900. Popplewell, Jos. M., Provan Chemical Works, Provanmill, Glasgow, Chemist.
1899. Porter, A. Felix, c/o E. I. du Pont de Nemours Powder Co., Haskell, N.J., U.S.A., Superintendent.
1908. Porter, A. Harold, 1417, Sixth Street, S.E., Minneapolis, Minn., U.S.A., Chemist.
1902. Porter, J. Edw., P.O. Box 785, and 205, W. Genesee Street, Syracuse, N.Y., U.S.A., Chemist.
1901. Porter, Jno. L., Water Purification Station, P.O. Box 791, Station B, New Orleans, La., U.S.A., Chemist.
1884. Potter Chas. E., Love Lane Sugar Refinery, Liverpool, Sugar Works Chemist.
1905. Potter, Chas. Ed., c/o City Dairy Co., Ltd., Spadina Crescent, Toronto, Canada, General Manager.
1888. Potter, Chas. J., Heaton Hall, Newcastle-on-Tyne, Cement Manufacturer.
- O.M. Potter, E. P., Salwick Hall, near Preston, and (Journals) c/o E. P. Potter and Co., Ltd., Little Lever, near Bolton, Alkali Manufacturer.
1906. Potter, Dr. H. Noel, Hollywood, Cal., U.S.A., Electrical Engineer.
1899. Potter, Rowland S., c/o Defender Dry Plate Co., Germantown, Philadelphia, Pa., U.S.A., Chemist.
1900. Potts, Geo. E., 18, Tremont Street, Pottsville, Pa., U.S.A., Explosives Manufacturer.
1900. Pough, Frank H., (subs.) 82, Beaver Street, New York City, and (Journals) 149, Columbia Heights, Brooklyn, N.Y., U.S.A., Assistant Secretary.
1900. Powell, Harry J., 125, Thurlow Park Road, Dulwich, S.E., Glass Manufacturer.
1884. Powell, L. S., The Old Manor House, Ashley, Stockbridge, Hants, Electrician.
1897. Power, Dr. Fred. B., Wellcome Research Laboratories, 6, King Street, Snow Hill, London, E.C., Director.
1907. Powers, Wm. R., c/o A. T. and S. F. R. R. Co., Topeka, Kans., U.S.A., Chief Chemist.
1902. Powney, Wm. E. F., 7, Mandalay Road, Clapham Common, S.W., Analytical Chemist.
1897. Prentice, Dr. Bertram, Royal Technical Institute, Salford, Lecturer on Chemistry.
1902. Prentice, Dr. David, The Nook, Whitefield Road, Stockton Heath, Warrington, Chemist.
1903. Prentice, Jas., Cossipore Sugar Works, Cossipore, Calcutta, India, Chemist.
1905. Prentiss, G. L., c/o Parson Manufacturing Co., 299, Broadway, New York City, U.S.A., Treasurer.
1900. Prescott, Saml. C., 739, Boylston Street, Boston, Mass., U.S.A., Instructor in Bacteriology.
1905. Preston, Jas. F., Lowell, Mass., U.S.A., Manufacturing Chemist.
1906. Preston-Jackson, J. W. A., Castleford, Yorkshire, Consulting and Analytical Chemist and Druggist.
- O.M. Price, Arthur F., 2503, Broadway, San Francisco, Cal., U.S.A., Analytical Chemist.
1905. Price, Dr. T. Slater, The Technical School, Birmingham, Lecturer on Chemistry.
1904. Pritchard, Norman B., 40, Quebec Street, Sherbrooke, Quebec, Canada, Superintendent.
1904. Prideaux, Dr. E. B. R., 17, Glengyle Terrace, and (Journals) Heriot Watt College, Edinburgh, Research Chemist.
1905. Priest, Geo. Wesley, Mansfield, Mass., U.S.A., Manufacturer.
1906. Pring, J. N., Physical Laboratories, University of Manchester, Student.
1899. Prinsen-Geerligs, H. C., Wanningstraat 17, Amsterdam, Holland, Director of Sugar Cane Experimental Station.
1893. Pritchard, Edgar J., 11, Cumberland Road, Kew, Surrey, Works Manager.
1903. Pritchard, Philip M., Chief Engineer's Office, United Alkali Co., Ltd., Widnes, Engineer.
1896. Prochazka, Dr. Geo. A., 138, West 13th Street, New York City, U.S.A., Colour Manufacturer.
- O.M. Procter, Prof. H. R., The University, Leeds; and (Journals) Rowangarth, Ben Rhydding, near Leeds, Lecturer on Tanning.
1884. Procter, J. W., Skeldergate Bridge, York, Manure Manufacturer.
1890. Procter, Miss Anne J., Free Library, Widnes, Librarian.
- O.M. Procter, C., 43A, London Road, Forest Hill, S.E., Analytical Chemist.
1901. Propach, C., 133, East Kinzie Street, Chicago, Ill., U.S.A., Colour Merchant.
1891. Proude, Jas., Providence Soap and Oil Works, Halifax, Yorks., Chemist and Manager.
1907. Pryce, Geo. A., c/o Philip Harris & Co., Ltd., 144 & 146, Edmund Street, Birmingham, Manager of Apparatus Department.
1907. Puckhaber, Geo. C., 805, Prospect Place, Brooklyn, N.Y., U.S.A., Glue Maker.
1906. Pudney, Sydney H., 156, Bellwood Avenue, Toronto, Canada, Foreman.
1905. Pugh, John V., Guiting House, Allesley, near Coventry, Works Director (Rudge Whitworth, Ltd.).
1899. Pullar, Edmund, Keirfield, Bridge of Allan, N.B., Manufacturer.
1894. Pullar, Herbert S., Pullar's Dyeworks, Perth, N.B., Dyer.
- O.M. Pullar, Sir Robert, M.P.; Journals to Jas. Craigie, Sandeman Public Library, Perth, N.B., Dyer.
- O.M. Pullar, R. D., Pullar's Dyeworks, Perth, N.B., Dyer.
1903. Pullin, Sydney R., c/o Palmarejo and Mexican Goldfields, Ltd., Chinipas, Chihuahua, Mexico, Chemist.
1902. Puntan, H. H. C., 10, London Chambers, Durban, Natal, Public Analyst.
1894. Purdie, Dr. Thos., F.R.S., 14, South Street, St. Andrews, N.B., Professor of Chemistry.
1905. Pyman, Dr. Frank Lee, Carlee, Selborne Road, Sideup, Kent, Chemist.
1908. Pyne, Albert R., 134, Carlton Street, Toronto, Canada, Chemist.

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1903. Queneau, Augustin L., c/o Wetherill Co., Erie Avenue, East of Erie Street, Philadelphia, Pa., U.S.A., Mining Engineer.
1887. Quibell, Oliver, Shalem Lodge, Newark-on-Trent, Manure Manufacturer.
1902. Quinan, Kenneth B., Cape Explosives Works, Somerset West, C.C., South Africa, Chemist.
1897. Quinan, Wm. R., (Journals) General Manager, Cape Explosives Works, Dynamite Factory, Cape Colony, South Africa; and (subscriptions) c/o Cape Explosives Works, Ltd., 15, St. Swithin's Lane, E.C., Superintendent (Powder Works).

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1900. Radley, Ernest G., 49, Ernest Street, West Norwood, S.E.
1908. Rae, Robert, Poplar House, Ditton, near Widnes, Metallurgical Chemist.
1895. Raegenner, Louis C., 141, Broadway, New York City, U.S.A., Patent Lawyer.
1906. Raff, Dr. Albert K., Mosaic, Pa., U.S.A., Chemist.
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- O.M. Ramsay, Sir William, K.C.B., F.R.S., University College, London, W.C.; Journals to 19, Chester Terrace, N.W., Professor of Chemistry.
1885. Ramsay, W., c/o Cammell, Laird and Co., Ltd., Birkenhead Ironworks, Birkenhead, Chemist and Assayer.
1906. Ranek, Samuel H., Ryerson Public Library Building, Grand Rapids, Mich., U.S.A., Librarian.
1901. Ransom, Francis, The Chilterns, Hitchin, Herts., Manufacturing Pharmaceutical Chemist.
1905. Ransom, H. B., 28, Belsize Park Gardens, Hampstead, N.W., Engineer.
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1898. Raschen, Dr. Julius, The Highlands, Runcorn, Cheshire, Consulting Chemist (United Alkali Co.).
1905. Raschig, Dr. F., Ludwigshafen a/Rhein, Germany, Manufacturing Chemist.
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1893. Ratchiff, Frank D., Medina, Widney Road, Knowle, near Birmingham, Vinegar Brewer.
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1904. Ratcliffe, Mrs. F. A., Haigh Park Chemical Works, Stourton near Leeds.
1898. Ratcliffe, Walter, 21, Mawdsley Street, Bolton, Analytical Chemist.
1895. Rau, Dr. H. M., 130-132, Pearl Street, New York City, U.S.A., Chemist.
1901. Rawlins, Herbert J. L., The Cottage, Rainhill, Lancashire, Managing Director.
1903. Rawolle, Frederick C., c/o Marx and Rawolle, 100, William Street, New York City, U.S.A., Chemist.
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1895. Read, E. J., Portland, Belmont Road, Westgate-on-Sea, Analyst.
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1902. Redfern, C. G., 4, South Street, Finsbury, London, E.C., Patent Agent.
1890. Redgate, J. G., Traffic Street, Nottingham, Aërated Water Manufacturer.
- O.M. Redwood, Sir Boverton, 4, Bishopsgate Street Within, London, E.C., Petroleum Expert.
1884. Redwood, Ilyd J., The Chestnuts, Erith Road, Bexley Heath, Kent, Technical Chemist.
1887. Redwood, Robt., 4, Bishopsgate Street Within, London, E.C., Secretary.
1891. Redwood, T. Horne, 2, West Ascent, St. Leonard's-on-Sea, Analytical Chemist.
1886. Rée, Dr. A., 15, Mauldeth Road, Withington, Manchester, Aniline Dye Manufacturer.
1884. Reed, Albert E., The Grange, Leigham Court Road, Streatham, S.W., Paper Works Chemist.
1902. Reed, Herbert C., c/o Stamford Manufacturing Co., Stamford, Conn., U.S.A., Chemist.
1895. Reed, Dr. J. Hastings, Hambledon Mill, *via* Cairns, North Queensland, Sugar Manufacturer.
1906. Reed, William, Bridge House, Bridge Road, Millwall, E., Foreman (Desilverising Works).
1893. Reekie, J. A., Woodhouse, Hayfield, Derbyshire, Calico Printer's Colour Mixer.
1883. Reeks, T. H., 106, Queen Victoria Street, London, E.C., Analytical and Consulting Chemist.
1897. Rees, W. H., c/o Alameda Sugar Co., Alvarado, Cal., U.S.A., Chemist.
1906. Rees, Walter J., c/o Chance Bros. and Co., Ltd., Smethwick, near Birmingham, Glass Works Chemist.
1900. Reese, Dr. Chas. L., Eastern Laboratory, P.O. Box 424, Chester, Pa., U.S.A., Chemist.
1897. Reid, Andrew, c/o L. and J. McLellan, 65, Port Dundas Road, Glasgow, Chemist.
1908. Reid, George, 72, Park Drive South, Whiteinch, Glasgow, Analyst.
1906. Reid, James, Moffat Mills, Airdrie, N.B., Chemist.
1905. Reid, Dr. John H., 11, Glover Street, Birkenhead, Chemist.
1907. Reid, Robert, Agencia de Tharsis, Huelva, Spain, Analytical Chemist.
1896. Reid, Robt., Oil Mills, Horbury Bridge, near Wakefield, Chemist.
- O.M. Reid, Walter F., Fieldside, Addlestone, Surrey, Technical Chemist.
1893. Reid, Wm., jun., Bombay Dyeworks, Dadur, Bombay, India, Dyer.
1907. Reimarus, Dr. C., Chemische Fabrik auf Actien (vorm. E. Schering), Müllerstrasse 170, Berlin, N., Germany, Manager.
1904. Reinherz, Otto, 9, Heaton Grove, Bradford, Yorks., Chemist.
1906. Reinhold, Gustave, 11, Hervey Road, Blackheath, S.E., Works Manager.
1898. Reitmeyer, Robt. E. D., 63, Crutched Friars, London, E.C., Chemical Merchant.
1904. Remington, Prof. Joseph P., 1832, Pine Street, Philadelphia, Pa., U.S.A., Author, U.S. Pharmacopœia.
1900. Remington, J. Stewart, Aynsome, Grange-over-Sands, R.S.O., Lanes., Consulting Chemist.
1903. Remsen, President Ira, Johns Hopkins University, Baltimore, Md., U.S.A., President.
1884. Renaut, F. W., 5, Elers Road, Ealing, W., Secretary.
- O.M. Rennie, Dr. E. H., University of Adelaide, South Australia, Professor of Chemistry.
1901. Renwick, Frank F., Norland House, Avenue Road, Brentwood, Essex, Chemist (Photographic Works).
1907. Reoch, Robert A. S., Cochecco Manufacturing Co., Dover, N.H., U.S.A., Printworks Superintendent.
1894. Rettie, Theodore, 16, Great King Street, Edinburgh, Metallurgical Chemist.
1895. Reubens, Chas. M., 148, West 111th Street, New York City, U.S.A., Chemist.
1905. Revis, Cecil, 7, Beverley Road, Barnes, S.W., Analyst.
- O.M. Reynolds, Dr. J. Emerson, F.R.S., 7, Grenville Place, South Kensington, S.W., Professor of Chemistry.
1904. Rhett, Edmund, c/o Virginia-Carolina Chemical Co., Durham, N.C., U.S.A., Works Manager.
1908. Rhoads, J. Edgar, Box 961, Wilmington, Del., U.S.A., Leather Chemist.
- O.M. Rhodes, E., c/o Thos. Vickers and Sons, Widnes, Technical Chemist.
1892. Rhodes, P. J., Bridge House, Church, Accrington, Dye and Print Works Manager.
1889. Richards, Edgar, 60, Ayrault Street, Newport, R.I., U.S.A., Analytical Chemist.
1888. Richardson, Dr. Clifford, 30, Church Street, New York City, U.S.A., Chemical Engineer.
1903. Richardson, F. J., Chemical Works, Ringsend Docks, Dublin, Ireland, Chemical Manure Manufacturer.

1884. Richardson, F. W., City Analyst's Office, Bradford ; and (Journals) Oak Lea, Menston-in-Wharfedale, Yorkshire, Analytical Chemist.
1900. Richardson, Jno. H., c/o H. D. Pochin and Co., Ltd., Salford, Manchester, Manager.
1905. Richardson, L. G., Russell Buildings, 10, Leeds Road, Bradford, Yorks., Chemist.
1889. Richardson, S. M., 415, Main Street, Bonhill, N.B., Analytical Chemist.
1891. Richardson, Walter W., Aldingham, Park View Crescent, Roundhay, Leeds, Manufacturing Chemist.
1903. Richardson, Wm., 2, Thonfield Road, West Park, Haddingley, Leeds, Drysalter.
1894. Richardson, Wm. H., Newsky Thread Mills, Malaja, Bolotnaja, St. Petersburg, Russia, Textile Chemist.
1904. Richardson, Wm. S., 201, High Street, Lincoln, Chemical Manure Manufacturer.
1886. Richmond, H. D., 39, Woodfield Road, Ealing, W., Chief Chemist (Aylesbury Dairy Co.).
1898. Richmond, Jno. E., 14, North Road, West Kirby, Cheshire, Alkali Works Manager.
1901. Richmond, Sylvester O., Royal William Yard, Plymouth, Analytical Chemist.
1907. Ricketts, Guy D., *See* Bengough, Guy D.
1886. Riddell, R., 87, Horninglow Street, Burton-on-Trent, Brewer.
1894. Ridding, Howard C., School of Mines, Clinton Road, Redruth, Cornwall, Principal.
1884. Rideal, Dr. Samuel, Laboratory, 28, Victoria Street, Westminster, S.W., Consulting Chemist.
1905. Ridge, H. M., Owtor Manor, Seaton Carew, Co. Durham, Mining Engineer.
- O.M. Ridsdale, C. H., Ravenscroft, Roman Road, Linthorpe, Middlesbrough, Analytical Chemist.
1899. Riederer, Emil J., c/o Eastern Dynamite Co., Forcite Works, Landing, N.J., U.S.A., Works Chemist.
1902. Riederer, Dr. Herman S., c/o Morris Herrmann and Co., 878, Mount Prospect Avenue, Newark, N.J., U.S.A., Chemist.
1908. Rigby, Wm. T., County Analyst's Laboratory, Temple Street, Birmingham, Public Analyst.
1907. Rigg, Gilbert, c/o New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A., Chemist.
1892. Riker, Jno. J., 46, Cedar Street, New York City, U.S.A., Merchant.
- O.M. Riley, E., 2, City Road, Finsbury Square, London, E.C., Metallurgical Chemist.
- O.M. Riley, J. E., c/o John Riley & Sons, Hapton, near Accrington, Chemical Manufacturer.
1905. Riley, Louis J., 8, Newton Road, London, W., Chemist.
1899. Rink, Arnold, 11, Bridgewater Street, Barbican, London, E.C., Tannin Extract Manufacturer.
1889. Rintoul, Wm., 4, Sewardstone Road, Waltham Abbey, Essex, Explosives Chemist.
1901. Ripley, Philip F., 48, Central Street, Andover, Mass., U.S.A., Chemist.
1909. Rising, Albert E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
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1907. Roberts, Chester, Swarthmore College, Swarthmore, Pa., U.S.A., Superintendent.
- O.M. Roberts, F. G., Adair, Oak Hill Lodge, Fognal, N.W., Chemical Manufacturer.
1901. Roberts, H. E. C., c/o British Explosives Synd., Pitsea, Essex, Chemist.
1907. Roberts, Percy R., c/o Blumenthal & Co., Wilmington, Del., U.S.A., Leather Chemist.
1885. Roberts, R. Wightwick, 22, Calle Arturo Prat, Valparaiso, Chili, Analytical and Consulting Chemist.
1900. Roberts, Wm. Brittain, Wilderspool House, Warrington, Brewer and Analyst.
1902. Roberts, Wm. H., 4, Sguall Street, Liverpool, Analytical Chemist.
1902. Robertshaw, Chas. D., c/o Chas. Price and Co., Oilworks, Belvedere, Kent, Analytical Chemist.
1891. Robertson, Alex. A., Riversdale, Cressington Park, Liverpool, Technical Chemist.
1897. Robertson, Andrew J., 2, North Ninth Street, Richmond, Va., U.S.A., Analytical Chemist.
1903. Robertson, Fred., The Hewan, Bearsden, Glasgow, Analytical Chemist.
1900. Robertson, Jas., Barneraig, South Medrox, by Glenboig, N.B., Analytical Chemist.
1891. Robertson, Dr. Robt., Research Dept., Royal Arsenal, Woolwich ; and (Journals) 29, Charlton Road, Blackheath, S.E., Analytical Chemist.
1897. Robinson, Clarence J., Westerleigh, West New Brighton, N.Y., U.S.A., Chemist.
1904. Robinson, Prof. Franklin C., Bowdoin College, Brunswick, Maine, U.S.A., Professor of Chemistry.
1902. Robinson, Hy., Fishwick, Culcheth Chemical Works, Newton Heath, Manchester, Manufacturing Chemist.
- O.M. Robinson, H. H., 75, Finborough Road, West Brompton, S.W., Analytical Chemist.
1907. Robinson, Herbert W., Robinson Bros., Ltd., Ryders Green, West Bromwich, Staffordshire, Tar Distiller.
- O.M. Robinson, Jno., 8, Albert Road, Widnes, Chemical Engineer.
- O.M. Robinson, Jos., Farnworth, Widnes, Chemical Manufacturer.
1887. Robinson, Thomas, (Journals) 401, West Street, Glasgow ; and (communications), The Villa, Nitschill, N.B., Chemical Works Manager.
1902. Robitschek, Carl, 200, Worth Street, New York City, U.S.A., Scientific Brewer.
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1904. Rodger, Robert, Government Laboratory, Clement's Inn Passage, Strand, London, W.C., Chemist.
1905. Rodger, R. L., Suffolk House, Cannon Street, London, E.C., Manager (Peña Copper Mines).
1909. Rody, Franz A., Balbach Smelting and Refining Works, Newark, N.J., U.S.A., Chemist.
1904. Roeber, Dr. E. F., 239, West 39th Street, New York City, U.S.A., Editor, "Electrochemical Industry."
1903. Roelofsens, Dr. J. A., c/o Coal Distillation Co., Middlesbrough, Yorks., Works Manager.
1905. Rogers, Dr. Allen, Pratt Institute, Brooklyn, N.Y., U.S.A., Research Chemist.
1900. Rogers, Geo. J., Pembrey Copper Works, Burry Port, South Wales, Chemist.
1890. Rogers, Harry, 5, Stoke Newington Common, London, N.
1908. Rogers, Harry V., May Street, Ilkeston, Derbyshire, Engineer.
1907. Rogers, H. L., c/o Ingeniero Residente, Ferro Carril de Buenos Aires al Pacifico, 25 de Mayo 277, Buenos Aires, Argentina, Analyst and Cement Expert.
1899. Rogers, John, c/o Nobel's Explosives Co., Ltd., Nobel House, Glasgow, Chemist.
1907. Roller, Frank R., 525, 31st Street, Oakland, Cal., U.S.A., Powder Works Superintendent.
1898. Roller, H. C., 295, Ferry Street, Newark, N.J., U.S.A., Superintendent.
1899. Rollin, Chas., Bylton, East Jarrow-on-Tyne, Chemical Manufacturer.
- O.M. Rollin, J. C., 1, St. Nicholas Buildings, Newcastle-on-Tyne, Chemical Manufacturer.
1907. Rolph, George M., c/o California and Hawaiian Sugar Refining Co., Crockett, Cal., U.S.A., Sugar Refiner.
1905. Romanes, J. W., Casa Colon, Huelva, Spain, Chemical Engineer.
1898. Roode, Rudolf de, International Paper Co., Glens Falls, N.Y., U.S.A., Chemist and Superintendent.
- O.M. Roseoe, Sir Henry, F.R.S., 10, Bramham Gardens, South Kensington, S.W., Consulting Chemist.
1904. Rose, Jno., Wicken House, Stretton, near Warrington, Technical Chemist.
1901. Rose, Jno. Leonard, 45, De Parys Avenue, Bedford, Chemist.
1902. Rosebrugh, Prof. T. K., Professor of Electrical Engineering.

1897. Rosengarten, Dr. Geo. D., 1700, Fitzwater Street, Station D, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1896. Rosenheim, Dr. Otto, 68, Belsize Park Gardens, Hampstead, N.W., Research Chemist.
1887. Ross, Alex. J. J., Tayavalla, Falkirk, N.B., Chemical Manufacturer.
1893. Ross, Arthur, I, Glengall Road, Old Kent Road, London, S.E., Analytical Chemist.
1900. Ross, Raymond, Public Analyst's Office, Burnley, Lancashire, Analytical Chemist.
1906. Rossi, Auguste J., c/o Roessler Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Mining Engineer.
1906. Rossi, Louis M., c/o Perth Amboy Chemical Works, Perth Amboy, N.J., U.S.A., Mining Engineer.
1906. Rossiter, E. C., 4, Park Road, West Smethwick, Birmingham, Chemical Engineer.
1888. Rothwell, C. F. Seymour, Photographic Works, Mobberley, Cheshire, Chemist.
1908. Rothwell, Herbert E., 241, Dunn Avenue, Toronto, Canada, Chemist.
1905. Rothwell, Robert R., 88, George Street, Moss Side, Manchester, Chemistry and Physics Teacher.
- O.M. Rottenburg, Paul, Castle Chambers, 55, West Regent Street, Glasgow, Chemical Merchant.
1899. Rouse, H. W., Anglo-Continental Guano Works, Victoria Docks, E., Foreman.
1903. Rouse, Wm., 25, Albert Street, Alexandria, Dumbartonshire, Chemist.
1906. Rowell, Herbert W., c/o Major and Co., Ltd., Seuloates, Hull, Analytical Chemist.
- O.M. Rowland, W. L., 4800, Chester Avenue, Philadelphia, Pa., U.S.A., Chemist.
1904. Rowley, Ernest W., Chemical Laboratory, Locomotive Department, North Eastern Railway, Gateshead-on-Tyne, Analytical Chemist.
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1901. Rowley, Walter Eugene, c/o Schoellkopf, Hartford, and Hanna Co., 100, William Street, New York City, U.S.A., Chemist.
1904. Rowling, S. R., 1, Beechwood, Kendal, Westmoreland, Chemist.
1896. Royal-Dawson, H., 6, Wimbourne Road, Edgbaston, Birmingham, Chemist.
1898. Royle, Chas. L., Sugar Chemist.
- O.M. Royse, S. W., St. Andrew's Chambers, 20, Albert Square, Manchester, Chemical Engineer.
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1896. Ruddock, Fred. G., Corporation Street, Warrington, Analytical Chemist.
1895. Rudge, Alfred, Sutton Alkali Works, St. Helens, Lanes., Analytical Chemist.
1908. Rudolf, Prof. Norman S., Dept. of Applied Chemistry, Indian Institute of Science, Bangalore, India, Professor.
1884. Ruffle, Jno., Musley, Ware, Herts., Consulting Chemist and Electrician.
1905. Rüger, Richard, 13, Balmoral Road, Fairfield, Liverpool, Chemist.
1898. Ruhl, Louis, c/o Roessler and Hasslacher Chemical Co., P.O. Box 1999, 100, William Street, New York City, U.S.A., Chemical Merchant.
- O.M. Rumble, C., Belmont Works, Battersea; and (Journals) 9, Sangora Road, New Wandsworth, London, S.W., Candle Works Chemist.
1899. Rumhold, Wm. R., c/o Hebburn and Son, Pancras Lane, Queen Victoria Street, London, E.C., Electro-Metallurgist.
1895. Rump, Ernest, The Leeds Phosphate Works, Hunslet, Leeds, Manager.
1903. Runting, D. A., Moreland Grove, Coburg, Melbourne, Vic., Australia, Assayer.
1903. Runyan, Elmer G., Hutchins Building, Washington, D.C., U.S.A., Chemist and Gas Inspector.
1899. Rushby, Wm., Oak View, Batley, Yorks., Analyst.
1906. Russell, David, Cadham, Markinch, Fife, Scotland, Paper Maker.
1908. Russell, Walter M., Office of Gas Inspector, City Hall, Dallas, Texas, U.S.A., Industrial Chemist.
- O.M. Russell, Dr. W. J., F.R.S., 31, Upper Hamilton Terrace, London, N.W., Professor of Chemistry.
1901. Rust, Robt. R., 312, West 97th Street, New York City, U.S.A., Chemist.
1905. Ryan, Prof. F. G., (Journals) c/o Parke, Davis and Co., Detroit, Mich., U.S.A., and (subscriptions) c/o Parke, Davis and Co., Beak Street, Regent Street, London, W., Manufacturing Chemist.

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1895. Saalfeld, Adolphe, 2, South King Street, Manchester, Chemical Merchant.
1895. Saabach, Dr. L., 111, Pearl Street, New York City, U.S.A., Consulting Chemist.
1908. Sabbaton, Frederic A., c/o Laurentide Paper Co., Ltd., Grande Mère, P.Q., Canada, Paper Manufacturer.
1905. Sabin, Alvah H., 432, Sandford Avenue, Flushing, N.Y., U.S.A., Chemist, Varnish Works.
1883. Sadler, A. E., Sand Hall, Ulverston, Lancashire, Manufacturing Chemist.
- O.M. Sadler, Sir Samuel A., Middlesbrough-on-Tees, Colour Manufacturer.
1908. Sadtler, Philip B., c/o Geo. M. Newhall Engineering Co., Ltd., 136, South 4th Street, Philadelphia, Pa., U.S.A., Engineer.
1884. Sadtler, Dr. S. P., 145, North 10th Street, Philadelphia, Pa., U.S.A., Consulting Chemist.
1896. Sadtler, Dr. S. S., c/o Samuel P. Sadtler and Son, 39, South 10th Street, Philadelphia, Pa., U.S.A., Analytical and Consulting Chemist.
1897. Sage, C. Edward, c/o W. C. Nickels, 41, Cheapside, London, E.C., Consulting Chemist.
1902. Sahm, Louis N., 22, Cliff Street, New York City, U.S.A., Chemist.
1907. Saiki, Kenkichi, Guantanamo Sugar Co., Los Canos, Guantanamo, Cuba, Chemist.
1884. Salamon, A. Gordon, 1, Fenchurch Avenue, London, E.C., Consulting Chemist.
1885. Salamon, Jno., Rainham, S.O., Essex, Manufacturing Chemist.
1884. Salis-Mayenfeld, Dr. E. von, 966, Madison Avenue, Albany, N.Y., U.S.A., Technical Chemist.
1907. Samuel, Marcus R. A., 12, Minorities, London, E.C., Merchant.
- O.M. Samuel, W. Cobden, 66, Croxted Road, West Dulwich, S.E., Analytical Chemist.
1896. Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.
1904. Sand, Dr. Henry J. S., University College, Nottingham, Lecturer and Demonstrator.
1909. Sandberg, Sixten, Skutskär Sulphite and Soda-pulp Mills, Skutskär, Sweden, Chemist and Mill Manager.
1906. Sanders, J. McConnell, c/o Dirección General de Aduanas, Palacio Nacional, Mexico, D. F., Analytical Chemist.
1902. Sanders, Warren W., 127, Vernon Street, Gardner, Mass., U.S.A., Chemist.
1895. Sanderson, John, c/o B. S. Cohen, Ltd., 15, Clerkenwell Close, London, E.C., Chemist.
1898. Sanderson, T. Crisp, Dubois Avenue, West New Brighton, N.Y., U.S.A., Chemical Engineer.
1907. Sandig, A., 229, Kinzie Street, Chicago, Ill., U.S.A., Sales Manager.
- O.M. Sanford, P. Gerald, 14, Wellington Road, Croydon, Public Analyst and Consulting Chemist.
1908. Sang, Alfred, c/o Garland Corporation, Pittsburg, Pa., U.S.A., Manufacturer and Consulting Engineer.
1890. Saniter, E. H., Strafford Villa, Moorgate, Rotherham, Analytical Chemist.
1901. Sargent, Dr. Geo. W., c/o The Carpenter Steel Co., Reading, Pa., U.S.A., Chemist and Metallurgist.
1909. Sargent, Ledyard W., Roessler and Hasslacher Chem. Co., Plant No. 2, Perth Amboy, N.J., U.S.A., Chemist.
1903. Saunders, Lewis E., 123, Buffalo Avenue, Niagara Falls, N.Y., U.S.A., Electro-Chemical Engineer.

1896. Saunders, Walter M., 20, Dewey Street, Olneyville, R.I., U.S.A., Analytical Chemist.
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1895. Sawers, Wm. D., 3, Hillside Gardens, Partick Hill, Glasgow, Chemist.
1901. Sawyer, Dr. Harris E., Bureau of Chemistry, Washington, D.C., U.S.A., Chemist.
1907. Saxe, Joel B., P.O. Box 554, Montreal, Canada, Chemist.
1898. Saxe, Sigmond, 107, Manhattan Avenue, New York City, U.S.A., Manufacturing Chemist.
1895. Sayer, Harry, 5, Orchard Road, High Barnet, Herts., Metallurgical Chemist.
1890. Sayers, Jos. J., Nobel Villa, Stevenston, Ayrshire, Explosives Chemist.
1895. Scales, F. Shillington, "Jersey," St. Barnabas Road, Cambridge.
1899. Schaak, Dr. Milton J., 108, Penn Street, Brooklyn, N.Y., U.S.A., Chemist.
- O.M. Schack-Sommer, Dr. C., 87, Victoria Street, London, S.W., Sugar Refiner.
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1899. Schaefer, Dr. L., Maywood, N.J., U.S.A., Manufacturing Chemist.
1908. Schatzmann, Dr. Paul, Isleben bei Fluelen, Switzerland, Chemist.
1908. Scheele, Edward H., 3, Lloyds Avenue, London, E.C., Chemical Merchant.
1906. Scheffler, Heinrich, c/o Orme & Co., 17-19, Russell Street, London Road, Manchester, Chemical Apparatus Manufacturer.
1903. Scheidel, Dr. Aug., Mutual Life of New York Building, Martin Place, Sydney, N.S.W., Australia, Managing Director.
1886. Schellhaas, Henry Alf., Thornhill, Beach Road, Hartford, Northwich, Mechanical Engineer.
1904. Schenk, Henry, 15, University Place, New York City, U.S.A.
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1902. Schlegel, Jno. Wm., cor. Main and Toledo Avenues, Elmhurst, Long Island, N.Y., U.S.A., Chemist.
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1902. Schlesinger, Basil E., Brookline, Mass., U.S.A., Chemist.
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1906. Schmidt, J., 52, Camberwell Green, London, S.E., Works Manager.
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1906. Schneible, Joseph, 122, Monroe Street, Chicago, Ill., U.S.A., Chemical Engineer.
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1899. Schniewind, Dr. F., c/o German American Coke and Gas Co., 17, Battery Place, New York City, U.S.A., President.
1904. Schniewind, Heinrich, Jun., Susquehanna Silk Mills, 18, West 18th Street, New York City, U.S.A., Vice-President and Treasurer.
1907. Schober, Prof. W. B., Lehigh University, South Bethlehem, Pa., U.S.A., Professor of Chemistry.
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1904. Schoeller, Dr. Walter R., c/o The Famatina Development Corporation, Chilecito, Prov. Rioja, Argentine Republic, Analytical Chemist.
1902. Schofield, Jas. A., The University, Sydney, N.S.W., Australia, Lecturer in Chemistry.
1908. Scholefield, Fred., c/o Henry Ashwell and Co., Ltd., New Basford, Nottingham, Works Chemist.
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1898. Scholes, Geo. R., Analytical Chemist.
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1908. Schüll, Gustav, Messrs. Carl Schleicher & Schüll, Düren, Rheinland, Germany, Filter Paper Manufacturer.
1906. Schulten, Dr. C., P.O. Box 279, Calcutta, India, Analytical Chemist.
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1909. Schwarz, Theo., Ashton House, Cliffe at Hoo, Kent, Technical Chemist.
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1889. Scott, Ernest G., 2, Talbot Court, Gracechurch Street, London, E.C.; and (Journals) 67, Lord Street, Liverpool, Soap Works Chemist.
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1906. Seabury, Richard W., c/o Boonton Rubber Co., Boonton, N.J., U.S.A., Factory Superintendent.
1909. Seager, Dan G., Box 57, Thebes, Ill., U.S.A., Chemist.
1889. Searl, Albert, Montreux, Victoria Road, Sideup, Kent, Technical Chemist.

1898. Searle, Alfred B., Cliftonville, Claremont, Sheffield, Analytical Chemist.
1905. Seaver, Joshua, 7, West Seventh Street, South Boston, Mass., U.S.A., Dealer in Dyestuffs and Chemicals.
1907. Sebold, George, 354, Elizabeth Avenue, Elizabeth, N.J., U.S.A.
1901. Sederholm, Erik, K. Flottans Varf, Stockholm, Sweden, Chemist (Royal Navy Board).
1905. Seebohm, H. C. A., 117, Hudson Street, New York City, U.S.A., Importer of Dyestuffs and Chemicals.
1905. Seeker, A. F., 528, Eighth Street, Brooklyn, N.Y., U.S.A., Food Analyst.
1907. Seelmann, Dr. A., Uhlenhorsterweg 3, Hamburg, Germany, Managing Director of Explosives Works.
1893. Sefton-Jones, Herbert, c/o W. P. Thompson and Co., 322, High Holborn, London, W.C., Chemist.
1902. Segaert, Edw., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1899. Seher, A., c/o Maas and Waldstein Co., Riverside Avenue, Newark, N.J., U.S.A., Chemist.
1907. Seidensticker, Lewis J., c/o Arbuckle Bros. Sugar Refinery, Foot of Pearl Street, Brooklyn, N.Y., U.S.A., Chief Chemist.
1896. Seldner, Rudolph, 1395, Dean Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1904. Seligman, Dr. Richard, 109, Queen Victoria Street, E.C.; and (Journals) 25, Brunswick Gardens, London, W., Chemist.
1903. Sellen, Elijah, Gasworks Laboratory, Elm Station, Montreal, Canada, Chemist.
1905. Sellers, Geo. E., Rock View, Milnsbridge, near Huddersfield, Aniline Colour Maker.
1898. Sen (Gupta), Nagendra Nath, 19, Lower Chitpur Road, Calcutta, India, Physician and Chemist.
1899. Senior, Francis L., Box 31, Sanford, Maine, U.S.A., Mill Chemist.
1906. Setz, C. F., Hereulaneum, Mo., U.S.A., Chemist and Metallurgist.
1905. Sewell, B. F. Brooke, P.O. Box, 70, Washington, D.C., U.S.A., Chemical Engineer.
1896. Seyler, Clarence A., Public Analyst's Office, Nelson Terrace, Swansea, Chemist and Assayer.
1907. Seymour, Tom G., 26, Karslake Road, Wavertree, Liverpool, Analytical Chemist.
1903. Shacklady, T. G., c/o British Turpentine Corporation, Ltd., Hayes, Middlesex, Technical Chemist.
1906. Shadbolt, Fred., c/o South Metropolitan Gas Co., Chemical Works, East Greenwich, S.E., Chemical Engineer and Manager.
1906. Shah, Prof. S. J., Dhanasutar's Street, Dehra's Pole, Ahmedabad, India, Professor of Science.
1905. Shainwald, R. L., jun., Bound Brook, N.J., U.S.A., and (Journals) Paperhuderstrasse 3, Hamburg, Germany, Chemist.
1906. Shankland, George A., Edge Hill, Mansfield Woodhouse, Notts., Manager.
1892. Shanks, Arch., Bridgend Mills, Dalry, Ayrshire, N.B., Chemist.
1908. Shanks, John, Dalmeny Hook, Barrhead, N.B., Sanitary Engineer.
1883. Sharp, James, Shirley Manor, Wyke, near Bradford, Yorks., Dyer.
1909. Sharp, James B., Thorn Bank, Marple, Cheshire, Chemical Representative (Meister, Lucius, und Brüning).
1903. Sharples, G. H., Holly Villas, Sutton Lane, Middlewich, Cheshire, Works Chemist.
1905. Sharples, Philip P., 22, Concord Avenue, Cambridge, Mass., U.S.A., President (Nat. Coal Tar Co.).
1884. Sharples, Stephen P., 26, Broad Street, Boston, Mass., U.S.A., Analytical Chemist.
1900. Sharwood, Wm. J., c/o Homestake Mining Co., Lead, South Dakota, U.S.A., Metallurgical Chemist.
1900. Shattuck, A. F., c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.
1906. Shaw, H. G., Box 373, Barberton, Ohio, U.S.A., Chemist.
1906. Shaw, Ronald W. F., c/o Thacker, Spink and Co., P.O. Box 54, Calcutta, India, Principal.
1908. Shaw, Dr. T. P., 1022, Dorchester West, Montreal, Canada, Doctor of Medicine.
1904. Shedden, Frank, Hurst Road, Hinekley, Leicestershire, Science Master.
1905. Sheldon, John C., 8, Glenbank Terrace, Lenzie, N.B., Chemist.
1903. Sheldon, Dr. N. L., Cordite Factory, Aruvankad, Nilgiri Hills, India, Works Manager.
1892. Shenton, Jas. P., 37, Torbay Road, Chorlton-cum-Hardy, near Manchester, Analytical Chemist.
1889. Shepard, Dr. Chas. U., (communications) P.O. Box 42, Summaerville, S.C.; and (Journals) P.O. Box 284, Charleston, S.C., U.S.A.
1906. Shepard, Jas. H., Experimental Station, Brookings, S. Dak., U.S.A., Agricultural Chemist.
1907. Shephard, Fred. G., 5, University Road, Galway, Ireland, Chemist.
1904. Shepherd, A. B., Copenhagen Oil Mills, Limehouse, London, E., Analytical Chemist.
1900. Shepherd, E. Sanger, 68, Adelaide Road, London, N.W., Scientific Instrument Maker.
1893. Shepherd, H. H. B., Northcote, Mount Pleasant Lane, Upper Clapton, N.E., Chemist.
1898. Shepherd, Reginald des F., Central Laboratory, Rhodes, Manchester, Printworks Chemist.
1909. Shepherd, Stephen W., Bradford Corporation Chemical Works, Frizinghall, Bradford, Yorks., Works Manager.
1899. Shero, John E., c/o Aluminium Co. of America, Niagara Falls, N.Y., U.S.A., Chemist.
1906. Sherwin, R. S., c/o Aluminium Co. of America, East St. Louis, Ill., U.S.A., Chemist.
1893. Shields, Dr. John, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1907. Shilstone, Herbert M., c/o Penick and Ford, Ltd., 416, South Front Street, New Orleans, La., U.S.A., Analytical Chemist.
1896. Shimomura, K., Shinkarasumaru Kojinguchi Sagaru, Kyoto, Japan, Professor of Chemistry.
1886. Shimose, Masachika, 110, Hakusan-totenmachi, Koishikawa, Tokyo, Japan, Chemical Engineer.
1888. Shishkoff, Sergius A., Perm, Russia, Glass Manufacturer.
1905. Shoffstall, Arthur S., c/o Orford Copper Co., New Brighton, S.I., N.Y., U.S.A., Chemist.
1899. Sholes, Chas. E., 164, Front Street, New York City, U.S.A., Chemical Agent.
1900. Shonk, Albert, 87, Dartmouth Road, Hendon, N., Analytical Chemist.
1897. Shores, Dr. Jeff. H., King's Road, Wallsend-on-Tyne, Chemist.
1904. Short, Andrew, Choppington, Morpeth, Works Chemist.
1902. Shoubridge, Sydney Y., M.I.C.E., Gasworks, Lower Sydenham, S.E., Gas Engineer.
1907. Shuey, Philip McG., 423, Bull Street, Savannah, Ga., U.S.A., Analytical Chemist.
1901. Shukoff, Dr. Alexis A., Borowaja No. 86, St. Petersburg, Russia, Technical Chemist.
1899. Shuler, Darius P., Sudbury, Ont., Canada, Chemist.
1890. Shutt, Frank T., Central Experimental Farm, Ottawa, Canada, Agricultural Chemist.
1906. Shuttleworth, E. B., 220, Sherbourne Street, Toronto, Canada, Chemist.
1901. Siau, Raymond L., Springfield Brewery, Wolverhampton, Research Chemist.
1902. Sibley, Samuel E., 13, Cook Road, Centennial Park, Sydney, N.S.W., Australia, Technical Chemist.
1907. Siebel, Fred. P., 1122, Montana Street, Chicago, Ill., U.S.A., Analytical Chemist.
1902. Siebold, Alfred, c/o British Dyewood and Chemical Co., Lacovia P.O., Jamaica, Technical Chemist.
1901. Silberrad, Dr. Oswald, Sunny Croft, Buckhurst Hill, Essex, Research Chemist.
1892. Silvester, Harry, 78, Holyhead Road, Handsworth, Birmingham, Analytical and Consulting Chemist.

1901. Sim, Wilfrid A., c/o Wm. Sim and Sons, 40, Jane Street, Leith, N.B., Colour Manufacturer.
1903. Simmons, Wm. H., Oakleigh, Stoke Newington Common, N., Analytical Chemist.
1898. Simon, Dr. A., 55-56, Bishopsgate Street, London, E.C., Chemical Engineer.
1890. Simonds, Dr. F. M., 60, Wall Street, New York City, U.S.A., Mining Engineer and Assayer.
1905. Simons, Albert J., Pontianak, Dutch West Borneo, vii Singapore, S.S., Engineer.
1906. Simons, F. D., Continental Mexican Rubber Co., Apartado 176, Torreon, Mexico, Chemist.
1902. Simonsen, Wm., 126, West 9th Street, Cincinnati, Ohio, U.S.A., Chemist.
1905. Simpson, Henry, 34, Kimbolton Avenue, Lenton Sands, Nottingham, Works Chemical Assistant.
- O.M. Simpson, W. S., The Gables, Cannon Hill, Southgate, N., Analytical Chemist.
1900. Sims, W. Edgar, c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Assistant Manager.
1894. Sinclair, Dr. W., 60, Stirling Road, Trinity, Edinburgh, Chemist.
1890. Sindall, R. W., 201, Wellmeadow Road, Catford, S.E., and (Journals) Oxford Court, Cannon Street, E.C., Paper Chemist.
1889. Singer, Ignatius, 3, Parkfield Road, Manningham, Bradford, Manufacturing Chemist.
1899. Singmaster, J. Arthur, c/o New Jersey Zinc Co. of Penna., Palmerton, Pa., U.S.A., Chemist.
1901. Sinnatt, Frank S., Glenside, Church Lane, Moston, Manchester, Demonstrator of Chemistry.
- O.M. Sisson, G., jun., 13, Grey Street, Newcastle-on-Tyne, Technical Chemist.
1905. Sjöström, Waldemar L., 37, Farnham Street, Lawrence, Mass., U.S.A., Dyeworks Superintendent.
1885. Skaife, Wilfred T., 70, Sherbrooke Street West, Montreal, Canada, Sugar Chemist.
1894. Skelton, John R., c/o Norwich Crape Co., Ltd., St. Augustine's, Norwich, Managing Director.
1897. Skertchly, W. P., Laboratory, 11, Billiter Square, London, E.C., Analytical Chemist.
1891. Skilton, C. F. E., c/o Beamish and Crawford, Ltd., Cork, Ireland, Brewer.
1901. Skinner, Hervey J., c/o A. D. Little, 93, Broad Street, Boston, Mass., U.S.A., Chemist.
1908. Skinner, Wm., 38, Sauchiehall Street, Glasgow, Analytical Chemist.
1904. Skirrow, Dr. F. W., 17, Curzon Avenue, Victoria Park, Manchester, Research Chemist.
1904. Skowronski, S., c/o Amer. Smelting & Refining Co., Manrer, N.J., U.S.A., Chemist.
1891. Skurray, Thos., The Brewery, 40, Oak Street, Abingdon, Berks, Brewer.
1904. Slater, Dr. Arthur, The Priory, Burton-on-Trent, Lecturer and Demonstrator.
1887. Slatter, Geo. W., 241, Carlton Terrace, Nab Wood, Shipley, Yorkshire, Analytical Chemist.
1906. Sleeper, Robt. R., 112, Charles Street, Lowell, Mass., U.S.A., Instructor in Dyeing.
1895. Slocum, Dr. Frank L., 401, South Linden Avenue, E.E., Pittsburg, Pa., U.S.A., Chemist.
1883. Smail, J. L., Warren Wood, Hayes Common, Beckenham, Kent, Chemical Manufacturer.
1908. Small, Bertram G., Beechlands, Timperley, Cheshire, Managing Engineer.
1898. Small, Fritz H., c/o Graton and Knight Manufacturing Co., Worcester, Mass., U.S.A., Chemist.
1904. Smallman, J. E., c/o Canada Chemical Manufacturing Co., Ltd., London, Ont., Canada, Chemist.
1904. Smart, Bertram J., Chem. Research Laboratory, Royal Arsenal, Woolwich, S.E., Chemist.
1906. Smart, Leslie A., 720, McIntyre Building, Winnipeg, Man., Canada, City Analyst.
- O.M. Smetham, A., 16, Brunswick Street, Liverpool, Analytical Chemist.
1904. Smith, Albert E., c/o Mount Hope Finishing Co., North Dighton, Mass., U.S.A., Superintendent.
1905. Smith, Prof. Albert W., Case Library, Cleveland, Ohio, U.S.A., Prof. of Chemistry.
1898. Smith, Alf. B., Ryecroft, Glossop, Derbyshire, Bleacher and Dyers' Manager.
1897. Smith, Allan, c/o Kellner-Partington Paper Pulp Co., Hallein, bei Salzburg, Austria, Chemist.
1896. Smith, Andrew T., c/o Castner-Kellner Alkali Co., Ltd., 43, Castle Street, Liverpool, General Manager.
1905. Smith, Arthur, Town End Chemical Works, Bramley, Leeds, Chemical Manufacturer.
1906. Smith, Arthur D., c/o Canfield Oil Co., Coraopolis, Pa., U.S.A., Superintendent.
1893. Smith, Edgar B., Box 599, Sydney, Nova Scotia, Canada, Chemist.
1906. Smith, E. A. Cappellet, c/o Baltimore Copper Smelting and Rolling Co., P. O. Station J., Baltimore, Md., U.S.A., Metallurgical Engineer.
1895. Smith, Dr. E. Ellsworth, 26, East 29th Street, New York City, U.S.A., Consulting Physiological Chemist.
1892. Smith, Ernest A., The Assay Office, Leopold Street, Sheffield, Assayer.
1903. Smith, Ewing, c/o Borneo Co., Ltd., Kuching, Sarawak, Borneo, Analytical Chemist.
1903. Smith, F. M., 100, William Street, New York City, U.S.A., President (Pacific Coast Borax Co.).
1891. Smith, Francis P., 24-26, East 21st Street, New York City, U.S.A., Chemist.
1907. Smith, Frank Morse, 100, William Street, New York City, U.S.A., Chemical Merchant.
- O.M. Smith, G., Roschall Terrace, Falkirk, N.B., Explosive Works Manager.
1908. Smith, George A., 1069, Prospect Place, Brooklyn, N.Y., U.S.A., Chemist (Printing Ink Manufacturing).
1907. Smith, George D., 216, Milk Street, Boston, Mass., U.S.A., Salesman.
1897. Smith, Sir Geo. J., c/o Bickford, Smith, and Co., Ltd., Tuckingmill, Cornwall, Fuse Manufacturer.
1906. Smith, Geo. Thos., 94, Leadenhall Street, London, E.C., Chemical and Colour Merchant.
1890. Smith, Harry, Tower House, Freshfield, near Liverpool, Cons. Chemist (Paints and Pigments).
1890. Smith, Harry E., 80, Knowles Street, East Cleveland, Ohio, U.S.A., Analytical Chemist.
1904. Smith, Henry, 83, Brownlow Road, Horwich, Bolton-le-Moors, Lancs., Analytical Chemist.
1902. Smith, Hy. Geo., Technological Museum, Harris Street, Ultimo, Sydney, N.S.W., Australia, Assistant Curator and Chemist.
1905. Smith, H. Melville, Ammunition Works, Abbey Wood, Kent, Engineer and Superintendent.
1901. Smith, H. Procter, Shotton Lane, Shotton, Flintshire, Metallurgical Chemist.
- O.M. Smith, H. R., 1, Aubert Park, Highbury, London, N., Analytical Chemist.
1890. Smith, H. Wood, c/o John Batt and Co., Ltd., 39, Old Broad Street, London, E.C., Chemist.
1905. Smith, Hugh Dunford, 8 and 10, The Side, Newcastle-on-Tyne, Analytical Chemist.
1906. Smith, Irwin J., P.O. Box 506, Troy, N.Y., U.S.A., Salesman.
- O.M. Smith, Jas., Ash Grove House, Radcliffe, Manchester.
1897. Smith, James, 80, Amphil Road, Aigburth, Liverpool, Analytical Chemist.
1903. Smith, James, Metallurgist.
1907. Smith, Jas. C., c/o Edward Ripley and Son, Ltd., Bowling Dyeworks, Bradford, Dyer.
1893. Smith, Jas. F., 131, Seamer Road, Scarborough, Yorks, Analytical Chemist.
1901. Smith, J. Cruickshank, Holmdene, Colebrooke Avenue, West Ealing, W., Technical Chemist.
- O.M. Smith, Dr. J. H., 60, Rue de la Côte St. Thibault, Bois Colombes, Seine, France, Chemist.
1888. Smith, J. Tertius, Richmond House, Plaistow, Essex, Technical Chemist.
- O.M. Smith, Jno. W., 7, Brookfield Street, Roslindale, Boston, Mass., U.S.A., Analytical Chemist.
1890. Smith, J. Wm., Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.

1896. Smith, Joseph Kent, 1144, Portland Street, Pittsburg, Pa., U.S.A., Chemist, American Vanadium Co.
1898. Smith, R. F. Wood, 9, Lower Thames Street, London, E.C., Consulting Chemist.
1890. Smith, Dr. R. Greig, Linnean Society's House, Elizabeth Bay, Sydney, N.S.W., Entomologist and Chemist.
1890. Smith, R. W., c/o New Transvaal Chemical Co., Delmore, Transvaal, S. Africa, Chemical Works Manager.
1897. Smith, Theophilus R., c/o Brotherton and Co., Ltd., The Wear Tar Works, South Dock, Sunderland, Chemist.
1907. Smith, Thorm, P.O. Box 106, Isabella, Tenn., U.S.A., Chemist (Ducktown Sulphur, &c., Co.).
1896. Smith, Walter E., 141, Cypress Street, Providence, R.I., U.S.A., Instructor in Chemistry.
1903. Smith, Dr. Warren R., Lewis Institute, Chicago, Ill., U.S.A., Teacher.
- O.M. Smith, Watson, 34, Upper Park Road, Haverstock Hill, N.W., Editor of Society's Journal.
1908. Smith, Dr. Watson, jun., De Feers Explosives Works, Somerset West, C.C., South Africa, Chemist.
- O.M. Smith, Wilfred, 182, West Street, Glasgow, Chemical Manufacturer.
1896. Smith, Dr. W. Stanley, Hollies House, Marchweil, near Wrexham, North Wales, Brewer.
- O.M. Smithells, Prof. A., F.R.S., The University, Leeds, Professor of Chemistry.
- O.M. Smithers, F. O., Dashwood House, 9, New Broad Street, London, E.C., Chemical Agent.
1902. Smoot, Albert M., 99, John Street, New York City, U.S.A., Analytical Chemist.
1902. Smythe, Dr. Jno. A., Armstrong College, Newcastle-on-Tyne, Demonstrator in Chemistry.
1902. Smythe, Dr. J. S., Rantallard, Lance Lane, Wavertree, Liverpool, Analytical Chemist.
1888. Snape, Dr. H. Lloyd, Balholm, Lathom Road, Southport, Director of Education for Lancashire.
1908. Snell, John F., Macdonald College P.O., Prov. Quebec, Canada, Assistant Professor of Chemistry.
1896. Snowdon, J., jun., Messrs. Snowdon, Sons & Co., Millwall, E., Chemical and Oil Manufacturer.
1900. Sodeau, Dr. Wm. H., 19, East Parade, Newcastle-on-Tyne, and (Journals) Torpedofabrik, Fiume, Hungary, Chemist.
1903. Sohlman, Ragnar, Bofors, Sweden, Manager (A. B. Bofors' Nobelkrut).
1894. Sohn, Chas. E., 52, Fore Street, London, E.C., and (Journals) 82, Wightman Road, Harringay, N., Analyst.
1906. Solomon, M., 45, Newhall Street, Birmingham, Manager (Carbon Works).
1895. Solvay, Armand, 25, Rue Prince Albert, Brussels, Cérant de la Société Solvay et Cie.
1884. Solvay, Ernest, 43, Rue des Champs Elysées, Brussels, Alkali Manufacturer.
1897. Somerset, H. St. John, jun., Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Assayer.
1884. Sommer, Adolf, corner 1st and Binney Streets, East Cambridge, Boston, Mass., U.S.A., Pharmaceutical Chemist.
1909. Sommer, Dr. Albert, 17, Battery Place, New York City, U.S.A., Engineer Chemist (The Texas Co.).
1904. Southall, A. W., Lower Priory, Birmingham, Manufacturing Chemist.
1908. Southcombe, James E., Imperial Oil Works, Salford, Lancashire, Chemist.
1896. Souther, H., 440, Capitol Avenue, Hartford, Conn., U.S.A., Chemical and Metallurgical Engineer.
1904. Southenden, F., 11, Gordon Road, Exeter, Teacher of Chemistry.
1892. Southern, Thos., Wheathill Chemical Works, St. Simon Street, Salford, Manufacturing Chemist.
1883. Soward, A. W., 28, Therapia Road, Honor Oak, S.E., Principal Clerk (Legacy Duty Office).
1908. Sowden, Parkin T., c/o Standard Silver Co., 35, Hayter Street, Toronto, Canada, Mechanical Engineer.
1890. Sowerby, Thos. H., Canal Soap Works, Verney Road, Rotherhithe, S.E., Soap Manufacturer.
- O.M. Sowerby, W. M., c/o United Alkali Co., Ltd., All-husen Works, Gateshead-on-Tyne, Manager.
1887. Spackman, Chas., Roschaugh, Clitheroe, Lancashire, Portland Cement Manufacturer.
1904. Sparre, Fin, 606, West 20th Street, Wilmington, Del., U.S.A., Chemist.
1904. Speiden, C. C., 46, Cliff Street, New York City, U.S.A., Chemical Merchant.
1905. Speight, W. E., Sewage Works, Deighton, Huddersfield, Chemist.
1883. Spence, D., Manchester Alum Works, Manchester, Alum Manufacturer.
1900. Spence, Howard, (Journals) Audley, Broad Road, Sale, Cheshire; and Alum Works, Manchester, Chemical Manufacturer.
1909. Spence, Jno., 113, West Regent Street, Glasgow, Analyst.
1883. Spence, Jno. W., Tiviot Colour Works, Manchester Road, Stockport, Drysalter.
1903. Spencer, A. Gordon, Central Experimental Farm, Ottawa, Canada, Chemist.
1906. Spencer, Fred. W., c/o Ammonia Co. of Australia, Clyde, and (Journals) Cheltenham, Redmyre Road, Strathfield, Sydney, N.S.W., Australia, Works Manager.
1909. Spencer, George, c/o The Gorton Rubber Co., Ltd., Openshaw, Manchester, Managing Director.
1884. Spencer, Jno., Globe Tube Works, Wednesbury, Tube Manufacturer.
1902. Sperry, Elmer A., 100, Marlborough Road, Prospect Park South, Brooklyn, N.Y., U.S.A., Electrical Engineer.
1897. Sperry, Erwin S., "The Brass World," 260, John Street, Bridgeport, Conn., U.S.A., Metallurgist and Editor.
1906. Spicer, J. Spofford, 2043, North Second Street, Harrisburg, Pa., U.S.A., Chemist (Penna. Dept. of Agriculture).
1884. Spiegel, Dr. Adolf, Messel, bei Darmstadt, Germany, Analytical Chemist.
1903. Spielmann, Dr. P. E., 21, Cadogan Gardens, London, S.W., Chemical Student.
1906. Spiera, Dr. V. G., 37, Thornton Avenue, Streatham Hill, S.W., Chemist.
1889. Spies, Adolph, 102, Fenchurch Street, London, E.C., Chemical Merchant.
1889. Spies, Hermann, 102, Fenchurch Street, London, E.C., Chemical Merchant.
1885. Spiller, A., Edison-Swan Electric Co., South Benwell Works, Newcastle-on-Tyne, Electrician.
- O.M. Spiller, J., 2, St. Mary's Road, Canonbury, London, N., Consulting Chemist.
1896. Spoor, J. L., Rede Court, Rochester, Kent, Portland Cement Manufacturer.
1900. Spurge, Edw. C., University Chib, Niagara Falls, N.Y., U.S.A., Chemist.
- O.M. Squire, P. W., 413, Oxford Street, London, W., Pharmaceutical Chemist.
1896. Stafford, Chas. H., c/o The Birkacre Printing Co., Chorley, Lancs., Colourist.
- O.M. Stahl, Dr. K. F., 57th Street and A. V. Ry., Pittsburg, Pa., U.S.A., Chemical Works Manager.
1905. Stahl, Dr. Paul G., 13, Square de Jussieu, Lille (Nord), France, Chemical Manufacturer.
1904. Standfast, Jno. T., c/o Messrs. Burt, Boulton, and Haywood, Ltd., Prince Regent's Wharf, Silvertown, E., Chemist.
1906. Stanley, Wm., Great Barrington, Mass., U.S.A., Engineer.
1888. Stantial, Frank G., c/o Cochrane Chemical Co., Everett, Mass., U.S.A., Technical Chemist.
1885. Staples, H. J., The Old Hall, Spondon, Derby, Colour Manufacturer.
- O.M. Stark, J. F., Rosedale, Bromborough, Cheshire, Works Manager.
1896. Statham, Noel, c/o The West Virginia Paper and Pulp Co., Mechanieville, N.Y., U.S.A., Engineer.
1908. Statiropoulos, Dr. John G., Anatolia College, Marsovan, Turkey-in-Asia, Chemist.

1907. Staud, Joseph E., c/o W. W. Laurence & Co., Pittsburgh, Pa., U.S.A., Chemist.
1904. Stauffacher, W., 64, Oberwilerstrasse, Basle, Switzerland, Chemical Works Manager.
1908. Stayer, Charles A., 8, East Center Street, South Manchester, Conn., U.S.A., Silk Colour Mixer.
1895. Stead, J. Christopher, Llanfynydd, Wrexham, North Wales, Technical Chemist.
- O.M. Stead, J. E., F.R.S., 11, Queen's Terrace, Middlesbrough-on-Tees, Analytical Chemist.
- O.M. Stebbins, Dr. J. H., 3, East 29th Street, New York City, U.S.A., Analytical Chemist.
- O.M. Steedman, R. H., Whitfield, Prestwick, Ayrshire, N.B., Chemical Manufacturer.
1896. Steel, Fred. W., c/o Cumming, Smith and Co., Yarraville, Melbourne, Vic., Australia, Chemist.
1900. Steel, Jno. S., Achernat, Blackburn, Melbourne, Vic., Australia, Chemist.
1884. Steel, R. Elliott, Cameron House, Sherborne, Dorset, Headmaster.
- O.M. Steel, Thos., Colonial Sugar Refinery, O'Connell Street, Sydney, N.S.W., Australia, Sugar Chemist.
1906. Steers, Thornton, 224, Grand Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1905. Steiger, George, c/o U.S. Geological Survey, Washington, D.C., U.S.A., Chemist.
1897. Stein, Sigmund, 214, Upper Parliament Street, Liverpool, Sugar Refinery Manager.
1897. Steinhart, Dr. Oscar J., 2 and 3, West Street, Finsbury Circus, London, E.C., Manufacturing Chemist.
1903. Stell, S. F., 25, Henry Street, Keighley, Yorks., Teacher of Chemistry.
1887. Stenhouse, T., 166, Drake Street, Rochdale, Analytical Chemist.
1908. Stenhouse, Thos., jun., Chemical Laboratory, H.M. Dockyard, Portsmouth, Analytical Chemist.
1904. Stephen, A. E., 33, Victoria Street, Ashfield, Sydney, N.S.W., Australia, Analytical Chemist.
1884. Stephens, H. Chas., M.P., Avenue House, Finchley, N., Ink Manufacturer.
1892. Stephens, M. E., 4, Carlton Gardens, London, S.W.; and (Journals) 57-60, Aldersgate Street, London, E.C., Ink Manufacturer.
1889. Stern, Arthur L., 148, High Street, Burton-on-Trent, Brewing Chemist.
1906. Sternberg, Frank J. N., 155, Dunn Avenue, Toronto, Canada, Analytical Chemist.
- O.M. Stuart, D. R., Osborne Cottage, Broxburn, West Lothian, N.B., Oilworks Chemist.
1903. Steven, A. B., The Technical College, Glasgow, Lecturer on Dyeing.
1907. Steven, Michael M., c/o The Distillers' Co., Ltd., 12, Torphichen Street, Edinburgh, Analytical Chemist.
1899. Stevenot, G. A., c/o H. A. Metz Co., 210, South Tryon Street, Charlotte, N.C., U.S.A., Chemist.
1898. Stevens, Arthur F., 96, Newgate Street, London, E.C., Paper Examiner.
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1907. Stevenson, Chas. E., 80, Polwarth Terrace, Edinburgh, Dyer.
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1903. Stewart, Jas., "The Gas World," 8, Bouverie Street, Fleet Street, London, E.C., Editor.
1909. Stewart, Jeffrey, India Refining Co., McKean and Swanton Streets, Philadelphia, Pa., U.S.A., Works Manager.
1890. Stewart, Robt., St. Ann's, Luton, Chemical Works Manager.
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1906. Stickland, Oliver W., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Works Chemist.
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1893. Stock, F. W., Keating, County Analyst's Office, Darlington, Analytical and Consulting Chemist.
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1908. Suart, Arthur B., c/o Johnson and Sons' Smelting Works, Paul Street, Finsbury, London, E.C., Bullion Refiner.
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1895. Summers, Bertrand S., c/o The Summers Fibre Co., Port Huron, Mich., U.S.A., Electro-Chemist.
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1907. Taylor, C. Marshall, International Creosoting and Construction Co., Texarkana, Texas, U.S.A., Chief Chemist.
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1886. Taylor, G. Crosland, Ravenscar, Helsby, near Warrington, Electrical Engineer.
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1905. Teeple, Dr. J. E., 50, Church Street, New York City, U.S.A., Director.

1908. Teichfeld, Arnold, Pruszkow, near Warsaw, Russian Poland, Chemist in Ceramic Industry.
1904. Teller, George L., The Columbus Laboratories, 103, State Street, Chicago, Ill., U.S.A., Chemist.
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1896. Tennille, Geo. F., c/o Southern Cotton Oil Co., 206, Bay Street East, Savannah, Ga., U.S.A., Chemist.
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1902. Thomas, Nehemiah M., Roseville Avenue, Pymble, N.S.W., Australia, Inspector.
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1898. Thomas, Wm. Harrison, jun., Mount Royal Spinning Co., St. Paul, Montreal, Canada, Printworks Chemist.
1905. Thomlinson, Wm., Seaton Carew Ironworks, West Hartlepool, Ironmaster.
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1898. Thompson, Edw. C., 32, Ulundi Road, Westcombe Park, S.E., Manufacturing Chemist.
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1895. Thompson, Gustave W., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.
1907. Thompson, Jas. G., Donegall Quay Mills, Belfast, Ireland, Corn Miller.
1903. Thompson, Jno. T., Corporation Sewage Works, Knostrop, Leeds, Analyst.
1907. Thompson, Milton S., 72, Broad Street, Boston, Mass., U.S.A., Manufacturer.
1885. Thompson, W., Sankey Hill, Earlestown, Lancashire, Sugar Refiner.
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1884. Thomson, Robt. T., 156, Bath Street, Glasgow, Analytical Chemist.
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1891. Thornton, David H., Brookfoot Dyeworks, Brighouse, Yorks., Dyer.
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1899. Thornton, Wm., Hermand, West Calder, N.B., Chemist.
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1907. Thorp, Thos., Moss Bank, Whitefield, near Manchester, Engineer.
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1905. Thorpe, Dr. J. F., F.R.S., Yarnaford, Heaton, Mersey, Lancs., Lecturer, Manchester University.
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1905. Torrey, Prof. H. A., Harvard Chemical Laboratory, Cambridge, Mass., U.S.A., Assistant Professor of Chemistry, Harvard University.
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1897. Turney, Fred. N., 10, Dieghem Straat, Saventhum, near Brussels, Belgium, Leather Dresser.
1887. Turney, Sir J., Trent Bridge Leather Works, Nottingham, Tanner.
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1897. Twynam, H., O.K. Copper Mine, *via* Cairns, Queensland, Australia, Mining Engineer.
- O.M. Twynam, T., Wynyard House, Chatham Road, Redcar, Yorks., Metallurgist.
1904. Tyler, Chas. R., c/o Dr. Francis Wyatt, 402, West 23rd Street, New York City, U.S.A., Analytical Chemist.
- O.M. Typke, P. G. W., Lawn House, New Malden, Surrey, Chemical Manufacturer.
- O.M. Tyrer, Thos., Stirling Chemical Works, Stratford, E.; and (Journals) 14, Sandwell Mansions, West End Lane, N.W., Chemical Manufacturer.
1899. Tysoe, Jos., South Metropolitan Gas Co., East Greenwich, S.E., M.Inst.C.E., Gas Engineer.

U

1907. Udal, John P., Ridge Road, Berea, Durban, Natal, Engineer.
1894. Uhlig, E. C., Citizens' Gas Works, Fifth and Hoyt Streets, Brooklyn, N.Y., U.S.A., Chemist.
1900. Uhlig, W. C., c/o Hygeia Distilled Water Co., 349, West 12th Street, New York City, U.S.A., Chemist.
- O.M. Umney, C., (Journals) Fernbrake, Branksome, Wood Road, Bournemouth; and (communications) 50, Southwark Street, London, S.E., Manufacturing Chemist.

1905. Umney, John C., 48, Southwark Street, London, S.E., Wholesale Druggist.
 1889. Underhill, Thos. J., "Stanley," Quernmore Road, Bromley, Kent, Inspector of Stores.
 1885. Underwood, G. R., 4, Emerson Street, Peabody, Mass., U.S.A., Glue Works Chemist.
 1908. Underwood, Norman, Bureau of Engraving and Printing, Treasury Dept., Washington, D.C., U.S.A., Chemist.
 1908. Unglaub, Adolf, 5120, Chestnut Street, Philadelphia, Pa., U.S.A., Chemical Engineer.
 1908. Upton, Wm. C., Sara Cook Street, Rawdwick, N.S.W., Australia, Soap and Candle Manufacturer.
 1883. Usmar, J. H., 22, Billiter Street, London, E.C., Chemical Merchant.
 1904. Uyeda, Toyokitsu, Takasago, Harima, Japan, Chemist.

V

1907. Vail, Jas. G., c/o Philadelphia Quartz Co., Delaware Avenue and Howell Street, Chester, Pa., U.S.A., Chemist.
 1896. Van der Linde, Harold, c/o Continental Rubber Co., 111, Broadway, New York City, U.S.A., Chief Chemist.
 1895. Vanderpool, Dr. Frank, 175, Park Avenue, Orange, N.J., U.S.A., Chemist.
 1903. Van Dyck, Edwin M., c/o Ault & Wiborg Co., 534, Pearl Street, New York City, U.S.A., Chemist and Ink Maker.
 1907. Van Essen, E. C., c/o Hemingway and Co., Marsh Gate Lane, Stratford, E., Technical Chemist.
 1897. Van Gelder, Arthur P., c/o E. I. du Pont de Nemours Powder Co., Landing, N.J., U.S.A., Superintendent.
 1891. Van Gundy, Chas. P., Laboratory, B. and O. R. R., Baltimore, Md., U.S.A., Metallurgical Chemist.
 1896. Van Laer, Norbert, Truman's Brewery, Burton-on-Trent, Brewer and Chemist.
 1897. Van Marken, J. C., Repelen, near Moers, Germany, Chemical Engineer.
 1908. Van Trump, Isaac, c/o The Barber Asphalt Paving Co., 1245, Stock Exchange Building, Chicago, Ill., U.S.A., Chemist.
 1888. Vargas-Vergara, J. M., Apartado No. 237, Bogota, Colombia, S. America, Metallurgical Chemist.
 1905. Varshnei, Ishwar Das, Talegaon, G. I. P. Railway, Poona District, India, Chemical Engineer.
 1898. Verity, Ben, Magog, Prov. Quebec, Canada, Print Works Chemist.
 1897. Verity, Victor, 12, Gladstone Street, East Boston, Mass., U.S.A., Chemical Works Foreman.
 1904. Vernon, R. H., Institut Erixa, Rothelstrasse, Zürich, Switzerland, Student.
 1907. Vial, Stanley B., University High School, Melbourne, Victoria, Australia, Principal.
 1908. Vickers, Benj. Trefall, Gascoigne Street, Boar Lane, Leeds, Oil Merchant.
 O.M. Vickers, Wm., c/o Thos. Vickers and Sons, Miles Platting, Manchester, Chemical Manufacturer.
 1907. Vietinghoff-Scheel, Dr. Karl Freiherr von, "Chemiker-Zeitung," Cöthen (Anhalt), Germany, Editor in Chief.
 1908. Vieweg, Dr. Walter, Steinheimer Landstrasse 20, Hanau a/M., Germany.
 1897. Vlies, Leonard E., Belmont, Gowan Road, Alexandra Park, Manchester.
 O.M. Voelcker, E. W., 22, Tudor Street, London, E.C., Analytical and Consulting Chemist.
 1887. Voelcker, Dr. J. A., 20, Upper Phillimore Gardens, Kensington, W., Agricultural Chemist.
 1901. Vogel, G. C., c/o Plister and Vogel Leather Co., Milwaukee, Wis., U.S.A., Tanner.
 1897. Vogel, Julius L. F., Hillersdon, East Molesey, Surrey, Engineer.
 1899. Vogeler, Gustav, 17, Philpot Lane, London, E.C., Merchant.

1897. Voorhees, Louis A., 111, Carroll Place, New Brunswick, N.J., U.S.A., Agricultural Chemist.
 1899. Voorhees, Samuel S., Technologic Branch, U.S. Geological Survey, Washington, D.C., U.S.A., Chemist.
 1902. Vorisek, Dr. Anton, College of Pharmacy, 115-119, West 68th Street, New York City, U.S.A., Instructor.
 1888. Vörster, Fritz, Cöln-Marienburg, Germany, Manufacturing Chemist.
 1885. Voss, Hermann, 19, Beekenharn Road, Beekenharn, Kent, Manure Works Manager.
 1899. Voss, Walter A., Eastwood Road, Rayleigh, Essex, Manufacturing Chemist.

W

1896. Wachtel, Gregory, Alexandrowski Prospect 21, St. Petersburg, Russia, Chemical Engineer.
 1904. Wackenreuter, A. G., 134-136, Kinzie Street, Chicago, Ill., U.S.A., Colour Manufacturer.
 1905. Waddell, Montgomery, 1, West 101st Street, New York City, U.S.A., Consulting Engineer.
 1902. Wade, Frank, 26, St. Roman's Avenue, Southsea, Analytical Chemist.
 1890. Wade, Jas. L., 28, West Kensington Gardens, London, W., Chemical Manufacturer.
 1889. Wadman, W. E., 102, Lord Avenue, Bayonne, N.J., U.S.A., Manufacturing Chemist.
 1897. Wagner, Dr. Theodore B., 14, Marquette Terrace, Chicago, Ill., U.S.A., Chemist.
 1893. Wagner, W. G., 12, North Common Road, Ealing, W., Manufacturing Chemist.
 1906. Wagstaffe, Dr. E. A., 22, Blackfriars Street, Manchester, Analytical Chemist.
 1906. Wahl, Dr. Robert, 327, Fullerton Avenue, Chicago, Ill., U.S.A., President, Brewer's School.
 1903. Wainwright, J., 15, Bolton Road, Port Sunlight, near Birkenhead, Soap Works Manager.
 1884. Wainwright, Dr. J. H., 22, West 46th Street, New York City, U.S.A., Analytical Chemist.
 1906. Wainwright, R. E., Woodside Dyeworks, Horsforth, near Leeds, Dyer.
 1895. Wainwright, Wm., c/o Spooner and Bailey, Manure Works, Eling, near Southampton, Chemist.
 1908. Wait, Douglas, c/o R. Gay and Co., Ltd., Langthorne Works, Stratford Market, London, E., Analytical Chemist.
 1901. Waite, C. Nelson, c/o The Jessup & Moore Paper Co., Delaware Mills, Wilmington, Del., U.S.A., Chemist.
 1899. Wakefield, Wm. C., Overthorpe, Thornhill, near Dewsbury, Chemist.
 1905. Waldenberger, Dr. C. A., c/o Independent Baking Powder Co., 322-328, Warren Street, Jersey City, N.J., U.S.A., Chemist.
 1894. Waldman, Louis J., P.O. Box 162, Albany, N.Y., U.S.A., Aniline Dye Manufacturer.
 1895. Waldstein, Dr. Martin E., 100, William Street, New York City, U.S.A., Manufacturing Chemist.
 1887. Walker, Archibald, 8, Crown Terrace, Glasgow, Distiller.
 1908. Walker, George, c/o Burmah Oil Co., P.O. Box 67, Rangoon, Burmah, Analytical Chemist.
 1897. Walker, H. V., 586, St. Mark's Avenue, Brooklyn, N.Y., U.S.A., Chemist.
 1894. Walker, Dr. Jas., University College, Dundee, Professor of Chemistry.
 1897. Walker, Jas. W., Marine Lodge, Irvine, N.B., Chemical Manufacturer.
 1906. Walker, Jas. W., Stonydale, Oakmoor, Stoke-on-Trent, Assayer.
 1902. Walker, Jno. H., Gourepore Works, Naihati, E.B.S.R., Bengal, India, Chemist.
 1884. Walker, S. R., Fern Bank, Starling Road, Radcliffe, Manchester, Foreman Dyer.
 1900. Walker, Dr. Wm. H., Mass. Institute of Technology, Boston, Mass., U.S.A., Chemical Expert.

1895. Walker, W. Sloane, c/o Walker, Ltd., Litherland, near Liverpool, Tanner.
1897. Wallace, Edwin C., P.O. Box 241, East Auburn, Cal., U.S.A., Chemist.
1897. Wallace, Robt. A., 12, Avonmore Mansions, West Kensington, W., Chemical Manufacturer.
1883. Wallace, Robert, 20, Murrayfield Avenue, Edinburgh, Distiller.
- O.M. Waller, Dr. Elwyn, 7, Franklin Place, Morristown, N.J., U.S.A., Professor of Chemistry.
1906. Wallerstein, Leo, 105, East 91st Street, New York City, U.S.A., Chemist.
1899. Wallerstein, Dr. Max, 105, East 91st Street, New York City, U.S.A., Chemist.
1886. Walsh, F. T., 12, Valentine Street, West Newton, Mass., U.S.A., Colour Printer.
1901. Walsh, Lionel O.P., c/o Burt, Boulton and Haywood, Ltd., Prince Regent's Wharf, Silvertown, E., Chemist.
1903. Walsh, Peter H., P.O. Box 469, Magog, Quebec, Canada, Analytical Chemist.
1907. Walsh, Philip C., 19, Grant Street, Newark, N.J., U.S.A., Electro-Chemist and Metallurgist.
1904. Walther, Wm., Holzappel's Compositions Co., Ltd., Heworth Shore, Felling-on-Tyne, Chemist and Works Manager.
1908. Walton, Robert H., Railway Stores, Eveleigh, Sydney, N.S.W., Analyst.
1902. Walton, Thos. U., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1895. Want, W. Philip, 44, Bishopsgate Street Without, London, E.C., Pharmacist and Editor.
1901. Warburton, Frank, 50, Rosebery Road, Muswell Hill, N., Manager.
1904. Warburton, George H., 366A, High Road, Brondesbury, N.W., Analytical Chemist.
1896. Warburton, Thos., 98, Stanley Grove, Longsight, Manchester, Chemist.
1903. Ward, Dudley R., Mysore Gold Mine, Marikuppam, Mysore State, South India, Analytical Chemist.
- O.M. Ward, Geo., Messrs. Hirst, Brooke, and Hirst, Ltd., Millgarth Mills, Leeds, Chemical Manufacturer.
1891. Ward, G. J., Hallam Fields, Ilkeston, Notts., Civil Engineer.
1884. Ward, Howard Chas., Yeatton, Hordle, Lymington, Hants., Deputy Chairman of Gas Co.
1898. Ward, John, Barnstone Blue Lias Lime Co., Ltd., Barnstone, Notts., Manager.
1899. Ward, Wm. J., Chemist.
1906. Wardlaw, Thos. D., c/o The Geigy Aniline and Extract Co., 60, Front Street West, Toronto, Canada, Manager.
1908. Wardleworth, Theo. H., 168, Côte Saint Antoine Road, Westmount, Montreal, Canada, Manufacturing Chemist.
1902. Waring, W. Geo., Webb City, Mo., U.S.A., Metallurgical Chemist.
1899. Warnes, Arthur R., c/o Josiah Hardman Ltd., Aston Church Road, Nechells, Birmingham, Chemist.
1890. Warren, Fiske, c/o S. D. Warren and Co., Cumberland Mills, Westbrook, Maine, U.S.A., Paper Manufacturer.
1902. Warren, H. D., Laboratory, Gutta Percha and Rubber Manufacturing Co., Ltd., 47, Yonge Street, Toronto, Canada, President.
1901. Warren, Jno. E., Eagle Chemical Works, Barchester Street, Poplar, E., Tar Distiller.
1907. Warren, W. H., Gas Works, Beckton, E., Gas Engineer.
1885. Waterfall, W. B., c/o Avon Manure Co., Bristol; and (Journals) Thirlmere, Clavering Road, Redland, Bristol, Manure Manufacturer.
1902. Watkins, E. J., (communications) 10, Montpelier Road; and (Journals) c/o Mellin's Food, Ltd., Stafford Street, Peckham, S.E., Works Chemist.
1898. Watkins, Willard H., c/o Schoellkopf, Hartford, and Hanna Co., P.O. Drawer 57, Buffalo, N.Y., U.S.A., Chemist.
1894. Watmough, Benj. I., Ryeburn, Stanley Road; and (Journals) c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Chemist.
1894. Watson, Alex. Forbes, St. James's Gate Brewery Laboratory, Watling Street, Dublin, Chemist.
1884. Watson, Chas., Fairfield, Washwood Heath Road, Birmingham, Manufacturing Chemist.
1894. Watson, Chas. Ernest, 28, Highfield Road, Stretford, Manchester, Chemical Assistant.
1908. Watson, C. I. Wilkinson, 20, Finlay Drive, Dennistoun, Glasgow, Chemist.
1890. Watson, Eric E., (Journals) c/o Straits Trading Co., Singapore, S.S.; (subs.) c/o S. Watson, Queen Insurance Buildings, Dale Street, Liverpool, Chemist.
1901. Watson, Herbert J., 38, Peel House Lane, Widnes, Chemist.
1903. Watson, H. W., c/o H. Hogarth, Denton Avenue, Gledhow, Leeds, Analytical Chemist.
1903. Watson, Hugh M., 22, Coleraine Road, Blackheath, S.E., Paint Manufacturer.
1894. Watson, Jas., Tyne View, Hebburn-on-Tyne, Alkali Works Manager.
1905. Watson, James, 41, Sherburn Street, Holderness Road, Hull, Manager.
1891. Watson, Jno., Langdon, Beaconsfield Road, Blackheath, S.E., Analytical Chemist.
- O.M. Watson, Jno. C., c/o Oriental Silk Printing Co., Paterson, N.J., U.S.A., Manager.
1904. Watson, Percy, 554, Somerset Avenue, Taunton, Mass., U.S.A., Chemist and Dyer.
- O.M. Watt, A., c/o Macfie and Sons, 34, Moorfields, Liverpool, Sugar Works Chemist.
1901. Watt, Francis L., 10, Northcote Chambers, Reiby Lane, Circular Quay, Sydney, N.S.W., Australia, Analytical Chemist.
1906. Watt, Dr. H. E., Imperial Institute, South Kensington, S.W., Chemist.
1904. Watt, John, 17, Maple Avenue, Toronto, Ont., Canada, Glass Manufacturer.
1893. Watts, Jno. Isaac, Fairleigh, Hartford, Cheshire, Alkali Works Manager.
1908. Watts, Jno. Wm., Newcastle Tar Works, Blaydon-on-Tyne, Manager.
1907. Waumsley, Harry, Monckton Maine Colliery, near Barnsley, Chemical Engineer.
1903. Wayland, Wm. A., 12, Albert Road, Brockley, S.E., Manufacturing Chemist.
1906. Webb, E. A., Woodbine and Burgess Avenues, Toronto, Canada, Technical Chemist.
1906. Webb, Frank H., 7, Dustin Street, Haverhill, Mass., U.S.A., Chemist.
1900. Webb, Jno. F., 20, Louvaine Road, St. John's Hill, Battersea, S.W., Mining and Electrical Engineer.
1905. Webber, W. J., 55, Kilby Street, Boston, Mass., U.S.A., Manufacturing Chemist.
1901. Webster, Geo. J., 115, Delaware Avenue, Toronto, Canada, Secretary.
1902. Webster, Jno., Chemical Laboratory, Guy's Hospital, London, S.E., Analyst.
1908. Webster, John H., 47, Horace Street, St. Helens, Lancs., Metallurgist and Salt Works Manager.
1906. Weddell, George, 20, Grainger Street West, Newcastle-on-Tyne, Manufacturing Chemist.
1904. Wedekind, Rud., Uerdingen, Niederrhein, Germany, Manufacturer of Alizarin and Bichromates.
1897. Wedge, Utley, Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., U.S.A., Chemist.
1902. Weed, Hy. T., 181, Prospect Park West, Brooklyn, N.Y., U.S.A., Teacher of Chemistry.
1893. Weeks, H. B., 2, Infield Park Road, Barrow-in-Furness, Analytical Chemist.
1898. Weeple, Lawrence, Pinchin's Wharf, Stratford, E., Colour Works Chemist.
1904. Weil, Jacob A., c/o The Power Gas Corporation, Ltd., 39, Victoria Street, Westminster, S.W., Chemist.
1902. Weiskopf, Dr. Erich, Dynamit Factory, Modderfontein, Transvaal, South Africa, Chemist.

1908. Weissmüller, Edward F., Hill Crest, Runcorn, Chemist.
1905. Weissmüller, Ernest C., Hill Crest, The Heath, Runcorn, Cheshire, Research Chemist.
1899. Weldon, Leonard E., 151, Egypt Road, New Basford, Nottingham, Dyer.
1907. Welham, Samuel D., c/o Brotherton and Co., Ltd., Church Road, Litherland, near Liverpool, Technical Chemist.
1903. Wellecome, Henry S., Snow Hill Buildings, London, E.C., Manufacturing Chemist.
1891. Wells, Jas. Gray, Carlton Lawn, Chester Road, Stretford, Manchester, Brewing Chemist.
1894. Wells, Pierson L., 86, Joralemon Street, Brooklyn, N.Y., U.S.A., Patent Lawyer and Engineer.
1885. Welsh, Jas., Printworks Manager.
1890. Welsh, Thos. L., 3, Prince's Gardens, Dowanhill, Glasgow, Analytical Chemist.
- O.M. Welsh, W., Holt Town Oil Works, Manchester.
1905. Welt, Dr. Ida, 18, West 83rd Street, New York City, U.S.A., Chemist.
1906. Wenger, Francis E., Clivedon, Wolstanton, Stoke-on-Trent, Ceramic Colour Manufacturer.
1909. Wentworth, Henry A., c/o Huff Electrostatic Separator Co., 60, India Street, Boston, Mass., U.S.A., Mining Engineer.
1903. Wesener, Dr. John A., 103, State Street, Chicago, Ill., U.S.A., Consulting Chemist.
1881. Wessel, Carl, (communications) Geheimer Commerzienrath C. Wessel, Bernburg; and (Journals), Deutsche Solvay-Werke Act.-Ges., Bernburg, Anhalt, Germany, Alkali Manufacturer.
1889. Wesson, D., c/o Southern Cotton Oil Co., 24, Broad Street, New York City, U.S.A., Technical Chemist and Cotton-Oil Expert.
1908. West, Chas. A., c/o American Camphor Refining Co., 14, Fulton Street, Boston, Mass., U.S.A., President.
1903. West, Leonard, Merrywood, Belper Road, Derby, Manufacturing Chemist.
1909. West, Percy C. H., 40, The Green, Norton, Co. Durham, Analytical Chemist.
1900. Westenfelder, B. D., 924, Clinton Street, Cincinnati, Ohio, U.S.A., Chemist.
1885. Westmoreland, J. W., 12, Arthington Terrace, Hunslet, Leeds, Metallurgical Chemist.
1898. Weston, David B., Sharon, Mass., U.S.A., Chemist.
1894. Weston, Robt. S., 14, Beacon Street, Boston, Mass., U.S.A., Chemist and Bacteriologist.
1885. Weston, Wm., 2, Ulundi Road, Blackheath, S.E., Analytical Chemist.
1908. Westwood, Arthur W., The Assay Office, Birmingham, Assay Master.
1890. Wetter, Jasper, 37-39, Essex Street, Strand, London, W.C., Patent Agent.
- O.M. Whalley, L. J. de, 148, Jerningham Road, New Cross, S.E., Sugar Chemist.
1908. Wheaton, H. J., 21, Chesterton Road, Cambridge, Chemical Engineer.
1909. Wheeler, Edward, 113, Highbury Quadrant, London, N., Demonstrator of Chemistry.
1898. Wheeler, Dr. Edwd. J., 79, Chapel Street, Albany, N.Y., U.S.A., Analytical Chemist.
1903. Wheeler, Ernest, 4, Fairfield Terrace, Higher Openshaw, Manchester, Metallurgical Chemist.
1906. Wheeler, Frank G., Trenton, Mich., U.S.A., Chemist.
1907. Wheeler, R. Vernon, The Colliery, Altofts, near Normanton, Chemist.
1895. Wheelwright, Dr. E. W., 24, Stanmore Road, Edgbaston, Birmingham.
1909. Wheelwright, Franklin R., 10, Weybosset Street, Providence, R.I., U.S.A., Paper Makers' Materials Manufacturer.
1905. Whetton, John, 624, Front Street East, Toronto, Canada, Manager of Canadian Branch of Read Holliday & Sons, Ltd.
1909. Whiffen, G. Goodman, Lombard Road, Battersea, London, S.W., Chemical Engineer.
- O.M. Whiffen, Thos. J., Cerris House, West Hill, Putney, S.W., Manufacturing Chemist.
- O.M. Whiffen, W. G., Lombard Road, Battersea, London, S.W., Manufacturing Chemist.
1893. Whitaker, Mf., Newlaithes Grange, Horsforth, Leeds, Dyer.
1899. Whitaker, Milton C., 825, Monmouth Street, Gloucester City, N.J., U.S.A., Chemist.
1895. Whitaker, Thos., Aire Vale Dye Works, Newlay, near Leeds, Dyer.
- O.M. Whitaker, Thorpe, (Journals) Bradford Dyers' Association, Ltd., and 35, Pemberton Drive, Bradford, Yorks., Dyer's Chemist.
1893. White, Arthur F., 2, Melbourn Grove, Thornbury, Bradford, Yorks., Manufacturing Druggist.
1908. White, George, c/o Hull Stearine Co., Cleveland Street, Hull, Oilworks Chemist.
1901. White, H. Graham, Mere Cottage, Oxtou, Birkenhead, Works Chemist.
1889. White, Henry, 245, Western Road, Crookes, Sheffield, Manufacturing Chemist.
1898. White, Jno., County Offices, St. Mary's Gate, Derby, Public Analyst to County of Derby.
- O.M. White, Paul T., Horton Field House, West Drayton, Chemical Manufacturer.
1905. White, William, Beloeil Station, Province Quebec, Canada, Chemist.
1894. White, W. Gilchrist, 133, Tottington Road, Bury, Lanes., Calico Printer's Chemist.
1906. White, Wm. T., c/o American Hide and Leather Co., Lowell, Mass., U.S.A., Leather Manufacturer.
1903. Whitehouse, P. L., c/o W. H. Keys, Ltd., West Bromwich, Staffordshire, Oil Chemist.
1906. Whiteley, C. E., 21, Brudenell View, Leeds, Demonstrator of Chemistry.
1885. Whiteley, R. Lloyd, The Institute, West Bromwich, Staffordshire, Principal.
1892. Whiteside, Jno. L., 376, St. Helen's Road, Bolton-le-Moors, Chemical Lecturer.
1908. Whiting, Jasper, 523, Board of Trade Building, Boston, Mass., U.S.A., Chemical Engineer.
1885. Whittaker, C. J., Winthrop, Andell Road, Lytham, Lancashire, Chemical Engineer.
1904. Whittier, Charles T., 322, Warren Street, Jersey City, N.J., U.S.A., Manager.
1901. Whitton, Jas. T., c/o Nobel's Explosives Co., Ltd., Ardeer, Stevenston, N.B., Chemist.
1884. Whowell, F., Croich Hey, Tottington, Bury, Lanes., Bleacher.
1899. Wiarda, Jno. C., 259-273, Green Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1897. Wiborg, F. B., The Ault and Wiborg Co., Cincinnati, Ohio, U.S.A., Manufacturer.
1890. Wickens, B. Foster, 31, Bermondsey Wall, London, S.E., Managing Director (Wickens, Pease, and Co., Ltd.).
1908. Wickes, Clarence S., 417, State Street, Camden, N.J., U.S.A., Factory Superintendent.
1905. Widmann, Eugene A., 595, Eighth Avenue, Brooklyn, N.Y., U.S.A., Dyestuff Merchant.
1904. Wieler, Eric E., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.
1904. Wiener, William, 624, Nelson Place, Newark, N.J., U.S.A., Analytical and Consulting Chemist.
1906. Wiffen, Henry J., 17, Albany Road, Manor Park, Essex, Manufacturing Chemist.
1883. Wiggin, W. W., Wiggin Street Works, Birmingham, Nickel Refiner.
1908. Wiggins, Elmer W., c/o E. I. du Pont Powder Co., Landing, N.J., U.S.A., Chemist.
1897. Wigglesworth, H., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
- O.M. Wightman, C. I., Fenchurch Avenue, London, E.C., Chemical Merchant.
1906. Wikner, Sigurd A., 39, Margaret Street, Hull, Tar Works Chemist.
1899. Wild, Roland C., The Grange, New Eltham, Kent, Analytical Chemist.
1893. Wilder, F. L., Morro Velho, Villa Novo de Lima, Estado de Minas Geraes, Brazil, Assayer.
1902. Wilder, Salmon W., jun., 33, Broad Street, Boston, Mass., U.S.A., Treasurer.

1899. Wildman, Arthur J., 133, Central Park Road, East Ham, E., Chemist.
1902. Wiley, Dr. Harvey W., Bureau of Chemistry, Department of Agriculture, Washington, D.C., U.S.A., Chief.
1906. Wilke, Wm., 86, Norwood Avenue, Buffalo, N.Y., U.S.A., Chemical Engineer.
1903. Wilkie, Jno. M., 38, South Road, West Bridgford, Nottingham, Analytical Chemist.
1885. Wilkin, Sir Walter, K.C.M.G., Appold Street, Finsbury, E.C., Yeast Manufacturer.
1895. Wilkins, Charles, 40, Church Lane, Hornsey, N., Manufacturing Perfumer.
1899. Wilkins, H. A. J., c/o New Jersey Zinc Co., 576, Fifth Avenue, New York City, U.S.A., Mining Engineer.
1904. Wilkinson, Prof. J. A., Transvaal University College, P.O. Box 1176, Johannesburg, Transvaal, Professor of Chemistry.
1886. Wilkinson, J. B., Tong Street, Dudley Hill, Bradford, Yorks., Chemical Manufacturer.
1906. Wilkinson, John E., 69, Lombard Street, Toronto, Canada, Gold and Silver Refiner.
1903. Willard, C. T., 29, Chestnut Street, Newark, N.J., U.S.A., Chemist.
1893. Willcox, Benjamin, 47, Lincoln's Inn Fields, London, W.C.; (Journals), 34, Hamilton Terrace, St. John's Wood, N.W., Patent Agent.
1903. Williams, Chas. E., Thornhayes, Sleaford, Seed Crusher.
1895. Williams, David T., 42, Finsbury Square, London, E.C., Chemist.
1891. Williams, Henry J., 161, Tremont Street, Boston, Mass., U.S.A., Chemical Engineer.
1908. Williams, Herbert E., c/o Albion Chemical Co., Riverside, Charlton, Kent, Chemist.
1904. Williams, Jno. T., Engineering Building, 114, Liberty Street, New York City, U.S.A.
1904. Williams, Naboth, 28, Rolleston Street, Warrington, Technical Chemist.
1902. Williams, Percy, c/o A. J. Simons, Pontianak, Dutch West Borneo, *via* Singapore, Chemist.
1885. Williams, Rowland, Hale Cote, Albert Park, Lancaster, Analytical Chemist.
1900. Williams, Saml. H., Glastonbury, Conn., U.S.A., Soap Manufacturer.
1903. Williams, S. M., 269, Springdale Avenue, East Orange, N.J., U.S.A., Chemist.
1885. Williams, T. Howell. See Idris, T. H. W.
1884. Williams, Prof. W. Carleton, Broomgrove, Goring-on-Thames, Professor of Chemistry.
1902. Williams, Walter Scott, Arnold Printworks, North Adams, Mass., U.S.A., Chemical Engineer.
1887. Williams, W., Collingwood, Beechfield, Roby, near Liverpool, Analytical Chemist.
- O.M. Williams, W. J., 5004, Franklin Street, Frankford, Philadelphia, Pa., U.S.A., Analytical Chemist.
1894. Williamson, J. Alex., The Croft, Chase Court Gardens, Enfield, N., Analytical Chemist.
- O.M. Williamson, Robt., Low Walker, Newcastle-on-Tyne, Technical Chemist.
1903. Wills, J. Laimson, 133, Midwood Street, Brooklyn, N.Y., U.S.A., Technical and Brewing Chemist.
1905. Wills, Wm. R., 162, Main Street, Waltham, Mass., U.S.A., Dyer.
1895. Wilson, Thos. L., St. Catherine's, Ont., Canada, Electrical Engineer.
1890. Wilson, Alf., c/o Messrs. J. and E. Sturge, 18, Wheeley's Lane, Birmingham, Chemist.
1884. Wilson, Anthony W., 20, Westcott Street, Hull, Colour Works Manager.
1888. Wilson, Cecil H., c/o Sheffield Smelting Co., Ltd., Royds Mills Street, Sheffield, Chemist.
- O.M. Wilson, C. J., 11, Old Queen Street, Westminster, S.W.
1888. Wilson, Dr. David, Carbeth, Killearn, by Glasgow.
1885. Wilson, Frank, 7, Bedford Square, London, W.C., Brewer.
1903. Wilson, Geo. C., 298, Ryars Road, Hillhead, Glasgow, Chemist.
- O.M. Wilson, G. E., The Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.
1902. Wilson, Geo. W., Simmondley, Glossop, Derbyshire, Works, Chemist.
1899. Wilson, Gordon, Ballan, Kirkintilloch, N.B.; and (Journals) British Club, Mexico, D.F., Chemist and Assayer.
1886. Wilson, Jno., Tyneside, Hagley Road, Birmingham, Technical Chemist.
1896. Wilson, Jno., The Vines, Oxford Road, Runcorn, Chemical Engineer.
1909. Wilson, Jno., Battersea Polytechnic, London, S.W., Head of Chem. Dept.
1905. Wilson, J. E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemical Salesman.
- O.M. Wilson, J. H., 8, Friar's Stile Road, Richmond, S.W., Chemical Manufacturer.
1906. Wilson, J. Murray, c/o Hamilton Powder Co., Beloeil Station, Prov. Quebec, Canada, Technical Chemist.
1902. Wilson, Leonard P., 19, Widdrington Road, Coventry, Technical Chemist.
- O.M. Wilson, R. H., Egglecliffe P.O., Co. Durham, Chemical Manufacturer.
1900. Wilson, Walter A., Ardeer, Stevenston, Ayrshire, Chemist.
1908. Wilson, William James, c/o Wilson's Portland Cement Co., Ltd., Warkworth, Auckland, New Zealand, Cement Works Manager.
1890. Wilson, W. W., Dalmonach House, Alexandria, Dumbartonshire, Analytical Chemist.
1884. Wilton, Thos., Winsor House, Beckton, E., Tar Works Manager.
1901. Wing, Herbert H., Monticello, N.Y., U.S.A., Chemical Engineer.
1892. Wing, J. D., 22, William Street, New York City, U.S.A., Merchant.
1892. Wingfield, T. R., 5, Bromwich Street, Bolton, Brewer.
- O.M. Wingham, A., 43, Taswell Road, Southsea, Hants., Metallurgical Chemist.
1908. Winkler, Hermann, Metallgesellschaft, Frankfurt a/Main, Germany, Merchant.
1906. Winkler, S. M., 38 and 40, Main Street, Cincinnati, Ohio, U.S.A., Chemical Merchant.
- O.M. Winsor, P. J., Heath House, Knutsford, Cheshire, Consulting Chemist.
1907. Winsloe, Louis S., 114, The Albany, Liverpool, Manufacturing Chemist.
1892. Winstanley, Hy., Bridge House, Cheadle Hulme, Cheshire, Technical Chemist.
1886. Winstone, E. H., Members' Mansions, 36, Victoria Street, London, S.W., Ink Manufacturer.
1907. Winther, Dr. A., Chemische Fabrik Griesheim-Elektron, Werk Oehler, Offenbach a/Main, Germany, Chemist.
1892. Wirtz, Dr. Quirin, 28, Great Ormond Street, London, W.C., Consulting Chemist.
1900. Wishart, Harlan L., Washburn, Wis., U.S.A., Chemist.
1889. Wishart, Jno., 39, St. Vincent Place, Glasgow, General Manager (Oakbank Gil Co., Ltd.).
1902. Withers, Prof. W. A., State A. and M. College, West Raleigh, N.C., U.S.A., Professor of Chemistry.
1906. Withey, Wm. S., Eldorado Banket Gold Mine, Lomagundi, South Rhodesia, South Africa.
- O.M. Witt, Dr. Otto N., Eberschenallee 10, Westend, bei Berlin, Professor of Chemistry.
1892. Witthaus, Dr. R. A., Cornell Medical College, 470, First Avenue and 28th Street, New York City, U.S.A., Professor of Chemistry.
1907. Wolcott, Townsend, 39, Whitehall Street, New York City, U.S.A.
1901. Wolf, August S., 206, West 95th Street, New York City, U.S.A., Chemist.
1903. Wolf, Jacques, c/o Jacques Wolf and Co., Passaic, N.J., U.S.A., Manufacturing Chemist.
1891. Woltereck, Dr. H. C., 3, Edinburgh Mansions, Howick Place, London, S.W., Consulting Chemist.

1903. Wolton, Wm. R., c/o Joseph Fison and Co., Ltd., Ipswich, Manager.
1906. Wood, E. Escoff, Hurricane House, Brymbo, near Wrexham, North Wales, Chemist and Metallurgist.
1900. Wood, Frank, Hazelhurst, Doneaster Road, Barnsley, Yorks., Assistant Manager (Glass Works).
1901. Wood, Frank S., Chin Chin, Heathcote Street, Newland, Hull, Cement Works Chemist.
1887. Wood, Jos. T., 62, Park Road, Nottingham, Tanner.
1886. Wood, Wm., 20, Rue Général van Merlen, Antwerp, Belgium, Bleacher and Dyer.
1908. Woodbridge, Walter B., 36, Baker Street, Reading, Berks., Chemist.
- O.M. Woodcock, R. C., c/o Sanitas Co., Ltd., Locksley Street, Linchouse, London, E., Technical Chemist.
1902. Woodhead, Chas. E., 458, Edge Lane, Droylsden, Manchester, Chemist.
1881. Woodhead, Jas., Inglewood, Slaithwaite, near Huddersfield, Tar Distiller.
1900. Woodrow, John, 84, Harpenden Road, South Wanstead, Essex, Chemist.
1906. Woodward, Horace A., 1268, Amsterdam Avenue, New York City, U.S.A., Chemist.
1904. Woolcott, Geo. H., Lady's Well Brewery, Cork, Ireland, Brewer's Chemist.
1904. Woolcott, Herbert, 44, Zinzan Street, Reading, Brewer's Chemist.
1896. Woolf, Julian, 51, Buckland Crescent, South Hampstead, N.W., Manufacturer.
1906. Woollett, Dr. George H., Science Schools, Sansome Street, Worcester, Principal.
- O.M. Woolley, G. S., Victoria Bridge, Manchester, Pharmaceutical Chemist.
1905. Woore, N. L., P.O. Mount Morgan, Queensland, Australia, Assayer.
1901. Worden, Edw. C., c/o Clark Thread Co., Newark, N.J., U.S.A., Analytical Chemist.
- O.M. Worrall, H., Crimsworth, Whalley Range, Manchester, Dyer.
1903. Worstell, Robt. A., 121, La Salle Street, Chicago, Ill., U.S.A., Paint and Varnish Specialist.
1900. Worthington, Arthur, Lynwood, Green Lane, Bolton, Chemist and Sub-Manager.
1896. Wrampelmeier, T. J., 2253, Piedmont Avenue, Berkeley, Cal., U.S.A., Chemist.
- O.M. Wray, O. J. P., Hazlemere, Coleraine Road, Blackheath, S.E., Technical Chemist.
1904. Wright, Allister M., Box 617, G.P.O., Christchurch, N.Z., Chemist (Christchurch Meat Co.).
1895. Wright, Arthur C., c/o Turner, Morrison, and Co., 6, Lyons Range, Calcutta, India, Chemist.
1908. Wright, C. Harold, Government Laboratory, Port of Spain, Trinidad, B.W.I., Analyst.
1904. Wright, Chas. L., c/o U.S. Geological Survey, 40th and Butler Streets, Pittsburg, Pa., U.S.A., Chemical Engineer.
1905. Wright, Daniel, 287, Maverick Street, East Boston, Mass., U.S.A., Manufacturer of Dyestuffs and Chemicals.
1908. Wright, Gilbert, Chemical Laboratory, University of Sydney, N.S.W., Demonstrator in Chemistry.
1901. Wright, Harold E., c/o Sir B. Samuelson and Co., Ltd., Middlesbrough, Chemist.
1907. Wright, J. G. E., c/o Edison & Swan United Electric Light Co., South Benwell Works, Newcastle-on-Tyne, Technical Chemist.
1907. Wright, John Henry, 22, Norwood Avenue, Shipley, Yorks., Technical Chemist.
1885. Wright, Jos., 19, Arboretum Street, Nottingham, Lace Dresser.
- O.M. Wright, L. T., c/o The Mountain Copper Co., 150, Pine Street, San Francisco, Cal., U.S.A., Chemical Engineer.
1900. Wright, Walter J., 2, St. Mary's Road, Faversham, Kent, Chemist (Cotton Powder Co.).
1890. Wülffing, Dr. Charles, Hönningen a/Rhein, Germany, Technical Chemist.
1907. Würster, Oscar H., The M. Werk Co., 7411, Poplar Street, Cincinnati, Ohio, U.S.A., Soap Works Chemist.
1906. Wuth, Dr. Berthold, Oaklands, Bramhall, Cheshire, Chemist.
1890. Wyall, Dr. Francis, 402, West 23rd Street, New York City, U.S.A., Consulting Chemist.
1905. Wyer, Malcolm G., The Library, State University, Iowa City, Iowa, U.S.A., Librarian.
- O.M. Wyld, Jno., The Avenue, Lidgett Park, Roundhay, Leeds, Chemical Works Manager.
1908. Wyler, Dr. Max, 65, Cecil Street, C. on M., Manchester, Manufacturing Chemist.
1906. Wynne, Prof. W. Palmer, F.R.S., The University, Sheffield, and (Journals) 17, Tiptonville Road, Sheffield, Professor of Chemistry.

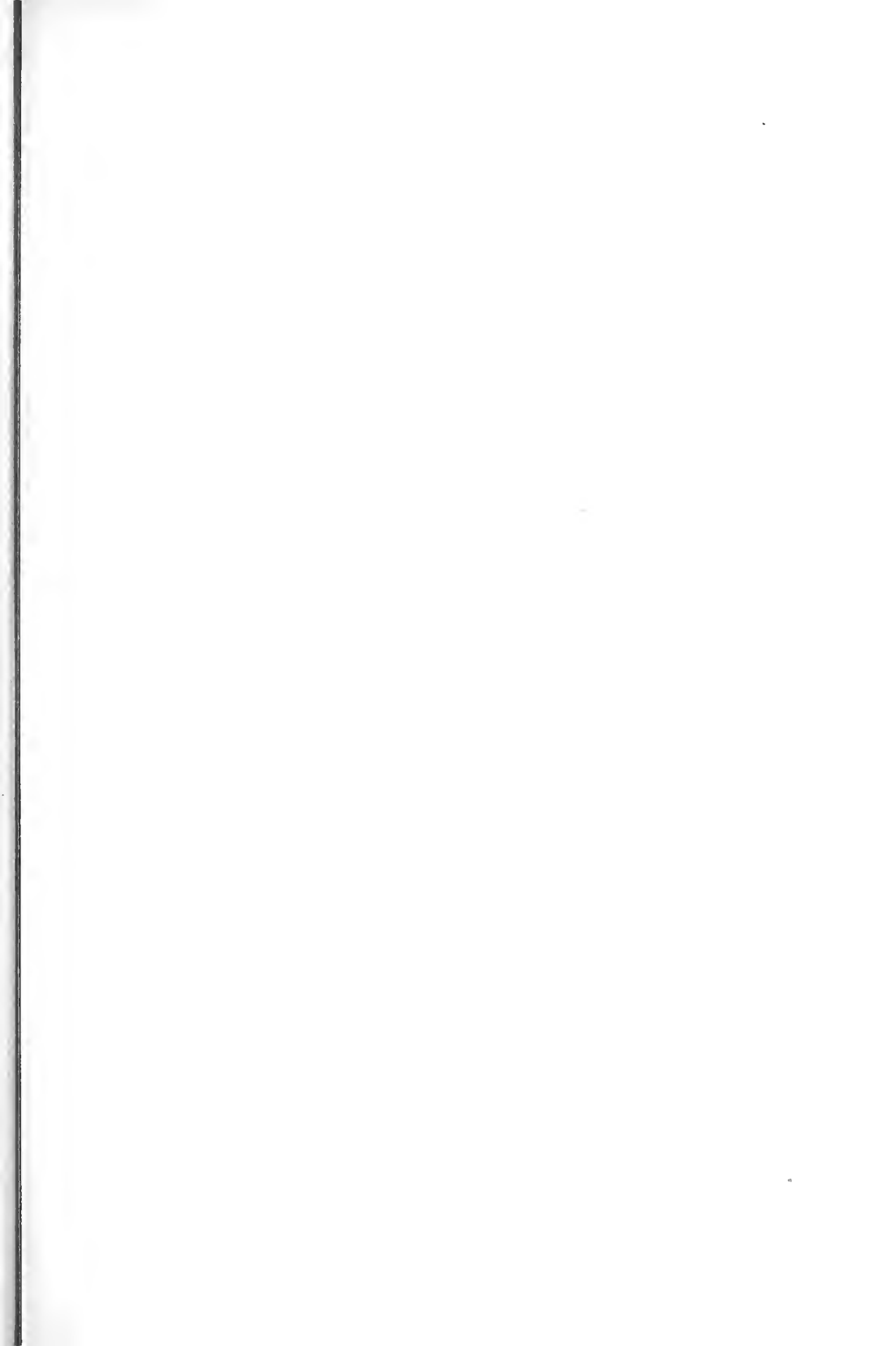
Y

1900. Yamaoka, S., 10, Nishikatamachi, Hongo, Tokyo, Japan, Chief Engineer.
1901. Yardley, Frank, c/o Henry Jutson and Sons, Liverpool Street, Birmingham, Chemical Manufacturer.
1899. Yates, Arthur, Lebong Donok, Benkoelen, Sumatra, Netherlands Indies, Metallurgist.
1897. Yates, Wm. H., 119, Hawkshead Street, Southport, Lancashire, Technical Chemist.
1906. Yerkes, Leonard A., c/o Jos. Baneroft and Sons Co., Wilmington, Del., U.S.A., Bleacher and Finisher.
1898. Yetton, Thos., 86, Bow Road, London, E., Consulting Distiller's Chemist.
1894. Yocum, Dr. Jno. H., 359, Halsey Street, Newark, N.J., U.S.A., Chemist.
1886. Yoshida, Prof. H., Imperial University of Kyoto, Kyoto, Japan, Professor of Chemistry.
1900. Yoshitake, E., 18, Tatsukacho, Hongo, Tokyo, Japan, Chemist.
1885. Young, Alfred C., 17, Vicar's Hill, Lewisham, S.E.
1901. Young, Dr. A. H. Innes, 54, Merton Road, Bootle, Student.
1885. Young, Brougham, 2A, Sigdon Road, Dalston, N.E., Analytical Chemist.
1902. Young, Chas. C., c/o Continental Color & Chemical Co., 32, India Street, Boston, Mass., U.S.A., Colourist.
1908. Young, Charles W., 1255, North 26th Street, Philadelphia, Pa., U.S.A., Soap Manufacturer.
1890. Young, Dr. Geo., 79, Harvard Court, Honeybourne Road, West Hampstead, N.W., Chemist.
1904. Young, James, 2A, Dartmouth Road, Brondesbury, N.W., Chemist.
- O.M. Young, Jno., 2, Montague Terrace, Kelvinside, Glasgow, Technical Chemist.
1886. Young, Jno., Claremont House, Beverley Road, Hull, Gas Engineer.
1904. Young, Jno. H., c/o The Cassel Cyanide Co., Ltd., Shuna Street, Maryhill, Glasgow, Technical Chemist.
1898. Young, J. W., 3, Murray Street, Higher Broughton, Manchester, Inspector under Alkali Acts.
1883. Young, Prof. Sydney, F.R.S., University Chemical Laboratory, Trinity College, Dublin, Professor of Chemistry.
- O.M. Young, W. C., Laboratory, 19-20, Aldgate, London, E.C., Gas Examiner and Consulting Chemist.
1898. Young, W. Gathorne, Analyst's Dept., G.N.R., Doncaster, Yorks., Chief Chemist.

Z

1899. Zabriskie, C. B., c/o Pacific Coast Borax Co., 100, William Street, New York City, U.S.A., Manager.
1897. Zacharias, Dr. P. D., Phillellinon Street 22, Athens, Greece, Industrial Chemist.
1897. Zahorski, Dr. Boleslas, Technical Chemist.
1906. Zambra, Edw., 942, Monadnock Building, Chicago, Ill., U.S.A., President (Zambra Co.).

1906. Zdanowicz, Joseph. 9, Knaresborough Place, Earl's Court, S.W., Chemical Engineer (Artificial Silk).
1899. Zilz, Henry. 20-26, Brunswick Place, City Road, London, E.C., Agent (Badische Anilin und Soda Fabrik).
- O.M. Zimmermann, A., 3, Lloyd's Avenue, London, E.C., Chemical Agent.
1905. Zimmermann, Chas., 9 & 10, St. Mary-at-Hill, London, E.C., Chemical Merchant.
1907. Zimmermann, Clarence L., 308, Johnson Court, Madison, Wis., U.S.A., Electro-Chemical Engineer.
1897. Zausser, Dr. Fred. G., Hastings-upon-Hudson, N.Y., U.S.A., Manufacturing Chemist.
1895. Zoeller, E. V., Tarboro, N.C., U.S.A., Cotton-seed Oil Refiner and Pharmacist.









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